	S J P N Trust's	Hirasugar Institute of Technology, Nidasoshi.	Dept. of CSE
	<i>Inculcating Values, Promoting Prosperity</i>		Academic
	Approved by AICTE, Recognized by Govt. of Karnataka and Permanently Affiliated to VTU Belagavi.		Course Plan
	Accredited at 'A' Grade by NAAC Programmes Accredited by NBA: CSE, ECE, EEE & ME		2021-22 (EVEN)

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, IIIC/Internship Coordinator NBA Criteria 1 Coordinator, Module Coordinator Students Mentor	Dr. K. B. Manwade	Mr. V. V. Manashi
2	Website Coordinator News & Publicity Coordinator Feedback Coordinator, Final year seminar Coordinator NBA Criteria 4 Coordinator, NACC Criteria 3 Co- Coordinator, Module Coordinator, System Programming Lab Incharge, Students Mentor	Dr. Mahesh. G. Huddar	Mr. A. K. Badakar
3	Dept. ED Cell Coordinator, NBA Criteria 6 Coordinator NACC Criteria 1 Co-coordinator, Module Coordinator Class Teacher for VIII Sem. Microprocessor Lab Incharge Students Mentor	Prof. N K Honnagoudar	Mr. A. K. Badakar
4	H.O.D, Innovation Club Coordinator, AICTE activity point Coordinator, Technical magazine / News letter NBA Criteria 7 and 10 Coordinator, Module Coordinator Project Lab Incharge, Students Mentor	Prof. S. V. Manjaragi	Mr. V. V. Manashi
5	GATE/Pre-placement Coaching Coordinator, Dept. T&P coordinator, NBA Criterion 9 Coordinator, NACC Criterion-5 Co-Coordinator, Class Teacher for IV Sem. Students Mentor	Prof. N M Patel	Mr. A. R. Bhiste
6	EMS/IA Coordinator, Alumni Coordinator, NBA Criteria 3 Coordinator, NACC Criterion-7 Co- Coordinator, Dept. Time table Coordinator / Meeting Coordinator, Module coordinator, Students Mentor	Prof. A. A. Daptardar	Mr. V. V. Manashi
7	Project/KSCST Coordinator, NBA Criteria 2 Coordinator HIT QUEST/Techno vision/Student Competitions, Class Teacher for VI Sem, Computer Center Lab Incharge Students Mentor	Prof. Rahul. A. Palakar	Mr. A. K. Badakar
10	Department Association Coordinator(STAC), AICTE /NIRF Coordinator, VTU/LIC Coordinator, Professional body Coordinator (IEEE/ISTE), NBA Criteria 5 Coordinator, Web Programming Lab Incharge, Students Mentor	Prof. P. G. Patil	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 Placement & III Cell	Prof. N. M. Patel (9739619661)	
14.	Anti Ragging Convener	Prof. M. I. Tanodi (9611998812)	
15.	Anti Squad Convener	Prof. M. I. Tanodi (9611998812)	
16.	Internal Complaint Committee Convener	Prof. S. S. Kamate (9008696825)	
17.	Grievance Redressal Convener	Prof. S. S. Tabhaj (9901398134)	
18.	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	10	14
2.	Technical Supporting Staff	04	10
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	17.00	8412968254
2	Dr. Mahesh. G. Huddar	Assoc. Prof	M. Tech, Ph.D	CSE	LMISTE	12.05	7411043272
3	Prof. N. K. Honnagoudar	Asst. Prof.	M.E	ECE	LMISTE	19.00	9449495302
4	Prof. S. V. Manjaragi	Asst. Prof.	M.Tech.(Ph.D)	CSE	LMISTE	18.00	9986658309
5	Prof. N. M. Patel	Asst. Prof	M. Tech	CSE	LMISTE	16.08	9739619661
6	Prof. A. A. Daptardar	Asst. Prof	M. Tech.	CSE	LMISTE	15.00	9620851002
7	Prof. Rahul .A. Palakar	Asst. Prof	M. Tech.	CSE	--	10.00	7829241219
8	Prof. P. G. Patil	Asst. Prof	M. Tech	CSE	LMISTE,CSI,IE	08.08	9743202717
9	Prof. R. R. Patil	Guest Lecturer	M. Tech	CSE	LMISTE	13.00	9739619661
10	Prof. C. R. Belavi	Guest Lecturer	M. Tech	CSE	LMISTE	12.00	782941219



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Dept. of CSE

Academic

Course Plan

2021-22 (EVEN)

4.0

Institute Academic Calendar

CALENDAR OF EVENTS FOR THE ACADEMIC YEAR 2021-22 OF IV SEMESTER (EVEN)

Date	Events																																																									
23-05-2022	Commencement of IV Semester Classes	<table border="1"> <thead> <tr> <th colspan="7">May-2022</th> </tr> <tr> <th>S</th> <th>M</th> <th>T</th> <th>W</th> <th>T</th> <th>F</th> <th>S</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> <td>6</td> <td>7</td> </tr> <tr> <td>8</td> <td>9</td> <td>10</td> <td>11</td> <td>12</td> <td>13</td> <td>14</td> </tr> <tr> <td>15</td> <td>16</td> <td>17</td> <td>18</td> <td>19</td> <td>20</td> <td>21</td> </tr> <tr> <td>22</td> <td>23</td> <td>24</td> <td>25</td> <td>26</td> <td>27</td> <td>28</td> </tr> <tr> <td>29</td> <td>30</td> <td>31</td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table>	May-2022							S	M	T	W	T	F	S	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31											
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31-05-2022	Anti-Tobacco Day	03-Basav Jayanthi, Akshay Tritiya, Khutub-E-Ramaza																																																								
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13-08-2022	TECHNOVISION -2K22	09-Last Day of Moharam, 15-Independence Day																																																								
29-08-2022 to 30-08-2022	Lab Internal Assessment for IV Semester	31-Varasiddhi Vinayaka Vrata																																																								
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	 17/5/22 Dr. B. V. Madiggond Dean (Acad)	 17/5/22 Dr. S. C. Kamate Principal																																																								



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Dept. of CSE

Academic

Course Plan

2021-22 (EVEN)

5.0 Department Academic Calendar

CALENDAR OF EVENTS FOR THE ACADEMIC YEAR 2021-22 OF IV, VI & VIII SEMESTER (EVEN)

Date	Events
04-04-2022	Commencement of VI/VIII Semester Classes
18-04-2022 to 29-04-2022	Training on Python under Skill India
09-05-2022 to 11-05-2022	First Internal Assessment for VI Semester
09-05-2022 to 10-05-2022	First Internal Assessment for VIII Semester
12-05-2022	Feedback-I on Teaching-Learning
16-05-2022	Display of 1 st I.A. Marks and submission of Feedback-I to office
17-05-2022	Webinar on Latest Technology
19-05-2022 to 21-05-2022	Industrial Visit 6 th & 8 th Semester
23-05-2022	Commencement of 4 th Semester
30-05-2022 to 31-05-2022	Second Internal Assessment for VIII Semester
31-05-2022	Indoor Sports Day
02-06-2022	Feedback-II on Teaching-Learning of VIII Semester
02-06-2022 to 04-06-2022	Face Painting & Rangoli Competition
06-06-2022	Display of 2 nd I.A. Marks and submission of Feedback-II to office of VIII Semester
07-06-2022	On Spot Poster Making Competition
09-06-2022 to 11-06-2022	Second Internal Assessment for VI Semester
13-06-2022	Feedback-II on Teaching-Learning of VI Semester
14-06-2022	32 Hours Workshop on "IoT" (6 th Sem)
15-06-2022	Display of 2 nd I.A. Marks and submission of Feedback-II to office of VI Semester
16-06-2022 to 18-06-2022	HSIT-FEST *
21-06-2022	International Yoga Day Celebration
27-06-2022 to 29-06-2022	1 st & 3 rd Internal Assessment for IV & VIII Semester
30-06-2022	Display of Final IA Marks of VIII Semester & Feedback I on TL- 4 th Sem
30-06-2022	Last working day of VIII th Semester
05-07-2022	Git & GitHub
11-07-2022 to 13-07-2022	Third Internal Assessment for VI Semester
14-07-2022 to 15-07-2022	Lab Internal Assessment for VI Semester
16-07-2022	Display of Final IA Marks of VI Semester
16-07-2022	Last working day of VI th Semester
19-07-2022	Placement Activity "Codeathon-2022"
21-07-2022	Project Exhibition
25-07-2022 to 27-07-2022	2 nd Internal Assessment for IV Semester
28-07-2022	Feedback-II on Teaching-Learning of IV Semester
29-07-2022	Graduation Day
02-08-2022	Industrial Visit for 4 th Semester
16-08-2022	Technical Talk by Industry Experts on Latest Technology
23-08-2022	Webinar on Latest Technology
29-08-2022 to 30-08-2022	Lab Internal Assessment for IV Semester
01-09-2022 to 03-09-2022	Third Internal Assessment for IV Semester
03-09-2022	Last working day of IV th Semester
18-07-2022 to 29-07-2022	Practical Examination of VI Semester
01-08-2022 to 20-08-2022	Theory Examination of VI Semester
04-07-2022 to 20-07-2022	Theory Examination of VIII Semester
05-09-2022 to 13-09-2022	Practical Examination of IV Semester
16-09-2022 to 08-10-2022	Theory Examination of IV Semester
22-07-2022 to 30-07-2022	Internship Viva Voce/Project Viva for VIII Semester

April- 2022						
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02-Ugadi Festival,
14- Dr. B. R. Ambedkar Jayanthi
15-Good Friday

May-2022						
S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

03-Basav Jayanthi, Akshay Tritiya,
Khutub-E-Ramazan

June-2022						
S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		


July-2022						
S	M	T	W	T	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

August-2022						
S	M	T	W	T	F	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

09-Last Day of Moharam, 15-Independence Day, 31-Varasiddhi Vinayaka Vrata

Prof. Prasanna Patil
STAC COORDINATOR

Prof. S. V. Manjaragi
HOD

	S J P N Trust's		Dept. of CSE
	Hirasugar Institute of Technology, Nidasoshi.		Academic
	<i>Inculcating Values, Promoting Prosperity</i>		Course Plan
	Approved by AICTE, Recognized by Govt. of Karnataka and Permanently Affiliated to VTU Belagavi.		2021-22 (EVEN)
Accredited at 'A' Grade by NAAC			
Programmes Accredited by NBA: CSE, ECE, EEE & ME			

6.0 Scheme of Teaching & Examination

B.E: Computer Science and Engineering

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI Scheme of Teaching and Examination 2018 – 19 Choice Based Credit System (CBCS) AND Outcome Based Education (OBE) (Effective from the academic year 2018 – 19)

IV SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department	Teaching Hours /Week			Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Duration in hours	CIE Marks	SEE Marks	Total Marks	
1	BSC	18MAT41	Complex Analysis, Probability and Statistical Methods	Mathematics	2	2	--	03	40	60	100	3
2	PCC	18CS42	Design and Analysis of Algorithms	CS / IS	3	2	--	03	40	60	100	4
3	PCC	18CS43	Operating Systems	CS / IS	3	0	--	03	40	60	100	3
4	PCC	18SC44	Microcontroller and Embedded Systems	CS / IS	3	0	--	03	40	60	100	3
5	PCC	18CS45	Object Oriented Concepts	CS / IS	3	0	--	03	40	60	100	3
6	PCC	18CS46	Data Communication	CS / IS	3	0	--	03	40	60	100	3
7	PCC	18CSL47	Design and Analysis of Algorithm Laboratory	CS / IS	--	2	2	03	40	60	100	2
8	PCC	18CSL48	Microcontroller and Embedded Systems Laboratory	CS / IS	--	2	2	03	40	60	100	2
9	HSMC	18KVK49	Vyavaharika Kannada (Kannada for communication)/	HSMC	--	2	--	--	100	--	100	1
		18KAK49	Aadalitha Kannada (Kannada for Administration)									
		OR	OR									
		18CPC39	Constitution of India, Professional Ethics and Cyber Law									
TOTAL					17	08	04	24	420	480	900	24
					OR	OR	OR	OR	OR			
					18	10	04	26	360	540		

Note: BSC: Basic Science, PCC: Professional Core, HSMC: Humanity and Social Science, NCMC: Non-credit mandatory course

18KVK49 Vyavaharika Kannada (Kannada for communication) is for non-Kannada speaking, reading and writing students and **18KAK49** Aadalitha Kannada (Kannada for Administration) is for students who speak, read and write Kannada.

Course prescribed to lateral entry Diploma holders admitted to III semester of Engineering programs

10	NCMC	18MATDIP41	Additional Mathematics - II	Mathematics	02	01	--	03	40	60	100	0
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(a) The mandatory non – credit courses Additional Mathematics I and II prescribed for III and IV semesters respectively, to the lateral entry Diploma holders admitted to III semester of BE/B.Tech programs, shall attend the classes during the respective semesters to complete all the formalities of the course and appear for the University examination. 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 F grade. In such a case, the students have to fulfill the requirements during subsequent semester/s to appear for SEE.

(b) These Courses shall not be considered for vertical progression, but completion of the courses shall be mandatory for the award of degree

Courses prescribed to lateral entry B. Sc degree holders admitted to III semester of Engineering programs

Lateral entrant students from B.Sc. Stream, shall clear the non-credit courses Engineering Graphics and Elements of Civil Engineering and Mechanics of the First Year Engineering Programme. These Courses shall not be considered for vertical progression, but completion of the courses shall be Mandatory for the award of degree.

AICTE activity Points: In case students fail to earn the prescribed activity Points, Eighth semester Grade Card shall be issued only after earning the Required activity Points. Students shall be admitted for the award of degree only after the release of the Eighth semester Grade Card.

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SUBJECT TITLE	COMPLEX ANALYSIS, PROBABILITY AND STATISTICAL METHODS		
Subject Code	18MAT41	IA Marks	40
Number of Lecture Hrs / Week	(2:2:0)	Exam Marks	60
Total Number of Lecture Hrs	45	Exam Hours	03
CREDITS – 03			

FACULTY DETAILS:		
Name: Prof. S. A. Patil	Designation: Asst. Professor	Experience: 10
No. of times course taught: 04	Specialization: Mathematics	

1.0 Prerequisite Subjects:

Sl. No	Branch	Semester	Subject
01	Computer Science and Engineering	III	Engineering Mathematics-III

2.0 Course Objectives

- To provide an insight into applications of complex variables, conformal mapping and special functions arising in potential theory, quantum mechanics, heat conduction and field theory.
- To develop probability distribution of discrete, continuous random variables and joint probability distribution occurring in digital signal processing, design engineering and microwave engineering.

3.0 Course Outcomes

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

	Course Outcome	POs
CO1	Use the concepts of analytic function and complex potentials to solve the problems arising in Electromagnetic field theory.	1,2,3,12
CO2	Utilize conformal transformation and complex integral arising in aerofoil theory, fluid flow Visualization and image processing.	1,2,3,12
CO3	Apply discrete and continuous probability distributions in analyzing the probability models arising in engineering field.	1,2,3,12
CO4	Make use of the correlation and regression analysis to fit a suitable mathematical model for the Statistical data.	1,2,3,12
CO5	Construct joint probability distributions and demonstrate the validity of testing the hypothesis.	1,2,3,12
Total Hours of instruction		50


4.0 Course Content

MODULE-I (09 Hours)

Calculus of complex functions: Review of function of a complex variable, limits, continuity, and differentiability. Analytic functions: Cauchy-Riemann equations in Cartesian and polar forms and consequences. **Construction of analytic functions:** Milne-Thomson method-Problems.

MODULE-II (09 Hours)

Conformal transformations: Introduction Discussion of transformations $w = z^2, w = e^z, w = z + \frac{1}{z} (z \neq 0)$. Bilinear transformations- Problems. **Complex integration:** Line integral of a complex function-Cauchy's theorem and Cauchy's integral formula and Problems.

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MODULE-III (09 Hours)
Probability Distributions: Review of basic probability theory. Random variables (discrete and continuous), Probability mass/density functions. Binomial, Poisson, exponential and normal distributions- problems (No derivation for mean and standard deviation)-Illustrative examples.

MODULE-IV (09 Hours)
Statistical Methods: Correlation and regression-Karl Pearson's coefficient of correlation and rank correlation-problems. Regression analysis- lines of regression –problems.**Curve Fitting:** Curve fitting by the method of least squares- fitting the curves of the form- $y = ax + b$, $y = ax^b$ and $y = ax^2 + bx + c$

MODULE-V (09 Hours)
Joint probability distribution: Joint Probability distribution for two discrete random variables, expectation and covariance. **Sampling Theory:** Introduction to sampling distributions, standard error, Type-I and Type-II errors. Test of Hypothesis for means, student's t-distribution, Chi-square distribution as a test of goodness of fit.

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	Calculus of complex functions is 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	Probability Distributions used to design and Analysis of algorithm, interpreting data, Machine learning and artificial intelligence
03	Sampling Theory are used in design engineering, Sensors, image scanning, electricity generation & Quality of the products

7.0 Gap Analysis and Mitigation

Sl. No	Delivery Type	Details
01	Tutorial	Topic: Sampling Theory

8.0 Books Used and Recommended to Students

Text Books
1. B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers, 44 th Edition, 2017.
2. E. Kreyszig: Advanced Engineering Mathematics, John Wiley & Sons, 10 th Edition, 2016
3. Srimanta Pal et al: Engineering Mathematics, Oxford University Press, 3 rd Edition, 2016
Reference Books
1. N.P.Bali and Manish Goyal: A Text Book of Engineering Mathematics, Laxmi Publishers, 2014.
2. B.V.Ramana: "Higher Engineering Mathematics" Tata McGraw-Hill, 2006.
3. C. Ray Wylie, Louis C. Barrett: Advanced Engineering Mathematics, McGraw-Hill, 6 th Edition 1995
4. S.S.Sastry: Introductory Methods of Numerical Analysis, Prentice Hall of India 4 th Edition 2010
5. Chandrika Prasad and Reena Garg : Advanced Engineering Mathematics, Khanna Publishing, 2018
6. H. K. Dass and Er. Rajnish Verma: "Higher Engineering Mathematics", S. Chand publishing, 1st edition, 2011.
Additional Study material & e-Books
1. N.P.Bali & Manish.Goyal, A Text book of Engineering Mathematics, 7 th edition, Laxmi Publications.

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

Website and Internet Contents References
1. http://nptel.ac.in/courses.php?disciplineID=111 2. http://www.khanacademy.org/ 3. http://www.class-central.com/subject/math

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

11.0 Examination Note

Internal Assessment: 30+10=40 Marks

50 marks –from three internal assessment test

10 marks- from the assignments

Scheme of Evaluation for Internal Assessment (50 Marks)

- a) Internal Assessment test in the same pattern as that of the main examination (Average of the three Tests): 50marks.
- b) Assignment marks for each module is 25. Average of 5 assignment marks will be taken and finally scale down to 10 marks.

