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, educating them in a state of the art infrastructure, by retaining the best practices, people and inspire them to imbibe real time problem solving skills, leadership qualities, human values and societal commitments, so that they emerge as competent professionals"

DEPARTMENTAL VISION

“To be the center of excellence in providing education in the field of Electronics and Communication Engineering to produce technically competent and socially responsible engineering graduates.”

DEPARTMENTAL MISSION

“Educating students to prepare them for professional competencies in the broader areas of the Electronics and Communication Engineering field by inculcating analytical skills, research abilities and encouraging culture of continuous learning for solving real time problems using modern tool”.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs):

PEO1:

Acquire core competence in Applied Science, Mathematics, and Electronics and Communication Engineering fundamentals to excel in professional carrier and higher study.

PEO2:

Design, Demonstrate and Analyze the Electronic Systems which are useful to society.

PEO3:

Maintain Professional and Ethical values, Employability skills, Multidisciplinary approach and an Ability to realize Engineering issues to broader social contest by engaging in lifelong learning.

PROGRAM SPECIFIC OUTCOMES(PSOS)

The graduates will be able to:

PSO1:

An ability to understand the concepts of Basic Electronics and Communication Engineering and to apply them to various areas like Signal Processing, VLSI, Embedded Systems, Communication Systems and Digital & Analog Devices

PSO2:

An ability to solve complex Electronics and Communication Engineering problems, using latest hardware and software tools, along with analytical skills to arrive at cost effective and appropriate solutions

PROGRAM OUTCOMES (POs):

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.
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 mangement 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.

STUDENT HELP DESK

Sl. No	Name of the faculty	Activities
1	Dr. M. C. Sarasamba	GATE / Pre placement Coaching
		Students Mentor
		Module Coordinator
		Research Center Coordinator
		Dept. NAAC Criteria Sub Coordinator
		NBA Criteria Coordinator
2	Prof. S. S. Malaj	GATE / Replacement Coaching
		Adv.Comm. Lab In charge
		Students Mentor
		Dept. NAAC Criteria Sub Coordinator
		NBA Criteria Coordinator
		NIRF Coordinator
3	Prof. S. S. Kamate	GATE / Pre placement Coaching
		VLSI Lab In charge
		Students Mentor
		Module Coordinator
		IEEE Coordinator/ IA Coordinator
		Dept. NAAC Criteria Sub Coordinator
		Project Coordinator
		NBA Criteria Coordinator
4	Prof. D. M. Kumbhar	GATE / Pre placement Coaching
		AC Lab In charge
		Students Mentor
		Dept. Association Coordinator
		Class Teacher
		IIIC Coordinator
		Dept. NAAC Criteria Sub Coordinator
		NBA Criteria Coordinator
		AICTE Activity Coordinator
		Dept. ED Cell Coordinator
5	Prof. S. S. Patil	GATE / Pre placement Coaching
		ARM & ES Lab In charge
		Students Mentor
		Class Teacher
		NBA Criteria Coordinator
		AICTE Activity Coordinator
		Admission Coordinator
		Module Coordinator

SL. No	Name of the faculty	Activities
6	Prof. D. B. Madihalli	GATE / Pre placement Coaching
		DSD Lab In charge
		Students Mentor
		NBA Coordinator
		News & Publicity Coordinator
		NBA Criteria Coordinator
		Website Coordinator
		VTU LIC Coordinator
7	Prof. P. V. Patil	GATE / Pre placement Coaching
		HDL Lab In charge
		Students Mentor
		NBA Criteria Coordinator
		T&P Cell Coordinator
		Alumni Coordinator
8	Dr. S. S. Ittannavar	GATE / Pre placement Coaching
		BSP /DSP Lab In charge
		Students Mentor
		Module Coordinator
		News Letter / Technical Magazine
		AICTE Coordinator
9	Prof. B. P. Khot	GATE / Pre placement Coaching
		CN/MC Lab In charge
		Students Mentor
		Dept. Time Table Coordinator & Meeting Coordinator
		Class Teacher
		NBA Criteria Coordinator
		Dept T&P Cell Coordinator
		AICTE Activity Coordinator
10	Prof. S. R. Mallurmath	EMS Coordinator
		GATE / Pre placement Coaching
		Students Mentor
		AICTE Activity Coordinator
		NBA Criteria Coordinator
11	Prof. K. S. Patil	GATE / Pre placement Coaching
		Students Mentor
		AICTE Activity Coordinator
		NBA Criteria Coordinator

CONTENTS

FACULTY POSITION

S.N.	Category	No. in position	Average experience
1	Teaching faculty.	10	18.64Y
2	Technical supporting staff.	03	24.02Y
3	Helper staff	02	23.03Y

MAJOR LABORATORIES

S. N.	Name of the laboratory	Area in Sq. Mtrs	Amount Invested in Lakhs	S. N.	Name of the laboratory	Area in Sq. Mtrs	Amount Invested in Lakhs
1	Digital Electronics Lab	71	1.54	5	VLSI Lab	71	39.03
2	Analog Electronics Lab	92	8.24	6	Project Lab	95	--
3	Advanced Commn & Commn + LIC Lab	92	20.01	7	Research/E-Yantra/DSP & C.N.Lab	71	12.15
4	HDL/MC / EMD Lab	71	22.61	8	Power Electronics Lab	--	4.86
Total Investment In The Department						**Rs. 109.09 Lacs**	

FACULTY DETAILS

Sl. No.	Name	Designation	Qualification	Specialization	Professional Membership	Teaching Exp.	Contact No.
1	Prof. M. C. Sarasamba	Prof. & HOD	Ph.D	E&C	LMISTE	20Y.06M	9480714746
2	Prof.S .S .Ittannavar	Assoc. Prof	Ph.D	DSP	LMISTE	12Y.00M	9964299498
3	Prof. S. S. Malaj	Asst. Prof	M.E.	E & TC	LMISTE	27Y.08M	9731795803
4	Prof.S. S. Kamate	Asst. Prof	M.Tech	Digital Electronics	LMISTE	22Y.01M	9008696825
5	Prof. D.M. Kumbhar	Asst. Prof	M.Tech	Electronics	LMISTE	21Y.00M	09373609880
6	Prof .Sachin .S. Patil	Asst. Prof	M.Tech	VLSI & Embedded	LMISTE	20Y.09M	9448102010
7	Prof .D.B. Madihalli	Asst. Prof	M.Tech	Industrial Electronics	LMISTE	17Y.08M	9902854324
8	Prof.P. V. Patil	Asst. Prof	M.Tech	VLSI & Embedded	LMISTE	12Y.06M	9731104059
9	Prof. B. P. Khot	Asst. Prof	M.Tech	Microelectronics & Control Systems	LMISTE	9Y.00M	9964019501
10	Prof. S. R. Mallurmath	Asst. Prof	M.Tech	Industrial Electronics	LMISTE	12Y.00M	7259865769
11	Prof. K. S. Patil	Asst. Prof	M.Tech	VLSI	LMISTE	30Y.06M	9902682781

TECHNICAL SUPPORTING STAFF

S.N.	Name	Qualification	Experience (in years)
1.	Sri. P. S. Desai	DEC	24Y-.07M
2.	Sri. V. V. Guruwodeyar	DEC	33Y-02 M
3.	Sri.M.A.Attar	DEC	14Y-09M

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
n Electronics and Communication Engineering (ECE)Scheme of Teaching and Examinations 2021
Outcome Based Education(OBE) and Choice Based Credit System (CBCS)
(Effective from the academic year 2021 - 22)

Swappable VII and VIII SEMESTER

VII SEMESTER

Sl. No	Course and Course Code	Course Title	Teaching Department (TD)and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
				Theory	Tutorial	Practical/	Self -Study	Duration in	CIE Marks	SEE Marks	Total Marks	
				L	T	P	S					
1	PCC 21EC71	Advanced VLSI	TD: ECE PSB: ECE	3	0	0		3	50	50	100	3
2	PCC 21EC72	Optical & Wireless Communication	TD: ECE PSB: ECE	2	0	0		3	50	50	100	2
3	PEC 21EC72X	Professional elective Course-II	TD: ECE PSB: ECE					3	50	50	100	3
4	PEC 21EC73X	Professional elective Course-III	TD: ECE PSB: ECE					3	50	50	100	3
5	OEC 21EC74X	Open elective Course-II	Concerned Department					3	50	50	100	3
6	Project 21ECP75	Project work		Two contact hours /week for interaction between the faculty and students.				3	100	100	200	10
							Total		**350**	**350**	**700**	**24**

VIII SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching	Teaching Hours /Week				Examination				Credits
					Theory	Tutorial	Practical/	Self -Study	Duration in	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	Seminar 21EC81		Technical Seminar		One contact hour /week for interaction between the faculty and students.				--	100	--	100	01
2	INT 21INT82		Research Internship/ Industry Internship		Two contact hours /week for interaction between the faculty and students.				03 (Batch wise)	100	100	200	15
3	NCMC	21NS83	National Service Scheme (NSS)	NSS	Completed during the intervening period of III semester to VIII semester.				--	50	50	100	0
		21PE83	Physical Education (PE) (Sports and Athletics)	PE									
		21YO83	Yoga	Yoga									
									Total	**250**	**150**	**400**	**16**

Professional Elective - II			
21EC721	Advanced Design Tools for VLSI (L:T:P :: 2:0:2)	21EC724	Biomedical Signal Processing (L:T:P :: 3:0:0)
21EC722	Digital Image Processing (L:T:P :: 2:0:2)	21EC725	Speech Signal Processing (L:T:P :: 3:0:0)
21EC723	DSP Algorithms & Architecture (L:T:P :: 3:0:0)		

Professional Elective - III			
21EC731	IoT & Wireless Sensor Networks (L:T:P :: 3:0:0)	21EC734	Machine Learning with Python (L:T:P :: 2:0:2)
21EC732	Network Security (L:T:P :: 3:0:0)	21EC735	Multimedia Communication (L:T:P :: 2:0:2)
21EC733	Fabrication technology (L:T:P :: 3:0:0)		

Open Electives - II offered by the Department to other Department students			
21EC741	Optical & Satellite Communication (L:T:P :: 3:0:0)	21EC744	Basic Digital Signal Processing (L:T:P :: 2:0:2)
21EC742	ARM Embedded Systems (L:T:P :: 3:0:0)	21EC745	E-waste Management (L:T:P :: 3:0:0)
21EC743	Basic Digital Image Processing (L:T:P :: 2:0:2)		

Note: PCC: Professional Core Course, **PEC:** Professional Elective Courses, **OEC**–Open Elective Course, **AEC** –Ability Enhancement Courses.
L –Lecture, T – Tutorial, P- Practical / Drawing, S – Self Study Component, CIE: Continuous Internal Evaluation, SEE: Semester End Examination.

