Nagarjuna College of Engineering & Technology, Bengaluru

An Autonomous Institute, Affiliated to VTU Belagavi

Scheme & Syllabus
of
III & IV Sem

As per the NEP 2020 Guidelines,
Choice-Based Credit System
&
Outcome-Based Education

CSE (Data Science)

w.e.f.
Academic Year 2022-2023

Name & Signature of BoS Member (VTU Nominee)

Vision

To prepare the next generation practitioners and researcher for data centric world by bringing together interdisciplinary faculty across the globe.

Mission

M1: To provide Skill Based Education to master the students in problem solving and analytical skills to enhance their niche expertise in the field Data Science

M2: To educate the students with latest technologies to update their knowledge in the field of Data Science

M3: To enable students to experience the Content Based Learning with premier quality data science education, research and industrial collaboration

M4: To enable students to become leaders in the Industry and Academia Nationally as well as internationally

M5: To guide students in research on Data Science, with the aim of having an ethical impact on society by tackling societal grand challenges

PROGRAM OUTCOMES (POs): Graduates of the Computer Science and Engineering – Data Science Program will be able to achieve the following

POs:

PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and Computer Science and Engineering principles to the solution of complex problems in Computer Science and Engineering.

PO2: Problem Analysis: Identify, formulate, research literature, and analyses complex Computer Science and Engineering problems reaching substantiated conclusions using first principles of mathematics and engineering sciences.

PO3: Design/Development of Solutions: Design solutions for complex Computer Science and Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct investigations of Complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions related to Computer Science and Engineering problems.

PO5: Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex Computer Science and Engineering activities with an understanding of the limitations.

PO6: The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional Computer Science and Engineering practice.

PO7: Environment and Sustainability: Understand the impact of the professional Computer Science and Engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the Computer Science and Engineering practice.

PO9: Individual and Team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: Communication: Communicate effectively on complex Computer Science and 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.

PO11: Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage Computer Science and Engineering projects and in multidisciplinary environments.

PO12: 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.

Program Specific Outcome (PSO)

PSO1: Ability to analyse complex computing issues and apply the principles to achieve related solution.

PSO2: Ability to design, implement and evaluate computing based solutions to meet range of computing requirements based in the data science.

PSO3: Ability to effectively communicate within diverse work group related to professional framework.

Program Educational Objectives (PEOs)

PEO 1: To make students competent for higher studies and employable, to meet industrial requirements.

PEO 2: To develop students having core competence in science, mathematics and fundamentals of Data Science to address ever changing industrial requirements globally.

PEO 3: To create academically conducive environment to learn engineering skills in the domains such as Data Analytics, Data Modelling, Data Visualization and Allied Technologies.

PEO 4: To enrich students with professional ethics, leadership qualities, and entrepreneurial skills.

PEO 5: An ability to engage in lifelong learning for effective adaptation to technological developments.

NAGARJUNA COLLEGE OF ENGINEERING & TECHNOLOGY, BENGALURU

B.E. in CSE (Data Science)

Scheme of Teaching and Examination 2021-22 as per NEP 2020

Outcome-Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the Academic Year 2021-22)

III SEMESTER

Sl. No.	Course and Course Code		Course Title	Teaching Department	Teaching Hours / Week				Duration in Hours	Examination			
					Theory / Lecture	Tutorial	Practical / Drawing	Self-study Component		CIE Marks	SEE Marks	Total Marks	Credits
					L	T	P	S					
1	BSC	21MAT31	Transform Calculus, Fourier Series and Numerical Techniques	Maths	2	2	0	0	3	50	50	100	3
2	IPCC	21CDI32	Data Structures and its Applications (IC)	CSEB	3	0	2	0	3	50	50	100	4
3	IPCC	21CDI33	Database Concepts using SQL (IC)	CSEB	3	0	2	0	3	50	50	100	4
4	PCC	21CDT34	Foundation of Data Science	CSEB	3	0	0	0	3	50	50	100	3
5	PCC	21CDL35	Object Oriented Programming with JAVA Lab	CSEB	0	0	2	0	3	50	50	100	1
6	UHV	21UHV36	Social Connect and Responsibility	Any Dept	1	0	0	0	1	50	50	100	1
7	HSMC	21KSK37 21KBK37	Samskrutika Kannada / Balake Kannada	HSMC	1	0	0	0	1	50	50	100	1
8	AEC	21AEC38X	Ability Enhancement Course – III	Any Dept	1	0	0	0	1	50	50	100	1
9	EDC	21EDC39	Entrepreneurship Development Course – 1	ISE / EDC	0	2	0	0	1	Audit Course			
				TOTAL	**14**	**4**	**6**	**0**	**19**	**400**	**400**	**800**	**18**
10	Scheduled activities for III to VIII semesters (NMDC)	21NS83	National Service Scheme (NSS)	NSS	All students have to register for any one of the courses namely National Service Scheme, Physical Education (PE) (Sports and Athletics) and Yoga with the concerned coordinator of the course during the first week of III semester. The activities shall be carried out from (for 5 semesters) between III semester to VIII semester. SEE in the above courses shall be conducted during VIII semester examinations and the accumulated CIE marks shall be added to the SEE marks. Successful completion of the registered course is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the colander prepared for the NSS, PE and Yoga activities.								
		21PE83	Physical Education (PE) (Sports and Athletics)	PE									
		21YO83	Yoga	Yoga									
Course prescribed to lateral entry Diploma holders admitted to III semester B.E./B.Tech programs													
1	NCMC	21MATDIP31	Additional Mathematics - I	Maths	2	2	--	--	--	100	--	100	0

Note: BSC: Basic Science Course, **PCC**: Professional Core Course, **HSMC**: Humanity and Social Science & Management Courses, AEC –Ability Enhancement Courses. **INT**–Internship, **UHV**- Universal Human Value Courses, **IPCC**: Integrated Professional Core Course, **CSEB** – Computer Science and Engineering Board (CS / IS / AI / AD/ IC / CD). **L–**Lecture**, T–** Tutorial, **P**-Practical/Drawing,**S–**Self Study Component, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Examination

21KSK37/47 Samskrutika Kannada is for students who speak, read and write Kannada and **21KBK37/47** Balake Kannada is for non-Kannada speaking, reading, and writing students.

Integrated Professional Core Course (IPCC): Refers to Professional Theory Core Course Integrated with Practical's of the same course. Credit for IPCC can be 04 and its Teaching–Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (BE/B.Tech.) 2021-22 may be referred.

21INT49 Inter/Intra Institutional Internship: All the students admitted to engineering programs under the lateral entry category shall have to undergo a mandatory 21INT49 Inter/Intra Institutional Internship of 03 weeks during the intervening period of III and IV semesters. The internship shall be slated for CIE only and will not have SEE. The letter grade earned through CIE shall be included in the IV semester grade card. The internship shall be considered as a head of passing and shall be considered for vertical progression and for the award of degree. Those, who do not take up / complete the internship shall be declared fail and shall have to complete during subsequently after satisfying the internship requirements. The faculty coordinator or mentor shall monitor the students' internship
progress and interact with them for the successful completion of the internship.

Non–credit mandatory courses (NCMC):

(A) Additional Mathematics I and II:

(1) These courses are prescribed for III and IV semesters respectively to lateral entry Diploma holders admitted to III semester of B.E./B.Tech., programs. They shall attend the classes during the respective semesters to complete all the formalities of the course and appear for the Continuous Internal Evaluation (CIE). In case, any student fails to register for the said course/fails to secure the minimum 40 % of the prescribed CIE marks, he/she shall be deemed to have secured an F grade. In such a case, the student has to fulfil the course requirements during subsequent semester/s to earn the qualifying CIE marks. These courses are slated for CIE only and has no SEE.

(2) Additional Mathematics I and II shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses shall be mandatory for the award of degree.

(3) Successful completion of the courses Additional Mathematics I and II shall be indicated as satisfactory in the grade card. Non- completion of the courses Additional Mathematics I and II shall be indicated as Unsatisfactory.

(B) National Service Scheme/Physical Education (Sport and Athletics)/ Yoga:

(1) Securing 40 % or more in CIE,35 % or more marks in SEE and 40 % or more in the sum total of CIE + SEE leads to successful completion of the registered course.

(2) In case, students fail to secure 35 % marks in SEE, they have to appear for SEE during the subsequent examinations conducted by the University.

(3) In case, any student fails to register for NSS, PE or Yoga/fails to secure the minimum 40 % of the prescribed CIE marks, he/she shall be deemed to have not completed the requirements of the course. In such a case, the student has to fulfil the course requirements during subsequent semester/s to earn the qualifying CIE marks.

(4) Successful completion of the course shall be indicated as satisfactory in the grade card. Non-completion of the course shall be indicated as Unsatisfactory.

(5) These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses shall be mandatory for the award of degree.

Ability Enhancement Course - III	
21CSL381	Mastering Office
21CSL382	Programming in C++

NAGARJUNA COLLEGE OF ENGINEERING & TECHNOLOGY, BENGALURU

B.E. in CSE (Data Science)

Scheme of Teaching and Examination 2021-22

Outcome-Based Education (OBE) and Choice Based Credit System

(CBCS)(Effective from the Academic Year 2021-22)

IV SEMESTER

Sl. No.	Course and Course Code		Course Title	Teaching Department	Teaching Hours / Week				Duration in Hours	Examination			
					Theory / Lecture	Tutorial	Practical / Drawing	Self-study Component		CIE Marks	SEE Marks	Total Marks	Credits
					L	T	P	S					
1	BSC	21CSM41	Mathematical Foundations for Computing	Maths	2	2	0	0	3	50	50	100	3
2	IPCC	21CDI42	Design and Analysis of Algorithms (IC)	CSEB	3	0	2	0	3	50	50	100	4
3	IPCC	21CDI43	Data Visualization using R (IC)	CSEB	3	0	2	0	3	50	50	100	4
4	PCC	21CDT44	Operating System	CSEB	3	0	0	0	3	50	50	100	3
5	AEC	21BET45	Biology for Engineers	BT/BSC / CSEB	2	0	0	0	2	50	50	100	2
6	PCC	21CDL46	Python Programming Lab	CSEB	0	0	2	0	3	50	50	100	1
7	HSMC	21CIP47	Constitution of India, Professional Ethics	HSMC	1	0	0	0	1	50	50	100	1
8	AEC	21AXX48X	Ability Enhancement Course – IV	Any Dept	1	0	0	0	1	50	50	100	1
9	UHV	21UHV49	Universal Human Values	Any Dept.	1	0	0	0	1	50	50	100	1
10	INT	21INT49	Inter/Intra Institutional Internship	Completed during the intervening period of II and III semesters by students admitted to first year of BE./B.Tech. and during the intervening period of III and IV semesters by Lateral entry students admitted to III semester. Evaluation by the appropriate authorities					3	100	--	100	2
11	EDC	21EDC49	Entrepreneurship Development Course – 2	ISE / EDC	0	2	0	0	1	Audit Course			
				TOTAL	17	2	6	0	21	550	450	1000	22
Course prescribed to lateral entry Diploma holders admitted to III semester of Engineering programs													
1	NCMC	21MATDIP41	Additional Mathematics - II	Maths	2	2	--	--	--	100	--	100	0

Note: BSC: Basic Science Course, **PCC**: Professional Core Course, **HSMC**: Humanity and Social Science & Management Courses, AEC –Ability Enhancement Courses. **INT**–Internship, **UHV**- Universal Human Value Courses, **IPCC**: Integrated Professional Core Course, **CSEB** – Computer Science and Engg. Board (CS / IS / AI / AD/ IC / CD)
L–Lecture**, T**–Tutorial, **P-**Practical/Drawing, **S–**Self Study Component, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Examination

21KSK37/47 Samskrutika Kannada is for students who speak, read and write Kannada and **21KBK37/47** Balake Kannada is for non-Kannada speaking, reading, and writing students.

Integrated Professional Core Course (IPCC): Refers to Professional Theory Core Course Integrated with Practical's of the same course. Credit for IPCC can be 04 and its Teaching–Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. For more details, the regulation governing the
Degree of Bachelor of Engineering /Technology (BE/B.Tech.) 2021-22 may be referred.

Non–credit mandatory courses (NCMC):

(A) Additional Mathematics I and II:

(1) These courses are prescribed for III and IV semesters respectively to lateral entry Diploma holders admitted to III semester of B.E./B.Tech., programs. They shall attend the classes during the respective semesters to complete all the formalities of the course and appear for the Continuous Internal Evaluation (CIE). In case, any student fails to register for the said course/fails to secure the minimum 40 % of the prescribed CIE marks, he/she shall be deemed to have secured an F grade. In such a case, the student has to fulfill the course requirements during subsequent semester/s to earn the qualifying CIE marks. These courses are slated for CIE only and has no SEE.
(2) Additional Mathematics I and II shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses shall be mandatory for the award of degree.
(3) Successful completion of the courses Additional Mathematics I and II shall be indicated as satisfactory in the grade card. Non-completion of the courses Additional Mathematics I and II shall be indicated as Unsatisfactory.

(B) National Service Scheme/Physical Education (Sport and Athletics)/ Yoga:

(1) Securing 40 % or more in CIE,35 % or more marks in SEE and 40 % or more in the sum total of CIE + SEE leads to successful completion of the registered course.
(2) In case, students fail to secure 35 % marks in SEE, they have to appear for SEE during the subsequent examinations conducted by the University.
(3) In case, any student fails to register for NSS, PE or Yoga/fails to secure the minimum 40 % of the prescribed CIE marks, he/she shall be deemed to have not completed the requirements of the course. In such a case, the student has to fulfill the course requirements during subsequent semester/s to earn the qualifying CIE marks.
(4) Successful completion of the course shall be indicated as satisfactory in the grade card. Non-completion of the course shall be indicated as Unsatisfactory.
(5) These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses shall be mandatory for the award of degree.

Ability Enhancement Course - III	
21CSL481	Web Programming
21CSL482	Unix Shell Programming
21CSL483	R Programming

Internship of 04 weeks during the intervening period of IV and V semesters; 21INT68 Innovation/ Entrepreneurship/ Societal based Internship.

(1) All the students shall have to undergo a mandatory internship of 04 weeks during the intervening period of IV and V semesters. The internship shall be slated for CIE only and will not have SEE. The letter grade earned through CIE shall be included in the VI semester grade card. The internship shall be considered as a head of passing and shall be considered for vertical progression and for the award of degree. Those, who do not take up / complete the internship shall be considered under F (fail) grade and shall have to complete during subsequently after satisfying the internship requirements.
(2) Innovation/ Entrepreneurship Internship shall be carried out at industry, State and Central Government /Non-government organizations (NGOs), micro, small and medium enterprise (MSME), Innovation centres or Incubation centres. Innovation need not be a single major breakthrough; it can also be a series of small or incremental changes. Innovation of any kind can also happen outside of the business world. Entrepreneurship internships offers a chance to gain hands on experience in the world of entrepreneurship and helps to learn what it takes to run a small entrepreneurial business by performing intern duties with an established company. This experience can then be applied to future business endeavours. Start-ups and small companies are a preferred place to learn the business tack ticks for future entrepreneurs as learning how a small business operates will serve the intern well when he/she manages his/her own company. Entrepreneurship acts as a catalyst to open the minds to creativity and innovation. Entrepreneurship internship can be from several sectors, including technology, small and medium-sized, and the service sector.
(3) Societal or social internship.
Urbanization is increasing on a global scale; and yet, half the world's population still resides in rural areas and is devoid of many things that urban population enjoy. Rural internship, is a work-based activity in which students will have a chance to solve/reduce the problems of the rural place for better living. As proposed under the AICTE rural internship programme, activities under Societal or social internship, particularly in rural areas, shall be considered
for 40 points under AICTE activity point programme.

TRANSFORM CALCULUS, FOURIER SERIES AND NUMERICAL TECHNIQUES

Course Code	**21MAT31**	**CIE Marks**	**50**
Teaching Hours/Week (L: T: P: S) (2:2:0:0)	**Credits (2:2:0:0)**	**SEE Marks**	**50**
Total Hours of Pedagogy	**40 hours**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course objectives:

The goal of the course Transform Calculus, Fourier series and Numerical techniques -21MAT 31 is

- To have an insight into solving ordinary differential equations by using Laplace transform techniques
- Learn to use the Fourier series to represent periodical physical phenomena in engineering analysis.
- To enable the students to study Fourier Transforms and concepts of infinite Fourier Sine and Cosine transforms and to learn the method of solving difference equations by the z-transform method.
- To develop proficiency in solving ordinary differential equations arising in engineeringapplications, using numerical methods.
- To understand the method of solving the variational problems.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various courseoutcomes.

1. In addition to the traditional lecture method, different types of innovative teaching methods maybe adopted so that the delivered lessons shall develop students theoretical and applied mathematical skills.
2. State the need for Mathematics with Engineering Studies and Provide real-life examples.
3. Support and guide the students for self–study.
4. You will also be responsible for assigning homework, grading assignments and quizzes,and documenting students' progress.
5. Encourage the students for group learning to improve their creative and analytical skills.
6. Show short related video lectures in the following ways:
   - As an introduction to new topics (pre-lecture activity).
   - As a revision of topics (post-lecture activity).
   - As additional examples (post-lecture activity).
   - As an additional material of challenging topics (pre-and post lecturer activity).
   - As a model solution of some exercises (post-lecture activity).

Module-1

Laplace Transform: Definition and Laplace transforms of elementary functions (statements only). Problems on Laplace's Transform of $e^{at}f(t)$, $t^n f(t)$, $\frac{f(t)}{t}$. Laplace transforms of Periodic functions (statement only) and unit-step function – problems.

Inverse Laplace transforms definition and problems, Convolution theorem to find the inverse Laplace transforms (without Proof) problems. Laplace transforms of derivatives, solution of differential equations. **08 Hours**

Self-study: Solution of simultaneous first-order differential equations.

[Text 1:21.1, 21.2, 21.3, 21.4, 21.5, 21.7, 21.9, 21.10,21.12, 21.14, 21.15, 21.17]

(RBT Levels: L1, L2 and L3)

Module-2

Fourier Series: Introduction to infinite series, convergence and divergence. Periodic functions, Dirichlet's condition. Fourier series of periodic functions with period 2π and arbitrary period. Half range Fourier series. Practical harmonic analysis. **08 Hours**

Self-study: Convergence of series by D' Alembert's Ratio test and, Cauchy's root test.

[Text 1: 9.3, 10.1, 10.2, 10.3, 10.4, 10.5, 10.6, 10.7, 10.11]

(RBT Levels: L1, L2 and L3)

Module-3

Infinite Fourier Transforms: Infinite Fourier transforms definition, Fourier sine and cosine transforms. Inverse Fourier transforms, Inverse Fourier cosine and sine transforms. Problems.

Z-Transforms: Difference equations, z-transform-definition, Standard z-transforms, Damping and shifting rules, Problems. Inverse z-transform and applications to solve difference equations. **08 Hours**

Self Study: Initial value and final value theorems, problems.

[Text 1: 22.1, 22.2, 22.4, 22.5, 23.1, 23.2, 23.3, 23.5, 23.6, 23.7, 23.15, 23.16, 31.1, 31.2]

(RBT Levels: L1, L2 and L3)

Module-4

Numerical solutions of simultaneous first order differential equations: Picards method, Taylor's series method and Runge-Kutta method. (No derivations of formulae).

Second-order differential equations: Runge-Kutta method and Milne's predictor and Corrector method. (No derivations of formulae). **08 Hours**

Self Study: Solution of Laplace's equation using standard five-point formula.

[Text 1: 32.1, 32.11, 32.12. Text 2: 21.3]

(RBT Levels: L1, L2 and L3)

Module-5

Calculus of Variations: Functionals, Euler's equation, Problems on externals of functional. Geodesics on a plane, Variational problems. **08 Hours**

Self Study: Hanging chain problem**.**

[Text 1: 35.1, 35.2, 35.3, 35.4, 35.5]

(RBT Levels: L1, L2 and L3)

Teaching-Learning Process for all modules	**Chalk and Talk/PowerPoint presentation/YouTube videos.**

Course Outcomes:

After successfully completing the course, the students will be able

1. To solve ordinary differential equations using Laplace transform.
2. Demonstrate the Fourier series to study the behaviour of periodic functions and their applicationsin system communications, digital signal processing and field theory.
3. To use Fourier transforms to analyze problems involving continuous-time signals and toapply Z-Transform techniques to solve difference equations
4. To solve mathematical models represented by initial or boundary value problems involving ordinarydifferential equations

5. Determine the externals of functionals using calculus of variations and solve problems Arising indynamics of rigid bodies and vibrational analysis.

Assessment Details (both CIE and SEE)

Component		Weightage (%)	
CIE's	CIE 1- At the end of 5th week	20	60
	CIE 2 - At the end of 10th week	20	
	CIE 3 - At the end of 15th week	20	
AA's	AAT-1- At the end of 4th week	10	40
	AAT-2- At the end of 9th week	10	
	AAT-3- At the end of 13th week	20	
Continuous Internal Evaluation Total Marks: 100. Reduced to 50 Marks			
Semester End Examination (SEE) Total Marks: 100. Reduced to 50 Marks			

Suggested Learning Resources:

Text Books:

1. **B. S. Grewal**: "Higher Engineering Mathematics", Khanna publishers, 44th Ed.2018.
2. **E. Kreyszig**: "Advanced Engineering Mathematics", John Wiley & Sons, 10th Ed. (Reprint), 2016.

Reference Books:

1. **B.V. Ramana:** "Higher Engineering Mathematics" McGraw-Hill Education, 11th Ed.
2. **Srimanta Pal & Subodh C.** Bhunia: "Engineering Mathematics" Oxford University Press,3rd Reprint, 2016.
3. **N.P Bali and Manish Goyal**: "A textbook of Engineering Mathematics" Laxmi **Publications, Latest edition.**
4. **C. Ray Wylie, Louis C. Barrett:** "Advanced Engineering Mathematics" McGraw – Hill Book Co.Newyork, Latest ed.
5. **Gupta C.B, Sing S.R and Mukesh Kumar:** "Engineering Mathematic for Semester I andII", Mc-Graw Hill Education(India) Pvt. Ltd 2015.
6. **H.K.Dass and Er. Rajnish Verma:** "Higher Engineering Mathematics" S.Chand Publication (2014).
7. **James Stewart: "**Calculus" Cengage publications, 7th edition, 4th Reprint 2019.

E-Resources:

- http://.ac.in/courses.php?disciplineID=111
- http://www.class-central.com/subject/math(MOOCs)
- http://academicearth.org/
- VTU e-Shikshana Program
- VTU EDUSAT Program

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- **Quizzes**
- Assignments
- **Seminars**

CO- PO Mapping :

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
21MAT31.1	3	1										
21MAT31.2	3	3										
21MAT31.3	3	2										
21MAT31.4	3	3										
21MAT31.5	2	2										

DATA STRUCTURES AND ITS APPLICATIONS			
Course Code	**21CDI32 (IC)**	**CIE Marks**	**50**
Teaching Hours/Week (L: T: P: S) (3:0:2:0)	**Credits (3:0:1:0)**	**SEE Marks**	**50**
Total Hours of Pedagogy	**40 hours Theory + 13 Lab slots**	**Total Marks**	**100**
Credits	**04**	**ExamHours**	**03**

Prerequisites:

Basics of C Language, Computer basics, Number System.

Course objectives:

This course will enable students to:

CLO 1. Explain the fundamentals of data structures and their applications essential for implementing solutions to problems.

CLO 2. Illustrate representation of data structures: Stack, Queues, Linked Lists, Trees and Graphs.

CLO 3. Design and Develop Solutions to problems using Arrays, Structures, Stack, Queues, Linked Lists.

CLO 4. Explore usage of Trees and Graph for application development.

CLO 5. Apply the Hashing techniques in mapping key value pairs.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

- Lecture method (L) does not mean only traditional lecture method, but a different type of teaching methods may be adopted to develop the outcomes.
- Show Video/animation films to explain the different concepts of Linear Algebra & Signal Processing.
- Encourage collaborative (Group) Learning in the class.
- Ask at least three HOTS (Higher Order Thinking) questions in the class, which promotes critical thinking.
- Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
- Topics will be introduced in a multiple representation.
- Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
- Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.
- Adopt Flipped class technique by sharing the materials / Sample Videos prior to the class and have discussions on the that topic in the succeeding classes.
- Give Programming Assignments.

Module-1
Introduction: Data Structures, Classifications (Primitive & Non-Primitive), Data structure operations (Traversing, inserting, deleting, searching, and sorting). Review of Arrays. Structures: Array of structures Self-Referential Structures. Dynamic Memory Allocation Functions. Representation of Linear Arrays in Memory, dynamically allocated arrays and Multidimensional Arrays**.** **Textbook 1: Chapter 1: 1.2, Chapter 2: 2.2 - 2.7, Text Textbook 2: Chapter 1: 1.1 - 1.4, Chapter 3: 3.1 - 3.3, 3.5, 3.7, Chapter 4: 4.1 - 4.9, 4.14 Textbook 3: Chapter 1: 1.3 08 Hours**
Module-2
Stacks: Definition, Stack Operations, Array Representation of Stacks, Stacks using Dynamic Arrays. Different representation of expression. Stack Applications: Infix to postfix conversion, Infix to prefix conversion, evaluation of postfix expression, recursion. **Queues:** Definition, Array Representation of Queues, Queue Operations, Circular Queues, Queues and Circular queues using Dynamic arrays. **Textbook 1: Chapter 3: 3.1 -3.4, 3.6 Textbook 2: Chapter 6: 6.1 -6.4, 6.5, 6.7-6.13 08 Hours**
Module-3
Linked Lists: Definition, classification of linked lists. Representation of different types of linked lists in Memory, Traversing, Insertion, Deletion, Searching, Sorting, and Concatenation Operations on Singly linked list, Doubly Linked lists, Circular linked lists. Linked Stacks and Queues**.** **Textbook 1: Chapter 4: 4.1 – 4.4, 4.5.2, 4.7, 4.8, Textbook 2: Chapter 5: 5.1 – 5.9 08 Hours**
Module-4
Trees 1: Terminologies, Binary Trees, Properties of Binary trees, Array and linked Representation of Binary Trees, Binary Tree Traversals - Inorder, postorder, preorder; Threaded binary trees, Binary Search Trees – Definition, Insertion, Deletion, Traversal, and Searching operation on Binary search tree. Application of Trees-Evaluation of Expression. **Textbook 1: Chapter 5: 5.1 –5.5, 5.7; Textbook 2: Chapter 7: 7.1 – 7.9 08 Hours**
Module-5
Trees 2: AVL tree, Red-black tree, Splay tree, B-tree. **Graphs:** Definitions, Terminologies, Matrix and Adjacency List Representation of Graphs, Traversal methods: Breadth First Search and Depth First Search. **Hashing:** Hash Table organizations, Hashing Functions, Static and Dynamic Hashing. **Textbook 1: Chapter 10:10.2, 10.3, 10.4, Textbook 2:7.10 – 7.12, 7.15 Chapter 11: 11.2, Textbook 1: Chapter 6 : 6.1–6.2, Chapter 8 : 8.1-8.3, Textbook 2: 8.1 – 8.3, 8.5, 8.7,** **Textbook 3: Chapter 15:15.1, 15.2,15.3, 15.4,15. 08 Hours**

Teaching-Learning Process for all modules	**Chalk and Talk, Power point presentation, flip teaching, YouTube videos**

PRACTICAL COMPONENTS

Sl. No	Experiments
1	Design, Develop and Implement a menu driven Program in C for the following Arrayoperations a. Inserting an Element (ELEM) at a given valid Position (POS) b. Deleting an Element at a given valid Position POS) c. Display of Array Elements Exit. d. Support the program with functions for each of the above operations

2	Design, Develop and Implement a menu driven Program in C for the following operations on STACK of Integers (Array Implementation of Stack with maximum sizeMAX) a. *Push* an Element on to Stack b. *Pop* an Element from Stack c. Demonstrate *Overflow* and *Underflow* situations on Stack d. Display the status of Stack e. Exit Support the program with appropriate functions for each of the above operations
3	Singly Linked List (SLL) of Integer Da a. Create a SLL stack of N integer. b. Display of SLL c. Perform Linear search. d.Create a SLL queue of N Students Data Concatenation of two SLLof integers
4	Design, Develop and Implement a menu driven Program in C for the following operations on Doubly Linked List (DLL) of Professor Data with the fields: ID, Name, Branch, Area of specialization a. Create a DLL stack of N Professor's Data b. Create a DLL queue of N Professor's Data c. Display the status of DLL and count the number of nodes in it
5	Given an array of elements, construct a complete binary tree from this array in level order fashion. That is, elements from left in the array will be filled in the tree level wise starting from level 0. Ex: Input : arr[] = {1, 2, 3, 4, 5, 6} Output : Root of the following tree1 / \ 2 3 / \ /\ 4 5 6
6	Design, Develop and Implement a menu driven Program in C for the following operations on Binary Search Tree (BST) of Integers a. Create a BST of N Integers b Traverse the BST in In order, Preorder and Post Order
7	Design, Develop and implement a program in C for the following operations on Graph (G) of cities a. Create a Graph of N cities using Adjacency Matrix. b. Print all the nodes reachable from a given starting node in a diagraph using DFS/BFS method.
8	Design and develop a program in C that uses Hash Function H:K->L as H(K)=K mod m(reminder method) and implement hashing technique to map a given key K to the address space L. Resolve the collision (if any) using linear probing.

Course Outcomes

At the end of the course the student will be able to:

CO 1. Identify different data structures and their applications.

CO 2. Apply stack and queues in solving problems.

CO 3. Demonstrate applications of linked list.

CO 4. Explore the applications of trees and graphs to model and solve the real-world problem.
CO 5. Make use of Hashing techniques and resolve collisions during mapping of key value pairs

Assessment Details (both CIE and SEE)

Component		Weightage (%)		
CIE's	CIE 1 5th week	20	60	Average of 3 tests for 20 marks
	CIE 2 10th week	20		
	CIE 3 15th week	20		
AAT's	AAT-1 10th week			10
	Lab Test	30		Reduced to 10
	Lab Record	20		10
Continuous Internal Evaluation Total Marks :100. Reduced to 50 Marks				
Semester End Examination (SEE) Total Marks :100. Reduced to 50 Marks				

Suggested Learning Resources:

Text Books:

1. Ellis Horowitz and Sartaj Sahni, Fundamentals of Data Structures in C, 2nd Ed, UniversitiesPress,2014.
2. Seymour Lipschutz, Data Structures Schaum's Outlines, Revised 1st Ed, McGraw Hill, 2014.
3. Reema Thareja, Data Structures using C, 3rd Ed, Oxford press, 2012.

Reference Books:

1. Gilberg and Forouzan, Data Structures: A Pseudo-code approach with C, 2nd Ed, CengageLearning,2014.
2. Jean-Paul Tremblay & Paul G. Sorenson, An Introduction to Data Structures withApplications,2nd Ed, McGraw Hill, 2013
3. A M Tenenbaum, Data Structures using C, PHI, 1989
4. Robert Kruse, Data Structures and Program Design in C, 2nd Ed, PHI, 1996

E-Resources:

1.http://elearning.vtu.ac.in/econtent/courses/video/CSE/06CS35.html

2.https://nptel.ac.in/courses/106/105/106105171/

3. http://www.nptelvideos.in/2012/11/data-structures-and-algorithms.html

CO- PO Mapping :

POS / **COs**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2							1			2	1		1
CO2	2	2	3	3	2				1			2	3		2
CO3	2	2	3	3	2				1			3	3		2
CO4	2	2	3	3	2				1			3	3		3
CO5	2	2	2	2	1				1			3	2		1
Average	2.2	2	2.75	2.75	1.75				1			2.6	2.4		1.8

DATABASE CONCEPTS USING SQL (IC)			
Course Code	**21CDI33 (IC)**	**CIE Marks**	**50**
Teaching Hours/Week (L: T: P: S)(3:0:2:0)	**Credits (3:0:1:0)**	**SEE Marks**	**50**
Total Hours of Pedagogy	**40 hours Theory + 13 Labslots**	**Total Marks**	**100**
Credits	**4**	**Exam Hours**	**03**

Prerequisites:

File System, Data Structures, Programming on files.

