	SJPN Trust's Hirasugar Institute of Technology, Nidasoshi. <i>Inculcating Values, Promoting Prosperity</i>	Dept. of CSE
	Approved by AICTE, New Delhi, Permanently Affiliated to VTU, Belagavi Recognized under 2(f) & 12B of UGC Act, 1956	Academic Course Plan
	Accredited at 'A' Grade by NAAC & Programmes Accredited by NBA:CSE & ECE	2022-23 (ODD)

INSTITUTE VISION

“To be a preferred institution in Engineering Education by achieving excellence in teaching and research and to remain as a source of pride for its commitment to holistic development of individual and society”

INSTITUTE MISSION

“To continuously strive for the overall development of students by educating them in a state-of-the-art-infrastructure, by retaining the best practices, faculties and inspire them to imbibe real time problem solving skills, leadership qualities, human values and societal commitments, so that they emerge as competent professionals”.

DEPARTMENT VISION

“To be a center of excellence in providing education in the field of Computer Science and Engineering to produce technically competent and socially responsible IT professionals”

DEPARTMENT MISSION


“To provide a theoretical foundation in computing with the exposure of latest tools and technologies, IT infrastructure and encourage students for continuous learning to make them competent professionals”

PROGRAM EDUCATIONAL OBJECTIVES (PEO's) :

1. *Pursue a successful career in the field of Computer Science & Engineering utilizing his/her knowledge and contribute to the profession as an excellent employee, or as an entrepreneur.*
2. *Apply the knowledge of mathematics & computer science fundamentals to analyze & formulate the solution to solve real time problems.*
3. *Exhibit the professional and ethical values, communication & teamwork skills, lifelong learning, multidisciplinary approach to address computer engineering and societal issues.*

PROGRAM OUTCOMES (PO's) :

1. **Engineering knowledge:** *Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.*
2. **Problem analysis:** *Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.*
3. **Design/development of solutions:** *Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.*
4. **Conduct investigations of complex problems:** *Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.*
5. **Modern tool usage:** *Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.*
6. **The engineer and society:** *Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.*

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7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.


PROGRAM SPECIFIC OUTCOMES (PSO's) :

PSO1: Understand, design and analyze computer programs in the areas related to Algorithms, System Software, Web design, Bigdata Analytics, Machine Learning and Networking.

PSO2: Make use of modern computer tools for creating innovative career paths to be an entrepreneur and desire for higher studies.

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1.0 Student Help Desk

Sl. No.	Purpose	Contact Person	
		Faculty	Instructor
1	Research Center Coordinator ,Dept. NBA Coordinator Conference / FDP / Workshop, IIC/Internship Coordinator, NBA Criteria 1 Coordinator Module Coordinator	Dr. K. B. Manwade	Mr. A. K. Talwar
2	Website Coordinator, Feedback Coordinator, Final year seminar Coordinator, NBA Criteria 4 Coordinator NACC Criteria 3 Co-Coordinator, Module Coordinator	Dr. Mahesh. G. Huddar	Mr. A. K. Badakar
3	Dept. ED Cell Coordinator ,NBA Criteria 6 Coordinator, NAAC Criteria 1 Co-coordinator Module Coordinator, Class Teacher for VII Sem Microprocessor Lab Incharge	Prof. N K Honnagoudar	Mr. V. V. Maneshi
4	Head of Department, Innovation Club Coordinator AICTE activity point Coordinator, NBA Criteria 7 and 10 Coordinator, Module Coordinator, Project Lab Incharge	Prof. S. V. Manjaragi	Mr. A. R. Bhiste
5	GATE/Pre-placement Coaching Coordinator, Dept. T&P coordinator, NBA Criterion 9 Coordinator NACC Criterion-5 Co-Coordinator, Class Teacher for V Sem	Prof. N M Patel	Mr. A. K. Badakar
6	EMS/IA Coordinator, Alumni Coordinator, NBA Criteria 3 Coordinator, NACC Criterion-7 Co-Coordinator, Dept. Time table Coordinator / Meeting Coordinator, Module coordinator	Prof. A A Daptardar	Mr. V. V. Maneshi
7	Department Association Coordinator (STAC), Technical magazine / Newsletter, Professional body Coordinator (IEEE/ISTE), NBA Criteria 5 Coordinator Web Programming Lab Incharge	Prof. P. G. Patil	Mr. A. K. Talwar
10	Project/KSCST Coordinator, NBA Criteria 2 Coordinator, Class Teacher for III Sem, Computer Center Lab Incharge	Prof. S. I. Mane	Mr. A. R. Bhiste
11	Dept. Library	Mr. A. R. Bhiste	
Institute Level			
12.	Dean Student Welfare Convener	Dr. Mahesh G. Huddar (7411043272)	
13.	Dean Placements and III Cell	Prof. N. M. Patel (9739619661)	
14.	Internal Complaint Committee Convener	Prof. S. S. Kamte (9008696825)	
15.	Grievance Redressal Convener	Prof. S. S. Tabhaj (9901398134)	
16.	Sports & Cultural/Extra-Curricular Activities Convener	Sri. S.B. Sarawadi (9739109383)	

2.0 Departmental Resources

Department of Computer Science and Engineering was established in the year 1996 and is housed in a total area of 1206 Sq. Mtrs.

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2.1 Faculty Position

Sl.No.	Category	No. in Position	Average experience (in years)
1.	Teaching Faculty	08	14.5
2.	Technical Supporting Staff	05	12.6
3.	Helper Staff	03	21

2.2 Major Laboratories

Sl.No.	Name of the laboratory	Area in Sq. Mtrs	Amount Invested (Rs. in Lakhs)
1.	System Programming Lab.	70	12.65
2.	C Programming Lab/ Algorithms/ Network Lab.	70	19.34
3.	Project Laboratory	70	20.06
4.	Microprocessors Lab.	70	22.14
5.	Web Programming/DBA Lab.	70	09.56
6.	Computer Center	220	234.79

Total Investment in the Department

Rs. 318.54 Lakhs

3.0 Teaching Faculty Details

Sl. No.	Name	Designation	Qualification	Specialization	Professional Membership	Teaching Exp (in yrs)	Phone No.
1	Dr. K. B. Manwade	Assoc. Prof	M. Tech, Ph.D	CSE	LMISTE,CSI	17.06	8412968254
2	Dr. Mahesh.G. Huddar	Assoc. Prof	M. Tech, Ph.D	CSE	LMISTE	13.00	7411043272
3	Prof. N. K. Honnagoudar	Asst. Prof.	M.E	ECE	LMISTE	19.06	9449495302
4	Prof. S. V. Manjaragi	Asst. Prof.	M.Tech.(Ph.D)	CSE	LMISTE	18.06	9986658309
5	Prof. N. M. Patel	Asst. Prof	M. Tech	CSE	LMISTE	17.01	9739619661
6	Prof. A.A. Daptardar	Asst. Prof	M. Tech.	CSE	LMISTE	15.06	9620851002
7	Prof. Prasanna. G. Patil	Asst. Prof	M. Tech	CSE	LMISTE,CSI,IE	09.1	9743202717
8	Prof. Sujata Mane	Asst. Prof	M. Tech	CNE	--	8.00	9743202717



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Dept. of CSE

Academic

Course Plan

2022-23 (ODD)


5.0 Department Academic Calendar

DEPARTMENT OF COMPUTER SCIENCE & ENGG. CALENDAR OF EVENTS FOR THE ACADEMIC YEAR 2022-23 (Odd)

Date	Events	
19-09-2022	Commencement of Classes for VII Semester	September-2022
10-10-2022	Commencement of Classes for V Semester	
14-10-2022	Tech Talk by Industry Expert on Latest Technology	S M T W T F S
27-10-2022 to 29-10-2022	First Internal Assessment for VII Semester	1 2 3
31-10-2022	Feedback -I on Teaching-Learning for VII Semester	4 5 6 7 8 9 10
31-10-2022	Commencement of Classes for III Semester	11 12 13 14 15 16 17
01-11-2022	Kannad Rajyothsava	18 19 20 21 22 23 24
03-11-2022	Display of 1 st Internal Assessment Marks and submission of Feedback-I of VII Semester to office	25 26 27 28 29 30
04-11-2022	Cooking Without Fire Competition	October-2022
05-11-2022 - 07-11-2022	32 Hours Workshop on "IoT" - V th Sem Students	S M T W T F S
12-11-2022	Industrial Visit - III & V Sem students	1 2 3 4 5 6 7 8
18-11-2022	Webinar on Latest Technology	9 10 11 12 13 14 15
19-11-2022	Inauguration of STAC Activities for the AY 2022-23 & Welcome function to 3 rd Sem Students	16 17 18 19 20 21 22
25-11-2022	Technical Essay Writing Competition	23 24 25 26 27 28 29
26-11-2022	First Assignment Submission of III Semester (PCC + IPCC)	30 31
28-11-2022 to 30-11-2022	Second Internal Assessment for VII Semester & First Internal Assessment for III (PCC + IPCC) /V Semester	04- Mahanavami, Ayudhapooja 05- Vijayadashami 24- Naraka Chaturdashi, 26- Balipadyami Deepavalli
01-12-2022	Feedback -II on Teaching-Learning for VII Semester & Feedback - I on Teaching-Learning for III/V Semester	November-2022
02-12-2022	Box Cricket	S M T W T F S
06-12-2022	Display of 2 nd Internal Assessment Marks and submission of Feedback-II of VII Semester & Display of 1 st Internal Assessment Marks and submission of Feedback-I of III/V Semester to office	1 2 3 4 5
09-12-2022	Coding Competition- "Codeathon-2022"	6 7 8 9 10 11 12
10-12-2022	Sports Day	13 14 15 16 17 18 19
16-12-2022	Git & GitHub Workshop	20 21 22 23 24 25 26
23-12-2022 & 24-12-2022	First Lab Internal Assessment for III Semester (PCC+AEC)	27 28 29 30
26-12-2022 & 27-12-2022	Lab Internal Assessment for VII Semester	01- Kannada Rajyothsava, 11- Kanakadasa Jayanti
29-12-2022 to 31-12-2022	Third Internal Assessment for VII Semester & Second Internal Assessment for III (PCC + IPCC) /V Semester	December-2022
31-12-2022	Last working day for VII Semester	S M T W T F S
02-01-2023	Feedback -II on Teaching-Learning for III/V Semester	1 2 3 4 5
05-01-2023	Display of Final IA Marks of VII Semester	6 7 8 9 10 11 12
05-01-2023	Display of 2 nd Internal Assessment Marks and submission of Feedback-II of III/V Semester to office	13 14 15 16 17 18 19
06-01-2023	One Day Short-Term training on Web Designing using WordPress	20 21 22 23 24 25 26
07-01-2023	Second Assignment Submission of III Semester (PCC + IPCC)	27 28 29 30 31
12-01-2023	National Youth Day	January-2023
15-01-2023	NSS Day	S M T W T F S
19-01-2023	Mini Project Exhibition and Competition	1 2 3 4 5 6 7
20-01-2023 & 21-01-2023	Lab Internal Assessment for V Semester	8 9 10 11 12 13 14
23-01-2023 to 25-01-2023	Third Internal Assessment for V Semester	15 16 17 18 19 20 21
26-01-2023	Republic Day	22 23 24 25 26 27 28
27-01-2023	Last working day for V Semester	29 30 31
30-01-2023 to 01-02-2023	Second Lab Internal Assessment for III Semester (PCC+IPCC+AEC)	14-Makara Sankranti, 26- Republic Day
31-01-2023	Display of Final IA Marks of V Semester	February-2023
06-02-2023 to 08-02-2023	Third Internal Assessment for III Semester (PCC)	S M T W T F S
11-02-2023	Last working day for III Semester	1 2 3 4
14-02-2023	Display of Final IA Marks of III Semester	5 6 7 8 9 10 11
		12 13 14 15 16 17 18
		19 20 21 22 23 24 25
		26 27 28
		18- Mahashivaratri


Prof. Prasanna Patil
STAC Coordinator

Prof. S. V. Manjaragi
HOD


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6.0 Scheme of Teaching & Examination


VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI												
B.E. in Computer Science and Engineering												
Scheme of Teaching and Examinations 2021												
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 (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination			Credits	
				Theory Lecture	Tutorial	Practical/	Self - Study	Duration in hours	CIE Marks	SEE Marks		Total Marks
				L	T	P	S					
1	BSC 21MAT31	Transform Calculus, Fourier Series and Numerical Techniques	Maths	3	0	0		03	50	50	100	3
2	IPCC 21CS32	Data Structures and Applications	Any CS Board Department	3	0	2		03	50	50	100	4
3	IPCC 21CS33	Analog and Digital Electronics		3	0	2		03	50	50	100	4
4	PCC 21CS34	Computer Organization and Architecture		3	0	0		03	50	50	100	3
5	PCC 21CSL35	Object Oriented Programming with JAVA Laboratory		0	0	2		03	50	50	100	1
6	UHV 21UH36	Social Connect and Responsibility	Any Department	0	0	1		01	50	50	100	1
7	HSMC 21KSK37/47	Samskrutika Kannada	TD and PSB:HSMC	1	0	0		01	50	50	100	1
	HSMC 21KBK37/47	Balake Kannada										
	OR											
	HSMC 21CIP37/47	Constitution of India and Professional Ethics										
8	AEC 21CS38X/21 CSL38X	Ability Enhancement Course - III	TD: Concerned department PSB: Concerned Board	If offered as Theory Course				01	50	50	100	1
				1	0	0						
				If offered as lab. course				02				
				0	0	2						
Total								400	400	800	18	
9	Scheduled activities for III to VIII semesters	NMDC 21NS83	National Service Scheme(NSS)	NSS	<p>All students have to register for any one of the course 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.</p> <p>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.</p>							
		NMDC 21PE83	Physical Education (PE)(Sports and Athletics)	PE								
		NMDC 21YO83	Yoga	Yoga								
Course prescribed to lateral entry Diploma holders admitted to III semester B.E./B.Tech programs												

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1	NCMC 21MATDIP31	Additional Mathematics - I	Maths	02	02	--	--	---	100	---	100	0
<p>Note: BSC: Basic Science Course, IPCC: Integrated Professional Core Course, PCC: Professional Core Course, INT –Internship, HSMC: Humanity and Social Science & Management Courses, AEC–Ability Enhancement Courses. UHV: Universal Human Value Course. L –Lecture, T – Tutorial, P- Practical/ Drawing, S – Self Study Component, CIE: Continuous Internal Evaluation, SEE: Semester End Examination. TD- Teaching Department, PSB: Paper Setting department</p> <p>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.</p> <p>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.</p> <p>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.</p>												
<p>Non-credit mandatory courses (NCMC):</p> <p>(A) Additional Mathematics I and II:</p> <p>(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.</p> <p>(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.</p> <p>(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.</p> <p>(B) National Service Scheme/Physical Education (Sport and Athletics)/ Yoga:</p> <p>(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.</p> <p>(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.</p> <p>(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.</p> <p>(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.</p> <p>(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.</p>												
Ability Enhancement Course - III												
21CSL381	Mastering Office		21CS383									
21CS382	Programming IN c++		21CS384									
Open Electives - II offered by the Department to other Department students												
21CS751	Programming in Python		21CS754	Introduction to Data Science								
21CS752	Introduction to AI and ML		21CS755									