Note: VII and VIII semesters of IV year of the programme

(1) Institutions can swap VII and VIII Semester Scheme of Teaching and Examinations to accommodate research internship/ industry internship afterthe VI semester**.**

(2) Credits earned for the courses of VII and VIII Semester Scheme of Teaching and Examinations shall be counted against the corresponding semesters whether VII or VIII semester is completed during the beginning of IV year or later part of IV year of the programme.

PROJECT WORK (21XXP75): The objective of the Project work is

(i) To encourage independent learning and the innovative attitude of the students.
(ii) To develop interactive attitude, communication skills, organization, time management, and presentation skills.
(iii) To impart flexibility and adaptability.
(iv) To inspire team working.
(v) To expand intellectual capacity, credibility, judgment and intuition.
(vi) To adhere to punctuality, setting and meeting deadlines.
(vii) To install responsibilities to oneself and others.
(viii) To train students to present the topic of project work in a seminar without any fear, face the audience confidently, enhance communicationskills, involve in group discussion to present and exchange ideas.

CIE procedure for Project Work:

(1) **Single discipline:** The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide.
The CIE marks awarded for the project work, shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

(2) **Interdisciplinary:** Continuous Internal Evaluation shall be group-wise at the college level with the participation of all guides of the college. Participation of external guide/s, if any, is desirable. The CIE marks awarded for the project work, shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

SEE procedure for Project Work: SEE for project work will be conducted by the two examiners appointed by the University. The SEE marks awarded for the project work shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the ratio
50:25:25.

TECHNICAL SEMINAR (21XXS81): The objective of the seminar is to inculcate self-learning, present the seminar topic confidently, enhance communication skill, involve in group discussion for exchange of ideas. Each student, under the guidance of a Faculty, shall choose, preferably, a recent topic of his/her interest relevant to the programme of Specialization.

(i) Carry out literature survey, systematically organize the content.
(ii) Prepare the report with own sentences, avoiding a cut and paste act.
(iii) Type the matter to acquaint with the use of Micro-soft equation and drawing tools or any such facilities.
(iv) Present the seminar topic orally and/or through PowerPoint slides.
(v) Answer the queries and involve in debate/discussion.
(vi) Submit a typed report with a list of references.

The participants shall take part in the discussion to foster a friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident.

Evaluation Procedure:

The CIE marks for the seminar shall be awarded (based on the relevance of the topic, presentation skill, participation in the question and answer session, and quality of report) by the committee constituted for the purpose by the Head of the Department. The committee shall consist of three teachers from the department with the senior-most acting as the Chairman.

Marks distribution for CIE of the course:
Seminar Report :50 Presentation Skill 25
Question and Answer: 25 marks. ■No SEE component for Technical Seminar

Non – credit mandatory courses (NCMC):
National Service Scheme/Physical Education (Sport and Athletics)/ Yoga:

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

(2) In case, students fail to secure 35 % marks in SEE, they has to appear for SEE during the subsequent examinations conducted by the University. **(3)**In case, any student fails to register for NSS, PE or Yoga/fails to secure the minimum 40 % of the prescribed CIE marks, he/she shall be deemed to have not completed the requirements of the course. In such a case, the student has to fulfill the course requirements during subsequently to earn thequalifying CIE marks subject to the maximum programme period.

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

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

	S J P N Trust's **Hirasugar Institute of Technology, Nidasoshi.** Approved by AICTE, New Delhi, Permanently Affiliated to VTU, Belagavi Recognized under 2(f) & 12B of UGC Act, 1956 Accredited at 'A+' Grade by NAAC & Programmes Accredited by NBA:CSE & ECE	IQAC File I-11 AY:2024-25 (Odd) Rev: 02

REVISED ACADEMIC CALENDAR OF EVENTS (CoE)

AY: 2024-25 (Odd Sems.: I, III, V & VII) (w.e.f.: 17th Sept. 2024)

Ref: 1. VTU CoE Revised Notification No.: VTU/BGM/BoS/Academic Calendar/2024-25/2623, Dated 4th Sept. 2024
2. VTU Circular No.: VTU/BGM/BoS/V sem/625/2024-25/26112, Dated 5th Sept. 2024

Calendar

September -2024

Sun	Mon	Tue	Wed	Thu	Fri	Sat
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					

October-2024

Sun	Mon	Tue	Wed	Thu	Fri	Sat
		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		

November -2024

Sun	Mon	Tue	Wed	Thu	Fri	Sat
					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

December -2024

Sun	Mon	Tue	Wed	Thu	Fri	Sat
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				

January -2025

Sun	Mon	Tue	Wed	Thu	Fri	Sat
			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	

Date	Events & Holidays
19th Aug. 2024	Commencement of III Sem Classes
5th Sept. 2024	Teachers Day (NSS & Dept. Associations)
7th Sept. 2024	GH: Varasidhi Vinayaka Vratha
9th Sept. 2024	LH: Shri Math Mahadasoha
9th Sept. 2024	Commencement of VII Sem Classes
15th Sept. 2024	National Engineer's Day (NSS)
16th Sept. 2024	GH: ID-E-Milad
17th Sept. 2024	Commencement of V Sem Classes, I Sem Induction Program & Viswakarma Day (Skill & Creativity Day by TP Cell)
28th Sept. 2024	Commencement of I Sem Classes & Engg. Orientation & About VTU
2nd Oct. 2024	GH: Mahatma Gandhi's Birthday & Mahalaya Amavasya UBA Sp. Gram Sabha/International Day of Non-violence
8th Oct. 2024	Ideathon & Project Synopsis Presentation (Mini & Major)
11th -12th Oct. 2024	GH: Mahanavami, Ayudh Pooja & Vijayadashami
15th & 16th Oct. 2024	National Women Farmers Day (WEC) & World Food Day (NSS)
17th Oct. 2024	GH: Maharshi Valmiki Jayanti (NSS)
18th October 2024	III Sem Welcome-Function & Inauguration of Dept. Association Activities
22nd October 2024	Academic Audit of AY:2023-24 (Odd & Even)
24th -26th Oct. 2024	1st IA Test for I , III, V & VII Sems. (On 01 CO/Module)
26th Oct. 2024	1st Feedback on Teaching & Learning by I, III, V & VII Sems
29th Oct. 2024	Mini-Anveshana-24 by AGASTYA International Foundation
29th Oct. 2024	Fresher's Day Celebration & Parents Meet
30th Oct. 2024	Display of 1st IA Test Marks of I, III, V & VII Sems
31st Oct. 2024	GH: Narak Chaturdashi
1st Nov. 2024	GH: Kannada Rajyotsav
2nd Nov. 2024	GH: Balipadyami Deepavali
9th Nov. 2024	Blood Donation Camp & Health Check-up Camp (YRC & NSS)
18th Nov. 2024	GH: Kanakdas Jayanti
20th & 21st Nov. 2024	1st Lab IA Test for I, III, V & VII Sems. (On 02 COs/5 Expts)
22nd -23rd Nov. 2024	HSIT-QUEST-2024
26th Nov. 2024	Constitution Day (NSS)
28th -30th Nov. 2024	2nd IA Test for I, III, V & VII Sems. (On 02 COs/Modules covered after 1st IAT)
30th Nov. 2024	2nd Feedback on Teaching & Learning by I, III, V & VII Sems. Students.
4th Dec. 2024	Display of 2nd IA Test Marks of I, III, V & VII Sems
3rd , 4th & 5th Dec. 2024	National Agriculture Education Day (NSS), Women in Agriculture Day (WEC) & World Soil Day (NSS)
9th Dec. 2024	International Anti-Corruption Day (NSS)
13th -14th Dec. 2024	Indoor Sports Competitions (By Sports & Yoga Dept.)
16th -18th Dec. 2024	3rd IA Test for III, V & VII Sems. (On 02 COs/Modules covered after 2nd IAT)
19th Dec. 2024	Final Lab IA Test for III, V & VII Sems. (On remaining 03 COs/5 Expts)
20th Dec. 2024	Display of 2nd IA Test Marks of I Sem & 3rd IA Test Marks of III,V&VII Sems.
20th Dec. 2024	Project Exhibition (Mini & Major) (Dept. Associations)
21st Dec. 2024	Last Working Day of III, V & VII Sems
25th Dec. 2024	GH: Christmas
27th -28th Dec. 2024	International Conference (R&D)
23rd Dec.24 – 1st Jan. 25	VTU Practical /Viva Examinations of III, V & VII Sems.
6th Jan. -4th Feb. 2025	VTU Theory Examinations of III, V & VII Sems.
10th Feb. 2025	Commencement of IV, VI & VIII Sems.
14th Jan. 2025	GH: Makhara Sankranti
15th & 16th Jan. 2025	Final Lab IA Test for I Sem. (On remaining 03 COs/5 Expts.)
20th -22nd Jan. 2025	3rd IA Test for I Sem. (On remaining 02 COs/Modules)
22nd Jan. 2025	Display of 3rd IA Test Marks of I Sem
25th Jan. 2025	Alumni Meet (By Alumni Association)
26th Jan. 2025	GH: Republic Day (NSS)
27th Jan. 2025	Last Working Day of I Sem
28th Jan-6th Feb. 2025	VTU Practical /Viva Examinations of I Sem.
7th Feb.-5th Mar. 2025	VTU Theory Examinations of I Sem.
10th Mar.. 2025	Commencement of II Sem.