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 25 marks, Total test marks are 50.
 - a. Q.No I or Q.No II = 25 Marks
 - b. Q.No III or Q.No IV = 25 Marks
 - c. **Total = 50 Marks**

Question Paper Pattern and instructions (Main Exam):

1. The question paper will have TEN questions.
2. There will be TWO questions from each module.
3. Each question will have questions covering all the topics under a module.
4. The students will have to answer FIVE full questions, selecting ONE full question from each module.
 Max. Marks: 100 and each question carries 20 marks.
 Exam Duration: 3 Hrs.
5. The total marks scored out of 100 marks will be scaled down to 60 marks.

12.0 Course Delivery Plan


Module	Lecture No.	Content of Lecturer	% of Portion
MODULE 1	1	Review of a function of a complex variable, limits, continuity, differentiability	20
	2	Analytic functions-Cauchy-Riemann equation in Cartesian form	
	3	Problems	
	4	Cauchy-Riemann equation in Polar form	
	5	Problems	
	6	construction of analytic functions	
	7	Properties of Cauchy-Riemann equation	
	8	Problems	
	9	Milne-Thomson method	

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MODULE 2	10	Conformal Transformations and discussion of transformations of $w = z^2$, $w = e^z$	20
	11	Discussion of Transformations: $w = z + (1/z)$.	
	12	Bilinear transformations	
	13	Problems	
	14	Complex line integrals-Cauchy's theorem	
	15	Cauchy's integral formula	
	16	Problems	
	17	Residue, poles	
	18	Cauchy's Residue theorem	
MODULE 3	19	Random variables (discrete and continuous)	20
	20	Probability mass/density functions	
	21	Binomial distribution.	
	22	Problems	
	23	Poisson distribution.	
	24	Problems	
	25	Exponential distribution.	
	26	Problems.	
MODULE 4	27	Normal distributions.	20
	28	Statistical Methods: Review of measures of central tendency and dispersion	
	29	Correlation-Karl Pearson's coefficient of correlation	
	30	Problems	
	31	Regression analysis- lines of regression (without proof) –problems	
	32	Curve fitting by the method of least squares, of the form, form $y = ax + b$,	
	33	Problems.	
	34	Curve fitting by the method of least squares: $y = a + bx + cx^2$	
MODULE 5	35	Problems.	20
	36	Curve fitting by the method of least squares $y = ae^{bx}$	
	37	Joint Probability distribution for two discrete random variables	
	38	Expectation, covariance.	
	39	Sampling & Sampling distributions	
	40	standard error, test of hypothesis for means and proportions	
	41	confidence limits for means	
	42	Problems.	
43	student's t-distribution		
44	Problems.		
45	Chi-square distribution as a test of goodness of fit.		

13.0 Assignments, Pop Quiz, Mini Project, Seminars

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 1
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 1
3	Assignment 3: Some important University Questions on	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 1

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	module three.					
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 1 and reference books 1
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 1 and reference books 1

14.0 QUESTION BANK

MODULE-1: Calculus of complex functions

- Derive Cauchy-Riemann equations in the Cartesian form.
- Derive Cauchy-Riemann equations in the Polar form.
- P.T if $f(z) = u + iv$ is an analytic then the family of curves $u(x,y) = C_1$, $v(x,y) = C_2$, C_1 & C_2 being Constants, intersect each other orthogonally
- S.T $w = \log z$, $z \neq 0$ is analytic & find .
- Find the analytic function $f(z)$ as a function of z given that the sum of its real & imaginary parts is
- $-y^2 + 3xy(x - y)$
- Determine the analytic function Whose imaginary part is 2θ
- Determine the analytic function Whose real part is $\frac{x \cosh y}{x + \cosh 2y}$
- Find the analytic function $f(z) = u + iv$ given $u - v = e^x(\cos y - \sin y)$
- If $f(z)$ analytic show that $\left[\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2} \right] |f(z)|^2 = 4|f'(z)|^2$

MODULE-2: Conformal transformations

- Discuss the conformal transformation of z^2
- Discuss the conformal transformation of e^z
- Find the bilinear transformation which map the points $z = 1, i, -i$ under this transformation find the image of $|z| < 1$.
- Find the bilinear transformation which maps $z = \infty, i, 0$ into $w = -1, -i, 1$. Also find the pts of transformation
- State & prove Cauchy integral Theorem.
- Verify Cauchy's theorem for the function $f(z) = z^2$ where c is the square having vertices
- $(0,0), (1,0), (1,1)$ & $(0,1)$
- Evaluate $\int dz$ over each of the following contours C , a) $|z| = 2\pi$, b) $|z| = \pi/2$, c) $|z-1| = 1$
- State & prove Cauchy integral Theorem.

MODULE-3: Probability Distributions

- Find the mean & variance of Binomial distribution.
- The marks of 1000 students in an examination follows in a normal distribution with mean 70 & SD 5. Find the number of students whose marks will be i) less than 65 , ii) more than 75 & iii) between 65 & 75.
- The probability mass function of a variate X is

$X = x_i$	-2	-1	0	1	2	3
$p(x)$	0.1	K	0.2	2k	0.3	k
- Find i) The value of K, ii) ≤ 0 , iii) > 1 iv) $2 < x \leq 1$
- If 10% of the rivets produced by a machine are defective, find the probability that, out of 12 rivets chosen at random.
- S.T mean & standard deviation of exponential distribution are equal.
- In a test of 2000 electric bulbs, it was found that the life of a bulb is a normal variable with average life of 2040 hours & standard deviation of 60 hours. Estimate the number of bulbs to burn for i) More than 2150 hours , ii) less than 1950 hours , Given that $p[0 \leq z \leq 1.83] = 0.4664$ & $p[0 \leq z \leq 1.33] = 0.4082$.
- 2% of the fusion manufactured by a firm are found to be defective .Find the probability that a box containing 200 fuses contains i) no defective fuse , ii) 3 or more defective fuses.
- In length of a telephone conversation is an exponential variate with mean 3 minutes. Find the probability that call i) ends in less than 3 minutes , ii) takes between 3 to 5 minutes.
- Suppose that the student IQ scores form a normal distribution with average 100 & standard deviation 20. Find the percentage of students whose (i) score less than 80 (ii) score more than 120 (iii) score falls between 80 & 120 (G T $P(1)=0.3413$)
- In a certain town the duration of a shower is exponentially distributed with mean 5 minutes what is the probability that a shower will last for i) 10 minutes or more, ii) less than 10 minutes, iii) betn 10 min & 12 min
- The probability that a person aged 60 years will live upto 70 is 0.65. what is the probability that out of 10 persons aged 60 atleast 7 of them will live upto 70.

MODULE-4: Statistical Methods

- Find the correlation coefficient and regression lines of y and x and x and y for the following data

x	1	2	3	4	5
y	2	5	3	8	7

- Find the coefficient of correlation for the following data.

x	10	14	18	22	26	30
y	18	12	24	6	30	36

- Compute the rank correlation coefficient for the following data

x	68	64	75	50	64	80	75	40	55	64
y	62	58	68	45	81	60	68	48	50	70

- Ten students got the following % of marks in two subjects x and y. Compute their rank correlation coefficient.

Marks in x	78	36	98	25	75	82	90	62	65	39
Marks in y	84	51	91	60	68	62	86	58	53	47

Curve Fitting and Optimization:

- Find the equation of the best fitting straight line for the data

x	0	1	2	3	4	5
y	9	8	24	28	26	20

- 2) A simply supported beam carries a concentrated load p at its midpoint corresponding to various Values of p the maximum deflection y is measured & is given below

p	100	120	140	160	180	200
y	0.45	0.55	0.60	0.70	0.80	0.85

Find the law of the form $y = a+bp$ & hence estimate y when $p = 150$.

- 3) Fit a second degree parabola of best fit $y = a+bx+cx^2$

x	1.0	1.5	2.0	2.5	3.0	3.5	4.0
y	1.1	1.3	1.6	2.0	2.7	3.4	4.1

- 4) Fit a second degree parabola $y = ax^2+bx+c$ in the least square sense for the following data

x	0	1	2	3	4
y	1	1.8	1.3	2.5	2.3

- 5) Fit a least square geometric curve $y = ax^b$ from the following data

x	1	2	3	4	5
y	0.5	2.0	4.5	8.0	12.5

- 6) The voltage v across a capacitor at time t sec is given by the following table

t	0	2	4	6	8
v	150	63	28	12	5.6

Use the method of least square of to fit a curve of the form $v = ae^{kt}$ to this data

MODULE-5: Joint probability distribution:

- Explain the following terms i) Null hypothesis , ii) Level of significance , iii) Type I & II errors , iv) Confidence limits.
- A sample of 100 days is taken from meteorological records of certain districts & 10 of them are found to be fussy. Find the 99.73 % confidence interval of the % of fussy days in the distinct.
- A certain stimulus administered to each of the 12 patients resulted in the following blood pressure 5,2,8,-1,3,0,6,-2,1,5,0,4, can it be calculated that stimulus will increase the blood pressure ?
[$t_{0.05}$ for 11 d.f = 2.201]
- A die was thrown 9000 times & a throw of 5 or 6 was obtained 3240 times. On the assumption of random throwing, do the data abdicate that the die is biased?
- A random sample of 100 records deaths in past year showed an average life span of 71.8 years. Assuming a population standard deviation of 8.9 years, does the data indicated that average life span today is greater than 70 years? Use a 0.05 level of significance.
- In 324 throws of a six faced die, an odd number turned up 181 times. Is it reasonable to think that the die is an unbiased one?
- Four coins are tossed 100 times & the following results were obtained

No. of Heads	0	1	2	3	4
Frequencies	5	29	36	25	5

Fit a Binomial distribution for the data & test the goodness of fit given

$$\chi^2_{0.05} = 9.49 \text{ for } 4 \text{ d. f}$$

- Find the student's 't' for the following variable values in a sample of eight -4,-2,-2,0,2,2,3,3 taking the mean of the universe to be zero.
- A coin was tossed 400 times & the head turned up 216 times. Test the hypotheses that the coin is in biased at 5% level significance.

10. A die was thrown 1200 times & the number 6 was obtained 236 times. Can the die be considered fair at level of significance?

11. The joint probability distribution for two random variables X and Y is as given below.

Y X	-2	-1	4	5
1	0.1	0.2	0	0.3
2	0.2	0.1	0.1	0

Find the marginal distributions of X, Y. Also find the covariance of X and Y.

12. The Joint probability distribution of two random variables X and Y is as follows





Y X	-4	2	7
1	1/8	1/4	1/8
5	1/4	1/8	1/8


13. Determine (i) Marginal distribution of X & Y (ii) $E(X)$, $E(Y)$ and $E(XY)$ (iii) $Cov(XY)$ (iv) $\rho(XY)$.

14. A fair coin is tossed 4 times. Let X denotes the number of heads occurring and let Y denotes the longest string of heads occurring. Find the joint distribution function of X and Y.

15.0 University Result

Examination	S+	FCD (S, A, B)	FC (C)	SC (D, E)	FAIL (F)	% Passing
June/July-2020	NA	41	02	00	00	100
Jan 2021	NA	46	07	00	00	100

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

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SUBJECT TITLE	DESIGN AND ANALYSIS OF ALGORITHMS		
Subject Code	18CS42	IA Marks	40
Number of Lecture Hrs / Week	04	Exam Marks	60
Total Number of Lecture Hrs	50	Exam Hours	03
CREDITS – 04			

FACULTY DETAILS:		
Name: Prof. A. A. Daptardar	Designation: Asst. Professor	Experience: 15 Years
No. of times course taught: 03		Specialization: Computer Science and Engineering

1.0 Prerequisite Subjects:

Sl. No	Branch	Semester	Subject
01	Computer Science and Engineering	I/II	PCD
02	Computer Science and Engineering	III	DSC

2.0 Course Objectives

This course will enable students to

1. Explain various computational problem solving techniques.
2. Apply appropriate method to solve a given problem.
3. Describe various methods of algorithm analysis.

3.0 Course Outcomes

After studying this course, students will be able to

CO	Course Outcome	RBT Level	POs
C211.1	Explain the specifications of algorithms, fundamental data structures and their operations.	L1, L2, L3	1,2,3,8,10,12
C211.2	Explain various searching problem solving techniques.	L1, L2, L3	1,2,3,8,10,12
C211.3	Explain various sorting problem solving techniques.	L1, L2, L3	1,2,3,8,10,12
C211.4	Estimate the computational complexity of different algorithms.	L1, L2, L3	1,2,3,8,10,12
C211.5	Choose appropriate algorithmic strategies for problem solving.	L1, L2, L3	1,2,3,8,10,12
Total Hours of instruction		50	

4.0 Course Content

Module 1


(10 Hours)

Introduction: What is an Algorithm? (T2:1.1), Algorithm Specification (T2:1.2), Analysis Framework (T1:2.1), **Performance Analysis:** Space complexity, Time Complexity (T2:1.3). **Asymptotic Notations:** Big-Oh notation (O), Omega notation (Ω), Theta notation (Θ), and Little-oh notation (o), **Mathematical analysis of Non-Recursive and recursive Algorithms with Examples (T1:2.2, 2.3, 2.4).** **Important Problem Types:** Sorting, Searching, String processing, Graph Problems, Combinatorial Problems. **Fundamental Data Structures:** Stacks, Queues, Graphs, Trees, Sets and Dictionaries.(T1:1.3,1.4)

Module 2

(10 Hours)

Divide and Conquer: General method, Binary search, Recurrence equation for divide and conquer, Finding the maximum and minimum (T2:3.1, 3.3, 3.4), Merge sort, Quick sort (T1:4.1, 4.2), Strassen's matrix multiplication (T2:3.8), Advantages and Disadvantages of divide and conquer. **Decrease and Conquer Approach:** Topological Sort. (T1:5.3)

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Module 3

(10 Hours)

Greedy Method: General method, Coin Change Problem, Knapsack Problem, Job sequencing with deadlines (T2:4.1, 4. (10 Hours)3, 4.5). **Minimum cost spanning trees:** Prim's Algorithm, Kruskal's Algorithm (T1:9.1, 9.2). **Single source shortest paths:** Dijkstra's Algorithm (T1:9.3). **Optimal Tree problem:** Huffman Trees and Codes (T1:9.4). **Transform and Conquer Approach:** Heaps and Heap Sort (T1:6.4).

Module 4

(10 Hours)

Dynamic Programming: General method with Examples, Multistage Graphs (T2:5.1, 5.2). **Transitive Closure:** Warshall's Algorithm, **All Pairs Shortest Paths:** Floyd's Algorithm, Optimal Binary Search Trees, Knapsack problem ((T1:8.2, 8.3, 8.4), Bellman-Ford Algorithm (T2:5.4), Travelling Sales Person problem (T2:5.9), Reliability design (T2:5.8).

Module 5

(10 Hours)

Backtracking: General method (T2:7.1), N-Queens problem (T1:12.1), Sum of subsets problem (T1:12.1), Graph coloring (T2:7.4), Hamiltonian cycles (T2:7.5). **Branch and Bound:** Assignment Problem, Travelling Sales Person problem (T1:12.2), **0/1 Knapsack problem (T2:8.2, T1:12.2):** LC Branch and Bound solution (T2:8.2), FIFO Branch and Bound solution (T2:8.2). **NP-Complete and NP-Hard problems:** Basic concepts, non-deterministic algorithms, P, NP, NP-Complete, and NP-Hard classes (T2:11.1).

5.0 Relevance to future subjects

Sl No	Semester	Subject	Topics
01	VIII	Project work	Design, Develop and Analysis

6.0 Relevance to Real World


SL.No	Real World Mapping
01	Design and analysis of algorithms for a problem
02	Development of a software applications

7.0 Gap Analysis and Mitigation

Sl. No	Delivery Type	Details
01	Tutorial	Different Algorithms' Discussion for some problems
02	NPTEL	Software Applications

8.0 Books Used and Recommended to Students

Text Books
1. Introduction to the Design and Analysis of Algorithms, Anany Levitin:, 2 nd Edition, 2009.Pearson
2. Computer Algorithms/C++, Ellis Horowitz, Satraj Sahni and Rajasekaran, 2 nd Edition, 2014, Universities Press
Reference Books
1. Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein, 3rd Edition, PHI
2. Design and Analysis of Algorithms , S. Sridhar, Oxford (Higher Education)
Additional Study material & e-Books
1. Lecture Notes for Algorithm Analysis and Design by Sandeep Sen
2. Introduction to the Design and Analysis of Algorithms by K. Raghava Rao

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

Website and Internet Contents References
1. http://freecomputerbooks.com/Introduction-to-Design-Analysis-of-Algorithms.html
2. http://www.freebookcentre.net/ComputerScience-Books-Download/Lecture-Notes-for-Algorithm-Analysis-and-Design-(PDF-124P).html
3. http://www.e-booksdirectory.com/details.php?ebook=9498

10.0 Magazines/Journals Used and Recommended to Students

Sl. No	Magazines/Journals	website
1	Journal of Discrete Algorithms	https://www.journals.elsevier.com/journal-of-discrete-algorithms/
2	American Journal of Algorithms and Computing	http://ajac.uscip.us/
3	International Journal of Computing Algorithm (IJCOA)	https://www.ijcoa.com/
4	International Journal of Algorithms Design and Analysis	http://journalspub.com/journalspub/JournalsDetails.aspx?jid=109

11.0 Examination Note

Internal Assessment: 30+10=40 Marks

- 50 marks –from three internal assessment test
- 10 marks- from the assignments

Scheme of Evaluation for Internal Assessment (50 Marks)


- a) Internal Assessment test in the same pattern as that of the main examination (Average of the three Tests): 50marks.
- b) Assignment marks for each module is 25. Average of 5 assignment marks will be taken and finally scale down to 10 marks.

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 25 marks, Total test marks are 50.
 - a. Q.No I or Q.No II = 25 Marks
 - b. Q.No III or Q.No IV = 25 Marks
 - c. **Total = 50 Marks**


Question Paper Pattern and instructions (Main Exam):

1. The question paper will have TEN questions.
2. There will be TWO questions from each module.
3. Each question will have questions covering all the topics under a module.
4. The students will have to answer FIVE full questions, selecting ONE full question from each module.
Max. Marks: 100 and each question carries 20 marks.
Exam Duration: 3 Hrs.
5. The total marks scored out of 100 marks will be scaled down to 60 marks.