Course objectives:

This course will enable students to:

CLO 1. Provide a strong foundation in database concepts, technology, and practice.

CLO 2. Practice SQL programming through a variety of database problems.

CLO 3. Demonstrate the use of concurrency and transactions in database

CLO 4. Design and build database applications for real world problems.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer methods (L) need not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem with different circuits/logic and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

Introduction to Databases: Introduction, Characteristics of database approach, Advantages of using the DBMS approach, History of database applications.

Overview of Database Languages and Architectures: Data Models, Schemas, and Instances. Three schema architecture and data independence, database languages, and interfaces, The Database System environment.

Conceptual Data Modelling using Entities and Relationships: Entity types, Entity sets, attributes, roles, and structural constraints, Weak entity types, ER diagrams, Examples

Textbook 1: Ch 1.1 to 1.8, 2.1 to 2.6, 3.1 to 3.7 **08 Hours**

Module-2

Relational Model: Relational Model Concepts, Relational Model Constraints and relational database schemas, Update operations, transactions, and dealing with constraint violations.

Relational Algebra: Unary and Binary relational operations, additional relational operations (aggregate, grouping, etc.) Examples of Queries in relational algebra.

Mapping Conceptual Design into a Logical Design: Relational Database Design using ER-to-Relational mapping.

Textbook 1:, Ch 5.1 to 5.3, 6.1 to 6.5, 7.1; 08 Hours

Module-3

SQL: SQL data definition and data types, specifying constraints in SQL, retrieval queries in SQL, INSERT, DELETE, and UPDATE statements in SQL, Additional features of SQL.

Advances Queries: More complex SQL retrieval queries, Specifying constraints as assertions and action triggers, Views in SQL, Schema change statements in SQL.

Database

Application Development: Accessing databases from applications, An introduction to JDBC, JDBC classes and interfaces, SQLJ, Stored procedures, Case study: The internet Bookshop.

Textbook 1: Ch 8.1 to 8.8; Textbook 2: 6.1 to 6.6; 08 Hours

Module-4

Normalization: Database Design Theory – Introduction to Normalization using Functional and Multivalued Dependencies: Informal design guidelines for relation schema, Functional Dependencies, Normal Forms based on Primary Keys, Second and Third Normal Forms, Boyce-Codd Normal Form, Multivalued Dependency and Fourth Normal Form, Join Dependencies and Fifth Normal Form. Examples on normal forms.

Normalization Algorithms: Inference Rules, Equivalence, and Minimal Cover, Properties of Relational Decompositions, Algorithms for Relational Database Schema Design, Nulls, Dangling tuples, and alternate Relational Designs, Further discussion of Multivalued dependencies and 4NF, Other dependencies and Normal Forms

Textbook 1: Ch 10.1 to -10.5, 11.1 to 11.6 08 Hours

Module-5

Transaction Processing: Introduction to Transaction Processing, Transaction and System concepts, Desirable properties of Transactions, Characterizing schedules based on recoverability, Characterizing schedules based on Serializability, Transaction support in SQL.

Concurrency Control in Databases: Two-phase locking techniques for Concurrency control, Concurrency control based on Timestamp ordering, Multiversion Concurrency control techniques, Validation Concurrency control techniques, Granularity of Data items and Multiple Granularity Locking.

Textbook 1: Ch 17.1 to 17.6, 18.1 to 18.5; 08 Hours

Teaching-Learning Process for all modules	**Chalk and Talk, Power point presentation, Active Learning Demonstration, problem based learning**

PRACTICAL COMPONENTS

Sl. No	**Experiments**
1	Design, develop, and implement the specified queries for the following problems using Oracle, MySQL, MS SQL Server, or any other DBMS under LINUX/Windows environment. Create Schema and insert at least 5 records for each table. Add appropriate database constraints. Demonstrating creation of tables, applying the view concepts on the tables.

	Program: Consider the following schema for a Library Database: **BOOK (Book_id, Title, Publisher_Name, Pub_Year)** **BOOK_AUTHORS(Book_id, Author_Name)** **PUBLISHER(Name, Address, Phone)** **BOOK_COPIES (Book_id, Programme_id, No-of_Copies)** **BOOK_LENDING (Book_id, Programme_id, Card_No, Date_Out, Due_Date)** **LIBRARY_PROGRAMME(Programme_id, Programme_Name, Address)** 1. Write ER Diagram for following tables. 2. Write SQL queries to Retrieve details of all books in the library – id, title, name of publisher, authors, number of copies in each Programme, etc. 3. Write SQL queries to Get the particulars of borrowers who have borrowed more than 3 books, but from Jan 2017 to Jun 2017. 4. Write SQL queries to Delete a book in BOOK table. Update the contents of other tables to reflect this data manipulation operation. 5. Write SQL queries to Partition the BOOK table based on year of publication. Demonstrate its working with a simple query. 6. Write SQL queries to Create a view of all books and its number of copies that are currently available in the Library. Reference: https://www.youtube.com/watch?v=AaSU-AOguls https://www.youtube.com/watch?v=-EwEvJxS-Fw
2	Design, develop, and implement the specified queries for the following problems using Oracle, MySQL, MS SQL Server, or any other DBMS under LINUX/Windows environment. Create Schema and insert at least 5 records for each table. Add appropriate database constraints. Discuss the various concepts on constraints and update operations. Program: Consider the following schema for Order Database: **SALESMAN(Salesman_id, Name, City, Commission)** **CUSTOMER(Customer_id, Cust_Name, City, Grade, Salesman_id)** **ORDERS(Ord_No, Purchase_Amt, Ord_Date, Customer_id, Salesman_id)** Write SQL queries to Count the customers with grades above Bangalore's average. 1. Find the name and numbers of all sales an who had more than one customer. 2. List all the salesman and indicate those who have and don't have customers in their cities (Use UNION operation.) 3. Create a view that finds the salesman who has the customer with the highest order of a day. 4. Demonstrate the DELETE operation by removing salesman with id 1000. All his orders must also be deleted. Reference: https://www.youtube.com/watch?v=AA-KL1jbMeY https://www.youtube.com/watch?v=7S_tz1z_5bA
3	Design, develop, and implement the specified queries for the following problems using Oracle, MySQL, MS SQL Server, or any other DBMS under LINUX/Windows environment. Create Schema and insert at least 5 records for each table. Add appropriate database constraints. Demonstrate the concepts of JOIN operations. Program: Consider the schema for Movie Database:

	ACTOR(Act_id, Act_Name, Act_Gender) **DIRECTOR(Dir_id, Dir_Name, Dir_Phone)** **MOVIES(Mov_id, Mov_Title, Mov_Year, Mov_Lang, Dir_id) MOVIE_CAST(Act_id, Mov_id, Role)** **RATING(Mov_id, Rev_Stars)** Write SQL queries to 1. List the titles of all movies directed by 'Hitchcock'. 2. Find the movie names where one or more actors acted in two or more movies. 3. List all actors who acted in a movie before 2000 and also in a movie after 2015(use JOIN operation). 4. Find the title of movies and number of stars for each movie that has at least one rating and find the highest number of stars that movie received. Sort the result by movie title. 5. Update rating of all movies directed by 'Steven Spielberg' to 5. Reference: https://www.youtube.com/watch?v=hSiCUNVKJAo https://www.youtube.com/watch?v=Eod3aQkFz84
4	Design, develop, and implement the specified queries for the following problems using Oracle, MySQL, MS SQL Server, or any other DBMS under LINUX/Windows environment. Create Schema and insert at least 5 records for each table. Add appropriate database constraints. Demonstrate the core concepts on table like nested and correlated nesting queries and also EXISTS and NOT EXISTS keywords. Program: Consider the schema for Company Database: **EMPLOYEE(SSN, Name, Address, Sex, Salary, SuperSSN, DNo)** **DEPARTMENT(DNo, DName, MgrSSN, MgrStartDate)** **DLOCATION(DNo,DLoc)** **PROJECT(PNo, PName, PLocation, DNo)** **WORKS_ON(SSN, PNo, Hours)** Write SQL queries to 1. Make a list of all project numbers for projects that involve an employee whose last name is 'Scott', either as a worker or as a manager of the department that controls the project. 2. Show the resulting salaries if every employee working on the 'IoT' project is given a 10 percent raise. 3. Find the sum of the salaries of all employees of the 'Accounts' department, as well as the maximum salary, the minimum salary, and the average salary in this department 4. Retrieve the name of each employee who works on all the projects controlled by department number 5 (use NOT EXISTS operator). 5. For each department that has more than five employees, retrieve the department number and the number of its employees who are making more than Rs.6,00,000. **Reference:** https://www.youtube.com/watch?v=Dk8f3ejqKts
5	**Mini project:** For any problem selected, make sure that the application should have five or more tables. Indicative areas include: Organization, health care, Ecommerce etc.

Course Outcomes

At the end of the course the student will be able to:

- CO 1. Identify, analyze and define database objects, enforce integrity constraints on a database using RDBMS

- CO 2. Use Structured Query Language (SQL) for database manipulation and also demonstrate the basic of query evaluation.
- CO 3. Design and build simple database systems and *relate* the concept of transaction, concurrency control and recovery in database
- CO 4. Develop application to interact with databases, relational algebra expression.
- CO 5. Develop applications using tuple and domain relation expression from queries.

Assessment Details (both CIE and SEE)

Component		Weightage (%)		
CIE's	CIE 1 5th week	20	60	Average of 3 tests for 20 marks
	CIE 2 10th week	20		
	CIE 3 15th week	20		
AAT's	AAT-1 10th week			10
	Lab Test	30		Reduced to 10
	Lab Record	20		10
Continuous Internal Evaluation Total Marks :100. Reduced to 50 Marks				
Semester End Examination (SEE) Total Marks :100. Reduced to 50 Marks				

Suggested Learning Resources:

Text Books:

1. Fundamentals of Database Systems, Ramez Elmasri and Shamkant B. Navathe, 7th Edition, 2017,Pearson.
2. Database management systems, Ramakrishnan, and Gehrke, 3rd Edition, 2014, McGraw Hill

Reference Books:

E-Resources:

1. https://www.youtube.com/watch?v=3EJlovevfcA
2. https://www.youtube.com/watch?v=9TwMRs3qTcU
3. https://www.youtube.com/watch?v=ZWl0Xow304I
4. https://www.youtube.com/watch?v=4YilEjkNPrQ
5. https://www.youtube.com/watch?v=CZTkgMoqVss
6. https://www.youtube.com/watch?v=Hl4NZB1XR9c
7. https://www.youtube.com/watch?v=EGEwkad_llA
8. https://www.youtube.com/watch?v=t5hsV9lC1rU

CO- PO Mapping :

CO Identification No.	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3										1	3		
CO 2	2	2	3	1	2							1	3		2
CO 3	2	2	3	2	1							1	2		2
CO4	2	2	3	2	1							1	2		2
CO5	2	2	3	1	2							1	3		2
Average	2.2	2.2	3	1.5	1.5							1	2.6		2

FOUNDATION OF DATA SCIENCE			
Course Code	**21CDT34**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P: S)	**3:0:0:0**	**SEE Marks**	**50**
Total Hours of Pedagogy	**40**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Prerequisites:

Machine Learning, Data Structures, Database, Bigdata.

Course Learning Objectives

This course will enable students to:

1. Provide a strong foundation for data science and application areas related to it.
2. Learn the process of working with data on large scale.
3. Explore the concepts of Data Processing.
4. Learn basic concepts of Machine Learning.
5. Prepare students for advanced courses in Data Science

Teaching-Learning Process (General Instructions)

These are sample Strategies; which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) need not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, andanalyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem with different circuits/logic and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

Introduction to Data Science: Importance of data Science-Need for Data Science, What is Data Science? Data Science Process, prerequisites for data science, Components of Data Science, Tools and Skills needed.

Statistics: Data Types, Variable Types, Statistics, Sampling Techniques, Information gain and Entropy. **08 Hours**

[Text Book1:1(1.1,1.2,1.3,1.5,1.6,1.7),2(2.1,2.2,2.3,2.4,2.5)].

Module-2

Probability: Probability Theory, Probability types, Probability Distribution Functions, Bayes Theorem.

Data Modeling and Analytics: Data Science Methodology-Analytics for data science, Example of Data Analytics, Data Analytics Life Cycle-Data Discovery, Data Preparation, Model Planning, Model Building, Communicate Results, Operationalization. **08 Hours**

[Text Book1:2(2.6,2.7,2.8,2.9),4(4.1,4.2,4.3)

Module-3

Machine learning –Designing a Learning System, Perspective and Issues in Machine Learning, Supervised learning, Unsupervised learning, Semi- supervised learning, Reinforcement Learning, Role of Machine Learning in Data Science, Data Science vs Machine Learning. **08 Hours**
[Text Book2:1.2(1.2.1,1.2.2,1.2.3,1.2.4,1.2.5),
https://www.geeksforgeeks.org/data-science-vs-machine-learning
https://www.zucisystems.com/blog/what-is-the-role-of-machine-learning-in-data-science

Module-4

Databases for Data Science – SQL-for Data Science, Basic Statistics with SQL, Data Wrangling, Filtering, Joins, Aggregation, Advanced No SQL for Data Science, Document Databases for Data science, Wide Column Databases for Data science, Graph Databases for Data Science. **08 Hours**
TextBook1:3.1(3.1.1,3.1.2,3.1.3), 3.2(3.2.1,3.2.2,3.2.3,3.2.4).

Module-5

Data Analytics and Text Mining: What is Text Mining?, Process of Text Mining, Difference between Text Mining and Data Mining, Major Text Mining Areas, Text Analytics, Text Analytics Steps, Basic Text Analytics Steps.
Introduction to NLP: Introduction, Major Components of NLP, Stages of NLP, Statistical Processing of NLP, Applications of NLP. **08 Hours**
TextBook1:6.1(6.1.1,6.1.1.1,6.1.1.2,6.1.1.3),6.2(6.2.1,6.2.2),6.3(6.3.1,6.3.2,6.3.3,6.3.4)

Teaching-Learning Process for all modules	Chalk and board, Active Learning, PPT Based presentation, Video

Course Outcomes
At the end of the course the student will be able to :

1: Understand the fundamental concepts of data science

2: Evaluate the data analysis techniques for applications handling large data and Demonstrate the datascience process.

3: Understand concept of machine learning used in the data science process.

4: Visualize and present the inference using various tools.

5: Learn to think through the ethics surrounding privacy, data sharing.

Assessment Details (both CIE and SEE)

Component		**Weightage (%)**	
CIE's	CIE 1 5th week	20	60
	CIE 2 10th week	20	
	CIE 3 15th week	20	
AAT's	AAT-1 10th week	10	
	AAT-2	10	
	AAT-3	20	
Continuous Internal Evaluation Total Marks: 100. Reduced to 50 Marks			
Semester End Examination (SEE) Total Marks: 100. Reduced to 50 Marks			

Suggested Learning Resources:

Text Books:

1. Fundamentals of Data Science**,** Sanjeev J. Wagh, Manisha S. Bhende, and Anuradha D. Thakare, First edition published 2022 by CRC Press.
2. Machine Learning, Tom Mitchell, McGraw Hill, 1997.

E-Resources

1. https://www.geeksforgeeks.org/data-science-vs-machine-learning
2. **https://www.zucisystems.com/blog/what-is-the-role-of-machine-learning-in-data-science**

CO- PO Mapping :

Pos / COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO1	PSO2	PSO3
COs	3	2	1	2	2						3	1	**2**	**--**	**3**
CO 2	2	3	2	2	1						2	1	**--**	**3**	**2**
CO 3	3	2	3	3	2						2	1	**--**	**3**	**2**
CO 4	1	3	2	1	2			3		3	3	1	**2**	**--**	**2**
CO 5	2	2	2	1	3			3		3	2	1		**2**	**3**

OBJECT ORIENTED PROGRAMMING WITH JAVA LABORATORY			
Course Code	**21CDL35**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P: S)	**0:0:2:0**	**SEE Marks**	**50**
Total Hours of Pedagogy	**24**	**Total Marks**	**100**
Credits	**1**	**Exam Hours**	**03**

Prerequisites:

C Programming Knowledge, Computer Basics, Data Structures**.**

Course Objectives:

CLO 1. Demonstrate the use of Eclipse/Netbeans IDE to create Java Applications.
CLO 2. Using java programming to develop programs for solving real-world problems.
CLO 3. Reinforce the understanding of basic object-oriented programming concepts.

	Note: two hours tutorial is suggested for each laboratory sessions.
	Prerequisite
	□ Students should be environment. □ Usage of IDEs like Eclipse/Netbeans should be introduced.
Sl. No.	***PART A – List of problems for which student should develop program and execute in the Laboratory***
1	Aim: Introduce the java fundamentals, data types, operators in java Program: Write a java program that prints all real solutions to the quadratic equation ax2+bx+c=0. Read in a, b, c and use the quadratic formula.
2	Aim: Demonstrating creation of java classes, objects, constructors, declaration and initialization of variables. Program: Create a Java class called **Student** with the following details as variables within it. USN Name Branch Phone Write a Java program to create n Student objects and print the USN, Name, Branch, and Phone of these objects with suitable headings.
3	Aim: Discuss the various Decision-making statements, loop constructs in java Program: A. Write a program to check prime number B. Write a program for Arithmetic calculator using switch case menu
4	Aim: Demonstrate the core object-oriented concept of Inheritance, polymorphism Design a super class called **Staff** with details as StaffId, Name, Phone, Salary. Extend this class by writing three subclasses namely Teaching (domain, publications), Technical (skills), and Contract (period). Write a Java program to read and display at least 3 staff objects of all three categories.
5	Aim: Introduce concepts of method overloading, constructor overloading, overriding. Program: Write a java program demonstrating Method overloading and Constructor overloading.

6	Aim: Introduce the concept of Abstraction, packages. Program: Develop a java application to implement currency converter (Dollar to INR, EURO to INR, Yen to INR and vice versa), distance converter (meter to KM, miles to KM and vice versa), time converter (hours to minutes, seconds and vice versa) using packages.
7	Aim: Introduction to abstract classes, abstract methods, and Interface in java
	Program: Write a program to generate the resume. Create 2 Java classes Teacher (data: personal information, qualification, experience, achievements) and Student (data: personal information, result, discipline) which implements the java interface Resume with the method biodata().
8	Aim: Demonstrate creation of threads using Thread class and Runnable interface, multi- threaded programming. Program: Write a Java program that implements a **multi-thread** application that has three threads. First thread generates a random integer for every 1 second; second thread computes the square of the number and prints; third thread will print the value of cube of the number.
9	Aim: Introduce java Collections. Program: Write a program to perform string operations using Array List. Write functions for the following a. Append - add at end b. Insert – add at particular index c. Search d. List all string starts with given letter.
10	Aim: Exception handling in java, introduction to throwable class, throw, throws, finally. Program: Write a Java program to read two integers a and b. **Compute** a/b and print, when b is not zero. Raise an exception when b is equal to zero.
11	Aim: Introduce File operations in java. Program: Write a java program that reads a file name from the user, displays information about whether the file exists, whether the file is readable, or writable, the type of file and the length of the file in bytes
12	Aim: Introduce java Applet, awt, swings. Programs: Develop an applet that displays a simple message in center of the screen. Develop a simple calculator using Swings.
	PART B – Practical Based Learning
01	A problem statement for each batch is to be generated in consultation with the co-examiner and student should develop an algorithm, program and execute the program for the given problem with appropriate outputs.

Course Outcome (Course Skill Set)
At the end of the course the student will be able to:

CO 1. Use Eclipse/NetBeans IDE to design, develop, debug Java Projects.
CO 2. Analyze the necessity for Object Oriented Programming paradigm over structured programming and become familiar with the fundamental concepts in OOP.
CO 3. Demonstrate the ability to design and develop java programs, analyze, and interpret object-oriented data and document results.

CO 4. Apply the concepts of multiprogramming, exception/event handling, abstraction to develop robust programs.
CO 5. Develop user friendly applications using File I/O and GUI concepts.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is

50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. The student has to secure not less than 35% (18 Marks out of 50) in the semester-end examination (SEE).

Continuous Internal Evaluation (CIE):

CIE marks for the practical course is **50 Marks**.

The split-up of CIE marks for record/ journal and test are in the ratio **60:40**.

Each experiment to be evaluated for conduction with observation sheet and record write-up.

Rubrics for the evaluation of the journal/write-up for hardware/software experiments designed by the faculty who is handling the laboratory session and is made known to students at the beginning of the practical session.

Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.

Total marks scored by the students are scaled downed to 30 marks (60% of maximum marks).

Weightage to be given for neatness and submission of record/write-up on time.

Department shall conduct 02 tests for 100 marks, the first test shall be conducted after the 8th week of the semester and the second test shall be conducted after the 14th week of the semester.

- In each test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability.
- Rubrics suggested in Annexure-II of Regulation book
- The average of 02 tests is scaled down to **20 marks** (40% of the maximum marks).
- The Sum of scaled-down marks scored in the report write-up/journal and average marks of two tests is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

SEE marks for the practical course is 50 Marks.

SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the University

All laboratory experiments are to be included for practical examination.

(Rubrics) Breakup of marks and the instructions printed on the cover page of the answer scriptto be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.

Students can pick one question (experiment) from the questions lot prepared by the internal /external examiners jointly.

Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.

Weightage of marks for PART A is 80% and for PART B is 20%. General rubrics suggested to be followed for part A and part B.

Change of experiment is allowed only once and Marks allotted to the procedure part to be made zero (Not allowed for Part B).

The duration of SEE is 03 hours

Rubrics suggested in Annexure-II of Regulation book

Suggested Learning Resources:

1. E Balagurusamy, Programming with Java, Graw Hill, 6th Edition, 2019.
2. Herbert Schildt, C: Java the Complete Reference, Mc Graw Hill, 11th Edition, 2020

CO- PO Mapping :

POS / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C211.1	2	3	2	1	-	-	-	-	-	-	-	2	2	2	1
C211.2	2	3	2	2	-	-	-	-	-	-	-	2	3	2	2
C211.3	1	2	3	1	-	-	-	-	-	-	-	1	2	3	3
C211.4	1	2	3	2	3	-	-	-	3	2	1	1	1	2	1
C211.5	1	2	3	2	3	-	-	-	3	2	1	1	2	1	1

SOCIAL CONNECT & RESPONSIBILITIES

Course Code	**21UHV36**	**CIE Marks**	**50**
Teaching Hours week (L:T:P:S)	**100**	**SEE Marks**	**50**
Total Hours of Pedagogy	**15**	**Total Marks**	**100**
Credits	**01**	**Exam Hours**	**03**

Prerequisites:

Society, Constitution, Ethics, Environment.

Objectives: The Course will

- Enable the student to do a deep drive into societal challenges being addressed by NGO(s), social enterprises & The government and build solutions to alleviate these complex social problems through immersion, design & technology.
- Provide a formal platform for students to communicate and connect to their surroundings.
- Enable to create of a responsible connection with society.

Learning Outcomes: The students are expected to have the ability to :

1. Understand social responsibility
2. Practice sustainability and creativity
3. Showcase planning and organizational skills

Contents:

The course is mainly activity-based that will offer a set of activities for the student that enables them to connect with fellow human beings, nature, society, and the world at large. The course will engage students in interactive sessions, open mic, reading groups, storytelling sessions, and semester-long activities conducted by faculty mentors. In the following a set of activities planned for the course have been listed.

Module-I

Plantation and adoption of a tree: Plantation of a tree that will be adopted for four years by a group of B.Tech. students. They will also make an excerpt either as a documentary or a photoblog describing the plant's origin, its usage in daily life, and its appearance in folklore and literature. **04 Hours**

Module-II

Heritage walk and crafts corner: Heritage tour, knowing the history and culture of the city, connecting to people around through their history, knowing the city and its craftsman, photoblog and documentary on evolution and practice of various craft forms. **04 Hours**

Module-III

Organic farming and waste management: usefulness of organic farming, wet waste management in neighboring villages, and implementation in the campus. **04 Hours**

Module-IV

Water Conservation: knowing the present practices in the surrounding villages and implementation in the campus, documentary or photo blog presenting the current practices. **04 Hours**

Module-V

Food Walk City's culinary practices, food lore, and indigenous materials of the region used in cooking. **04 Hours**

Teaching Learning Process	Chalk and board, Active Learning, PPT Based presentation, Video

Activities

Jamming session, open mic, and poetry: Platform to connect to others. Share the stories with others. **Share the experience of Social Connect**. Exhibit the talent like playing instruments, singing, one-act play, art-painting, and fine art.

PEDAGOGY

The pedagogy will include interactive lectures, inspiring guest talks, field visits, social immersion, and a course project. Applying and synthesizing information from these sources to define the social problem to address and take up the solution as the course project, with your group. Social immersion with NGOs/social sections will be a key part of the course. Will all lead to the course project that will address the needs of the social sector?

COURSE TOPICS:

The course will introduce social context and various players in the social space, and present approaches to discovering and understanding social needs. Social immersion and inspiring conversional will culminate in developing an actual, idea for problem-based intervention, based on an in-depth understanding of a key social problem.

A total of 14-20 hrs engagement per semester is required for the 3rd semester of the B.E. /B.Tech. program. The students will be divided into 10 groups of 35 each. Each group will be handled by two **faculty mentors**. Faculty mentors will design the activities (particularly Jamming sessions open mic ,and poetry)

Faculty mentors has to design the evaluation system.

Guideline for Assessment Process:

Continuous Internal Evaluation (CIE)

After completion of, the social connect, the student shall prepare, with daily **diary** as reference, a comprehensive report in consultation with the mentor/s to indicate what he has observed and learned inthe social connect period. The report should be signed by the mentor. The report shall be evaluated onthe basis of the following criteria and/or other relevant criteria pertaining to the activity completed.

Marks allotted for the diary are out of 50.
Planning and scheduling the social connect
Information/Data collected during the social connect
Analysis of the information/data and report writing

Considering all above points allotting the marks as mentioned below-

Excellent	80 to 100
Good	60 to 79
Satisfactory	40 to 59
Unsatisfactory and fail	< 39

Semester End Examination (SEE)

This Jamming session will be conducted at the end of the course for 50 marks

Jamming session includes -Platform to connect to others. Share the stories with others. Share the experience of Social Connect. Exhibit the talent like playing instruments, singing, one-act play, art-painting, and fine art.

Faculty mentor has to design the evaluation system for Jamming session.

CO-PO Mapping:

POs / COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	2				2	1			2		2	3	2	
CO2	2	2		1	3		3					1	2	2	2
CO3	2	2		1	1						2	3	3		
Avg	2	2		1	2	2	2			2	2	2	2.6	2	2

BE - **III/IV Semester – Common to all**

ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ

ವಿಷಯ ಸಂಕೇತ (Course Code)	21KSK39/49	ನಿರಂತರ ಆಂತರಿಕ ಮೌಲ್ಯಮಾಪನದ ಅಂಕಗಳು	50
ಒಂದು ವಾರಕ್ಕೆ ಬೋಧನಾ ಅವಧಿ (Teaching Hours / Week (L:T:P: S)	0:2:0:1	ಸೆಮಿಸ್ಟರ್ ಅಂತ್ಯದ ಪರೀಕ್ಷೆಯ ಅಂಕಗಳು	50
ಒಟ್ಟು ಬೋಧನಾ ಅವಧಿ Total Hours of Pedagogy	25 ಗಂಟೆಗಳು	ಒಟ್ಟು ಅಂಕಗಳು	100
ಕ್ರೆಡಿಟ್ಸ್ (Credits)	01	ಪರೀಕ್ಷೆಯ ಅವಧಿ	01 ಗಂಟೆ

ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ ಪಠ್ಯದ ಕಲಿಕೆಯ ಉದ್ದೇಶಗಳು:

1. ವೃತ್ತಿಪರ ಪದವಿ ವಿದ್ಯಾರ್ಥಿಗಳಾಗಿರುವುದರಿಂದ ಕನ್ನಡ ಭಾಷೆ, ಸಾಹಿತ್ಯ ಮತ್ತು ಕನ್ನಡದ ಸಂಸ್ಕೃತಿಯ ಪರಿಚಯ ಮಾಡಿಕೊಡುವುದು.
2. ಕನ್ನಡ ಸಾಹಿತ್ಯದ ಪ್ರಧಾನ ಭಾಗವಾದ ಆಧುನಿಕ ಪೂರ್ವ ಮತ್ತು ಆಧುನಿಕ ಕಾವ್ಯಗಳನ್ನು ಸಾಂಕೇತಿಕವಾಗಿ ಪರಿಚಯಿಸಿ ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಸಾಹಿತ್ಯ ಮತ್ತು ಸಂಸ್ಕೃತಿಯ ಬಗ್ಗೆ ಅರಿವು ಹಾಗೂ ಆಸಕ್ತಿಯನ್ನು ಮೂಡಿಸುವುದು.
3. ತಾಂತ್ರಿಕ ವ್ಯಕ್ತಿಗಳ ಪರಿಚಯವನ್ನು ಹಾಗೂ ಅವರುಗಳ ಸಾಧಿಸಿದ ವಿಷಯಗಳನ್ನು ಪರಿಚಯಿಸುವುದು.
4. ಕನ್ನಡ ಶಬ್ದಸಂಪತ್ತಿನ ಪರಿಚಯ ಮತ್ತು ಕನ್ನಡ ಭಾಷೆಯ ಬಳಕೆ ಹಾಗೂ ಕನ್ನಡದಲ್ಲಿ ಪತ್ರ ವ್ಯವಹಾರವನ್ನು ತಿಳಿಸಿಕೊಡುವುದು.

ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವ್ಯವಸ್ಥೆ (Teaching-Learning Process - General Instructions) :

These are sample Strategies, which teacher can use to accelerate the attainment of the course outcomes.

1. ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡವನ್ನು ಬೋಧಿಸಲು ತರಗತಿಯಲ್ಲಿ ಶಿಕ್ಷಕರು ಪ್ರಸ್ತುತ ಪುಸ್ತಕ ಆಧಾರಿಸಿ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನವನ್ನು ಅನುಸರಿಸುವುದು. ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ತಯಾರಿಸಲು ವಿದ್ಯಾರ್ಥಿಗಳನ್ನು ಪ್ರೇರೇಪಿಸುವುದು ಮತ್ತು ತರಗತಿಯಲ್ಲಿ ಅವುಗಳನ್ನು ಚರ್ಚಿಸಲು ಅವಕಾಶ ಮಾಡಿಕೊಡುವುದು.
2. ಇತ್ತೀಚಿನ ತಂತ್ರಜ್ಞಾನದ ಅನುಕೂಲಗಳನ್ನು ಬಳಸಿಕೊಳ್ಳುವುದು - ಅಂದರೆ ಕವಿ-ಕಾವ್ಯ ಪರಿಚಯದಲ್ಲಿ ಕವಿಗಳ ಚಿತ್ರಣ ಮತ್ತು ಲೇಖನಗಳು ಮತ್ತು ಕಥೆ ಕಾವ್ಯಗಳ ಮೂಲ ಅಂಶಗಳಿಗೆ ಸಂಬಂಧಪಟ್ಟ ಧ್ವನಿ ಚಿತ್ರಗಳು, ಸಂಭಾಷಣೆಗಳು, ಈಗಾಗಲೇ ಇತರ ವಿಮರ್ಶಕರು ಬರೆದಿರುವ ವಿಮರ್ಶಾತ್ಮಕ ವಿಷಯಗಳನ್ನು ಟಿಪಿಟಿ, ಡಿಜಿಟಲ್ ಮಾಧ್ಯಮಗಳ ಮುಖಾಂತರ ವಿಶ್ಲೇಷಿಸುವುದು.
3. ನವೀನ ಮಾದರಿಯ ಸಾಹಿತ್ಯ ಬೋಧನೆಗೆ ಸಂಬಂಧಪಟ್ಟ ವಿಧಾನಗಳನ್ನು ಶಿಕ್ಷಕರು ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ಅನುಕೂಲವಾಗುವ ರೀತಿಯಲ್ಲಿ ಅಳವಡಿಸಿಕೊಳ್ಳಬಹುದು.