GH: General Holiday, LH: Local Holiday, NSS: National Service Scheme, WEC: Women Empowerment Cell, YRC: Youth Red-Cross, CO: Course Outcome

Dr.S.N.Topannavar
IQAC Coordinator & Dean (Academics)

Dr.S.C.Kamate
Principal

Nidasoshi, Taq: Hukkeri, Dist: Belgaum, Karnataka - 591 236
Phone:+91-8333-278887, Fax:278886, Web: www.hsit.ac.in, Mail: principal@hsit.ac.in

Subject Title	**Advanced VLSI**		
Subject Code	21EC71	**IA Marks**	50
Number of Lecture Hrs /	03 L	**Exam Marks**	50
Total Number of Lecture Hrs	40	**Exam Hours**	03

FACULTY DETAILS:		
Name: Prof. S. S. Kamate	**Designation:** Asst. Professor	**Experience:22** yrs
No. of times course taught:01	**Specialization:** Digital Electronics	

1.0 Prerequisite Subjects:

Sl. No	**Branch**	**Semester**	**Subject**
01	ECE	III	VLSI Design & Testing
02	ECE	III	Digital System Design using Verilog

2.0 Course Objectives

1. Learn overview of VLSI design flow
2. Emphasize on Back end VLSI design flow
3. Learn basics of verification with reference to System Verilog
4.

3.0 Course Outcomes

Having successfully completed this course, the student will be able to draw and analyze.

	Course Outcome	**Cognitive Level**	**POs**
C401.1	Understand VLSI design flow	U	PO1, PO2, PO6, PO8, PO10
C401.2	Describe the concepts of ASIC design methodology	U	PO1, PO2, PO6, PO8, PO10
C401.3	Create floor plan including partition and routing with the use of CAD algorithms	U	PO1, PO2, PO6, PO8, PO10
C401.4	Will have better insights into VLSI back-end design flow	U	PO1, PO2, PO6, PO8, PO10
C401.5	Learn verification basics and System Verilog	U	PO1, PO2, PO6, PO8, PO10
Total Hours of instruction		**40**	

4.0 Course Content

Course Content:

Module	**Teaching Hours**	**Bloom's Taxonomy (RBT) level**
Module 1: **Introduction to ASICs**: Full custom, Semi-custom and Programmable ASICs, ASIC Design flow, ASIC cell libraries. CMOS Logic: Data path Logic Cells: Data Path Elements, Adders: Carry skip, Carry bypass, Carry save, Carry select, Conditional sum, Multiplier (Booth encoding), Data path Operators, I/O cells, Cell Compilers. Text Book 1	**08 Hours**	**L1, L2, L3**

Module 2: **Floor planning and placement**: Goals and objectives, Measurement of delay in Floor planning, Floor planning tools, Channel definition, I/O and Power planning and Clock planning. Placement: Goals and Objectives, Min-cut Placement algorithm, Iterative Placement Improvement, Time driven placement methods, Physical Design Flow. **Routing**: Global Routing: Goals and objectives, Global Routing Methods, Global routing between blocks, Back annotation. Text Book 1	**08 Hours**	**L1,L2,L3**
Module 3: Verification Guidelines: The verification process, basic test bench functionality, directed testing, methodology basics, constrained random stimulus, randomization, functional coverage, test bench components, layered test bench. Data Types: Built in Data types, fixed and dynamic arrays, Queues, associative arrays, linked lists, array methods, choosing a type, creating new types with type def, creating user defined structures, type conversion, Enumerated types, constants and strings, Expression width. Text Book 2	**08 Hours**	**L1,L2,L3**
Module 4: Procedural Statements and Routines: Procedural statements, Tasks, Functions and void functions, Task and function overview, Routine arguments, returning from a routine, Local data storage, time values. Connecting the test bench and design: Separating the test bench and design, The interface construct, Stimulus timing, Interface driving and sampling, System Verilog assertions. Text Book 2	**08 Hours**	**L1,L2,L3**
Module 5: **Randomization**: Introduction, What to randomize? , Randomization in System Verilog, Random number functions, Common randomization problems, Random Number Generators. **Functional Coverage**: Coverage types, Coverage strategies, Simple coverage example, Anatomy of Cover group and Triggering a Cover group, Data sampling, Cross coverage, Generic Cover groups, Coverage options, Analyzing coverage data, measuring coverage statistics during simulation. Text Book 2	**08 Hours**	**L1,L2,L3**

5.0 Relevance to future subjects

Sl No	Semester	Subject	Topics
01	VI	VLSI Lab	VLSI Design
02	VIII	Projects on VLSI	Projects and Research

6.0 Relevance to Real World

SL.No	Real World Mapping
01	Analyze different types of VLSI Designs
02	Design of different types of VLSI chips

7.0 Gap Analysis and Mitigation

Sl. No	Delivery Type	Details
01	Tutorial	Topic: VLSI Lab
02	NPTEL	Demonstration and Application

8.0 Books Used and Recommended to Students

Text Books
Text Books: 1. Michael John Sebastian Smith, Application - Specific Integrated Circuits, Addison-Wesley Professional, 2005. 2. Chris Spear, System Verilog for Verification – A guide to learning the Test bench language features, Springer Publications, Second Edition, 2010.
Reference Books
Reference Books:
Additional Study material & e-Books
1. VTU online notes.
2. Michael John Sebastian Smith, Application - Specific Integrated Circuits,
3. System Verilog for Verification – A guide to learning the Test bench language features,

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

Website and Internet Contents References
01) https://www.youtube.com/watch?v=CLS3bjeDp_g&list=PLANsADRSK3O4Nf9ih74msINMf7Ghqwi20&index=2
02) https://www.youtube.com/watch?v=vAooT6aKLMc&list=PLANsADRSK3O4Nf9ih74msINMf7Ghqwi20&index=3
03) https://www.youtube.com/watch?v=y_hEbgWWuQs&list=PLF4DeZAfqGSar69xWgw5TpFuszBd1FSJJ
04) https://www.youtube.com/watch?v=Bts4c-sPOiE&list=PLF4DeZAfqGSar69xWgw5TpFuszBd1FSJJ&index=4
05)https://www.youtube.com/watch?v=eRx8OCVbq_4&list=PLF4DeZAfqGSar69xWgw5TpFuszBd1FSJJ&index=2

10.0 Magazines/Journals Used and Recommended to Students

Sl. No	Magazines/Journals	website
1	IEEE Xplorer	http://ieee.com
2	International Journal of Science and Technology	http://www.sciencedirect.com/science/journal/00207683
3	Journal of Communication Engineering	http://ieee.com

11.0 Examination Note

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

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

Two assignments each of **10 Marks**

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

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

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

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

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

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

Semester End Examination:

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

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

The students have to answer 5 full questions, selecting one full question from each module. Marks scored out of 100 shall be reduced proportionally to 50 marks

12.0 Course Delivery Plan

Course Delivery Plan:

MODULE	LECTURE NO.	CONTENT OF LECTURE	% OF PORTION
1	1	Full custom	20
	2	Semi-custom and Programmable ASICs	
	3	ASIC Design flow	
	4	ASIC cell libraries	
	5	CMOS Logic: Data path Logic Cells:	
	6	Data Path Elements, Adders	
	7	Carry skip, Carry bypass	
	8	Carry save, Carry select, Conditional sum, Multiplier	
	9	Cell Compilers	
	10	Data path Operators, I/O cells,	
2	11	Goals and objectives,	40
	12	Measurement of delay in Floor planning	
	13	Floor planning tools, Channel definition,	
	14	I/O and Power planning and Clock planning	
	15	Placement: Goals and Objectives	
	16	Min-cut Placement algorithm	
	17	Iterative Placement Improvement, Time driven placement methods	
	18	Physical Design Flow,	
	19	Global Routing Methods	
	20	Global routing between blocks, Back annotation	
3	21	The verification process, basic test bench functionality	60
	22	Directed testing, methodology basics, constrained random stimulus	
	23	randomization, functional coverage, test bench components	
	24	test bench components, layered test bench	
	25	Built in Data types, fixed and dynamic arrays	
	26	Queues, associative arrays, linked lists,array methods, choosing a	
	27	Creating new types with type def, creating user defined structures	
	28	Type conversion, Enumerated types, constants and strings,	

