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 centre 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 sustainble 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

Sr.No	Name of the faculty	Activities
1	Dr.M.C.Sarasamba	GATE / Preplacement Coaching
		Students Mentor
		Module Coordinator
		Research Center Coordinator
		Dept. NAAC Criteria Sub Coordinator
		NBA Criteria Coordinator
2	Prof. S. S. Malaj	GATE / Preplacement Coaching
		Adv.Comm. Lab In charge
		Students Mentor
		Dept. NAAC Criteria Sub Coordinator
		NBA Criteria Coordinator
		NIRF Coordinator
3	Prof. S. S. Kamate	GATE / Preplacement Coaching
		VLSI Lab In charge
		Students Mentor
		Module Coordinator
		IEEE Coordinator/ IA Cordinator
		Dept. NAAC Criteria Sub Coordinator
		Project Coordinator
		NBA Criteria Coordinator
4	Prof. D. M. Kumbhar	GATE / Preplacement 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

Sr.No	Name of the faculty	Activities
5	Prof. S. S. Patil	GATE / Preplacement Coaching
		ARM & ES Lab In charge
		Students Mentor
		Class Teacher
		NBA Criteria Coordinator
		AICTE Activity Coordinator
		Admission Coordinator
		Module Coordinator
6	Prof. D. B. Madihalli	GATE / Preplacement 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 / Preplacement Coaching
		HDL Lab In charge
		Students Mentor
		NBA Criteria Coordinator
		T&P Cell Coordinator
		Alumni Coordinator
8	Dr. S. S. Ittannavar	GATE / Preplacement Coaching
		BSP /DSP Lab In charge
		Students Mentor
		Module Coordinator
		News Letter / Technical Magazine
		AICTE Coordinator
9	Prof. B. P. Khot	GATE / Preplacement 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 / Preplacement Coaching
		Students Mentor
		AICTE Activity Coordinator
		NBA Criteria Coordinator
11	Prof. K.S.Patil	GATE / Preplacement Coaching
		Students Mentor
		AICTE Activity Coordinator
		NBA Criteria Coordinator

CONTENTS

FACULTY POSITION

S.N.	Category	No. in position	Average experience
1	Teaching faculty.	09	17.00Y
2	Technical supporting staff.	04	22.08Y
3	Helper staff	02	22.00Y

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	35.51
2	Analog Electronics (ED &I) Lab	92	8.24	6	Project Lab	95	--
3	Advanced Commn & Commn + LIC Lab	92	20.50	7	Research/E-Yantra/DSP & C.N.Lab	71	16.49
4	HDL/MC / EMD Lab	71	19.57	8	Power Electronics Lab	--	4.86
Total Investment In The Department						**Rs. 95.31 Lacs**	

FACULTY DETAILS

TEACHING FACULTY

S.N.	Name and Designation	Qualification	Specialization	Professional Membership	Teaching Exp.	Contact No.
1	Prof. M.C.Sarasamba	Ph.D	E&C	LMISTE	18Y.05M	9480714746
2	Assoc.Prof.S .S .Ittannavar	Ph.D	DSP	LMISTE	10Y.05M	9964299498
3	Asst.Prof. S. S. Malaj	M.E.	E & TC	LMISTE	26Y.01M	9731795803
4	Asst.Prof.S.S.Kamate	M.Tech	Digital Electronics	LMISTE	20Y.06M	9008696825
5	Asst.Prof. D.M. Kumbhar	M.Tech	Electronics	LMISTE	19Y.04M	09373609880
6	Asst.Prof. Sachin .S. Patil	M.Tech	VLSI & Embedded	LMISTE	19Y.02M	9448102010
7	Asst.Prof .D.B. Madihalli	M.Tech	Industrial Electronics	LMISTE	16Y.01M	9902854324
8	Asst.Prof.P.V.Patil	M.Tech	VLSI & Embedded	LMISTE	10Y.10M	9731104059
9	Asst.Prof. B. P. Khot	M.Tech	Microelectronics & Control Systems	LMISTE	7Y.05M	9964019501
10	Asst.Prof. S.R.Mallurmath	M.Tech	Industrial Electronics	LMISTE	10Y.04M	7259865769
11	Asst.Prof. K.S.Patil	M.Tech	VLSI	LMISTE	29Y.00M	9902682781

TECHNICAL SUPPORTING STAFF

S.N.	Name	Qualification	Experience (in years)
1.	Sri. P. S. Desai	DEC	23Y-.01M
2.	Sri. V. V. Guruwodeyar	DEC	31Y-08 M
3.	Sri.M.A.Attar	DEC	13Y-03M

VISVESVARAYA TECHNOLOGICAL UNIVERSITY,
BELAGAVI
B.E. in 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)