ಘಟಕ -1 ಲೇಖನಗಳು

1. ಕರ್ನಾಟಕ ಸಂಸ್ಕೃತಿ - ಹಂಪ ನಾಗರಾಜಯ್ಯ
2. ಕರ್ನಾಟಕದ ಏಕೀಕರಣ : ಒಂದು ಅಪೂರ್ವ ಚರಿತ್ರೆ - ಜಿ. ವೆಂಕಟಸುಬ್ಬಯ್ಯ
3. ಆಡಳಿತ ಭಾಷೆಯಾಗಿ ಕನ್ನಡ - ಡಾ. ಎಲ್. ತಿಮ್ಮೇಶ ಮತ್ತು ಪ್ರೋ. ವಿ. ಕೇಶವಮೂರ್ತಿ

ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ	ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವಿಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು.

ಘಟಕ -2 ಆಧುನಿಕ ಪೂರ್ವದ ಕಾವ್ಯ ಭಾಗ	
1. ವಚನಗಳು : ಬಸವಣ್ಣ, ಅಕ್ಕಮಹಾದೇವಿ, ಅಲ್ಲಮಪ್ರಭು, ಆಯ್ದಕ್ಕಿ ಮಾರಯ್ಯ, ಜೇಡರದಾಸಿಮಯ್ಯ, ಆಯ್ದಕ್ಕಿ ಲಕ್ಕಮ್ಮ. 2. ಕೀರ್ತನೆಗಳು : ಅದರಿಂದೇನು ಫಲ ಇದರಿಂದೇನು ಫಲ - ಪುರಂದರದಾಸರು ತಲ್ಲಣಿಸದಿರು ಕಂಡ್ಯ ತಾಳು ಮನವೇ - ಕನಕದಾಸರು 3. ತತ್ವಪದಗಳು : ಸಾವಿರ ಕೊಡಗಳ ಸುಟ್ಟು - ಶಿಶುನಾಳ ಶರೀಫ	
ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ	ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವಿಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು.
ಘಟಕ -3 ಆಧುನಿಕ ಕಾವ್ಯಭಾಗ	
1. ಡಿವಿಜಿ ರವರ ಮಂಕುತಿಮ್ಮನ ಕಗ್ಗದಿಂದ ಅಯ್ದ ಕೆಲವು ಭಾಗಗಳು 2. ಕುರುಡು ಕಾಂಚಾಣ : ದಾ.ರಾ. ಬೇಂದ್ರೆ 3. ಹೊಸಬಾಳಿನ ಗೀತೆ : ಕುವೆಂಪು	
ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ	ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವಿಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು.
ಘಟಕ -4 ತಾಂತ್ರಿಕ ವ್ಯಕ್ತಿಗಳ ಪರಿಚಯ	
1. ಡಾ. ಸರ್. ಎಂ. ವಿಶ್ವೇಶ್ವರಯ್ಯ : ವ್ಯಕ್ತಿ ಮತ್ತು ಐತಿಹ್ಯ - ಎ ಎನ್ ಮೂರ್ತಿರಾವ್ 2. ಕರಕುಶಲ ಕಲೆಗಳು ಮತ್ತು ಪರಂಪರೆಯ ವಿಜ್ಞಾನ : ಕರೀಗೌಡ ಬೀಚನಹಳ್ಳಿ	
ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ	ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವಿಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು.
ಘಟಕ -5 ಕಥೆ ಮತ್ತು ಪ್ರವಾಸ ಕಥನ	
1. ಯುಗಾದಿ : ವಸುಧೇಂದ್ರ 2. ಮೆಗಾನೆ ಎಂಬ ಗಿರಿಜನ ಪರ್ವತ : ಹಿ.ಚಿ. ಬೋರಲಿಂಗಯ್ಯ	
ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ	ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವಿಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು.

ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ ಕಲಿಕೆಯಿಂದ ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ಆಗುವ ಪರಿಣಾಮಗಳು (course Outcomes):

1. ಕನ್ನಡ ಭಾಷೆ, ಸಾಹಿತ್ಯ ಮತ್ತು ಕನ್ನಡದ ಸಂಸ್ಕೃತಿಯ ಪರಿಚಯವಾಗುತ್ತದೆ.
2. ಕನ್ನಡ ಸಾಹಿತ್ಯದ ಆಧುನಿಕ ಪೂರ್ವ ಮತ್ತು ಆಧುನಿಕ ಕಾವ್ಯಗಳು ಮತ್ತು ಸಂಸ್ಕೃತಿಯ ಬಗ್ಗೆ ಆಸಕ್ತಿಯು ಮೂಡುತ್ತದೆ.
3. ತಾಂತ್ರಿಕ ವ್ಯಕ್ತಿಗಳ ಪರಿಚಯವಾಗುತ್ತದೆ.
4. ಕನ್ನಡ ಭಾಷಾಭ್ಯಾಸ, ಸಾಮಾನ್ಯ ಕನ್ನಡ ಹಾಗೂ ಆಡಳಿತ ಕನ್ನಡದ ಪದಗಳ ಪರಿಚಯವಾಗುತ್ತದೆ.

ಮೌಲ್ಯಮಾಪನದ ವಿಧಾನ (**Assessment Details- both CIE and SEE**) :

(methods of CIE - MCQ, Quizzes, Open book test, Seminar or micro project)
The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The student has to obtain a minimum of 40% marks individually both in CIE and 35% marks in SEE to pass. Theory Semester End Exam (SEE) is conducted for 50 marks (01 hour duration). Based on this grading will be awarded.

Continuous Internal Evaluation:
Three Tests each of **20 Marks (duration 01 hour)**

a. First test at the end of 5th week of the semester
b. Second test at the end of the 10th week of the semester
c. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks : 1.** First assignment at the end of 4th week of the semester
2. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks (duration 01 hours)**
3. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**
CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.
ಸೆಮಿಸ್ಟರ್ ಅಂತ್ಯದ ಪರೀಕ್ಷೆಯು ಈ ಕೆಳಗಿನಂತಿರುತ್ತದೆ - **Semester End Exam (SEE):**

SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject.
1. The question paper will have 50 questions. Each question is set for 01 mark.

SEE Pattern will be in MCQ Model for 50 marks. Duration of the exam is 01 Hour.

ಪಠ್ಯಪುಸ್ತಕ :

ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ

ಡಾ. ಹಿ.ಚಿ.ಬೋರಲಿಂಗಯ್ಯ ಮತ್ತು ಡಾ. ಎಲ್. ತಿಮ್ಮೇಶ,
ಪ್ರಸಾರಾಂಗ, ವಿಶ್ವೇಶ್ವರಯ್ಯ ತಾಂತ್ರಿಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಬೆಳಗಾವಿ.

BE - III / IV Semester – Common to All

ಬಳಕೆ ಕನ್ನಡ - baLake Kannada (Kannada for Usage)

ಕನ್ನಡ ಕಲಿಕೆಗಾಗಿ ನಿಗದಿಪಡಿಸಿದ ಪಠ್ಯಪುಸ್ತಕ - (Prescribed Textbook to Learn Kannada)

ವಿಷಯ ಸಂಕೇತ (Course Code)	21KBK39/49	ನಿರಂತರ ಆಂತರಿಕ ಮೌಲ್ಯಮಾಪನದ ಅಂಕಗಳು (Continuous Internal Evaluation Marks)	50
ಒಂದು ವಾರಕ್ಕೆ ಬೋಧನಾ ಅವಧಿ (Teaching Hours / Week (L:T:P: S)	0:2:0:1	ಸೆಮಿಸ್ಟರ್ ಅಂತ್ಯದ ಪರೀಕ್ಷೆಯ ಅಂಕಗಳು (Semester End Examination Marks)	50
ಒಟ್ಟು ಬೋಧನಾ ಅವಧಿ Total Hours of Pedagogy	25 ಗಂಟೆಗಳು	ಒಟ್ಟು ಅಂಕಗಳು (Total Marks)	100
ಕ್ರೆಡಿಟ್ಸ್ (Credits)	01	ಪರೀಕ್ಷೆಯ ಅವಧಿ (Exam Hours)	01 ಗಂಟೆ

ಬಳಕೆ ಕನ್ನಡ ಪಠ್ಯದ ಕಲಿಕೆಯ ಉದ್ದೇಶಗಳು (Course Learning Objectives):

- To Create the awareness regarding the necessity of learning local language for comfortable and healthy life.
- To enable learners to Listen and understand the Kannada language properly.
- To speak, read and write Kannada language as per requirement.
- To train the learners for correct and polite conservation.

ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವ್ಯವಸ್ಥೆ (Teaching-Learning Process - General Instructions) :

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. ಬಳಕೆ ಕನ್ನಡವನ್ನು ತರಗತಿಯಲ್ಲಿ ಶಿಕ್ಷಕರು ಬೋಧಿಸಲು ವಿಟಿಯು ಸೂಚಿಸಿರುವ ಪಠ್ಯಪುಸ್ತಕವನ್ನು ಉಪಯೊಗಿಸಬೇಕು.
2. ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ತಯಾರಿಸಲು ವಿದ್ಯಾರ್ಥಿಗಳನ್ನು ಉತ್ತೇಜಿಸುವುದು ಮತ್ತು ತರಗತಿಯಲ್ಲಿ ಅವುಗಳನ್ನು ಚರ್ಚಿಸಲು ಅವಕಾಶ ಮಾಡಿಕೊಡುವುದು.
3. ಪ್ರತಿ ವಿದ್ಯಾರ್ಥಿ ಪುಸ್ತಕವನ್ನು ತರಗತಿಯಲ್ಲಿ ಬಳಸುವಂತೆ ನೋಡಿಕೊಳ್ಳುವುದು ಮತ್ತು ಪ್ರತಿ ಪಾಠ ಮತ್ತು ಪ್ರವಚನಗಳ ಮೂಲ ಅಂಶಗಳಿಗೆ ಸಂಬಂಧಪಟ್ಟಂತೆ ಪೂರಕ ಚಟುವಟಿಕೆಗಳಿಗೆ ತೊಡಗಿಸತಕ್ಕದ್ದು.
1. ಡಿಜಿಟಲ್ ತಂತ್ರಜ್ಞಾನದ ಮುಖಾಂತರ ಇತ್ತೀಚೆಗೆ ಡಿಜಿಟಲೀಕರಣ ಗೊಂಡಿರುವ ಭಾಷೆ ಕಲಿಕೆಯ ವಿಧಾನಗಳನ್ನು ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ಮುಖಾಂತರ ಚರ್ಚಿಸಲು ಕ್ರಮಕೈಗೊಳ್ಳುವುದು. ಇದರಿಂದ ವಿದ್ಯಾರ್ಥಿಗಳನ್ನು ತರಗತಿಯಲ್ಲಿ ಹೆಚ್ಚು ಏಕಾಗ್ರತೆಯಿಂದ ಪಾಠ ಕೇಳಲು ಮತ್ತು ಅಧ್ಯಯನದಲ್ಲಿ ತೊಡಗಲು ಅನುಕೂಲವಾಗುತ್ತದೆ.
2. ಭಾಷಾಕಲಿಕೆಯ ಪ್ರಯೋಗಾಲಯದ ಮುಖಾಂತರ ಬಹುಬೇಗ ಕನ್ನಡ ಭಾಷೆಯನ್ನು ಕಲಿಯಲು ಅನುಕೂಲವಾಗುವಂತೆ ಕಾರ್ಯಚಟುವಟಿಕೆಗಳನ್ನು ಮತ್ತು ಕ್ರಿಯಾ ಯೋಜನೆಗಳನ್ನು ರೂಪಿಸುವುದು.

Module-1

1. Introduction, Necessity of learning a local language. Methods to learn the Kannada language.
2. Easy learning of a Kannada Language: A few tips. Hints for correct and polite conservation, Listening and Speaking Activities
3. Key to Transcription.
4. **ವೈಯಕ್ತಿಕ, ಸ್ವಾಮ್ಯಸೂಚಕ/ಸಂಬಂಧಿತ ಸಾರ್ವನಾಮಗಳು ಮತ್ತು ಪ್ರಶ್ನಾರ್ಥಕ ಪದಗಳು - Personal Pronouns, Possessive Forms, Interrogative words**

ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ	ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವಿಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು.

Module-2

1. ನಾಮಪದಗಳ ಸಂಬಂಧಾರ್ಥಕ ರೂಪಗಳು, ಸಂದೇಹಾಸ್ಪದ ಪ್ರಶ್ನೆಗಳು ಮತ್ತು ಸಂಬಂಧವಾಚಕ ನಾಮಪದಗಳು - **Possessive forms of nouns, dubitive question and Relative nouns**
2. ಗುಣ, ಪರಿಮಾಣ ಮತ್ತು ವರ್ಣಬಣ್ಣ ವಿಶೇಷಣಗಳು, ಸಂಖ್ಯಾವಾಚಕಗಳು **Qualitative, Quantitative and Colour Adjectives, Numerals**
3. **ಕಾರಕ ರೂಪಗಳು ಮತ್ತು ವಿಭಕ್ತಿ ಪ್ರತ್ಯಯಗಳು – ಸಪ್ತಮಿ ವಿಭಕ್ತಿ ಪ್ರತ್ಯಯ – (ಅ, ಅದು, ಅವು, ಅಲ್ಲಿ) Predictive Forms, Locative Case**

ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ	ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವಿಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು.

Module-3

1. **ಚತುರ್ಥಿ ವಿಭಕ್ತಿ ಪ್ರತ್ಯಯದ ಬಳಕೆ ಮತ್ತು ಸಂಖ್ಯಾವಾಚಕಗಳು – Dative Cases, and Numerals**
4. **ಸಂಖ್ಯಾಗುಣವಾಚಕಗಳು ಮತ್ತು ಬಹುವಚನ ನಾಮರೂಪಗಳು – Ordinal numerals and Plural markers**
5. **ನ್ಯೂನ / ನಿಷೇಧಾರ್ಥಕ ಕ್ರಿಯಾಪದಗಳು ಮತ್ತು ವರ್ಣ ಗುಣವಾಚಕಗಳು Defective / Negative Verbs and Colour Adjectives**

ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ	ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವಿಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು.

Module-4

1. ಅಪ್ಪಣೆ / ಒಪ್ಪಿಗೆ, ನಿರ್ದೇಶನ, ಪ್ರೋತ್ಸಾಹ ಮತು ಒತ್ತಾಯ ಅರ್ಥರೂಪ ಪದಗಳು ಮತ್ತು ವಾಕ್ಯಗಳು **Permission, Commands, encouraging and Urging words (Imperative words and sentences)**
2. ಸಾಮಾನ್ಯ ಸಂಭಾಷಣೆಗಳಲ್ಲಿ ದ್ವಿತೀಯ ವಿಭಕ್ತಿ ಪ್ರತ್ಯಯಗಳು ಮತ್ತು ಸಂಭವನೀಯ ಪ್ರಕಾರಗಳು **Accusative Cases and Potential Forms used in General Communication**
3. "ಇರು ಮತ್ತು ಇರಲ್ಲ" ಸಹಾಯಕ ಕ್ರಿಯಾಪದಗಳು, ಸಂಭಾವ್ಯಸೂಚಕ ಮತ್ತು ನಿಷೇಧಾರ್ಥಕ ಕ್ರಿಯಾ ಪದಗಳು - Helping Verbs "iru and iralla", Corresponding Future and Negation Verbs
6. ಹೋಲಿಕೆ (ತರತಮ) , ಸಂಬಂಧ ಸೂಚಕ ಮತ್ತು ವಸ್ತು ಸೂಚಕ ಪ್ರತ್ಯಯಗಳು ಮತ್ತು ನಿಷೇಧಾರ್ಥಕ ಪದಗಳ ಬಳಕೆ- Comparitive, Relationship, Identification and Negation Words

ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ	ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವಿಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು.

Module-5

1. ಕಾಲ ಮತ್ತು ಸಮಯದ ಹಾಗೂ ಕ್ರಿಯಾಪದಗಳ ವಿವಿಧ ಪ್ರಕಾರಗಳು - ifferent types of forms of Tense, Time and Verbs
2. ದ್, -ತ್, - ತು, - ಇತು, - ಆಗಿ, - ಅಲ್ಲ, - ಗ್, -ಕ್, ಇದೆ, ಕ್ರಿಯಾ ಪ್ರತ್ಯಯಗಳೊಂದಿಗೆ ಭೂತ, ಭವಿಷ್ಯತ್ ಮತ್ತು ವರ್ತಮಾನ ಕಾಲ ವಾಕ್ಯ ರಚನೆ - Formation of Past, Future and Present Tense Sentences with Verb Forms
3. **Kannada Vocabulary List : ಸಂಭಾಷಣೆಯಲ್ಲಿ ದಿನೋಪಯೋಗಿ ಕನ್ನಡ ಪದಗಳು - Kannada Words in Conversation**

ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ	ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವಿಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು.

ಬಳಕೆ ಕನ್ನಡ ಪಠ್ಯದ ಕಲಿಕೆಯಿಂದ ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ಆಗುವ ಅನುಕೂಲಗಳು ಮತ್ತು ಫಲಿತಾಂಶಗಳು: **course Outcomes (Course Skill** Set): At the end of the Course, The Students will be able

1. To understand the necessity of learning of local language for comfortable life.
2. To Listen and understand the Kannada language properly.
3. To speak, read and write Kannada language as per requirement.
4. To communicate (converse) in Kannada language in their daily life with kannada speakers.
5. To speak in polite conservation.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Tests each of **20 Marks (duration 01 hour**)

a. First test at the end of 5th week of the semester
b. Second test at the end of the 10th week of the semester
c. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks : 1.** First assignment at the end of 4th week of the semester

7. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

8. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

ಸೆಮಿಸ್ಟರ್ ಅಂತ್ಯದ ಪರೀಕ್ಷೆಯು ಈ ಕೆಳಗಿನಂತಿರುತ್ತದೆ - **Semester End Exam (SEE):**

SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject.

2. The question paper will have 50 questions. Each question is set for 01 mark.
3. SEE Pattern will be in MCQ Model for 50 marks. Duration of the exam is 01 Hour.

Textbook :

ಬಳಕೆ ಕನ್ನಡ

ಲೇಖಕರು : ಡಾ. ಎಲ್. ತಿಮ್ಮೇಶ

ಪ್ರಸಾರಾಂಗ, ವಿಶ್ವೇಶ್ವರಯ್ಯ ತಾಂತ್ರಿಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಬೆಳಗಾವಿ.

Ability Enhancement Course - Mastering Office			
Course Code	**21CSL381**	**CIE Marks**	**50**
Teaching Hours week (L:T:P:S) (0:0:2:0)	**Credits (0:0:2:0)**	**SEE Marks**	**50**
Total Hours of Pedagogy	**10 Practical**	**Total Marks**	**100**
Credits	**01**	**Exam Hours**	**03**

Prerequisites:

Basic knowledge of Computer operation, typing and operating mouse device.

Course Objectives:

CLO1. Understand the basics of computers and prepare documents and small presentations.
CLO2. Attain the knowledge about spreadsheet/worksheet with various options.
CLO3. Create simple presentations using templates various options available.
CLO4. Demonstrate the ability to apply application software in an office environment.
CLO5. Use MS Office to create projects, applications.

Syllabus

Module 1: MS WORD

Introduction, Identifying tools, working on Text (cut, copy, paste, Font, Line spacing), Formatting (indents, Paragraph, Tabs, alignment, Multilevel numbering and Bulleting), Working with Objects (Shapes, Clipart and Picture, Word Art, Smart Art, Page Number, Date & Time), Header & Footers (Inserting objects in the header and footer), Page break, Page bordering, Page background, Tables (Table Formatting, Table Styles, Alignment, properties, Merge and split), Printing (Page Setup, Setting margins, Print Preview, Print)

Lab program

Create a resume specifying the details like shape for photo, Name, Father Name, Date of Birth, Address, skills learnt, education details (use table), paper published, projects any and do alignment, use headers footers.

Create a document for department web page (should contain relevant images, description about department) and the data should be protected.

Module 2: MS EXCEL

Introduction to Excel (Understanding rows and columns, Naming Cells, Working with excel workbook and sheets), Formatting excel work book (Formatting Text, Font, Wrap text, Merge and Centre, Currency, Accounting, Modifying Columns, Rows & Cells), Formulae and functions (Simple Formulas, own formula, Date and Time Functions, Financial Functions, Logical Functions), Sort and Filter Data (Sort and filtering data, Custom filtering, Conditional formatting), Creating Effective Charts (chart with Chart Tool, Design, Format, and Layout options, Chart styles and other properties), Analyse Data Using PivotTables and Pivot Charts (Framework Using the PivotTable and PivotChart, Inserting slicer, Creating Calculated fields), Proofing and Printing (Page setup, Setting print area, Header and Footer, Setting margins, Print Preview, Print)

Lab program

Create a student database of internal marks and calculate the average of 3 internal, percentage and eligibility checking for SEE criteria, listing toppers using formula and function, identify slow learner and fast learners (using filtering)

Apply chart and provide the legends, axis, margins, data points, series for the above data.

Module 3: MS POWERPOINT

Introduction to PowerPoint (Typing the text, Alignment of text, Formatting Text, Font, Cut, Copy, Paste, Find & Replace, Working with Tabs and Indents), Creating slides and applying themes, Working with bullets and numbering, Working with Objects, Hyperlinks and Action Buttons, Animation and Slide Transition, Slide show.

Lab program

Design a power point presentation for performing the quiz activity by use the alignment, animation, sound, transition and hyperlink for navigation.

Prepare PPT slides on new technology, providing the information (about, diagrams, technique, method, working, pros and cons, applications)

Module 4: MS ACCESS and Advance features

Introduction to MS ACCESS, Creating tables, Adding columns, setting properties like primary key and data types, filling the values, modifying the table, Query, Reports,

Mail merge, Hyperlinks, Sharing and Maintaining Document, Styles and Content, Proofing the document (Check Spelling, Grammar, Setting AutoCorrect Options), Use Macros to Automate Tasks, Protecting and sharing the work book, Hyperlinks, Lookup and Reference, Functions Mathematical Functions, Statistical Functions, Text Functions. Working With Movies and Sounds, SmartArt and Tables, Proofing and Printing

Lab Programs:

Design an invitation card and provide the details of the programme, also perform the mail merging using MS access for database.

Module 5: Case study and mini project

My Dream Car: A Microsoft Excel Project - This project has students do a cost analysis on a group of selected dream cars in order to calculate which would be best for them. Across its 15 pages of content, students practice their Excel skills by creating tables, using formulas, and analysing data to form conclusions.

Back to School what's Cool This Year: A Microsoft PowerPoint and Excel Project - This project has students create Excel spread sheets and PowerPoint presentations to predict and present what clothing and accessories they believe will be popular that school year. For this back-to-school project, students will compile data, write formulas, and display their predictions to their peers.

Analyse Your Favourite Players' Performance: A Microsoft Excel Project - This project has students analyse the athletic statistics of their chosen sports star. Throughout this project, students collect data, create charts, and calculate trend lines to display how their favourite athlete performs.

A Year Events in Review Project - In this project, students design a PowerPoint presentation that informs an audience on the past year's events and personal achievements the student has accomplished. Across its 12 parts, showcase their skills when it comes to designing and presenting a PowerPoint.

Microsoft Word & Excel Magazine Project - This intensive project has students design and creates a 14-page magazine using Microsoft Word and Excel. Along the way, students will demonstrate their creativity by using photos, columns, text boxes, tables, and other aspects of Microsoft software to complete the project.

Microsoft Word & PowerPoint Book Project - This lighter project is designed for early high school and middle school, and has students demonstrate their skills in Word and PowerPoint by creating their own book. Though meant as a capstone assignment, this project has a lighter workload than the other available options from the Tech Twins.

Social Media Page Activity using Microsoft Word - This project has students create a social media page for a famous person of their choice. In doing so, students showcase Microsoft Word skills like font formatting, object alignment, inserting text boxes, and more.

House for Sale Flyer Activity Project using Microsoft Word - In this project, students create a

one-page flyer to advertise a house for sale—either their own or somewhere fictitious. Along the way, they'll demonstrate design skills in Word by using shapes, WordArt, columns, tables, and more to create their flyer.

Movie Poster Activity using Microsoft PowerPoint - Designed for early high school and middle school, this project has students create a movie poster using Microsoft PowerPoint. In crafting the poster, they'll employ creative design skills, formatting work, text effects, and more.

Course Outcomes:

At the end of the course the student will be able to:

CO1. Know the basics of documents, spreadsheets, presentations with audio, video and graphs.

CO2. Create, edit, save and print documents with list tables, header, footer, graphic, spellchecker, mail merge and grammar checker

CO 3. Analysing and solving spreadsheet with formula, macros spell checker etc.

CO 4. Demonstrate the ability to apply application software in an office environment.

CO 5. Designing and modifying database, query.

CO-PO/PSO mapping

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO 1	3				3				2			2	3	3	1
CO 2	2	3		1	3				2		2	2	3	3	
CO 3	3			3	3				2		2	2	3	3	
CO 4		2	3		3				2				2	3	1
CO 5	2		1	2	3				2	2	2	2		3	
Aver	**2**	**2**	**2**	**2**	**3**				**2**	**2**	**2**	**2**	**2**	**2**	**1**

Ability Enhancement Course - PROGRAMMING IN C++			
Course Code	**21CSL382**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P: S)	**0:0:2:0**	**SEE Marks**	**50**
Total Hours of Pedagogy	**12**	**Total Marks**	**100**
Credits	**01**	**Exam Hours**	**01**

Prerequisites:

Programming Concepts, C Programming, Algorithms, Flowchart.

Course Objectives:

CLO 1. Understanding about object oriented programming and Gain knowledge about the capability to store information together in an object.
CLO 2. Understand the capability of a class to rely upon another class and functions.
CLO 3. Understand about constructors which are special type of functions.
CLO 4. Create and process data in files using file I/O functions
CLO 5. Use the generic programming features of C++ including Exception handling.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) need not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem with different circuits/logic and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

Introduction to Object Oriented Programming: Computer programming background- C++ overview- First C++ Program -Basic C++ syntax, Object Oriented Programming: What is an object, Classes, methods and messages, abstraction and encapsulation, inheritance, abstract classes, polymorphism.

Textbook 1: Chapter 1(1.1 to 1.8)

Module-2

Functions in C++: Tokens – Keywords – Identifiers and constants – Operators in C++ – Scope resolution operator – Expressions and their types – Special assignment expressions – Function prototyping – Call by reference – Return by reference – Inline functions -Default arguments – Function overloading.

Textbook 2: Chapter 3(3.2,3.3,3.4,3.13,3.14,3.19, 3.20), Chapter 4(4.3,4.4,4.5,4.6,4.7,4.9)
Module-3
Inheritance & Polymorphism: Derived class Constructors, destructors-Types of Inheritance- Defining Derived classes, Single Inheritance, Multiple, Hierarchical Inheritance, Hybrid Inheritance. **Textbook 2: Chapter 6 (6.2,6.11) chapter 8 (8.1 to,8.8)**
Module-4
I/O Streams: C++ Class Hierarchy- File Stream-Text File Handling- Binary File Handling during file operations. **Textbook 1: Chapter 12(12.5) , Chapter 13 (13.6,13.7)**
Module-5
Exception Handling: Introduction to Exception - Benefits of Exception handling- Try and catch block-Throw statement- Pre-defined exceptions in C++ . **Textbook 2: Chapter 13 (13.2 to13.6)**

Teaching-Learning Process	Chalk and board, MOOC, Practical based learning, practical's

Laboratory Programs

1	The variables are stored in the memory and need to declare the variables with data types. Demonstrate with program to find the Size of fundamental data types using C++ compiler.
2	There will be range for data values in storage, show the output by using program to find check the upper and lower limit of all data types in C++.
3	C++ is an Object oriented program, we will write and illustrate with a program to create an object of a class and access class attributes.
4	C++ program to create a class to demonstrate the use of objects with a program in C++ to read and add two distance.
5	Member functions are used as a part of object in class of OOPs concept, let's see how to use functions in the program of C++.
6	Depending on the number and type of arguments passed, the corresponding display() function in C++ is called for Overloading Using Different Number of Parameters.
7	The three types of the parametric constructor, one for initialization of name only, second to initialization of age only and third to initialize both name and age. Program to be created three different types of objects and initialized them in different ways, and printed values for each of them
8	C++ program to read and print employee information with department and of information using hierarchical inheritance.
9	Implement the exception handling blocks for both exceptions with a program that can throw integer and double exceptions in the same try block.
10	Demonstrate the process of working with file handling through a program in c++ to reading and writing data on a file.

Course Outcomes (Course Skill Set):

At the end of the course the student will be able to:

CO1. Able to understand and design the solution to a problem using object-oriented programming concepts.

CO2. Able to reuse the code with extensible Class types, User-defined operators and function Overloading.

CO3. Achieve code reusability and extensibility by means of Inheritance and Polymorphism

CO4. Identify and explore the Performance analysis of I/O Streams.

CO5. Implement the features of C++ including templates, exceptions and file handling for providing programmed solutions to complex problems.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marksand will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper has to be designed to attain the different levels of Bloom's taxonomyas per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 01 hours)**

SEE paper will be set for 50 questions of each of 01 marks. The pattern of the question paper is MCQ.The time allotted for SEE is 01 hours

Textbooks

1. Bhushan Trivedi, "Programming with ANSI C++", Oxford Press, Second Edition, 2012.
2. Balagurusamy E, Object Oriented Programming with C++, Tata McGraw Hill Education Pvt.Ltd , Fourth Edition 2010.

Reference Books

1. Bhave , " Object Oriented Programming With C++", Pearson Education , 2004.
2. Ray Lischner, "Exploring C++ : The programmer's introduction to C++" , apress, 2010
3. Bhave , " Object Oriented Programming With C++", Pearson Education , 2004

Weblinks and Video Lectures (e-Resources):

1. Basics of C++ - https://www.youtube.com/watch?v=BClS40yzssA
2. Functions of C++ - https://www.youtube.com/watch?v=p8ehAjZWjPw

Tutorial Link:

1. https://www.w3schools.com/cpp/cpp_intro.asp
2. https://www.edx.org/course/introduction-to-c-3

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- **Demonstration of simple projects**

CO/PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	3	2	1	3						3	3	2
CO2	2	2	1	2	2	1	1					2	3	3	3
CO3	2	1	1	2	2	3	1					2	3	3	2
CO4	3	2	2	1	2	2	3						2	2	2
CO5	3	3	2	2	2	1	2	1	1				3	2	2
	2.4	2.0	1.4	2.4	2.0	1.4	2.2	1.0	1.0			2.0	2.8	2.6	2.1

3-Strong 2-Medium 1-Low

Entrepreneurship Development Course-I: Developing the Opportunity			
Course Code	**21EDC39**	**CIE Marks**	**50**
Teaching Hours week (L:T:P:S) (0:2:0:0)	**Audit Course**	**SEE Marks**	**50**
Total Hours of Pedagogy	**20**	**Total Marks**	**100**
Credits	**00**	**Exam Hours**	**03**

Objectives:

The Course will

Contents:

Course Description

How does a good idea become a viable business opportunity? What is entrepreneurship and who fits the profile of an entrepreneur? This introductory course is designed to introduce you to the foundational concepts of entrepreneurship, including the definition of entrepreneurship, the profile of the entrepreneur, the difference between entrepreneurship and entrepreneurial management, and the role of venture creation in society. You'll explore where technology entrepreneurship and impact entrepreneurship align and where they diverge, and you'll learn proven techniques for identifying the opportunity, assessing the opportunity, hypothesis testing and creating a prototype.

By the end of this course, you'll know how to test, validate and prototype your idea, and also whether or not you fit the profile of an entrepreneur! You'll also be ready to move on to the next phase of entrepreneurship in Entrepreneurship 2: Launching the Start-Up.

Module-I

Introduction to Entrepreneurship

Course Introduction, Profile of the Entrepreneur, Entrepreneurship in Established Firms, Venture Creation's Role in Society, Types of Enterprises, Technology Entrepreneurship, Impact Entrepreneurship.

06 Hours

Module-II

Opportunity Analysis

Opportunities and Uncertainty, Push and Pull and the Sources of Innovation, Customers as Sources of Opportunities, Importance of the Idea (VIDE Model), Assessing Opportunities, The Tournament Approach.