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21CS753	Introduction to Big Data	
<p>Note: PCC: Professional Core Course, PEC: Professional Elective Courses, OEC–Open Elective Course, AEC –Ability Enhancement Courses. L –Lecture, T – Tutorial, P- Practical / Drawing, S – Self Study Component, CIE: Continuous Internal Evaluation, SEE: Semester End Examination.</p>		
<p>Note: VII and VIII semesters of IV year of the programme</p> <p>(1) Institutions can swap VII and VIII Semester Scheme of Teaching and Examinations to accommodate research internship/ industry internship after the VI semester.</p> <p>(2) Credits earned for the courses of VII and VIII Semester Scheme of Teaching and Examinations shall be counted against the corresponding semesters whether VII or VIII semester is completed during the beginning of IV year or later part of IV year of the programme.</p>		
<p>PROJECT WORK (21XXP76): The objective of the Project work is</p> <ul style="list-style-type: none"> (i) To encourage independent learning and the innovative attitude of the students. (ii) To develop interactive attitude, communication skills, organization, time management, and presentation skills. (iii) To impart flexibility and adaptability. (iv) To inspire team working. (v) To expand intellectual capacity, credibility, judgment and intuition. (vi) To adhere to punctuality, setting and meeting deadlines. (vii) To instil responsibilities to oneself and others. (viii) To train students to present the topic of project work in a seminar without any fear, face the audience confidently, enhance communication skills, involve in group discussion to present and exchange ideas. <p>CIE procedure for Project Work:</p> <p>(1) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide.</p> <p>The CIE marks awarded for the project work, shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.</p> <p>(2) Interdisciplinary: Continuous Internal Evaluation shall be group-wise at the college level with the participation of all guides of the college. Participation of external guide/s, if any, is desirable. The CIE marks awarded for the project work, shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.</p> <p>SEE procedure for Project Work: SEE for project work will be conducted by the two examiners appointed by the University. The SEE marks awarded for the project work, shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the ratio 50:25:25.</p>		
<p>TECHNICAL SEMINAR (21XXS81): The objective of the seminar is to inculcate self-learning, present the seminar topic confidently, enhance communication skill, involve in group discussion for exchange of ideas. Each student, under the guidance of a Faculty, shall choose, preferably, a recent topic of his/her interest relevant to the programme of Specialization.</p> <ul style="list-style-type: none"> (i) Carry out literature survey, systematically organize the content. (ii) Prepare the report with own sentences, avoiding a cut and paste act. (iii) Type the matter to acquaint with the use of Micro-soft equation and drawing tools or any such facilities. (iv) Present the seminar topic orally and/or through PowerPoint slides. (v) Answer the queries and involve in debate/discussion. (vi) Submit a typed report with a list of references. <p>The participants shall take part in the discussion to foster a friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident.</p> <p>Evaluation Procedure:</p> <p>The CIE marks for the seminar shall be awarded (based on the relevance of the topic, presentation skill, participation in the question and answer session, and quality of report) by the committee constituted for the purpose by the Head of the Department. The committee shall consist of three teachers from the department with the senior-most acting as the Chairman.</p> <p>Marks distribution for CIE of the course:</p> <p>Seminar Report:50 marks Presentation skill:25 marks Question and Answer: 25 marks. ■ No SEE component for Technical Seminar</p>		

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Non – credit mandatory courses (NCMC):

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 subsequently to earn the qualifying CIE marks subject to the maximum programme period.
- (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.

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Subject Title	Transform Calculus, Fourier Series and Numerical Techniques		
Subject Code	21MAT31	IA Marks	50
Number of Lecture Hrs / Week	04	Exam Marks	50
Total Number of Lecture Hrs	40	Exam Hours	03
CREDITS – 03			

FACULTY DETAILS:		
Name: Prof. S.I. Shivamoggimath	Designation: Asst. Professor	Experience: 10
No. of times course taught: 01	Specialization: Mathematics	

1.0 Prerequisite Subjects:

Sl. No	Branch	Semester	Subject
01	Computer Science Engineering	II	Advanced Calculus & Numerical Methods

2.0 Course Objectives


Course Learning Objectives:

- To have an insight into Fourier series, Fourier transforms, Laplace transforms, Difference equations and Z-Transforms.
- To develop the proficiency in variation calculus and solving ODE's arising in engineering applications, using numerical methods.

3.0 Course Outcomes

Having successfully completed this course, the student will be able to

Course Code	Course Outcome	RBT L	POs
C201.1	Use Laplace transform and inverse Laplace transform in solving differential/ integral equation arising in network analysis, control systems and other fields of engineering.	L1,L2	1,2,3,12
C201.2	Demonstrate the Fourier series to study the behavior of periodic functions and their applications in system communications, digital signal processing and field theory.	L1, L2	1,2,3,12
C201.3	To use Fourier transforms to analyze problems involving continuous-time signals and to apply Z-Transform techniques to solve difference equations	L1, L2	1,2,3,12
C201.4	To solve mathematical models represented by initial or boundary value problems involving partial differential equations	L1, L2	1,2,3,12
C201.5	Determine the externals of functional using calculus of variations and solve problems arising in dynamics of rigid bodies and vibration analysis.	L1,L2,L3	1,2,3,12
Total Hours of instruction		40	

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4.0 Course Content

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 Transform: Definition and problems, Convolution theorem to find the inverse Laplace transforms (without Proof) and problems. Laplace transforms of derivatives, solution of differential equations.

Self-study: Solution of simultaneous first-order differential equations. **(8 Hours)**

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. **Self-study:** Convergence of series by D'Alembert's Ratio test and, Cauchy's root test. **(8 Hours)**

Module -3: Infinite Fourier Transforms and Z-Transforms

Infinite Fourier transforms definition, Fourier sine and cosine transforms. Inverse Fourier transforms, Inverse Fourier cosine and sine transforms. Problems. Difference equations, z-transform-definition, Standard z-transforms, Damping and shifting rules, Problems. Inverse z-transform and applications to solve difference equations. **Self Study:** Initial value and final value theorems, problems. **(8 Hours)**

Module -4: Numerical Solution of Partial Differential Equations

Classifications of second-order partial differential equations, finite difference approximations to derivatives, Solution of Laplace's equation using standard five-point formula. Solution of heat equation by Schmidt explicit formula and Crank- Nicholson method, Solution of the Wave equation. Problems. **Self Study:** Solution of Poisson equations using standard five-point formula. **(8 Hours)**

Module -5: Numerical Solution of Second-Order ODEs and Calculus of Variations


Second-order differential equations - Runge-Kutta method and Milne's predictor and corrector method. (No derivations of formulae). Calculus of Variations: Functionals, Euler's equation, Problems on extremals of functional. Geodesics on a plane, Variational problems. **Self Study:** Hanging chain problem **(8 Hours)**

5.0 Relevance to future subjects

Sl. No.	Semester	Subject	Topics
01	Common to all	Common to all engineering Subjects	Signal and Analysis, Field Theory, Thermodynamics, Fluid Dynamics etc

6.0 Relevance to Real World

Sl. No	Real World Mapping
01	Numerical methods are used to solve engineering problems. For examples will be drawn from a variety of engineering problems, including heat transfer, vibrations, dynamics, fluid mechanics, etc.
02	Laplace transform are used in various areas of physics, electrical engineering, control engineering,

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	optics, mathematics and signal processing. Laplace Transform is widely used by electronic engineers to solve quickly differential equations occurring in the analysis of electronic circuits
03	Fourier series is that very little information is lost from the signal during the transformation. The Fourier transform maintains information on amplitude, harmonics, and phase and uses all parts of the waveform to translate the signal into the frequency domain.

7.0 Gap Analysis and Mitigation

Sl. No	Delivery Type	Details
01	Tutorial	Topic: Calculus of Variations

8.0 Books Used and Recommended to Students


Text Books
1. B.S. Grewal, Higher Engineering Mathematics, 44 th Edition 2018, Khanna Publishers.
2. E. Kreyszig: Advanced Engineering Mathematics, John Wiley & Sons, 10th Ed., 2016.
3. Srimanta Pal et al Engineering Mathematics, 3rd Edition, 2016, Oxford University Press.
Reference Books
1. V. Ramana: "Higher Engineering Mathematics" McGraw-Hill Education, 11 th Ed.
2. Srimanta Pal & Subodh C. Bhunia: "Engineering Mathematics" Oxford University Press, 3 rd 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. New York, Latest ed.
5. Gupta C.B, Sing S.R and Mukesh Kumar: "Engineering Mathematic for Semester I and II", McGraw 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, 7 th edition, 4 th Reprint 2019.

9.0 Relevant Websites (Reputed Universities and Others) for Notes/Animation/Videos Recommended

Website and Internet Contents References
Web links and Video Lectures:
1. http://nptel.ac.in/courses.php?disciplineID=111
2. http://www.class-central.com/subject/math(MOOCs)
3. http://academicearth.org/
4. VTU Edusat Programme
5. VTU e-Shikshana Program
6. http://www.bookstreet.in .

10.0 Magazines/Journals Used and Recommended to Students

Sl. No	Magazines/Journals	website
1	+ Plus Magazine	https://plus.maths.org/issue44 .
2	Mathematics Magazine	www.mathematicsmagazine.com

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11.0 Examination Note

Assessment Details (both CIE and SEE)

The weight age 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 out of 50). 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:

1. Three Unit Tests each of 20 Marks (duration 01 hour)
2. First test at the end of 5th week of the semester
3. Second test at the end of the 10th week of the semester
4. Third test at the end of the 15th week of the semester.

Two assignments each of 10 Marks

5. First assignment at the end of 4th week of the semester
6. 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)**
7. 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**)

- The question paper will be set for 100 marks and marks scored will be proportionally scaled down to 50 marks
- The question paper will have ten questions. Each question is set for 20 marks.
- 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.

12.0 Course Delivery Plan


Module No.	Lecture No.	Content of Lecturer	% of Portion
1	1	Definition, transforms of elementary functions & Properties	20
	2	Problems	
	3	Periodic function	
	4	Unit step function & Problems	
	5	Inverse Laplace Transforms	

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	6	Convolution theorem	
	7	Solution of linear differential equations using Laplace Transforms	
	8	Problems	
2	9	Introduction to infinite series	20
	10	convergence and divergence	
	11	Introduction, Periodic functions, Dirichlet's conditions	
	12	Fourier series of periodic functions of period 2π & Problems	
	13	Fourier series of periodic functions of arbitrary period $2l$ & Problems	
	14	Fourier series of even & odd functions	
	15	Half range Fourier series & Problems	
16	Practical harmonic analysis		
3	17	Introduction, Infinite Fourier transform	20
	18	Fourier sine transforms & Problems	
	19	Fourier cosine transforms & Problems	
	20	Inverse Fourier transforms & Problems	
	21	z-transform-definition & Standard z-transforms	
	22	Initial value and final value theorems (without proof) and problems	
	23	Inverse z-transform & Problems	
4	24	Applications of z-transforms to solve difference equations	20
	25	Classifications of second-order partial differential equations	
	26	Finite difference approximations to derivatives	
	27	Solution of Laplace's equation using standard five-point formula.	
	28	Problems.	
	29	Solution of heat equation by Schmidt explicit formula	
	30	Solution of heat equation by Crank- Nicholson method	
5	31	Solution of the Wave equation	20
	32	Problems.	
	33	Numerical solution of second order ordinary differential equations	
	34	Runge -Kutta method & Problems.	
	35	Milne's method & Problems.	
	36	Problems.	
	37	Calculus of Variations: Variation of function & Functional, variation problems	
38	Euler's equation		
39	Problems		
	40	Geodesics and problems	

13.0 Assignments

Sl. No.	Title	Outcome expected	Allied study	Week No.	Individual / Group activity	Reference: book/website /Paper
1	Assignment 1: University Questions	Students study the Topics and write the Answers. Get practice to solve university questions.	Module 1 of the syllabus	2	Individual Activity.	Book 1, of the reference list. Website of the Reference list
2	Assignment 2: University Questions	Students study the Topics and write the Answers. Get practice to solve university questions.	Module 2 of the syllabus	4	Individual Activity.	Book 1, 2 of the reference list. Website of the Reference list
3	Assignment 3: University	Students study the Topics and write the Answers. Get	Module 3 of the	6	Individual Activity.	Book 1, 2 of the reference list.

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	Questions	practice to solve university questions.	syllabus			Website of the Reference list
4	Assignment 4: University Questions	Students study the Topics and write the Answers. Get practice to solve university questions.	Module 4 of the syllabus	8	Individual Activity.	Book 1, 2 of the reference list. Website of the Reference list
5	Assignment 5: University Questions	Students study the Topics and write the Answers. Get practice to solve university questions.	Module 5 of the syllabus	10	Individual Activity.	Book 1, 2 of the reference list. Website of the Reference list

14.0 QUESTION BANK

Module-1: Laplace Transform

- Find the Laplace Transform of $\sin 2t \sin 3t$ & $\sin^3 2t$.
- Find $L(e^{3t} \sin 2t)$ & $L(e^{4t} \sin 2t \cos t)$.
- Find $L\left(\frac{1-e^{-t}}{t}\right)$ & $L\left[\frac{\cos at - \cos bt}{t}\right]$
- Using unit step function find LT of $f(t) = \begin{cases} \sin t, & 0 < t < \pi \\ \sin 2t, & \pi < t < 2\pi \\ \sin 3t, & t > 2\pi \end{cases}$
- Express $f(t) = \begin{cases} \cos t, & 0 < t < \pi \\ \cos 2t, & \pi < t < 2\pi \\ \cos 3t, & t > 2\pi \end{cases}$ in terms unit step function & hence find LT
- Evaluate $L[t^2 u(t-3)]$.
- Find the inverse transform $\frac{s+2}{s^2-4s+13}$.
- Find $L^{-1}\left(\frac{4s+5}{(s-1)^2(s+2)}\right)$
- Find $L^{-1}\left(\frac{s}{s^4+4a^4}\right)$.
- Find $L^{-1}\left(\frac{s}{(s^2+a^2)^2}\right)$.
- Find $L^{-1}\left[\log\left(\frac{s+1}{s-1}\right)\right]$
- Find $L^{-1}\left[\frac{s}{(2s-1)(3s-1)}\right]$
- Using the Convolution THM obtain the $L^{-1}\left[\frac{s}{(s^2+a^2)^2}\right]$.
- Solve the differential equation $\frac{d^2y}{dx^2} - 3\frac{dy}{dx} + 2y = e^{3t}$ with $y(0) = 0 = y'(0)$, using LT
- Solve the differential equation $y'' + 4y' + 3y = e^{-t}$, $y(0) = 1 = y'(0)$. Using LT

Module-2: Fourier series

- Obtain a Fourier series to represent e^{-ax} from $(-\pi, x)$
- Expand $f(x) = x \sin x$, $0 < x < 2$, in a Fourier series.
- For a function $f(x)$ defined by $f(x) = |x|$, $-\pi < x < \pi$, obtain a Fourier series. Deduce that

$$\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \frac{1}{7^2} = \frac{\pi^2}{8}$$

- Find the Fourier series for the function $f(x) = \frac{\pi-x}{2}$ in $(0, 2\pi)$.