V 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	BSC 21EC51	Digital Communication	TD: ECE PSB: ECE	3	0	0	1	03	50	50	100	3
2	IPCC 21EC52	Computer Originations & ARM Microcontrollers	TD: ECE, CSE PSB: ECE	3	0	2		03	50	50	100	4
3	PCC 21EC53	Computer Networks	TD: ECE PSB: ECE	3	0	0	1	03	50	50	100	3
4	PCC 21EC54	Electromagnetic waves	TD: ECE PSB: ECE	3	0	0		03	50	50	100	3
5	PCC 21ECL55	Communication Lab II		0	0	2		03	50	50	100	1
6	AEC 21EC56	Research Methodology & Intellectual Property Rights	TD: Any Departmen tPSB: As identified by University	2	0	0		02	50	50	100	2
7	HSMC 21CIV57	Environmental Studies	TD: Civil/ Environmenta l /Chemistry /Biotech. PSB: Civil Engg	1	0	0		1	50	50	100	1
8	AEC 21EC58X	Ability Enhancement Course-V	Concerne dBoard	If offered as Theory courses: 1	0	0		01	50	50	100	1
				If offered as lab. courses: 0	0	2		02				
								Total	**400**	**400**	**800**	**18**

Ability Enhancement Course - V

21EC581	IoT (Internet of Things) Lab	21EC583	Antenna Design & Testing
21EC582	Communication Simulink Toolbox	21EC584	Microwaves toolbox

Note: BSC: Basic Science Course, PCC: Professional Core Course, IPCC: Integrated Professional Core Course, AEC –Ability Enhancement Course INT –Internship, HSMC: Humanity and Social Science & Management Courses.
L –Lecture, T – Tutorial, P- Practical/ Drawing, S – Self Study Component, CIE: Continuous Internal Evaluation, SEE: Semester End Examination.

Integrated Professional Core Course (IPCC): refers to Professional Theory Core Course Integrated with Practical of the same course. Credit for IPCC can be 04 and its Teaching – Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). Theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by CIE only and there shall be no SEE. For more details the regulation governing the Degree of Bachelor of Engineering /Technology (BE/B.Tech.) 2021-22 may be referred.

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:2023-24 (Odd)
	Rev: 01

REVISED ACADEMIC CALENDAR OF EVENTS-02 (CoE-02) OF III & V SEM FOR THE AY: 2023-24

Ref:
1. VTU CoE Notification No.: VTU/BGM/ACA/2023-24/3252, Dated 30th Sept. 2023
2. VTU CoE Notification No.: VTU/BGM/ACA/2023-24/2668, Dated 25th Aug. 2023
3. VTU Revised CoE Notification No.: VTU/BGM/ACA/2023-24/3681, Dated 20th Oct. 2023

Calendar

October -2023

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 -2023

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 -2023

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 -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			

February -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		

March -2024

Sun	Mon	Tue	Wed	Thu	Fri	Sat
31					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

Date	Events & Holidays
28th Sept.2023	GH: Eid-Milad
2nd Oct. 2023	GH: Gandhi Jayanthi
14th Oct.2023	GH: Mahalaya Amavasya
17th Oct. 2023	Fresher's day: A Welcome Function for 1st year students
23rd -24th Oct. 2023	GH: Mahanavami, Ayudhapooja, Vijayadasami
25th Oct to 23rd Nov. 2023	V Sem Innovation/Entrepreneurship/Societal Internship (2021 Scheme)
28th Oct. 2023	Valmiki Jayanti
1st Nov. 2023	GH: Kannada Rajyothsava
14th Nov. 2023	GH: Balipadyami, Deepavali
15th Nov. 2023	Commencement of III Semester Classes
25th Nov. 2023	Commencement of V Semester Classes
30th Nov. 2023	GH: Kanakadasa Jayanti
8th-9th Dec. 2023	International Conference
25th Dec. 2023	GH: Christmas
21st-23rd Dec.2023	1st IA Test for III & V Semesters
23rd Dec. 2023	1st Feedback on Teaching-Learning (III & V Sems.)
27th Dec. 2023	Display of 1st IA Test Marks (III & V Sems.)
12th Jan. 2024	National Youth Day
15th Jan. 2024	GH: Uttarayana Punya Kala Sankrathi (Tentative)
19th -20th Jan. 2024	Lab IA Test-I (III Sem. 2022 Scheme & V Sem. 2021 Scheme)
22nd-24th Jan. 2024	2nd IA Test for III & V Semesters
24th Jan. 2024	2nd Feedback on Teaching-Learning (III & V Sems.)
26th Jan. 2024	Republic Day
29th Jan. 2024	Display of 2nd IA Test Marks (III & V Sems.)
9th -10th Feb. 2024	Lab IA Test-II (III Sem. 2022 Scheme)
15th-17th Feb. 2024	3rd IA Test for III Semester
19th Feb. 2024	Display of 3rd IA Test Marks (III Sem.)
20th Feb. 2024	Last Working Day of the III Semester
21st -29th Feb. 2024	III Semester VTU Practical Examination
04th -23rd March. 2024	III Semester VTU Theory Exams (SEE)
1st & 2nd March 2024	Lab IA Test-II (V Sem. 2021 Scheme)
5th -7th March 2024	3rd IA Test for V Sem
9th March 2024	Display of 3rd IA Test Marks
8th March 2024	GH: Mahashivaratri & International Women's Day
9th March 2024	Last Working Day of the V Semester
11th-20th March. 2024	V Semester Practical Examination
1st April 2024	Commencement of IV Semester
22nd March-20th April 24	V Semester VTU Theory Exams (SEE)
22nd April 2024	Commencement of VI Semester
29th March 2024	GH: Good Friday