06 Hours

Module-III

Markets, Need-Finding and Planning

Defining the Focal Market, Understanding User Needs, Competitive Analysis, Generating Ideas with Individuals and Groups, Planning: Assumptions, Planning: Discovery Driven Planning, Planning: Discovery Driven Planning Worksheet

06 Hours

Module-IV

Pitching, Testing, and Prototyping

The Elevator Pitch, testing your idea: Customer Interviews, testing your idea: Surveys, creating a Prototype: Physical Goods, creating a Prototype: Software, Creating a Prototype: Services, Summary and What's Ahead.

06 Hours

Suggested Learning Resources:

Textbooks

1. Entrepreneurial Development Reprint Edn. 2006 Edition by S S Khanka S Chand; Reprint Edn. 2006 edition (December 1, 2007)
2. Entrepreneurial Development Paperback – 1 September 2014 by Vasant Desai
3. Dynamics Of Entrepreneurial Development And Management Paperback by Vasant Desai (Author)

4. Business Development For Dummies Paperback – April 20, 2015 by Anna Kennedy (Author)

Course Outcomes:

CO1: Classify and compare types of enterprises and their roles.
CO2: Apply Evaluation process of your own opportunities to discover new ones.

CO3: Develop a useful model for your own enterprise.

CO4: Identify the key components of a successful pitch and plan for building a prototype.

CO5: Test, validate and prototype your idea, and also the profile of an entrepreneur.

CO- PO Mapping :

POs / **COs**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PO 12**
CO1	1	2							1			1
CO2	2	3		3					3			1
CO3			3	2				2	3			3
CO4	2	2						2	3			3
CO5					2	2	2		3			3

EMPLOYABILITY SKILLS - I

Sem &Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
3rd Sem/21CPH39	0:0:4:0	0	AUDIT COURSE	3 Hours	

This course will enable students to:

- Understand different types of Numerical / Arithmetical problems.
- Understand the different Data interpretation problems.
- To enhance interpersonal and soft skills for professional development.
- Enables students to develop their ability to reason by introducing them to elements of formal reasoning.
- To develop Problem Solving, confidence building, organizational, team working skills.

Syllabus

Module – I

Aptitude 1:
Quantitative Aptitude – Number System, Problems on HCF and LCM, Decimal Fractions and Simplification, Averages
Logical Reasoning - Analogy

06 Hours

Module – II

Aptitude 2:
Quantitative Aptitude – Ratios, Proportions and Variations, Partnership
Logical Reasoning – Number and Letter Series, Coding and Decoding

06 Hours

Module – III

Aptitude 3:
Quantitative Aptitude – Percentages, Profit & Loss
Logical Reasoning – Blood Relations, Seating Arrangement

06 Hours

Module – IV

Aptitude 4:
Quantitative Aptitude – Time and Work
Logical Reasoning – Data Arrangement
Soft Skills – Group Discussions

04 Hours

Module – V

Aptitude 5:
Verbal Ability – Ordering of Sentences, Reading Comprehension, Change of Speech & Voice

04 Hours

Text Books:

1. R S Aggarwal: "Quantitative Aptitude for competitive examinations", (Chapters 1-3,6-8,10-18,20-22,26-28,30,31,35-39), S. Chand Publishing, New Delhi, 2014, ISBN-13: 978-81-219-2498-6.

Reference Books:

1. R.S. Aggarwal "A Modern Approach to Verbal & Non-Verbal Reasoning (Old Edition)" 2001.
2. R.S. Aggarwal "A Modern Approach to Logical Reasoning (Old Edition)" 1999.

E-Resources:

1. https://employabilityskills.org/development/
2. https://anivda.com/personal-development-for-employability/

MATHEMATICAL FOUNDATIONS FOR COMPUTING			
Course Code	**21CSM41**	**CIE Marks**	**50**
Teaching Hours/Week (L: T: P: S) (2:2:0:0)	**Credits (2:2:0:0)**	**SEE Marks**	**50**
Total Hours of Pedagogy	**40 hours**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course objectives:

The goal of the course Mathematical Foundations For Computing- 21CSM 41 is to

- Understand an intense foundational introduction to fundamental concepts in discrete mathematics.
- Interpret, identify, and solve the language associated with logical structure, sets, relations and functions, modular arithmetic.
- Have insight into Statistical methods, Correlation and regression analysis. Fitting of curves.
- To develop probability distribution of discrete and continuous random variables, Joint probability distribution occurs in digital signal processing, design engineering and micro wave engineering.
- To understand the concept of sampling and inference..

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. In addition to the traditional lecture method, different types of innovative teaching methods maybe adopted so that the delivered lessons shall develop students theoretical and applied mathematical skills.
2. State the need for Mathematics with Engineering Studies and Provide real-life examples.
3. Support and guide the students for self–study.
4. You will also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress.
5. Encourage the students for group learning to improve their creative and analytical skills.
6. Show short related video lectures in the following ways:
   - As an introduction to new topics (pre-lecture activity).
   - As a revision of topics (post-lecture activity).
   - As additional examples (post-lecture activity).
   - As an additional material of challenging topics (pre-and post-lecture activity).
   - As a model solution of some exercises (post-lecture activity).

Module-1

Fundamentals of Logic: Basic connectives and truth tables, Logical equivalence – The laws of Logic, Logical implication – Rules of Inference. Fundamentals of Logic contd.: The Use of Quantifiers-Quantifiers, Definitions, and the Proofs of Theorems. **8 Hours**

Self-study: Problems on Logical equivalence.[Text 1: 2.1, 2.2, 2.3, 2.4, 2.5]

(RBT Levels: L1, L2 and L3)

Module-2

Relations and Functions: Cartesian Products and Relations, Functions – Plain and One-to-One, Onto Functions. Function Composition, and Inverse Functions.

Relations: Properties of Relations, Computer Recognition – Zero-One Matrices and DirectedGraphs, Partial Orders – Hasse Diagrams, Equivalence Relations and Partitions.

Introduction to Graph Theory: Definitions and Examples, Sub graphs, Complements, and Graph Isomorphism, Vertex Degree, Euler Trails and Circuits. **8 Hours**

Self-study: The Pigeon-hole Principle, problems and its applications.

[Text 1: 5.1, 5.2, 5.3, 5.6, 7.1, 7.2, 7.3, 7.4, 11.1, 11.2, 11.3]

(RBT Levels: L1, L2 and L3)

Module-3

Curve Fitting: Curve fitting by the method of least squares- fitting the curves of the form- $y = ax + b$, $y = ax^b$, $= ax^2 + bx + c$.

Statistical Methods: Correlation and regression-Karl Pearson's coefficient of correlation and rank correlation-problems. Regression analysis- lines of regression –problems. **8 Hours**

Self-study: Fitting of the curve $y = ax^b$. Angle between two regression lines, problems.

[Text 1: 24.1, 24.4, 24.5, 24.6, 25.12, 25.13, 25.14, 25.16]

(RBT Levels: L1, L2 and L3)

Module-4

Probability Distribution.

Review of basic probability theory. Random variables (discrete and continuous), probability mass and density functions. Mathematical expectation, mean and variance. Binomial, Poisson and normal distributions- problems (derivations for mean and standard deviation for Binomial and Poisson distributions only)-Illustrative examples. **8 Hours**

Self-study: exponential distribution.

[Text 1: 26.1, 26.2, 26.7, 26.8, 26.9, 26.10, 26.13, 26.14, 26.15, 26.16]

(RBT Levels: L1, L2 and L3)

Module-5

Joint probability distribution: Joint Probability distribution for two discrete random variables, expectation, covariance and correlation.

Sampling Theory: Introduction to sampling distributions, standard error, Type-I and Type-II errors. Test of hypothesis for means, student's t-distribution, Chi-square distribution as a test of goodness offit. **8 Hours**

Self-Study: Point estimation and interval estimation

[Text 1: 27.1, 27.2, 27.3, 27.4 27.5, 27.6, 27.7, 27.9, 27.10, 27.11, 27.12, 27.13, 27.14, 27.15, 27.16, 27.17, 27.18. Text 3: 5.6, 5.7]

(RBT Levels: L1, L2 and L3)

Teaching-Learning Process for all modules	**Chalk and Talk/PowerPoint presentation/YouTube videos.**

Course Outcomes:

After successfully completing the course, the students will be able to :

1. Apply the concepts of logic for effective computation and relating problems in the Engineering domain.
2. Analyze the concepts of functions and relations to various fields of Engineering. Comprehend the concepts of Graph Theory for various applications of Computational sciences.
3. Make use of the correlation and regression analysis to fit a suitable mathematical model forthe statistical data.
4. Apply discrete and continuous probability distributions in analysing the probability models arising in the engineering field.
5. Construct joint probability distributions and demonstrate the validity oftesting the hypothesis.

Assessment Details (both CIE and SEE)

Component		Weightage (%)	
CIE's	CIE 1- At the end of 5th week	20	60
	CIE 2 - At the end of 10th week	20	
	CIE 3 - At the end of 15th week	20	
AAT's	AAT-1- At the end of 4th week	10	40
	AAT-2- At the end of 9th week	10	
	AAT-3- At the end of 13th week	20	
Continuous Internal Evaluation Total Marks: 100. Reduced to 50 Marks			
Semester End Examination (SEE) Total Marks: 100. Reduced to 50 Marks			

Suggested Learning Resources:

Text Books:

1. **Ralph P. Grimaldi and B V Ramana**: Discrete and Combinatorial Mathematics- An Applied Introduction, Pearson Education, Asia, Fifth edition – 2007. ISBN 978-81-7758-424-0.
2. **B. S. Grewal:** Higher Engineering Mathematics B. S. Grewal Khanna Publishers 44th Edition, 2017.
3. **Seymour Lipschutz and Marc Lars Lipson: –**Probability‖, (Chapters: 5 and 8),McGraw Hill Education (India) Private Limited, Chennai, Special Indian Edition, 2010,

Reference Books:

1. **Kenneth H. Rosen**: Discrete Mathematics and its Applications, Tata – McGraw Hill, Sixth Edition, Sixth reprint 2008. ISBN-(13):978-0-07-064824-1.
2. **C. L. Liu and D P Mohapatra:** Elementary Discrete Mathematics, Tata- McGraw Hill, Sixth Edition, ISBN:10:0-07-066913-9.
3. **J.P. Tremblay and R. Manohar:** Discrete Mathematical Structures with Applications to Computer Science, Tata – McGraw Hill, 35TH reprint 2008. ISBN 13:978-0-07- 463113-3.
4. **C. Ray Wylie, Louis C. Barrett: –**Advanced Engineering Mathematics‖ McGraw – Hill 6th Edition 1995.
5. **B. V. Ramana**: Higher Engineering Mathematics, McGraw-Hill 11th Edition,2010
6. **N. P. Bali and Manish Goyal:** A Text-Book of Engineering Mathematics,Laxmi Publications 2014
7. **Chandrika Prasad and Reena Garg:** Advanced Engineering Mathematics, Khanna Publishing, 2018

E-Resources:

List of NPTEL videos for various topics of Discrete Mathematical Structures

https://www.youtube.com/watch?v=9AUCdsmBGmA&list=PL0862D1A947252D20&index=10

https://www.youtube.com/watch?v=oU60TuGHxe0&list=PL0862D1A947252D20&index=11

https://www.youtube.com/watch?v=_BIKq9Xo_5A&list=PL0862D1A947252D20&index=13

https://www.youtube.com/watch?v=RMLR2JHHeWo&list=PL0862D1A947252D20&index=14

https://www.youtube.com/watch?v=nf9e0_ylGdc&list=PL0862D1A947252D20&index=15

https://www.youtube.com/watch?v=7cTWea9YAJE&list=PL0862D1A947252D20&index=24

https://www.youtube.com/watch?v=695iAm935cY&list=PL0862D1A947252D20&index=25

https://www.youtube.com/watch?v=ZECJHfsf4Vs&list=PL0862D1A947252D20&index=26

https://www.youtube.com/watch?v=Dsi7x-A89Mw&list=PL0862D1A947252D20&index=28

https://www.youtube.com/watch?v=xlUFkMKSB3Y&list=PL0862D1A947252D20

https://www.youtube.com/watch?v=0uTE24o3q-o&list=PL0862D1A947252D20&index=2

https://www.youtube.com/watch?v=DmCltf8ypks&list=PL0862D1A947252D20&index=3

https://www.youtube.com/watch?v=jNeISigUCo0&list=PL0862D1A947252D20&index=4

http://nptel.ac.in/courses.php?disciplineID=111

http://www.class-central.com/subject/math(MOOCs) http://academicearth.org/

VTU EDUSAT PROGRAMME – 20

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Quizzes
- Assignments
- Seminars

CO- PO Mapping :

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
21CSM41.1	3	1				1						
21CSM41.2	3	3										
21CSM41.3	3	2				2						
21CSM41.4	3	3				2						
21CSM41.5	2	2				2						

DESIGN AND ANALYSIS OF ALGORITHMS

Course Code	**21CDI42**	**CIE Marks**	**50**
Teaching Hours/Week (L: T: P: S) (3:0:2:0)	**3:0:2:0**	**SEE Marks**	**50**
Total Hours of Pedagogy	**40 T + 20 P**	**Total Marks**	**100**
Credits	**04**	**Exam Hours**	**03**

Prerequisites:

Data Structures, Algorithms, Algebra.

Course Learning Objectives:

CLO1. Explain the methods of analysing the algorithms and to analyze performance of algorithms.

CLO2. State algorithm‘s efficiencies using asymptotic notations.

CLO3. Solve problems using algorithm design methods such as the brute force method, greedy method, divide and conquer, decrease and conquer, transform and conquer, dynamic programming, backtracking and branch and bound.

CLO 4. Choose the appropriate data structure and algorithm design method for a specified application.

CLO 5. Introduce P and NP classes.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) does not mean only traditional lecture method, but different type of teaching methods may be adopted to develop the outcomes.
2. Show Video/animation films to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students‘ Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather thansimply recall it.
6. Topics will be introduced in a multiple representation.
7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

Introduction: What is an Algorithm? It‘s Properties. Algorithm Specification-using natural language, using Pseudo code convention, Fundamentals of Algorithmic Problem solving, Analysis Framework-Time efficiency and space efficiency, Worst-case, Best-case and Average case efficiency.

Performance Analysis: Estimating Space complexity and Time complexity of algorithms.

Asymptotic Notations: Big-Oh notation (O), Omega notation (Ω), Theta notation with examples, Basic efficiency classes, Mathematical analysis of Non-Recursive and Recursive Algorithms with Examples.

Brute force design technique: Selection sort, sequential search, string matching algorithm with complexity Analysis. **08 Hours**

Textbook 1: Chapter 1 (Sections 1.1,1.2), Chapter 2(Sections 2.1,2.2,2.3,2.4), Chapter 3(Section 3.1,3.2) Textbook 2: Chapter 1(section 1.1,1.2,1.3)

Module-2
Divide and Conquer: General method, Recurrence equation for divide and conquer, solving it using Master‘s theorem. , Divide and Conquer algorithms and complexity Analysis of Finding the maximum & minimum, Binary search, Merge sort, Quick sort. **Decrease and Conquer Approach**: Introduction, Insertion sort, Graph searching algorithms, Topological Sorting. It‘s efficiency analysis. **08 Hours** **Textbook 2: Chapter 3(Sections 3.1,3.3,3.4,3.5,3.6)** **Textbook 1: Chapter 4 (Sections 4.1,4.2,4.3), Chapter 5(Section 5.1,5.2,5.3)**
Module-3
Greedy Method: General method, Knapsack Problem, solving Job sequencingwith deadlines Problems. **Minimum cost spanning trees**: Prim‘s Algorithm, Kruskal‘s Algorithm with performance analysis. **Single source shortest paths**: Dijkstra's Algorithm. **Transform and Conquer Approach**: Introduction, Heaps and Heap Sort. **08 Hours** **Textbook 2: Chapter 4(Sections 4.1,4.3,4.5)** **Textbook 1: Chapter 9(Section 9.1,9.2,9.3,9.4), Chapter 6(section 6.4)**
Module-4
Dynamic Programming: General method with Examples, Multistage Graphs. **Transitive Closure**: Warshall‘s Algorithm. **All Pairs Shortest Paths**: Floyd's Algorithm, Travelling Sales man, Bellman-Ford Algorithm. **Space-Time Tradeoffs**: Introduction, Sorting by Counting, Input Enhancement in String Matching-Harspool‘s algorithm. **08 Hours** **Textbook 2: Chapter 5 (Sections 5.1,5.2,5.4,5.9)** **Textbook 1: Chapter 8(Sections 8.2,8.4), Chapter 7 (Sections 7.1,7.2)**
Module-5
Backtracking: General method, solution using back tracking to N-Queens problem, Sum of subsets problem. **Branch and Bound**: Assignment Problem, 0/1 Knapsack problem **NP-Complete and NP-Hard problems**: Basic concepts, non- deterministic algorithms, P, NP,NP-Complete, and NP-Hard classes. **08 Hours** **Textbook 1: Chapter 12 (Sections 12.1,12.2) Chapter 11(11.3)** **Textbook 2: Chapter 7 (Sections 7.1,7.2,7.3,7.4,7.5) Chapter 11 (Section 11.1)**

Teaching-Learning Process for all modules	1. Chalk & board, Active Learning, MOOC, Problem based Learning. 2. Laboratory Demonstration.

PRACTICAL COMPONENTS

Sl. No	Experiments
1	Sort a given set of n integer elements us complexity. Run the program for varied a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator. Demonstrate using C/Java how the brute force method works along with its time complexity analysis: worst case, average case and best case.
2	Sort a given set of n integer elements using Merge Sort method and compute its time complexity. Run the program for varied values of n> 5000, and record the time taken to sort. Plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator. Demonstrate using C/Java how the divide-and-conquer method works along with its time complexity analysis: worst case, average case and best case.

3	Write & Execute C/Java ProgramTo solve Knapsack problem using Greedy method.
4	Write & Execute C/Java ProgramTo find shortest paths to other vertices from a given vertex in a weighted connected graph, using Dijkstra's algorithm
5	Write & Execute C/Java ProgramTo find Minimum Cost Spanning Tree of a given connected undirected graph using Kruskal's algorithm. Use Union-Find algorithms in your program.
6	Write & Execute C/Java Program To find Minimum Cost Spanning Tree of a given connected undirected graph using Prim's algorithm.
7	Write C/ Java programs to Solve All-Pairs Shortest Paths problem using Floyd's algorithm.
8	Write C/ Java programs to Solve 0/1 Knapsack problem using Dynamic Programming method.
9	Design and implement C/Java Program to find a subset of a given set S = {Sl, S2,…, Sn} of n positive integers whose SUM is equal to a given positive integer d. For example, if S = {1, 2, 5, 6, 8} and d= 9, there are two solutions {1, 2, 6} and {1, 8}. Display a suitable message, if the given problem instance doesn't have a solution.
10	Design and implement C/Java Program to implement N queens using backtracking principle.

At the end of the course the student will be able to:

CO 1. Analyze the performance of the algorithms, state the efficiency using asymptotic notations and analyze mathematically the complexity of the algorithm.

CO 2. Apply divide and conquer approaches and decrease and conquer approaches in solving the problems analyze the same

CO 3. Apply the appropriate algorithmic design technique like greedy method, transform and conquer approaches and compare the efficiency of algorithms to solve the given problem.

CO 4. Apply and analyze dynamic programming approaches to solve some problems. and improve an algorithm time efficiency by sacrificing space.

CO 5. Apply and analyze backtracking, branch and bound methods and to describe P, NP and NP- Complete problems.

Assessment Details (both CIE and SEE)

Component		**Weightage (%)**		
CIE's	CIE 1 5th week	20	60	Average of 3 tests for 20 marks
	CIE 2 10th week	20		
	CIE 3 15th week	20		
AAT's	AAT-1 10th week			10
	Lab Test	30		Reduced to 10
	Lab Record	20		10
Continuous Internal Evaluation Total Marks :100. Reduced to 50 Marks				
Semester End Examination (SEE) Total Marks :100. Reduced to 50 Marks				

Suggested Learning Resources:

Textbooks

1. Introduction to the Design and Analysis of Algorithms, Anany Levitin: 2nd Edition, 2009. Pearson.
2. Computer Algorithms/C++, Ellis Horowitz, SatrajSahni and Rajasekaran, 2nd Edition, 2014, Universities Press.

Reference Books:

1. Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein, 3rd Edition, PHI.
2. Design and Analysis of Algorithms, S. Sridhar, Oxford (Higher Education)

Weblinks and Video Lectures (e-Resources):

1. http://elearning.vtu.ac.in/econtent/courses/video/CSE/06CS43.html
2. https://nptel.ac.in/courses/106/101/106101060/
3. http://elearning.vtu.ac.in/econtent/courses/video/FEP/ADA.html
4. http://cse01-iiith.vlabs.ac.in/
5. http://openclassroom.stanford.edu/MainFolder/CoursePage.php?course= Intro To Algorithms

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

1. Real world problem solving and puzzles using group discussion. E.g., Fake coinidentification, Peasant, wolf, goat, cabbage puzzle, Konigsberg bridge puzzle etc.,
2. Demonstration of solution to a problem through programming.

CO-PO & PSO Mapping:

POs / COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
C01	2	3			2				1			1	3		
C02	3	2							1			2	3	2	
CO3	2	2	3		1				1				3		1
CO4	2	3	3		1				1				3		1
C05	2	3	2										3		
Avg	2.2	2.6	2.6		1.33				1			1.5	3	2	1

3-Strong, 2-Medium, 1-low

DATA VISUALIZATION USING R (IC)			
Course Code	**21CDI43**	**CIE Marks**	**50**
Teaching Hours/Week (L: T: P: S) (3:0:2:0)	**3:0:2:0**	**SEE Marks**	**50**
Total Hours of Pedagogy	**40 T + 20 P**	**Total Marks**	**100**
Credits	**04**	**Exam Hours**	**03**

Prerequisites: Basic knowledge of programming, excel, data handling and various graphs.

Course Description:

In this course, you will learn the Grammar of Graphics, a system for describing and building graphs, and how the ggplot2 data visualization package for R applies this concept to basic bar charts, histograms, pie charts, scatter plots, line plots, and box plots.

Objectives:

As a student will be able to:

- Learn how to generate basic visualizations
- Understand the limitations and advantages of using certain visualizations
- Develop interactive visualizations and applications
- Understand various data exploratory functions in R
- Learn ways of presenting the data to our audience

Module – I

Introduction to R Programming

A Simple Guide to R: Installing packages and getting help in R, Data types & Special values in R, Matrices and editing in R, Data frames and editing in R, Importing and exporting data in R, Writing function and inbuilt functions in R, Loops and control statements in R, Using par to beautify and saving plots in R. Basic and Interactive Plots: Introducing a scatter plot, Scatter plots with texts, labels, and lines, Connecting points and generating interactive scatter plot, Simple and interactive bar plot, Simple line plot, Generating an interactive Gantt/timeline chart in R, Merging histograms, Making an interactive bubble plot, Constructing a waterfall plot in R.

Textbook 1: Chapter 1, Chapter 2 **08 Hours**

Module – II

Maps and Dendrograms

Heat Maps and Dendrograms: Introduction, Constructing a simple dendrogram, Creating dendrograms with colors and labels, Creating and generating heat map with customized colors, Generating an integrated dendrogram and a heat map, Creating a three-dimensional heat map and a stereo map, Constructing a tree map in R, **Maps:** Introduction, Regional maps, Choropleth maps, A guide to contour maps, Constructing maps with bubbles, Integrating text with maps, Introducing shapefiles, Creating cartograms

Textbook 1: Chapter 3, Chapter 4 **08 Hours**

Module – III

The Pie Chart and Adding 3D

The Pie Chart and its alternatives: Introduction, Generating a simple pie chart, Constructing pie charts with labels, Creating donut plots and interactive plots, Generating a slope chart, Constructinga fan plot.

Adding the Third Dimension: Introduction, Constructing a 3D scatter plot, Generating a 3D scatter plot with text, A simple 3D pie chart, A simple 3D histogram, Generating a 3D contour plot, Integrating a 3D contour and a surface plot, Animating a 3D surface plot.

Textbook 1: Chapter 5, Chapter 6 **08 Hours**

Module – IV

Higher Dimensions Data and Visualization

Data in Higher Dimensions: Introduction, Constructing a sunflower plot, Creating a hexbin plot, Generating interactive calendar maps, Creating Chernoff faces in R, Constructing a coxcomb plot in R, Constructing network plots, Constructing a radial plot, Generating a very basic pyramid plot.
Visualizing Continuous Data: Introduction, Generating a candlestick plot, Generating interactive candlestick plots, Generating a decomposed time series, Plotting a regression line, Constructing a box and whiskers plot, Generating a violin plot, Generating a quantile-quantile plot (QQ plot), Generating a density plot, Generating a simple correlation plot.

Textbook 1: Chapter 7, Chapter 8 **08 Hours**

Module – V

Visualizing Text and Creating Applications

Visualizing Text and XKCD-style Plots: Introduction, Generating a word cloud, Constructing a word cloud from a document, Generating a comparison cloud, Constructing a correlation plot and a phrase tree, Generating plots with custom fonts, Generating an XKCD-style plot.
Creating Applications in R: Introduction, Creating animated plots in R, Creating a presentation in R, A basic introduction to API and XML, Constructing a bar plot using XML in R, Creating a very simple shiny app in R.

Textbook 1: Chapter 9, Chapter 10 **08 Hours**

Teaching-Learning Process for all modules	1. Chalk & board, Active Learning, MOOC, Problem based Learning. 2. Laboratory Demonstration.

PRACTICAL COMPONENTS

Sl. No	**Experiments**
1	Generating an interactive Gantt/timeline chart by redefining to the new dataframe.
2	Illustrate the steps for creating the scattered plot with example using legends, text, abline functions using the given dataset

DATE	**Gini**	**gdp_ann**	**Presidents**	**ineql**	**years**
01-01-1967	0.397	861.7	Johnson	2.935356	1967
01-01-1968	0.386	942.5	Johnson	2.974281	1968
01-01-1970	0.394	1075.9	Nixon	3.031772	1970
01-01-1971	0.396	1167.8	Nixon	3.067368	1971
01-01-1972	0.401	1282.4	Nixon	3.108024	1972
01-01-1975	0.397	1688.9	Ford	3.227604	1975
01-01-1976	0.398	1877.6	Ford	3.273603	1976
01-01-1978	0.402	2356.6	Carter	3.372286	1978

01-01-1979	0.404	2632.2	Carter	3.420319	1979	
01-01-1988	0.426	5252.6	Reagan	3.720374	1988	
01-01-1989	0.431	5657.7	Reagan	3.75264	1989	
01-01-1990	0.428	5979.6	G. Bush	3.776672	1990	
01-01-1991	0.428	6174	G. Bush	3.790567	1991	
01-01-2000	0.462	10289.7	Clinton	4.012403	2000	
01-01-2001	0.466	10625.3	Clinton	4.026341	2001	
01-01-2010	0.47	14958.3	Obama	4.174882	2010	
01-01-2011	0.477	15533.8	Obama	4.191278	2011	

3 Generate a heat map with labels for the dataset and mentioning the x label = " Body Count per month", y label = "Years" using the given dataset

years	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2003	3	2	3977	3435	546	597	647	794	565	517	486	526
2004	610	663	1004	1303	654	901	825	877	1033	1016	1652	1112
2005	1188	1284	902	1144	1392	1346	1530	2276	1422	1298	1467	1133
2006	1544	1570	1946	1801	2272	2571	3297	2865	2562	2983	3077	2891
2007	3013	2673	2710	2540	2834	2192	2690	2481	1366	1295	1110	987
2008	847	1072	1643	1299	890	747	643	682	606	590	535	582
2009	372	403	426	567	390	501	407	618	333	435	226	475
2010	263	304	336	385	387	385	443	516	254	312	307	218
2011	389	254	311	289	381	386	308	401	397	366	279	388
2012	524	356	377	392	304	529	469	422	396	290	253	275
2013	357	360	403	545	888	659	1145	1012	1221	1095	903	983

4 Construct a 3D scatter plot for the data to include two additional columns: names and gender and a function to load the data in the active session and save it as a data frame.

5 Project the 3D histogram with the z variable as well by generating the data for the x and y values x = y = seq(-4,4,by =0.5)

6 Generate the donut plot for the following dataset by providing the labels ("Army", "Navy", "Air Force‖, ‒Marines") and percentage for the traumatic brain injuries data = c(179718,41370,41914,44280)

7 Creating a hexbin plot by generating a fake dataset and generating 1000 normally distributed random numbers

8 Researchers have observed that equity prices or stock returns do not have a normal distribution and the actual distribution of returns contains fat tails. Construct a quantile-quantile plot (QQ plot) to display the data of MSFT and FAKE quantiles.

9 Generate a correlation plot considering the data :

rates=c("USD/EUR","USD/GBP","USD/CHF","USD/JPY","USD/CAD","USD/AUD","USD/IDR")

10 Considering the inaugural speeches given by President Obama and former president George Bush, two clouds provide us with a great contrast on how these individuals perceive the nation and its citizens. Generate a comparison cloud to eliminate the stop words and project the document matrix.

Course Outcomes:

Students will be able to:

Sl. No.	Course Outcomes
C203.1	Implement different methods of Data visualization
C203.2	Describe and design maps and dendrograms using R
C203.3	Create and generate the pie chart and 3D plots
C203.4	Describe and Analyze high dimensional data and visualize continuous data
C203.5	Visualize after analysis of the text and create applications in R

Assessment Details (both CIE and SEE)

Component		**Weightage (%)**		
CIE's	CIE 1 5th week	20	60	Average of 3 tests for 20 marks
	CIE 2 10th week	20		
	CIE 3 15th week	20		
AAT's	AAT-1 10th week			10
	Lab Test	30		Reduced to 10
	Lab Record	20		10
Continuous Internal Evaluation Total Marks :100. Reduced to 50 Marks				
Semester End Examination (SEE) Total Marks :100. Reduced to 50 Marks				

Suggested Learning Resources:

Textbooks:

1) R Data Visualization Cookbook - Atmajitsinh Gohil, Published by Packet Publishing Ltd., January 2015
2) The Book of R – Tilman M. Davies, No Starch Press, Inc.

Reference Books:

1) Data Visualization with R - Rob Kabacof, Opensource publications, 2018
2) R for Dummies - Andrie de Vries and Joris Meys, Published by: John Wiley & Sons, Inc., 2015
3) Data Visualization with R – Thomas Rahlf, Springer publications, 2014

CO-PO & PSO Mapping:

POS COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C203.1	3				3							
C203.2	1		3		2							
C203.3	1	1	3		3							
C203.4	1	3	1	2	3							
C203.5	1	2	2	2	3					2		
C203	1.4	2	2.25	2	2.8					2		

CO-PSO MAPPING

CO. No.	PSO1	PSO2	PSO3
C203.1	2		2
C203.2			2
C203.3	2		2
C203.4			2
C203.5	2		2
C203	**2**		**2**

OPERATING SYSTEM

Course Code	**21CDT44**	**CIE Marks**	**50**
Teaching Hours/Weeks (L: T: P: S)	**3: 0: 0: 0**	**SEE Marks**	**50**
Total Hours of Pedagogy	**40**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Prerequisites:

Computer Basics, Computer organization, Computer Architecture.

Course Learning Objectives

CLO 1. Understanding the role of operating system with its function and services. (Understanding)
CLO 2. Compare Various Algorithm used for CPU Scheduling, Memory management and Disk Scheduling Algorithm.(Evaluate)
CLO 3. Apply various concepts related with Deadlock to solve Problems.(Apply)
CLO 4. Analyze Protection and Security Mechanism in Operating System.(Analyze)

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various Course outcomes.

1. Lecturer method (L) does not mean only traditional lecture method, but different type of teaching methods may be adopted to develop the outcomes.
2. Show Video/animation films to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOTS (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
6. Topics will be introduced in a multiple representation.
7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module – I

Operating System:

Operating Systems Overview- Overview and Functions of operating systems, protection and security, distributed systems, operating Systems structures, services, system calls and their working. History and generation of operating system.