Hence deduce that $\frac{\pi}{4} = 1 - \frac{1}{3} + \frac{1}{5} - \dots$



5. Find the Fourier series to represent $f(x) = x + x^2$ from $x = -\pi$ to $x = \pi$ and deduce that

$$\frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \frac{1}{4^2} = \frac{\pi^2}{12}$$

6. Expand $f(x) = e^{-x}$ as a Fourier series in the interval $(-l, l)$

7. Obtain Fourier series for the function

$$f(x) = \begin{cases} \pi x, & 0 \leq x \leq 1 \\ \pi(2-x), & 1 \leq x \leq 2 \end{cases} \quad \text{and deduce that } \frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \frac{1}{7^2} + \dots$$

8. Develop $f(x)$ in Fourier series in the interval $(-2, 2)$ if $f(x) = \begin{cases} 0, & -2 < x < 0 \\ 1, & 0 < x < 2 \end{cases}$

9. Find the half range cosine series for the function $f(x) = x^2$ in the range $0 \leq x \leq 1$

10. Find the complex form of the Fourier series of the periodic function $f(x) = \cos ax$, in $-\pi < x < \pi$.

11. The following table gives the variation of periodic current over a period

t sec	0	T/6	T/3	T/2	2T/3	5T/6	T
A amp	1.98	1.30	1.05	1.30	-0.88	-0.25	1.98

Show that there is a direct current part of 0.75 amp in the variable current and obtain the amplitude of the first harmonic.

12. Obtain the Fourier expansion of $f(x) = 2x - x^2$ in $0 \leq x \leq 2$

13. Obtain the constant term and the coefficient of the first sine and cosine terms in the Fourier expansion of y as given below.

x	0	1	2	3	4	5
y	9	18	24	28	26	20

Module-3: Infinite Fourier Transforms and Z-Transforms

1. Find the Fourier transform of

$$f(x) = \begin{cases} 1, & |x| < 1 \\ 0, & |x| > 1 \end{cases} \quad \text{Hence evaluate } \int_0^{\infty} \frac{\sin x}{x} dx$$

2. Find the Fourier transform of the function

$$f(x) = \begin{cases} x, & |x| \leq \alpha \\ 0, & |x| > \alpha \end{cases} \quad \text{Where } \alpha \text{ is a positive constant?}$$

3. Find the Fourier transform of $\cos ax^2$

4. Find the Fourier sine transform of $e^{-ax/x}$

5. Find the Fourier sine and cosine transform of $f(x) = \begin{cases} 1, & 0 \leq x < a \\ 0, & x \geq a \end{cases}$

6. Find the finite Fourier sine and cosine transform of $f(x) = 2x, 0 < x < 4$.

7. Find the cosine transform of $f(x) = \frac{1}{1+x^2}$


8. Find the Fourier sine transform of $e^{-|x|}$

9. Find the Fourier transform of $f(x) = \begin{cases} a^2 - x^2, & |x| < a \\ 0, & |x| > a \end{cases}$ and Evaluate $\int_0^{\infty} \frac{\sin x - x \cos x}{x^3} dx$.

10. Find the Fourier sine transform of $f(x) = \frac{e^{-ax}}{x}, a > 0$.

11. Find the Fourier cosine transform of $f(x) = \begin{cases} x, & 0 < x < 1 \\ 2-x, & 1 < x < 2 \\ 0, & x > 2 \end{cases}$.

12. Find the Fourier transform of $f(x) = e^{-|x|}$ and Evaluate $\int_0^{\infty} \frac{x \sin mx}{1+x^2} dx$.

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13. Find the Fourier transform of $f(x) = e^{-|x|}$ and Evaluate $\int_0^{\infty} \frac{x \sin mx}{1+x^2} dx$.
14. P.T. $z_T(n^2) = \frac{z^2+z}{(z-1)^3}$
15. P.T. $z_T(n^3) = \frac{z^3+4z^2+2}{(z-1)^4}$
16. P.T. $z_T(\cos\theta) = \frac{z(z-\cos\theta)}{z^2-2z\cos\theta+1}$
17. P.T. $z_T(\sin\theta) = \frac{(z\sin\theta)}{z^2-2z\cos\theta+1}$
18. P.T. $z_T(a^n \cos n\theta) = \frac{z(z-a\cos\theta)}{z^2-2az\cos\theta+a^2}$
19. Find the Z-transform of $\cos hn\theta$ & $\sin hn\theta$.
20. Find the Z-transform of $(n+1)^2$
21. Using the inversion integral method find the inverse Z-transform of $\frac{3z}{(z-1)(z-2)}$
22. Solve $y_{n+2} + 6y_{n+1} + 9y_n = 2^n$ with $y_0 = y_1 = 0$ using Z-transform
23. Solve the difference equation $y_{n+2} + 2y_{n+1} + y_n = n$ with $y_0 = y_1 = 0$ using Z-Transform.
24. Obtain the z-transform of $\cos n\theta$ and $\sin n\theta$
25. Find the Inverse z-transform of $\frac{2z^2+3z}{(z+2)(z-4)}$.
26. If $\bar{u}(z) = \frac{2z^2+3z+12}{(z-1)^4}$, find the value of u_0, u_1, u_2, u_3 .
27. Solve the difference equation $u_{n+2} + 6u_{n+1} + 9u_n = 2^n, u_0 = u_1 = 0$.

Module -4: Numerical Solution of Partial Differential Equations

1. Solve $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$ in $0 < x < 5, t \geq 0$ given that $u(x, 0) = 20, u(0, t) = 0, u(5, t) = 100$. Compute u for the time step with $h = 1$ by Crank Nicholson method.
2. Find the solution of the parabolic equation $u_{xx} = 2u_t$ when $u(0, t) = 0 = u(4, t) = 0$ and $u(x, 0) = x(4-x)$, taking $h = 1$. Find the values up to $t = 5$.
3. Solve the equation $\frac{\partial^2 u}{\partial x^2} = \frac{\partial u}{\partial t}$ with the conditions $u(0, t) = 0, u(x, 0) = x(1-x)$ and $u(1, t) = 0$. Assume $h = 0.1$. Tabulate u for $t = k, 2k$ and $3k$ choosing an appropriate value of k .
4. Solve the boundary value problem $u_{tt} = u_{xx}$ with the conditions $u(0, t) = u(1, t) = 0, u(x, 0) = \frac{1}{2}x(1-x)$ and $u_t(x, 0) = 0$, taking $h = k = 0.1$ for $0 \leq t \leq 0.4$. Compare your solution with the exact solution at $x = 0.5$ and $t = 0.3$.
5. Solve $y_{tt} = y_{xx}$ upto $t = 0.5$ with a spacing of 0.1 subject to $y(0, t) = 0, y(1, t) = 0, y_t(x, 0) = 0$ and $y(x, 0) = 10 + x(1-x)$. Solve the equation $u_{xx} + u_{yy} = 0$ for the following square mesh with boundary values as shown in Fig. Iterate until the maximum difference between the successive values at any point is less than 0.001.

Module -5: Numerical Methods and Calculus of Variation





1. Use R- K method to solve $y' = xy^2 - y^2$ for $x = 0.2$ correct to 4 decimal places. $y(0) = 1$ & $y'(0) = 0$


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2. Evaluate $y(0.2)$ by RK method given that $y'' - x(y')^2 + y^2 = 0, y(0) = 1, y'(0) = 0$
3. Given $y'' - xy' - y = 0$ with the initial conditions $y(0)=1, y'(0)=0$. Compute $y(0.2)$ and $y'(0.2)$ by taking $h=0.2$ and using fourth order Runge Kutta method.
4. Obtain the solution of the equation $2 \frac{d^2y}{dx^2} = 4x + \frac{dy}{dx}$ at the point $x = 1.4$ by applying Milne's method given that $y(1) = 2, y(1.1) = 2.2156, y(1.2) = 2.4649, y(1.3) = 2.7514, y'(1) = 2, y'(1.1) = 2.3178, y'(1.2) = 2.6725$ and $y'(1.3) = 3.0657$.
5. Using R-K method of order four, solve $y'' = y + xy', y(0) = 1, y'(0)$ to find $y(0.2)$ & $y'(0.2)$.
6. Show that the Geodesics on a plane are straight line.
7. Find the Geodesics on a right circular cylinder of radius a.
8. Find the extremals of the functional $\int_{x_0}^{x_1} \frac{(y')^2}{x^3} dx$
9. Show that the shortest distance between any two points in a plane is a straight line.
10. Prove that Catenaries' is the curve which when rotated about a line generates a surface of minimum area.
11. Find the extremely of the functional $\int_0^\pi (y'^2 - y^2 + 4y \cos x) dx; y(0) = 0 = y(\pi)$
12. Solve the variation problem $\delta \int_1^2 (x^2(y')^2 + 2y(x+y)) dx = 0$, given $y(1) = y(2) = 0$
13. Find the path on which a particle in the absence of friction will slide from one point to another in a shortest time under the action of gravity.
14. Find the curve passing through the point (x_1, y_1) and (x_2, y_2) which when rotated about the x axis gives the minimum surface area.
15. Find the curve on which the functional $\int_0^1 (y'^2 + 12xy) dx$ with $y(0) = 0$ and $y(1) = 1$ can be extremised.

16.0 University Result

Examination	FCD (S+, S, A)	FC (B)	SC (C, D, E)	% Passing
NIL	NIL	NIL	NIL	NIL

Prepared by	Checked by		
			
Prof. S. A. Patil	Dr. S. L. Patil	HOD	Principal

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Subject Title		DATA STRUCTURES & APPLICATIONS	
Subject Code	21CS32	CIE Marks	50
		SEE Marks	50
Number of Lecture Hrs / Week	3:0:2:0	Total Marks	100
Total Number of Lecture Hrs	40T+20P	Exam Hours	03
Credits: 4			

FACULTY DETAILS:		
Name: Prof. S. I. Mane	Designation: Assistant Professor	Experience: 08 yrs
No. of times course taught: 01 (including present)	Specialization: Computer Network Engineering	

1.0 Prerequisite Subjects:

Sl. No	Branch	Semester	Subject
01	Computer Science and Engg.	I / II	Programming for problem solving
02	Computer Science and Engg.	I / II	Mathematics: Set, Relation, Matrices etc.

2.0 Course Objectives

1. Explain fundamentals of data structures and their applications essential for implementing solutions to problems.
2. Illustrate linear representation of data structures: Stack, Queues, Lists, Trees and Graphs.
3. Design and Develop solutions to problems using Arrays, Structures, Stack, Queues, Linked Lists.
4. Explore usage of Trees and Graph for Application development.
5. Apply the hashing techniques in mapping key value pairs.

3.0 Course Outcomes

At the end of the course the students should be able to:


COs	Course Outcome	Cognitive Level	POs/PSO
C202.1	Identify different data structures and their applications.	L3	PO1, PO2, PO3, PO8, PO10, PO12, PSO1, PSO2
C202.2	Apply stack and queues in solving problems.	L3	PO1, PO2, PO3, PO8, PO10, PO12, PSO1, PSO2
C202.3	Demonstrate application of linked list.	L2	PO1, PO2, PO3, PO8, PO10, PO12, PSO1, PSO2
C202.4	Explore the applications of trees and graphs to model and solve the real world problem.	L3	PO1, PO2, PO3, PO8, PO10, PO12, PSO1, PSO2
C202.5	Make use of Hashing techniques and resolve collisions during mapping of key value pairs.	L3	PO1, PO2, PO3, PO8, PO10, PO12, PSO1, PSO2
Total Hours of instruction			40

4.0 Course Content

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. Demonstration of representation of Polynomials and Sparse Matrices with arrays.

8 Hours

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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

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, Dequeues, Priority Queues.

Textbook 1: Chapter 3: 3.1 -3.4, 3.6 Textbook 2: Chapter 6: 6.1 -6.4, 6.5, 6.7-6.13 8 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, and header linked lists. Linked Stacks and Queues. Applications of Linked lists – Polynomials, Sparse matrix representation. Programming Examples. **8 Hours**

Textbook 1: Chapter 4: 4.1 – 4.4, 4.5.2, 4.7, 4.8, Textbook 2: Chapter 5: 5.1 – 5.9

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. **8 Hours**

Textbook 1: Chapter 5: 5.1 –5.5, 5.7; Textbook 2: Chapter 7: 7.1 – 7.9

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. **8 Hours**

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, 15.4,15.5 and 15.7

5.0 Relevance to future subjects


S. No.	Semester	Subject	Topics
01	IV	Design and Analysis of Algorithms	-
02	V/VI	DBMS, SSCD, CN	-

6.0 Relevance to Real World

Sl.No	Real World Mapping
01	Implementation of solution to the problems using appropriate Data structures and algorithms.

7.0 Gap Analysis and Mitigation

Sl. No	Delivery Type	Details
01	Tutorial	Topic: Introduction, Stack and Queues, Linked List
02	NPTEL	Topic: Tress and Graphs

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8.0 Books Used and Recommended to Students

Text Books
<ol style="list-style-type: none"> 1. Ellis Horowitz and Sartaj Sahni, Fundamentals of Data Structures in C, 2nd Ed, Universities Press, 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
<ol style="list-style-type: none"> 1. Gilberg and Forouzan, Data Structures: A Pseudo-code approach with C, 2nd Ed, Cengage Learning, 2014. 2. Jean-Paul Tremblay & Paul G. Sorenson, An Introduction to Data Structures with Applications, 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

9.0 Relevant Websites (Reputed Universities and Others) for Notes/ Animation/ Videos Recommended

Website and Internet Contents References
<ol style="list-style-type: none"> 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 4. https://www.youtube.com/watch?v=3Xo6P_V-qns&t=201s 5. https://nptel.ac.in/courses/106/102/106102064/ 6. https://ds1-iiith.vlabs.ac.in/exp/stacks-queues/index.htm 7. https://nptel.ac.in/courses/106/102/106102064/ 8. https://ds1-iiith.vlabs.ac.in/exp/linked-list/basics/overview.html 9. https://ds1-iiith.vlabs.ac.in/List%20of%20experiments.html 10. https://ds1-iiith.vlabs.ac.in/exp/linked-list/basics/overview.html 11. https://ds1-iiith.vlabs.ac.in/List%20of%20experiments.htm 12. https://ds1-iiith.vlabs.ac.in/exp/tree-traversal/depth-first_traversal/dft-practice.ht

10.0 Magazines/Journals Used and Recommended to Students

Sl.No	Magazines/Journals	Website
1	ACM journals	www.dl.acm.org/pubs.cfm
2	IBM journal of Research & Development	https://link.springer.com/journal/453
3	Research papers/Data structures	https://wiki.haskell.org/Research_papers/Data_structures

11.0 Examination Note


Continuous Internal Evaluation: 50 Marks

A) 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

B) Two assignments each of 10 Marks

4. First assignment at the end of 4th week of the semester

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

C) Practical Sessions need to be assessed by appropriate rubrics and viva-voce method. This will contribute to **20 marks.**

1. Rubrics for each Experiment taken average for all Lab components – 15 Marks.
2. Viva-Voce– 5 Marks (more emphasized on demonstration topics)

The sum of three tests, two assignments, and practical sessions will be out of 100 marks and will be scaled down to 50 marks .