GH: General Holiday, LH: Local Holiday

27/11/23

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

Hirasugar Institute of Technology NIDASOSHI. PIN-591236.

28/11/23

Dr.S.C.Kamate
Principal

Subject Title	**Digital Communication**		
Subject Code	21EC51	**IA Marks (60) +Assignments (20) + Quiz/Seminar (20) out of 100 scale down to 50 Marks**	50
Number of Lecture Hrs/Week /	04(L)	**Exam Marks (appearing for)**	50 (100)
Total Number of Lecture Hrs	40Theory	**Exam Hours**	03
CREDITS – 04			
FACULTY DETAILS:			
Name: Dr. S. S. Ittannavar	**Designation:** Associate Professor	**Experience:**11 years	
No. of times course taught: 06	**Specialization:** Digital Signal Processing		

1.0 Prerequisite Subjects:

Sl. No	Branch	Semester	Subject
01	Students should have the knowledge of basic subjects	1 & 2	Basic Electronics, Principles of Communication system

2.0 Course Objectives

This course will enable students to:

- Understand the concept of signal processing of digital data and signal conversion to symbols at the transmitter and receiver.
- Compute performance metrics and parameters for symbol processing and recovery in ideal and corrupted channel conditions.
- Understand the principles of spread spectrum communications.
- Understand the basic principles of information theory and various source coding techniques.
- Build a comprehensive knowledge about various Source and Channel Coding techniques.
- Discuss the different types of errors and error detection and controlling codes used in the communication channel.
- Understand the concepts of convolution codes and analyze the code words using time domain and transform domain approach.

3.0 Course Outcomes

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

	Course Outcome	Cognitive Level	PO's
CO1	Analyze different digital modulation techniques and choose the appropriate modulation technique	U	1,2,3,4,6,7,9, 10,11,12
CO2	Test and validate symbol processing and performance parameters at the receiver under ideal and corrupted band limited channels.	U	1,2,3,4,5,6,7,9, 10,11,12
CO3	Differentiate various spread spectrum schemes and compute the performance parameters of communication system.	U	1,2,3,4,5,6,7,9, 10,11,12
CO4	Apply the fundamentals of information theory and perform source coding for given message	U	1,2,3,4,5,6,7,9, 10,11,12
CO5	Apply different encoding and decoding techniques with error Detection and Correction.	U	1,2,3,4,5,6,7,9, 10,11,12
Total Hours of instruction		**40**	

4.0 Course Content

Modules	Teaching Hours	Bloom's Taxonomy (RBT) level
Module 1		
Digital Modulation Techniques: Phase shift Keying techniques using coherent detection: generation, detection and error probabilities of BPSK and QPSK, M–ary PSK, M–ary QAM. Frequency shift keying techniques using Coherent detection: BFSK generation, detection and error probability. Non coherent orthogonal modulation techniques: BFSK, DPSK Symbol representation, Block diagrams treatment of Transmitter and Receiver, Probability of error (without derivation of probability of error equation).	**08**	**L1, L2,L3**
Module -2		
Signalling Communication through Band Limited AWGN Channels: Signalling over AWGN Channels- Introduction, Geometric representation of signals, Gram- Schmidt Orthogonalization procedure, Conversion of the continuous AWGN channel into a vector channel (without statistical characterization), Optimum receivers using coherent detection: ML Decoding, Correlation receiver, matched filter receiver. **Signal design for Band limited Channels**: Design of band limited signals for zero lSI-The Nyquist Criterion (statement only), Design of band limited signals with controlled lSI-Partial Response signals, Probability of error for detection of Digital PAM: Symbol-by-Symbol detection of data with controlled lSI.	**08**	**L1, L2,L3**
Module-3		
Principles of Spread Spectrum: Spread Spectrum Communication Systems: Model of a Spread Spectrum Digital Communication System, Direct Sequence Spread Spectrum Systems, Effect of De-spreading on a narrowband Interference, Probability of error (statement only), Some applications of DS Spread Spectrum Signals, Generation of PN Sequences, Frequency Hopped Spread Spectrum, CDMA based on IS- 95.	**08**	**L1, L2,L3**
Module-4		
Introduction to Information Theory: Measure of information, Average information content of symbols in long independent sequences. **Source Coding:** Encoding of the Source Output, Shannon's Encoding Algorithm, Shannon-Fano Encoding Algorithm, Huffman coding. **Error Control Coding:** Introduction, Examples of Error control coding, methods of Controlling Errors, Types of Errors, types of Codes.	**08**	**L1, L2,L3**
Module-5		
Linear Block Codes: Matrix description of Linear Block Codes, Error Detection & Correction capabilities of Linear Block Codes, Single error correction Hamming code, Table lookup Decoding using Standard Array. **Convolution codes:** Convolution Encoder, Time domain approach, Transform domain approach, Code Tree, Trellis and State Diagram.	**08**	**L1, L2, L3**