Process and Threads:

Process and Threads - Process concepts, threads, scheduling-criteria, Algorithms, and their evaluation. Process Scheduling, Scheduling, case studies UNIX. Linux. Windows

Textbook 1: Chapter - 1,2,3

08 Hours

Module – II

Concurrency Control(IPC):

Process synchronization, critical- section problem. classic problems of Synchronization, Software Solutions for synchronization problem.

Hardware Solutions for synchronization problem. Synchronization and Their applications. [Understanding of Semaphore – Mutex – Monitor – Event Counters]

Textbook 1: Chapter - 4,5 **08 Hours**

Module – III

Memory Management:

Memory: Swapping, contiguous memory allocation, paging, page table, segmentation, virtual memory, demand paging, page- replacement, Allocation of frames,

Virtual Memory: Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page fault, Working Set, Dirty page/Dirty bit – Demand paging (Concepts only) – Page

Replacement policies : Least Recently used (LRU) Optimal (OPT) , Second Chance (SC), First in First Out (FIFO), Not recently used (NRU).

Textbook 1: Chapter – 8,9,10 **08 Hours**

Module – IV

Principles of Deadlock:

Deadlock - system model, deadlock and its characterization with example, deadlock prevention techniques with example, detection and avoidance of a deadlock, methods to get recovery form deadlock

File System Interface:

File system Interface- the concept of a file, Access Methods. Directory Structure. File system mounting, file protection and sharing mechanism. File System implementation- File system structure, file/directory implementation, efficiency and performance, file allocation methods, Free-space management.

Textbook 1: Chapter - 7,11 **08 Hours**

Module – V

Mass Storage Structure & I/O System:

Mass-storage structure- RAID structure, Disk structure, disk Attachment, disk scheduling, swap-space management. stable-storage Implementation. Overview of Mass-storage structure. Tertiary storage Structure.

I/O systems- Hardware, application l/o interface, kernel I/O subsystem, Transforming I/O requests to Hardware operations. STREAMS, performance.

Protection & Security:

Protection - Protection. Goals of Protection, Principles of Protection. Domain of protection Access Matrix, Implementation of Access Matrix. Access control, Revocation of Access Rights.

Case Study: The Linux Operating System: Linux history; Design principles; Kernel modules; Process management; Scheduling; Memory Management; File systems, Input and output; Inter-process communication.

Textbook 1: Chapter - 2,21 **08 Hours**

Teaching-Learning Process for all modules	**Chalk and Talk, PowerPoint presentation, flip teaching, YouTube videos**

COURSE OUTCOMES:

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

CO 1: Demonstrate functional architecture of an operating system.
CO 2: Describe process scheduling and Multithreading Concepts.
CO 3: Use suitable techniques for handling the deadlocks.
CO 4: Apply various memory management techniques.
CO 5: Realize the different concepts of OS in platform of usage through case studies.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course. Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module

Suggested Learning Resources:

Text Books

1. Operating System Concepts- Abraham Silberchatz, Peter B. Galvin, Greg Gagne, 9th ed.
2. Operating Systems - Internals and Design Principles. Stallings, 6th Edition- 2009. Pearson education.
3. Operating systems- A Concept based Approach-D.M.Dhamdhere. 3rd Edition.TMH

Reference:

1. Modern Operating Systems, Andrew S Tanenbaum 3rd edition PHI.
2. Principles of Operating Systems, B.L. Stuart. Cengage learning, India Edition.
3. Operating Systems. A.S. Godboie.2nd Edition, TMH

CO-PO & PSO Mapping:

CO Identification No.	Program Outcomes (PO)												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
C01	2	2	2	2	-	-	-	-	-	-	-	2	2	2	2
CO2	2	3	3	2	-	-	-	-	-	-	-	2	2	3	3
C03	2	2	2	2	-	-	-	-	-	-	-	2	2	2	2
C04	2	3	3	2	-	-	-	-	-	-	-	2	2	2	2
CO5	3	2	2	2	-	-	-	-	-	-	-	3	3	3	3
Average	**2.2**	**2.4**	**2.4**	**2**	-	-	-	-	-	-	-	**2.2**	**2.2**	**2.4**	**2.4**

3-Strong, 2-Medium, 1-low

BIOLOGY FOR ENGINEERS

Course Code	**21BET45**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P: S)	**1:2:0:0 /2:0:0:0**	**SEE Marks**	**50**
Total Hours of Pedagogy	**25**	**Total Marks**	**100**
Credits	**02**	**Exam Hours**	**02**

Prerequisites:

Bio System, Biology, Eco System.

Course objectives:

- To familiarize the students with the basic biological concepts and their engineering applications.
- To enable the students with an understanding of bio design principles to create novel devices and structures.
- To provide the students an appreciation of how biological systems can be re-designed as substitute products for natural systems.
- To motivate the students develop the interdisciplinary vision of biological engineering.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

- ✓ Explanation via real life problem, situation modelling, and deliberation of solutions, hands-on sessions, reflective and questioning /inquiry-based teaching.
- ✓ Instructions with interactions in classroom lectures (physical/hybrid).
- ✓ Use of ICT tools, including YouTube videos, related MOOCs, AR/VR/MR tools.
- ✓ Flipped classroom sessions (~10% of the classes).
- ✓ Industrial visits, Guests talks and competitions for learning beyond the syllabus.
- ✓ Students' participation through audio-video based content creation for the syllabus (as assignments).
- ✓ Use of gamification tools (in both physical/hybrid classes) for creative learning outcomes.
- ✓ Students' seminars (in solo or group) /oral presentations.

Module-1

BIOMOLECULES AND THEIR APPLICATIONS (QUALITATIVE): Carbohydrates (cellulose-based water filters, PHA and PLA as bioplastics), Nucleic acids (DNA Vaccine for Rabies and RNA vaccines for Covid19, Forensics – DNA fingerprinting), Proteins (Proteins as food – whey protein and meat analogs, Plant based proteins), lipids (biodiesel, cleaning agents/detergents), Enzymes (glucose-oxidase in biosensors, lignolytic enzyme in bio-bleaching). **05 Hours**

Module-2

HUMAN ORGAN SYSTEMS AND BIO DESIGNS - 1 (QUALITATIVE): Brain as a CPU system (architecture, CNS and Peripheral Nervous System, signal transmission, EEG, Robotic arms for prosthetics. Engineering solutions for Parkinson's disease).Eye as a Camera system (architecture of rod and cone cells, optical corrections, cataract, lens materials, bionic eye).Heart as a pump system (architecture, electrical signalling - ECG monitoring and heart related issues, reasons for blockages of blood vessels, design of stents, pace makers, defibrillators). **05 Hours**

Module-3

HUMAN ORGAN SYSTEMS AND BIO-DESIGNS - 2 (QUALITATIVE): Lungs as purification system (architecture, gas exchange mechanisms, spirometry, abnormal lung physiology - COPD, Ventilators, Heart-lung machine).Kidney as a filtration system (architecture, mechanism of filtration, CKD, dialysis systems). Muscular and Skeletal Systems as scaffolds (architecture, mechanisms, bioengineering solutions for muscular dystrophy and osteoporosis). **05 Hours**

Module-4

NATURE-BIOINSPIRED MATERIALS AND MECHANISMS (QUALITATIVE): Echolocation (ultrasonography, sonars), Photosynthesis (photovoltaic cells, bionic leaf). Bird flying (GPS and aircrafts), Lotus leaf effect (Super hydrophobic and self-cleaning surfaces), Plant burrs (Velcro), Shark skin (Friction reducing swim suits), Kingfisher beak (Bullet train). Human Blood substitutes - hemoglobin-based oxygen carriers (HBOCs) and per fluorocarbons (PFCs). **05 Hours**

Module-5

TRENDS IN BIOENGINEERING (QUALITATIVE): Bioprinting techniques and materials, 3D printing of ear, bone and skin. 3D printed foods. Electrical tongue and electrical nose in food science, DNA origami and Biocomputing, Bioimaging and Artificial Intelligence for disease diagnosis. Self-healing Bioconcrete (based on bacillus spores, calcium lactate nutrients and biomineralization processes) and Bioremediation and Biomining via microbial surface adsorption (removal of heavy metals like Lead, Cadmium, Mercury, Arsenic). **05 Hours**

Teaching-Learning Process for all modules	**Chalk and Talk, PowerPoint presentation, flip teaching, YouTube videos**

Course outcomes (Course Skill Set)
At the end of the course the student will be able to:

- Elucidate the basic biological concepts via relevant industrial applications and case studies.
- Evaluate the principles of design and development, for exploring novel bioengineering projects.
- Corroborate the concepts of biomimetics for specific requirements.
- Think critically towards exploring innovative biobased solutions for socially relevant problems.

Assessment Details (both CIE and SEE)

Component		Weightage (%)	
CIE's	CIE 1 5th week	20	60
	CIE 2 10th week	20	
	CIE 3 15th week	20	
AAT's	AAT-1 10th week	10	
	AAT-2	10	
	AAT-3	20	
Continuous Internal Evaluation Total Marks: 100. Reduced to 50 Marks			
Semester End Examination (SEE) Total Marks: 100. Reduced to 50 Marks			

Suggested Learning Resources:

- Human Physiology, Stuart Fox, Krista Rompolski, McGraw-Hill eBook. 16th Edition, 2022
- Biology for Engineers, Thyagarajan S., Selvamurugan N., Rajesh M.P., Nazeer R.A., Thilagaraj W., Barathi S., andJaganthan M.K., Tata McGraw-Hill, New Delhi, 2012.
- Biology for Engineers, Arthur T. Johnson, CRC Press, Taylor and Francis, 2011
- Biomedical Instrumentation, Leslie Cromwell, Prentice Hall 2011.
- Biology for Engineers, Sohini Singh and Tanu Allen, Vayu Education of India, New Delhi, 2014.
- Biomimetics: Nature-Based Innovation, Yoseph Bar-Cohen, 1st edition, 2012, CRC Press.
- Bio-Inspired Artificial Intelligence: Theories, Methods and Technologies, D. Floreano and C. Mattiussi, MIT Press,2008.
- Bioremediation of heavy metals: bacterial participation, by C R Sunilkumar, N Geetha A C Udayashankar LambertAcademic Publishing, 2019.
- 3D Bioprinting: Fundamentals, Principles and Applications by Ibrahim Ozbolat, Academic Press, 2016.
- Electronic Noses and Tongues in Food Science, Maria Rodriguez Mende, Academic Press, 2016.
- Blood Substitutes, Robert Winslow, Elsevier, 2005

Web links and Video Lectures (e-Resources):

- VTU EDUSAT / SWAYAM / NPTEL / MOOCS / Coursera / MIT-open learning resource
- https://nptel.ac.in/courses/121106008
- https://freevideolectures.com/course/4877/nptel-biology-engineers-other-non-biologists
- https://ocw.mit.edu/courses/20-020-introduction-to-biological-engineering-design-spring-2009
- https://ocw.mit.edu/courses/20-010j-introduction-to-bioengineering-be-010j-spring-2006
- https://www.coursera.org/courses?query=biology
- https://onlinecourses.nptel.ac.in/noc19_ge31/preview
- https://www.classcentral.com/subject/biology
- https://www.futurelearn.com/courses/biology-basic-concepts

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Group Discussion of Case studies
- Model Making and seminar/poster presentations
- Design of novel device/equipment like Cellulose-based water filters, Filtration system mimicking the kidney, Bioremediation unit for E-waste management, AI and ML based Bioimaging,

CO / PO Mapping

CO/PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	3					2			1	3		1	1		2
CO2	2	1	3	2	1	1	1	1	2	2		2	1		3
CO3	2	1		2						1			2		1
CO4	1	3		1		2	2	2	2	1			2		2
Average	2	1.66	3	1.66	1	1.66	1.5	1.5	1.66	1.75		1.5	1.5		2

PYTHON PROGRAMMING LABORATORY

Course Code	21CDL46	CIE Marks	50
Teaching Hours/Weeks (L:T:P:S) (0:0:2:0)	Credits (0:0:1:0)	SEE Marks	50
Total Hours of Pedagogy	24 Hours	Total Marks	100
Credits	01	Exam Hours	03

Course Objectives:

1. Demonstrate the use of IDLE, Jupiter note book or PyCharm IDE to create Python Applications
2. Using Python programming language to develop programs for solving real-world problems
3. Implement the Object-Oriented Programming concepts in Python.
4. Appraise the need for working with various documents like Excel, PDF, Word and Others
5. Demonstrate regular expression using python programming

Note: Two hours tutorial is suggested for each laboratory sessions.

Prerequisite

- Students should be familiarized about Python installation and setting Python environment
- Usage of IDLE, Jupiter note book or IDE like PyCharm should be introduced

Python Installation: https://www.youtube.com/watch?v=Kn1HF3oD19c PyCharm Installation: https://www.youtube.com/watch?v=SZUNUB6nz3g

Sl. No.	***PART A – List of problems for which student should develop program and execute in the Laboratory***
1	**Aim:** Introduce the Python fundamentals, data types, operators, flow control and exception handling in Python a) Students test marks for each course is considered as the best of two test average marks out of three test‘s marks, Implement a python program to find the test average marks, take input from the user. b) Implement a Python program to check whether a given number is palindrome or not and also count the number of occurrences of each digit in the input number. Data types: https://www.youtube.com/watch?v=gCCVsvgR2KU Operators: https://www.youtube.com/watch?v=v5MR5JnKcZI Flow Control: https://www.youtube.com/watch?v=PqFKRqpHrjwFor loop: https://www.youtube.com/watch?v=0ZvaDa8eT5s While loop: https://www.youtube.com/watch?v=HZARImviDxg Exceptions: https://www.youtube.com/watch?v=6SPDvPK38tw
2	**Aim:** Demonstrating creation of functions, passing parameters and return values a) Defined as a function F as Fn = Fn-1 + Fn-2. Write a Python program which accepts a value for N (where N >0) as input and pass this value to the function. Display suitable error message if the condition for input value is not followed. b) Demonstrate how to implement a python program to convert binary to decimal, octal to hexadecimal using functions. Functions: https://www.youtube.com/watch?v=BVfCWuca9nw Arguments: https://www.youtube.com/watch?v=ijXMGpoMkhQ Return value: https://www.youtube.com/watch?v=nuNXiEDnM44
3	**Aim:** Demonstration of manipulation of strings using string methods a) When an interpreter reads a line/ sentence from user, find the number of words, digits, uppercase letters and lowercase letters in that sentence; demonstrate with the help of python programming. b) Let us take two strings compare and find the string similarity between two given strings with the help of python programming.

	Sample Output: **Sample Output:** Original string: Original string: Python Exercises Python Exercises Python Exercises Python Exercise Similarity between two said strings: Similarity between two said strings:1.0 0.967741935483871 Strings: https://www.youtube.com/watch?v=lSItwlnF0eU String functions: https://www.youtube.com/watch?v=9a3CxJyTq00
4	**Aim:** Discuss different collections like list, tuple and dictionary a) User enters a list of random numbers, the programmer need to arrange these random numbers in ascending order with sorting techniques such as insertion sort and mergesort using lists in python. b) Demonstrate with a python program to convert roman numbers into integer values using dictionaries, by taking inputs from user. Lists: https://www.youtube.com/watch?v=Eaz5e6M8tL4 List methods: https://www.youtube.com/watch?v=8-RDVWGktuITuples: https://www.youtube.com/watch?v=bdS4dHIJGBc Tuple operations: https://www.youtube.com/watch?v=TItKabcTTQ4 Dictionary: https://www.youtube.com/watch?v=4Q0pW8XBOkc Dictionary methods:https://www.youtube.com/watch?v=oLeNHuORpNY
5	**Aim:** Demonstration of pattern recognition with and without using regular expressions a) Implement a function called is phone number () to recognize a pattern 415-555-4242 without using regular expression and also write the code to recognize the same pattern using regular expression. b) Develop a python program that could search the text in a file for phone numbers (+919900889977) and email addresses (sample@gmail.com) Regular expressions: https://www.youtube.com/watch?v=LnzFnZfHLS4
6	**Aim:** Demonstration of reading, writing and organizing files. a) Demonstrate how files are read in python by considering **myfile.txt** as an example file name which is entered by the user to perform the following operations. 1. Display the first N line of the file 2. Find the frequency of occurrence of the word accepted from the user in the file b) Python is termed as secure language, demonstrate a simple method of securing data by creating a ZIP file of a particular folder which contains several files inside it. Files: https://www.youtube.com/watch?v=vuyb7CxZgbU https://www.youtube.com/watch?v=FqcjKewJTQ0 File organization: https://www.youtube.com/watch?v=MRuq3SRXses
7	**Aim:** Demonstration of the concepts of classes, methods, objects and inheritance

	a) Inheritance is one of the main pillars of OOPs concept. By using inheritance, a child class acquires all properties and behaviors of parent class. Referring the above inheritance concept write a python program to find the area of triangle, circle and rectangle. b) Implement a python program by creating a class called Employee to store the details of Name, Employee_ID, Department and Salary, and implement a method to update salary of employees belonging to a given department. OOP's concepts: https://www.youtube.com/watch?v=qiSCMNBIP2gInheritance: https://www.youtube.com/watch?v=Cn7AkDb4pIU
8	**Aim:** Demonstration of classes and methods with polymorphism and overriding a) Inheritance applies to classes, whereas polymorphism applies to methods, using these concepts implement a python program to find whether the given input is palindrome or not (for both string and integer). Overriding: https://www.youtube.com/watch?v=CcTzTuIsoFk
9	**Aim:** Demonstration of working with excel spreadsheets and web scraping a) XKCD is a web comic website consists of many curious comics and sometimes user wants to save that comic image on their local devices, a user has to visit every page of the comic website. instead implement a python program to downloadthe all XKCD comics. b) In python programming how to read the data from the spreadsheet and write the data in to the spreadsheet , by using the load_workbook() method, demonstrate with code snippet. Web scraping: https://www.youtube.com/watch?v=ng2o98k983k Excel: https://www.youtube.com/watch?v=nsKNPHJ9iPc
10	**Aim:** Demonstration of working with PDF, word and JSON files a) Demonstrate with a python program the possible ways to combine select pages from many PDFs. b) Accessing current weather data for any location on Earth, We collect and process weather data from different sources such as global and local weather models, satellites, radars and a vast network of weather stations and in different format. Implement a python program to fetch current weather data from the JSON file format. PDFs: https://www.youtube.com/watch?v=q70xzDG6nls https://www.youtube.com/watch?v=JhQVD7Y1bsA https://www.youtube.com/watch?v=FcrW-ESdY-A Word files: https://www.youtube.com/watch?v=ZU3cSl51jWE JSON files: https://www.youtube.com/watch?v=9N6a-VLBa2I
	Python (Full Course): https://www.youtube.com/watch?v=_uQrJ0TkZlc
Pedagogy	For the above experiments the following pedagogy can be considered. Problem based learning, Active learning, MOOC, Chalk &Talk
PART B – Practical Based Learning	
A problem statement for each batch is to be generated in consultation with the co-examiner and student should develop an algorithm, program and execute the program for the given problem with appropriate outputs.	

Course Outcomes:

1. Demonstrate proficiency in handling of loops and creation of functions.
2. Identify the methods to create and manipulate lists, tuples and dictionaries.
3. Discover the commonly used operations involving regular expressions and file system.
4. Interpret the concepts of Object-Oriented Programming as used in Python.
5. Determine the need for scraping websites and working with PDF, JSON and other file formats.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. The student has to secure not less than 35% (18 Marks out of 50) in the semester-end examination (SEE).

Continuous Internal Evaluation (CIE):

CIE marks for the practical course is **50 Marks**.

The split-up of CIE marks for record/ journal and test are in the ratio **60:40**.

- Each experiment to be evaluated for conduction with observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments designed by the faculty who is handling the laboratory session and is made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled downed to 30 marks (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct 02 tests for 100 marks, the first test shall be conducted after the 8^{th} week of the semester and the second test shall be conducted after the 14^{th} week of the semester.
- In each test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student‘s performance and learning ability. Rubrics suggested in Annexure-II of Regulation book
- The average of 02 tests is scaled down to **20 marks** (40% of the maximum marks).

The Sum of scaled-down marks scored in the report write-up/journal and average marks of two tests is the total CIE marks scored by the student.

- SEE marks for the practical course is 50 Marks.
- SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the University
- All laboratory experiments are to be included for practical examination.
- (Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.
- Students can pick one question (experiment) from the questions lot prepared by the internal /external examiners jointly.
- Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.
- General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)
- Students can pick one experiment from the questions lot of PART A with equal choice to all the students in a batch. For PART B examiners should frame a question for each batch, student should develop an algorithm, program, execute and demonstrate the results with

appropriate output for the given problem.

- Weightage of marks for PART A is 80% and for PART B is 20%. General rubricssuggested to be followed for part A and part B.
- Change of experiment is allowed only once and Marks allotted to the procedure part tobe made zero(Not allowed for Part B).
- The duration of SEE is 03 hours

Rubrics suggested in Annexure-II of Regulation book

Suggested Learning Resources:

Textbooks:

1. Al Sweigart, **"Automate the Boring Stuff with Python",**1stEdition, No Starch Press, 2015.(Available under CC-BY-NC-SA license at https://automatetheboringstuff.com/)
2. Reema Thareja **–Python Programming Using Problem Solving Approach‖** Oxford University Press.
3. Allen B. Downey, **"Think Python: How to Think Like a Computer Scientist",** 2nd Edition, Green Tea Press, 2015. (Available under CC-BY-NC license at http://greenteapress.com/thinkpython2/thinkpython2.pdf)

CO- PO Mapping :

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1		2											3	1	
CO2	2		3										1	3	
CO3	1	3											1		
CO4	3	2											1		
CO5	1	2		2	3				2				3		1

Constitution of India and Professional Ethics (CIP)			
Course Code	**21CIP47**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P:S)	**0:2:0:1**	**SEE Marks**	**50**
Total Hours of Pedagogy	**25 Hours**	**Total Marks**	**100**
Credits	**01**	**Exam Hours**	**01 Hour**

Prerequisites:

Constitution, Civics, Ethics, Society, Fundamental Rights.

Course objectives: This course will enable the students

- To know the fundamental political structure & codes, procedures, powers, and duties ofIndian government institutions, fundamental rights, directive principles, and the duties of citizens.
- To understand engineering ethics and their responsibilities, identify their individual roles and ethical responsibilities towards society.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

- ✓ Teachers shall adopt suitable pedagogy for effective teaching - learning process. The pedagogy shall involve the combination of different methodologies which suit modern technological toolsand software‘s to meet the present requirements of the Global employment market.
  - (i) Direct instructional method (Low /Old Technology),
  - (ii) Flipped classrooms (High/advanced Technological tools),
  - (iii) Blended learning (combination of both),
  - (iv) Enquiry and evaluation based learning,
  - (v) Personalized learning,
  - (vi) Problems based learning through discussion,
  - (vii) Following the method of expeditionary learning Tools and techniques,

1. Apart from conventional lecture methods, various types of innovative teaching techniques through videos, animation films may be adapted so that the delivered lesson can enhance the students in theoretical applied and practical skills in teaching of 21CIP39/49 in general.

Module - 1

Introduction to Indian Constitution: Definition of Constitution, Necessity of the Constitution, Societies before and after the Constitution adoption. Introduction to the Indian constitution, Making of the Constitution, Role of the Constituent Assembly. Preamble of Indian Constitution & Key concepts of the Preamble. Salient features of India Constitution. **04 Hours**

Module - 2

Fundamental Rights (FR’s), Directive Principles of State Policy (DPSP’s) and Fundamental Duties (FD’s): Fundamental Rights and its Restriction and limitations in different Complex Situations. DPSP‘s and its present relevance in Indian society. Fundamental Duties and its Scope and significance in Nation building. **04 Hours**

Module - 3

Union Executive: Parliamentary System, Union Executive – President, Prime Minister, Union Cabinet, Parliament - LS and RS, Parliamentary Committees, Important Parliamentary Terminologies. Supreme Court of India, Judicial Reviews and Judicial Activism. **04 Hours**

Module - 4

State Executive & Elections, Amendments and Emergency Provisions: State Executive, Election Commission, Elections & Electoral Process. Amendment to Constitution (Why and How) and Important Constitutional Amendments till today. Emergency Provisions. **04 Hours**

Module-5

Professional Ethics: Definition of Ethics & Values. Professional & Engineering Ethics. Positive and Negative aspects of Engineering Ethics. Clash of Ethics, Conflicts of Interest. The impediments to Responsibility. Professional Risks, Professional Safety and liability in Engineering. Trust & Reliability in Engineering, Intellectual Property Rights (IPR's). **04 Hours**

Teaching-Learning Process	Chalk and talk method, Videos, Power Point presentation to teach. Creating real time stations in classroom discussions, Giving activities and assignments (Connecting Campus & community with administration real time situations).

Course outcome (Course Skill Set)

At the end of the course the student should :

CO 1: Have constitutional knowledge and legal literacy.

CO 2: Understand Engineering and Professional ethics and responsibilities of Engineers.

Assessment Details (both CIE and SEE)

Component		Weightage (%)	
CIE's	CIE 1 5th week	20	60
	CIE 2 10th week	20	
	CIE 3 15th week	20	
AAT's	AAT-1 10th week	10	
	AAT-2	10	
	AAT-3	20	
Continuous Internal Evaluation Total Marks: 100. Reduced to 50 Marks			
Semester End Examination (SEE) Total Marks: 100. Reduced to 50 Marks			

Textbook:

1.**"Constitution of India & Professional Ethics"** Published by Prasaranga or published on VTU website with the consent of the university authorities VTU Belagavi.

CO/PO Mapping

CO/PO Mapping	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	3					2						1	2		
CO2	2					3	2	3		2		1	1		2

UNIVERSAL HUMAN VALUES-II

Course Code	**21UHV49**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P:S)	**2:0:0:0**	**SEE Marks**	**50**
Total Hours of Pedagogy	**20**	**Total Marks**	**100**
Credits	**01**	**Exam Hours**	**01**

Prerequisites:

Society, Constitution, Ethics, Environment.

Course objectives:

This introductory course input is intended:

1. To help the students appreciate the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
2. To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
3. To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature.

This course is intended to provide a much-needed orientational input in value education to the young enquiring minds.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. The methodology of this course is explorational and thus universally adaptable. It involves asystematic and rational study of the human being vis-à-vis the rest of existence.
2. The course is in the form of 20 lectures (discussions)
3. It is free from any dogma or value prescriptions.
4. It is a process of self-investigation and self-exploration, and not of giving sermons. Whatever is found as truth or reality is stated as a proposal and the students are facilitated to verify it in their own right, based on their Natural Acceptance and subsequent Experiential Validation – the whole existence is the lab and every activity is a source of reflection.
5. This process of self-exploration takes the form of a dialogue between the teacher and the students to begin with, and then to continue within the student in every activity, leading to continuous self- evolution.
6. This self-exploration also enables them to critically evaluate their pre-conditionings and present beliefs.

Module-1

Introduction to Value Education

Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education) Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Happiness and Prosperity – Current Scenario, Method to Fulfill the Basic Human Aspirations. **04 Hours**

Module-2

Harmony in the Human Being

Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to ensure self-regulation and Health.

04 Hours

Module-3

Harmony in the Family and Society

Harmony in the Family – the Basic Unit of Human Interaction, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Other Feelings, Justice in Human-to-Human Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order.

04 Hours

Module-4

Harmony in the Nature/Existence

Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence. **04 Hours**

Module-5

Implications of the Holistic Understanding – a Look at Professional Ethics

Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics Holistic Technologies, Production Systems and Management Models- Typical Case Studies, Strategies for Transition towards Value-based Life and Profession

04 Hours

Teaching-Learning Process	Introduction to the concepts- Chalk and talk method, Discussion, Sharing of experiences, Live Examples and videos

Course outcome (Course Skill Set)

By the end of the course, students are expected to become more aware of themselves, and their surroundings (family, society, nature); they would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.

They would have better critical ability. They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society). It is hoped that they would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.

Therefore, the course and further follow up is expected to positively impact common graduate attributes like:

1. Holistic vision of life
2. Socially responsible behavior
3. Environmentally responsible work
4. Ethical human conduct
5. Having Competence and Capabilities for Maintaining Health and Hygiene
6. Appreciation and aspiration for excellence (merit) and gratitude for all

Assessment Details (both CIE and SEE)

Component		Weightage (%)	
CIE's	CIE 1 5th week	20	60
	CIE 2 10th week	20	
	CIE 3 15th week	20	
AAT's	AAT-1 10th week	10	
	AAT-2	10	
	AAT-3	20	
Continuous Internal Evaluation Total Marks: 100. Reduced to 50 Marks			
Semester End Examination (SEE) Total Marks: 100. Reduced to 50 Marks			

Suggested Learning Resources:

Books

-READINGS:

Text Book and Teachers Manual

a. The Textbook

A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2**nd** Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1

b. The Teacher‟s Manual

Teachers‟ Manual for A Foundation Course in Human Values and Professional Ethics, R R Gaur, RAsthana, G

Reference Books

1. Jeevan Vidya: EkParichaya, A Nagaraj, JeevanVidyaPrakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj – Pandit Sunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)
14. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991
15. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, Limits to Growth –Club of Rome‟s report, Universe Books.
16. A Nagraj, 1998, Jeevan Vidya Ek Parichay, Divya Path Sansthan, Amarkantak.
17. P L Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.
18. A N Tripathy, 2003, Human Values, New Age International Publishers.
19. SubhasPalekar, 2000, How to practice Natural Farming, Pracheen (Vaidik) KrishiTantraShodh, Amravati.
20. E G Seebauer & Robert L. Berry, 2000, Fundamentals of Ethics for Scientists & Engineers , Oxford University Press
21. M Govindrajran, S Natrajan & V.S. Senthil Kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd.

22. B P Banerjee, 2005, Foundations of Ethics and Management, Excel Books.
23. B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.

Web links and Video Lectures (e-Resources):

1. Value Education websites, https://www.uhv.org.in/uhv-ii, http://uhv.ac.in, http://www.uptu.ac.in
2. **Story of Stuff, http://www.storyofstuff.com**
3. **Al Gore, An Inconvenient Truth, Paramount Classics, USA**
4. **Charlie Chaplin, Modern Times, United Artists, USA**
5. **IIT Delhi, Modern Technology – the Untold Story**
6. Gandhi A., Right Here Right Now, Cyclewala Productions
7. https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw
8. https://fdp-si.aicte-india.org/8dayUHV_download.php
9. https://www.youtube.com/watch?v=8ovkLRYXIjE
10. https://www.youtube.com/watch?v=OgdNx0X923I
11. https://www.youtube.com/watch?v=nGRcbRpvGoU
12. https://www.youtube.com/watch?v=sDxGXOgYEKM

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

CO/PO Mapping

CO/PO Mapping	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	1	2	3	2		1		2	3	2	1	2	3	1	2
CO2	2	1	3	2	1	2	3	1	2		1	3	2	1	1
CO3	3	3	1	2	3	1	2	3	1	3	2	2	1		2
CO4	2	3	1	3	3	2	2	3	1	1	2	2	1		2

Ability Enhancement Course – UNIX & Shell Programming			
Course Code	21CSL482	CIE Marks	50
Teaching Hours/Week (L:T:P: S)(0:0:2:0)	Credits (0:0:1:0)	SEE Marks	50
Total Hours of Pedagogy	20 Practical	Total Marks	100
Credits	01	Exam Hours	01

Course Objectives:

CLO 1. Describe basic and advanced Unix commands.

CLO 2. Explain the role of filters and file compression techniques..

CLO 3. Apply knowledge of programming language development tools..

CLO 4. Utilize the knowledge of Unix/Linux system administration and networking.

CLO 5. Analyze and understand genesis and diversity of both Linux and Unix system utilities

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) needs not to be only a traditional lecture method, but alternative effectiveteaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes criticalthinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem with different circuits/logic and encourage thestudents to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helpsimprove the students' understanding.

Unix & Shell Programming Laboratory:

1) Use of Basic UNIX Shell Commands: ls, mkdir, rmdir, cd, cat, touch, file, wc, sort, cut,

2) Commands related to inode, I/O redirection and piping, process control commands, mails.