Semester End Examination: 50 Marks

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. Marks scored shall be proportionally reduced to 50 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

Question Paper Pattern (IA):


1. Two main questions to be set from syllabus covered up to IA tests.
2. Student has to answer two full main questions and each question carries 10.
 - a. Q.No I or Q.No II =10 Marks
 - b. Q.No III or Q.No IV =10Marks
 - c. **Total =20 Marks**

SPECIAL INSTRUCTIONS


1. The total exam duration is 3 hours.
2. Use black ink ball point pen for writing examination.
3. Drawing should be drawn using dark pencil.
4. Read the questions carefully.
5. Answer the questions up to the point.

12.0 Course Delivery Plan


Module	Lecture No./Practical Session	Content of Lecture	% of Portion
Module-1	L1	Introduction: Data Structures, Classification of Data Structures: Primitive and Non-Primitive.	20
	L2	Data structure operations (Traversing, inserting, deleting, searching, and sorting).	
	L3	Review of Arrays ,Structures, Self-Referential Structures	
	L4	Dynamic Memory Allocation Functions.	
	L5	Representation of Linear Arrays in Memory	
	L6	Dynamically allocated arrays and Multidimensional Arrays.	
	L7	Demonstration of representation of Polynomials with arrays	
	L8	Sparse Matrices with arrays.	

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	P1	Design, Develop and Implement a menu driven Program in C for the following Array Operations a. Creating an Array of N Integer Elements b. Display of Array Elements with Suitable Headings c. Exit. Support the program with functions for each of the above operations.	20
	P2	Design, Develop and Implement a menu driven Program in C for the following Array operations 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 d. Exit. Support the program with functions for each of the above operation	
Module-2	L1	Stacks: Definition, Stack Operations, Array Representation of Stacks.	20
	L2	Stacks using Dynamic Arrays. Different representation of expression.	
	L3	Stack Applications: Infix to postfix conversion, Infix to prefix conversion	
	L4	evaluation of postfix expression, recursion.	
	L5	Queues: Definition, Array Representation of queues, Queue Operations.	
	L6	Circular Queues	
	L7	Queues and Circular queues using Dynamic arrays.	
	L8	Dequeues, Priority Queues.	
	P1	Design, Develop and Implement a menu driven Program in C for the following operations on STACK of Integers (Array Implementation of Stack with maximum size MAX) 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	20
	P2	Design, Develop and Implement a Program in C for the following Stack Applications a. Evaluation of Suffix expression with single digit operands and operators: +, -, *, /, %, ^ b. Solving Tower of Hanoi problem with n disks	
Module-3	L1	Linked Lists: Definition, classification of linked lists. Representation of different types of linked lists in Memory	20
	L2	Traversing, Insertion, Deletion on Singly linked lists	
	L3	Searching, Sorting, and Concatenation Operations on Singly linked lists	
	L4	Doubly Linked lists	
	L5	Circular linked lists, and header linked lists	
	L6	Linked Stacks and Queues.	
	L7	Applications of Linked lists – Polynomials,	
	L8	Sparse matrix representation, Programming Examples.	

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	P1	Singly Linked List (SLL) of Integer Data a. Create a SLL stack of N integer. b. Display of SLL c. Linear search. Create a SLL queue of N Students Data Concatenation of two SLL of integers.	
	P2	Design, Develop and Implement a menu driven Program in C for the following operation 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 Display the status of DLL and count the number of nodes in it.	20
Module-4	L1	Trees: Terminology, Binary Trees	20
	L2	Properties of Binary trees	
	L3	Array and linked Representation of Binary Trees	
	L4	Binary Tree Traversals - Inorder, Postorder, Preorder;	
	L5	Threaded binary trees	
	L6	Binary Search Trees – Definition, Insertion, Deletion,	
	L7	Traversal, Searching.	
	L8	Application of Trees: Evaluation of Expression.	
	P1	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 tree <pre> 1 /\ 2 3 /\ \ 4 5 6 </pre>	20
	P2	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 Inorder, Preorder and Post Order	
Module-5	L1	Trees 2: AVL tree, Red-black tree	20
	L2	Splay tree, B-tree	
	L3	Graphs: Definitions, Terminologies	
	L4	Matrix and Adjacency List Representation of Graphs	
	L5	Traversal methods: Breadth First Search and	
	L6	Depth First Search.	
	L7	Hashing: The Hash Table organizations, Hashing Functions.	
	L8	Static and Dynamic Hashing.	
	P1	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.	20
	P2	Design and develop a program in C that uses Hash Function $H:K \rightarrow L$ as $H(K) = K \text{ mod } m$ (remainder method) and implement hashing technique to map a given key K to the address space L. Resolve the collision (if any) using linear probing.	

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13.0 QUESTION BANK

Module -1


1. What is data structure? What are the various types of data structure? Explain. (Jan-2020)
2. How does a structure differ from a union? Mention any 2 uses of structure..
3. Define an array, array pointer and array of pointer. Explain declaration and initialization of 1D array and 2D array.
4. What is structure and self-referential structure? Explain with a simple example to each.
5. What is union? Explain the differences between structure and union with an example.
6. Define Data structures. Give its classification. What are the basic operations that can be performed on data structure?
7. What is structure and self-referential structure? Explain with a simple example to each.
8. Write the Knuth Morris Pratt pattern matching Algorithm/Function in C and apply the same to search the pattern : “abcdabcy” in the text “abcxabcdabxabcabcdabcy”. (Jan-2020/2022)
9. Consider the given two polynomials, $A(x) = 8x^{24} + 5x^2 + x+1$ & $B(x) = 4x^{14} + 10x^2+ 1$ Represent the polynomials using array of structures.
10. Explain with an Examples :i) malloc() ii) calloc() iii) realloc() iv) free(). (Jan-2020)
11. What is the difference between Static memory allocation and dynamic memory allocation? Explain.
12. How Union is different from structure? Illustrate with example.
13. Write a C function to implement string insertion operation. Illustrate the process with suitable example.
14. Consider the given two polynomials, $A(x) = 3x^{11} + 5x^2 + 8$ and $B(x) = x^4 + 10x^2 + 1$ Represent the polynomials using array of structures.
15. Give the ADT for Sparse matrix. Express the following Sparse matrix in the triplet form and find its transpose.

$$A = \begin{pmatrix} 10 & 0 & 0 & 25 & 0 \\ 0 & 23 & 0 & 0 & 45 \\ 0 & 0 & 0 & 0 & 32 \\ 42 & 0 & 0 & 31 & 0 \\ 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 30 & 0 & 0 \end{pmatrix}$$

16. Consider the given two polynomials, $A(x) = 4x^{15} + 3x^4 + 5$ and $B(x) = x^4 + 10x^2 + 1$ Represent the polynomials using array of structures.
17. Define an array, array pointer and array of pointer. Explain declaration and initialization of 1D array and 2D array.
18. What is structure? How it is different from array? Explain different types of structure declaration with examples and give difference between Structure and Union. (Jan-2020)
19. Define pointers. How to declare and initialize pointers, explain with example. (Jan-2020)
20. Write a C program to: (Jan-2020)
 - (i). Compare strings
 - (ii). Concatenate two strings
21. List and explain the functions supported in C for dynamic memory allocation. (Jan-2022)

Module-2

1. How do you define a data structure? How is stack represented? Give a C program to construct a stack of integers and perform all the necessary operations on it. (Jan-2022)
2. Write the algorithm to implement a stack using dynamic array whose initial capacity is 1 and array doubling is used to increase the stack’s capacity whenever an element is added to a full stack. Implement the

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- operation-Push, pop and display. *(DEC-2016)*
3. Write an algorithm to convert a valid infix expression to a postfix expression. Also evaluate the following suffix expression for the values: A=1 B=2 C=3. AB+C-BA+C\$-
 4. What is the advantage of circular queue over ordinary queue? Mention any 2 applications of queues. Write an algorithm CQINSERT for static implementation of circular queue.
 5. Explain the working of a simple queue, dequeue and priority Queue.
 6. Define stack. Implement push and pop functions for stack using arrays.
 7. Implement addq and deleteq functions for the circular queue.
 8. Write the postfix form of the following expression: $(a+b)*d+e/(f+a*d)+c$
 9. Write the prefix form of the following expression: $(a+b)*d+e/(f+a*d)+c$
 10. Write the postfix form of the following expression: $((a/(b-c+d))*(e-a)*c)$
 11. Write the prefix form of the following expression: $((a/(b-c+d))*(e-a)*c)$
 12. What is recursion? Write a C function to find factorial and GCD.
 13. Define Stack. Give the implementation of push, pop and display functions. Include check for Empty and full conditions. *(Jan-2020)*
 14. Write the postfix form of the following expressions using stack: *(Jan-2020)*
 - (i) $A \$ B * C - D + E | F | (G+H)$
 - (ii) $A - B | (C * D \$ E)$
 15. Write an algorithm to evaluate a postfix expression and apply the same for the given postfix expression. ABC - D * + E \$ F + and assume A=6, B=3, C=2, D=5 E=1 and F=7. *(Jan-2020)*
 16. Define Recursion. Write recursive functions for following: *(Jan-2020/22)*
 - (i) Factorial of a number
 - (ii) Tower of Hanoi
 17. What is the advantage of circular queue over ordinary queue? Write a C program to simulate the working of Circular queue of integers using array. Provide the following operations: *(Jan-2020)*
 - (i) Insert
 - (ii) Delete
 - (iii) Display
 18. Write a note on Dequeue and priority queue. *(Jan-2020)*
 19. Write an algorithm to convert infix expression into postfix and also trace the same for expression $(a+b)*d+e/f+c$. *(Jan-2022)*
 20. Write an Ackermann function and apply the same to evaluate A(1,2) *(Jan-2022)*
 21. Explain various operations on circular queue using array. *(Jan-2022)*

Module-3

1. List out any two applications of linked list and any two advantages of doubly linked list over singly linked list.
2. Write a C program to simulate an ordinary queue using a singly linked list..
3. Write a C program to simulate Stack using a singly linked list.
4. Give an algorithm to insert a node at a specified position for a given singly linked list.
5. Write a C function to add two polynomials in C and explain its memory mapping.
6. What is sparse matrix? Explain sparse matrix representation in C with an example.
7. What is polynomial? What is the degree of the polynomial? Write a function to add two polynomials?
8. Write a c Program to merge two linked list.
9. Write a C program to remove duplicates in the linked list.
10. With neat Diagram, explain the circular linked list.



11. Write a c program to perform the following operations on doubly linked list: i) insert a node ii) delete a node.
12. For the given sparse matrix write the diagrammatic linked list representation.
13. What is Linked list? Explain the different types of Linked list with neat diagram. (Jan-2020)
14. Write a C function to Insert a node at front and delete a node from rear end in a circular linked list. (Jan-2020)
15. Write a C function for the concatenation of two doubly linked lists. (Jan-2020)
16. Describe the doubly linked lists with advantages and disadvantages. Write a C function to delete a node from a circular doubly linked list with header node. (Jan-2020)
17. For the given sparse matrix, give diagrammatic linked representation: (Jan-2020)

$$a = \begin{pmatrix} 0 & 1 & 2 \\ 3 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}$$

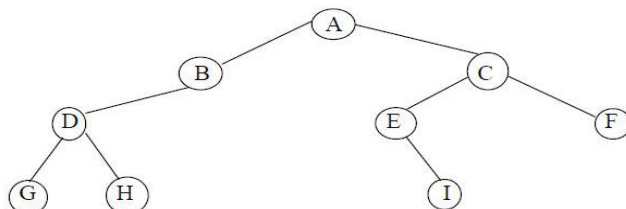
18. Write a C function to add two polynomials represented as circular queue with header node. (Jan-2020)
19. Give the node structure of create a single linked list of inters and write the functions to perform the following operations: i) Create a list containing three nodes with data 10,20,30 using front insertion. ii) Insert node with data 40 at end of list iii) Delete a node whose data is 30. iv) Display list contents. (Jan-2022)
20. Write function for i) Findings the length of list ii) Concatenate two lists ii)Reverse a list. (Jan-2022)
21. For the given sparse matrix, give diagrammatic linked representation (Jan-2022)

$$A = \begin{pmatrix} 3 & 0 & 0 & 0 \\ 5 & 0 & 0 & 6 \\ 0 & 0 & 0 & 0 \\ 4 & 0 & 0 & 8 \\ 0 & 0 & 9 & 0 \end{pmatrix}$$


22. List out differences between single linked list and double linked list .Write the functions i)Insert a node at rear end ii) Delete a node at rear end iii) search a node with given value. (Jan-2022)

Module-4

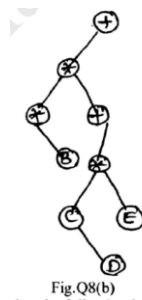
1. Define the following: i) Binary tree ii) Complete binary tree iii) Almost complete binary tree
iv) Binary search tree v) Depth of a tree
2. Given the following graph, write the inorder, preorder and postorder traversals.



3. In brief describe any 4 applications of trees.
4. Construct a binary tree from the traversal order given below:
PREORDER = A B D E F C G H L J K
INORDER = D B F E A G C L J H K
5. Construct a expression tree for: $((6 + (3 - 2) * 5) ^ 2 + 3)$ and traverse it in all 3 orders and also write their respective functions.