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12.0 Course Delivery Plan

Module	Lecture No.	Content of Lecturer	% of Portion
1	1	Introduction: What is an Algorithm? (T2:1.1), Algorithm Specification (T2:1.2), Analysis Framework (T1:2.1).	20
	2	Performance Analysis: Space complexity, Time complexity (T2:1.3).	
	3	Asymptotic Notations: Big-Oh notation (O), Omega notation (Ω), Theta notation (Θ), and	
	4	Little-oh notation (o).	
	5	Mathematical analysis of Non-Recursive and recursive Algorithms with Examples (T1:2.2,	
	6	2.3, and 2.4).	
	7	Important Problem Types: Sorting, Searching, String processing, Graph Problems,	
	8	Combinatorial Problems.	
	9	Fundamental Data Structures: Stacks, Queues, Graphs, Trees, Sets and	
	10	Dictionaries.(T1:1.3,1.4)	
2	11	Divide and Conquer: General method.	20
	12	Binary search, Recurrence equation for divides and conquers.	
	13		
	14	Finding the maximum and minimum (T2:3.1, 3.3, and 3.4).	
	15		
	16	Merge sort, Quick sort (T1:4.1, 4.2).	
	17		
	18	Strassen's matrix multiplication (T2:3.8).	
	19	Advantages and Disadvantages of divide and conquer.	
	20	Decrease and Conquer Approach: Topological Sort. (T1:5.3)	
3	21	Greedy Method: General method.	20
	22		
	23	Coin Change Problem, Knapsack Problem, Job sequencing with deadlines (T2:4.1, 4.3, and	
	24	4.5).	
	25	Minimum cost spanning trees: Prim's Algorithm, Kruskal's Algorithm (T1:9.1, 9.2).	
	26		
	27	Single source shortest paths: Dijkstra's Algorithm (T1:9.3).	
	28	Optimal Tree problem: Huffman Trees and Codes (T1:9.4).	
	29		
	30	Transform and Conquer Approach: Heaps and Heap Sort (T1:6.4).	
4	31	Dynamic Programming: General method with Examples.	20
	32		
	33	Multistage Graphs (T2:5.1, 5.2)	
	34	Transitive Closure: Warshall's Algorithm	
	35	All Pairs Shortest Paths: Floyd's Algorithm, Optimal Binary Search Trees, Knapsack	
	36	problem ((T1:8.2, 8.3, 8.4).	
	37		
	38	Bellman-Ford Algorithm (T2:5.4)	
	39	Travelling Sales Person problem (T2:5.9)	
	40	Reliability design (T2:5.8).	
5	41	Backtracking: General method (T2:7.1).	20
	42	N-Queens problem (T1:12.1).	
	43	Sum of subsets problem (T1:12.1)	
	44	Graph coloring (T2:7.4)	
	45	Hamiltonian cycles (T2:7.5).	
	46	Branch and Bound: Assignment Problem, Travelling Sales Person problem (T1:12.2),	
	47	0/1 Knapsack problem (T2:8.2, T1:12.2)	
	48	LC Branch and Bound solution (T2:8.2), FIFO Branch and Bound solution (T2:8.2).	
	49	NP-Complete and NP-Hard problems: Basic concepts, non-deterministic algorithms, P,	
	50	NP, NP-Complete, and NP-Hard classes (T2:11.1).	

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13.0 Assignments, Pop Quiz, Mini Project, Seminars

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 1
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 1,2
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 1,2
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 1,2
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 1,2

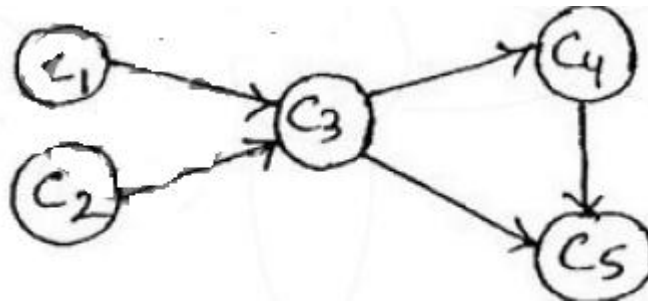
14.0 QUESTION BANK

Module 1: Introduction

1. What is an Algorithm? What are the criteria that an algorithm must satisfy? [Dec-2018]
2. What is performance analysis? Explain time complexity and space complexity with the examples.
3. [July-2017]
4. With the help of a flowchart, explain the various steps of algorithm design & analysis process.
5. Define algorithm. Explain asymptotic notations used for algorithm analysis. [July-2017]
6. Given a positive decimal integer n, write a recursive algorithm which computes the number of binary digits in the binary representation of n. Write the corresponding recurrence relation and solve it
7. Mention the general plan for Analyzing time efficiency of non-recursive algorithms with example. [July-2017]
8. Mention the general plan for Analyzing time efficiency of recursive algorithms; and analyze and establish the order of growth of Tower of Hanoi algorithm. .[July-2017]
9. Define the fundamental data structures.
10. Write and analyze the algorithm of element uniqueness problem and establish its order of growth.
11. Explain the asymptotic notations with examples. [Dec-2018]
12. Distinguish between the two common ways to represent a graph. [Dec-2018]
13. Discuss about the important problem types and fundamental data structures. [Dec-2018]

Module 2: Divide and Conquer

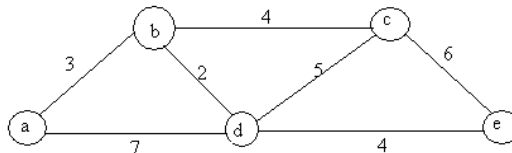
- How do you apply divide-and-conquer technique for sorting? Write the algorithm for Merge Sort. [July-2017]
- Write and briefly explain the recursive binary search algorithm. [July-2017]
- Write Quick sort algorithm. Trace the same on data set 25, 10, 72, 18, 40, 11, 64, 58, 32, 9. [July-2017]
- Write Quick sort algorithm. Trace the same on data set 65, 70, 75, 80, 85, 60, 55, 50, 45. [Dec-2018]
- Explain the concept of divide and conquer. Design an algorithm for merge sort and derive its time complexity. [Dec-2018]
- Briefly explain the Strassen's matrix multiplication. Obtain its time complexity. [Dec-2018]
- Advantages and Disadvantages of divide and conquer. Illustrate the topological sorting for the following graph.



- Write the merge sort algorithm and sort the list E, X, A, M, P, L, E in the alphabetical order using merge sort.

Module 3: Greedy Method

- What is Greedy Technique? Write Prim's algorithm. [July-2017]
- Sort the given list of numbers using heap sort. 2, 9, 7, 6, 5, 8. [July-2017]
- Solve the following instance of the single source shortest path problem with vertex 'a' as the source. (Jan-2010, June/July 2015)



- Explain the Dijkstra's algorithm to find single source shortest paths to other vertices. [July-2017]
- Construct the Huffman tree and resulting code word for the following data and encode the word DAD and ADD [July-2017]

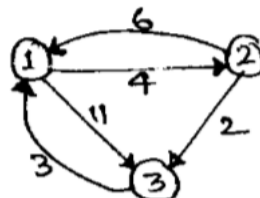
Character	A	B	C	D	__
Probabilities	0.35	0.1	0.2	0.2	0.15

Module 4: Dynamic Programming

- Explain dynamic programming? [July-2017]
- Apply Warshall's algorithm to find the transitive closure of the graph defined by the following adjacency matrix:

0	1	0	0
0	0	1	0
0	0	0	1
0	0	0	0

- Write Floyd's algorithm to solve all-pair-shortest-path problem, find the all-pair-shortest-path for given graph



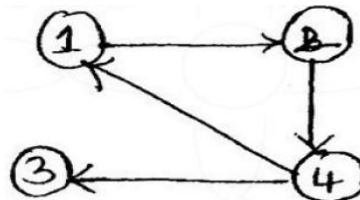
4. Draw the decision tree for the 3-elements insertion sort.
5. Apply Floyd's algorithm to solve the all-pairs shortest path problem for the graph whose weight matrix is given below:

0	2	∞	1	8
6	0	3	2	∞
∞	∞	0	4	∞
∞	∞	2	0	3
3	∞	∞	∞	0

6. Apply Floyd's algorithm to solve the all-pairs shortest path problem for the graph whose weight matrix is given below:

0	∞	3	∞
2	0	∞	∞
∞	7	0	1
6	∞	∞	0

7. Using Dynamic programming, solve the following knapsack instance:
 $N=3$, $[w_1, w_2, w_3]=[1, 2, 3]$ and $[p_1, p_2, p_3]=[18, 16, 6]$ and $M=4$.
6. Write Warshall's algorithm to find transitive closure.
7. Trace the following graph using Warshall's algorithm. [July-2017]



8. Give the necessary recurrence relation used to solve 0/1 Knapsack problem using dynamic programming. Apply it to solve the following instance & show the results $n=4$ $m=5$ values 12, 10, 20, 15 & weights are 2, 1, 3, 2 respectively. [July-2017]
9. Explain multistage graphs. Write multistage algorithm to forward approach. [July-2017]

Module 5: Backtracking

1. Explain back tracking technique. Illustrate N-queens problem using backtracking. [July-2017]
2. Write the pseudo code for backtracking algorithm. Draw the state-space tree for the sum of subset problem of the instance: $S = \{5, 7, 8, \text{ and } 10\}$ and $d=1$. (Jan-2010)
3. Write the pseudo code for backtracking algorithm. Draw the state-space tree for the sum of subset problem of the instance: $S = \{3, 5, 6, 7\}$ and $d=15$. [July-2017]
4. Explain Hamiltonian circuit problem.
5. Solve the following instance of Knapsack problem using branch and bound algorithm:

Item	1	2	3	4
Weight	4	7	5	3
Value	40	42	25	12

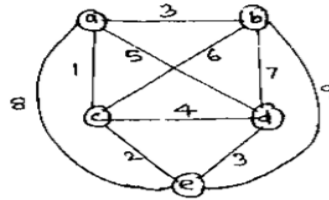
The capacity of the knapsack is $W=10$.

6. Explain LC Branch and bound algorithm FIFO Branch and bound. [July-2017]
7. What is branch and bound? How is it different from back tracking?
8. Solve 8-queen problem for a feasible sequence (6, 4, 7, and 1).
9. Explain how Traveling Salesman Problem can be solved by using Branch-and-Bound.
10. Write and Explain Approximation Algorithm for the Knapsack Problem.
11. For the given $n \times n$ matrix C for a job assignment problem find the optimal solution using branch & bound. Give complete state space tree for the instance of assignment problem solved with best first branch & bound algorithm. [July-2017]

C=


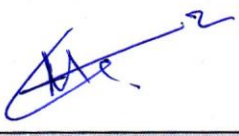


Job1	Job 2	Job 3	Job 4	
9	2	7	8	Person a
6	4	3	7	Person b
5	8	1	8	Person c
7	6	9	4	Person d


12. With the help of state space tree, solve the traveling salesman problem of the given figure. Using branch-and-bound algorithm.



15.0 University Result

Examination	S+	FCD (S, A, B)	FC (C)	SC (D, E)	FAIL (F)	% Passing
June/July-2020	NA	33	10	00	00	100
June/July-2021	NA	37	15	01	00	100

Prepared by	Checked by		
 Prof. A. A. Daptardar	 Dr. Mahesh G. Huddar	 HOD	 Principal

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SUBJECT TITLE	OPERATING SYSTEMS		
Subject Code	18CS43	IA Marks	30
		Assignment	10
Number of Lecture Hrs / Week	04	Exam Marks	60
Total Number of Lecture Hrs	40	Exam Hours	03

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

1.0 Prerequisite Subjects:

Sl. No	Branch	Semester	Subject
01	Computer Science	I/II	CPS
02	Computer Science	III	DSA

2.0 Course Objectives

1. Introduce concepts and terminology used in OS
2. Explain threading and multithreaded systems
3. Illustrate process synchronization and concept of Deadlock
4. Introduce Memory and Virtual memory management, File system and storage techniques.

3.0 Course Outcomes

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

	Course Outcome	Cognitive Level	POs/PSOs
C212.1	Demonstrate need for Operating System and its types.	L2	PO-1,2,3,4,7,10, PSO1,PSO2
C212.2	Explain the multithreaded systems and scheduling algorithms.	L2	PO-1,2,3,4,7,10, PSO1,PSO2
C212.3	Illustrate the concept of process synchronization and Deadlock.	L2	PO-1,2,3,4,7,10, PSO1,PSO2
C212.4	Explain the concept of memory management and File System.	L2	PO-1,2,3,4,7,10, PSO1,PSO2
C212.5	Illustrate the different concepts of disk management, Protection and Linux System case studies.	L2	PO-1,2,3,4,7,10, PSO1,PSO2
Total Hours of instruction			40


4.0 Course Content

Module – 1

08 Hours

Introduction to operating systems, System structures: What operating systems do; Computer System organization; Computer System architecture; Operating System structure; Operating System operations; Process management; Memory management; Storage management; Protection and Security; Distributed system; Special-purpose systems; Computing environments. Operating System Services; User - Operating System interface; System calls; Types of system calls; System programs; Operating system design and implementation; Operating System structure; Virtual machines; Operating System generation; System boot. **Process Management** Process concept; Process scheduling; Operations on processes; Inter process communication

Text book 1: Chapter 1, 2.1, 2.3, 2.4, 2.5, 2.6, 2.8, 2.9, 2.10, 3.1, 3.2, 3.3, 3.4

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Module – 2

08 Hours

Multi-threaded Programming: Overview; Multithreading models; Thread Libraries; Threading issues. Process Scheduling: Basic concepts; Scheduling Criteria; Scheduling Algorithms; Multiple-processor scheduling; Thread scheduling. **Process Synchronization:** Synchronization: The critical section problem; Peterson's solution; Synchronization hardware; Semaphores; Classical problems of synchronization; Monitors.

Text book 1: Chapter 4.1, 4.2, 4.3, 4.4, 5.1, 5.2, 5.3, 5.4, 5.5, 6.2, 6.3, 6.4, 6.5, 6.6, 6.7

Module – 3

08 Hours

Deadlocks : Deadlocks; System model; Deadlock characterization; Methods for handling deadlocks; Deadlock prevention; Deadlock avoidance; Deadlock detection and recovery from deadlock. **Memory Management:** Memory management strategies: Background; Swapping; Contiguous memory allocation; Paging; Structure of page table; Segmentation.

Text book 1: Chapter 7, 8.1 to 8.6

Module – 4

08 Hours

Virtual Memory Management: Background; Demand paging; Copy-on-write; Page replacement; Allocation of frames; Thrashing. **File System, Implementation of File System:** File system: File concept; Access methods; Directory structure; File system mounting; File sharing; Protection: Implementing File system: File system structure; File system implementation; Directory implementation; Allocation methods; Free space management.

Text book 1: Chapter 9.1. To 9.6, 10.1 to 10.5

Module – 5

08 Hours

Secondary Storage Structures, Protection: Mass storage structures; Disk structure; Disk attachment; Disk scheduling; Disk management; Swap space management. Protection: Goals of protection, Principles of protection, Domain of protection, Access matrix, Implementation of access matrix, Access control, Revocation of access rights, Capability-Based systems. **Case Study: The Linux Operating System:** Linux history; Design principles; Kernel modules; Process management; Scheduling; Memory Management; File systems, Input and output; Inter-process communication.

Text book 1: Chapter 12.1 to 12.6, 21.1 to 21.9

5.0 Relevance to future subjects

Sl No	Semester	Subject	Topics
01	VI	System Software Lab	
02	VIII	Project Work	

6.0 Relevance to Real World


Sl. No	Real World Mapping
01	Project Development

7.0 Gap Analysis and Mitigation

Sl. No	Delivery Type	Details
01	Tutorial	Topic: MODULE – I TO MODULE-V
02	NPTEL	Videos

8.0 Books Used and Recommended to Students

Text Books
1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System Principles 7 th edition, Wiley-India, 2006.
Reference Books
1. Ann McHoes Ida M Fylnn, Understanding Operating System, Cengage Learning, 6 th Edition
2. D.M Dhamdhare, Operating Systems: A Concept Based Approach 3rd Ed, McGraw- Hill, 2013.
3. P.C.P. Bhatt, An Introduction to Operating Systems: Concepts and Practice 4th Edition, PHI(EEE), 2014.
4. William Stallings Operating Systems: Internals and Design Principles, 6th Edition, Pearson.
Additional Study material & e-Books
Notes and Videos

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

Website and Internet Contents References
1) https://youtu.be/xcCM11ChT38

10.0 Magazines/Journals Used and Recommended to Students

Sl.No	Magazines/Journals	Website
1	UX Magazines	https://uxmag.com/topics/operating-systems
2	STM Journal	stmjournals.com/Journal-of-Operating-Systems-evelopment-and-Trends.html

11.0 Examination Note

Internal Assessment: 30+10=40 Marks

- 50 marks –from three internal assessment test
- 10 marks- from the assignments

Scheme of Evaluation for Internal Assessment (50 Marks)


- a) Internal Assessment test in the same pattern as that of the main examination (Average of the three Tests): 50marks.
- b) Assignment marks for each module is 25. Average of 5 assignment marks will be taken and finally scale down to 10 marks.

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 25 marks, Total test marks are 50.
 - a. Q.No I or Q.No II = 25 Marks
 - b. Q.No III or Q.No IV = 25 Marks
 - c. **Total = 50 Marks**


Question Paper Pattern and instructions (Main Exam):

1. The question paper will have TEN questions.
2. There will be TWO questions from each module.
3. Each question will have questions covering all the topics under a module.
4. The students will have to answer FIVE full questions, selecting ONE full question from each module.
Max. Marks: 100 and each question carries 20 marks.
Exam Duration: 3 Hrs.
5. The total marks scored out of 100 marks will be scaled down to 60 marks.

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12.0 Course Delivery Plan

Module No.	Lecture No.	Content of Lecture	% of Portion
1	1	What operating systems do; Computer System organization;	20
	2	Computer System architecture; Operating System structure; Operating System operations;	
	3	Process management; Memory management; Storage management; Protection and security; Distributed system;	
	4	Special-purpose systems; Computing environments. Operating System Services; User – Operating System interface;	
	5	System calls; Types of system calls;	
	6	System programs; Operating System design and implementation;	
	7	Operating System structure; Virtual machines;	
	8	Operating System generation; System boot.	
	9	Process concept; Process scheduling.	
	10	Operations on processes; Inter-process communication.	
2	11	Multi-Threaded Programming: Overview; Multithreading models;	20
	12	Thread Libraries; threading issues.	
	13	Process Scheduling: Basic concepts; Scheduling criteria;	
	14	Scheduling algorithms;	
	15	Multiple-Processor scheduling; Thread scheduling.	
	16	Synchronization;	
	17	The Critical section problem; Peterson's solution;	
	18	Synchronization hardware; Semaphores;	
	19	Classical problems of synchronization;	
	20	Monitors.	
3	21	Deadlocks: System model;	20
	22	Deadlock characterization;	
	23	Methods for handling deadlocks;	
	24	Deadlock prevention;	
	25	Deadlock avoidance;	
	26	Deadlock detection and recovery from deadlock.	
	27	Memory Management Strategies: Background;	
	28	Swapping; Contiguous memory allocation;	
	29	Paging; Structure of page table;	
	30	Segmentation.	
4	31	Virtual Memory Management: Background; Demand paging;	20
	32	Copy-on-write;	
	33	Page replacement;	
	34	Allocation of frames; Thrashing.	
	35	File System: File concept; Access methods;	
	36	Directory structure	
	37	File system mounting; File sharing; Protection.	
	38	Implementing File System: File system structure;	
	39	File system implementation; Directory implementation;	
	40	Allocation methods; Free space management.	
5	41	Mass storage structures; Disk structure; Disk attachment;	20
	42	Disk scheduling; Disk management; Swap space management.	
	43	Protection: Goals of protection, Principles of protection, Domain of protection,	
	44	Access matrix, Implementation of access matrix,	
	45	Access control, Revocation of access rights, Capability-Based systems.	
	46	Linux history; Design principles;	
	47	Kernel modules; Process management;	
	48	Scheduling; Memory management;	
	49	File systems, Input and output;	
	50	Inter-process communication.	