3) Shell Programming: Shell script exercises based on following:
   - (i) Interactive shell scripts
   - (ii) Positional parameters
   - (iii) Arithmetic
   - (iv) if-then-fi, if-then- else-fi, nested if-else
   - (v) Logical operators
   - (vi) else + if equals elif, case structure
   - (vii) while, until, for loops, use of break

4) Write a shell script to create a file. Follow the instructions
   - (i) Input a page profile to yourself, copy it into other existing file;
   - (ii) Start printing file at certain line
   - (iii) Print all the difference between two file, copy the two files.
   - (iv) Print lines matching certain word pattern

5) Write shell script for-
   (i) Showing the count of users logged in,
   (ii) Printing Column list of files in your home directory
   (iii) Listing your job with below normal priority
   (iv) Continue running your job after logging out.

6) Write a shell script to change data format. Show the time taken in execution of this script.

7) Write a shell script to print files names in a directory showing date of creation & serial number of the file.

8) Write a shell script to count lines, words and characters in its input (do not use wc).

9) Write a shell script to print end of a Glossary file in reverse order using Array. (Use awk tail)

10) Write a shell script to check whether Ram logged in, Continue checking further after every 30 seconds till success.

11) Write a shell script to compute gcd lcm & of two numbers. Use the basic function to find gcd & LCM of N numbers.

12) Write a shell script to find whether a given number is prime. Take a large number such as 15 digits or higher and use a proper algorithm.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

7. First test at the end of 5th week of the semester
8. Second test at the end of the 10th week of the semester
9. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

10. First assignment at the end of 4th week of the semester
11. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

12. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marksand will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper has to be designed to attain the different levels of Bloom's taxonomyas per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 01 hours)**

SEE paper will be set for 50 questions of each of 01 marks. The pattern of the question paper is MCQ.The time allotted for SEE is 01 hours

Textbooks

1.Sumitabha Das: ―UNIX – Concepts and Applications‖, (Chapters 1, 2, 4, 6-9, 11-14, 17, 19) TataMcGraw Hill, Noida, 4th Edition, 15th Reprint, 2011, ISBN-13: 978-0-07-063546-3.

Reference Books

1. Behrouz A. Forouzan and Richard F. Gilberg: ―UNIX and Shell programming‖, CengageLearning, India, 1st Edition, 2005, ISBN: 81-35-0325-9.
2. M G Venkatesh Murthy: ―UNIX and Shell programming‖, Pearson Education, Delhi, 1st Edition,2005, ISBN: 81-7758-745-5.

Weblinks and Video Lectures (e-Resources):

1. http://www.mhhe.com/das/uca
2. http://www.tutorialspoint.com/unix/unix_tutorials.pdf.
3. http://www.perldoc.perl.org

CO- PO & PSO Mapping:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	2	2								2	2	2
CO2	2	2	1	2	2								2	2	3
CO3	2	2	1	3	2								3	2	2
CO4	2	2	1	3	2								3	2	2
CO5	2	2	1	3	2								3	2	2

Ability Enhancement Course – R Programming			
Course Code	21CSL483	CIE Marks	50
Teaching Hours/Week (L:T:P: S) (0:0:2:0)	Credits (0:0:1:0)	SEE Marks	50
Total Hours of Pedagogy	20 Practical	Total Marks	100
Credits	01	Exam Hours	01

Course Objectives:

CLO1. Understanding and being able to use basic programming concepts
CLO2. Automate data analysis
CLO3. Working collaboratively and openly on code
CLO4. Knowing how to generate dynamic documentsCLO5. To use continuous approach.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) needs not to be only a traditional lecture method, but alternative effectiveteaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes criticalthinking.
5. Adopt Problem Based Learning (PBL), which fosters students‘ Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem with different circuits/logic and encourage thestudents to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helpsimprove the students' understanding.

R Programming Laboratory:

Module 1:

Introduction: Overview of R, R data types and objects, reading and writing data, sub setting R Objects, Essentials of the R Language, Installing R, Running R, Packages in R, Calculations, Complex numbers in R, Rounding, Arithmetic, Modulo and integer quotients, Variable names and assignment, Operators, Integers, Factors, Logical operations

Lab program

5. Download and install R-Programming environment and install basic packages using install.packages()command in R.
6. Learn all the basics of R-Programming (Data types, Variables, Operators etc,.).
7. Write a program to find list of even numbers from 1 to n using R-Loops.

Module 2:

Control structures, functions, scoping rules, dates and times, Introduction to Functions, preview of Some Important R Data Structures, Vectors, Character Strings, Matrices, Lists, Data Frames, Classes Vectors: Generating sequences, Vectors and subscripts, Extracting elements of a vector using subscripts, Working with logical subscripts, Scalars, Vectors, Arrays, and Matrices, Adding and Deleting Vector Elements, Obtaining the Length of a Vector, Matrices and Arrays as Vectors Vector Arithmetic and Logical Operations, Vector Indexing, Common Vector Operations

Lab program

1. Create a function to print squares of numbers in sequence.
2. Write a program to join columns and rows in a data frame using cbind() and rbind() in R.

Module 3:

Lists: Creating Lists, General List Operations, List Indexing Adding and Deleting List Elements, Getting the Size ofa List, Extended Example: Text Concordance Accessing List Components and Values Applying Functions to Lists, DATA FRAMES, Creating Data Frames, Accessing Data Frames, Other Matrix-Like Operations.

Lab program

1. Implement different String Manipulation functions in R.
2. Implement different data structures in R (Vectors, Lists, Data Frames)

Module 4:

FACTORS AND TABLES, Factors and Levels, Common Functions Used with Factors, Working with Tables, Matrix/Array-Like Operations on Tables , Extracting a Subtable, Finding the Largest Cells in a Table, Math Functions, Calculating a Probability, Cumulative Sums and Products, Minima and Maxima, Calculus, Functions for Statistical Distributions

Lab Programs:

1. Write a program to read a csv file and analyze the data in the file in R.
2. Create pie chart and bar chart using R.
3. Create a data set and do statistical analysis on the data using R.

Module 5:

Data Visualization using R: Scatter Plots - Box Plots - Scatter Plots and Box-and-Whisker Plots Together -Customize plot axes, labels, add legends, and add colours.

Lab Programs:

1. Construct a 3D scatter plot for the data to include two additional columns: names and gender and afunction to load the data in the active session and save it as a data frame.
2. Implement the fan plot for the dataset data = c(179718,41370,41914,44280) and assign a set of colorsto a variable and call it colors.
3. Project the 3D histogram with the z variable as well by generating the data for the x and y values usingthe seq() function: x = y = seq(-4,4,by =0.5)

Course Outcomes:

At the end of the course the student will be able to:

CO1. Understand basics and different data sets using R programming

CO2. Construct or plot graphs and charts

CO3. Analyse the data and know descriptive statistics by using R

ProgrammingCO4. Develop programming logic using R – Packages.

CO5. Predict the data and take decisions through R programming.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marksand will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper has to be designed to attain the different levels of Bloom's taxonomyas per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 01 hours)**

SEE paper will be set for 50 questions of each of 01 marks. The pattern of the question paper is MCQ.The time allotted for SEE is 01 hours

Text Books:

1. Crawley, M. J. (2006), ‐Statistics - An introduction using R‖, John Wiley, London 32.
2. Purohit, S.G.; Gore, S.D. and Deshmukh, S.R. (2015), ‐Statistics using R‖, second edition. Narosa Publishing House, New Delhi.
3. Shahababa B. (2011) , ‐Biostatistics with R‖, Springer, New York.
4. Braun & Murdoch (2007), ‐A first course in statistical programming with R‖, Cambridge University Press, New Delhi.

e- Resources & other digital material:

1. https://cran.r-project.org/doc/contrib/Owen-TheRGuide.pdf
2. https://sphweb.bumc.bu.edu/otlt/MPH-Modules/BS/R/R-Manual/R-Manual2.html
3. https://smac-group.github.io/ds/
4. https://www.geeksforgeeks.org/predictive-analysis-in-rprogramming /#:~:text=Predictive %20analysis%20in%20R%20Language,are%20used%20in %20predictive%20analysis

CO-PO/PSO mapping:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3				3								3		
CO2	2	3		1	3								3		
CO3	3			3	3								3	2	
CO4		2	3		3								1	2	
CO5	2		1	2	3										
Avg.	**2.5**	**2.5**	**2**	**2**	**3**								**2.5**	**2**	

Entrepreneurship Development Course – II: Launching your Start-Up			
Course Code	**21EDC49**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P:S) (0:2:0:0)	**Credits (0:0:0:0)**	**SEE Marks**	**50**
Total Hours of Pedagogy	**20**	**Total Marks**	**100**
Credits	**Audit Course**	**Exam Hours**	**01**

Course Description

Once you have a prototype and a clearer vision of the opportunity, you'll need to create a small organization to discover how to create a repeatable and scalable business model. Designed to provide you with a comprehensive overview of the critical components of creating a start-up, Entrepreneurship 2: Launching the Start-up, provides practical, real-world knowledge about the lean approach, the minimum viable product, when to pivot, when to quit your day job, the art of the pitch, building and managing a team, allocating equity, and building your external team, advisory board members, professional services, and entrepreneurial strategy. At the end of this course, you'll be able to create a strategy for launch, including knowing who you need to hire, how to manage them to provide the greatest value, and what legal aspects are involved. You'll also be prepared for Entrepreneurship 3: Growth Strategies.

Module 1: Preparing to Launch: Essential Components

This module was created to give you the information you need to begin to take your validated opportunity, build an MVP, and begin to design a winning pitch. Smart entrepreneurs can avoid wasting time by designing an initial product that only serves the core needs of its customers, and may be able to avoid an unnecessary pivot by finding the right product-market fit early on. By the end of this module, you'll understand if your product is truly minimally viable, know why an MVP is a good strategy, be able to design a strategy to validate your hypothesis, identify the key components of a successful pitch, and decide whether or not to quit your day job.

Module 2: Building the Team

This module was designed to give you critical insights into the often-overlooked dynamics of founding team formation, early hires, and allocation of equity. You'll examine the research that shows why the composition of the founding team can be an important indicator of future revenue, why some motivations of the team are more profitable than others, how to get the right hires for your team, common mistakes in hiring key players, and why equity allocation is so vital to a start-up's survival. By the end of this module, you'll be better prepared to position your start-up for success by making data-driven decisions about your founding partners, your early hires, your first managers, and equity allocation.

Syllabus: The Importance of the Founding Team, The Role of Early Hires, Goals and Motivations, Founder's Agreements, Hiring Key Management, Finding Technical Resources, Allocating Equity

Module 3: Networks, Professional Services, and Intellectual Property

In this module, you'll learn about your external team: the advisors, mentors, and professionals you'll need to give your start-up the best possible chance for success. Many start-ups either ignore or over-invest in professional advisors, accountants, and lawyers. You'll explore what kinds of professionals you should hire, when to do so, and for how long. You'll also cover the differences between patents, intellectual property, and trade secrets so that you know what kind of protection you need. And you'll examine the various legal entities your enterprise may assume, so you can choose the appropriate entity for your venture. By the end of this module, you'll be able to define the legal form of your enterprise, the best way to protect your idea, how to determine what professional services will be most useful, and how to apply theories of social networks to make the most suitable choices for your set of advisors.

Syllabus: Networks, Innovation, and Entrepreneurship, Mentors, Advisors, and Advisory Boards, Professional Services: Lawyers and Accountants, Intellectual Property Overview, Summary - Legal Forms of the Enterprise

Module 4: Branding, Strategy, and Summary

In this module, you'll examine a variety of proven strategies to set your venture up for success. You'll learn a proven process for choosing a name for your venture, and explore successful strategies for developing a brand personality. You'll also explore existing resources in the entrepreneurial ecosystem, and dive deeply into entrepreneurial strategies. By the end of this module, you'll be able to take your product or service to market with a name, a brand, a strategy that positions your venture for success.

Syllabus: Branding and Naming, Launching Your Startup – Branding, Bias and Meritocracy, Incubators and Accelerators, Entrepreneurial Strategy.

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

Course Outcomes:

CO1: Design a strategy to validate your hypothesis, identify the key components of a successful pitch.

CO2: Prepare for position your start-up for success by making data-driven decisions.

CO3: Determine professional services will be most useful, and apply theories of social networks to make the most suitable choices for your set of advisors.

CO4: Take product or service to market with a name, a brand, a strategy that positions your venture for success.

CO5: Create a strategy & manage launching enterprises to provide the greatest value, and what legal aspects are involved.

CO- PO Mapping :

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	2	2	3						3			2
CO2	2								2			2
CO3				2	2			2		3		3
CO4				1		2	2	2				3
CO5	1		3	3					3			3

NAGARJUNA
COLLEGE OF ENGINEERING & TECHNOLOGY
(An Autonomous College under VTU)

Department of CSE (Data Science)

V & VI Semester
Scheme and Syllabus
With effect from Academic Year 2022-23

Vision
To prepare the next generation practitioners and researcher for data centric world by bringing together interdisciplinary faculty across the globe.

Mission
M1: To provide Skill Based Education to master the students in problem solving and analytical skills to enhance their niche expertise in the field Data Science
M2: To educate the students with latest technologies to update their knowledge in the field of Data Science
M3: To enable students to experience the Content Based Learning with premier quality data science education, research and industrial collaboration
M4: To enable students to become leaders in the Industry and Academia Nationally as well as internationally
M5: To guide students in research on Data Science, with the aim of having an ethical impact on society by tackling societal grand challenges

PROGRAM OUTCOMES (POs): Graduates of the Computer Science and Engineering – Data Science Program will be able to achieve the following
POs:
PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and Computer Science and Engineering principles to the solution of complex problems in Computer Science and Engineering.
PO2: Problem Analysis: Identify, formulate, research literature, and analyses complex Computer Science and Engineering problems reaching substantiated conclusions using first principles of mathematics and engineering sciences.
PO3: Design/Development of Solutions: Design solutions for complex Computer Science and Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4: Conduct investigations of Complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions related to Computer Science and Engineering problems.
PO5: Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex

Computer Science and Engineering activities with an understanding of the limitations.
PO6: The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional Computer Science and Engineering practice.
PO7: Environment and Sustainability: Understand the impact of the professional Computer Science and Engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the Computer Science and Engineering practice.
PO9: Individual and Team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10: Communication: Communicate effectively on complex Computer Science and 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.
PO11: Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage Computer Science and Engineering projects and in multidisciplinary environments.
PO12: 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.

Program Specific Outcome (PSO)

PSO1: Ability to analyse complex computing issues and apply the principles to achieve related solution.
PSO2: Ability to design, implement and evaluate computing based solutions to meet range of computing requirements based in the data science.
PSO3: Ability to effectively communicate within diverse work group related to professional framework.

Program Educational Objectives (PEOs)

PEO 1: To make students competent for higher studies and employable, to meet industrial requirements.
PEO 2: To develop students having core competence in science, mathematics and fundamentals of Data Science to address ever changing industrial requirements globally.
PEO 3: To create academically conducive environment to learn engineering skills in the domains such as Data Analytics, Data Modelling, Data Visualization and Allied Technologies.
PEO 4: To enrich students with professional ethics, leadership qualities, and entrepreneurial skills.
PEO 5: An ability to engage in lifelong learning for effective adaptation to technological developments.

Fifth Semester B.E. CSE-DS – Scheme

SL. No	Course Code	Course Name	Total Credits	L: T: P: S (Hrs./Week)	Online	Offline	Marks
1	20CDI51	Machine Learning (IC)	3	2 : 0 : 2 : 0	-	100%	100
2	20CDI52	Computer Networks (IC)	4	3 : 0 : 2 : 0	-	100%	100
3	20CDI53	Data Mining & Data Warehousing (IC)	4	3 : 0 : 2 : 0	-	100%	100
4	20CDT54	Software Engineering	3	3 : 0 : 0 : 0	-	100%	100
5	20CDT55	Supply Chain management	3	3 : 0 : 0 : 0	-	100%	100
6	20CDT56X	Professional Elective 1	3	3 : 0 : 0 : 0	-	100%	100
7	20CDP57	Mini Project	3	0 : 0 : 6 : 0	-	100%	100
8	20PEC58	Employability Skills	2	1 : 2 : 0 : 0	-	100%	100
		Total	**25**	**18 : 2 : 12 : 0**	-		**800**
Note: Internship has to be completed compulsorily before VIII Semester							

Professional Elective 1

SL. No	Course Code	Course Name
1	20CDT561	Wireless sensor networks
2	20CDT562	Internet of Things
3	20CDT563	Information Retrieval

Sixth Semester B.E. CSE-DS – Scheme

SL. No	Course Code	Course Name	Total Credits	L: T: P: S (Hrs./Week)	Online	Offline	Marks
1	20CDI61	Android Application Programming (IC)	4	3 : 0 : 2 : 0	-	100%	100
2	20CDI62	Big Data Analytics (IC)	3	2 : 0 : 2 : 0	-	100%	100
3	20CDI63	Advanced Web Programming (IC)	4	3 : 0 : 2 : 0	-	100%	100
4	20CDT64	Cloud Computing	3	3 : 0 : 0 : 0	-	100%	100
5	20CDT65X	Professional Electives 2	3	3 : 0 : 0 : 0	-	100%	100
6	20CDT66X	Professional Elective 3	3	3 : 0 : 0 : 0	-	100%	100
7	20ENV67	Environmental Studies	1	1 : 0 : 0 : 0	-	100%	100
8	20CDT68	Research Methodology	2	2 : 0 : 0 : 0	-	100%	100
9	20PET69	Employability Skills	2	1 : 2 : 0 : 0	-	100%	100
		Total	25	21 : 2 : 6 : 0			**900**
Note: Internship has to be completed compulsorily before VIII Semester							

Professional Elective 2

SL. No	Course Code	Course Name
1	20CDT651	Software Testing and Quality Assurance
2	20CDT652	Artificial Intelligence
3	20CDT653	Block chain Technology

Professional Elective 3

SL. No	Course Code	Course Name
1	20CDT661	Digital Image Processing
2	20CDT662	Computer Vision
3	20CDT663	Devops
4	20CDT664	Unix Shell Programming

MACHINE LEARNING (IC)

Course Code	L: T : P : S	Credits	Exam Marks	Exam Duration	Course Type
20CDI51	2 : 0 : 2 : 0	3	CIE:50 SEE:50	3 Hours	PCI

Prerequisites: Linear algebra, Trigonometry, Statistics, Calculus, JAVA / Python Programming.

Course Objectives:

As a student will be able to learn:

- The basics of Machine learning with examples.
- Decision tree algorithms and classify supervised, unsupervised and reinforcement learning algorithms.
- Artificial Neural Networks with multi perceptron's.
- How to evaluate hypothesis for learning and Bayesian algorithms?
- Probability learning theory and hypothesis learning.

Syllabus

Module – I

Introduction: Well posed learning problems, Designing a Learning system, Perspective and Issues in Machine Learning. Concept Learning: Concept learning task, Concept learning as search, Find-S algorithm, Version space, Candidate Elimination algorithm, Inductive Bias.

08 Hours

Module – II

Decision Tree Learning: Decision tree representation, Appropriate problems for decision tree learning, Basic decision tree learning algorithm, hypothesis space search in decision tree learning, Inductive bias in decision tree learning, Issues in decision tree learning**.**

08 Hours

Module – III

Artificial Neural Networks: Introduction, Neural Network representation, Appropriate problems, Perceptron's, Back propagation algorithm.

08 Hours

Module – IV

Bayesian Learning: Introduction, Bayes theorem, Bayes theorem and concept learning, ML and LS error hypothesis, ML for predicting probabilities, MDL principle, Naive Bayes classifier, Bayesian belief networks, EM algorithm**.**

08 Hours

Module – V

Evaluating Hypothesis: Motivation, estimating hypothesis accuracy, Basics of sampling theorem, General approach for deriving confidence intervals, Difference in error of two hypotheses, Comparing learning algorithms. Instance Based Learning: Introduction, k-nearest neighbor learning, locally weighted regression, radial basis function, cased-based reasoning**.**

08 Hours

Course Outcomes:

After studying this course, the students will be able to:

- Choose the learning techniques and investigate concept learning.
- Identify the characteristics of decision tree and solve problems associated with.
- Apply effectively neural networks for appropriate applications.
- Apply Bayesian techniques and derive effectively learning rules.
- Evaluate hypothesis and investigate instant based learning and reinforced learning.

Text Books:

1. Tom M. Mitchell, "Machine Learning", (Chapters: 1.1–1.3, 2.1-2.5, 2.7, 3.1-3.7, 4.1–4.6, 6.1–6.6, 6.9, 6.11, 6.12, 5.1-5.6, 8.1-8.5, 13.1-13.3), India Edition, 2013, McGraw Hill Education**.**

Reference Books:

1. Trevor Hastie, Robert Tibshirani, Jerome Friedman, "The Elements of Statistical Learning", 2nd Edition, Springer series in statistics.
2. Ethem Alpaydın, "Introduction to Machine Learning", 2nd Edition, MIT press.

Reference Online Resources:

1. https://www.geeksforgeeks.org/machine-learning/
2. https://www.javatpoint.com/machine-learning

List of Programs

Part A

1. Write a R program to compute
   - Central Tendency Measures: Mean, Median, Mode
   - Measure of Dispersion: Variance, Standard Deviation
2. Write a R program to implement Simple Linear Regression, Decision tree, KNN, Logistic Regression, K-Means Clustering.

Part B

Performance analysis of Classification Algorithms on a specific dataset (Mini Project)

COMPUTER NETWORKS (IC)

Course Code	L: T : P : S	Credits	Exam Marks	Exam Duration	Course Type
20CDI52	3 : 0 : 2 : 0	4	CIE:50 SEE:50	3 Hours	PCI

Course Learning Objectives

CLO 1. Understand the basics principle and standards for data Communication, Network Types, Topologies and Protocols.

CLO 2. Recognize the data link design issues and various data link protocols used for data transmission.

CLO 3. Familiarize the design, working and implementation of Internet protocols as well as routing protocols responsible for network layer communication.

Syllabus

Module- I: INTRODUCTION AND PHYSICAL LAYER

Network hardware, Network software, Reference models - OSI, TCP/IP; Example networks – Internet; Wireless LANs - 802.11.
Physical Layer - Guided transmission media, Wireless transmission, Switching – Circuit switches, Packet switching.

08 Hours

Module - II: DATA LINK LAYER AND MEDIUM ACCESS CONTROL SUBLAYER

Data Link Layer: Data link layer design issues, Error detection and correction - CRC, Hamming codes; Elementary data link protocols, Sliding window protocols.
Medium Access Control Sub layer: ALOHA, Carrier sense multiple access protocols, Collision free protocols, Ethernet.

08 Hours

Module - III: NETWORK LAYER

Network layer design issues, Routing algorithms - Shortest path algorithm, Flooding, Distance vector routing, Hierarchical routing, Broadcast routing, Multicast routing, Congestion control algorithms, Network layer in the internet - The IP version 4 protocol, IP addresses, IP version 6, Internet control protocols, OSPF, BGP.

08 Hours

Module - IV: TRANSPORT LAYER

UDP–Segment header, Remote procedure call, Real-time transport protocols; **TCP** – service model, Protocol, Segment header, Connection establishment, Connection release, Sliding window, Timer management, Congestion control.

08 Hours

Module - V: APPLICATION LAYER

Domain Name System (DNS) - Name space, Domain resource records, Name servers; Electronic mail - Architecture and services, User agent, Message formats, Message transfer, The World Wide Web - Architectural overview, HTTP, FTP.

08 Hours

Laboratory Component:

1. Study and submission of Report on Network Hardware Components, Network cables and Servers.
2. Implement the following data link layer framing methods Using Java.
   i) Character count
   ii) Character stuffing
   iii) Bit stuffing

3. Design and develop a Java program to compute checksum for the given frame 1101011011 using CRC-12, CRC-16, and CRC-CCIP. Display the actual bit string transmitted. Suppose any bit is inverted during transmission. Show that this error is detected at the receiver's end.
4. Implement Dijkstra's algorithm to compute the shortest path from Source to Destination in the network using Java
5. Implementation of Basic Network Commands and Network Configuration Commands using Command Prompt.
6. Implement three nodes point – to – point network with duplex links between them. Set the queue size, vary the bandwidth and find the number of packets dropped using NS2.
7. Build a LAN with Hubs and Switches and perform Simulation of LAN using packet Tracer
8. Build a Multi-LAN with Router Configuration and perform Simulation of Multi-LAN using packet Tracer.
9. Implement transmission of ping messages/trace route over a network topology consisting of 6 nodes and find the number of packets dropped due to congestion using NS2.
10. Implementation of RIP using Packet Tracer
11. Simulation of OSPF Protocol using Packet Tracer
12. Configure and simulation of a VLAN using Packet Tracer

COURSE OUTCOMES:

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

- Gain Knowledge on the principles and standards of Reference Models, types of network topologies, Functions of layers and protocols.
- Analyze Subnetting and routing algorithms for finding optimal paths in networks.
- Develop and Solve problems related to flow control, error control and congestion control in data transmission.
- Simulate the Network Topologies using the Packet Tracer Tool to analyze packet Transmission.
- Apply Ethical principles and standards for developing network-based solutions.

Text Books

1. Andrew S. Tanenbaum and David J. Wetherall, Computer Networks, Pearson, 5th Edition, 2015.

Reference:

1. Behrouz A. Forouzan, Data Communications and Networking, McGraw Hill, 5th Edition, 2013.
2. James F. Kurose and Keith W. Ross, Computer Networking: A Top-Down Approach, Pearson, 7th Edition, 2017.

E-Resources:

- https://archive.org/details/Data.Communications.and.Networking.5th.Edition
- https://www.cisco.com/c/en/us/solutions/smallbusiness/resourcecenter/networking/networking-basics.html.
- http://ptgmedia.pearsoncmg.com/images/9780133814743/samplepages/9780133814743.pdf

DATA MINING & DATA WAREHOUSING (IC)

Course Code	L:T:P:S	Credits	Exam Marks	Exam duration	Course Type
20CDI53	3:0:2:0	4	CIE:50 SEE:50	3 hours	PCI

Course Objectives:

This course will enable students to,

- Identify the scope and necessity of Data Mining and Warehousing forth society
- Describe various Data Models and Design Methodologies of Data Warehousing destined to solve the root problems
- UnderstandvariousToolsofDataMiningandtheirTechniquestosolvetherealtimeproblems
- Learn how to analyze the data, identify the problems, and choose the relevant algorithms to apply.
- Assess the Pros and Cons of various algorithms and analyze their behavior on real datasets.

Syllabus

Module – I

Data Mining: Introduction - Steps in KDD - System Architecture – Types of data -Data mining functionalities - Classification of data mining systems - Integration of a data mining system with a data warehouse - Issues - Data Preprocessing – Data Mining Application**.**

08 Hours

Module – II

Data Warehousing: Data warehousing components - Building a data warehouse - Multi Dimensional Data Model - OLAP Operation in the Multi- Dimensional Model - Three Tier Data Warehouse Architecture - Schemas for Multi-dimensional data Model - Online Analytical Processing (OLAP) - OLAP Vs OLTP Integrated OLAM and OLAP Architecture**.**

08 Hours

Module – III

Association Rule Mining: Mining frequent patterns - Associations and correlations - Mining Methods Finding Frequent item set using Candidate Generation - Generating Association Rules from Frequent Item sets - Mining Frequent item set without Candidate Generation Mining various kinds of association rules - Mining Multi-Level Association Rule.

08 Hours

Module – IV

Classification and Prediction: Classification and prediction - Issues Regarding Classification and Prediction - Classification by Decision Tree Induction - Bayesian classification – Bayes' Theorem - Naïve Bayesian Classification - Bayesian Belief Network - Rule based classification - Classification by Back propagation - Support vector machines - Prediction-Linear Regression.

08 Hours

Module – V

Clustering, Applications and Trends in Data Mining: Cluster analysis - Types of data in Cluster Analysis- Categorization of major clustering methods - Partitioning methods– Hierarchical methods - Density-based methods - Grid-based methods - Model based clustering methods -Constraint Based cluster analysis - Outlier analysis - Social Impacts of Data Mining.

08 Hours

DATA G MINING AND DATA WAREHOUSIN LAB INDEX

S.No	Name of the Experiment
1	Installation of WEKA Tool
2	Creating new Arff File https://machinelearningmastery.com/load-csv-machine-learning-data-weka/
3	Pre-Processes Techniques on Data Set
	Pre-process a given dataset based on Handling Missing Values
4	Generate Association Rules using the Apriori Algorithm
5	Generating association rules using fpgrowth algorithm
6	Build a Decision Tree by using J48algorithm
7	Naïve bayes classification on a givendata set

Course Outcomes:

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

CO1: Assess Raw Input Data and process it to provide suitable input for a range of data mining algorithm

CO2: Design and Modelling of Data Warehouse

CO3: Discover interesting pattern from large amount of data

CO4: Design and Deploy appropriate Classification Techniques

CO5: Able to cluster high dimensional data

Text Books:

1) Jiawei Han and Micheline Kamber, "Data Mining Concepts and Techniques", 2ndEdition, Elsevier, 2007,ISBN-10 -9789380931913,ISBN-13-978-9380931913.
2) Alex Berson and Stephen J. Smith, "Data Warehousing, Data Mining & OLAP", Published by Tata McGraw-Hill Education Pvt. Ltd., 2004, ISBN 10: 0070587418 / ISBN 13: 9780070587410.
3) Pang-Ning Tan, Michael Steinbach and Vipin Kumar, "Introduction to Data Mining", Person Education, 2007.ISBN-13-9788131714720,ISBN-10-8131714720.
4) G. K. Gupta, "Introduction to Data Mining with Case Studies", Easter Economy Edition, Prentice Hall of India, 2006,ISBN-13:9788120350021,ISBN - 10 :8120350022.
5) Daniel T.Larose, "Data Mining Methods and Models", Publisher-John Wiley & Sons, 2006, 2006,ISBN 8126507764, 9788126507764.

References:

1. Pieter Adriagus, DolfZantinge"DataMining",Addison-WesleyPublisher,Pearson education,2007, ISBN978-81-317-0717-3.
2. Sam Anahory, Dennis Murray "Data Warehousing in the Real World", Pearson education,ISBN978-81-317-0459-2,2009.

E-Resources:

1) https://study.com/academy/lesson/data-warehousing-and-data-mining-information-for-business-intelligence.html
2) http://myweb.sabanciuniv.edu/rdehkharghani/files/2016/02/The-Morgan-Kaufmann-Series-in-Data-Management-Systems-Jiawei-Han-Micheline-Kamber-Jian-Pei-Data-Mining.-Concepts-and-Techniques-3rd-Edition-Morgan-Kaufmann-2011.pdf.
3) https://www-users.cs.umn.edu/~kumar001/dmbook/index.php

SOFTWARE ENGINEERING

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
20CDT54	3:0:0:0	3	CIE:50 SEE:50	3 hours	PCC

Pre-requisite: Software Development Life Cycle (SDLC), Scripting Language, Version Control Tool, Database

Course Objectives:

This course will enable students to,

- Recollect Software process models and compare their applicability
- Acquire Software Requirement Analysis and Specification
- Acquire Systematic software design procedure for Object Oriented and Real Time software
- Interpret how to develop and test a software application/product
- Cognize software cost estimation techniques and to know project management

Syllabus

Module – I

Introduction to Software Engineering & Software Process Model: what is Software Engineering (SE), Difference between SE and System Engineering. The evolving role of software – the changing nature of software- Life cycle models [Text Book-1]

Software Process Model: - Water fall, Incremental, Spiral, Evolutionary, Prototyping Concurrent development – Specialized Process Models: Component-Based Development, The Formal Methods Model, and Aspect-Oriented Software Development [Text Book-2]

08 Hours

Module – II

Software Requirement Analysis and Specifications: Functional and Non-Functional, User, System – Requirement, Interface specification, software requirement documents.[Text Book-1]

Requirement Engineering Process: Feasibility Studies, Requirements Elicitation and analysis, Requirement Validation and Requirement management. [Text Book-1]

System Model: Context Model, Behavioral model, Data Model, Object Model, Structured Model [Text Book-1]

08 Hours

Module – III

Software Design: Architectural design, Architectural Design Document, Client Server Architecture Distributed Object Architecture. [Text Book-1]

Object Oriented Design: Object Oriented Design Process, Design Evolution, [Text Book-1]

Real time Software Design: System Design, Real time Operating System, Monitoring and Control System and Data Acquisition System [Text Book-1]

08 Hours

Module – IV

Software Development and Testing: Rapid Software Development-Agile Methods, Extreme Programming, Rapid Application Development, [Text Book-1]

Software Reuse: Reuse landscape, Design Pattern, Application system Reuse [Text Book-1]

Verification and Validation; Planning Verification & Validation, Software Inspection, Verification and formal Methods. [Text Book-1]

Software Testing: Approaches of Software Testing, Software Testing Strategies, Test Strategies for Object Oriented Software-Unit Testing, Integration Testing [Text Book-2]

08 Hours

Module – V

Software Cost Estimation and Project Management: Software cost estimation - COCOMO model – Estimation Techniques, Project Duration and Staffing, [Text Book-1]
Quality management: Quality Assurance and Standard, Quality Planning and Quality Control [Text Book-1]
Configuration Management: Configuration Management Planning, Change Management, Version and Release Management [Text Book-1]
Emerging Technology: Security Concepts, Security Risk Management. [Text Book-1]
08 Hours

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

- Identify and apply Software life cycle and process models to compare their applicability
- Analyze the types of requirements and summarize Requirement Engineering for various System models
- Design data, functional and behavioural model for any given software requirement
- Apply appropriate techniques and Test the software application/product for a given problem
- Comprehend concepts of software quality assurance and software configuration management

Text Books:

1. Ian Sommerville, "Software Engineering", 8th Edition,ISBN-10-9332582696,ISBN-13- 978-9332582699,Pearson Education (24 May 2017).
2. Rogar Pressman, "Software Engineering and Application", 7th Edition, McGraw Hill Education Publication, 2009,ISBN-13:9789339212087.