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6. What is threaded binary tree? Explain right in and left in threaded binary trees.
7. What is tree? Explain.
 - i) Root node ii) degree iii) Siblings iv) Depth of the a tree and give examples. v) forest.
8. What is a binary tree? State its properties? How it is represented using array and linked list give example.
9. Describe the binary search tree, with example. Write a recursive function to search for a key value in a binary Search tree.
10. Construct the b-tree from the given traversals:
 Preorder – ABDCEF In order - BDAEFC Post order – DBFECA
11. Write a C program to evaluate an expression tree.
12. Briefly discuss an array and linked list representation of tree.
13. Write an algorithm for BFS and DFS graph traversal methods. (July-2019)
14. What is a Tree? With suitable, define: (Jan-2020)
 - (i) Binary tree
 - (ii) Level of the Binary tree
 - (iii) Complete binary tree
 - (iv) Degree of the tree
15. Write the C routines to traverse the tree using: (Jan-2020) (Jan-2022)
 - (i) Pre-order traversal
 - (ii) Post-order traversal
16. For the given data, draw a binary search tree and show the array and linked list representation of the same: 100, 85, 45, 55, 110, 20, 70, 65. (Jan- 2020)
17. What is the advantage of Threaded binary tree over binary tree? Explain the construction of threaded binary tree for 10, 20, 30, 40 and 50. (Jan-2020)
18. Define expression tree. For a tree given in Fig.Q8(b) traverse the tree using in-order, pre-order and post-order traversals. (Jan-2020)

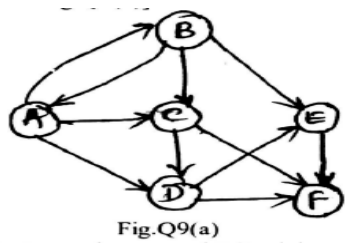


19. Construct a Binary search tree by using the following in-order and pre-order traversals: (Jan-2020)
 Inorder: BCAEDGHFI
 Preorder: ABCDEFGHI
20. Write the recursive search algorithm for a binary search tree. (Jan-2022)
21. Define the following: i) Binary tree ii) Complete binary tree iii) Strict binary tree
 iv) Skewed Binary tree (Jan-2022)
22. Write routines for: i) Copying of binary trees ii) Testing equality of binary trees. (Jan-2022)

Module-5

1. Define and explain the following terminologies with suitable graph example (July-2019)
 - i) graph ii) an edge iii) weighted edge iv) vertex v) degree of a vertex
2. Define and explain the following terminologies with suitable graph example





- i) in-degree of a vertex ii) out-degree of a vertex iii) directed graph iv) an un-directed graph
 v) complete graph vi) incomplete graph vii) sub graph viii) simple path ix) cycle
- What are restrictions on graphs?
 - Explain a graph with two connected component and strongly connected component. Explain in detail the graph representations with an example
 - Adjacency matrix
 - Adjacency lists
 - Adjacency multiclass
 - Explain BFS and DFS algorithms with suitable examples. (Jan-2022)
 - Explain the working of Radix sort method with example.
 - What is hashing? Explain hash functions. (Jan-2022)
 - What do you mean by static hashing and dynamic hashing? Explain
 - Explain different Collision-resolution Techniques.
 - Explain in brief, different ways of File Organizations - Sequential, Indexed Sequential, Random Access.
 - Apply Insertion sort technique for the following elements: 77, 33, 44, 11, 88, 22, 66, 55. (July-2019)
 - Explain Hashing and collision. What are the methods used to resolve collision. (July-2019)
 - What are the basic operations that can be performed on a file? List the methods used for file organization (any 2). (July-2019)
 - Define graph. For the given graph, show the adjacency matrix and adjacency list representation of the graph [Ref. Fig.Q9(a)] (Jan-2020) (Jan-2022)




- What are the methods used for traversing a graph? Explain any one with example and write C function for the same. (Jan-2020)
- Write a C function for Insertion sort. Sort the following list with insertion sort: 50, 30, 10, 70, 40, 30, 60. (Jan-2020)
- What is collision? What are the methods to resolve collision? Explain linear probing with an example. (Jan-2020)
- Explain in detail about static and dynamic hashing. (Jan-2020) (Jan-2022)
- Briefly explain the basic operations that can be performed on a file. Explain indexed sequential file organization. (Jan-2020) (Jan-2022)

14.0 University Result

Examination	FCD	FC	SC	% Passing
NIL	NIL	NIL	NIL	NIL

Prepared by	Checked by		
 Prof. S.I. Mane	 Dr. Mahesh G. Huddar	 HOD	 Principal

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SUBJECT TITLE		ANALOG AND DIGITAL ELECTRONICS	
Subject Code	21CS33	IA Marks	50
Number of Lecture Hrs / Week	3:0:2:0	Exam Marks	50
Total Number of Lecture Hrs	40 T + 20 P	Total Marks	100
CREDITS – 04		Exam Hours	03

FACULTY DETAILS:		
Name: Prof .N.K.Honnagoudar	Designation: Asst. Professor	Experience: 20
No. of times course taught:07		Specialization: Electronics

1.0 Prerequisite Subjects:

Sl. No	Branch	Semester	Subject
01	Computer Science Engineering	III	Analog and Digital Electronics

2.0 Course Objectives

This course will enable students to

1. Explain the use of photo electronics devices, 555 timer IC, Regulator ICs and uA741 Opamp IC
2. Make use of simplifying techniques in the design of combinational circuits.
3. Illustrate combinational and sequential digital circuits.
4. Demonstrate the use of flip-flops and apply for registers.
5. Design and test counters, Analog-to-Digital and Digital-to-Analog conversion techniques.

3.0 Course Outcomes

Having successfully completed this course, the student will be able to draw and use modeling software's to generate


CO	Course Outcome	Cognitive Level	POs
C203.1	Design and analyze application of analog circuits using photo devices, timer IC, power supply regulator IC and OPAMP.	L1, L2,L3	1,2,3,4,6,8,12
C203.2	Explain the basic principles of A/D and D/A conversion circuits and develop the same.	L1, L2,L3	1,2,3,4,6,8,12
C203.3	Simplify digital circuits using Karnaugh Map , and Quine-McClusky Methods	L1, L2,L3	1,2,3,4,6,8,12
C203.4	Explain Gates and flip flops and make us in designing different data processing circuits, registers	L1, L2,L3	1,2,3,4,6,8,12
C203.5	Develop simple HDL programs.	L1, L2,L3	1,2,3,4,6,8,12
Total Hours of instruction			40

4.0 Course Content

MODULE-I

8 Hours

BJT Biasing: Fixed bias, Collector to base Bias, voltage divider bias Operational Amplifier Application Circuits: Peak Detector, Schmitt trigger, Active Filters, Non-Linear Amplifier, Relaxation Oscillator, Current-to-Voltage and Voltage-to-Current Converter, Regulated Power Supply Parameters, adjustable voltage regulator, D to A and A to D converter. **Textbook 1: Part A: Chapter 4 (Sections 4.2, 4.3, 4.4), Chapter 7 (Sections 7.4, 7.6 to 7.11), Chapter 8 (Sections 8.1 and 8.5), Chapter 9. RBT L1,L2,L3**

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MODULE-II

8 Hours

Karnaugh maps: minimum forms of switching functions, two and three variable Karnaugh maps, four variable karnaugh maps, determination of minimum expressions using essential prime implicants, Quine-McClusky Method: determination of prime implicants, The prime implicant chart, petricks method, simplification of incompletely specified functions, simplification using map-entered variables **Text book 1:Part B: Chapter 5 (Sections 5.1 to 5.4) Chapter 6(Sections 6.1 to 6.5) RBT: L1, L2,L3**

MODULE-III

8 Hours

Combinational circuit design and simulation using gates: Review of Combinational circuit design, design of circuits with limited Gate Fan-in ,Gate delays and Timing diagrams, Hazards in combinational Logic, simulation and testing of logic circuits Multiplexers, Decoders and Programmable Logic Devices: Multiplexers, three state buffers, decoders and encoders, Programmable Logic devices.. **Text book 1:Part B: Chapter 8,Chapter 9 (Sections 9.1 to 9.6) RBT: L1, L2,L3**

MODULE-IV

8 Hour

Introduction to VHDL: VHDL description of combinational circuits, VHDL Models for multiplexers, VHDL Modules. Latches and Flip-Flops: Set Reset Latch, Gated Latches, Edge-Triggered D Flip Flop 3,SR Flip Flop, J K Flip Flop, T Flip Flop. Textbook 1: Part B: Chapter 10(Sections 10.1 to 10.3), Chapter 11 (Sections 11.1 to 11.7) RBT: L1, L2,L3

MODULE-V

8 Hours

Registers and Counters: Registers and Register Transfers, Parallel Adder with accumulator, shift registers, design of Binary counters, counters for other sequences, counter design using SR and J K Flip Flops Textbook 1: Part B: Chapter 12 (Sections 12.1 to 12.5) RBT L1, L2,L3

5.0 Relevance to future subjects

Sl. No	Semester	Subject	Topics
01	III & VII	Logic systems	Logic design and analysis

6.0 Relevance to Real World


Sl. No	Real World Mapping
01	Logic methods are used to solve engineering problems.
02	Combination logic circuits are used to design several application
03	Analog to digital and digital to analog application in various fields

7.0 Gap Analysis and Mitigation

Sl. No	Delivery Type	Details
01	Tutorial	Topic: K-Map QM Method

8.0 Books Used and Recommended to Students

Text Books
1. Charles H Roth and Larry L Kinney, Analog and Digital Electronics, Cengage Learning,2019 .
Reference Books
1. Anil K Maini, Varsha Agarwal, Electronic Devices and Circuits, Wiley, 2012.

	SJPN Trust's Hirasugar Institute of Technology, Nidasoshi. <i>Inculcating Values, Promoting Prosperity.</i> Approved by AICTE, New Delhi, Permanently Affiliated to VTU, Belagavi Recognized under 2(f) & 12B of UGC Act, 1956 Accredited at 'A' Grade by NAAC & Programmes Accredited by NBA: CSE & ECE.	Dept. of CSE
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2. Donald P Leach, Albert Paul Malvino & Goutam Saha, Digital Principles and Applications, 8th Edition, Tata McGraw Hill, 2015.
3. M. Morris Mani, Digital Design, 4th Edition, Pearson Prentice Hall, 2008.
4. David A. Bell, Electronic Devices and Circuits, 5th Edition, Oxford University Press, 2008 Stephen Brown,

Additional Study material & e-Books

1. Analog Electronic Circuits: <https://nptel.ac.in/courses/108/102/108102112/>
2. Digital Electronic Circuits: <https://nptel.ac.in/courses/108/105/108105132/>
3. Analog Electronics Lab: <http://vlabs.iitkgp.ac.in/be/>
4. Digital Electronics Lab: <http://vlabs.iitkgp.ac.in/dec>

9.0 Relevant Websites (Reputed Universities and Others) for Notes/Animation/Videos Recommended

Website and Internet Contents References

1. www.iitg.ac.in/apvajpeyi/ph218/PH-218%20-%20Introduction.pdf
2. electronics-course.com/

10.0 Magazines/Journals Used and Recommended to Students

Sl. No	Magazines/Journals	website
1	IJCOT - International Journal of Computer & Organization Trends	https://www.ieee.org/documents/ieee_focus_on_computer_hardware.pdf

11.0 Examination Note

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

Practical Sessions need to be assessed by appropriate rubrics and viva-voce method. This will contribute to 20 marks.

- Rubrics for each Experiment taken average for all Lab components – 15 Marks.
- Viva-Voce– 5 Marks (more emphasized on demonstration topics)

The sum of three tests, two assignments, and practical sessions will be out of 100 marks and will be scaled down to 50 marks (to have a 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).

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CIE methods /question paper has to be 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. Marks scored shall be proportionally reduced to 50 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.

12.0 Course Delivery Plan

Module	Lecture No./Practical No	Content of Lecture	% of Portion
1	L1	BJT Biasing: Fixed bias,	20
	L2	Collector to base Bias, voltage divider bias	
	L3	Operational Amplifier Application Circuits: Peak Detector	
	L4	Schmitt trigger, Active Filters.	
	L5	Non-Linear Amplifier, Relaxation Oscillator.	
	L6	Current-to-Voltage and Voltage-to-Current Converter.	
	L7	Regulated Power Supply Parameters.	
	L8	adjustable voltage regulator, D to A and A to D converter.	
	P1	Simulate BJT CE voltage divider biased voltage amplifier using any suitable circuit simulator.	
	P2	Using ua 741 Op-amp, design a 1 kHz Relaxation Oscillator with 50% duty cycle	
	P3	Design an astable multivibrator circuit for three cases of duty cycle (50%, 50%) using NE 555 timer IC.	
	P4	Using ua 741 op-amp, design a window comparator for any given UTP and LTP.	
2	9	Karnaugh maps: minimum forms of switching functions,	20
	10	two and three variable Karnaugh maps, four variable Karnaugh maps.	
	11	determination of minimum expressions using essential prime implicants.	
	12	Quine-McClusky Method: determination of prime implicants	
	13	the prime implicant chart, Petricks method.	
	14	simplification of incompletely specified functions	
	15	simplification using map-entered variables	
	16	Revision.	
P5	Given a 4-variable logic expression, simplify it using appropriate technique and implement the same using basic gates.		
3	17	Combinational circuit design and simulation using gates.	20
	18	Review of Combinational circuit design.	
	19	Design of circuits with limited Gate Fan-in, Gate delays and Timing diagrams	
	20	Hazards in combinational Logic, simulation.	
	21	testing of logic circuits.	
	22	Multiplexers, Decoders and Programmable Logic Devices.	
	23	Multiplexers, three state buffers.	
	24	decoders and encoders, Programmable Logic devices.	
P6	Given a 4-variable logic expression, simplify it using appropriate technique and realize the simplified logic expression using 8:1 multiplexer IC.		

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	P7	Design and implement code converter I) Binary to Gray (II) Gray to Binary Code.	
4	25	Introduction to VHDL.	20
	26	Description of combinational circuits,	
	27	VHDL Models for multiplexers.	
	28	VHDL Modules. Latches and Flip-Flops.	
	29	Set Reset Latch, Gated Latches.	
	30	Edge-Triggered D Flip Flop 3,SR Flip Flop.	
	31	J K Flip Flop, T Flip Flop.	
	32	Revision.	
	P8	Given a 4-variable logic expression, simplify it using appropriate technique and simulate the same in HDL simulator	
P9	Realize a J-K Master / Slave Flip-Flop using NAND gates and verify its truth table. And implement the same in HDL.		
5	33	Registers and Counters .	20
	34	Registers and Register Transfers.	
	35	Parallel Adder with accumulator.	
	36	shift registers.	
	37	Design of Binary counters.	
	38	counters for other sequences.	
	39	counter design using SR	
	40	J K Flip Flops.	
	P10	Design and implement a mod-n ($n < 8$) Synchronous up counter using J-K flip-flop Ic demonstrate its working.	
	P11	Design and implement an asynchronous counter using decade counter IC to count up from 0 to n ($n \leq 9$) and demonstrate on 7-segment display (using IC-7447)	

13.0 QUESTION BANK

MODULE-1: Photo Diodes


1. Explain about biasing of a Transistor.(JAN 2018/ AUG2019)
2. Explain about common base biasing. .(JAN 2018)
3. What are the applications of OP-AMP. .(AUG2019)
4. Explain the performance parameter of op-amp. .(JAN 2020)
5. Explain about V to I and I to V. .(JAN 2020/ AUG2019)
6. Explain with circuit diagram Schmitt trigger. .(JAN 2020/ AUG2020)
7. Explain with circuit diagram peak detector. .(JAN 2018)
8. Explain with circuit diagram active filters. .(AUG20)
9. Explain with circuit diagram multivibrators using 555 timers. (AUG2021)

MODULE-2: K-MAPS

1. What is k-map? How its simplify the Boolean expressions. .(JAN 2018)
2. What is Quine-McClusky Method? .(JAN 2019)
3. Explain Q-M method with suitable example.(JAN 2018).
4. Explain about prime implicit chart. .(JAN 2018)
5. Explain incompletely specified functions. .(JAN 2018)
6. What is prime implicants explain with suitable examples. .(JAN 2018)

MODULE-3: Combinational circuits.

1. Differentiate between combinational circuit and Sequential circuits. .(AUG2019)
2. What is multiplexer and de-multiplexer. .(JAN 2018)

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3. Define programmable logic Device. .(JAN 2018)
4. Explain about programmable logic array. .(JAN 2021)
5. Brief explanation about PLA. .(JAN 2019)

MODULE-4: VHDL.

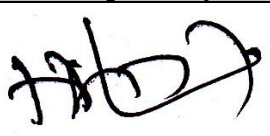
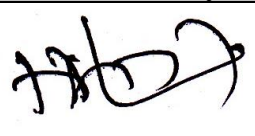


1. What is VHDL. .(JAN 2018)
2. Explain VHDL model for multiplexers and Demultiplexers. .(JAN 2018)
3. Explain about set and reset flip-flop. .(AUG2019)
4. Describe T-flip-flop and D flip-flop. .(JAN 2018)
5. Explain about asynchronous sequential circuits. .(JAN 2021)
6. Write a program of fulladder using verilog and VHDL. .(JAN 2018)
7. Write a program of Half adder using verilog and VHDL.(JAN 2018)
8. Write a program of R-S flip-flop using verilog and VHDL.(JAN 2019)


MODULE-5: Counters.