5.0 Relevance to future subjects

Sl. No	Semester	Subject	Topics
01	VIII	Project work	Design Communication system
02	VIII	Wireless Communication	Modulation Techniques

6.0 Relevance to Real World

SL.No	Real World Mapping
01	Digital Communication Technologies are digital tools that allow two or more people to communicate with one another.
02	These can be written, verbal, visual or audible communication

7.0 Gap Analysis and Mitigation

Sl. No	Delivery Type	Details
01	Tutorial	Topic: Digital Modulation Techniques, Spread Spectrum Modulation Techniques.
02	NPTEL	ISI, Equalizers.

8.0 Books Used and Recommended to Students

Text Books

1. Simon Haykin, "Digital Communication Systems", John Wiley & sons, First Edition, 2014, ISBN 978-0-471-64735-5.
2. John G Proakis and Masoud Salehi, "Fundamentals of Communication Systems", 2014 Edition, Pearson Education, ISBN 978-8-131-70573-5.
3. K Sam Shanmugam, "Digital and analog communication systems", John Wiley India Pvt. Ltd, 1996.
4. Hari Bhat, Ganesh Rao, "Information Theory and Coding", Cengage, 2017.
5. Todd K Moon, "Error Correction Coding", Wiley Std. Edition, 2006.

Reference Books

1. Bernard Sklar, "Digital Communications – Fundamentals and Applications", Second Edition, Pearson Education, 2016, ISBN: 9780134724058.
2. K Sam Shanmugam, "Digital and analog communication systems", John Wiley India Pvt. Ltd, 1996.

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

Website and Internet Contents References

1) www.citystudentsgroup.com
2) http://everythingvtu.wordpress.com
3) www.nptelvideos.in/2012/12/digital-communication.html

10.0 Magazines/Journals Used and Recommended to Students

Sl.No	Magazines/Journals	website
1	IEEE Transactions on Communication systems	ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=4547466
2	Digital Communications and Networks - Journal - Elsevier	www.journals.elsevier.com/digital-communications-and-networks/
3	International Journal of Digital Communication and Networks	ijdcn.co.in
4	Journal of Communication - Wiley Online Library	onlinelibrary.wiley.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/ 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**)

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 proportionally reduced to 50 marks

12.0 Course Delivery Plan

Module No.	Lecture No.	Content of Lecture	Teaching Method	% of Portion
1. Digital Modulation Techniques	1	**Digital Modulation Techniques**: Phase shift Keying techniques using coherent detection:	Chalk and talk	20
	2	Generation, detection & error probabilities of BPSK.	Chalk and talk	
	3	QPSK, M–ary PSK, M–ary QAM.	Chalk and talk	
	4	Frequency shift keying techniques using Coherent detection	Chalk and talk	
	5	BFSK generation, detection and error probability.	Chalk and talk	
	6	Non coherent orthogonal modulation techniques: BFSK,	Chalk and talk	
	7	DPSK Symbol representation, Block diagrams treatment of Transmitter and Receiver,	Chalk and talk	
	8	Probability of error (without derivation of probability of error equation).	Chalk and talk	
2.	9	Signalling Communication through Band Limited AWGN Channels: Signalling over AWGN Channels-Introduction	Chalk and talk	20
	10	Geometric representation of signals, Gram- Schmidt Orthogonalization procedure,	Chalk and talk	
	11	Conversion of the continuous AWGN channel into a vector channel (without statistical characterization)	Chalk and talk	
	12	Optimum receivers using coherent detection: ML Decoding,	Chalk and talk	
	13	Correlation receiver, matched filter receiver.	Chalk and talk	
	14	Signal design for Band limited Channels: Design of band limited signals for zero lSI-The Nyquist Criterion (statement only),	Chalk and talk	
	15	Design of band limited signals with controlled lSI-Partial Response signals,	Chalk and talk	
	16	Probability of error for detection of Digital PAM: Symbol-by-Symbol detection of data with controlled lSI.	Chalk and talk	