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13.0 Assignments, Pop Quiz, Mini Project, Seminars

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 1 and reference books
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 1 and reference books
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 1 and reference books
4	Assignment 4: Some important University Questions and comprehensive questions on module four.	Students study the Topics and write the Answers. Get practice to solve questions.	Module four of the syllabus	11	Individual Activity. Witten solutions expected.	Text book 1 and reference books
5	Assignment 5: Some important University Questions and comprehensive questions on module five.	Students study the Topics and write the Answers. Get practice to solve questions.	Module five of the syllabus	13	Individual Activity. Witten solutions expected.	Text book 1 and reference books

14.0 QUESTION BANK

MODULE – 1

1. Define operating system. With a neat diagram, explain the dual mode operation of OS. (Jun-2018)
2. Explain the role operating system with user &viewpoints.
3. Explain the services of operating system that are helpful for user and the system. (Jun-2018)
4. List the operating system responsibilities in connection with a process management and memory management.
5. Explain the following terms.
i) Virtual Machine ii) CPU Scheduler iii) System Call iv) Context Switch (Jun-2018)
6. Explain types of multiprocessors systems and type of clustering. What is fault tolerant system?
7. Give the features of symmetric & asymmetric multiprocessor system.
8. Explain the graceful degradation and 'fault tolerant' in a multiprocessor system.
9. Explain two sets of operating system services that are helpful to the user as well as efficient operation of the system.
10. Briefly explain the common classes of services provided by the various operating systems for helping the user and for ensuring the efficient operation of the system.
11. Write and explain the sequence of system calls for copying a file to another(new) file.
12. Explain the layered approach of operating system structure, with supporting diagram. (Jun-2018)
13. What are virtual machines? Explain the advantages with neat diagram.
14. What are the essential properties of batch, real time and distributed operating systems.
15. Explain the concept of virtual machine. Bring out its advantages.
16. Differentiate between trap and interrupt.
17. What are virtual machines? How are they implemented?
18. What are the ways in which threads terminates?



19. With the help of an example, explain the concept of virtual machines.
20. Distinguish among the following terminologies associated with the operating system and explain each of them in detail. Multi programming systems, Multitasking systems and Multiprocessor systems.
21. What is process? Draw and explain the process state diagram. (Jun-2018)
22. Differentiate between process and thread, short term and medium term schedules, user level and kernel level threads and waiting and turnaround time.
23. Describe operations an OS takes to context switch between processes.
24. What is PCB? Enumerate and explain various fields in PCB.
25. Discuss the operations of process creation and process termination in UNIX.
26. What is interposes communication? Explain direct and indirect communication with respect to Message passing system. (Jun-2018)
27. Discuss the implementation of IPC using shared memory and message passing.
28. Distinguish between the following pairs of terms:
 - i. Symmetric and Asymmetric multiprocessor systems
 - ii. CPU burst and I/O burst Jobs
 - iii. User view and System view of OS
 - iv. Batch systems and Time Sharing System
 - v. User Mode and Kernel mode operations

MODULE – 2

1. Differentiate between user level thread & kernel level thread and process & Thread.
2. Write a note on multithreaded models. What are the benefits of multithreaded programming?(Jun-2018)
3. List out the threading issues & Explain.
4. Define the five scheduling criteria considered in process management.
5. Consider 4 jobs with (arrival time, burst time) as (0, 5) (0.2, 2) (0.6, 8) (1.2, 4). Find the average turnaround time and waiting time for the jobs using FCFS, SJF and RR(q=1) scheduling algorithms.
6. Consider the following set of processes.


Process	Arrival Time	Burst Time
P1	0	1
P2	1	9
P3	2	1
P4	3	9

- a. Draw Gantt charts showing the execution of these processes using FCFS, preemptive SJF, non-pre-emptive SJF and RR (Quantum 1) scheduling schemes.
 - b. Compute the turnaround time and waiting time for each process for each of the schemes above.
 - c. Compute the average turnaround time and average waiting time in each scheme and thus
 - d. Find the best scheme in this particular case.
7. Why thread is called LWP? Describe any one threading model.
 8. Suppose the following jobs arrive for processing at the times indicated. Each job will run the listed amount of time.

Job	1	2	3
Arrival Time	0.0	0.4	1.0
Burst Time	8	4	1

- a. Give Gantt chart illustrating the execution of these jobs using the non-pre-emptive FCFS and SJF scheduling algorithms
 - b. What is turnaround time and waiting time of each job for the above algorithms?
 - c. Compute average turnaround time if CPU is left idle for 1 unit and then SJF is used.(Job1 and Job2 will wait during this time)
9. Consider the following set of processor with a length of CPU burst time given in milliseconds.

Process	Arrival time	Burst time	Priority
P1	0	7	4
P2	3	2	2
P3	4	3	1
P4	4	1	4
P5	5	3	3

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- a. Find the average waiting time & average turnaround time using Gantt chart for the following scheduling algorithms.
- b. Preemptive SJF
- c. Preemptive Priority (Smaller number represents high priority)
- d. Round-Robin (time slice = 1ms)
10. Write an algorithm for producer problem with a bounded buffer explains the race condition problem.
11. Define race condition. Explain reader's Writer's problem with semaphores.
12. Define race condition. List the requirements that a solution to the critical problem must satisfy.
13. What is critical section problem? What are the three requirements to be met by a solution to the critical Section problem? (Jun-2018)
14. Explain Peterson's solution to the critical section problem. (Jun-2018)
15. Define an algorithms Test And Set () & Swap(). Show that they satisfy mutual exclusion.
16. What is synchronization? Explain synchronization hardware.
17. What are semaphores? Explain two preemptive semaphore operations. What are the advantages of semaphores?
18. What are the types of semaphores? Explain any three uses of semaphores.
19. What are semaphores? Explain the solution to producer-consumer problem using semaphores.
20. How the semaphores are implemented?
21. Describe the bounded buffer problem & give the solution for the same using semaphores.
22. Write the structure of producer & consumer processes.
23. Describe the reader & writer problem & give a solution for the same using semaphores. Write the structure of reader & writer processes.
24. Explain the dining philosopher problem with Semaphores. (Jun-2018)
25. What is monitor? Write the monitor solution for the dining philosopher problem.
26. Explain the syntax and schematic view of monitors. (Jun-2018)
27. Describe the following: i) Semaphore ii) wait() operation iii) signal () operation

MODULE – 3

1. What is a deadlock? Explain the necessary conditions for its occurrence. (Jun-2018)
2. Explain how Resource-Allocation graphs are used to describe deadlocks.
3. Write a note on deadlock prevention.
4. What are the methods available for handling deadlocks? Explain Banker's algorithm.
5. Deadlock occurs if cycle exists. Justify your answers.
6. For the following information find the safe sequence using Banker's algorithm, the number of resources for R1, R2, R3 are 7, 7, 10 respectively.

Process	Allocated resources			Maximum Requirements		
	R1	R2	R3			
P1	2	2	3	3	6	8
P2	2	0	3	4	3	3
P3	1	2	4	3	3	4

7. Describe Banker's algorithms for deadlock avoidance
8. Write note on deadlock detection.
9. List any four examples of deadlock that are related to computer systems.
10. Discuss the various approaches used for deadlock recovery.
11. Write a note on dynamic Loading and Linking.
12. What is swapping? Does this increase OS overhead? Justify your answer.
13. What is locality of reference? Differentiate between paging and segmentation.
14. Write a note on Contiguous memory allocation.
15. What do you mean by dynamic storage allocation problem? Explain possible solutions to this problem.
16. What is internal & external fragmentation?
17. Bring out differences between internal & external fragmentation? How are they overcome?
18. Explain the buddy-system, used for managing free memory assigned to kernel process.
19. What is paging? Explain paging hardware with translation look-aside buffer. (Jun-2018)
20. Why TLB is important. In simple paging what information is stored in TLB.
21. Write a note on shared pages.
22. Explain the hierarchical, Hashed and inverted paging technique for structuring the page table. (Jun-2018)

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23. Describe the Segmentation technique.
24. Given 5 memory partitions 100KB, 500KB, 200KB, 300KB and 600KB, how each of the first fit, best fit and worst fit algorithms place processes of 212KB, 417KB, 112KB and 426KB size. Which algorithm makes efficient use of memory? (Jun-2018)

MODULE – 4

1. Describe the demand paging system.
2. What is paging and swapping?
3. What is Page Fault? Discuss the steps involved in handling the page fault with diagram. (Jun-2018)
4. What is thrashing explain.
5. Explain the concept of forward-mapped page table.
6. Let the user process size be 1MB & the data transfer rate from memory to disk be 5MB per second. Determine the time required for the program data transfer to disk from memory. If the average latency is 8 msec, determine the total swapping time.
7. Explain internal and external fragmentation with a neat diagram.
8. Consider the following page reference string. 1, 2, 3, 5, 2, 3, 5, 7, 2, 1, 2, 3, 8, 6, 4, 3, 2, 2, 3, 6. How many page faults would occur in the case of i) LRU ii) FIFO iii) Optimal algorithms assuming 3 frames. Note that initially all frames are empty.
9. Given the memory partitions 100K, 500K, 200K, 300K and 600K, apply the first and best fit algorithms to place, 212K, 417k, 112K and 426K in memory.
10. For the following page reference calculate the page faults that occur using FIFO and LRU for 3 and 4 page frames respectively. 5, 4, 3, 2, 1, 4, 3, 5, 4, 3, 2, 1, 5.
11. Consider the following page reference stream: 1, 2, 3, 4, 2, 1, 5, 6, 2, 1, 2, 3, 7, 6, 3, 2, 1, 3, 3, 6. How many page faults would occur for LRU, FIFO and optimal replacement algorithms assuming 3 and 5 frames? Which one of the above is most efficient?
12. A hypothetical main memory can store only 3 frames simultaneously. The sequence in which the pages will be required is given below : 7, 0, 1, 2, 0, 3, 0, 4, 2, 3, 0, 3, 2, 1, 2, 0, 1, 7, 0, 1. Indicate the sequence in which the three frames will be filled in i) FIFO ii) Optimal Page Replacement iii) Least Recently Used methods of page replacement. Indicate the number of page faults in each case. (Jun-2018)
13. Explain copy-on-write process in virtual memory. (Jun-2018)
14. What is file? Describe different access modes on files.
15. Discuss the following in brief i) File attributes ii) File types iii) Sequential file access iv) Tree structured directory structure.
16. List the common file types along with its extensions and functions.
17. List the different directory structure. Explain acyclic – graph directory and tree structured directory. (Jun-2018)
18. Explain different storage methods available for storing file, with neat diagram.
19. Explain the Single, two, tree level, acyclic graph and general graph directory structure.
20. What are directories? Explain File mounting.
21. What is a file? Also list different file operations. (Jun-2018)
22. Write a note on Directory implementation
23. Discuss the Contiguous allocation of disk space.
24. Explain different disk space allocation methods with an example. (Jun-2018)
25. Discuss the Linked allocation of disk space. Is FAT link file allocation? Discuss.
26. Discuss the Indexed allocation of disk space.
27. Write a note on free-space management.
28. Briefly explain the methods of keeping tracks of free space on disks.
29. How do the modern operating systems concurrently support multiple types of file system? Explain its implementation, in detail.

MODULE – 5





1. Explain the FCFS, SSTF, SCAN, C-SCAN, LOOK and C-LOOK disk scheduling algorithm in brief with example.
2. Explain sector slipping, with an example.
3. Describe the access matrix model for protection purpose.
4. Suppose the portion of cylinder is at 53. Sketch the graphical representation for the queue of pending requests in the order- 98, 183, 37, 122, 14, 124, 65, 67 for FCFS, SSTF and LOOK scheduling schemes. Give your comment on this scenario in a computer system. (Jun-2018)


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5. Suppose a disk drive has 5000 cylinders numbered 0 to 4999. Drive is currently serving request at cylinder 143, and previous request was at cylinder 125, queue of pending requests in FIFO order is 86, 1470, 913, 1774, 948, 1509, 1022, 1750, 130. Starting from current head position, what is the total distance (in cylinders) that the disk arm moves to satisfy all pending request for FCFS, SSTF, LOOK, SCAN disk scheduling algorithms.
6. What is an access matrix? Explain the different methods of implementing access matrix. (Jun-2018)
7. Explain bad-block recovery in disk. (Jun-2018)
8. Write a short note on swap space management and revocation of access rights.
9. Explain the various questions that arise in Revocation of access rights.
10. What are the components of Linux System?
11. What are the parts included in Process Context.
12. Distinguish between fork() and clone() system call. Also customize the clone() system call to fork() functionality, with suitable modifications/settings.
13. Explain the Process scheduling in Linux System.
14. Write a note on Kernel Synchronization and memory management.
15. Explain process management in Linux. (Jun-2018)
16. Explain the Linux device drive the block structure.
17. What are design principles of Linux OS? Explain. (Jun-2018)
18. What do you mean by cloning? How it is achieved in Linux systems.
19. How IPC is handled in Linux? Explain with an example. (Jun-2018)
20. Differentiate between static & dynamic linking.
21. Explain Linux file system.
22. Write a note on Linux security model.
23. How does Linux manage authentication and access control mechanisms?
24. Write short notes on:
 - a. Components of a Linux system
 - b. Inter process communication
 - c. Thrashing
 - d. Monitors

14.0 University Result

Examination	FCD	FC	SC	F	% Passing
July/Aug-2021	42	10	01	00	100
Aug/Sep 2020	31	12	00	00	100

Prepared by	Checked by		
 Prof. Prasanna Patil	 Prof. A. A. Daptardar	 HOD	 Principal

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SUBJECT TITLE	MICROCONTROLLERS AND EMBEDDED SYSTEMS		
Subject Code	18CS44	IA Marks	40
Number of Lecture Hrs / Week	3:0:0	Exam Marks	60
Total Number of Lecture Hrs	40	Exam Hours	03
CREDITS – 04			

FACULTY DETAILS:		
Name: Prof. N K Honnagoudar	Designation: Asst.Professor	Experience: 20
No. of times course taught: 02	Specialization: Electronics	

1.0 Prerequisite Subjects:

Sl. No	Branch	Semester	Subject
01	Computer Science engineering	III	Computer Organization

2.0 Course Objectives

This course will enable students to

1. Differentiate between microprocessors and microcontrollers.
2. Explain the architecture of ARM processor with its instruction set.
3. Identify the applicability of the embedded system
4. Comprehend the real time operating system used for the embedded system

3.0 Course Outcomes

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

CO	Course Outcome	Cognitive Level	POs
C213.1	Describe the architectural features and instructions of ARM microcontroller.	L2	PO1, PO2, PO3,PO8,P12, PSO1,PSO2
C213.2	Apply the knowledge gained for Programming ARM for different applications.	L2	PO1,PO2, PO3, PO8, P12, PSO1, PSO2,
C213.3	Interface external devices and I/O with ARM microcontroller.	L2	PO1,PO2,PO3,PO8,P12,PSO1, PSO2
C213.4	Interpret the basic hardware components and their selection method based on the characteristics and attributes of an embedded system..	L2	PO1,PO2,PO3, PO8, P12, PSO1, PSO2
C213.5	Develop the hardware /software co-design and firmware design approaches.	L2	PO1, PO2, PO3, PO8, P12, PSO1, PSO2

4.0 Course Content

Module-I


(08 Hours)

Microprocessors versus Microcontrollers, ARM Embedded Systems: The RISC design philosophy, The ARM Design Philosophy, Embedded System Hardware, Embedded System Software, ARM Processor Fundamentals: Registers, Current Program Status Register, Pipeline, Exceptions, Interrupts, and the Vector Table , Core Extensions Text book 1:Chapter1 - 1.1 to 1.4, Chapter2 - 2.1 to 2.5 RBT: L1, L2

Module-II

(08 Hours)

Introduction to ARM instruction sets: data processing instructions, program instructions, software interrupt instructions, Program status register instructions, coprocessor instructions, Loading constants.ARM programming using assembly language: Writing assembly code, profiling and cycle counting, instruction scheduling Register allocation, conditional Execution, Looping constructs. Text book 1:Chapter3 – (3.1 to 3.6) (Excluding 3.5.2) Chapter6 - (6.1 to 6.6) RBT: L1, L2

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Module-III

(08 Hours)

Embedded System Components: Embedded Vs General computing system, Classification of Embedded systems, Major applications and purpose of ES. Core of an Embedded System including all types of processor/controller, Memory, Sensors, Actuators, LED, 7 segment LED display, stepper motor, Keyboard, Push button switch, Communication Interface (onboard and external types), Embedded firmware, Other system components. Text book 2: All the Topics from Chapter1 and Chapter2

Module-IV

(08 Hours)

Embedded System Design Concepts: Characteristics and Quality Attributes of Embedded Systems, Operational and non-operational quality attributes, Embedded Systems-Application and Domain specific, Hardware Software Co-Design and Program Modeling, embedded firmware design and development
Text book 2: Chapter-3, Chapter-4, Chapter-7 (Sections 7.1, 7.2 only), Chapter-9 (Sections 9.1, 9.2, 9.3.1, 9.3.2 only)

Module-V

(08 Hours)

RTOS and IDE for Embedded System Design: Operating System basics, Types of operating systems, Task, process and threads (Only POSIX Threads with an example program), Thread preemption, Preemptive Task scheduling techniques, Task Communication, Task synchronization issues – Racing and Deadlock, Concept of Binary and counting semaphores (Mutex example without any program), How to choose an RTOS, Integration and testing of Embedded hardware and firmware, Embedded system Development Environment – Block diagram (excluding Keil), Disassembler/decompiler, simulator, emulator and debugging techniques
Text book 2: Chapter-10 (Sections 10.1, 10.2, 10.3, 10.5.2, 10.7, 10.8.1.1, 10.8.1.2, 10.8.2.2, 10.10 only), Chapter 12, Chapter-13 (block diagram before 13.1, 13.3, 13.4, 13.5, 13.6 only)

5.0 Relevance to future subjects

Sl No	Semester	Subject	Topics
01	VIII	Project work	Models

6.0 Relevance to Real World


SL.No	Real World Mapping
01	Industrial applications, model creation for analysis.
02	Development of a software embedded applications

7.0 Gap Analysis and Mitigation

Sl. No	Delivery Type	Details
01	NPTEL	Microcontrollers
02	NPTEL	ARM Processor.

8.0 Books Used and Recommended to Students

Text Books
1. Andrew N Sloss, Dominic Symes and Chris Wright, ARM system developers guide, Elsevier, Morgan Kaufman Publishers, 2008.
2. Shibu K V, "Introduction to Embedded Systems", Tata McGraw Hill Education, Private Limited, 2nd Edition.
Reference Books
1. The Insider's Guide to the ARM7 Based Microcontrollers, Hitex Ltd., 1st edition, 2005
2. Steve Furber, ARM System-on-Chip Architecture, Second Edition, Pearson, 2015
3. Raj Kamal, Embedded System, Tata McGraw-Hill Publishers, 2nd Edition, 2008
4. Rangunandan, An Introduction to ARM System Design, Cengage Publication
Additional Study material & e-Books

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

Website and Internet Contents References
NPTEL

10.0 Magazines/Journals Used and Recommended to Students

Sl.No	Magazines/Journals	website
1	IEEE	http://ieeexplore.ieee.org
2	CSI	http://www.csi-india.org/

11.0 Examination Note

Internal Assessment: 30+10=40 Marks

- 50 marks –from three internal assessment test
- 10 marks- from the assignments

Scheme of Evaluation for Internal Assessment (50 Marks)

- a) Internal Assessment test in the same pattern as that of the main examination (Average of the three Tests): 50marks.
- b) Assignment marks for each module is 25. Average of 5 assignment marks will be taken and finally scale down to 10 marks.