4	29	Procedural statements, Tasks, Functions and void functions	80
	30	Task and function overview, Routine arguments	
	31	Returning from a routine, Local data storage, time values.	
	32	Separating the test bench and design	
	33	The interface construct,	
	34	Interface driving and sampling, System	
	35	System Verilog assertions	
5	36	Introduction, What to randomize	100
	37	Randomization in System Verilog	
	38	Random number functions,	
	39	Common randomization problems	
	40	Random Number Generators	
	41	Coverage types, Coverage strategies	
	42	Simple coverage example	
	43	Anatomy of Cover group and Triggering a Cover group	
	44	Data sampling, Cross coverage	
	45	Generic Cover groups, Coverage options, Analyzing coverage data	
	46	measuring coverage statistics during simulation	

13.0 QUESTION BANK

MODULE -1

1. With neat flow diagram explain the steps involved in ASIC design
2. With neat sketches, explain the following:
   i) Programmable logic devices
   ii) ii) Structured gate arrays
3. Explain carry select adder and how it is extended to form n- bit conditional sum adder.
4. With relevant diagram and equations, explain the conventional ripple carry adder with it's limitations.
5. Write short notes on
   i) I/O cells
   ii) Cell compilers
6. Explain in detail the steps involved in ASIC design
7. Explain the functioning and limitations of ripple carry adder.
8. Explain the following
   i) Placement using simulated annealing
   ii) Timing driven placement method

MODULE -2

1. Briefly explain the following:
   i) Goals and objectives of placement
   ii) Timing driven placement method.
2. Explain measurement of delay in floor planning.
3. Explain the following
   i) Power distribution scheme
   ii) Clock planning
4. Explain the following routing techniques
   i) Clock routing
   ii) Power routing
5. Explain global routing between the blocks.
9. Explain the following
   i) Placement using simulated annealing
   ii) Timing driven placement method
6. Explain the following
   i) Left edge algorithms
   ii) Area routing algorithm

MODULE -3

1. Explain the verification process in system Verilog
2. Explain factors in randomizing the stimulus to a design
3. Describe various array methods with examples.
4. Write a note on user defined data types in system Verilog
5. Explain constraints and strings in system Verilog with examples
6. Write a program to demonstrate push_front, pop_front, push_back and pop_back with respect to Queues.
7. Declare four variables red, black, white and green through Enumerated type declaration use the keywords 'first' and 'next' to step through the variables and display the output.
8. Demonstrate Full adder with 'Interface' construct.
9. Write a program to demonstrate the difference between 'rand' and 'randc'.
10. Demonstrate Random Control with randcase and $urandom_range.
11. Demonstrate 4-bit adder with the verification environment.

MODULE -4

1. Write the difference between Tasks and functions in system Verilog.
2. Explain automatic storage and variable initialization with system Verilog.
3. Describe how to specify time values in system Verilog.
4. Explain different types of system Verilog assertions with example
5. Design a top level test bench

MODULE-5

1. What is coverage? Explain coverage types in system Verilog.
2. Explain functional coverage inside class with program.
3. Write a note on data sampling
4. What is cross coverage? Explain.
5. Explain generic cover groups in Verilog.
6. Write a note on data sampling.
7. Explain common randomization problems in system Verilog.

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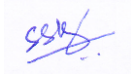
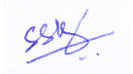
15.0 University Result

Examination	FCD	FC	SC	% Passing
New Subject				

Prepared by	Checked by		
			
Prof. S. S. Kamate	Prof. S. S. Kamate	HOD	Principal

Subject Title	**Optical and Wireless Communication**		
Subject Code	21EC72	CIE Marks	50
Number of Lecture Hrs/Week /	02 L : 01 S	**Exam Marks (appearing for)**	50(100)
Total Number of Lecture Hrs	30 Hours	**Exam Hours**	03
CREDITS – 02			

FACULTY DETAILS:		
Name: Prof. S. S. Malaj	**Designation:** Assistant Professor	**Experience:**25 years
No. of times course taught: Nil	**Specialization:** E & TC	

1.0 Prerequisite Subjects:

Sl. No	Branch	Semester	Subject
01	Students should have the knowledge of basic subjects and ipcc subjects	1,2 & 6	Introduction to Electronics and communication, Communication systems Microwave theory and Antennas

2.0 Course Objectives

This course will enable students to :

- Learn the basic principle of optical fiber communication with different modes of light propagation.
- Understand the transmission characteristics and losses in optical fiber.
- Study of optical components and its applications in optical communication networks.
- Understand the concepts of propagation over wireless channels from a physics standpoint
- Understand the multiple access techniques used in cellular communications standards.
- Application of Communication theory both Physical and networking to understand GSM systems that handle mobile telephony
-

3.0 Course Outcomes

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

	Course Outcome	Cognitive	PO's
CO1	Classification and characterization of optical fibers with different modes of signal propagation.	U	1,2,3,4,6,7,9,10, 11,12
CO2	Describe the constructional features and the characteristics of optical fiber and optical devices used for signal transmission and	U	1,2,3,4,5,6,7,9, 10,11,12
CO3	Understand the essential concepts and principles of mobile radio channel and cellular communication.	U	1,2,3,4,5,6,7,9, 10,11,12
CO4	Describe various multiple access techniques used in wireless communication systems	U	1,2,3,4,5,6,7,9, 10,11,12
CO5	Describe the GSM architecture and procedures to establish call set up, call progress handling and call tear down in a GSM cellular	U	1,2,3,4,5,6,7,9, 10,11,12
Total Hours of instruction		**30**	

4.0 Course Content

Theory		
Modules	**Teaching Hours**	**Bloom's Taxonomy (RBT) level**
Module 1		
Optical Fiber Structures: Optical Fiber Modes and Configurations, Mode theory for circular waveguides, Single mode fibers, Fiber materials. Attenuation and Dispersion: Attenuation, Absorption, Scattering Losses, Bending loss, Signal Dispersion: Modal delay, Group delay, Material dispersion.	08	L1,L2,L3
Module -2		
Optical Sources and detectors: Light Emitting Diode: LED Structures, Light source materials, Quantum efficiency and LED power, Laser Diodes: Modes and threshold conditions, Rate equations, External quantum efficiency, Resonant frequencies, Photodetectors: The pin Photodetector, Avalanche Photodiodes. WDM Concepts: Overview of WDM, Isolators and Circulators, Fiber grating filters, Dielectric thin-film filters, Diffraction Gratings.	08	L1,L2,L3
Module-3		
Mobile Communication Engineering: Wireless Network generations, Basic propagation Mechanisms, Mobile radio Channel. Principles of Cellular Communications: Cellular terminology, Cell structure and Cluster, Frequency reuse concept, Cluster size and system capacity, Frequency Reuse Distance, Cochannel Interference and signal quality.	08	L1,L2,L3
Module-4		
Multiple Access Techniques: FDMA, TDMA, CDMA, SDMA, Hybrid Multiple Access Techniques, Multicarrier Multiple Access Schemes. A Basic Cellular System: A basic cellular system connected to PSTN, Parts of basic cellular system, Operation of a cellular system.	08	L1,L2,L3
Module-5		
Global System for Mobile (GSM): GSM Network Architecture, GSM signalling protocol architecture, Identifiers used in GSM system, GSM Channels, Frame structure for GSM, GSM Call procedures, GSM hand-off Procedures, GSM Services and features.	08	L1,L2,L3

5.0 Relevance to future subjects

Sl. No	Semester	Subject	Topics
01	VIII	Project Work	Project

6.0 Relevance to Real World

SL.No	Real World Mapping
01	System Design using Optical fiber and Cellular phone
02	System Design using GSM Services.

7.0 Gap Analysis and Mitigation

Sl. No	Delivery Type	Details
01	Tutorial	Topic: Wireless communication
02	NPTEL	Topic: Optical Communications

8.0 Books Used and Recommended to Students

Text Books
1.Gerd Keiser, Optical Fibre Communications,5th Edition, McGraw Hill Education (India) Private Limited, 2016. ISBN:1-25-900687-5. 2. T L Signal, Wireless Communications, McGraw Hill Education (India) Private Limited, 2016, ISBN:0- 07-068178-3.
Reference Books
1. John M Senior, Optical Fiber Communications, Principles and Practice, 3rd Edition, Pearson Education, 2010, ISBN:978-81-317-3266-3 2. Theodore Rappaport, Wireless Communications: Principles and Practice, 2nd Edition, Prentice Hall Communications Engineering and Emerging Technologies Series, 2002, ISBN 0-13-042232-0. 3. Gary Mullet, Introduction to Wireless Telecommunications Systems and Networks, First Edition, Cengage Learning India Pvt Ltd., 2006, ISBN - 13: 978-81-315-0559-5.

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

Website and Internet Contents References
https://ieeexplore.ieee.org

10.0 Magazines/Journals Used and Recommended to Students

Sl.No	Magazines/Journals	website
1	Optical Wireless Communications	www.ieee.org
2	Optical Communications and Networks	www.comsoc.org

11.0 Examination Note

Assessment Details (both CIE and SEE)
Marks scored by the students will be proportionally scaled down to 50 marks
The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE(Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.
Continuous Internal Evaluation:
Three Unit Tests each of 20 Marks (duration 01 hour)
1. First test at the end of 5 th week of the semester
2. Second test at the end of the 10 th week of the semester
3. Third test at the end of the 15 th week of the semester
Two assignments each of 10 Marks
4. First assignment at the end of 4 th week of the semester
5. Second assignment at the end of 9 th week of the semester
Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for 20

Marks (duration 01 hours)
6. At the end of the 13th week of the semester
The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will **be scaled down to 50 marks** (to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).
CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the Outcome defined for the course.
Semester End Examination:
Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject **(duration 03 hours**)
1. The question paper will be set for 100 marks. Marks scored shall be proportionally reduced to 50 marks
2. The question paper will have ten questions. Each question is set for 20 marks.
3. There will be 2 questions from each module. Each of the two questions is under a module (with a maximum of 2 sub-questions).
4. The students have to answer 5 full questions, selecting one full question from each module. Marks scored out of 100 shall be reduced proportionally to 50 marks.