1. Explain about types of registers. .(JAN 2019)
2. Explain about types of counters in logic circuits. (JAN 2021)
3. What is shift registers. (JAN 2021)
4. Explain about synchronous counters. (AUG2021)
5. Explain about asynchronous counters. (AUG2019)
6. Write a program of MOD 5 synchronous counter using verilog and VHDL.(AUG 2019)
7. Write a program of MOD 10 asynchronous counter using verilog and VHDL.(AUG2021)
8. Write a program of parallel adder using verilog and VHDL.(JAN 2019/ AUG2021)

14.0 University Result

Examination	S+	S	A	B	C	D	E	% Passing
NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL

Prepared by	Checked by		
			
Prof. N.K.Honnagoudar	Prof. N.K.Honnagoudar	HOD	Principal

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Subject Title	COMPUTER ORGANIZATION AND ARCHITECTURE		
Subject Code	21CS34	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0:0	SEE Marks	50
Total Number of Lecture Hrs	40	Total Marks	100
CREDITS	03	Exam Hours	03

FACULTY DETAILS:		
Name: Prof. P.V.PATIL	Designation: Asst. Professor	Experience: 10
No. of times course taught: 02	Specialization: VLSI Design & Embedded Systems	

1.0 Prerequisite Subjects:

Sl. No	Branch	Semester	Subject
01	Computer Science and Engineering	I/II	Basic Electronics

2.0 Course Objectives


Course Learning Objectives:

1. Understand the organization and architecture of computer systems, their structure and operation
2. Illustrate the concept of machine instructions and programs
3. Demonstrate different ways of communicating with I/O devices
4. Describe different types memory devices and their functions
5. Explain arithmetic and logical operations with different data types
6. Demonstrate processing unit with parallel processing and pipeline architecture

3.0 Course Outcomes

Having successfully completed this course, the student will be able to

Course Code	Course Outcome	RBT level	POs
C204.1	Explain the organization and architecture of computer systems with machine instructions and programs	L1,L2	1,2,3,12
C204.2	Analyze the input/output devices communicating with computer system	L1, L2	1,2,3,12
C204.3	Demonstrate the functions of different types of memory devices	L1, L2,L3	1,2,3,12
C204.4	Apply different data types on simple arithmetic and logical unit	L1, L2,L3	1,2,3,12
C204.5	Analyze the functions of basic processing unit, Parallel processing and pipelining	L1,L2	1,2,3,12
Total Hours of instruction		50	

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4.0 Course Content

Module-1 Hours 08

Basic Structure of Computers: Basic Operational Concepts, Bus Structures, Performance – Processor Clock, Basic Performance Equation, Clock Rate, Performance Measurement. **Machine Instructions and Programs:** Memory Location and Addresses, Memory Operations, Instructions and Instruction Sequencing, Addressing Modes

Module -2 Hours 08

Input/output Organization: Accessing I/O Devices, Interrupts – Interrupt Hardware, Direct Memory Access, Buses, Interface Circuits

Module -3 Hours 08

Memory System: Basic Concepts, Semiconductor RAM Memories, Read Only Memories, Speed, Size, and Cost, Cache Memories – Mapping Functions, Virtual memories

Module -4 Hours 08

Arithmetic: Numbers, Arithmetic Operations and Characters, Addition and Subtraction of Signed Numbers, Design of Fast Adders, Multiplication of Positive Numbers

Basic Processing Unit: Fundamental Concepts, Execution of a Complete Instruction, Hardwired control, Micro programmed control

Module -5 Hours 08

Pipeline and Vector Processing: Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, Vector Processing, Array Processors

5.0 Relevance to future subjects


Sl. No.	Semester	Subject	Topics
01	VII	Final Year Project	Communication, Networking

6.0 Relevance to Real World

Sl. No	Real World Mapping
01	To program and interface any hardware to the computer system the knowledge computer organization & its architectures are essential
02	To design final year project the knowledge computer organization & its architectures are essential

7.0 Gap Analysis and Mitigation

Sl. No	Delivery Type	Details
01	NPTEL	Computer Organization

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8.0 Books Used and Recommended to Students

Text Books
1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Computer Organization, 5th Edition, Tata McGraw Hill
2. M. Morris Mano, Computer System Architecture, PHI, 3rd Edition
Reference Books
1 William Stallings: Computer Organization & Architecture, 9th Edition, Pearson
Additional Study material & e-Books
1. N.P.Bali & Manish.Goyal, a Text book of Engineering Mathematics, 7 th edition, Laxmi Publications.

9.0 Relevant Websites (Reputed Universities and Others) for Notes/Animation/Videos Recommended

Website and Internet Contents References
Web links and Video Lectures:
1. https://nptel.ac.in/courses/106/103/106103068/
2. https://nptel.ac.in/content/storage2/courses/106103068/pdf/coa.pdf
3. https://nptel.ac.in/courses/106/105/106105163/
4. https://nptel.ac.in/courses/106/106/106106092/
5. https://nptel.ac.in/courses/106/106/106106166/
6. http://www.nptelvideos.in/2012/11/computer-organization.html

10.0 Magazines/Journals Used and Recommended to Students

Sl. No	Magazines/Journals	website
1	IEEE	http://ieeexplore.ieee.org/Xplore/home.jsp

11.0 Examination Note

The weight age 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

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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 has to be 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**)

12.0 Course Delivery Plan

Module No.	Lecture No.	Content of Lecturer	% of Portion
1	1	Basic Operational Concepts, Bus Structures	20
	2	Performance, Processor Clock	
	3	Basic Performance Equation, Clock Rate	
	4	Performance Measurement	
	5	Memory Location and Addresses	
	6	Memory Operations	
	7	Instructions and Instruction Sequencing,	
	8	Addressing Modes	
2	9	Accessing I/O Devices	20
	10	Interrupts	
	11	Interrupt Hardware	
	12	Direct Memory Access	
	13	Buses	
	14	Interface Circuits	
3	15	Memory System	20
	16	Basic Concepts	
	17	Semiconductor RAM Memories	
	18	Read Only Memories	
	19	Speed, Size, and Cost,	
	20	Cache Memories,	
	21	Mapping Functions	
	22	Virtual memories	
4	23	Arithmetic	20
	24	Numbers	
	25	Arithmetic Operations and Characters,	
	26	Addition and Subtraction of Signed Numbers,	
	27	Design of Fast Adders, Multiplication of Positive Numbers	
	28	Basic Processing Unit:	
	29	Fundamental Concepts	
	30	Execution of a Complete Instruction,	
	31	Hardwired control, Micro programmed control	

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5	32	Pipeline	20
	33	Vector Processing	
	34	Parallel Processing	
	35	Pipelining,	
	36	Arithmetic Pipeline	
	37	Instruction Pipeline	
	38	Instruction Pipeline	
	39	Vector Processing	
	40	Array Processors	


13.0 Assignments

Sl.No.	Title	Outcome expected	Allied study	Week No.	Individual / Group activity	Reference: book/website /Paper
1	Assignment 1: Some important University Questions on Module one.	Students study the Topics and write the Answers. Get practice to solve questions	Module one of the syllabus	3	Individual Activity. Witten solutions expected.	Text book
2	Assignment 2: Some important University Questions on Module two	Students study the Topics and write the Answers. Get practice to solve questions	Module two of the syllabus	6	Individual Activity. Witten solutions expected.	Text book
3	Assignment 3: Some important University Questions on module three.	Students study the Topics and write the Answers. Get practice to solve questions	Module three of the syllabus	9	Individual Activity. Witten solutions expected.	Text book
4	Assignment 4: Some important University Questions on and comprehensive questions module four.	Students study the Topics and write the Answers. Get practice to solve questions	Module four of the syllabus	11	Group Activity power point presentation	Text book and reference books
5	Assignment 5: Some important University Questions on and comprehensive questions module five.	Students study the Topics and write the Answers. Get practice to solve questions	Module five of the syllabus	13	Group Activity power point presentation	Text book and reference books

14.0 QUESTION BANK

MODULE-1


1. Explain with a neat diagram the connection between the processor and the computer memory. (05 Marks Jan-19)
2. Explain the Basic Instruction types with example. **(05 Marks Jan-19)**

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3. Define Addressing mode, explain the various addressing modes with example. **(10 Marks Jan-19)**
4. Write an assembly program that reads a line of characters and display it. **(05 Marks Jan-19)**
5. What are assembler directives? Point out and explain the various directives with example. **(05 Marks Jan-19)**
6. Point out various shifts and rotate instruction and example with a neat diagram and example. **(10 Marks Jan-19)**
7. With a neat diagram discuss the basic operational concept of a computer [June/July 2017]
8. Explain methods to improve the performance of computer [June/July 2017]
9. Explain Big-Endian, little Endian and assignment byte addressability [June/July 2017]
10. What are the addressing modes? Explain the different 4 types of addressing modes with examples [June/July 2017]
11. Write the use of Rotate and shift instruction with example [June/July 2017]
12. What is stack and queue? Write the line of code to implement the same. [June/July 2017]
13. Explain the following for a computer MAR, MDR, PC ALU, and Control unit.
14. Explain the operation of two bus structure.
15. Explain Clearly SPEC rating and its significance
16. Briefly explain the history of computer development from First generations to 4th Generation
17. Mention the difference between CISC and RISC processors.
18. Explain with examples, all the generic addressing modes, with assembler syntax.
19. Mention the differences between CISC and RISC processors.
20. Write basic performance equation? Explain the role of the parameters on the performance of the computer.
21. Define the terms processor clock, RISC, SPEC rating, basic performance equation.
22. Write the basic performance equation? Explain the role of the parameters on the performance of the computer.

MODULE -2

1. Define interrupt. Point out and explain the various ways of enabling and disabling interrupts. **(07 Marks Jan-19)**
2. What are Exceptions? Point out and explain the different kinds of exceptions. **(05 Marks Jan-19)**
3. What is interrupt nesting, explain with a neat diagram the implementation of interrupt priority, using individual interrupt request and acknowledge lines. **(08 Marks Jan-19)**
4. What is Bus Arbitration? Explain centralized and distributed arbitration. With a neat diagram. **(10 Marks Jan-19)**
5. Explain Universal serial Bus tree structure and split bus operation with a neat diagram. **(10 Marks Jan-19)**
6. Define bus arbitration? Explain in detail any one approach of bus arbitration. [June/July 2017]
7. What are priority interrupts? Explain any one interrupt priority scheme. [June/July 2017]
8. Write a note on register in DMA interface. [June/July 2017]
9. With a block diagram explain how the printer interfaced to processor. [June/July 2017]
10. Explain the following with respect to U.S.B [June/July 2017]
 - i) U.S.B Architecture
 - ii) U.S.B protocols
11. What is an assembler? Explain the functions of Assembler
12. Describe any three modes of addressing.
13. Write a program to evaluate the Expression $S=A*B+C*D$
14. What are the different types of addressing modes?
15. What is word alignment of a machine explain what are the consecutive addresses of aligned words for 16, 32 and 64.
16. Bring out the five key differences between subroutine and interrupt service routine.
17. What is the function of assembler directives? Give two examples of assembler directives used for the reservation for memory locations for variables, state their functions.
18. Define an addressing mode explain the following addressing modes with examples: Indirect, indexed, relative and auto increment.
19. Explain how the parameters are passed to a subroutine?
20. Differentiate between stack and queue.

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21. Explain the Big Endian and Little Endian assignment.
22. Write a short note on SCSI BUS and PCI bus
23. Explain the significance of USB and PCI bus
24. Explain the split bus organization with diagram
25. Explain the USB packet format clearly.
26. Draw the block diagram of USB structure connected to the host computer.
27. Briefly explain all fields of packets that are used for communication between a host and a device connected to an USB port.
28. In a computer system, PCI bus is used to connect devices to the processor bus. Consider a bus transaction in which the processor reads four 32 bit words from the memory.

MODULE -3

1. Explain synchronous DRAMS with a block diagram. (05 Marks Jan-19)
2. Define ROM ; point out and explain various types of ROMS.(05 Marks Jan-19)
3. Define cache memory, explain various types of it with a neat block diagram. (10 Marks Jan-19)
4. What is Virtual memory? Explain virtual memory organization.(7 Marks Jan-19)
5. Explain the optical disk organization with a neat diagram.(10 Marks Jan-19)
6. Define Hit rate and miss penalty.(3 Marks Jan-19)
7. Define. **[June/July 2017]**
 - i) Memory Latency
 - ii) Memory bandwidth
 - iii) Hit-rate
 - iv) Miss-penalty
8. With a neat diagram explain the internal organization of a 2Mx8 dynamic memory chip. **[June/July 2017]**
9. Explain associative mapping technique and set associative mapping technique. **[June/July 2017]**
10. What is virtual memory? With a diagram explain how virtual memory address is translated. **[June/July 2017]**
11. Write a note on **[June/July 2017]**
 - i) Magnetic tape system
 - ii) Flash memory
12. What is Stack? Explain its role in subroutine nesting
13. What is DMA? Explain the Generation of two channel DMA controller
14. Explain parameter passing with an example.
15. Explain with a diagram the interface circuit of printer connected to the processor
16. Explain the hard ware register that are needed in DMA controller chip and why is it necessary
17. For a DMA controller to be able to interrupt the processor?
18. What are the advantages do DMA and DMAC?.
19. Define following interrupt, vectored interrupt, interrupt nesting and an exception and give 2 examples.
20. Explain in brief with the help of diagram, the working principle of daisy chain with multiple priority levels and multiple devices in each level.
21. Explain I/o mapped I/o and describe any two methods of connecting multiple interrupting devices to CPU.
22. What is DMA? Explain the generation of two channel DMA controller.
23. Explain the synchronous bus. Also give the timing of an input transfer on a synchronous bus with a timing diagram.
24. Define full handshake.
25. Explain the following with respect to USB addressing and USB protocols.
26. Explain I/o mapped I/o and describe any two methods of connecting multiple interrupting devices to CPU.

MODULE -4

1. Draw 4-bit carry-look ahead adder and explain.(10 Marks Jan-19)
2. Perform multiplication for -13 and + 9 using Booth's Algorithm and explain Booth's Algorithm process.(10 Marks Jan-19)
3. Explain with a neat figure the circuit arrangement for binary division.(10 Marks Jan-19)

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4. Explain IEEE standard for floating point number. (10 Marks Jan-19)
5. Perform following operations on the 5-bit signed numbers using 2's complement representation system. Also indicate overflow has occurred. [June/July 2017]
 - i) $(-9) + (-7)$ ii) $(+7) - (-8)$.
6. Explain with a neat block diagram, 4 bit carry look ahead adder. [June/July 2017]
7. Explain the concept of carry save addition for the multiplication operation, $M \times Q = P$ for 4-bit operands with diagram and suitable example. [June/July 2017]
8. Multiply the following signed 2's complement numbers using Booth's algorithm multiplicand = $(010111)_2$, multiplier = $(110110)_2$ [June/July 2017]
9. Perform division operation on the following unsigned numbers using the restoration method. Dividend = $(10101)_2$, divisor = $(00100)_2$. [June/July 2017]
10. With a neat diagram explain the floating point addition/ subtraction unit. [June/July 2017]
11. Describe the organization of 64×8 memory using $16 \times 1k$ static memory chips
12. Explain the internal organization of $2M \times 8$ dynamic memory chip.
13. Differentiate between SRAM and SDRAM chips
14. Define the following Memory access time, memory cycle time, RAM, static memories.
15. Differentiate between the static RAM and DRAM giving four key differences. State the primary usage of SRAM and DRAM in contemporary computer systems.
16. Define memory latency and bandwidth in case of burst operation that is used for transferring a block of data to or from synchronous DRAM memory unit.