REFERENCES

1. Pankaj Jalote, "Software Engineering, A Precise Approach", Wiley India, 2010,ISBN: 9788126523115
2. Pfleeger and Lawrance, "Software Engineering: Theory and Practice" Pearson Education, 2 nd Edition, 2001.
3. Stephan Schach, "Software Engineering", Tata McGraw Hill, 2007.
4. Rajib Mall, "Fundamentals of Software Engineering", 3 rd Edition, PHI Learning Private Limited, 2009, .ISBN-10-9788120338197,ISBN-13-978-8120338197.
5. Kelkar S.A., "Software Engineering", ISBN 10: 8120332725, ISBN 13: 9788120332720, Publisher: Prentice-Hall of India Pvt. Ltd, 2007.

E-Resources:

1. https://www.pearson.com/us/higher-education/product/Sommerville-Software-Engineering-9th-Edition/9780137035151.html.
2. https://www.abebooks.com/9788120332720/Software-Engineering-Kelkar-S-A-8120332725/plp
3. https://www.wileyindia.com/pankaj-jalote-s-software-engineering-a-precise-approach.html

SUPPLY CHAIN MANAGEMENT

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
20CDT55	3:0:0:0	3	CIE:50 SEE:50	3 hours	PCC

Course Objectives:

The objectives of this course are

- To provide Knowledge on logistics and supply chain management
- To enable them in designing the distribution network
- To train the students in knowing the supply chain Analysis
- Impart knowledge on Dimensions of logistic
- To know the recent trends in supply chain management

Syllabus

Module – I

Introduction to Supply Chain Management: Supply chain - objectives - importance - decision phases - process view competitive and supply chain strategies - achieving strategic fit – supply chain drivers - obstacles – framework – facilities -inventory-transportation-information-sourcing-pricing.

08 Hours

Module – II

Designing the distribution network: Role of distribution - factors influencing distribution - design options - e-business and its impact distribution networks in practice –network design in the supply chain - role of network -factors affecting the network design decisions modeling for supply chain. Role of transportation - modes and their performance – transportation infrastructure and policies - design options and their trade-offs tailored transportation.

08 Hours

Module – III

Supply Chain Analysis: Sourcing - In-house or Outsource - 3rd and 4th PLs - supplier scoring and assessment, selection - design collaboration - Procurement process - Sourcing planning and analysis. Pricing and revenue management for multiple customers, perishable products, seasonal demand, bulk and spot contracts.

08 Hours

Module – IV

Dimensions of Logistics: A macro and micro dimension - logistics interfaces with other areas - approach to analyzing logistics systems - logistics and systems analysis - techniques of logistics system analysis - factors affecting the cost and importance of logistics. Demand Management and Customer Service Outbound to customer logistics systems - Demand Management –Traditional Forecasting CPFRP - customer service - expected cost of stock outs - channels of distribution.

08 Hours

Module – V

Recent Trends in Supply Chain Management-Introduction, New Developments in Supply Chain Management, Outsourcing Supply Chain Operations, Co-Maker ship, The Role of E-Commerce in Supply Chain Management, Green Supply Chain Management, Distribution Resource Planning, World Class Supply Chain Management.

08 Hours

Course Outcomes:

At the end of the course, students will be able to

- Understand the strategic role of logistic and supply chain management in the cost reduction and offering best service to the customer
- Understand Advantages of SCM in business
- Apply the knowledge of supply chain Analysis
- Analyze reengineered business processes for successful SCM implementation
- Evaluate Recent trend in supply chain management

TEXT BOOKS:

- Sunil Chopra and Peter Meindl, Supply Chain Management – "Strategy, Planning and Operation", 3rd Edition, Pearson/PHI,2007.
- Supply Chain Management by Janat Shah Pearson Publication2008.

REFERENCE BOOKS:

- A Logistic approach to Supply Chain Management – Coyle, Bardi, Longley, Cengage Learning,1/e
- Donald J Bowersox, Dand J Closs, M Bixby Coluper, "Supply Chain Logistics Management", 2nd edition, TMH,2008.
- Wisner, Keong Leong and Keah-Choon Tan, "Principles of Supply Chain Management A Balanced Approach", Cengage Learning,1/e
- David Simchi-Levi et al, "Designing and Managing the Supply Chain" –Concepts

WIRELESS SENSOR NETWORKS

Course Code	L:T:P:S	Credits	Exam Marks	Exam duration	Course Type
20CDT561	3:0:0:0	3	CIE:50 SEE:50	3 Hours	PEC

Prerequisites: Basic knowledge of Data Communication Networks.

Descriptions:

Wireless sensor networks (WSNs) refer to networks of spatially dispersed and dedicated sensors that monitor and record the physical conditions of the environment and forward the collected data to a central location provide an interdisciplinary, integrative overview of latest development in the domain of smart farming.

Course Objectives:

This course will enable students to:

1. To make students understand the basics of Wireless Sensor Networks.
2. To familiarize with learning of the Architecture of WSN.
3. To understand the concepts of Networking and Networking in WSN.
4. To study the design consideration of topology control and solution to the various problems.
5. To introduce the hardware and software platforms and tool in WSN

Syllabus

Module – I

Overview of Wireless Sensor Networks- Single-Node Architecture - Hardware Components - Network Characteristic s - unique constraints and challenges, Enabling Technologies for Wireless Sensor Networks Types of wireless sensor networks.

08 Hours

Module – II

Architectures - Network Architecture, Sensor Networks - Scenarios - Design Principle, Physical Layer and Transceiver Design Considerations, Optimization Goals and Figures of Merit, Gateway Concepts, Operating Systems and Execution Environments - introduction to Tiny OS and nest Internet to WSN Communication.

08 Hours

Module – III

Networking Sensors - MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols and Wakeup Concepts – SMAC, BMAC Protocol, IEEE 802.15.4 standard and ZigBee, the Mediation Device Protocol, Wakeup Radio Concepts, Address and Name Management, Assignment of MAC Addresses, Routing Protocols Energy Efficient Routing, Geographic Routing.

08 Hours

Module – IV

Infrastructure Establishment - Topology Control, Clustering, Time Synchronization, Localization and Positioning, Sensor Tasking and Control.

08 Hours

Module – V

Sensor Network Platforms and Tools –Sensor Node Hardware – Berkeley Motes, Programming Challenges, Node level software platforms, Node level Simulators, State centric programming.

08 Hours

Course Outcomes:

1. Understand challenges and technologies for wireless networks
2. Understand architecture and sensors
3. Describe the communication, energy efficiency, computing, storage and transmission
4. Establishing infrastructure and simulations
5. Explain the concept of programming the in WSN environment

Text books:

1. Holger Karl & Andreas Willig, "Protocols And Architectures for Wireless Sensor Networks", JohnWiley, 2005.
2. Feng Zhao & Leonidas J.Guibas, “Wireless Sensor Networks An Information Processing Approach", Elsevier, 2007.
3. Waltenegus Dargie , Christian Poellabauer, “Fundamentals of Wireless Sensor Networks Theoryand Practice”, John Wiley & Sons Publications, 2011

Reference books:

1. Kazem Sohraby, Daniel Minoli, &TaiebZnati, “Wireless Sensor Networks Technology, Protocols, and Applications”, John Wiley, 2007.
2. Anna Hac, “Wireless Sensor Network Designs”, John Wiley, 2003

Web Links for Reference:

1. https://nptel.ac.in/courses/106/105/106105160/
2. https://onlinecourses.swayam2.ac.in/arp19_ap52/preview
3. https://cse.iitkgp.ac.in/~smisra/course/wasn.html

Research Papers:

1. I.F. Akyildiz, W. Su, Y. Sankarasubramaniam and E. Cayirci, “Wireless sensor networks: a survey”, Computer Networks, 38 (2002) 393–422.
2. EikoYoneki and Jean Bacon, “A survey of Wireless Sensor Network technologies: research trends and middleware’s role”, Technical Report, University of Cambridge, September 2005.

INTERNET OF THINGS

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
20CDT562	3:0:0:0	3	CIE:50 SEE:50	3 hours	PEC

Course Objectives:

This course will enable the students to:

- Gain the knowledge about IOT concepts.
- Know different Application protocols for IOT.
- Understand methods of deploying smart objects and connect them to network.
- Know the diverse methods of deploying smart objects and connect them to network.
- Learn about genesis and impact of IOT applications

Syllabus

Module – I

Introduction to Internet of Things: Definition and Characteristics of IOT, Physical Design of IOT– IOT Protocols, IOT communication models, IOT Communication APIs IOT enabled Technologies – Wireless Sensor Networks, Cloud Computing, Big data analytics, Communication protocols, Embedded Systems, IOT Levels and Templates. Overview of Microprocessor and Microcontroller, Basics of Sensors and actuators.

08 Hours

Module – II

Prototyping IoT Objects Using Microprocessor/Microcontroller: Working principles of sensors and actuators – Setting up the board - Programming for IOT – Reading from Sensors, Communication: Connecting microcontroller with mobile devices – communication through Bluetooth, Wi-Fi, Ethernet, Zigbee, RFID, NFC.

08 Hours

Module – III

IOT Architecture and Protocols: Architecture Reference Model- Introduction, Reference Model and architecture, IOT reference Model. Protocols- 6 Low PAN, RPL, CoAP, MQTT.

08 Hours

Module – IV

Smart Objects: The "Things" in IOT, Sensors, Actuators, and Smart Objects, Sensor Networks, Connecting Smart Objects, Communications Criteria.

08 Hours

Module – V

Cloud Services For IOT: Introduction to Cloud Storage models and communication APIs Webserver – Web server for IOT, Cloud for IOT, Python web application framework designing a RESTful web API, Amazon Web services for IOT.

08 Hours

Course outcomes:

After studying this course, students will be able to

CO1: Analyze IOT architectural components.

CO2: Interfacing Sensor and Actuator with Arduino development board.

CO3: Describe protocols of resource constraint network.

CO4: Compare and contrast the deployment of smart objects and the technologies to connect them to network.

CO5: Design and develop IOT applications.

.

Text Book:

1) "Internet of Things (A Hands-on-Approach)" byVijay Madisetti and Arshdeep Bahga, 1stEdition, VPT, 2014. ISBN 13: 9780996025515
2) Srinivasa K G, "Internet of Things", CENGAGE Leaning India, 2017 ISBN: 9789386858955
3) David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, "IOT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", 1st Edition, Pearson Education (Cisco Press Indian Reprint). (ISBN: 978-9386873743)

Reference Books:

1) Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-on-Approach)", 1st Edition,VPT, 2014. (ISBN: 978-8173719547)
2) Raj Kamal, "Internet of Things: Architecture and Design Principles", 1st Edition, McGraw HillEducation, 2017. (ISBN: 978-9352605224)
3) "The Internet of Things – Key applications and Protocols" by Olivier Hersent, David Boswarthick, Omar Elloumi , , Wiley, 2012 ISBN: 978-1-119-99435-0

Reference sites:

1) www.coursera.org/specializations/IOT
2) www.futurelearn.com/courses/internet-of-things

INFORMATION RETRIEVAL

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
20CDT563	3:0:0:0	3	CIE:50 SEE:50	3 hours	PEC

Prerequisite:

- Probabilistic models, statistical language models, Text classification & Text clustering

Course Objectives:

This course is designed to:

- Learn to write code for text indexing and retrieval.
- Learn to evaluate information retrieval systems
- Learn to analyze textual and semi-structured datasets
- Learn to evaluate information retrieval systems
- Learn about text similarity measure
- Understanding about search engine
- Text Classification

Syllabus

Module – I

Overview of text retrieval systems: Boolean retrieval, the term vocabulary and postings lists, Dictionaries and tolerant retrieval, Index construction and compression. **Retrieval models and implementation: Vector Space Models,** Vector Space Model, TF-IDF Weight, Evaluation in information retrieval.

08 Hours

Module – II

Query expansion and feedback: Relevance feedback, pseudo relevance feedback, Query Reformulation.

08 Hours

Module – III

Probabilistic models; statistical language models: Okapi/BM25, Language models, KL-divergence, Smoothing.

08 Hours

Module – IV

Text classification & Text clustering: The text classification problem, Naive Bayes text classification, k- nearest neighbors, Support vector Machine, Feature Selection, Vector-space clustering, K-means algorithm, Hierarchical clustering, DBSCAN algorithm, PAM and PAMK
EM algorithm**.** **08 Hours**

Module – V

Web search basics, crawling, indexes, Link analysis: Web Characteristic, Crawling, Web as a graph, Page Rank, Hubs and Authorities, **IR applications:** Information extraction, Question answering, Opinion summarization, Social Network**.**

08 Hours

Course outcomes:

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

- To Understand Document as Vector
- Performance evolution metric for IR
- To understand search Engine functionality
- Various Supervised and Unsupervised Learning Method

Text Book:

- Christopher D. Manning, Prabhakar Raghavan and Hinrich Schütze, Introduction to Information Retrieval, Cambridge University Press. 2008.
  http://nlp.stanford.edu/IR-book/information-retrieval-book.html

- ChengXiang Zhai, Statistical Language Models for Information Retrieval (Synthesis Lectures Series on Human Language Technologies), Morgan & Claypool Publishers, 2008.

ANDROID APPLICATION PROGRAMMING (IC)

Course Code	L : T : P : S	Credits	Exam Marks	Exam Duration	Course Type
20CDI61	3 : 0 : 2 : 0	4	CIE:50 SEE:50	3 Hours	PCI

Prerequisite: Basic Knowledge of JAVA Programming and XML (Extension Markup Language)

Course Objectives:

This course will enable students to:

- Outline the Android SDK features and the Development Framework and understanding Activities.
- Learn adaptive, responsive user interfaces that work across a wide range of devices.
- Identify background work and long-running tasks in Android applications
- Describe the concepts of Storing, sharing and retrieving data in Android applications
- Learn permissions, security and performance affect applications.

Syllabus

Module- I

Basics of Android: What Is Android? Android Versions, Features of Android, Architecture of Android, Android Devices in the Market, The Android Market, Obtaining the Required Tools, Eclipse, Android SDK, Android Development Tools (ADT), Creating Android Virtual Devices (AVDs), Creating Your First Android Application, Anatomy of an Android Application. Understanding Activities, Applying Styles and Themes to Activity, Hiding the Activity Title, displaying a Dialog Window, displaying a Progress Dialog, Linking Activities Using Intents, Resolving Intent Filter Collision, Returning Results from an Intent**.**

08 Hours

Module- II

Components of Screen, Views and Layouts: Understanding the Components of a Screen, Views and View Groups, Linear Layout, Absolute Layout, Table Layout, Relative Layout, Frame Layout, Scroll View, Adapting to Display Orientation, Anchoring Views, Resizing and Repositioning, Managing Changes to Screen Orientation, Persisting State Information during Changes in Configuration, Detecting Orientation Changes, Controlling the Orientation of the Activity, Creating the User Interface Programmatically, Basic Views.

08 Hours

Module- III

Image Views, Preferences ( ) and Storage: Using Image Views to Display Pictures - Gallery and Image View Views, Image Switcher, Grid View, Using Menus with Views - Creating the Helper Methods, Options Menu, Context Menu, Saving and Loading User Preferences - Using get Shared Preferences( ), Using get Preferences( ), Persisting Data to Files - Saving to Internal Storage, Saving to External Storage (SD Card), Choosing the Best Storage Option, Using Static Resources, Creating and Using Databases.

08 Hours

Module- IV

Content Provider, SMS Messaging Sharing Data in Android, using a Content Provider - Predefined Query String Constants, Projections, Filtering, Sorting, Creating Your Own Content Providers - Using the Content Provider. SMS Messaging - Sending SMS Messages Programmatically, Getting Feedback after Sending the Message, Sending SMS Messages Using Intent, Receiving SMS Messages, updating an Activity from a Broadcast Receiver, Invoking an Activity from a Broadcast Receiver.

08 Hours

Module- V

Services, Activities and Publishing APK Files. Creating Your Own Services - Performing Long-Running Tasks in a Service, Performing Repeated Tasks in a Service, Executing Asynchronous Tasks on, Separate Threads Using Intent Service, Communicating between a Service and an Activity, Binding Activities to Services. Preparing for Publishing, Versioning, Digitally Signing Your Android Applications, Deploying APK Files - Using the adb.exe Tool, using a Web Server, publishing on the Android Market, creating a Developer Profile, Submitting Your Apps.

08 Hours

List of Experiments

Programs supplement the lecture concepts will be based on the latest version of Android SDK.

PART-A

1) Develop an android app which displays "Hello World" message
2) Using Android, Create a login Activity. It asks "username" and "password" from user. If username and password are valid, it displays Welcome message using new activity
3) Create Implicit Intents
4) "Happy Birth Day" App using TextView and ImageView
5) Set and retrieve shared preferences

PART-B

1) Develop an android app which displays a form to get following information from user. 1) Username 2) Password 3) Email Address 4) Phone Number 5) Country Form should be followed by a Button with label "Submit". When user clicks the button, a message should be displayed to user describing the information entered. Utilize suitable UI controls (i.e. widgets). [When user enters country in Auto Complete TextView, list of states should be displayed in Spinner automatically]
2) The Simple Calculator app has two edit texts and four buttons. When you enter two numbers and click a button, the app performs the calculation for that button and displays the result.
3) Develop an android app for Text to Speech.
4) Create the MP3 player like application with service

Course Outcomes:

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

CO1: Comprehend the basic features of Android Platform and Create Activities in Android.
CO2: Demonstrate the design concepts of user interface using components and views in Android.
CO3: Create and use databases for Android Application.
CO4: Implement messaging services in Android.
CO5: Deploy mobile applications in various market place for distribution

Text Books:

1) Wei – Meng Lee: "Beginning Android Application Development", Wiley publications, ISBN: 978-1-118-01711-1, (Chapters 1-8,10,11).
2) Reto Meier: "Professional Android 4 Application Development", Wiley publications Publisher, 2012, ISBN-10: 812653608X

Reference Books:

1) Mark Murphy: "Beginning Android 3", Apress Springer India Pvt. Ltd., 1st Edition, 2011, ISBN-13: 978-1-4302-3297-1
2) Sayed Hashimi, Satya Komatineni, Dave MacLean; Pro Android 4; Apress Springer India Pvt Ltd; 1st Edition; 2012; ISBN: 978-1-4302-3930-7.
3) Reto Meier: "Professional Android 2 Application Development", Wiley India Pvt. Ltd., 1st Editic 2012, ISBN: 9788126525898.
4) James Steele: "The Android Developer's Cookbook: Building Applications with the Android SDK", Addison-Wesley Professional, 2010.

E-Resources:

1) https://developers.google.com/training/adf
2) https://goo.gl/ADKvq8
3) https://innovator.samsungmobile.com

BIG DATA ANALYTICS

Course Code	L : T : P : S	Credits	Exam Marks	Exam Duration	Course Type
20CDI62	2 : 0 : 2 : 0	3	CIE: 50 SEE: 50	3 hours	PCI

Prerequisite: Good knowledge skill on Database and Data Structures

Course Objectives:

This course will enable students to

- Understand Big – Data, Hadoop Distributed File system and Map Reduce.
- Explore Hadoop tools and manage Hadoop Administration.
- Appraise the role of Business intelligence and its applications across industries.
- Assess core data mining techniques for data analytics.
- Learn various Text Mining techniques.

Syllabus

Module – I

Introduction to Big Data: Big Data and its importance, Four Vs, Big data applications. Introduction to Hadoop: Hadoop Distributed File System Basics, Hadoop components, Hadoop Eco-System, Hadoop Map Reduce Framework.

08 Hours

Module – II

Essential Hadoop Tools – Yarn, Hive, Oozie, Pig, Flume, Hadoop YARN Applications, Managing Hadoop with Apache Ambari, Basic Hadoop Administration Procedures.

08 Hours

Module – III

Business Intelligence Concepts and Application – BI – Tools, Skills, Applications, Data Warehousing – Approaches and Architecture, Data Mining – CRISP – DM, Techniques, Tools, Myths, Mistakes, Data Visualization – Types of charts.

08 Hours

Module – IV

Decision Trees- Pseudo code, Regression – Logistic, Advantages and Disadvantages, Artificial Neural Networks – Design principles, steps in developing ANN, Advantages and Disadvantages, Cluster Analysis - K-means algorithm, Association Rule Mining - Apriori algorithm.

08 Hours

Module – V

Text Mining – Architecture, TDM, Applications, Naïve-Bayes Analysis - Model, Advantages and Disadvantages, Support Vector Machines - Model, Advantages and Disadvantages, Web Mining – Content, Structure, Usage, Social Network Analysis - Techniques and Algorithm, Page Rank, Practical Considerations.

08 Hours

List of Experiments:

1. Downloading and installing Hadoop; Understanding different Hadoop modes. Startup scripts, Configuration files.
2. Hadoop Implementation of file management tasks, such as Adding files and directories, Retrieving files and Deleting files
3. Implement of Matrix Multiplication with Hadoop Map Reduce
4. Run a basic Word Count Map Reduce program to understand Map Reduce Paradigm.
5. Implementation of K-means clustering using Map Reduce
6. Installation of Hive along with practice examples.
7. Installation of HBase, Installing thrift along with Practice examples
8. Patrice importing and exporting data from various data bases.

Course Outcomes

On completion of this course, the students are able to:

CO1: Master the concepts of Big Data, HDFS and Map Reduce framework

CO2: Investigate Hadoop related tools for Big Data Analytics and perform basic Hadoop Administration

CO3: Recognize the role of Business Intelligence, Data warehousing and Visualization in decision making

CO4: Demonstrate the importance of core data mining techniques for data analytics

CO5: Illustrate and analyze Text Mining Techniques

Text Books:

1) Douglas Eadline,"Hadoop 2 Quick-Start Guide: Learn the Essentials of Big Data Computing in the Apache Hadoop 2 Ecosystem", 1stEdition, Pearson Education, 2016. ISBN-13: 978-9332570351
2) Anil Maheshwari, "Data Analytics", 1st Edition, McGraw Hill Education, 2017. ISBN-13: 978-9352604180

Reference Books:

1) Tom White, ―Hadoop: The Definitive Guide‖,4 Edition, O'Reilly Media,
2) Boris Lublin sky, Kevin T. Smith, Alexey Yakubovich, ―Professional Hadoop Solutions",1st Edition, Wrox Press, 2014ISBN-13: 978-8126551071
3) Eric Sammer, ―Hadoop Operations: A Guide for Developers and Administrators",1st Edition, O'Reilly Media, 2012.ISBN-13: 978-9350239261

E-Resources:

1) https://www.tutorialspoint.com/big_data_tutorials.htm
2) https://nptel.ac.in/courses/106/104/106104189/

ADVANCED WEB PROGRAMMING (IC)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
20CDI63	3:0:2:0	4	CIE:50 SEE:50	3 Hours	PCI

Course Objectives:

This course will enable the students to

1. Apply the knowledge to manage and to handle web site design and development to solve the real world problems.
2. Illustrate user content using Bootstrap Frontend Framework.
3. Understand Node JS and its facilities.
4. Learn ES6 and build your Interactive React User Interface.
5. Develop Java based web applications using React JS and Spring Boot.

Module – I

Bootstrap 5: Front-end Design Framework

Bootstrap Scaffolding, Bootstrap CSS, Bootstrap Layout Components, Bootstrap JavaScript Plugins, Using Bootstrap, Understanding Bootstrap Admin Templates.

08 Hours

Module – II

Node JS: Back-end JavaScript runtime environment

Introduction to NodeJS, Setting up NodeJS, First Application, Node Package Manager (npm), Template Engines: Jade and Handlerbars, Web Modules, Setting up Express Framework, Web app development in Express Framework.

08 Hours

Module – III

ECMA Script 6 (ES6): Foundation for Modern Javascript Frameworks

ES6: What is ES6?, let & const keywords, Arrow functions, Default Parameters, Template literals, Destructuring Assignments, Enhanced Object Literals, Block scope, Spread and Rest operators, Classes, Inheritance, Static properties and methods, Promises, Iterators and Iterables, Generators, Modules, ReactJS: What is React? Why React? Just React – Hello World, Using create-react-app, Anatomy of react project, Running the app, Debugging first react app.

08 Hours

Module – IV

React: Building UI

Templating using JSX (Javascript Syntax Extension): Working with React, understanding the structure. Components: Significance of component architecture, Types of components, Functional, Class based, Pure, Component Composition. Working with states and props, Event Handling in React, Understanding component lifecycle and handling errors, Working with Forms, Context API, Code Splitting, Hooks, Routing using React Router, Introduction to Redux, Redux Middleware.

08 Hours

Module – V

Spring Boot: Building Java based Web Application

Introduction to Micro Services, What is Spring Boot?, Why Spring Boot? How does itwork? Spring boot bootstrapping, Spring boot tomcat development, build system, Building RESTFul Web services, Building Web application using React UI and spring Boot.

08 Hours

Lab Experiments

1. Explain the role of the following semantic elements of HTML5 with syntax and script segments:
   i <nav> ii <section> iii <aside>.
2. Build a web server using HTTP Module in Node JS and perform file system modules like
   i. Read files
   ii. Create files
   iii. Update files
   iv. Delete files
   v. Rename files
3. Perform CRUD Operation in MongoDB with connection to NodeJS.
4. Write a Program to handle async wait in Javascript.
5. Design a page by creating Class and Functional based Components in React JS.
6. Create a basic app with Spring Boot and React to handle RESTful APIs for performing CRUD operations.

Course outcomes:
At the end of the course, the student will be able to:

1. Demonstrate an ability to identify formulate and solve the web based problems .
2. Ability to apply conceptual skills of web site design and development.
3. Adapt Bootstrap framework for frontend views.
4. Develop Web App in NodeJS platform using Express framework.
5. Develop Java based Web Apps using ReactJS and Spring Boot.

Text Books:

1. Aravind Shenoy, Ulrich Sossou, "Learning Bootstrap" Packet Publishing.
2. Ethan Brown, "Web Development with Node & Express", O'Reilly Publications, ISBN: 978-1-491-94930-6
3. Alex Banks & Eve Porcello, "Learning React – Modern Patterns for Developing React Apps", O'Reilly Publications, ISBN: 978-1-492-05172-5
4. Juha Hinkula, "Hands-On Full Stack Development with Spring Boot 2 and React: Build modern and scalable full stack applications using Spring Framework 5 and React with Hooks", 2nd Edition.

Reference Books:

1. Dr. Axel Rauschmayer, "ES6-Javascript for Impatient Programmers", ISBN 978-1-09-121009-7
2. Fabio Cimo, "Bootstrap Programming Cookbook"
3. Craig Walls, "Spring in Action" Manning Shelter Island Publications, 5th Edition, ISBN: 9781617294945.

Justification:

- The syllabus previously prepared earlier was not up to the industrial requirements, most of content already upgraded.
- The students need to get awareness about the skills and tools been upgraded.
- The reframed syllabus covers the content of Full Stack Web Development to meet the industrial standards.
- The students will undergo the practical hands on for designing the Websites.

CLOUD COMPUTING

Course Code	L : T : P : S	Credits	Exam Marks	Exam Duration	Course Type
20CDT64	3 : 0 : 0 : 0	3	CIE:50 SEE:50	3 Hours	PCC

Prerequisite: Computer Networks, Database Management System, Operating system

Course Objectives:

This course will enable students to

- Identify the Cloud infrastructure components and service management processes
- Explain the fundamentals of cloud computing
- Gain the knowledge about virtualization and its techniques.
- Illustrate the cloud application programming and Aneka platform
- Differentiate Various cloud platforms used in industry

Syllabus

Module – I

Introduction: Cloud Computing at a Glance, The Vision of Cloud Computing, Defining a Cloud, A Closer Look, Cloud Computing Reference Model, Characteristics and Benefits, Challenges Ahead, Historical Developments, Distributed Systems, Virtualization, Web 2.0,Service-Oriented Computing, Utility- Oriented Computing, Building Cloud Computing Environments, Application Development, Infrastructure and System Development, Computing Platforms and Technologies, Google App Engine, Microsoft Azure, Hadoop, Force.com and Salesforce.com, Manjra soft Aneka.

08 Hours

Module – II

Cloud Computing Architecture: Introduction, Cloud Reference Model, Architecture, Infrastructure / Hardware as a Service, Platform as a Service, Software as a Service, Types of Clouds, Public Clouds, Private Clouds, Hybrid Clouds, Community Clouds, Economics of the Cloud, Open Challenges, Cloud Definition, Cloud Interoperability and Standards Scalability and Fault Tolerance Security, Trust, and Privacy Organizational Aspects. Aneka: Cloud Application Platform, Framework Overview, Anatomy of the Aneka Container, From the Ground Up: Platform Abstraction Layer, Fabric Services, foundation Services, Application Services, Building Aneka Clouds, Infrastructure Organization, Logical Organization, Private Cloud Deployment Mode, Public Cloud Deployment Mode, Hybrid Cloud Deployment Mode.

08 Hours

Module – III

Concurrent Computing: Thread Programming, Introducing Parallelism for Single Machine Computation, Programming Applications with Threads, What is a Thread?, Thread APIs, Multithreading with Aneka, Introducing the Thread Programming Model, Aneka Thread vs. Common Threads. High-Throughput Computing: Task Programming, Task Computing, characterizing a Task, Computing Categories, Frameworks for Task Computing, Task-based Application Models, Embarrassingly Parallel Applications, Parameter Sweep Applications, Workflow Applications with Task Dependencies.

08 Hours

Module – IV

Data Intensive Computing: Map-Reduce Programming, What is Data-Intensive Computing? Characterizing Data-Intensive Computations, Challenges Ahead, Historical Perspective, Technologies for Data-Intensive Computing, Storage Systems, Programming Platforms.

08 Hours

Module – V

Cloud Platforms in Industry: Amazon Web Services, Compute Services, Storage Services, Communication Services, Additional Services, Google App Engine, Architecture and Core Concepts, Application Life-Cycle, Cost Model, Observations, Microsoft Azure, Azure Core Concepts, SQL Azure, Windows Azure Platform Appliance. Cloud Applications: Scientific Applications, Business and Consumer Applications, CRM and ERP, Productivity, Social Networking, Media Applications, Multiplayer Online Gaming.

08 Hours

Course Outcomes

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

CO1: Explain cloud computing, classify services of cloud computing
CO2: Illustrate architecture and programming in cloud
CO3: Demonstrate data intensive computing.
CO4: Apply cloud computing services to commercial systems for deploying cloud
CO5: Analyzing different Cloud platform in industry and their applications

Text Books:

1. Rajkumar Buyya, Christian Vecchiola, and ThamaraiSelvi, "Mastering Cloud Computing", McGraw Hill Education, ISBN*:* 9780124095397

Reference Books:

1) Dan C. Marinescu, "Cloud Computing Theory and Practice", Morgan Kaufmann, Elsevier 2013.
2) Thomas Erl: "Cloud Computing", Pearson Education, 1st Edition, 2014, ISBN-13: 978-9332535923.