12.0 Course Delivery Plan

Module No.	Lecture No.	Content of Lecture	Teaching Method	% Of Portion
				20
1	1	Optical Fiber Modes and Configurations	Chalk and talk	
	2	Mode theory for circular waveguides, Single mode fibers	Chalk and talk	
	3	Fiber materials.	Chalk and talk	
	4	Attenuation, Absorption, Scattering Losses	Chalk and talk	
	5	Bending loss, Signal Dispersion	Chalk and talk	
	6	Modal delay, Group delay, Material dispersion	Chalk and talk	
2	7	Light Emitting Diode: LED Structures, Light source materials	Chalk and talk	20
	8	Quantum efficiency and LED power, Laser Diodes: Modes and threshold conditions, Rate equations	Chalk and talk	
	9	External quantum efficiency, Resonant frequencies, Photo detectors	Chalk and talk	
	10	The pin Photo detector, Avalanche Photodiodes	Chalk and talk	
	11	Overview of WDM, Isolators and Circulators, Fiber grating filters	Chalk and talk	
	12	Dielectric thin-film filters, Diffraction Gratings	Chalk and talk	
3	13	Wireless Network generations, Basic propagation Mechanisms	Chalk and talk	20
	14	Mobile radio Channel.	Chalk and talk PPT	
	15	Cellular terminology, Cell structure and Cluster, Frequency reuse concept	Chalk and talk PPT	
	16	Cluster size and system capacity	Chalk and talk	
	17	Frequency Reuse Distance	PPT	
	18	Co channel Interference and signal quality	Chalk and talk	

4	19	FDMA, TDMA, CDMA	PPT	20
	20	SDMA, Hybrid Multiple Access Techniques	Chalk and talk	
	21	Multicarrier Multiple Access Schemes.	PPT	
	22	A basic cellular system connected to PSTN	Chalk and talk	
	23	Parts of basic cellular system	Chalk and talk	
	24	Operation of a cellular system.	Chalk and talk	
5	25	GSM Network Architecture, GSM signaling protocol architecture.	Chalk and talk	20
	26	Identifiers used in GSM system.	Chalk and talk	
	27	GSM Channels, Frame structure for GSM.	Chalk and talk	
	28	GSM Call procedures.	Chalk and talk	
	29	GSM hand-off Procedures.	Chalk and talk YouTube Videos	
	30	GSM Services and features.	Chalk and talk	

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	Students study the Topics and will prepare for Final Exam.	Module-1,2 of the syllabus	3	Individual Activity	Text Book 1
2	Assignment 2: University Questions	Students study the Topics and will prepare for Final Exam.	Module-3,4,5 of the syllabus	6	Individual Activity.	Text Book 4

14.0 University Result

Examination	Total Students	FCD	FC	SC	FAIL	% of passing
First Time Introduced	← Not Applicable →					

15.0 QUESTION BANK

Module 1

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Q1 Explain the different optical Fiber modes and Configurations.
Q2 Explain Mode theory for circular waveguides.
Q3 Explain single mode fibers.
Q4. Describe Step Index Fiber Structure.
Q4 Explain Fiber materials.

Q5 Explain Attenuation, Absorption, scattering loss, Bending loss, Signal dispersion.
Q6 Explain Modal delay, Group delay, Material Dispersion.
Q7. Consider a multimode silica fiber that has a core refractive index n1=1.48 and a cladding index n2= 1.46. find a) Critical angle b) Numerical Aperture c) Acceptance angle
Q8. A step index fiber has a normalized freq V=26.6 at a 1300 nm wavelength. If the core radius is 25µm.What is numerical aperture.

Module 2

Q1 Explain LED, LED Structures.
Q2 Explain Light source materials.
Q3 What is Quantum efficiency and LED power.
Q4 Explain Laser Diodes: Modes and threshold conditions.
Q5 Explain Rate equations, External quantum efficiency, Resonant frequencies.
Q6 Explain Photodetectors, pin Photodetector, Avalanche Photodiodes.
Q7 Explain Isolators and Circulators.
Q8 Explain Fiber grating filters, Dielectric thin-film filters, Diffraction Gratings.
Q9 A low loss fiber has average loss of 3 dB/km at 900 nm. Compute the length over which –
a) Power decreases by 50 % b) Power decreases by 75 %.

Module 3

Q1 Explain Wireless Network generations, Basic propagation Mechanisms.
Q2 Explain mobile radio channel.
Q3 Explain Cellular terminology, Cell structure and Cluster.
Q4 Explain Frequency reuse concept, Cluster size and system capacity.
Q5 Explain Frequency Reuse Distance, Co channel Interference and signal quality.

Module 4

Q1 Explain FDMA, TDMA, CDMA, SDMA, Hybrid Multiple Access Techniques.
Q2 Explain Multicarrier Multiple Access Schemes.
Q3 Explain a basic cellular system connected to PSTN.
Q4 Explain Parts of basic cellular system, Operation of a cellular system.

Module 5

Q1 Explain Global System for Mobile (GSM): GSM Network Architecture.
Q2 Explain GSM signaling protocol architecture.
Q3 Explain Identifiers used in GSM system, GSM Channels, Frame structure for GSM, GSM Call procedures, GSM hand-off Procedures.
Q4 Describe GSM Services and features

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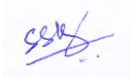
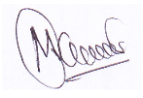
			
Prof. S. S. Malaj	**Prof. S. S. Kamate**	**HOD**	**Principal**

Subject Title	**Digital Image Processing**		
Subject Code	**21EC732**	**CIE Marks**	**50**
Number of Lecture Hrs /	**03**	**SEE Marks**	**50**
Total Number of Lecture Hrs	**40**	**Exam Hours**	**03**

Faculty Details:		
Name: Prof. B. P. Khot	**Designation: Assistant Professor**	**Experience: 8.10 Years**
No. of times course taught: 06	**Specialization: Microelectronics and control systems**	

1.0 Prerequisite Subjects:

Sr. No.	Branch	Semester	Subject
01	Electronics & Communication	III	Digital Electronics
02	Electronics & Communication	V	Digital signal Processing

2.0 Course Objectives

1. Understand the fundamentals of digital image processing.
2. Understand the image transform used in digital image processing.
3. Understand the image enhancement techniques in spatial domain used in digital image processing.
4. Understand the Color Image Processing and frequency domain enhancement techniques in digital image processing.
5. Understand the image restoration techniques and methods used in digital image processing.

3.0 Course Outcomes

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

	Course Outcome	RBT Level	POs
C404.1	Understand image formation and the role human visual system plays in perception of gray and color image data.	L1, L2, L3	PO1-PO6, PO10-PO12
C404.2	Compute various transforms on digital images.	L1, L2, L3	PO1-PO6, PO10-PO12
C404.3	Conduct independent study and analysis of Image Enhancement techniques.	L1, L2, L3	PO1-PO6, PO10-PO12
C404.4	Apply image processing techniques in frequency (Fourier) domain.	L1, L2, L3	PO1-PO6, PO10-PO12
C404.5	Design image restoration techniques.	L1, L2, L3	PO1-PO6, PO10-PO12
Total Hours of instruction		40	

4.0 Course Content

Module-1	RBT Level
Digital Image Fundamentals: What is Digital Image Processing? Origins of Digital Image Processing, Examples of fields that use DIP, Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Elements of Visual Perception, Image Sensing and Acquisition, Image Sampling and Quantization, Some Basic Relationships Between Pixels. [Text 1: Chapter 1, Chapter 2: Sections 2.1 to 2.5] 8 Hours	L1, L2, L3
Module-2	
Image Transforms: Introduction, Two-Dimensional Orthogonal and Unitary Transforms, Properties of Unitary Transforms, Two-Dimensional DFT, cosine Transform, Haar Transform. Text 2: Chapter 5: Sections 5.1 to 5.3, 5.5, 5.6, 5.9] 8 Hours	L1, L2, L3
Module-3	
Spatial Domain: Some Basic Intensity Transformation Functions, Histogram Processing, Fundamentals of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters [Text: Chapter 3: Sections 3.2 to 3.6] 8 Hours	L1, L2, L3
Module-4	
Frequency Domain: Basics of Filtering in the Frequency Domain, Image Smoothing and Image Sharpening Using Frequency Domain Filters. **Color Image Processing:** Color Fundamentals, Color Models, Pseudo-color Image Processing. [Text: Chapter 5: Sections 5.2, to 5.9] 8 Hours	L1, L2, L3
Module-5	
Restoration: A model of the Image Degradation/Restoration Process, Noise models, Restoration in the Presence of Noise Only using Spatial Filtering and Frequency Domain Filtering, Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering. [Text 1: Chapter 5: Sections 5.1, to 5.4.3, 5.7, 5.8] 8 Hours	L1, L2, L3

5.0 Relevance to future subjects

Sr. No.	Semester	Subject	Topics
01	VIII	Project work	Image Processing Projects

6.0 Relevance to Real World

Sr. No.	Real World Mapping
01	Machine vision (Robotics)
02	Medical image Processing
03	Video processing (TVs, monitors, displays)