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 25 marks, Total test marks are 50.
 - a. Q.No I or Q.No II = 25 Marks
 - b. Q.No III or Q.No IV = 25 Marks
 - c. **Total = 50 Marks**

Question Paper Pattern and instructions (Main Exam):

1. The question paper will have TEN questions.
2. There will be TWO questions from each module.
3. Each question will have questions covering all the topics under a module.
4. The students will have to answer FIVE full questions, selecting ONE full question from each module.
Max. Marks: 100 and each question carries 20 marks.
Exam Duration: 3 Hrs.
5. The total marks scored out of 100 marks will be scaled down to 60 marks.

12.0 Course Delivery Plan

Module	Lecture No.	Content of Lecturer	% of Portion
MODULE 1:	1	Microprocessors versus Microcontrollers.	20
	2	ARM Embedded Systems: The RISC design philosophy.	
	3	The ARM Design Philosophy.	
	4	Embedded System Hardware,	
	5	Embedded System Software.	
	6	ARM Processor Fundamentals: Registers,	
	7	Current Program Status Register.	
	8	Pipeline, Exceptions, Interrupts, and the Vector Table , Core Extensions.	
MODULE 2:	1	Introduction to ARM instruction sets:	20
	2	Data processing instructions, program instructions.	
	3	Software interrupt instructions, Program status register instructions.	
	4	Coprocessor instructions, Loading constants.	
	5	ARM programming using assembly language:	
	6	Writing assembly code.	


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	7	Cycle counting, instruction scheduling. Register allocation	
	8	Conditional Execution, Looping constructs.	
MODULE 3:	1	Embedded System Components: Embedded Vs General computing system.	20
	2	Classification of Embedded systems.	
	3	Major applications. and purpose of ES.	
	4	Core of an Embedded System including all types of processor/controller, Memory.	
	5	Memory, Sensors, Actuators.	
	6	LED, 7 segment LED display.	
	7	Stepper motor, Keyboard,	
	8	Push button switch, Communication Interface (onboard and external types), Embedded firmware, Other system components.	
MODULE 4:	1	Embedded System Design Concepts:	20
	2	Characteristics and Quality Attributes of Embedded Systems.	
	3	Operational and non-operational quality attributes.	
	4	Embedded Systems.	
	5	Application and Domain specific.	
	6	Hardware Software Co-Design.	
	7	Program Modeling.	
	8	Embedded firmware design and development.	
MODULE 5:	1	RTOS and IDE for Embedded System Design: Operating System basics.	20
	2	Types of operating systems.	
	3	Task, process and threads (Only POSIX Threads with an example program).	
	4	Thread preemption, Preemptive Task scheduling techniques.	
	5	Task Communication, Task synchronization issues.	
	6	Racing and Deadlock, Concept of Binary and counting semaphores (Mutex example without any program).	
	7	How to choose an RTOS, Integration and testing of Embedded hardware and firmware, Embedded system.	
	8	Development Environment – Block diagram (excluding Kiel), Disassemble/decompile, simulator, emulator and debugging techniques.	

13.0

Assignments, Pop Quiz, Mini Project, Seminars

Sl.No.	Title	Outcome expected	Allied study	Week No.	Individual / Group activity	Reference: book/website /Paper
1	Assignment 1: University Questions on The microcontrollers.	Students study the Topics and write the Answers. Get practice to solve university questions.	Module 1 syllabus	2	Individual Activity. Printed solution expected.	Text book 1
2	Assignment 2: University Questions on Arithmetic and logic instructions and programs of microcontrollers.	Students study the Topics and write the Answers. Get practice to solve university questions.	Module 2 syllabus	4	Individual Activity. Printed solution expected.	Text book 1
3	Assignment 3: University Questions on Signed Numbers and Strings	Students study the Topics and write the Answers. Get practice to solve university questions.	Module 3 syllabus	6	Individual Activity. Printed solution expected.	Text book 2
4	Assignment 4: University Questions on ARM Embedded Systems	Students study the Topics and write the Answers. Get practice to solve university questions.	Module 4 syllabus	8	Individual Activity. Printed solution expected.	Text book 2

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5	Assignment 5: University Questions on Introduction to ARM Instruction Set	Students study the Topics and write the Answers. Get practice to solve university questions.	Module 5 syllabus	10	Individual Activity. Printed solution expected.	Text book 2
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14.0

QUESTION BANK

Module-I:

1. What is microcontroller and explain
2. Differentiate between microprocessor and micro controllers(Jan 2022)
3. Explain different instruction sets of microcontrollers.
4. Explain ARM processors. (Jan 2022)
5. Explain about RISC design Philosophy.(Jan2022)
6. Explain about AMBA bus protocol..(Jan22)
7. Explain about static RAM and Dynamic RAM.(Jan2022)
8. Explain about Embedded system software.(Jan21)
9. With block diagram explain ARM core data flow model (Jan 2022)
10. With block diagram explain Programming Model(Jun 2021)
11. Explain the format of CPSR and SPSR.
12. Explain 5 stages of pipeline organization.
13. Explain about cache and tightly coupled memory.

Module-II:


1. Explain different types of instructions in ARM processors.(Jan 2022)
2. How BCD to ASCII conversion can be done
3. What is interrupt and explain it
4. Explain different interrupts used in microcontrollers. (Jan 2022)
5. Write a short note on instruction scheduling.
6. Explain about Barrel shifter with examples .(Jan 2022)
7. Explain about SWAP instruction with examples.
8. Explain software interrupt instructions.
9. Explain about co processor instruction(Jan2022)
10. Write an ALP to scan 32 bit numbers stored in the array to find number of negative in it.

Module-III:

1. Explain about embedded V/S different computing system.
2. Classification of embedded system.
3. Explain memory sensors.
4. Explain the activators.
5. Explain stepper motor interfacing.
6. Explain characteristics of embedded system (Jan22)
7. Explain core of an embedded system.
8. Explain about RISC and SISC processor.(Jan22)
9. Compare Von-Neumann and harvard architecture.
10. Generate PWM and DAC using RISC processor.

Module-IV:

1. Explain Embedded System Design Concepts.
2. Explain Characteristics and Quality Attributes of Embedded Systems .
3. Explain Operational and non-operational quality attributes.
4. Write a short note on Embedded Systems.
5. Explain embedded firmware design and development.
6. Write an ALP to move the content of one 16 bit variable value to another 16 variable result.(Jan22).
7. Write an ALP to scan 16 bit numbers stored in the array to find the number of negative.
8. Write an ALP to scan to multiply two 16 bit numbers.
9. Write an ALP to scan to Divide two 16 bit numbers.
10. Explain about pipeline Hazards.




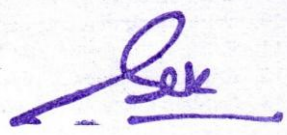
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Module-V:

1. Explain RTOS and IDE for Embedded System Design .
2. Explain Thread preemption and Preemptive Task scheduling techniques.
3. Define Task Communication .
4. Explain Racing and Deadlock, Concept of Binary and counting semaphores
5. How to choose an RTOS, Integration and testing of Embedded hardware and firmware, Embedded system.
6. Comparison between molithic kernel and micro kernel.
7. Explain types of operating system.
8. Explain characteristic of real time operating systems.(Jan22)
9. Explain about message passing.
10. Explain about threads.

15.0 University Result

Examination	S+	FCD (S, A, B)	FC (C)	SC (D, E)	FAIL (F)	% Passing
2020-21	NA	44	08	01	00	100
2019-20	NA	39	04	00	00	100

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

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SUBJECT TITLE	OBJECT ORIENTED CONCEPTS		
Subject Code	18CS45	IA Marks	40
Number of Lecture Hrs / Week	03	Exam Marks	60
Total Number of Lecture Hrs	40	Exam Hours	03
CREDITS-03			

FACULTY DETAILS:

Name: Dr. Mahesh G. Huddar	Designation: Associate Professor	Experience: 11.9 Years
No. of times course taught: 01		Specialization: Computer Science & Engineering

1.0 Prerequisite Subjects:

Sl. No	Branch	Semester	Subject
01	Computer Science and Engineering	I	Programming in C & Data Structures

2.0 Course Objectives

This course will enable students to

1. Learn fundamental features of object oriented language and JAVA.
2. Set up Java JDK environment to create, debug and run simple Java programs.
3. Create multi-threaded programs and event handling mechanisms.
4. Introduce event driven Graphical User Interface (GUI) programming using applets and swings..

3.0 Course Outcomes

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

	Course Outcome	Cognitive Level	POs
C214.1	Explain concepts of object oriented programming with C++.	L2	PO1, PO2, PO3, PO5 PO12
C214.2	Develop Java programs to solve problems.	L3	PO1, PO2, PO3, PO5 PO12
C214.3	Explain Inheritance, Exceptions, Packages and Interfaces in Java.	L2	PO1, PO2, PO3, PO5 PO12
C214.4	Develop multithreaded programs.	L3	PO1, PO2, PO3, PO5 PO12
C214.5	Develop simple event based Graphical User Interfaces using Swings.	L3	PO1, PO2, PO3, PO5 PO12
Total Hours of instruction		50	

4.0 Course Content


Module – 1

08 Hours

Introduction to Object Oriented Concepts:

A Review of structures, Procedure–Oriented Programming system, Object Oriented Programming System, Comparison of Object Oriented Language with C, Console I/O, variables and reference variables, Function Prototyping, Function Overloading. **Class and Objects:** Introduction, member functions and data, objects and functions.

Text book 1: Ch 1: 1.1 to 1.9 Ch 2: 2.1 to 2.6 Ch 4: 4.1 to 4.2

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Module -2

08 Hours

Objects and arrays, Namespaces, Nested classes, Constructors, Destructors. **Introduction to Java:** Java's magic: the Byte code; Java Development Kit (JDK); the Java Buzzwords, Object-oriented programming; Simple Java programs. Data types, variables and arrays, Operators, Control Statements.

Text book 1: Ch 2: 2.4 to 2.6 Ch 4: 4.1 to 4.2

Text book 2: Ch:1 Ch: 2 Ch:3 Ch:4 Ch:5

Module- 3

08 Hours

Classes, Inheritance, Exceptions: Classes: Classes fundamentals; Declaring objects; Constructors, this keyword, garbage collection. **Inheritance:** Inheritance basics, using super, creating multi level hierarchy, method overriding. **Exception handling:** Exception handling in Java.

Text book 2: Ch:6 Ch: 8 Ch:10

Module- 4

08 Hours

Packages and Inetrfaces : Packages, Access Protection, Importing Packages, Interfaces. **Multi Threaded Programming, Event Handling:** Multi Threaded Programming: What are threads? How to make the classes threadable ; Extending threads; Implementing runnable; Synchronization; Changing state of the thread; Bounded buffer problems, readwrite problem, producer consumer problems

Text book 2: Ch:9 Ch:11

Module -5

08 Hours

Event Handling: Two event handling mechanisms; The delegation event model; Event classes; Sources of events; Event listener interfaces; Using the delegation event model; Adapter classes; Inner classes. **Swings:** Swings: The origins of Swing; Two key Swing features; Components and Containers; The Swing Packages; A simple Swing Application; Create a Swing Applet; JLabel and ImageIcon; JTextField;The Swing Buttons; JTabbedPane; JScrollPane; JList; JComboBox; JTable.

Text book 2: Ch 22: Ch: 29 Ch: 30

5.0 Relevance to future subjects


Sl No	Semester	Subject	Topics
01	IV	Design & analysis of Algorithms Lab	Implementation of various algorithms using Java.
02	V	Advanced Java & J2EE	Java Enumerations, Collection Framework, JDBC, Servlets, JSP
03	VII	Web Programming	Java Script
04	VIII	Project work	Implementation of the projects using Java.

6.0 Relevance to Real World

SL.No	Real World Mapping
01	Designing commercial e-commerce website, android applications
02	Developing scientific application and financial applications like electronic trading systems.
03	Developing Software tools such as Eclipse, InetelliJ Idea and Netbeans IDE.

7.0 Gap Analysis and Mitigation

Sl. No	Delivery Type	Details
01	Tutorial	Topic: Module I-Module V
02	NPTEL	Applets Programming Videos

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8.0 Books Used and Recommended to Students

Text Books
<ol style="list-style-type: none"> Sourav Sahay, Object Oriented Programming with C++ , 2nd Ed, Oxford University Press,2006 (Chapters 1, 2, 4) Herbert Schildt, Java the Complete Reference, 7th Edition, Tata McGraw Hill, 2007. (Chapters 1, 2, 3, 4, 5, 6, 8, 9,10, 11, 21, 22, 29, 30)
Reference Books
<ol style="list-style-type: none"> Mahesh Bhavne and Sunil Patekar, "Programming with Java", First Edition, Pearson Education,2008, ISBN:9788131720806 Herbert Schildt, The Complete Reference C++, 4th Edition, Tata McGraw Hill, 2003. Stanley B.Lippmann, Josee Lajore, C++ Primer, 4th Edition, Pearson Education, 2005. Rajkumar Buyya,S Thamarasi selvi, xingchen chu, Object oriented Programming with java, Tata McGraw Hill education private limited. Richard A Johnson, Introduction to Java Programming and OOAD, CENGAGE Learning. E Balagurusamy, Programming with Java A primer, Tata McGraw Hill companies.
Additional Study material & e-Books
<ol style="list-style-type: none"> https://docs.oracle.com/javase/tutorial/ http://javabeginnerstutorial.com/core-java http://onlinevideolecture.com/ebooks/?subject=Java https://www.youtube.com/playlist?list=PLS1QulWo1RIbfTjQvTdj8Y6yyq4R7g-AI www.codejava.net/books/4-best-free-java-e-books-for-beginners

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

Website and Internet Contents References
<ol style="list-style-type: none"> www.nptelvideos.com/java/java_video_lectures_tutorials.php https://www.cse.iitb.ac.in/~nlp-ai/javalect_august2004.html www.nptel.ac.in/courses/106105084/28

10.0 Magazines/Journals Used and Recommended to Students

Sl.No	Magazines/Journals	website
1	Java Magazine - Oracle	www.oracle.com/technetwork/java/javamagazine/
2.	Java - IEEE Conferences, Publications, and Resources	https://www.computer.org/software-magazine/
3.	Java Developer's Journal - Steven Gould	https://jsrd.springeropen.com/

11.0 Examination Note

Internal Assessment: 30+10=40 Marks


50 marks –from three internal assessment test

10 marks- from the assignments

Scheme of Evaluation for Internal Assessment (50 Marks)

a) Internal Assessment test in the same pattern as that of the main examination (Average of the three Tests): 50marks.

b) Assignment marks for each module is 25. Average of 5 assignment marks will be taken and finally scale down to 10 marks.

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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 25 marks, Total test marks are 50.
 - a. Q.No I or Q.No II = 25 Marks
 - b. Q.No III or Q.No IV = 25 Marks
 - c. **Total = 50 Marks**

Question Paper Pattern and instructions (Main Exam):

1. The question paper will have TEN questions.
2. There will be TWO questions from each module.
3. Each question will have questions covering all the topics under a module.
4. The students will have to answer FIVE full questions, selecting ONE full question from each module.
 Max. Marks: 100 and each question carries 20 marks.
 Exam Duration: 3 Hrs.
5. The total marks scored out of 100 marks will be scaled down to 60 marks.

12.0 Course Delivery Plan

Module	Lecture No.	Content of Lecturer	% of Portion
PART - A			
MODULE 1	1	A Review of structures, Procedure–Oriented Programming system	20
	2	Object Oriented Programming System, Comparison of Object Oriented Language with C	
	3	Console I/O	
	4	Variables and Reference Variables	
	5	Function Prototyping, Function Overloading	
	6	Class and Objects: Introduction	
	7	Member functions and data	
	8	objects and functions	
MODULE 2	9	Objects and Arrays	20
	10	Namespaces, Nested classes	
	11	Constructors, Destructors	
	12	Introduction to Java: Java’s magic: the Byte code	
	13	Java Development Kit (JDK), Java Buzzwords	
	14	Object-oriented programming; Simple Java programs	
	15	Data types, Variables and arrays	
	16	Operators, Control Statements	
MODULE 3	17	Classes: Classes fundamentals;	20
	18	Declaring objects	
	19	Constructors	
	20	this keyword, garbage collection	
	21	Inheritance: inheritance basics, using super	
	22	Creating multi level hierarchy	
	23	Method overriding	
	24	Exception handling: Exception handling in Java	
MODULE 4	25	Packages	20
	26	Access Protection	
	27	Importing Packages, Interfaces	
	28	Multi Threaded Programming: What are threads? How to make the classes threadable?	
	29	Extending threads; Implementing runnable	
	30	Synchronization; Changing state of the thread	
	31	Bounded buffer problems	
	32	Read-write problem, producer consumer problems.	

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MODULE 5	33	Event Handling: Two event handling mechanisms; The delegation event model;	20
	34	Event classes; Sources of events	
	35	Event listener interfaces; Using the delegation event model;	
	36	Adapter classes, Inner classes	
	37	Swings: Swings: The origins of Swing; Two key Swing features; Components and Containers	
	38	The Swing Packages; A simple Swing Application	
	39	Create a Swing Applet; JLabel and ImageIcon; JTextField;The Swing Buttons;	
	40	JTabbedPane; JScrollPane; JList; JComboBox; JTable.	