MODULE -5

1. Explain three — bus organization of the datapath with a neat block diagrams. (06 Marks Jan-19)
2. Explain Hard Wired Control Unit Organization in a processing unit. (06 Marks Jan-19)
3. Draw and explain multiple bus organization of CPU, and write the control sequence for the instruction Add R4, R5, R6 for the multiple bus organization. [June/July 2017]
4. Explain with neat diagram, micro-programmed control method for design of control unit and write the micro-routine for the instruction Branch < 0. [June/July 2017]
5. With block diagram, explain the working of microwave oven in an embedded system. [June/July 2017]
6. With block diagram, explain parallel I/O interface. [June/July 2017]
7. Write a note on Fast adders and Multiply 10011 & 01001 .
8. Explain the representation of Floating point numbers using IEEE Format.
9. Explain the Restoring Division Algorithms method.
10. Indicate Fast multiplication using one example.
11. Compare the booth's algorithm and fast multiplication algorithms.
12. Explain with block diagram 4 bit carry look ahead adder.
13. Perform division of numbers 8 by 3 using non restoring division algorithm.
14. Explain the fetching of word from memory with the help of timing diagram.
15. Explain the 3 bus organization of the data path with a neat diagram and write control sequence for the instruction ADD R4, R5, R6 for the 3 bus organization.
16. Compare between hardwired and micro-programmed control.
17. List the actions needed to execute the instruction Add R1, (R3).
18. Write the sequence of control to perform the actions for single bus structure. Explain the steps.

16.0 University Result

Examination	FCD (S+, S, A)	FC (B)	SC (C, D, E)	% Passing
NA	NA	NA	NA	NA

Prepared by	Checked by		
 Prof. P.V. Patil	 Prof. N. K. Honnagoudar	 HOD	 Principal

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Subject Title	OBJECT ORIENTED PROGRAMMING WITH JAVA		
Subject Code	21CSL35	IA Marks	50
No of Lecture Hrs + Practical Hrs /	00L + 02P	Exam Marks	50
Total No of Lecture + Practical Hrs	24	Exam Hours	03
CREDITS – 02			

FACULTY DETAILS:		
Name: Prof. Prasanna Patil	Designation: Asst. Professor	Experience: 9 Years
No. of times course taught: 01 Time		Specialization: Computer Science & Engineering

1.0 Prerequisite Subjects:

Sl. No	Branch	Semester	Subject
01	Computer Science and Engineering	I/II	Programming in C
02	Computer Science and Engineering	III	Programming in C++

2.0 Course Objectives

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


3.0 Course Outcomes

The student, after successful completion of the course, will be able to


COs	Course Outcome	RBT Level	POs
C205.1	Use Eclipse/NetBeans IDE to design, develop, debug Java Projects.	L3	1,2,3,5,8,9,10,11,12
C205.2	Analyze the necessity for Object Oriented Programming paradigm over structured programming and become familiar with the fundamental concepts in OOP.	L3	1,2,3,5,8,9,10,11,12
C205.3	Demonstrate the ability to design and develop java programs, analyze, and interpret object-oriented data and document results.	L3	1,2,3,5,8,9,10,11,12
C205.4	Apply the concepts of multiprogramming, exception/event handling, abstraction to develop robust programs.	L3	1,2,3,5,8,9,10,11,12
C205.5	Develop user friendly applications using File I/O and GUI concepts.	L3	1,2,3,5,8,9,10,11,12
Total Hours of instruction			24

4.0 Course Content

Descriptions (if any):	
<ul style="list-style-type: none"> • Students should be familiarized about java installation and setting the java environment. • Usage of IDEs like Eclipse/NetBeans should be introduced. 	
PART A – List of problems for which student should develop program and execute in the Laboratory.	
PART B – Practical Based Learning	
PART - A	
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 $ax^2+bx+c=0$. Read in

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	a, b, c and use the quadratic formula.
2	<p>Aim: Demonstrating creation of java classes, objects, constructors, declaration and initialization of variables.</p> <p>Program: Create a Java class called Student with the following details as variables within it.</p> <p>USN Name Branch Phone</p> <p>Write a Java program to create n Student objects and print the USN, Name, Branch, and Phone of these objects with suitable headings.</p>
3	<p>Aim: Discuss the various Decision-making statements, loop constructs in java</p> <p>Program:</p> <p>A. Write a program to check prime number B. Write a program for Arithmetic calculator using switch case menu</p>
4	<p>Aim: Demonstrate the core object-oriented concept of Inheritance, polymorphism</p> <p>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.</p>
5	<p>Aim: Introduce concepts of method overloading, constructor overloading, overriding.</p> <p>Program: Write a java program demonstrating Method overloading and Constructor overloading.</p>
6	<p>Aim: Introduce the concept of Abstraction, packages.</p> <p>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.</p>
7	<p>Aim: Introduction to abstract classes, abstract methods, and Interface in java</p> <p>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().</p>
8	<p>Aim: Demonstrate creation of threads using Thread class and Runnable interface, multithreaded programming.</p> <p>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.</p>
9	<p>Aim: Introduce java Collections.</p> <p>Program: Write a program to perform string operations using ArrayList. 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.</p>
10	<p>Aim: Exception handling in java, introduction to throwable class, throw, throws, finally.</p> <p>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.</p>
11	<p>Aim: Introduce File operations in java.</p> <p>Program:</p> <p>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</p>
12	<p>Aim: Introduce java Applet, awt, swings.</p> <p>Program:</p> <p>Develop an applet that displays a simple message in center of the screen. Develop a simple calculator using Swings.</p>
PART-B	
1	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.

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5.0 Relevance to future subjects

SL. No	Semester	Subject	Topics / Relevance
01	VI	Project work	Academic Mini Project
02	VIII	Project work	Academic Project

6.0 Relevance to Real World

SL. No	Real World Mapping
01	Development of Android Applications.
02	Development of Database Applications using Java.

7.0 Books Used and Recommended to Students

Text Books	
1.	E Balagurusamy, Programming with Java, Graw Hill, 6 th Edition, 2019.
2.	Herbert Schildt, C: Java the Complete Reference, McGraw Hill, 11 th Edition, 2020
Reference Books	
1.	Head First Java: A Brain-Friendly Guide, Author: Kathy Sierra
2.	Java: The Complete Reference, Author: Herbert Schildt
Additional Study material & e-Books	
1.	Java Notes for Professionals. Download: https://goalkicker.com/JavaBook/
2.	Object-Oriented vs. Functional Programming. Download: http://www.oreilly.com/programming/free/object-oriented-vs-functional-programming.csp
3.	Java: The Legend. Download: http://www.oreilly.com/programming/free/java-the-legend.csp

8.0 Relevant Websites (Reputed Universities and Others) for Notes/Animation/Videos Recommended

Website and Internet Contents References	
1.	https://www.coursera.org/
2.	https://swayam.gov.in/
3.	https://nptel.ac.in/
4.	https://www.udemy.com/
5.	https://www.mooc.org/

9.0 Magazines/Journals Used and Recommended to Students

Sl.No	Magazines/Journals	website
1	CSI communications	www.csi-india.org

10.0 Examination Note


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.

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- 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 down 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 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 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

Internal Assessment:


Scheme of Evaluation for Continuous Assessment (30 Marks)

Each Experiment will be evaluated for 10 marks & then total sum will be reduce it to 30 Marks.

Description	Max.
Observation, Write-up of Procedure/ Program/ Algorithm and Execution of Experiment	04
Viva-Voce	02
Record Writing	04
Total	10

Scheme of Evaluation for Internal Assessment (20 Marks)


- Each Lab IA will be conducted for 50 marks & then will be reduced to 20 Marks.

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Description	Max. marks
Write-up of Procedure/ Program/ Algorithm	10
Conduction / Execution	25
Viva-Voce	15
Total	50

11.0 Course Delivery Plan


Expt. No	Lecture / Practical No	Name of the Experiment	% Of Portion
		PART-A	
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 $ax^2+bx+c=0$. Read in a, b, c and use the quadratic formula.	7.69%
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.	7.69%
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	7.69%
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.	7.69%
5		Aim: Introduce concepts of method overloading, constructor overloading, overriding. Program: Write a java program demonstrating Method overloading and Constructor overloading.	7.69%
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.	7.69%
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().	7.69%
8		Aim: Demonstrate creation of threads using Thread class and Runnable interface, multithreaded programming. Program: Write a Java program that implements a multi-thread application that	7.69%

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		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 ArrayList. 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.	7.69%
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.	7.69%
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	7.69%
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.	7.69%
PART-B			
1		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.	7.69%

12.0 Question Bank





SL. NO.	Viva Questions
1	Explain JDK, JRE and JVM?
2	Explain public static void main(String args[]) in Java.
3	Why Java is platform independent?
4	why is main method declared as static?
5	Is JDK required on each machine to run a java program?
6	What is a Constructor?
7	What are the differences between C++ and Java?
8	Can we have a class with no Constructor in it? What will happen during object creation?
9	What is No-arg constructor?
10	If I don't provide any arguments on the command line, then what will the value stored in the String array passed into the main() method, empty or NULL?
11	How many types of constructors are used in Java?
12	Is constructor inherited?
13	What are the differences between the constructors and methods?
14	Can we have both Default Constructor and Parameterized Constructor in the same class?
15	What is super keyword?
16	What are usages of java super Keyword?
17	What is Inheritance in Java?
18	How to use Inheritance in Java?
19	Can A Class Extends More Than One Class In Java?
20	What is interface in java?
21	Can we achieve multiple inheritance by using interface?
22	Is it compulsory for a class which is declared as abstract to have at least one abstract method?
23	Abstract class must have only abstract methods. True or false?


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24	What is the main difference between abstract method and final method?
25	What is ArrayStoreException in java? When you will get this exception?
26	Can you pass the negative number as an array size?
27	Can you change the size of the array once you define it? OR can you insert or delete the elements after creating an array?
28	What is the difference between int[] a and int a[] ?
29	What are the differences between Array and ArrayList in java?
30	What is Exception in Java?
31	What are the Exception Handling Keywords in Java?
32	What is difference between throw and throws keyword in Java?
33	What happens when exception is thrown by main method?
34	What is difference between Checked and Unchecked Exception in Java?
35	What is a Java package?
36	Which package is always imported by default?
37	Is there a performance impact due to a large number of import statements that are unused?
38	Can I import same package/class twice?
39	Does importing a package imports the sub packages as well?
40	What is thread in Java?
41	What is Multithreading?
42	What are the two ways of creating a thread?
43	Can we call run() method of Thread class?
44	What is synchronization?
45	What are the types of I / O streams?
46	Difference between Reader/Writer and InputStream/Output Stream?
47	What is an I/O filter?
48	What are the file access modes?
49	What is common and how do the following streams differ: InputStream, OutputStream, Reader, Writer?
50	What is an Applet?
51	Explain the life cycle of an Applet.
52	what is the difference between an Applet and a Java Application?
53	what are the restrictions imposed on Java applets?
54	Should Applets Have Constructors?

13.0 University Result

Examination	# of Students Appeared	# of Students Passed	FCD	FC	SC	Fail	% Passing
NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL

Prepared by	Checked by		
			
Prof. Prasanna Patil	Dr. Mahesh G. Huddar	HOD	Principal

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SUBJECT: Programming in C++			
Subject Code	21CS382	CIE Marks: IA-Tests(20) + Assignments(10)+ Quiz/GD/Seminar(20)	50
Teaching Hours/Week (L:T)	1:0	SEE Marks(Appearing)	50(100)
Total Hours of Pedagogy	40	Total marks(CIE + SEE)	100
Credits	01	SEE Hours	03

FACULTY DETAILS:		
Name: Dr. K B Manwade	Designation: Associate. Professor	Experience: 18Yrs
No. of times course taught: 2	Specialization: Computer Science and Engineering	

1.0 Prerequisite Subjects:

Sl. No	Branch	Semester	Subject
01	-	I/II	Problem solving through programming


2.0 Course Objectives

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

3.0 Course Outcomes [C208]

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

CO	Course Outcome	Cognitive Level	POs
C208.1	Explain the object oriented programming concepts, terminologies in object oriented programming and difference between C and C++	L1,L2	1,2,3,8,10
C208.2	Understand and define different types of functions inside the class and out side the class definition.	L1,L2	1,2,3,8,10
C208.3	Design and implement inheritance and polymorphism in C++ programming language.	L1,L2,L3	1, 2, 3,8,10
C208.4	Design and Develop programs using text as well as binary file handling concepts.	L1,L2,L3	1, 2,3,8,10
C208.5	Design and implement exception handling code to handle run time errors in the program.	L1,L2,L3	1, 2,3,8,10

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4.0 Course Content

Module-1

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

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.

Module- 3

Inheritance & Polymorphism: Derived class Constructors, destructors-Types of Inheritance- Defining Derived classes, Single Inheritance, Multiple, Hierarchical Inheritance, Hybrid Inheritance.

Module- 4

I/O Streams: C++ Class Hierarchy- File Stream-Text File Handling- Binary File Handling during file operations.

Module-5

Exception Handling: Introduction to Exception - Benefits of Exception handling- Try and catch block- Throw statement- Pre-defined exceptions in C++ .

5.0 Relevance to future subjects

S. No	Semester	Subject	Topics
01	III	Data Structures & Applications	Class, Object, Function
02	IV	Design of Algorithms	Inheritance, Polymorphism, File handling, Exception handling

6.0 Relevance to Real World


S. No	Real World Mapping
01	Concepts from this course can be used for developing procedural as well as object oriented programs.