7.0 Gap Analysis and Mitigation

Sr. No.	Delivery Type	Details
01	NPTEL	Image Enhancement, Image Restoration

8.0 Books Used and Recommended to Students

Text Books
1. Digital Image Processing- Rafael C Gonzalez and Richard E Woods, PHI, 3rd Edition 2010. 2. Fundamentals of Digital Image Processing- A K Jain, PHI Learning Private Limited 2014.
Reference Books
1. Digital Image Processing- S Jayaraman, S Esakkirajan, T Veerakumar, Tata McGraw Hill, 2014

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

Website and Internet Contents References
1. Image databases, https://imageprocessingplace.com/root_files_V3/image_databases.htm 2. Student support materials, https://imageprocessingplace.com/root_files_V3/students/students.htm 3. NPTEL Course, Introduction to Digital Image Processing, https://nptel.ac.in/courses/117105079 4. Computer Vision and Image Processing, https://nptel.ac.in/courses/108103174 5. Image Processing and Computer Vision – Matlab and Simulink, 6. https://in.mathworks.com/solutions/image-video-processing.html

10.0 Magazines/Journals Used and Recommended to Students

Sr. No.	Magazines/Journals	Website
1	Introduction of Digital Image Processing	http://textofvideo.nptel.ac.in/117105135/lec1.pdf
2	Digital image fundamentals	http://www.acfr.usyd.edu.au/courses/amme4710/Lectures/AMME4710-Chap2-DigitalImageFundamentals.pdf
3	Image enhancement	https://link.springer.com/content/pdf/10.1007%2F978-1-4471-2751-2_4.pdf
4	Image Enhancement	http://textofvideo.nptel.ac.in/117105079/lec17.pdf
5	Image Restoration - I	http://textofvideo.nptel.ac.in/117105079/lec22.pdf
6	Color Image Processing	http://textofvideo.nptel.ac.in/117105079/lec26.pdf
7	Fundamental Concepts & an Overview of the Wavelet Theory	http://web.iitd.ac.in/~sumeet/WaveletTutorial.pdf
8	Mathematical Morphology- III	http://textofvideo.nptel.ac.in/117105079/lec35.pdf
9	Image Segmentation	http://textofvideo.nptel.ac.in/117105079/lec29.pdf

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

1. Verilog /VHDL coding for Image manipulation.
2. Simulink models for Image processing.

12.0 Examination Note

Details Assessment (both CIE and SEE)

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

Continuous Internal Evaluation:

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

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

Two assignments each of 10 Marks

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

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

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

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

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

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

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

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

The students have to answer 5 full questions, selecting one full question from each module.. Marks scored out of 100 shall be reduced proportionally to 50 marks

12.0 Course Delivery Plan

1	1	Digital Image Fundamentals: What is Digital Image Processing?	20
	2	Origins of Digital Image Processing	
	3	Examples of fields that use DIP,	
	4	Fundamental Steps in Digital Image Processing	
	5	Components of an Image Processing System	
	6	Elements of Visual Perception, Image Sensing and Acquisition	
	7	Image Sampling and Quantization	
	8	Some Basic Relationships Between Pixels	
2	9	Image Transforms: Introduction	20
	10	Two-Dimensional Orthogonal Transforms	
	11	**Two-Dimensional** Unitary Transforms	
	12	Properties of Unitary Transforms	
	13	Properties of Unitary Transforms	
	14	Two-Dimensional DFT	
	15	cosine Transform	
	16	Haar Transform	
3	17	Spatial Domain: Introduction	20
	18	Some Basic Intensity Transformation Functions	
	19	Some Basic Intensity Transformation Functions	
	20	Histogram Processing	
	21	Histogram Processing	
	22	Fundamentals of Spatial Filtering	
	23	Smoothing Spatial Filters	
	24	Sharpening Spatial Filters	

4	25	Frequency Domain: Introduction	20
	26	Basics of Filtering in the Frequency Domain	
	27	Basics of Filtering in the Frequency Domain	
	28	Image Smoothing Using Frequency Domain Filters	
	29	Image Sharpening Using Frequency Domain Filters	
	30	Color Image Processing: Color Fundamentals	
	31	Color Models	
	32	Pseudo-color Image Processing	
5	33	Restoration: A model of the Image Degradation/Restoration Process,	20
	34	Noise models,	
	35	Restoration in the Presence of Noise Only using Spatial Filtering	
	36	Restoration in the Presence of Noise Only using Spatial Filtering	
	37	Restoration in the Presence of Noise Only using Frequency Domain Filtering,	
	38	Restoration in the Presence of Noise Only using Frequency Domain Filtering,	
	39	Inverse Filtering,	
	40	Minimum Mean Square Error (Wiener) Filtering.	
		Total	100

13.0 Assignments, Pop Quiz, Mini Project, Seminars

Sr. No.	Title	Outcome expected	Allied study	Week No.	Individual / Group activity	Reference: book/website /Paper
1	Assignment 1:	Students study the Topics and write the Answers. Get practice to solve university questions.	Module 1,3,2 of the syllabus	4	Individual Activity.	Text Book 1, Reference book 1, 2 of the reference list. Website of the Reference list.
2	Assignment 2:	Students study the Topics and write the Answers. Get practice to solve university questions.	Module 4,5 of the syllabus	9	Individual Activity.	Text Book 1, Reference book 1, 2 of the reference list. Website of the Reference list.

14.0 QUESTION BANK

Module 1: Digital image fundamentals

1. What is digital image processing?
2. Write a note on origins of digital image processing.
3. Explain the fundamental steps in digital image processing.
4. Explain the fields that use DIP.
5. Explain about visual perception
6. Briefly explain the components of an image processing system.
7. Explain image sensing and acquisition.

Module 2: Digital image fundamentals

1. What is digital image processing?
2. Write a note on origins of digital image processing.
3. Explain the fundamental steps in digital image processing.
4. Explain the fields that use DIP.

5. Explain about visual perception
6. Briefly explain the components of an image processing system.
7. Explain image sensing and acquisition.

Module 3: Spatial Domain:

1. Explain image sampling and quantization.
2. Explain some basic relationships between pixels.
3. Write a note on linear and nonlinear operations.
4. Write a note on basic intensity transformation functions.
5. Explain histogram processing.
6. Explain the fundamentals of spatial filtering.
7. Write a note on smoothing spatial filters
8. Write a note on sharpening spatial filters.

Module 4: Frequency Domain

1. Explain preliminary concepts of selective filtering.
2. Explain Discrete Fourier Transform (DFT) of two variables.
3. Explain properties of the 2-D DFT.
4. Explain filtering in the frequency domain.
5. Write a note on image sharpening using frequency domain filters.
6. Write a note on image smoothing using frequency domain filters.
7. Write a note on color fundamentals.
8. Write a note on color models.
9. Explain pseudo color image processing.

Module 5: Restoration

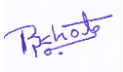
1. Write a note on restoration process.
2. Explain noise models.
3. Explain restoration in the presence of noise only, using spatial filtering.
4. Write a note on restoration in the presence of noise only, using frequency domain filtering.
5. Write a note on linear degradations.
6. Explain position-invariant degradations.
7. Explain Minimum Mean Square Error (Wiener) filtering.

15.0 University Result

Examination	FCD	FC	SC	% Passing
Dec.-2013/Jan-2014	37	04	01	100
Dec.-2014/Jan-2015	13	17	07	100
Dec.-2017/Jan-2018	21	10	04	100
Dec -2018/Jan-2019	31	15	09	100
Dec -2019/Jan-2020	28	09	06	100
Dec -2020/Jan-2021	25	10	00	100

2018 Scheme

Examination	S	A	B	C	D	E	% Passing
Feb 2022	9	12	9	2	3	-	100

Prepared by	Checked by		
			
Prof. B. P. Khot	Dr. S. S. Ittannavar	HOD	Principal

Subject Title	**NETWORK SECURITY**		
Subject Code	21EC742	**IA Marks**	50
Number of Lecture Hrs /	03	**Exam Marks**	50
Total Number of Lecture Hrs	40	**Exam Hours**	03

Faculty Details:		
Name: Prof. B. P. Khot	**Designation:** Asst. Professor	**Experience:** 8.10 Yrs
No. of times course taught: 5	**Specialization:** Microelectronics and Control Systems	

1.0 Prerequisite Subjects:

Sr. No.	Branch	Semester	Subject
01	Electronics & Communication Engineering	IV	Computer Organization and Architecture
02	Electronics & Communication Engineering	VII	Computer Networks

2.0 Course Objectives

- **Preparation:** To prepare students with fundamental knowledge/ overview in the field of Network Security with knowledge of security mechanisms and services.
- **Core Competence:** To equip students with a basic foundation of Network Security by delivering the basics of Transport Level Security, Secure Socket Layer, Internet Protocol security, Intruders, Intrusion detection and Malicious Software, Firewalls, Firewall characteristics, Biasing and Configuration.