3.	17	**Principles of Spread Spectrum**: Spread Spectrum Communication Systems:	Chalk and talk	20
	18	Model of a Spread Spectrum Digital Communication System,	Chalk and talk	
	19	Direct Sequence Spread Spectrum Systems,	Chalk and talk	
	20	Effect of De-spreading on a narrowband Interference,	Chalk and talk	
	21	Probability of error (statement only),	Chalk and talk	
	22	Some applications of DS Spread Spectrum Signals,	Chalk and talk	
	23	Generation of PN Sequences,	Chalk and talk	
	24	Frequency Hopped Spread Spectrum, CDMA based on IS- 95.	Chalk and talk	
4.	25	**Introduction to Information Theory:** Measure of information	Chalk and talk	20
	26	Average information content of symbols in long independent sequences.	Chalk and talk	
	27	**Source Coding:** Encoding of the Source Output	Chalk and talk	
	28	Shannon's Encoding Algorithm	Chalk and talk	
	29	Shannon-Fano Encoding Algorithm, Huffman coding.	Chalk and talk	
	30	**Error Control Coding:** Introduction,	Chalk and talk	
	31	Examples of Error control coding, methods of Controlling Errors.	Chalk and talk	
	32	Types of Errors, types of Codes.	Chalk and talk	
5.	33	**Linear Block Codes:** Matrix description of Linear Block Codes,	Chalk and talk	20
	34	Error Detection & Correction capabilities of Linear Block Codes	Chalk and talk	
	35	Single error correction Hamming code	Chalk and talk	
	36	Table lookup Decoding using Standard Array.	Chalk and talk	
	37	**Convolution codes:** Convolution Encoder.	Chalk and talk	
	38	Time domain approach	Chalk and talk	
	39	Transform domain approach	Chalk and talk	
	40	Code Tree, Trellis and State Diagram.	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 Digital Modulation Techniques, Signaling Communication through Band Limited AWGN Channels and Principles of Spread Spectrum	Students study the Topics and will prepare for Final Exam.	Module-1, 2 & 3 of the syllabus	9	Individual Activity	Text Book 1& Text Book 2
2	Assignment 2: University Questions on Source Coding, Error Coding and Convolution codes.	Students study the Topics and will prepare for Final Exam.	Module-4 & 5 of the syllabus	12	Individual Activity.	Text Book 1& Text Book 2

13.014.0 University Result

Examination	S+	S	A	B	C	D	E	F	% of passing
First Time Introduced	-	-	-	-	-	-	-	-	-

15.0 QUESTION BANK

1. Explain about geometric representation of signals.
2. Explain about Gram-Schmidt Orthogonalization procedure.
3. Explain about Conversion of the continuous AWGN channel into a vector channel.
4. Explain Nyquist criterion for distortion less transmission.
5. Explain Properties of matched filter.
6. Explain correlative coding.
7. Discuss baseband M-ary PAM systems.
8. Explain Coherent & Non coherent detection.
9. Explain Differential phase shift keying with block diagram.
10. The bit stream 1011100011 is to be transmitted using DPSK. Determine the encoded Sequence & transmitted phase sequence.
11. Explain QPSK.
12. Explain ASK.
13. Explain BPSK.
14. Explain BFSK.
15. Explain the block diagram of baseband transmission of binary data.
16. Explain Nyquist criterion for distortion less transmission.
17. What is meant by raised cosine channel?
18. Explain EYE pattern with neat sketches.
19. Discuss baseband M-ary PAM systems.
20. Explain Spread spectrum modulation & give the applications of spread spectrum modulation.
21. Explain Model of Spread spectrum Digital Communication System.
22. Explain generation of pseudo-noise sequences & Maximum length sequences.
23. Explain properties of Maximum length sequences.
24. Explain principle of DSSS & DPSK TX & RX.
25. Define Processing gain.
26. Explain applications of DSSS.
27. Explain principle of FHSS & list types of FHSS.