13.0 Assignments, Pop Quiz, Mini Project, Seminars

Sl.No.	Title	Outcome expected	Allied study	Week No.	Individual / Group activity	Reference: book/website /Paper
1	Assignment 1: University Questions on introduction and requirements engineering	Students study the Topics and write the Answers. Get practice to solve university questions.	Module I of the syllabus	2	Individual Activity. Printed solution expected.	Book 1 of the reference list. Website of the Reference list & Text Book 1
2	Assignment 2: University Questions on system models, design and implementation	Students study the Topics and write the Answers. Get practice to solve university questions.	Module II of the syllabus	4	Individual Activity. Printed solution expected.	Book 1 of the reference list. Website of the Reference list & Text Book 2
3	Assignment 3: University Questions on software testing and evolution	Students study the Topics and write the Answers. Get practice to solve university questions.	Module III of the syllabus	6	Individual Activity. Printed solution expected.	Book 1 of the reference list. Website of the Reference list & Text Book 2
4	Assignment 4: University Questions on project planning and quality management	Students study the Topics and write the Answers. Get practice to solve university questions.	Module IV of the syllabus	8	Individual Activity. Printed solution expected.	Book 1 of the reference list. Website of the Reference list & Text Book 2
5	Assignment 5: University Questions on Agile software development	Students study the Topics and write the Answers. Get practice to solve university questions.	Module V of the syllabus	10	Individual Activity. Printed solution expected.	Book 1 and SCRUM primer of the reference list. Website of the Reference list & Text Book 2

14.0 QUESTION BANK

Module: 1


1. Compare Object Oriented Programming with C. Discuss three OOP principles.
2. Write the differences between procedure oriented program and object oriented program. (Jan-2019)
3. List and explain any four features of Object Oriented Program. (Jan-2019)
4. State the important features of Object Oriented programming paradigm. (July-2018)
5. List out the difference between procedure oriented program and object oriented program. (Jan-2018)
6. Explain function prototyping with example. (Jan-2018, July-2018)
7. Explain function overloading with example. (Jan-2018)

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8. What is function overloading? Write a C++ program to define three overloaded functions to find the sum of two integers, sum of two floating numbers and sum of three integers. (Jan-2019)
9. Explain the concepts of Objects, Classes with suitable examples.
10. Define a Student class with following measures: (Jan-2019)
 - a. Data members: RollNo, Name, average marks
 - b. Member functions: to read data, to print data, write a C++ program to read data of 10 students and print the 10 students information.
11. What is function polymorphism? Write a program in C++ using overloaded function to find area of circle, triangle, and rectangle. (July-2017)
12. Define a friend function. Illustrate with an example. (Jan-2019)
13. Explain how one can bridge two classes using friend function. Write C++ program to find the sum of two numbers using bridge friend function add(). (July-2017)
14. What is the reference variable? Explain. Also write a program in C++ to swap two int values and display the values before and after swapping. (July-2017)
15. What are static member of a class? Write a C++ program to count the number of objects created. (July-2017)
16. Explain the concept of object oriented program i) Encapsulation ii) Polymorphism iii) Inheritance iv) Data initialization.
17. Write a C++ program to get employees details (empno, ename, bsalary(initialized to 1000 by constructor) and allowance) of Employee class through keyboard using the method Getdata() and display them using the method Dispdata() on console in the format empno,ename , bsalary, allowance. (July-2018)
18. Define Function Overloading and write a C++ program for finding areas of circle ($PI * r * r$), rectangle ($l * b$) and square ($x * x$) by getting r, l, b and x through keyboard and printing the areas on console using the method Area() applying the concept of function overloading. (July-2018)

Module: 2


1. Discuss objects and arrays with suitable examples.
2. What are constructors and destructors? Explain with a C++ program.
3. Explain namespace, with an example. (July-2018)
4. How do namespace help in preventing pollution of the global name space? (Jan-2018)
5. With an example explain Nested Classes.
6. What is constructor? Mention it's types. Explain parameterized constructor with an example. (Jan-2019)
7. Can you overload constructor and destructor justify with suitable program. (July-2017)
8. What is constructor? List the different type of constructors and explain default constructor with example
9. How do name space helps in preventing pollution of the global namespace. (July-2017)
10. Briefly explain any six key considerations used for designing JAVA language. (Dec.10)
11. Explain how java is robust and interactive. (Jan-2018)
12. State the features used in C++ which are eliminated in Java. Why?
13. How "compile once and run anywhere" is implemented in Java. Discuss. (Dec.10, Jun-14, July-2017)
14. Discuss briefly the concept of byte code in Java.(July-2018)
15. Define bytecode. How does it help java programs achieve portability? (Jan-2019)
16. Explain the features of Java.(May/June.10)
17. Elucidate how Java is a platform independent language, with neat sketches. (July-2018)
18. List and explain Java buzzwords. (Dec.09/Jan.10, Jun-14, July-2017, Jan-2019)
19. Explain the process of creating and running Java programs.(July-2018)
20. Write a Java program to print factorial of the number 'n' using for loop. (July-2018)
21. Explain the structure of a Java program and its keywords with an example. (July-2018)
22. Write a program to calculate the average among the elements {8, 6, 2, 7} using for each in Java. How for each is different from for loop? (July-2017)
23. Write a Java program to sum only the first five elements of the array {1,2,3,4,5,6,7,8,9,10} using for each version of the for loop.
24. Write java program to sum only first five elements of the array using for each looping. (Jan-2018)
25. Explain the operation of the following operators with example. (Jan-2018)
 - a. % ii) >>> iii) &&
26. Write & demonstrate a Java program to initialize & display different types of integers & floating type variable. (Dec-14)
27. Write java program to initialize and display different types of integer and floating point variables. (Jan-2018)
28. Explain different access specifiers in Java & their scope. (Dec.09, Dec-14)
29. Define type casting. Explain with an example. (Dec-14, Jan-2019)
30. Explain type conversion, with an example. (July-2017)

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31. What is type casting? Illustrate with an example. What is meant by automatic type promotion? (Jan-2018)
32. How arrays are defined in Java? Explain with an example. (Dec-11, Jun-13 Dec-14)
33. Explain the concepts of arrays in Java with examples. Also write a program that creates and initializes a four integer elements array. Find the sum and average of its values. (July-2017)
34. How arrays are defined in Java? Explain with an example. (July-2018)
35. How to declare two dimensional arrays in java? Explain with simple example. (Jan-2018)
36. Write a Java program to illustrate the use of multidimensional arrays.
37. Discuss operators in Java. (Dec.10)
38. Write a note on object instantiation. (Dec.09/Jan.10)
39. What is jump statement? Explain with examples. (Dec-12, Jun-13)
40. Explain : i) >>> ii) short circuit logical operators iii) for each (Jun-14)
41. With an example explain the working of >> and >>> (unsigned right shift) (Jan-2019)
42. Describe the process of building & running Java program. (Jun-14)

Module- 3

1. What is command-line argument? Write a program to demonstrate command-line arguments. (Jun-13)
2. What are the different types of inner classes? Write a program to demonstrate inner class. (Dec.10) (May/June.10)
3. WAP in JAVA to implement stack that can hold 10 integer values. (Dec-12)
4. Differentiate C++ language and Java language with respect to inheritance, and also mention the use of super and this in Java Inheritance. (Dec.10)
5. Define inheritance. List the different types of inheritance. (Jan-2018)
6. Discuss the following terms with an example: i) super ii) final (Jan-2019)
7. Define inheritance. Explain the multilevel hierarchy with an example program, (Jan-2019)
8. Elucidate the concept of inheritance and its classifications in Java with sketches. (July-2018)
9. With an example, give two uses of super keyword? (July-2017)
10. Illustrate with example a super class variable can reference a subclass object. (Jan-2018)
11. Explain package and its types and import command in Java with examples. (July-2018)
12. Describe the various levels of access protections available for packages and their implications. (Jan-2018, Jan-2019)
13. Which is the alternative method to implement multiple inheritance in Java? Explain with an example. (Dec.09/Jan.10)
14. Explain the role of interfaces while implementing multiple inheritance in Java. (Dec.10, July-2017)
15. Write a Java program to define an interface called Area which contains method called Compute() and calculate the areas of rectangle ($l * b$) and triangle ($1/2 * b * h$) using classes Rectangle and Triangle. (July-18)
16. With an example program explain the method overriding? (Dec.10)
17. Compare and contrast method overloading and method overriding with suitable examples. (July-2017, Jan-18)
18. When constructors are called in the class hierarchy? (July-2017)
19. Distinguish between method overloading and overriding in Java, with suitable example. (Jan-2019)
20. Why overridden methods are used in Java? Explain with an example. (Jun-13)
21. Give the basic form of an exception handling block. (Jan-2018)
22. Define the role of Exception handling in software development. (July-2018)
23. What is an exception? Give an example for nested try statements. (Dec-12)
24. Define exception. Explain the exception handling mechanism with an example. (Jan-2019)
25. Explain Java's built-in exceptions. (June-10)
26. What is the importance of the clause finally? (Jan-2018)
27. Create a try block that is likely to generate three types of exception and incorporate necessary catch block to catch and handle them. (Dec.09)
28. Write a Java program for illustrating the exception handling when a number is divided by zero and an array has a negative index value. (July-2018)


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Module- 4

1. What are threads? Provide any two typical applications where multithreaded programming is used. (Dec.10)
2. Define the concept of multithreading in Java and explain the different phases in the life cycle of a thread, with a neat sketch. (July-2018)
3. With an example program show the Thread creation.
4. What is Thread? Explain two ways of creation of thread. (Jan-2018, Jan-2019)
5. Demonstrate creating multiple threads.
6. Write a Java program, which creates two threads, one thread displays “VTU-Belgaum” for every 100 seconds, and another thread displays “Karnataka” for every 50 sec’s, continuously. (Dec.10)
7. What is meant by Thread Priority? How to assign & get thread priority? (Dec.09, Jun-13 Dec-14)
8. With syntax explain the use of `isAlive()` and `join()` methods. (Jan-2019)
9. Discuss briefly Synchronization in Java (2). (July-2018)
10. What is synchronization? When do we use it? (Jan-2018)
11. Write an example Program for implementing static synchronization in Java. (July-2018)
12. Elucidate the two ways of making a class threadable, with examples. (July-2018)
13. What is need of synchronization? Explain with an example, how synchronization is implemented in Java? (Dec.09, Jun-14, Jun-15, Jan-19)
14. What is synchronization? What is the role of synchronization in threads? Demonstrate a program using synchronized methods. (Jun.10)
15. How do I serialize an object to a file?
16. What is multithreaded programming? Explain with an example hoe inter thread communication is implemented in Java. (Jun-13)
17. What is producer – consumer problem? Explain the solution for producer-consumer problem with a program. (Jun.10, Jun-14)
18. What is synchronization? Explain the role of synchronization with producer & consumer problem. (Dec-14, Jan-2018)
19. Why is the “main” thread important? Write a Java program that creates multiple child threads & also ensures that the main thread is last to stop. (Jun-15)

Module -5





1. Describe the delegation event model and explain what happens internally at a button click. (July-2018)
2. Explain delegation event model used to handle events in Java. What are events, event listeners and event sources? (Jan-2019)
3. What are the two event handling mechanisms in Java?
4. Explain Delegation event model used to handle events in java. (Jan-208)
5. Explain the delegation event model used to handle events in Java. What are events, event listeners & event sources? (Dec.10, Jun-15)
6. What are the Event classes? (Dec.10)
7. Explain `KeyEvent` and `MouseEvent` class. (Jan-2018)
8. Write a Java program to handle mouse and keyboard events.
9. Explain Adapter classes, with examples. (Dec.09, Jun.10)
10. Explain Adapter class and Inner class with example. (Jan-2019)
11. Write a note on event listener interfaces. (Jun-13)
12. Explain any two event listener interfaces with its functions or methods. (Dec-14)
13. Briefly explain the role of: i) `ActionEvent` class ii) `AdjustmentEvent` class (Dec-12)
14. What is delegation event model? Describe the significance of adapter class, with an example. (Jun-14)
15. Describe the key feature of swings. (Jan-2019)
16. Write the advantages of swing over AWT. (July-2018)
17. What are Swings? Provide any two typical applications of swings. (Dec.10)
18. Explain MVC architecture of Swings. (Dec-12)
19. What are the deficiencies of AWT that are overcome by Swings? Explain the two key features of swings. (Jun-15)
20. Create a simple swing Application.
21. Explain the various components of swing package. (Dec.10)
22. Briefly explain the containers and components in swings. (Jun.10, Jun-13)
23. Explain `JLabel`, `JTabbedPane`, `JScrollPane`, `JComboBox`. (Dec.10, Jun.10)
24. Explain `JScrollPane` with an example. (Dec-14)
25. Explain `JComboBox` with an example. (Dec-14)


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26. Explain with syntax the following : I) JLabel ii) JTextField iii) JButton iv) JCheckBox (Jun-15, Jan-18/19)
27. Describe the different types of Swing buttons. (Dec-12)
28. Create a swing applet that has two buttons named alpha and beta. When either of the buttons pressed, it should display "alpha was pressed" and "beta was pressed", respectively. (Dec.09, Jun-14, Jan-2018)
29. Name and explain the different types of swing buttons. Give their syntax. (Dec.09)
30. Write the steps to create JTable. Write a program to create a table with the column headings "Fname, Lname, Age" and insert at least 5 records in the table and display. (Dec.09, Jun-13)
31. Write a Java swing applet , which accepts a text from JText field and display the same text with selected font size and color using JLabel. (Dec.10)
32. What is swing? List the main swing features. Explain the different types of panes of swing containers. (Jun-14).
33. List the different types of swing buttons. Write a program to create four types of buttons on JApplet. Use suitable events to show actions on the buttons & use JLabel to display the action invoked. (Jun -14)
34. Write a Swing applet program to demonstrate with two Jbuttons named India & Srilanka. When either of the buttons pressed, it should display respective label with its icon. Refer the image icons "India.gif" & "Srilanka.gif". Set the initial label is "press a button". (Dec-14)
35. Write a swing program for displaying anyone of the options. C , C++ , Java, Php through the selection of Combo box by clicking show button. (July-2018)

15.0 University Result

Examination	No. of Students	No. of Students passed	FCD	FC	SC	Fail	% Passing
2020-21	53	41	10	02	0	0	100
2019-20	43	43	30	12	1	0	100

Prepared by	Checked by		
 Dr. Mahesh G. Huddar	 Dr. Mahesh G. Huddar	 HOD	 Principal

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SUBJECT TITLE	DATA COMMUNICATION		
Subject Code	18CS46	IA Marks	40
Number of Lecture Hrs / Week	04	Exam Marks	60
Total Number of Lecture Hrs	40	Exam Hours	03
CREDITS – 03			

FACULTY DETAILS:		
Name: Prof. Nyamatulla M Patel	Designation: Asst. Professor	Experience: 16.8 Years
No. of times course taught: 01	Specialization: Computer Science and Engineering	

1.0 Prerequisite Subjects:

Sl. No	Branch	Semester	Subject
01	Computer Science and Engineering	I/II	Programming in C and Data Structures
02	Computer Science and Engineering	III	Discrete Mathematics and Applications

2.0 Course Objectives

1. Comprehend the transmission technique of digital data between two or more computers and a computer network that allows computers to exchange data.
2. Explain with the basics of data communication and various types of computer networks.
3. Demonstrate Medium Access Control protocols for reliable and noisy channels.
4. Expose wireless and wired LANs..

3.0 Course Outcomes

After studying this course, students will be able to

CO	Course Outcome	Cognitive Level	POs
C214.1	Explain the various components of data communication.	U	1,2,3,5,12
C214.2	Explain the fundamentals of digital communication and switching.	U	1,2,3,5,12
C214.3	Compare and contrast data link layer protocols.	U	1,2,3,5,12
C214.4	Summarize IEEE 802.xx standards	U	1,2,3,5,12
Total Hours of instruction			40

4.0 Course Content

Module 1

8 Hours

Introduction: Data Communications, Networks, Network Types, Internet History, Standards and Administration, **Networks Models:** Protocol Layering, TCP/IP Protocol suite, The OSI model, **Introduction to Physical Layer-1:** Data and Signals, Digital Signals, Transmission Impairment, Data Rate limits, Performance.

Textbook1: Ch 1.1 to 1.5, 2.1 to 2.3, 3.1, 3.3 to 3.6

RBT: L1, L2


Module 2

8 Hours

Digital Transmission: Digital to digital conversion (Only Line coding: Polar, Bipolar and Manchester coding). **Physical Layer-2:** Analog to digital conversion (only PCM), Transmission Modes, **Analog Transmission:** Digital to analog conversion.

Textbook1: Ch 4.1 to 4.3, 5.1

RBT: L1, L2

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Module 3

8 Hours

Bandwidth Utilization: Multiplexing and Spread Spectrum, Switching: Introduction, Circuit Switched Networks and Packet switching. **Error Detection and Correction:** Introduction, Block coding, cyclic codes, Checksum,

Textbook1: Ch 6.1, 6.2, 8.1 to 8.3, 10.1 to 10.4

RBT: L1, L2

Module 4

8 Hours

Data link control: DLC services, Data link layer protocols, Point to Point protocol (Framing, Transition phases only).

Media Access control: Random Access, Controlled Access and Channelization, **Introduction to Data-Link Layer:** Introduction, Link-Layer Addressing, ARP **IPv4 Addressing and subnetting:** Classful and CIDR addressing, DHCP, NAT

Textbook1: Ch 9.1, 9.2, 11.1, 11.2 11.4, 12.1 to 12.3, 18.4

RBT: L1, L2

Module 5

8 Hours

Wired LANs Ethernet: Ethernet Protocol, Standard Ethernet, Fast Ethernet, Gigabit Ethernet and 10 Gigabit Ethernet,

Wireless LANs: Introduction, IEEE 802.11 Project and Bluetooth. **Other wireless Networks:** Cellular Telephony

Textbook1: Ch 13.1 to 13.5, 15.1 to 15.3, 16.2

RBT: L1, L2

5.0 Relevance to future subjects

Sl. No	Semester	Subject	Topics
01	VIII	Project work	Computer networks related projects

6.0 Relevance to Real World


Sl. No	Real World Mapping
01	Design computer network solutions
02	Development of a software applications

7.0 Gap Analysis and Mitigation

Sl. No	Delivery Type	Details
01	Tutorial	Numerical Solving
02	NPTEL	Computer Networks

8.0 Books Used and Recommended to Students

Text Books
1. Behrouz A. Forouzan, Data Communications and Networking 5E, 5th Edition, Tata McGraw-Hill, 2013.
Reference Books
1. Alberto Leon-Garcia and Indra Widjaja: Communication Networks - Fundamental Concepts and Key architectures, 2nd Edition Tata McGraw-Hill, 2004.
2. William Stallings: Data and Computer Communication, 8th Edition, Pearson Education, 2007.
3. Larry L. Peterson and Bruce S. Davie: Computer Networks – A Systems Approach, 4 th Edition, Elsevier, 2007.
4. Nader F. Mir: Computer and Communication Networks, Pearson Education, 2007
Additional Study material & e-Books
1. Andrew S. Tanenbaum , Computer Networks, 5 th Edition
2. Kuros Ross, Computer Networks a Top Down Approach, 6 th Edition, Pearson Education.

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

Website and Internet Contents References
1. https://www.tutorialspoint.com/computer_fundamentals/computer_networking.htm

10.0 Magazines/Journals Used and Recommended to Students

Sl.No	Magazines/Journals	Website
1	The International Journal of Computer and Telecommunications Networking	https://www.journals.elsevier.com/computer-networks/
2	The Journal of Network and Computer Applications	https://www.journals.elsevier.com/journal-of-network-and-computer-applications/

11.0 Examination Note

Internal Assessment: 30+10=40 Marks

- 50 marks –from three internal assessment test
- 10 marks- from the assignments

Scheme of Evaluation for Internal Assessment (50 Marks)

- a) Internal Assessment test in the same pattern as that of the main examination (Average of the three Tests): 50marks.
- b) Assignment marks for each module is 25. Average of 5 assignment marks will be taken and finally scale down to 10 marks.