3.0 Course Outcomes

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

Sr. No.	Course Outcome	RBT Level	POs
C409.1	Explain network security services and mechanisms and explain security concepts	L1, L2, L3	PO1-PO3, PO5, PO6, PO8,PO12
C409.2	Understand the concept of Transport Level Security and Secure Socket Layer.	L1, L2, L3	PO1-PO3, PO5, PO12
C409.3	Explain Security concerns in Internet Protocol security	L1, L2, L3	PO1-PO3, PO5, PO6, PO8, PO12
C409.4	Explain Intruders, Intrusion detection and Malicious Software	L1, L2, L3	PO1-PO6, PO8, PO12
C409.5	Explain Firewalls, Firewall Characteristics, Biasing and Configuration	L1, L2, L3	PO1-PO6, PO8, PO12
Total Hours of instruction		**40**	

4.0 Course Content

Module-1
Attacks on Computers and Computer Security: Need for Security, Security Approaches, Principles of Security Types of Attacks. (Text2: Chapter1) Security Mechanisms, Services and Attacks, A model for Network security (Text1: Chapter1: 3, 4, 5, 6) Network Access Control, Extensible Authentication Protocol (Text1: Chapter 16: Section 1,2) **8 Hours**
Module-2
Transport Level Security: Web Security Considerations, Secure Sockets Layer, Transport Layer Security, HTTPS, Secure Shell (SSH) (Chapter15 of Text 1). **8 Hours**
Module-3
IP Security: Overview of IP Security (IPSec), IP Security Architecture, Modes of Operation, Security Associations (SA), Authentication Header (AH), Encapsulating Security Payload (ESP), Internet Key Exchange. (Chapter19 of Text1) **8 Hours**
Module-4
Intruders, Intrusion Detection. (Chapter20 of Text1) MALICIOUS SOFTWARE: Viruses and Related Threats, Virus Countermeasures, (Chapter21of Text1) **8 Hours**
Module-5
Firewalls: The Need for firewalls, Firewall Characteristics, Types of Firewalls, Firewall Biasing, Firewall location and configuration. (Chapter 22 of Text1) **8 Hours**

5.0 Relevance to future subjects

Sr. No.	Semester	Subject	Topics
01	VIII	Project work	Security based Projects
02	M. Tech (SE) 2nd SEM	Information and Network Security	Secured Communication system design

6.0 Relevance to Real World

Sr. No.	Real World Mapping
01	Secured internet banking and business
02	Secured communication required for military, Navy and Air force sectors.

7.0 Gap Analysis and Mitigation

Sr. No.	Delivery Type	Details
01	Tutorial	Topic: Encryption & Decryption Algorithms concepts & numerical
02	NPTEL	Encryption & Decryption Algorithms, SET, Malicious Software

8.0 Books Used and Recommended to Students

Text Books
1. **Cryptography and Network Security Principles and Practice!, Pearson Education Inc., William Stallings, 5th Edition, 2014, ISBN: 978-81-317- 6166-3**
2. **Cryptography and Network Security**, Atul Kahate, TMH, 2003.
Reference Books
1. **Cryptography and Network Security, Behrouz A. Forouzan, TMH, 2007.**

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

Website and Internet Contents References
1. https://nptel.ac.in/courses/106105031/ 2. https://www.infosecurity-magazine.com/ 3. https://www.securitymagazine.com/keywords/1944-network-security 4. https://www.coursera.org/learn/information-security-data

10.0 Magazines/Journals Used and Recommended to Students

Sr. No.	Magazines/Journals	Website
1	Cyber Security; Issue and Challenges in E-Commerce	https://www.worldwidejournals.com/paripex/recent_issues_pdf/2016/January/January_2016_1453357435__63.pdf
2	International cyber security challenges	https://bib.irb.hr/datoteka/878827.Duic_Cvrtila_Ivanjko_International_cyber_security_challenges_.pdf
3	International cyber security challenges	https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=7973625

11.0 Examination Note

Assessment Details (both CIE and SEE)

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

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Two assignments each of 10 Marks

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

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

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

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be scaled down to 50 marks (to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course). CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

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

The students have to answer 5 full questions, selecting one full question from each module. Marks scored out of 100 shall be reduced proportionally to 50 marks

12.0 Course Delivery Plan

MODULE	LECTURE NO.	CONTENT OF LECTURE	% OF PORTION
1	1	**Attacks on Computers and Computer Security:** Introduction	20
	2	Need for Security,	
	3	Security Approaches	
	4	Principles of Security Types of Attacks.	
	5	Security Mechanisms, Services and Attacks	
	6	A model for Network security	
	7	Network Access Control	
	8	Extensible Authentication Protocol	
2	9	**Transport Level Security:** Introduction	20
	10	Web Security Considerations,	
	11	Secure Sockets Layer	
	12	Secure Sockets Layer	
	13	Transport Layer Security	
	14	Transport Layer Security	
	15	HTTPS	
	16	Secure Shell (SSH)	
3	17	**IP Security:** Overview of IP Security (IPSec)	20
	18	IP Security Architecture	
	19	Modes of Operation	
	20	Security Associations (SA)	
	21	Security Associations (SA)	
	22	Authentication Header (AH)	
	23	Encapsulating Security Payload (ESP)	
	24	Internet Key Exchange	

MODULE	LECTURE NO.	CONTENT OF LECTURE	% OF PORTION
4	25	Intruders	80
	26	Intrusion Detection	
	27	Intrusion Detection	
	28	MALICIOUS SOFTWARE:	
	29	Viruses and Related Threats	
	30	Viruses and Related Threats	
	31	Virus Countermeasures	
	32	Virus Countermeasures	
5	33	**Firewalls:** The Need for firewalls	100
	34	Firewall Characteristics	
	35	Types of Firewalls	
	36	Types of Firewalls	
	37	Firewall Biasing	
	38	Firewall Biasing	
	39	Firewall location and configuration	
	40	Firewall location and configuration	

13.0 IMPORTANT QUESTIONS

MODULE 1

1. What is Computer Security? Explain Need for Computer Security
2. Discuss Security Approaches
3. Explain Principles of Security
4. Explain active Attacks
5. Explain passive Attacks
6. Explain Types of Criminal Attacks
7. What are the four phases of virus in its lifetime?
8. Discuss worm and Trojan horse.
9. Explain Generations of anti-virus software.
10. Explain Steps in the execution of a Java program on the Internet.
11. Explain model for Network security
12. Explain Security Mechanisms and Services and Attacks
13. Explain Network Access Control
14. Explain Extensible Authentication Protocol

MODULE 2

1. Web Security Threats Web Traffic Security Approaches
2. Explain Secure Socket Layer (SSL) Architecture
3. Explain SSL Record Protocol
4. Explain Handshake Protocol
5. Explain Change Cipher Spec Protocol Alert Protocol

6. Explain HTTPS Connection Initiation
7. Explain HTTPS Connection Closure
8. Explain Secure Shell (SSH)
9. Explain SSH Transport Layer Protocol
10. Explain SSH User Authentication Protocol and Connection Protocol

MODULE 3

1. Explain Applications of IPsec
2. Explain Benefits of IPsec
3. Explain Transport and Tunnel Modes
4. Explain IP Security Policy
5. Explain Security Associations and Security Association
6. Explain Encapsulating Security Payload
7. Explain ESP Format Encryption and Authentication Algorithms
8. Explain Combining Security Associations Authentication Plus Confidentiality
9. Explain Basic Combinations of Security Associations
10. Explain Internet Key Exchange Key Determination Protocol Header and Payload Formats

MODULE 4

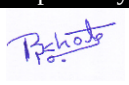
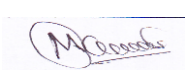
1. Explain Intruder Behavior Patterns
2. Explain Intrusion Detection
3. Explain Intrusion Detection Exchange Format
4. Explain Intrusion Techniques
5. Explain Intrusion Detection
6. Explain Detection Statistical Anomaly
7. Explain Rule-Based Intrusion Detection
8. Explain Distributed Intrusion Detection
9. Explain Password Protection
10. Explain Password Selection Strategies

MODULE 5

1. Explain Packet Filtering Firewall
2. Explain Stateful Inspection Firewalls
3. Explain Application-Level Gateway
4. Explain Circuit-Level Gateway
5. Explain Basing Bastion
6. Explain Host Host-Based Firewalls
7. Explain Personal Firewall
8. Explain DMZ Networks
9. Explain Virtual Private Networks
10. Explain Distributed Firewalls

16.0 University Result

Examination	FCD	FC	SC	% Passing
June 2022	17	17	1	100%
June 2023	4	13	12	100%
June 2024	17	13	15	100%

Prepared by	Checked by		
			
Prof. B. P. Khot	Dr. S. S. Ittannavar	HOD	Principal

Subject Title	**Electric Vehicles**		
Subject Code	21EE752	**CIE Marks**	50
Number of Lecture Hrs / Week	03	**SEE Marks**	50
Credits	03	**Exam Hours**	03

FACULTY DETAILS:		
Name: Prof. O. B. Heddurshetti	**Designation:** Asst. Professor	**Experience:**18 years
No. of times course taught:01	**Specialization:** Power Electronics	

1.0 Prerequisite Subjects:

Sl. No	Branch	Semester	Subject
01	Electrical and Electronics Engineering	I/II	Basic Electrical Engineering
02	Electrical and Electronics Engineering	IV	Electric motors
03	Electrical and Electronics Engineering	V	Power Electronics

2.0 Course Objectives

- To understand the fundamental laws and vehicle mechanics.
- To understand working of Electric Vehicles and recent trends.
- Ability to analyze different power converter topology used for electric vehicle application.
- Ability to develop the electric propulsion unit and its control for application of electric vehicles.