Prepared by	Checked by		
Dr. S. S. Ittannavar	Dr. M.C.Sarsamba	HOD	Principal

Subject Title	**Computer Originations & ARM Microcontrollers**		
Subject Code	21EC52	**IA Marks (20) +Assignments (10)**	30
Number of Lecture Hrs/Week /	03(L)	**Exam Marks**	20
Total Number of Lecture Hrs	40Theory + 13 Lab Slots	**Exam Hours**	03
CREDITS – 04			

FACULTY DETAILS:		
Name: Prof. K.S.PATIL	**Designation:** Assistant Professor	**Experience:**30 years
No. of times course taught: 01	**Specialization:** VSLI & Embedded systems	

1.0 Prerequisite Subjects:

Sl. No	Branch	Semester	Subject
01	Students should have the knowledge of Computer subjects	3 & 4	

2.0 Course Objectives

This course will enable students to :

1. Explain the basic organization of a computer system.
2. Demonstrate functioning of different sub systems, such as processor, Input/output, and memory
3. Describe the architectural features and instructions of 32-bit microcontroller ARM Cortex M3.
4. Apply the knowledge gained for Programming ARM Cortex M3 for different applications.
5. Understand the basic hardware components and their selection method based on the characteristics and attributes of an embedded system.

3.0 Course Outcomes

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

	Course Outcome	Cognitive Level	PO's
CO1	Explain the basic organization of a computer system.	U	1,2,3,4,6,7,9,10 ,11,12
CO2	Demonstrate functioning of different sub systems, such as processor,	U	1,2,3,4,5,6,7,9,
CO3	Describe the architectural features and instructions of 32-bit microcontroller ARM Cortex M3.	U	1,2,3,4,5,6,7,9, 10,11,12
CO4	Apply the knowledge gained for Programming ARM Cortex M3 for different applications.	U	1,2,3,4,5,6,7,9, 10,11,12
Total Hours of instruction		**40**	

4.0 Course Content

Theory		
Modules	**Teaching Hours**	**Bloom's Taxonomy (RBT) level**
Module 1		
Basic Structure of Computers: Basic Operational Concepts, Bus Structures, Performance – Processor Clock, Basic Performance Equation, Clock Rate, Performance Measurement **Input/Output Organization:** Accessing I/O Devices, Interrupts – Interrupt Hardware, Direct Memory Access, Buses, Interface Circuits, Standard I/O Interfaces – PCI Bus, SCSI Bus, USB.	08	L1,L2,L3
Module -2		
Memory System: Basic Concepts, Semiconductor RAM Memories, Read Only Memories, Speed, Size, and Cost, Cache Memories – Mapping Functions, Replacement Algorithms, Performance Considerations. **Basic Processing Unit:** Some Fundamental Concepts, Execution of a Complete Instruction, Multiple Bus Organization, Hard-wired Control, Micro programmed Control. Basic concepts of pipelining,	08	L1,L2,L3
Module-3		
ARM Embedded Systems: Introduction, RISC design philosophy, ARM design philosophy, Embedded system hardware – AMBA bus protocol, ARM bus technology, Memory, Peripherals, Embedded system software – Initialization (BOOT) code, Operating System, Applications. ARM Processor Fundamentals, ARM core dataflow model, registers, current program status register, Pipeline, Exceptions, Interrupts and Vector Table, Core extensions.	08	L1,L2,L3
Module-4		
Introduction to the ARM Instruction set: Introduction, Data processing instructions, Load - Store instruction, Software interrupt instructions, Program status register instructions, Loading constants, ARMv5E extensions, Conditional Execution.	08	L1,L2,L3
Module-5		
Introduction to the THUMB instruction set: Introduction, THUMB register usage, ARM – THUMB interworking, Other branch instructions, Data processing instructions, Stack instructions, Software interrupt instructions. **Efficient C Programming:** Overview of C Compilers and optimization, Basic C Data types, C looping structures	08	L1,L2,L3

5.0 Relevance to future subjects

Sl. No	Semester	Subject	Topics
01	VI	Mini Project	HDL
02	VIII	Project Work	Embedded system & HDL based projects

6.0 Relevance to Real World

SL.No	Real World Mapping
01	Analyze digital circuits in real time applications
02	Integrated Circuits (Chip)
03	Model creation for analysis

7.0 Gap Analysis and Mitigation

Sl. No	Delivery Type	Details
01	Tutorial	Topic: Solving different types of problems.

8.0 Books Used and Recommended to Students

Text Books
1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Computer Organization, 5th Edition, Tata McGraw Hill, 2002. (Listed topics only from Chapters 1, 2, 4, 5, 8). **2.** Andrew N Sloss, Dominic System and Chris Wright, "ARM System Developers Guide", Elsevier, Morgan Kaufman publisher, 1st Edition, 2008.
Reference Books
1. .

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

Website and Internet Contents References
4) https://nptel.co.in
5) http://www.slideshare.net/farohalolya/HDL
6) https://www.youtube.com

10.0 Magazines/Journals Used and Recommended to Students

Sl.No	Magazines/Journals	website
1	IEEE Explorer	http://ieeexplore.ieee.org/Xplore/home.jsp
2	International Journal of Science and Technology	http://www.sciencedirect.com/science/journal/00207683
3	PC World	http://www.pcworld.com/article/146957/components/article.html

11.0 Examination Note

Assessment Details both (CIE and SEE):

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

CIE for the theory component of IPCC:

Two tests each of **20 marks (duration 01 hour)**

i) First test at the end of 5th week of the semester.

ii) Second test at the end of the 10th week of the semester.