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 25 marks, Total test marks are 50.
 - a. Q.No I or Q.No II = 25 Marks
 - b. Q.No III or Q.No IV = 25 Marks
 - c. **Total = 50 Marks**

Question Paper Pattern and instructions (Main Exam):

1. The question paper will have TEN questions.
2. There will be TWO questions from each module.
3. Each question will have questions covering all the topics under a module.
4. The students will have to answer FIVE full questions, selecting ONE full question from each module.
Max. Marks: 100 and each question carries 20 marks.
Exam Duration: 3 Hrs.
5. The total marks scored out of 100 marks will be scaled down to 60 marks.

12.0 Course Delivery Plan

Module	Lecture No.	Content of Lecturer	% of Portion
1	1	Introduction to Data Communications , Networks, Network Types,	20
	2	Internet History, Standards and Administration	
	3	Networks Models: Protocol Layering	
	4	TCP/IP Protocol suite, The OSI model	
	5	Introduction to Physical Layer-1: Data and Signals	
	6	Data and Signals ,Transmission Impairment	
	7	Data Rate limits	
	8	Performance	
2	9	Digital Transmission: Digital to digital conversion (Only Line coding: Polar, Bipolar and Manchester coding).	20


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	10	Digital Transmission: Digital to digital conversion (Only Line coding: Polar, Bipolar and Manchester coding).	
	11	Physical Layer-2: Analog to digital conversion (only PCM), Transmission Modes,	
	12	Physical Layer-2: Analog to digital conversion (only PCM), Transmission Modes,	
	13	Analog Transmission: Digital to analog conversion.	
	14	Analog Transmission: Digital to analog conversion.	
	15	Analog Transmission: Digital to analog conversion.	
	16	Analog Transmission: Digital to analog conversion.	
3	17	Bandwidth Utilization: Multiplexing and Spread Spectrum,	20
	18	Bandwidth Utilization: Multiplexing and Spread Spectrum,	
	19	Bandwidth Utilization: Multiplexing and Spread Spectrum,	
	20	Switching: Introduction, Circuit Switched Networks and Packet switching.	
	21	Switching: Introduction, Circuit Switched Networks and Packet switching.	
	22	Error Detection and Correction: Introduction Block coding	
	23	Cyclic codes	
4	24	Checksum	20
	25	Data link control: DLC services	
	26	Data link layer protocols	
	27	Point to Point protocol (Framing, Transition phases only).	
	28	Media Access control: Random Access	
	29	Controlled Access and Channelization	
	30	Introduction to Data-Link Layer: Introduction, Link-Layer Addressing, ARP	
31	IPv4 Addressing and subnetting: Classful and CIDR addressing		
5	32	DHCP, NAT	20
	33	Wired LANs Ethernet: Ethernet Protocol	
	34	Standard Ethernet	
	35	Fast Ethernet	
	36	Gigabit Ethernet and 10 Gigabit Ethernet	
	37	Wireless LANs: Introduction	
	38	IEEE 802.11 Project ,Bluetooth	
	39	Cellular Telephony	
40	Cellular Telephony		

13.0

Assignments, Pop Quiz, Mini Project, Seminars

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 Behrouz A. Forouzan, Data Commn, and N/W
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 Behrouz A. Forouzan, Data Commn, and N/W
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 Behrouz A. Forouzan, Data Commn, and N/W

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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	Individual Activity. Witten solutions expected.	Text book Behrouz A.Forouzan, Data Commn, and N/W
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	Individual Activity. Witten solutions expected.	Text book Behrouz A. Forouzan, Data Commn, and N/W

14.0


QUESTION BANK

Module - 1


1. What is data communication? List and explain the five characteristics of a data communication system, with examples.
2. What are the five important components of data communications?
3. Give the comparison between LAN, MAN and WAN with an example.
4. Describe with a neat diagram. The functionalities of each layer in the TCP/IP model.
5. Differentiate between: i) ARP and RARP ii) ICMP and IGMP iii) UDP and TCP.
6. With neat diagram explain mesh topology with applications of each.
7. What are standards? Name any four standard organizations.
8. Name and explain four topologies of computer networks.
9. What is Protocol? What are the key elements of a protocol?
10. Explain different transmission modes.
11. For n devices in n/w, what is the number of cable links required for a mesh, ring and star topologies?
12. Explain the different level of addressing used in an internet with a suitable example for each level of addressing in TCP/IP?
13. An analog signal has a bandwidth of 40 kHz. If we use four levels in the signal. What is the minimum bandwidth of the digital signal?
14. What is data communication? With neat diagram, explain four basic topologies. (June/July 2017 -05 marks)
15. What is noiseless channel? Find out maximum bit rate in noiseless channel with a bandwidth of 3000Hz transmitting a signal with two signal level. (June/July 2017 -04 marks)
16. Define data communication. Explain the fundamental characteristics of a data communication system. With a neat diagram explain the components of data communication? (Dec-17/Jan 18 -06 marks)
17. Explain TCP/IP protocol suite of computer networks with neat diagram. (Dec-17/Jan 18 -08 marks)
18. Assume that five devices are connected in mesh topology. How many duplex links are needed? How many ports are needed for each? (Dec-17/Jan 18 -02 marks)
19. A network with bandwidth of 10 Mbps can pass only an average of 18000 frames per minute with each frame carrying an average of 10000 bits. What is the throughput of this network. (Dec-17/Jan 18 -02 marks)
20. Define data communication. Explain any two fundamental characteristics of a data communication and basic network topology. (June/July 18 -08 marks)
21. List out the network criteria. Explain TCP/IP protocol suite with neat diagram. (June/July 18 -08 marks)

Module 2

1. Describe with neat waveform any two polar line coding schemes.
2. Give data rate formula suggested by Nyquist and Shannon. Low pass communication has BW of 1 m Hz .what is the Shannon capacity of the channel if SNR is 40 dB? What bit rate is attained using 8-level pulses?
3. Calculate the Shannon channel capacity in the following cases: BW 20 kHz SNR dB 40; BW =200 kHz SNR dB 6.
4. A file contains 3 million bytes. How long does it take to download this file using a 100 kbps channel?
5. Define line coding. Describe Unipolar NRZ, polar NRZ-L, Bipolar AMI and Manchester encoding by applying on the information sequence 101011100.
6. Define the following: Bandwidth, Through Put, Transmission Time, Latency and Jitter.
7. Explain phase shift keying in detail.


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8. An analog signal has a bit rate of 10000 bps and the bandwidth of 2000 baud. How many data elements are carried by each signal element? How many signal elements do we need?
9. An analog signal has a bit rate of 8000bps and a baud rate of 1000 baud. How many data elements are carried by each signal element? How many signal elements do we need?
10. Explain the amplitude modulation.
11. A voice grade channel of a telephone network has a bandwidth of 3.4 kHz, Calculate i) channel capacity for $S/N=30\text{Db}$ ii) S/N required to support information transfer at 4800 bps.
12. With a neat waveform. Explain three methods of digital to analog conversion. Draw waveform with input data 10100.
13. Describe ASK, FSK and PSK mechanisms and apply them over the digital data 101101.
14. Explain PCM and quantization process with steps and example. (June/July 2017 -08 marks)
15. Explain amplitude shift keying modulation process. (June/July 2017 -04 marks)
16. Find out bit rate if available bandwidth is 100 KHz which spans from 200 to 300KHz. Consider ASK with $d=1$ $r=1$. (June/July 2017 -04 marks)
17. Explain with suitable diagram PCM encoder used for analog to digital conversion with example. (Dec-17/Jan 18 -06 marks)
18. Briefly explain with neat diagrams ASK and FSK modulation techniques and specify the bandwidth requirements. (Dec-17/Jan 18 -08 marks)
19. We need to send data 3 bits at a time at a bit rate of 3Mbps.the carrier frequency is 10MHz. calculate the number of levels(different frequencies, band rate and bandwidth). (Dec-17/Jan 18 -04 marks)
20. List out the types of transmission modes. Explain the steps of pulse code modulation process with an example. (June/July 18 -08 marks)
21. Explain FSK and QAM modulation process with suitable example. (June/July 18 -08 marks)
22. Define Line coding and list out its characteristics. Represent the following sequence 1011001011 using polar and bipolar scheme. (June/July 18 -08 marks)
23. List out the causes of transmission impairment. Explain the characteristics of analog and digital signals. (June/July 18 -08 marks)
24. Explain different causes for transmission impairments during signal transmission through media. (Dec-17/Jan 18 -06 marks)
25. Define line coding. List out its characteristics. Represent the sequence 10100110 using polar and biphasic schemes. (Dec-17/Jan 18 -08 marks)
26. Explain TCP/IP protocol suite with encapsulation decapsulation process. (June/July 2017 -08 marks)
27. Explain different characteristics of periodic analog signal. Find the phase in degree and radian of a sine wave with offset $\frac{1}{4}$ cycle with respect to time '0'(zero). (June/July 2017 -03 marks)
28. Draw line codes of the sequence 010011 using NRZ, NRZ-L,NRZ-I, Manchester,RZ and differential Manchester schemes. (June/July 2017 06 marks)
29. Explain digital signal transmission methods. (June/July 2017 -06 marks)
30. Explain briefly, with neat figures, the two approaches for digital transmission.
31. A signal travels through an amplifier and the power is increased 10 times. Calculate the power gained.
32. Explain three causes of transmission impairments.
33. What is the Nyquist sampling rate for each of the following signals? i) A low pass signal with bandwidth of 200 kHz. ii) A band pass signal with bandwidth of 300 kHz having lowest frequency of 200 kHz.
34. We want to digitize the human voice. What is the bit rate, assuming 8 bits per sample?
35. Discuss 8b/10b coding scheme.
36. Explain the delta modulation.
37. Suppose an application layer wants to send 100-bytes message to its peer process using the existing TCP connection. The TCP consists of message plus 20 bytes of header. The segment is encapsulated into IP packet that has an additional 20 bytes of header. The IP packet in turn goes inside the Ethernet frame that has 18 bytes of header and trailer. What percentages of the transmitted byte in the physical layer correspond to the message information?
38. Define bandwidth. A periodic signal has a bandwidth of 20 Hz. The highest frequency is 60Hz. What is the lowest frequency? Draw the spectrum, if the signal contains all frequencies of the same amplitude

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Module - 3

1. What is FDM? Briefly explain its multiplexing and de-multiplexing process.
2. Explain briefly the two spread spectrum techniques.
3. What is switching? Differentiate circuit switch network with packet switched network.
4. Explain how TDM differs from FDM, with neat diagram.
5. What is time division multiplexing? Explain how statistical TDM overcomes the disadvantages of synchronous TDM.
6. Explain how the message can be sent from one system to another using datagram approach and calculate total delay with appropriate diagrams. (Dec-17/Jan 18 -06 marks)
7. Define Multiplexing. Explain synchronous TDM with data rate management and its limitations. (June/July 18 -10 marks)
8. List out three phases of circuit-switched network. Explain Datagram-switched network. (June/July 18 -06 marks)
9. What is multiplexing ? Define synchronous TDM with data rate management strategies. (June/July 2017 -08 marks)
10. Define multiplexing. State and explain the data rate management to handle disparity in input data rates in TDM. (Dec-17/Jan 18 -05 marks)
11. Four 1 Kbps connections are multiplexed together. A unit is 1 bit. Find i) duration of 1 bit before multiplexing ii) transmission rate of link iii) duration of each time slot. (Dec-17/Jan 18 -03 marks)
12. What is spread spectrum ? Explain FHSS and bandwidth sharing. (June/July 2017 -08marks)
13. What is TDM? Four sources create 250 characters per second. The frame contains one character from each source and one extra bit for synchronization. Find i) the data rate of each source. ii) Duration of each character in each source. iii) The frame rate iv) duration of output frame. v) Frame size in bits. vi) Data rate of link.
14. We have four sources, each creating 250 characters /sec. if the interleaved unit is one character and 1 synchronization bit is added to each frame, find i) The data rate of each source. ii) The duration of each character in each source. iii) The frame rate. iv) The duration of each frame. v) The no of bits in each frame. vi) The data rate of the link.
15. Define and explain synchronous TDM.
16. What is multiplexing? With neat diagram explain FDM.
17. Draw a CRC encoder and decoder for CRC code with C (7, 4). Also explain how this CRC design works, with an example.
18. Define line of sight propagation.
19. Explain the checksum with an example.
20. Explain the types of errors.
21. Find the code word C(x) for the information $d(x) = x^3 + 1$ with the generator polynomial $t(x) = x^3 + x + 1$.
22. What is hamming distance? Explain simple parity check code C (5, 4) with $d_{\min} = 1$. How many bits can be corrected?
23. What is CRC? If the generating polynomial for CRC code is $x^4 + x^3 + 1$ and message word is 11110000 determine check bits and coded word.
24. What is internet checksum? List the steps undertaken by sender and receiver for error detection.
25. Explain with an example of block coding method for error detection and correction. What is the Hamming distance? Find the minimum Hamming distance of the coding scheme shown in the table.
26. Explain how CRC is used in detecting errors for the following polynomial, $g(x) = x^4 + x + 1$. Consider the information sequence 1101011011. i) Find the code word corresponding to this sequence. ii) If the code word has error in third bit. What does receiver obtain when it does its error checking?
27. How does datawords and codewords is represented in block coding and also explain how can errors be selected and corrected by block coding . (June/July 2017 -10 marks)
28. Find the codeword using CRC given data is 1101 and generator is 1100.(June/July 2017 -06 marks)
29. Find the codeword at the sender site using CRC given dataword is 101001111and generator 10111. (Dec-17/Jan 18 -05 marks)
30. Explain with neat diagram ,simple parity check codes. (Dec-17/Jan 18 -06 marks)
31. Explain with examples, computation of internet checksum. List the steps undertaken by sender and receiver for error detection. (Dec-17/Jan 18 -05 marks)
32. Define Cyclic code. Find the code word using CRC for given data word 1001 and divisor 1011. (June/July 18 -08 marks)


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Module - 4

1. Explain the frame format and transitional phases of point to point protocol.
2. Differentiate between character oriented protocol and bit oriented protocol frame format for framing.
3. Briefly explain about point to point protocol.
4. Describe the different controlled access methods.
5. Explain i) CSMA ii) CSMA/CD ii) Slotted ALOHA.
6. What do you mean by channelization? Explain the protocols used for channelization.
7. A network transmits 200 bit frame on a shared channel of 200 kbps. For aloha and slotted aloha, what is the, i) Requirement to make the frame collision free? ii) Throughput if the system produces 1000 frames/sec?
8. Define channelization and list its three protocols?
9. How does p-persistent method improve efficiency?
10. Explain why collision is an issue in a random access protocol but not in controlled access or channelizing protocols?
11. Explain any two popular control access methods, with a neat diagram.
12. What is channelization ? List and explain channelization protocols. (June/July 2017- 12 marks)
13. Describe pure ALOHA and Slotted ALOHA. (June/July 2017 -06 marks)
14. Explain Carrier Sense Multiple Access with Collision Detection. (June/July 2017 -06 marks)
15. Explain the working of CSMA/CD with suitable flow diagram. (Dec-17/Jan 18 -07 marks)
16. A network using CSMA/CD has a bandwidth of 10Mbps. If the propagation time is 25.6 μ s what is the minimum size of the frame ? (Dec-17/Jan 18 -03 marks)
17. Define channelization. Explain CDMA with an example. (Dec-17/Jan 18 -06 marks)
18. A pure ALOHA transmits 200 bitsframe on a shared channel of 200 Kbps. What is the throughput if the system produces 1000 frames per second? (Dec-17/Jan 18 -04 marks)
19. List out the Random Access protocols and explain CSMA/CD. (June/July 18 -10 marks)
20. List out channelization protocols. Explain CDMA. (June/July 18 -06 marks)
21. Define Frames. Explain the steps of flow control at data link layer with diagram. (June/July 18 -08 marks)
22. Explain Stop and Wait protocol with neat diagram. (June/July 18 -08 marks)
23. Explain frame structure of PPP protocol, with neat diagram. (June/July 18 -08 marks)
24. Explain stop and wait protocol with appropriate diagrams. (Dec-17/Jan 18 -05 marks)
25. Explain different frame types in HDLC. (Dec-17/Jan 18 -06 marks)
26. Explain transistion phases of PPP protocol. (Dec-17/Jan 18 -05 marks)
27. Calculate the time takes to send 2 million bits of data in a system that uses stop and wait protocols, if the distance between sender and receiver is 2000 kms. Assume packet size is 400 bits and propagation speed is 2x1⁰⁸ m. No data or control bit is lost.
33. List the protocols for noisy channels. Explain stop and wait protocol for noiseless channels.
34. Define piggybacking and its usefulness.
35. Write explanatory note s on the different phases of PPP.
36. Explain the selective repeat and stop and wait ARQ.
28. Discuss HDLC protocol.
29. With neat diagram, explain any two protocols of noisy Channel. (June/July 2017 -12 marks)
30. Explain the frame format of HDLC protocol. (June/July 2017 -04 marks)
31. Explain Class full addressing.
32. Find the netid and hosteid of the following: i) 111.64.2.6 ii) 131.57.9.3 ii) 207.64.52.11 iv) 225.34.2.1
33. What is CIDR? Explain.
34. Write a note on network address translation (NAT).
35. Explain DHCP message format
36. Explain DHCP operation in detail

Module - 5

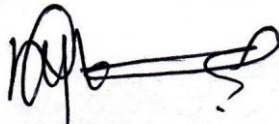



15. Explain 802.3 MAC frame format and frame length.
16. Discuss the 802.11 MAC layer frame format.
17. Explain the IEEE 802.11 architecture.
18. Explain the hidden and exposed station problem in IEEE 802.11.
19. In brief explain blue tooth layers.
20. Explain the services of IEEE 802.11 standards.
21. Write a short note on: i) Bluetooth ii) cellular telephone.
22. Explain the five standards of IMT – 2000 radio – interface of 3G systems.
23. Explain wireless-LAN, with neat architecture and list out its characteristics. (June/July 18 -08 marks)


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|--|-----------------------------|
| 24. Explain the layers of Bluetooth, with neat diagram. | (June/July 18 -08 marks) |
| 25. Discuss 802.3 MAC frame format. | (Dec-17/Jan 18 -06 marks) |
| 26. Define Bluetooth and explain the architecture of the same. | (Dec-17/Jan 18 -06 marks) |
| 27. Define Bluetooth and its architecture. | (June/July 2017 -04 marks) |
| 28. Describe Gigabit Ethernet. | (June/July 2017 -04 marks) |
| 29. Explain the operation of cellular telephony. | (Dec-17/Jan 18 -06 marks) |
| 30. Explain fourth generation (4G) of cellular telephony. | (June/July 18 -08 marks) |

14.0 University Result

Examination	No. of Students	No. of Students Passed	FCD	FC	SC	% Passing
2020-21	53	53	36	15	02	100
2019-20	43	43	38	04	01	100

Prepared by	Checked by		
 Prof. N. M. Patel	 Prof. S. V. Manjaragi	 HOD	 Principal

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SUBJECT TITLE	DESIGN AND ANALYSIS OF ALGORITHMS LABORATORY		
Subject Code	18CSL47	IA Marks	40
No of Lecture Hrs + Practical Hrs / Week	01 I + 02 P	Exam Marks	60
Total No of Lecture + Practical Hrs	40	Exam Hours	03
CREDITS – 02			

FACULTY DETAILS:		
Name: Prof. A. A. Daptardar	Designation: Asst. Professor	Experience: 15 Years
No. of times course taught: 03		Specialization: Computer Science and Engineering

1.0 Prerequisite Subjects:

Sl. No	Branch	Semester	Subject
01	Computer Science and Engineering	I/II	Programming in C and Data Structures
02	Computer Science and Engineering	III	Data Structures with C
03	Computer Science and Engineering	III	OOP with C++ concepts (2014 scheme)

2.0 Course Objectives

This course will enable students to:

1. Design and implement various algorithms in JAVA.
2. Employ various design strategies for problem solving.
3. Measure and compare the performance of different algorithms.