7.0 Gap Analysis and Mitigation

S. No	Delivery Type	Details
01	E-content	https://www.w3schools.com/cpp/cpp_intro.asp https://www.edx.org/course/introduction-to-c-3
02	MOOC	https://onlinecourses.nptel.ac.in/noc21_cs02 https://nptel.ac.in/courses/106105234

8.0 Books Used and Recommended to Students

Text Books
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

	SJPN Trust's Hirasugar Institute of Technology, Nidasoshi. <i>Inculcating Values, Promoting Prosperity.</i>	Dept. of CSE
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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

Additional Study material & e-Books

1. C++ Tutorials –videos on YouTube
2. https://onlinecourses.nptel.ac.in/noc19_cs48

9.0

Relevant Websites (Reputed Universities and Others) for Notes /Animation / Videos Recommended

Website and Internet Contents References

- 1) <https://archive.nptel.ac.in/courses/106/105/106105151/>

10.0

Magazines/Journals Used and Recommended to Students

S.No	Magazines/Journals	website
1	<u>C/C++ Users Wiki Journal</u>	https://en.wikipedia.org/
2	<u>Electronics for You</u>	https://electronicsforu.com/

11.0

Examination Note

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:

(I) 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

(II) 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

(III) 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 has to be 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 01 hours)

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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

12.0 Course Delivery Plan

Module	Lecture No.	Content of Lecture	Teaching-Learning Process	% of Portion
		PART - A		
1	1	Computer programming background- C++ overview-First C++ Program, Basic C++ syntax,	Chalk & board, PPT, Animation, Active Learning	20
	2	Object Oriented Programming, What is an object, Classes		
	3	methods and messages		
	4	abstraction and encapsulation, inheritance		
	5	abstract classes, polymorphism		
2	6	Functions in C++: Tokens – Keywords – Identifiers and constants	Chalk & board, Active Learning, Problem based learning	20
	7	Operators in C++ – Scope resolution operator		
	8	Expressions and their types – Special assignment expressions		
	9	Function prototyping, Call by reference – Return by reference		
	10	Inline functions -Default arguments, Function overloading		
3	11	Inheritance & Polymorphism	Chalk & board, PPT, Animation, NPTEL, Active Learning	20
	12	Derived class Constructors, destructors		
	13	Types of Inheritance, Defining Derived classes		
	14	Single Inheritance, Multiple		
	15	Hierarchical Inheritance, Hybrid Inheritance		
4	16	I/O Streams: C++ Class Hierarchy	Chalk & board, Problem based learning	20
	17	File Stream-Text File Handling		
	18	File Stream-Text File Handling		
	19	Binary File Handling during file operations		
	20	Binary File Handling during file operations		
5	21	Exception Handling: Types of errors	Chalk & board, MOOC	20
	22	Introduction to Exception		
	23	Benefits of Exception handling		
	24	Try and catch block-block- Throw statement		
	25	Pre-defined exceptions in C++		

13.0 Assignments, Quiz, GD, Mini Project, Seminars

S. No.	Title	Outcome expected	Related Study	Week No.	Individual / Group activity	Reference: book/website /Paper
1	Assignment-1: Function prototyping – Call by reference – Return by reference – Inline functions -Default arguments – Function overloading (10Marks)	Students study the Topic and write the Answers.	Chapter-2 of Module-2	4	Individual Activity.	Book 1, 2 of the reference list.

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2	Assignment-2: Derived class Constructors, destructors-Types of Inheritance- Defining Derived classes, Single Inheritance, Multiple, Hierarchical Inheritance, Hybrid Inheritance (10Marks)	Students study the Topics and write the Answers.	Chapter-1 of Module-3	9	Individual Activity.	Book 1, 2 of the reference list.
3	Quiz/Seminar/GD (20Marks)	Students study the Topics and answer the Quiz / present seminar.	Will be Notified later.	13	Individual/Group activity.	Book 1, 2 of the reference list.


14.0 QUESTION BANK

Module: 1

- 1 Discuss the syntactical differences between C and C++
- 2 What are entities? What are the two different types? Pick some other system of your choice. Write down the entities involved in that system. Now, differentiate them into two types—one that has a real-world counterpart and the other that the programmer needs for programming convenience.
- 3 What are data and function attributes of the system? Take the same system and design a few data and function attributes of the entities involved.
- 4 What are programs of the system? Take some other system of your choice and decide at least four programs that you may need to code that system.
- 5 What are methods? Pick at least three different entities of the system that you have chosen and write a few methods for that object. Show how these methods are used for queries and how these methods respond back.
- 6 How are classes and objects modelled in C++? Why do we usually have multiple objects associated with a single class? How are real-world classes and objects related with C++ classes and objects?
- 7 What is the law of abstraction? How does it help the user of the objects? Give an example of your choice to illustrate the need for abstraction.
- 8 Explain the difference between the public and private attributes of the class. For your own system, decide which attribute will be public and which attribute will remain private. Give your reasons for deciding so.
- 9 What is encapsulation? How does it help a programmer to design the system better?
- 10 What is inheritance? Try to enhance the system in a way that at least two classes are inherited further.
- 11 What is an is-a relationship? How is it connected with inheritance?
- 12 How does inheritance help the programmer? Take your system as an example and explain the answer.
- 13 What are abstract classes? Give a few examples of abstract classes.
- 14 What is polymorphism? What are the different types of polymorphism? Give some examples of the real world where polymorphism is achieved.
- 15 Differentiate between static and dynamic binding.
- 16 Why does the object-oriented philosophy need functions to be defined inside the classes? What could be the advantage? Provide your own logical answer.

Module -2


- 1 List out the differences between C functions and C++ functions.
- 2 Write a simple program with two or more functions. If you are working with either Turbo C or Visual C++, try to trace the function to look at the sequence of function calling.
- 3 What are the advantages and disadvantages of inline functions? When are inline functions preferred over normal functions?

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- 4 Write a macro for finding the maximum of two numbers. Use it in finding the maximum of five numbers. Rewrite the same program using inline function for finding the maximum of two numbers and discuss the advantages and disadvantages of both the approaches with respect to your program.
- 5 Show a case where default arguments are important. Why does a single default argument function prevent the overloading of a same function without any argument?
- 6 How can you check if your compiler applies NRV? It is made mandatory in the standard. Check with your compiler manual how to enable or disable the NRV.
- 7 What is the advantage of having this pointer? Where can it be useful?
- 8 List the differences between member and nonmember functions. Can you add a few other differences yourself?
- 9 When we return a reference it is better than returning a large object as it requires more context switching. It also has a disadvantage. One can unknowingly use that function in the LHS with unforeseen consequences. What is the solution to this problem?
- 10 How is polymorphism related to function overloading?
- 11 Give an example where it is better to have overloaded functions than default arguments.
- 12 Discuss the importance of friend. Give an example where a friend function is a better choice than a non-member function.
- 13 Discuss the disadvantages of making more member functions than possible in a class. What are the ways one can make member a function a non-member one?
- 14 What is the difference between a normal function and a const function? Show a case where const function is more useful than normal function.
- 15 What is the usefulness of static functions? Compare static functions with normal functions.
- 16 Differentiate between private and public functions. Give one example of a private function that is useful for a class.
- 17 How can pointer to function be defined for a class member function? List out the differences between pointer to normal functions and pointer to member functions
- 18 How can we define pointer to static functions? Test it using a small program of your choice.
- 19 What is the advantage of function pointers? Give an example other than shown in the book to explain the advantage. Show the usefulness of the ::* operator.
- 20 What is name mangling? Why is it required?
- 21 What is linkage specification? Explain the need for linkage specification.

Module- 3

- 1 What are the advantages of using inheritance?
- 2 What is the difference between public and private inheritance?
- 3 What is the difference between protected inheritance and other types of inheritance?
- 4 Explain the statement "The private members of the base class are indirectly available to the derived class".
- 5 Explain how different types of data members are treated under different types of inheritance.
- 6 How is protected access specifier different from other access specifiers while further inheriting a class?
- 7 Why does the C++ object model implement the base class subjects in the derived class object?
- 8 What are the disadvantages of multiple inheritance?
- 9 What are the issues one must consider when dealing with multiple inheritance?
- 10 What is the advantage of access declaration?
- 11 List few cases where we need to derive multiple classes from a single class.
- 12 Give an example of conversion of a program using dynamic_cast to typeid other than the one provided in the book.
- 13 Is it possible to convert a problem solved using dynamic_cast to one using typeid? Give your views on such conversion.
- 14 Write down the differences between solutions provided using typeid and using dynamic_cast.

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- 15 What are the problems with the use of typeid mechanism for solving problems?
- 16 Design a few class hierarchies yourself. Identify cases where we can use virtual functions, typeid, and dynamic_cast.
- 17 Draw a comparison between different casting operators.
- 18 When working with templates, do we need to use RTTI?
- 19 Suggest a few cases where downcasting or cross casting is useful.
- 20 What are polymorphic objects?

Module- 4





- 1 What are streams? Why they are useful?
- 2 What is the difference between I/O provided by C and C++?
- 3 What is new in I/O provided by the ANSI C++ compared to the older I/O of C++?
- 4 What is the importance of ios member flags in formatting I/O?
- 5 What is the difference between I/O using put() and get() and that using getline() and write()?
- 6 What is the advantage of giving two arguments to setf()? Why does it require two arguments?
- 7 Discuss how various member functions of ios can be used for formatting I/O.
- 8 How can we clear all the flags for formatting at the same time?
- 9 What are the differences between manipulators and ios functions?
- 10 What is the requirement for passing and returning reference from a manipulator function?


Module- 5

- 1 What are the different mechanisms of traditional error handling? What is the problem with them?
- 2 What is the need for a communication mechanism between the library designer and the library user? How does exception handling mechanism help?
- 3 What is the problem of destroying objects? How can exception handling help here?
- 4 What is the role of each of the components of the exception handling mechanism?
- 5 What is the role of the terminate() function in exception handling? Why does the exception handling mechanism not call abort() directly?
- 6 What is the difference between throwing exceptions inside and outside the function?
- 7 What is the importance of throwing objects rather than built-in type values?
- 8 When do we need multiple catch blocks for a single try block? Give an example.
- 9 What is the importance of catch all (catch (...))?
- 10 What are exception specifications? In which cases are they needed?
- 11 What is rethrow? What is its use?
- 12 What is the set_terminate() function? Why is it needed?
- 13 What is the unexpected() function? Give an example to explain the need of it.
- 14 What is uncaught_exception() function and why do we need it?
- 15 What are the disadvantages of the exception handling mechanism?

15.0 University Result

Examination	S+	S	A	B	C	D	E	F	% Passing
JAN - 2021	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL

Prepared by	Checked by		
 Dr. K B Manwade	 Dr. Mahesh G. Huddar	 HOD	 Principal

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Subject Title	SOCIAL CONNECT AND RESPONSIBILITY		
Subject Code	21UH36/ 21SCR36	Activity & Reports (10) x 5	50
Number of Lecture Hrs/Week	01(P)	Exam Marks (appearing for)	50
Total Number of Lecture Hrs	15 Lab Slots	Exam Hours	03
CREDITS – 01			

FACULTY DETAILS:		
Name: Shri. S. B. Sarwade	Designation: Assistant Professor	Experience: 19 years
No. of times course taught: 00	Specialization: VLSI Design & ES	

1.0 Prerequisite Subjects:

Sl. No	Branch	Semester	Subject
01	Students should have the knowledge of basic subjects	1 & 2	Universal Human Values

2.0 Course Objectives

1. 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.
2. Provide a formal platform for students to communicate and connect with their surroundings.


3.0 Course Outcomes

Having successfully completed this course, the student will be able to

CO's	Course Outcome	Cognitive Level	PO's
C206.1	Develop an eco-friendly relationship for saving the natural resources and preservation of nature.	U	6,7,8,9,10
C206.2	Develop multicultural awareness and appreciation for Music and Drama by exposing learners to various forms of Art.	U	3,6,7,8,9,10,12
C206.3	Understand the concept of agricultural operations.	U	3,6,7,8,9,10,12
C206.4	Develop an eco-friendly relationship for saving the natural resources and preservation of nature.	U	3,6,7,8,9,10,12
C206.5	Describe the regional culinary practices and its importance in day-to-day life.	U	3,6,7,8,9,10,12
Total Hours of instruction			15

4.0 Course Content

Practical/Theory		
Modules	Teaching Hours	Bloom's Taxonomy (RBT) level
Module 1		
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.	03	L1
Module -2		

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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.	03	L1
Module-3		
Organic farming and waste management: usefulness of organic farming, wet waste management in neighboring villages, and implementation in the campus.	03	L1
Module-4		
Water Conservation: knowing the present practices in the surrounding villages and implementation in the campus, documentary or photo blog presenting the current practices.	03	L1
Module-5		
Food Walk: City's culinary practices, food lore, and indigenous materials of the region used in cooking.	03	L1

5.0 Relevance to future subjects

Sl. No	Semester	Subject	Topics
01	I/II	Universal Human Values	Social Connectivity

6.0 Relevance to Real World

SL.No	Real World Mapping
01	Connecting to Nature and

7.0 Books Used and Recommended to Students

Reference Books
1. Universal Human Values and Professional Ethics, Dr. Ritu Soryan, 2022
2. Universal Human Values and Professional Ethics - S.K. Kataria

8.0 Relevant Websites (Reputed Universities and Others) for Notes/Animation/Videos Recommended

Website and Internet Contents References
1) https://nptel.co.in
2) http://www.uhv.org.in/uhv-1

9.0 Examination Note

Assessment Details both (CIE and SEE):


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 in the social connect period. The report should be signed by the mentor. The report shall be evaluated on the 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

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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 the Jamming session.

10.0 Course Delivery Plan

Module No.	Session No.	Content of Lecture	Teaching Method	% Portion Covered
1. Plantation and adoption of a tree	1	Plantation in campus	Activity	20
	2	Excerpt either as a documentary or a photoblog describing the plant's origin, its usage in daily life,	Activity	
	3	Its appearance in folklore and literature.	Activity	
2. Heritage walk and crafts corner	4	Visit Heritage place near to college	Activity	20
	5	Knowing the history and culture of the city, connecting to people around through their history, knowing the city	Activity	
	6	Its craftsman, photoblog and documentary on evolution and practice of various craft forms.	Activity	
3. Organic farming and waste management	7	Visiting nearby Village	Activity	20
	8	Usefulness of organic farming, wet waste management in neighboring villages.	Activity	
	9	Implementation in the campus	Activity	
4. Water Conservation	10	Visiting nearby Village	Activity	20
	11	Knowing the present practices in the surrounding villages.	Activity	
	12	Implementation in the campus, documentary or photo blog presenting the current practices.	Activity	
5. Food Walk	13	Visiting food streets. Or food corners	Activity	20
	14	City's culinary practices, food lore	Activity	
	15	indigenous materials of the region used in cooking.	Activity	





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		Academics
		Course Plan
		2022-23 ODD

11.0 Assignments, Pop Quiz, Mini Project, Seminars

Sl.No.	Title	Outcome expected	Allied study	Week No.	Individual / Group activity
1	Activity Report 1: Plantation and adoption of a tree	Students carry the activity and will prepare for Final Exam.	Module-1 of the syllabus	3	Group Activity
2	Activity Report 2: Heritage walk and crafts corner	Students carry the activity and will prepare for Final Exam.	Module-2 of the syllabus	6	Group Activity
3	Activity Report 3: Organic farming and waste management	Students carry the activity and will prepare for Final Exam.	Module-3 of the syllabus	9	Group Activity
4	Activity Report 4: Water Conservation	Students carry the activity and will prepare for Final Exam.	Module-4 of the syllabus	12	Group Activity
5	Activity Report 5: Food Walk	Students carry the activity and will prepare for Final Exam.	Module-5 of the syllabus	15	Group Activity

12.0 University Result

Examination	S+	S	A	B	C	D	E	F	% Passing
NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL

Prepared by	Checked by		
			
Shri. S. B. Sarawadi	Shri. S. B. Sarawadi	HOD	Principal