Two assignments each of **10 marks**

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

ii) Second assignment at the end of 9th week of the semester.

Scaled down marks of two tests and two assignments added will be CIE marks for the theory component of IPCC for 30 marks.

CIE for the practical component of IPCC:

- On completion of every experiment / program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day. The **15 marks** are for conducting the experiment and preparation of the laboratory record, the other **05 marks** shall be for the test conducted at the end of the semester.
- The CIE marks awarded in the case of the practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for **10 marks**. Marks of all experiments write ups are added and scaled down to 15 marks.
- The laboratory test (duration 03 hours) at the end of the 15th week of the semester / after completion of all the experiments (whichever is early) shall be conducted for **50 marks** and scaled down to **05 marks**.

Scaled down marks of write up evaluations and tests added will be CIE marks for the laboratory component of IPCC for **20 marks**.

SEE for IPCC:

Theory SEE will be conducted by university as per the scheduled time table with common question papers for the course (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.

The theory portion of the IPCC shall be for both CIE & SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper shall include questions from the practical component.

- The minimum marks to be secured in CIE to appear for SEE shall be the 12 (40% of maximum marks - 30) in the theory component and 08 (40% of maximum marks – 20) in the practical component. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included. The maximum of 04/05 questions to be set from the practical component of IPCC, the total marks of all questions should not be more than the 20 marks.
- SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify in the SEE. Marks secured will be scaled down to 50.

12.0 Course Delivery Plan

Module No.	Lecture No.	Content of Lecture	Teaching Method	% Of Portion
1 **Basic Structure of Computers** **Input/ Output Organization**:	1	Basic Operational Concepts, Bus Structures,	Chalk and talk	20
	2	Performance – Processor Clock,	Chalk and talk	
	3	Basic-Performance Equation, Clock Rate,	Chalk and talk	
	4	Performance Measurement	Chalk and talk	
	5	Accessing I/O Devices, Interrupts – Interrupt Hardware	Chalk and talk	
	6	Direct Memory Access, Buses,	Chalk and talk	
	7	Interface Circuits, Standard I/O Interfaces	Chalk and talk	
	8	PCI Bus, SCSI Bus, USB.	Chalk and talk	
2 **Memory System:** **Basic Processing Unit:**	9	Basic Concepts, Semiconductor RAM Memories	Chalk and talk	20
	10	Read Only Memories, Speed, Size, and Cost, Cache Memories	Chalk and talk	
	11	Mapping Functions, Replacement Algorithms,	Chalk and talk	
	12	Performance Considerations.	Chalk and talk	
	13	Some Fundamental Concepts, Execution of a Complete Instruction	Chalk and talk	
	14	Multiple Bus Organization,	Chalk and talk	
	15	Hard-wired Control, Micro programmed Control.	Chalk and talk	
	16	Basic concepts of pipelining,	Chalk and talk & YouTube Videos	
3 ARM Embedded Systems:	17	Introduction, RISC design philosophy, ARM design philosophy	Chalk and talk & YouTube Videos	20
	18	Embedded system hardware – AMBA bus protocol, ARM bus technology,	Chalk and talk	
	19	Memory, Peripherals, Embedded system software – Initialization (BOOT) code,	Chalk and talk	
	20	Operating System, Applications.	Chalk and talk	
	21	ARM Processor Fundamentals, ARM core dataflow model	Chalk and talk	
	22	Registers, current program status register	Chalk and talk	
	23	Pipeline, Exceptions, Interrupts	Chalk and talk	
	24	Vector Table, Core extensions.	Chalk and talk	

4 Introduction to the ARM Instruction set:	25	Introduction, Data processing instructions	Chalk and talk & YouTube Videos	20
	26	Load - Store instruction,	Chalk and talk	
	27	Software interrupt instructions,	Chalk and talk	
	28	Program status register instructions	Chalk and talk	
	29	Loading constants,	Chalk and talk	
	30	ARMv5E extensions,	Chalk and talk	
	31	Conditional Execution.	Chalk and talk	
	32	Over view of Instructions	Chalk and talk	
5 Introduction to the THUMB instruction set:	33	Introduction, THUMB register usage	Chalk and talk & YouTube Videos	20
	34	ARM – THUMB interworking	Chalk and talk	
	35	Other branch instructions, Data processing instructions	Chalk and talk	
	36	Stack instructions, Software interrupt instructions.	Chalk and talk	
	37	Efficient C Programming Overview of C Compilers	Chalk and talk	
	38	and optimization	Chalk and talk	
	39	Basic C Data types,	Chalk and talk	
	40	C looping structures.	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 Basic Structure of Computer, **Memory System:**	Students study the Topics and will prepare for Final Exam.	Module-1-2.5 of the Syllabus	4	Individual Activity	Text Book 1
2	Assignment 2: University Questions on ARM Embedded Systems Introduction to the ARM Instruction Introduction to the THUMB instruction set:	Students study the Topics and will prepare for Final Exam.	Module-2.5 to 5 of the syllabus	9	Individual Activity.	Text Book 2