3.0 Course Outcomes

The students should be able to:

CO	Course Outcome	Cognitive	POs
C216.1	Develop Java programs to demonstrate Inheritance, Exception handling and multi-threading concepts.	L3	1,2,3,5,6,8,9,10,12
C216.2	Develop a Java Program to demonstrate the stack operations.	L3	1,2,3,5,6,8,9,10,12
C216.3	Develop the variety of algorithms using Greedy, dynamic programming and Backtracking techniques.	L3	1,2,3,5,6,8,9,10,12
C216.4	Analyze the performance of sorting algorithms based on divide-and-conquer technique.	L4	1,2,3,5,6,8,9,10,12
Total Hours of instruction			40


4.0 Course Content

Description:

Design, develop, and implement the specified algorithms for the following problems using Java language under LINUX /Windows environment .Net beans / Eclipse IDE tool can be used for development and demonstration.

Experiments

1.	A	Create a Java class called <i>Student</i> with the following details as variables within it. (i) USN (ii) Name (iii) Branch (iv) Phone Write a Java program to create <i>n Student</i> objects and print the USN, Name, Branch, and Phone of these objects with suitable headings.
	B	Write a Java program to implement the Stack using arrays. Write Push(), Pop(), and Display() methods to demonstrate its working.

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2.	A	Design a superclass called <i>Staff</i> with details as StaffId, Name, Phone, and Salary. Extend this class by writing three subclasses namely <i>Teaching</i> (domain, publications), <i>Technical</i> (skills), and <i>Contract</i> (period). Write a Java program to read and display at least 3 <i>staff</i> objects of all three categories.
	B	Write a Java class called <i>Customer</i> to store their name and date_of_birth. The date_of_birth format should be dd/mm/yyyy. Write methods to read customer data as <name, dd/mm/yyyy> and display as <name, dd, mm, yyyy> using String Tokenizer class considering the delimiter character as “/”.
3.	A	Write a Java program to read two integers <i>a</i> and <i>b</i> . Compute <i>a/b</i> and print, when <i>b</i> is not zero. Raise an exception when <i>b</i> is equal to zero.
	B	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.
4.		Sort a given set of <i>n</i> integer elements using Quick Sort method and compute its time complexity. Run the program for varied values of <i>n</i> > 5000 and record the time taken to sort. Plot a graph of the time taken versus <i>n</i> on graph sheet. The elements can be read from a file or can be generated using the random number generator. Demonstrate using Java how the divide and- conquer method works along with its time complexity analysis: worst case, average case and best case.
5.		Sort a given set of <i>n</i> integer elements using Merge Sort method and compute its time complexity. Run the program for varied values of <i>n</i> > 5000, and record the time taken to sort. Plot a graph of the time taken versus <i>n</i> on graph sheet. The elements can be read from a file or can be generated using the random number generator. Demonstrate using Java how the divide and- conquer method works along with its time complexity analysis: worst case, average case and best case.
6.		Implement in Java, the 0/1 Knapsack problem using (a) Dynamic Programming method (b) Greedy method.
7.		From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm . Write the program in Java.
8.		Find Minimum Cost Spanning Tree of a given connected undirected graph using Kruskal's algorithm . Use Union-Find algorithms in your program.
9.		Find Minimum Cost Spanning Tree of a given connected undirected graph using Prim's algorithm .
10.		Write Java programs to (a) Implement All-Pairs Shortest Paths problem using Floyd's algorithm . (b) Implement Travelling Sales Person problem using Dynamic programming.
11.		Design and implement in Java to find a subset of a given set $S = \{S_1, S_2, \dots, S_n\}$ of <i>n</i> positive integers whose SUM is equal to a given positive integer <i>d</i> . For example, if $S = \{1, 2, 5, 6, 8\}$ and <i>d</i> = 9, there are two solutions {1, 2, 6} and {1, 8}. Display a suitable message, if the given problem instance doesn't have a solution.
12.		Design and implement in Java to find all Hamiltonian Cycles in a connected undirected Graph <i>G</i> of <i>n</i> vertices using backtracking principle.

5.0 Relevance to future subjects

Sl No	Semester	Subject	Topics
01	VIII	Project work	Design and Develop software applications

6.0 Relevance to Real World

SL. No	Real World Mapping
01	Development of software applications

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7.0 Books Used and Recommended to Students

Text Books
3. Introduction to the Design and Analysis of Algorithms, Anany Levitin:, 2rd Edition, 2009.Pearson
4. Computer Algorithms/C++, Ellis Horowitz, Satraj Sahni and Rajasekaran, 2nd Edition, 2014, Universities Press
Reference Books
3. Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein, 3rd Edition, PHI
4. Design and Analysis of Algorithms , S. Sridhar, Oxford (Higher Education)
Additional Study material & e-Books
3. Lecture Notes for Algorithm Analysis and Design by Sandeep Sen
4. Introduction to the Design and Analysis of Algorithms by K. Raghava Rao

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

Website and Internet Contents References
1. http://freecomputerbooks.com/Introduction-to-Design-Analysis-of-Algorithms.html
2. http://www.freebookcentre.net/ComputerScience-Books-Download/Lecture-Notes-for-Algorithm-Analysis-and-Design-(PDF-124P).html
3. http://www.e-booksdirectory.com/details.php?ebook=9498

9.0 Magazines/Journals Used and Recommended to Students

Sl.No	Magazines/Journals	website
1	Journal of Discrete Algorithms	https://www.journals.elsevier.com/journal-of-discrete-algorithms/
2	American Journal of Algorithms and Computing	http://ajac.uscip.us/
3	International Journal of Computing Algorithm (IJCOA)	https://www.ijcoa.com/
4	International Journal of Algorithms Design and Analysis	http://journalspub.com/journalspub/JournalsDetails.aspx?jid=109

10.0 Examination Note

Internal Assessment: 40 Marks


- Continuous evaluation of each lab experiment will be done for 24 marks and its average marks will be considered.

Lab experiment conduction procedure

- A student has to perform one experiment every week.

Scheme of Evaluation for Continuous Assessment (24 Marks)

Description	Max. marks
Write-up & Conduction	18
Results & Discussion	04
Viva-Voce	02
Total	24

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Scheme of Evaluation for Internal Assessment (16 Marks)

- Lab IA will be conducted for 16 marks.


Description	Max. marks
Procedure & Write-up	2.4
Conduction & Outcome	11.2
Viva-Voce	2.4
Total	16

Conduction of External Practical Examination:

1. All laboratory experiments (TWELVE nos) are to be included for practical examination.
2. Students are allowed to pick one experiment from the lot.
3. Strictly follow the instructions as printed on the cover page of answer script
4. Marks distribution: Procedure + Conduction + Viva: 15 + 70 +15 (100).
5. Change of experiment is allowed only once and marks allotted to the procedure part to be made zero.

11.0 Course Delivery Plan

Expt. No.	Lecture/ Practical No.	Experiment Name	% of portion
1	1	A. Create a Java class called <i>Student</i> with the following details as variables within it. (i) USN (ii) Name (iii) Branch (iv) Phone Write a Java program to create <i>n Student</i> objects and print the USN, Name, Branch, and Phone of these objects with suitable headings. B. Write a Java program to implement the Stack using arrays. Write Push(), Pop(), and Display() methods to demonstrate its working.	8.33
2	2	A. Design a superclass called <i>Staff</i> with details as StaffId, Name, Phone, and Salary. Extend this class by writing three subclasses namely <i>Teaching</i> (domain, publications), <i>Technical</i> (skills), and <i>Contract</i> (period). Write a Java program to read and display at least 3 <i>staff</i> objects of all three categories. B. Write a Java class called <i>Customer</i> to store their name and date_of_birth. The date_of_birth format should be dd/mm/yyyy. Write methods to read customer data as <name, dd/mm/yyyy> and display as <name, dd, mm, yyyy> using StringTokenizer class considering the delimiter character as “/”.	8.33
3	3	A. Write a Java program to read two integers <i>a</i> and <i>b</i> . Compute <i>a/b</i> and print, when <i>b</i> is not zero. Raise an exception when <i>b</i> is equal to zero. B. 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.	8.33


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4	4	Sort a given set of n integer elements using Quick Sort method and compute its time complexity. Run the program for varied values of $n > 5000$ and record the time taken to sort. Plot a graph of the time taken versus n on graph sheet. The elements can be read from a file or can be generated using the random number generator. Demonstrate using Java how the divide-and-conquer method works along with its time complexity analysis: worst case, average case and best case.	8.33
5	5	Sort a given set of n integer elements using Merge Sort method and compute its time complexity. Run the program for varied values of $n > 5000$, and record the time taken to sort. Plot a graph of the time taken versus n on graph sheet. The elements can be read from a file or can be generated using the random number generator. Demonstrate using Java how the divide-and-conquer method works along with its time complexity analysis: worst case, average case and best case.	8.33
6	6	Implement in Java, the 0/1 Knapsack problem using (a) Dynamic Programming method (b) Greedy method.	8.33
7	7	From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm . Write the program in Java.	8.33
8	8	Find Minimum Cost Spanning Tree of a given connected undirected graph using Kruskal's algorithm . Use Union-Find algorithms in your program.	8.33
9	9	Find Minimum Cost Spanning Tree of a given connected undirected graph using Prim's algorithm .	8.33
10	10	Write Java programs to (a) Implement All-Pairs Shortest Paths problem using Floyd's algorithm . (b) Implement Travelling Sales Person problem using Dynamic programming.	8.33
11	11	Design and implement in Java to find a subset of a given set $S = \{S_1, S_2, \dots, S_n\}$ of n positive integers whose SUM is equal to a given positive integer d . For example, if $S = \{1, 2, 5, 6, 8\}$ and $d = 9$, there are two solutions $\{1, 2, 6\}$ and $\{1, 8\}$. Display a suitable message, if the given problem instance doesn't have a solution.	8.33
12	12	Design and implement in Java to find all Hamiltonian Cycles in a connected undirected Graph G of n vertices using backtracking principle.	8.33

12.0


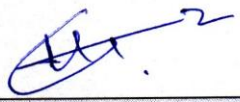


QUESTION BANK


- 1 What is an algorithm?
- 2 What is space and time efficiency?
- 3 How do you measure order of growth?
- 4 Define the Stacks and Queues.
- 5 Define graph.
- 6 Define the trees and sets.
- 7 What are Divide-and-Conquer?
- 8 What is Greedy Technique?
- 9 Explain the Heaps and Heap Sort with examples.
- 10 What is dynamic programming?
- 11 What is branch and bound?
- 12 What is binary search?
- 13 What is merge sort?
- 14 What is quick sort?
- 15 Define an array.
- 16 What is java programming?
- 17 What do you mean by multi thread application?
- 18 What is minimum cost spanning tree?
- 19 Define backtracking.
- 20 Define Hamilton cycle.

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13.0 University Result

Examination	S+	FCD (S, A, B)	FC (C)	SC (D, E)	FAIL (F)	% Passing
June/July-2020	NA	41	02	00	00	100
June/July-2021	NA	26	24	03	00	100

Prepared by	Checked by		
 Prof. A. A. Daptardar	 Dr. Mahesh G. Huddar	 HOD	 Principal

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SUBJECT TITLE	MICROCONTROLLERS & EMBEDDED SYSTEMS LABORATORY		
Subject Code	18CSL48	IA Marks	40
No of Lecture Hrs + Practical Hrs/	0:2:2	Exam Marks	60
Total No of Lecture + Practical Hrs	36	Exam Hours	03
CREDITS – 02			

FACULTY DETAILS:		
Name: N K Honnagoudar	Designation: Asst. Prof	Experience: 20 Years
No. of times course taught: 03 Time		Specialization: Electronics

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	Computer Organization.

2.0 Course Objectives

This course will enable students to:

1. Develop and test Assembly Language Program (ALP) using ARM7TDMI/LPC2148
2. Conduct the experiments on an ARM7TDMI/LPC2148 evaluation board using evaluation version of Embedded 'C' & Keil Uvision-4 tool/compiler.

3.0 Course Outcomes

The students should be able to:

CO	Course Outcome	Cognitive Level	POs
C217.1	Develop and test Assembly Language Program (ALP) using ARM7TDMI/LPC2148	L2	1,2,3,8,12
C217.2	Conduct the following experiments on an ARM7TDMI/LPC2148.	L2	1,2,3,8,12
C217.3	Evaluation board using evaluation version of Embedded 'C' & Keil Uvision-	L2	1,2,3,8,12
C217.4	Choose micro controllers for various kinds of applications.	L2	1,2,3,8,12
Total Hours of instruction			40


4.0 Course Content

Description:

Demonstration and Explanation hardware components and Faculty in-charge should explain microcontroller architecture, pin diagram in one slot. The second slot, the Faculty in-charge should explain instruction set types/category etc. Students have to prepare a write-up on the same and include it in the Lab record and to be evaluated.

Experiments

1.	A	Write an ALP to multiply two 16 bit binary numbers.
2.	A	Write an ALP to find the sum of first 10 integer numbers.
3.	A	Write an ALP to find factorial of a number.
4.	A	Write an ALP to add an array of 16 bit numbers and store the 32 bit result in internal RAM
5.	A	Write an ALP to find the square of a number (1 to 10) using look-up table.
6.	A	Write an ALP to find the largest/smallest number in an array of 32 numbers
7.	A	Write an ALP to arrange a series of 32 bit numbers in ascending/descending order.
8.	A	Write an ALP to count the number of ones and zeros in two consecutive memory locations.
9.	B	Display "Hello World" message using Internal UART.

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10.	B	Interface and Control a DC Motor.
11.	B	Interface a Stepper motor and rotate it in clockwise and anti-clockwise direction.
12.	B	Determine Digital output for a given Analog input using Internal ADC of ARM controller.
13.	B	Interface a DAC and generate Triangular and Square waveforms.
14.	B	Interface a 4x4 keyboard and display the key code on an LCD.
15.	B	Demonstrate the use of an external interrupt to toggle an LED On/Off.
16.	B	Display the Hex digits 0 to F on a 7-segment LED interface, with an appropriate delay in between

5.0 Relevance to future subjects

Sl No	Semester	Subject	Topics
01	VIII	Project work	Design and Develop software applications

6.0 Relevance to Real World

SL.No	Real World Mapping
01	Development of software applications

7.0 Books Used and Recommended to Students


Text Books
1. Andrew N Sloss, Dominic Symes and Chris Wright, ARM system developers guide, Elsevier, Morgan Kaufman publishers, 2008. 2. 2.Shibu K V, "Introduction to Embedded Systems", Tata McGraw Hill Education, Private Limited, 2nd Edition. Reference
Reference Books
1. The Insider's Guide to the ARM7 Based Microcontrollers, Hitex Ltd., 1st edition, 2005 2. Steve Furber, ARM System-on-Chip Architecture, Second Edition, Pearson, 2015 3. Raj Kamal, Embedded System, Tata McGraw-Hill Publishers, 2nd Edition, 2008 4. Rangunandan, An Introduction to ARM System Design, Cengage Publication.
Additional Study material & e-Books

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

Website and Internet Contents References
1. http://freecomputerbooks.com/Introduction-to-microcontrollers -of-.html

9.0 Magazines/Journals Used and Recommended to Students

Sl.No	Magazines/Journals	website
1	Journal of microcontrollers	https://www.journals.elsevier.com/journal-of-microcontrollers/

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10.0

Examination Note

All laboratory experiments (all 7 + 6 nos) are to be included for practical examination.

- Students are allowed to pick one experiment from each of the lot.
- Strictly follow the instructions as printed on the cover page of answer script for breakup of marks
- PART –A: Procedure + Conduction + Viva : 4 + 21 + 5 = 30 Marks
- PART –B: Procedure + Conduction + Viva: 10 + 49+ 11 = 70 Marks
- Change of experiment is allowed only once and marks allotted to the procedure part to be made zero.

Scheme of Evaluation for Continuous Assessment (30 Marks)

Description	Max. marks
Write-up	10
Conduction & Outcome	15
Viva-Voce	05
Total	30

Scheme of Evaluation for Internal Assessment (10 Marks)


- Lab IA will be conducted for 10 marks.

Description	Max. marks
Write-up & Conduction	05
Outcome & Conclusion	03
Viva-Voce	02
Total	10

11.0

Course Delivery Plan

Expt. No.	Lecture/ Practical No.	Experiment Name	% of portion
1	1	Write an ALP to multiply two 16 bit binary numbers.	6.25
2	2	Write an ALP to find the sum of first 10 integer numbers.	6.25
3	3	Write an ALP to find factorial of a number.	6.25
4	4	Write an ALP to add an array of 16 bit numbers and store the 32 bit result in internal RAM	6.25
5	5	Write an ALP to find the square of a number (1 to 10) using look-up table.	6.25
6	6	Write an ALP to find the largest/smallest number in an array of 32 numbers	6.25
7	7	Write an ALP to arrange a series of 32 bit numbers in ascending/descending order.	6.25
8	8	Write an ALP to count the number of ones and zeros in two consecutive memory locations.	6.25
9	9	Display "Hello World" message using Internal UART.	6.25
10	10	Interface and Control a DC Motor.	6.25
11	11	Interface a Stepper motor and rotate it in clockwise and anti-clockwise direction.	6.25
12	12	Determine Digital output for a given Analog input using Internal ADC of ARM controller.	6.25
13	13	Interface a DAC and generate Triangular and Square waveforms.	6.25
14	14	Interface a 4x4 keyboard and display the key code on an LCD.	6.25
15	15	Demonstrate the use of an external interrupt to toggle an LED On/Off.	6.25
16	16	Display the Hex digits 0 to F on a 7-segment LED interface, with an appropriate delay in between	6.25





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		Academic
		Course Plan
		2021-22 (Even)

12.0 QUESTION BANK

1. Define of Microcontrollers?
2. Define of ARM processors?
3. Examples for Microprocessor?
4. Examples for Microcontroller?
5. Difference between Microprocessor & Microcontroller?
6. Pin configuration of microcontroller and significance of each pin?
7. Addressing modes of microcontrollers?
8. Instruction set of microcontrollers?
9. What are the different types of registers in ARM
10. What is flag register?
11. What is thumb instruction?
12. What are the different addressing modes of ARM

13.0 University Result

Examination	S+	FCD (S, A, B)	FC (C)	SC (D, E)	FAIL (F)	% Passing
2020-21	NA	43	09	01	00	100
2019-20	NA	41	02	00	00	100

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