3.0 Course Outcomes

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

	Course Outcome	RBT level	POs
C414.1	Explain the roadway fundamentals, laws of motion, vehicle mechanics and propulsion system design.	L2	1,2,3,7,8,12
C414.2	Explain the working of electric vehicles and hybrid electric vehicles in recent trends.	L2	1,2,3,7,8,12
C414.3	Model batteries, Fuel cells, PEMFC and super capacitors.	L3	1,2,3,7,8,12
C414.4	Discuss DC and AC drive topologies used for electric vehicle application.	L3	1,2,3,7,8,12
C414.5	Develop the electric propulsion unit and its control for application of electric vehicles.	L3	1,2,3,7,8,12

4.0 Course Content

Module-1
Vehicle Mechanics: Roadway Fundamentals, Laws of Motion, Vehicle Kinetics, Dynamics of Vehicle Motion, Propulsion Power, Force-Velocity Characteristics, Maximum Grad ability, Velocity and Acceleration, Constant FTR, Level Road, Velocity Profile, Distance Traversed, Tractive Power, Energy Required, Non- constant FTR, General Acceleration, Propulsion System Design.

Module-2
Electric and Hybrid Electric Vehicles: Configuration of Electric Vehicles, Performance of Electric Vehicles,
Traction motor characteristics, Tractive effort and Transmission requirement, Vehicle performance, Tractive effort in normal driving, Energy consumption Concept of Hybrid Electric Drive Trains, Architecture of Hybrid Electric Drive Trains, Series Hybrid Electric Drive Trains, Parallel hybrid electric drive trains.

Module-3
Energy storage for EV and HEV: Energy storage requirements, Battery parameters, Types of Batteries, Modelling of Battery, Fuel Cell basic principle and operation, Types of Fuel Cells, PEMFC and its operation,
Modelling of PEMFC, Super capacitors.

Module-4
Electric Propulsion: EV consideration, DC motor drives and speed control, Induction motor drives, Permanent Magnet Motor Drives, Switch Reluctance Motor Drive for Electric Vehicles, Configuration and control of Drives.

Module-5
Design of Electric and Hybrid Electric Vehicles: Series Hybrid Electric Drive Train Design: Operating patterns, control strategies, Sizing of major components, power rating of traction motor, power rating of engine /generator, design of PPS Parallel Hybrid Electric Drive Train Design: Control strategies of parallel hybrid drive train, design of engine power capacity, design of electric motor drive capacity, transmission design, energy storage design.

5.0 Relevance to future subjects

Sl No	Semester	Subject	Topics
1	VII & VIII	Project Work	Electric vehicle based projects

6.0 Relevance to Real World

SL No	Real World Mapping
01	Design of electric & hybrid electric vehicles.

7.0 Gap Analysis and Mitigation

Sl. No	Delivery Type	Details
01	Practical Assignment	Practical assignments will be given to the students to study the design of EVs and HEVs.
02	Power point presentation and video lectures	Topic related to EVs and HEVs.

8.0 Books Used and Recommended to Students

Text Books
1. Electric and Hybrid Vehicles: Design Fundamentals, Iqbal Husain, CRC Press, 2003. 2. Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design, M. Ehsani, Y. Gao, S.Gay and Ali Emadi, CRC Press, 2005. .
Reference Books
1. Energy Management Strategies for Electric and Plug-in Hybrid Electric Vehicles, Sheldon S. Williamson, Springer, 2013. 2. Modern Electric Vehicle Technology, C.C. Chan and K.T. Chau, Oxford University, 2001. 3. Hybrid Electric Vehicles Principles And Applications With Practical Perspectives, Chris Mi, M. Abul Masrur, David Wenzhong Gao, Wiley Publication, 2011.
Additional Study material & e-Books
1. Jack Erjavec and Jeff Arias, “Hybrid, Electric and Fuel Cell Vehicles”, Cengage Learning, 2012.

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

Website and Internet Contents References
• https://archive.nptel.ac.in/courses/108/106/108106170/

10.0 Magazines/Journals Used and Recommended to Students

Sl.No	Magazines/Journals	website
1	International Journal of Electric and Hybrid Vehicles (IJEHV)	https://www.inderscience.com/jhome.php?jcode=ijehv
2	SAE International Journal of Electrified Vehicles	https://www.sae.org/publications/collections/content/E-JOURNAL-14
3	Trends in electric vehicles research	https://www.sciencedirect.com/science/article/pii/S136192092300278X

11.0 Examination Note

Assessment Details (both CIE and SEE)

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

Continuous Internal Evaluation:

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

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester Two assignments each of **10 Marks**
4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

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

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

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

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

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

Semester End Examination:

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

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

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

12.0 Course Delivery Plan

Module No.	Lecture No.	Content of Lecture	% of Portion
1	1	Roadway Fundamentals, Dynamics of Vehicle Motion	20%
	2	Laws of Motion, Vehicle Kinetics	
	3	Propulsion Power, Force-Velocity Characteristics	
	4	Maximum Gradability, Velocity and Acceleration	
	5	Constant FTR, Level Road, Velocity Profile	
	6	Distance Traversed, Tractive Power, Energy Required	
	7	Non- constant FTR, General Acceleration	
	8	Propulsion System Design.	

2	9	Configuration of Electric Vehicles,	20%
	10	Performance of Electric Vehicles, Traction motor characteristics	
	11	Tractive effort and Transmission requirement, Vehicle performance	
	12	Tractive effort in normal driving	
	13	Energy consumption Concept of Hybrid Electric Drive Trains	
	14	Architecture of Hybrid Electric Drive Trains	
	15	Series Hybrid Electric Drive Trains	
	16	Parallel hybrid electric drive trains	
3	17	Energy storage requirements	20%
	18	Battery parameters	
	19	Types of Batteries	
	20	Modelling of Battery	
	21	Fuel Cell basic principle and operation	
	22	Types of Fuel Cells	
	23	PEMFC and its operation	
	24	Modelling of PEMFC, Supercapacitors	
4	25	EV consideration,	20%
	26	DC motor drives and speed control	
	27	DC motor drives and speed control	
	28	Induction motor drives	
	29	Induction motor drives	
	30	Permanent Magnet Motor Drives	
	31	Switch Reluctance Motor Drive for Electric Vehicles	
	32	Configuration and control of Drives.	
5	33	Series Hybrid Electric Drive Train Design: Operating patterns	20%
	34	control strategies, Sizing of major components	
	35	power rating of traction motor, power rating of engine /generator	
	36	design of PPS Parallel Hybrid Electric Drive Train Design	
	37	Control strategies of parallel hybrid drive train	
	38	design of engine power capacity	
	39	design of electric motor drive capacity	
	40	transmission design, energy storage design	

13.0 Assigments

Sl. No.	Title	Outcome expected	Allied study	Week No.	Individual / Group activity	Reference: book/website /Paper
1	Assignment 1: Questions onvehicle mechanics and electric & hybrid electric vehicles.	Students will be able to explain vehicle mechanics and electric & hybrid electric vehicles.	Module 1&2of the syllabus	4	Individual Activity.	Books 1 & 2 of the book list
2	Assignment 2:Questions onvehicle battery & propulsion systems.	Students will be able to explain vehicle battery & propulsion systems.	Module 3 &4 of the syllabus	9	Individual Activity.	Books 1 & 2 of the book list

14.0 QUESTION BANK

Module 1:

1. Define rolling resistance.
2. Define aero dynamic drag.
3. What is tractive effort.
4. Define speed ratio.
5. What are the types subsystems in electric vehicle.
6. Draw the diagram of primary electric vehicle.
7. What are the types of electric vehicle.
8. Compare electric vehicle and hybrid electric vehicle.
9. What are the types of hybrid electric vehicle.
10. What are the components of electric vehicle.
11. Define clutch ,differentiator ,and vehicle controller.
12. Draw the traction motor characteristics of electric vehicle.
13. Define gradability ,maximum speed ,maximum cruising speed and acceleration time.
14. Draw the tractive effort and speed characteristics.
15. Write the torque equation and velocity equation of electric vehicle.
16. Define energy consumption.
17. What are the operating modes of series hybrid electric drive train.
18. What is pure engine mode and pure electric mode.
19. What id regenerative.
20. Define electric traction motor.

Module 2:

1. Discuss the history of hybrid electric vehicles
2. Discuss the environmental importance of EV and their social impacts
3. Explain the functional block diagrams of the various HEV configurations
4. Explain the different power flow control modes of a typical series hybrid system with the help of block diagrams
5. Explain the different power flow control modes of a typical parallel hybrid system with the help of block diagrams
6. Explain the different power flow control modes of a typical Series-parallel hybrid system with the help of block diagrams

Module 3:

1. Explain the Amp- hr measurement and direct measurement of SOC in battery.
2. Classify and Explain the different energy management strategies
3. Explain fuel cell and flywheel as energy source elements in electric and hybrid electric vehicle
4. How to explain the concept of Super Capacitor based energy storage
5. How to explain the concept of Lithium Ion Battery.
6. Explain the concept of operation principles of flywheels
7. Hybridization of different energy storage device

Module 4:

1 Discuss the Combined armature and Field Control method for DC Motor drives.
2 Explain the two-quadrant operation (Class-C) of chopper DC motor drive with suitable waveforms for electric vehicle.
3 Explain the four-quadrant operation of chopper DC motor drive for electric vehicle.
4 Discuss in detail about the control of permanent magnet motor drives.
5 Closed loop Torque control of BLDC motor drive
6 How to explain the concept of Sensorless Control of BLDC Motor drive using Back EMF method
7 Switch Reluctance Motor drives Modes of operation

Module 5:

1 Define gradeability.
2 Justify the need of transmission system in EV.
3 What is peaking power source.
4 What are the types of hybrid electric drive train.
5 What is series hybrid drive train.
6 What are the control strategies of series hybrid drive train.
7 Mention the control strategies of parallel hybrid drive train.
8 What is parallel hybrid drive train.
9 What are the components of series hybrid electric drive train
10 Mention the components of parallel hybrid electric drive train

Prepared by	Checked by		
			
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