Reference Online Resources:

1) http://index-of.co.uk/Cloud-Computing-Books/Mastering%20Cloud%20Computing%20-%20Rajkumar%20Buyya.pdf
2) http://nptel.ac.in/courses/106105033/41
3) http://video.mit.edu/watch/mitef-nyc-cloud-computing-8347/

ENVIRONMENTAL STUDIES					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
20ENV57/67	**1:0:0:0**	**1**	**CIE:50 SEE:50**	**1 Hours**	**HSMC**

Course Objectives: To recognize major concepts in environmental sciences and demonstrate in-depth understanding of the environment. The industrial revolution and development have led to the stress on environment in the form of pollution. Checking of the pollution in all fronts at local and global level encompassing the issues of carbon credit, ozone level depletion, global warming, desertification and polar ice cap melting. The main objectives of the course is to expose to students to the problems and mitigation measures concerned to the environmental components like resources, air, water and land.

Syllabus

Module 1:

Ecosystems (Structure and Function): Forest, Desert, Wetlands, Riverine, Oceanic and Lake. **Biodiversity:** Types, Value; Hot-spots; Threats and Conservation of biodiversity, Forest Wealth, and Deforestation. **3 Hours**

Module 2:

Advances in Energy Systems (Merits, Demerits, Global Status and Applications)**:** Hydrogen, Solar, OTEC, Tidal and Wind.

Natural Resource Management (Concept and case-studies): Disaster Management, Sustainable Mining, Cloud Seeding, and Carbon Trading. **4 Hours**

Module 3:

Environmental Pollution (Sources, Impacts, Corrective and Preventive measures, Relevant Environmental Acts, Case-studies)**:** Surface and Ground Water Pollution; Noise pollution; Soil Pollution and Air Pollution.

Waste Management & Public Health Aspects: Bio-medical Wastes; Solid waste; Hazardous wastes; E-wastes; Industrial and Municipal Sludge. **4 Hours**

Module 4:

Global Environmental Concerns (Concept, policies and case-studies): Ground water depletion/ recharging, Climate Change; Acid Rain; Ozone Depletion; Radon and Fluoride problem in drinking water; Resettlement and rehabilitation of people, Environmental Toxicology. **3 Hours**

Module 5:

Latest Developments in Environmental Pollution Mitigation Tools (Concept and Applications): G.I.S. & Remote Sensing, Environment Impact Assessment, Environmental Management Systems, ISO14001; Environmental Stewardship- NGOs.

Field work: Visit to an Environmental Engineering Laboratory or Green Building; Visit to a local area to document environment assets river / forest / grassland / hill / mountain. Visit to a local polluted site-urban/rural/industrial/agricultural/Water Treatment Plant/ Waste water treatment Plant. Study of common plants, insects, birds. Study of simple ecosystems-pond, river, hills lopes; etc (field work equal to 2 lecture works) ought to be Followed by understanding of process and its brief documentation. **4 Hours**

Course outcomes: At the end of the course, students will be able to: ·

- CO1: Understand the principles of ecology and environmental issues that apply to air, land, and water issues on a global scale, ·
- CO2: Develop critical thinking and/or observation skills, and apply them to the analysis of a problem or question related to the environment.
- CO3: Demonstrate ecology knowledge of a complex relationship between biotic and a biotic components.
- CO4: Apply their ecological knowledge to illustrate and graph a problem and describe the realities that managers face when dealing with complex issues.

Sl. No	Name of the Textbook/s	Title of the Book Author/s	Name of the Publisher	Edition and Year
1	Environmental Studies	Benny Joseph	Tata Mc Graw – Hill.	2nd Edition, 2012
2	Environmental Studies	S M Prakash	Pristine Publishing House, Mangalore	3rd Edition, 2018
3	Environmental Studies – From Crisis to Cure	R Rajagopalan	Oxford Publisher	2005
4.	Environmental Studies	R. Geetha Balakrishna, K. G. Lakshminarayana Bhatta	SM Publications.	2016
Reference Books				
1	Principals of Environmental Science and Engineering	Raman Sivakumar	Cengage learning, Singapur.	2nd Edition, 2005
2	Environmental Science – working with the Earth	G. Tyler Miller Jr.	Thomson Brooks /Cole,	11th Edition, 2006
3	Text Book of Environmental and Ecology	Pratiba Sing, Anoop Singh & Piyush Malaviya	Acme Learning Pvt. Ltd. New Delhi.	1stEdition

RESEARCH METHODOLOGY

Course Code	L : T : P : S	Credits	Exam Marks	Exam Duration	Course Type
20CDT68	2 : 0 : 0 : 0	2	CIE:50 SEE:50	3 Hours	AEC

Course objectives:

1. To give an overview of the research methodology and explain the technique of defining a research problem
2. To explain the functions of the literature review in research.
3. To explain carrying out a literature search, its review, developing theoretical and conceptual frame works and writinga review and research reports.
4. To explain various Testing of Hypotheses and statistical analysis.
5. To discuss techniques of Interpretation and effective Report Writing.

Syllabus

Module – I

Research Methodology: Introduction, Meaning of Research, Objectives of Research, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Research Process, Criteria of Good Research, Problems Encountered by Researchers in India.

Defining the Research Problem: Research Problem, Selecting the Problem, Necessity of Defining the Problem,Technique Involved in Defining a Problem, An Illustration.

08 Hours

Module – II

Reviewing the literature: Place of the literature review in research, bringing clarity and focus to research problem, improving research methodology, broadening knowledge base in research area, enabling contextual findings, Review of the literature, searching the existing literature, reviewing the selected literature, developing a theoretical framework, developing a conceptual framework, writing about the literature reviewed.[Book 2, Chapter 3].

Research Design: Meaning of Research Design, Need for Research Design, Features of a Good Design, Important Concepts Relating to Research Design, Different Research Designs, Basic Principles of ExperimentalDesigns, Important Experimental Designs.

08 Hours

Module – III

Design of Sample Surveys: Design of Sampling: Introduction, Sample Design, Sampling and Non Sampling Errors, Sample Survey versus Census Survey, Types of Sampling Designs.

Measurement and Scaling: Qualitative and Quantitative Data, Classifications of Measurement Scales, Goodness of Measurement Scales, Sources of Error in Measurement, Techniques of Developing Measurement Tools, Scaling, Scale Classification Bases, Scaling Technics, Multidimensional Scaling, Deciding the Scale.

08 Hours

Module – IV

Data Collection: Introduction, Experimental and Surveys, Collection of Primary Data, Collection of Secondary Data,Selection of Appropriate Method for Data Collection, Case Study Method.

Testing of Hypotheses: Hypothesis, Basic Concepts Concerning Testing of Hypotheses, Testing of Hypothesis, Test Statistics and Critical Region, Critical Value and Decision Rule, Procedure for Hypothesis Testing, Hypothesis Testing for Mean, Proportion, Variance, for Difference of Two Mean, for Difference of Two Proportions, for Difference of Two Variances, P-Value approach, Power of Test, Limitations of the Tests of Hypothesis.

08 Hours

Module – V
Chi-square Test: Test of Difference of more than Two Proportions, Test of Independence of Attributes, Test of Goodness of Fit, Cautions in Using Chi-Square Tests. **Interpretation and Report Writing:** Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports. **08 Hours**
Course Outcomes (Course Skill Set) At the end of the course the student will be able to: CO1. Explain the meaning of engineering research. CO2. Explore the procedure of Literature Review and Technical Reading. C03. Explain the fundamentals of Testing of Hypotheses and statistical analysis. CO4. Explore the techniques of Interpretation and effective Report Writing. CO5. Comprehend the basic principles of research methodologies.

Textbooks				
1	Research Methodology: Methods and Techniques	C. R. Kothari, G aurav Garg	New Age Internat ional	4th Edition, 2019
2	Research Methodology a step-by- step guide for beginners	Ranjit Kumar	SAGE Publications Ltd	3rd Edition, 2011
Reference Books				
1	"Research Methods for Engineers"	David V. Thiel	Cambridge University Press	2020

Online Resources

1. https://onlinecourses.nptel.ac.in/noc22_ge08/preview
2. https://archive.nptel.ac.in/courses/127/106/127106227/
3. https://onlinecourses.swayam2.ac.in/cec20_hs17/preview
4. https://archive.nptel.ac.in/courses/110/105/110105139/

SOFTWARE TESTING AND QUALITY ASSURANCE

Course Code	L : T : P:S	Credits	Exam Marks	Exam Duration	Course Type
20CDT651	3:0:0:0	3	100	3hrs	PEC

Prerequisite: Software Engineering (Software Design) Basic concepts: encapsulation, abstraction, inheritance, and polymorphism.

Course Description: Regardless of the software development approach, from the classic waterfall to extreme programming (XP), all of the experts agree that quality software development requires both analysis and design. The Unified Modelling Language (UML) provides a common, standard notation for recording both analysis models and design artefacts. This course delves into the processes of both object-oriented analysis and object-oriented design using UML as the notation language.

Course Objectives:

- To learn the importance of modelling in the software development life cycle.
- To apply the UML notation and symbols.
- To know the design patterns. To learn the object-oriented approach systems design and software solutions.
- To know the object oriented software testing.

Syllabus

Module – I

Basic concepts: objects, classes, abstract classes, data types, ADT, encapsulation and information hiding, inheritance, association, aggregation, composition, polymorphism, dynamic binding, object-oriented principles.

08 Hours

Module – II

Modelling Using UML: Use case diagrams, class diagrams, various relationships among classes: generalization, association, aggregation, composition, inheritance, dependency etc., object diagram, UML packages, activity diagram, state machine diagram, sequence diagram, communication diagram, interaction overview diagram, component diagram, deployment diagram, UML 2 diagrams.

08 Hours

Module – III

Design Patterns: Basic pattern concepts, Types of patterns, some common design patterns such as Expert, Creator, Façade, MVS, MVC, Publish-Subscribe, Observer, Proxy etc.

08 Hours

Module – IV

Designing using UML: Overview of OOAD methodology, Use case model development, Domain modelling, Identification of entity objects, Brooch's object identification method, Interaction modelling, CRC cards, Applications of the analysis and design process, object-oriented design principles. OOD goodness criteria, CK Metrics, LK Metrics, MOOD Metrics, Code Refactoring.

08 Hours

Module – V

Testing Object Oriented Software: Challenges in testing object-oriented software, Implications of object-oriented Features in testing object-oriented software, Importance of grey-box testing of object-oriented software, Coverage analysis, State-based testing, Class testing, Fault-Based Testing, Scenario-Based Test Design, Integration Testing: Thread-based integration Strategies, Use-based integration Strategies, Cluster Testing, Validation Testing, System Testing, Testing tools.

08 Hours

Course Outcomes:

At the end of this course, the students will learn:

- Understand the importance of modelling in the software development life cycle.
- Analyze to apply the UML notation and symbols.
- Understand the design patterns.
- Design and develop the object-oriented approach systems Design and software solutions.
- Explore object oriented software testing.

Text Book:

1. Rajib Mall, "Fundamentals of Software Engineering", 5th Edition, PHI, 2018.

Reference Books:

1. Rumbaugh and Blaha, Object-oriented Modelling and design with UML, Pearson, 2007.
2. Bernd Bruegge and, Allen H. Dutoit, Object-Oriented Software Engineering Using UML, Patterns, and Java, Pearson, 2009.

ARTIFICIAL INTELLIGENCE

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
20CDT652	3:0:0:0	3	CIE:50 SEE:50	3 hours	PEC

Course Objectives:

This course will enable students to:

- Understand AI technique to a given concrete problem
- Study non-trivial AI techniques to handle complex problem
- Understand uncertainty and Problem-solving techniques.
- Learn various symbolic knowledge representations to specify domains and reasoning tasks of a situated software agent.
- Gain knowledge on logical systems for inference over formal domain

Syllabus

Module – I

Introduction: What is AI? Intelligent Agents: Agents and environment; Rationality; the nature of environment; the structure of agents. Problem solving: Problem-solving agents; Example problems; Searching for solution; Uninformed search strategies.

08 Hours

Module – II

Informed Search, Exploration, Constraint Satisfaction, Adverbial Search: Informed search strategies; Heuristic functions; On-line search agents and unknown environment. Constraint satisfaction Problems; Backtracking search for CSPs. Adverbial search: Games; Optimal decisions in games; Alpha- Beta pruning.

08 Hours

Module – III

Logical Agents: Knowledge-based agents; The wumpus world as an example world; Logic; propositional logic Reasoning patterns in propositional logic; Effective propositional inference; Agents based on propositional logic.

08 Hours

Module – IV

First-Order Logic, Inference in First-OrderLogic-1: Representation revisited; Syntax and semantics of first-order logic; Using first-order logic; Knowledge engineering in first-order logic. Propositional versus first-order inference; Unification and lifting.

08 Hours

Module – V

Inference in First-Order Logic-2: Forward chaining; backward chaining; Resolution.

08 Hours

Course Outcomes:

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

CO1: Design intelligent agents for solving simple gaming problems.
CO2: Apply non-trivial AI techniques to handle complex problems.
CO3: Apply various symbolic knowledge representation to specific problems.
CO4: Design Knowledge-based agents.
CO5: Describe syntax and semantics of first-order logic.

Text Books:

- Stuart Russel, Peter Norvig: "Artificial Intelligence A Modern Approach", 2nd Edition, Pearson Education, 2003, (Chapters 1.1, 2, 3.1 - 3.4, 4.1, 4.2, 4.5, 5.1, 5.2, 6.1- 6.3, 7, 8, 9, 10, 11.1, 11.2, 11.4, 11.5, 13.1, 13.4, 13.5, 13.6,) ISBN:0-13-103805-2.

Reference Books:

- Elaine Rich, Kevin Knight: "Artificial Intelligence", 3rd Edition, Tata McGraw Hill, 2009, ISBN-10: 0070087709.
- Nils J. Nilsson: "Principles of ArtificialIntelligence", Elsevier, 1980, ISBN: 978-3-540-11340-9.

E-Resources:

- http://stpk.cs.rtu.lv/sites/all/files/stpk/materiali/MI/Artificial%20Intelligence
- http://www.getfreeebooks.com/16-sites-with-free-artificial-intelligence-ebook

BLOCK CHAIN TECHNOLOGY

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
20CDT653	3 : 0 : 0 : 0	3	CIE:50 SEE:50	3hrs	PEC

Prerequisite: Network Security and Information Security

Course Objectives:

- Understand about Symmetric and Asymmetric Encryption, block chain and Bit coin concepts
- Analyse the Working of Block Chain System.
- Design, build, and deploy smart contracts and distributed applications
- Evaluate security, privacy, and efficiency of a given block chain system.
- Cognize about 'digital' currency, Storage and Currency Exchange Services.

Syllabus

Module – I

Introduction to Block chain: Back story of Block chain, what is Block chain? Centralized vs. Decentralized Systems, Layers of Block chain, why is Block Chain Important? Limitations of Centralized Systems, Block chain Adoption So Far, Block chain Uses and Use Cases How Block chain Works-1: Laying the Block Chain Foundation, Cryptography, Symmetric Key Cryptography, Cryptographic Hash Functions.

08 Hours

Module – II

Cryptography and Transactions: Asymmetric Key Cryptography, Diffie-Hellman Key Exchange, Symmetric vs. Asymmetric Key Cryptography, Merkle Trees, Putting It All Together, Properties of Block Chain Solutions, Block chain Transactions, Distributed Consensus Mechanisms, Block chain Applications, Scaling Block chain, Off-Chain Computation, Sharding Block Chain State.

08 Hours

Module – III

Bitcoin Works: The History of Money, Dawn of Bitcoin, What Is Bitcoin? Working with Bitcoins, The Bitcoin Block chain, Block Structure, The Genesis Block, The Bitcoin Network, Network Discovery for a New Node, Bitcoin Transactions, Consensus and Block Mining, Block Propagation, Bitcoin Scripts, Bitcoin Transactions Revisited, Scripts.

08 Hours

Module – IV

Ethereum and Crypto Currencies: Ethereum Introduction, Ethereum Block chain, Elements of Ethereum Block chain and Smart Contracts, The Turing Completeness of Smart Contract Languages and verification challenges**,** Cryptographic Hash Functions**,** Hash Pointers and Data Structures, Digital Signatures, Public Keys as Identities, A Simple Crypto currency.

08 Hours

Module – V

How to Store and Use Bitcoins: Simple Local Storage, Hot and Cold Storage, Splitting and Sharing Keys, Online Wallets and Exchanges, Payment Services, Transaction Fees, Currency Exchange Markets.

08 Hours

Course Outcomes

After the completion of this course, student will be able to

- Gain Knowledge in Symmetric Encryption, Asymmetric Encryption, Block Chain System and Crypto currencies.
- Analyze the working of Block Chain System, Ledger Transaction and Mining mechanism.
- Design and Implement Ethereum block chain contract.
- Pertain to ethical and legal usage of Block chain applications.
- Use of Bitcoins, online wallets, Currency Exchanges and payment services.

Text Books:

1. Beginning Block chain: A Beginner's Guide to Building Block Chain Solutions by Bikramaditya Singhal, Gautam Dhameja and Priyansu Sekhar Panda

2. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, Bit coin and Crypto-currency Technologies: A Comprehensive Introduction, Princeton University Press (July 19,2016).

Reference Books:

1. Mastering Bit coin by Andreas M. Antonopoulos
2. Block chain Technology: Crypto-currency and Applications by S. Shukla, M. Dhawan, S. Sharma, S. Venkatesan, Oxford University Press 2019.
3. Imran Bashir, Mastering Block chain: Deeper Insights into Decentralization, Cryptography, Bitcoin, and Popular Block chain Frameworks, Packt Publishing, 1st Edition, 2017.

E-Resources:

1. NPTEL online course: https://nptel.ac.in/courses/106/104/106104220/#
2. Udemy: https://www.udemy.com/course/build-your-blockchain-az/
3. EDUXLABS Online training://eduxlabs.com/courses/block chain technology- training/?tab=tab-curriculum

DIGITAL IMAGE PROCESSING

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
20CDT661	3:0:0:0	3	CIE:50 SEE:50	3 Hours	PEC

Course Objectives:

This course will enable students to:

- Study the fundamental concepts of image representation and image processing system.
- Evaluate techniques followed in image enhancements
- Illustrate image segmentation and compression algorithms

Syllabus

Module – I

Introduction to Image Processing: Digital Image Fundamentals Light, brightness adaption and discrimination, Human visual system, Image as a 2D data, Image representation Gray scale and Color images, Image sampling and quantization, Color Fundamentals, Color Models, Pseudo-color image processing.

08 Hours

Module – II

Image Enhancement In The Spatial Domain: Some Basic Gray Level Transformations, Histogram Processing, Enhancement Using Arithmetic/Logic Operations, Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters, Combining Spatial Enhancement Methods.

08 Hours

Module – III

Image Enhancement in Frequency Domain: Introduction, Fourier Transform, Discrete Fourier Transform (DFT), properties of DFT, Discrete Cosine Transform (DCT), Image filtering in frequency domain.

08 Hours

Module – IV

Image Segmentation: Introduction, Detection of isolated points, line detection, Edge detection, Edge linking, Region based segmentation- Region growing, split and merge technique, local processing, regional processing, Hough transform, Segmentation using Threshold.

08 Hours

Module – V

Image Compression: Introduction, coding Redundancy, Inter-pixel redundancy, image compression model, Lossy and Lossless compression, Huffman Coding, Arithmetic Coding, LZW coding, Transform Coding, Sub-image size selection, blocking, DCT implementation using FFT, run length coding.

08Hours

Course Outcomes:

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

- Explain fundamentals of image processing
- Compare transformation algorithms
- Contrast enhancement, segmentation and compression techniques

Text Book:

1. Rafael C. Gonzalez and Richard E. Woods: "Digital Image Processing, 3rdEdition, Pearson Education, Pearson Education, 2014, ISBN-10: 9332518467, ISBN-13: 9789332518469,

Reference Books:

1. S Jayaraman, S Esakkirajan, T Veerakumar: "Digital Image Processing", Tata Mc- Graw HillPublication.

2. S Sridhar: "Digital Image Processing", Oxford University Press, ISBN-10: 0199459355, ISBN-13:9780199459353.

E-Resources:

1. https://www.abebooks.com/9789332518469/Digital-Image-Processing-3rd-Edi-tion-9

2. www.synergy.ac.in/intranet/classnotes/introduction.pdf

COMPUTER VISION

Course Code	L : T : P:S	Credits	Exam Marks	Exam Duration	Course Type
20CDT662	3:0:0:0	3	CIE:50 SEE:50	3hrs	PEC

Prerequisite: Computer graphics, drawing and animation Image processing techniques

Course Objectives:

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

- Recall image processing techniques for computer vision
- Do shape and region analysis
- Elucidate Hough Transform and its applications to detect lines, circles, ellipse
- Apply three-dimensional image analysis techniques
- Exploit motion analysis
- Study real world applications of computer vision algorithms

Module – I

Image Processing Foundations: Fundamentals of Image Processing Techniques – Classical Filtering Operations – Thresholding Techniques – Edge Detection Techniques – Corner and Interest Point Detection–Mathematical Morphology –Texture.

08 Hours

Module – II

Shapes and Regions: Binary Shape Analysis – Connectedness – Object Labeling and Counting – Size Filtering – Distance Functions – Skeletons and Thinning – Deformable Shape Analysis – Boundary Tracking Procedures – Active Contours – Shape Models and Shape Recognition – Centroidal Profiles – Handling Occlusion – Boundary Length Measures – Boundary Descriptors – Chain Codes – Fourier Descriptors – Region Descriptors – Moments.

08 Hours

Module – III

Hough Transform: Line Detection – Hough Transform (HT) For Line Detection – Foot-of-Normal Method – Line Localization – Line Fitting – RANSAC for Straight Line Detection – HTBased Circular Object Detection – Accurate Center Location – Speed Problem – Ellipse Detection – Case Study: Human Iris Location – Hole Detection – Generalized Hough Transform – Spatial Matched Filtering – GHT for Ellipse Detection – Object Location – GHT for Feature Collation.

08 Hours

Module – IV

3D Vision and Motion: Methods for 3D Vision – Projection Schemes – Shape From Shading– Photometric Stereo –Shape from Texture – Shape from Focus – Active Range Finding – Surface Representations –Point-Based Representation – Volumetric Representations – 3D Object Recognition – 3D Reconstruction – Introduction to Motion – Triangulation – Bundle Adjustment – Translational Alignment – Parametric Motion – Spline-Based Motion – Optical Flow – Layered Motion.

08 Hours

Module – V

Applications: Application: Content Based Image Retrieval, Content Based Video Retrieval.

08 Hours

Case Study: Face Recognition, Gait Recognition.

Text Books:

1. E. R. Davies, (2012), ,Computer & Machine Vision', Fourth Edition, Academic Press.
2. R.Szeliski,(2011), ComputerV ision: Algorithms and Applications',Springer 2011.
3. Simon J. D. Prince, (2012) ,Computer Vision: Models, Learning, and Inference', Cambridge University Press, 2012.
3. MarkNixonandAlbertoS.Aquado,(2012),FeatureExtraction&ImageProcessing for Computer Vision', Third Edition, Academic Press.

Reference Books:

1. D.L.Baggioetal.,(2012),Mastering Open CV with Practical Computer Vision Projects', Packet Publishing,.
2. Jan Erik Solem, (2012),Programming Computer Vision with Python: Tools and algorithms for analyzing images', O'Reilly Media.

Course Outcomes:

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

CO Nos.	Course Outcomes
CO1	Explain the basic image processing techniques
CO2	Interpret in-shape , boundary tracking and apply chain codes in region detection
CO3	Apply hough transform for detection of geometric shapes like line, ellipse and objects.
CO4	Illustrate 3D vision process and motion estimation techniques
CO5	Apply computer vision in real time scenario.

DEVOPS

Course Code	L : T : P : S	Credits	Exam Marks	Exam Duration	Course Type
20CDT663	3 : 0 : 0 : 0	3	CIE:50 SEE:50	3 Hours	PEC

Course objectives:

This course will enable students to:

- Understand the DevOps Concepts and DevOps Tool.
- Expose to the evolving Applications and advance features of Jenkins and Docker.
- Get Familiarize with Docker and Chef workstations.
- Understand the importance of testing using Jenkins, AWS EC2.
- Identify and understand security in Jenkins and monitor the azure Applications.

Syllabus

Module – I

Introduction to DevOps Concepts: Understanding DevOps movement, DevOps with changing times, The waterfall model, Agile Model, Why DevOps? DevOps lifecycle, Benefits of DevOps.

08 Hours

Module – II

Continuous Integration with Jenkins 2: Introduction, Installing Jenkins, Jenkins dashboard, Configuration Java, Maven/Ant in Jenkins, Creating and Configuring build job for Java application with Maven, Managing Nodes, Email notifications based on build status.

08 Hours

Module – III

Containers: Overview of Docker containers, Understanding the difference between virtual machines and containers, Installing and configuring Docker, Creating a Tomcat container.

Cloud Computing and Configuration Management: An overview of the Chef Configuration management tool, Installing and configuring a Chef workstation, Installing knife plugins for Amazon Web Services and Microsoft Azure.

08 Hours

Module – IV

Automated Testing (Functional and Load Testing): Functional testing using Selenium, Functional test execution in Jenkins, Load test execution using Jenkins.

Orchestration - End-to-End Automation: End-to-end automation of application life cycle management using Jenkins, End-to-end automation using Jenkins, Chef, and AWS EC2, End-to-end automation using Jenkins and AWS Elastic Beanstalk, End-to end automation using Jenkins and Microsoft Azure app services, End-to-end automation orchestration of application life cycle Management using VSTS.

08 Hours

Module – V

Security and Monitoring: Security in Jenkins and VSTS, Security in Jenkins and VSTS, Monitoring Jenkins and Microsoft Azure, Monitoring Jenkins, Azure Web Apps troubleshooting and monitoring, Azure App Services - CPU and memory consumption, Azure App Services - Activity log, Azure Application Insights for application monitoring, Azure web application monitoring, Diagnostics logs.

08 Hours

Laboratory Component:

1) Download and install Jenkins CI on GCP.
2) Configuration. Change language interface and Create the first Jenkins job
3) Build Triggers, corn syntax, Artifacts.
4) Create and run Jenkins pipeline.
5) Create parameterized jobs in Jenkins.
6) Install and configure Docker.

Course outcomes:

On completion of this course, the students are able to:

CO1: Understand the fundamentals of DevOps engineering and be fully proficient with DevOps terminologies, concepts, benefits, and deployment options to meet your business requirements

CO2: Build jobs and configurations in Jenkins and Master in docker , Continuous Delivery and chef Configuration Management.

CO3: Create tomcat container and work on Dockers and chef workstation.

CO4: Analyze, design and evaluate automation scripts & systems.

CO5: Use Azure application services and monitor the security issues in Jenkins and Microsoft Azure.

Text Books:

- Mitesh Soni: DevOps for Web Development,Packet Publishing,ISBN:9781786465702,Released October 2016
- Mitesh Soni: DevOps Bootcamp-A fast-paced guide to implement DevOps with ease, May2017(Chapters: 3,4,6,7,8),ISBN 978-1-78728-596-5.

Reference Books

- Len Bass, Ingo Weber, Liming Zhu, Devops Software Architect's perspective, first edition, ISBN 978-0-13-404984-7,2015 Pearson Education, Inc.
- Trevor Roberts, Jr.,Josh Atwell, Egle Sigler, Yvo van Doorn, Devops for VMware Administrator, First Printing: April 2015, ISBN-10: 0-13-384647-4, ISBN-13: 978-0-13-384647-8,Pearson Education, Inc.
- Sanjeev Sharma "The DevOps Adoption Playbook: A Guide to Adopting DevOps in a Multi-Speed IT Enterprise "Published by John Wiley & Sons, Inc. ISBN: 978-1-119-30874-4, ISBN:978-1-119-31052-5 (eBook) ,ISBN: 978-1-119-31076-1 (eBook)

E-Recourses

- https://resources.collab.net/devops-101/what-is-devops.
- https://www.ibm.com/cloud/learn/devops-a-complete-guide.
- https://newrelic.com/devops/what-is-devops
- https://www.oreilly.com/library/view/devops-for-web/9781786465702/

UNIX and Shell Programming

Course Code	L : T : P : S	Credits	Exam Marks	Exam Duration	Course Type
20CDT664	3 : 0 : 0 : 0	3	CIE:50 SEE:50	3 Hours	PEC

Course Objectives:

This course will enable students to:

- Learn basic commands to interact with UNIX System and VI editor.
- Understand the history, origin, features and architecture of UNIX Operating System.
- Identify and define key terms related to operating system
- Develop the ability to evaluate regular expressions and use them for pattern matching.
- Apply essential facets of SHELL programming in order to solve the SHELL script problems.

Syllabus

Module - I

General Overview of the System : System structure, user perspective ,O/S services assumption about Hardware: The Kernel and buffer cache architecture of Unix O/System concepts, Kernel data Structure, System administration , Buffer headers, Structure of the buffer pool ,Scenarios for retrieval of the buffer, Reading and writing disk block, Advantage and disadvantage of buffer cache.

08 Hours

Module – II

The File system –The Basics of Files-What's in a File-Directories and File Names-Permissions-I Nodes-The Directory Hierarchy, File Attributes and Permissions-The File Command knowing the File Type-The Chmod Command Changing File Permissions-The Chown Command Changing the Owner of a File-The Chgrp Command Changing the Group of a File.

08 Hours

Module – III

Internal Representation of Files: INODES, Structure of regular, Directories conversions of a path name to an inode, Super block, Inode assignment to a new file, Allocation of disk blocks. System Calls for the System: Open read write file and record close, File creation, Operation of special files change directory and change root, change owner and change mode, STAT and FSTAT, PIPES Mounting and unmounting files system, Link Unlink.

08 Hours

Module – III

Structures of Processes and process control: Process states and transitions layout of system memory, the context of a process, manipulation of process address space, Sleep process creation/termination. The user Id of a process, changing the size of a process. The SHELL Interprocess Communication and multiprocessor system: Process tracing system V IPO network communication sockets problem of multiprocessors systems, solution with master and hare process, and solution with semaphores

08 Hours

Module – V

Introduction to shell: Shell Bourne shell, C shell, Unix commands, permissions, editors, filters, sed, grep family, shell variables, scripts, meta characters and environment, if and case statements, for while and until loops. Shell programming. Connecting MYSQL to Shell, Running SQL queries from Shell Scripts, Generating a report and storing in a file Shopping cart. Case Study of LINUX operating System.

08 Hours

Instructional Method and Pedagogy:

1. At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
2. Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
3. Three internal exam will be conducted as a part of internal theory evaluation.
4. Assignments based on the course content will be given to the students for each unit and will be evaluated at regular interval evaluation.
5. Surprise tests/Quizzes/Seminar/tutorial will be conducted having a share of five marks in the overall internal evaluation.

Course Outcomes:

On completion of this course, the students are able to:

- Describe history, origin, feature and architecture of UNIX operating system.
- Construct and edit files, search for any patterns using regular expressions.
- Solve complex jobs using tools and utilities available in UNIX.
- Design and develop various tasks by using Shell scripting.

Text Book:

1. Sumitabha Das: "UNIX – Concepts and Applications", (Chapters 1,2,4,6-9,11-14,17,19), Tata McGraw Hill, Noida, 4th Edition, 15th Reprint, 2011, ISBN-13: 978-0-07-063546-3.

Reference Books:

1. Behrouz A. Forouzan and Richard F. Gilberg: "UNIX and Shell programming", Cengage Learning, India, 1st Edition, 2005, ISBN: 81-35-0325-9.
2. M G Venkatesh Murthy: "UNIX and Shell programming", Pearson Education, Delhi, 1st Edition, 2005, ISBN: 81-7758-745-5.

E-Resources:

1. http://www.mhhe.com/das/uca
2. http://www.tutorialspoint.com/unix/unix_tutorials.pdf.
3. http://www.perldoc.perl.org/