14.0 University Result

Examination	S+	S	A	B	C	D	E	F	% of passing
First Time Introduced	-	-	-	-	-	-	-	-	-

15.0 QUESTION BANK

Theory

Module – 1

1. With a neat diagram explain basic functional units of computer
2. With a neat diagram explain basic operational concepts of computer(Fundamental).
3. Explain the concept of communication between memory and processor with the respective registers. (*Also show how to add A + B to form C)
4. Define the functions of following processor registers:
   MAR, MDR, IP & IR.
5. Explain Bus structure with diagram. Discuss about memory mapped I/O.
6. What is performance measurement? Discuss the basic performance equation. (Also explain the methods to improve the performance of the computer)
7. With neat block diagram explain connections between the processor& Memory
8. Define Processor Clock & Clock rate
9. Explain Single Bus Structure
10. Explain Accessing I/O devices
11. Explain the Mechanism used for interfacing I/O Devices
12. With fig explain Interrupt Hardware
13. How multiple Devices are handled
14. With block diagram explain DMA controller of a Computer System
15. Explain necessity of BUS
16. Explain Synchronous Port BUS
17. Explain Asynchronous Port BUS
18. Explain Standard I/O Interface
19. Explain Data Transfer in PCI
20. Explain USB Architecture

Module -2

1. Explain Basic Concepts of Memory System
2. Explain semiconductor RAM Memories.
3. With fig explain Static RAM Cell
4. Explain CMOS Memory Cell
5. With Block diagram explain Synchronous DRAM
6. What is Memory Controller
7. With fig explain ROM Cell
8. Mention Types of ROM. Explain each one
9. What is Mapping Function.
10. What are the types of mapping Function

Module -3

1.What is RISC design Philosophy? Explain RISC .design and mention rules
2.Expalin ARM Design Philosophy
3. With Block Digram explain 4 main hardware components
4. Explain AMBA Bus Processor
5. Explain ARM Core data flow model
6.Explain General purpose registers
7. Explain current program status Register
8. Explain pipe line of Arm7 three stage pipe line

Module – 4

1. List with example of Data processing Instruction
2. Explain Load-Store instruction of Arm Processor
3. Explain software Interrupt Instruction
4. List the Programmer Status register Instruction of Arm Processor.
5. Explain the structure of the verilog module.
6. Explain loading Const
7. Explain conditional Execution

Module – 5

1. Write a note on THUMB Register usage
2. Explain ARM-THUMB Interworking
3. Explain other –Branch Instruction
4. Explain Data Processing Instruction
5. Explain Stack Instruction
6. Explain software Interrupt Instruction
7. Explain Basic ‘c’ data Types
8. What are the ‘C’ looping Structure

Prepared by	Checked by		
Prof. K.S.Patil	Prof.S.S.Patil	HOD	Principal

Subject Title	**Computer Organization & ARM Microcontrollers**		
Subject Code	21EC52	**Laboratory Work**	20
Number of Lecture Hrs/Week /	2(P)	**Exam marks**	50
Total Number of Lecture Hrs	13 Lab Slots	**Test Hours**	03
CREDITS-4			

FACULTY DETAILS:		
Name: Prof. S. R. Malluramath	**Designation:** Assistant Professor	**Experience:**10 years
No. of times course taught: 01	**Specialization:** Industrial Electronics	

1.0 Prerequisite Subjects:

Sl. No	Branch	Semester	Subject
01	Electronics & Communication Engineering	III	Digital Electronics
02	Electronics & Communication Engineering	IV	Microprocessor & MicroprocessorLaboratory

2.0 Course Objectives

This course will enable students to:

- Explain the basic organization of a computer system.
- Demonstrate functioning of different sub systems, such as processor, Input/output, and memory.
- Describe the architectural features and instructions of 32-bit microcontroller ARM Cortex M3.
- Apply the knowledge gained for Programming ARM Cortex M3 for different applications.
- Understand the basic hardware components and their selection method based on the characteristics and attributes of an embedded system.

3.0 Course Outcomes

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

	Course Outcome	**Cognitive Level**	**PO's**
CO1	Explain the basic organization of a computer system.	L1,L2,L3	PO1-8,12
CO2	Demonstrate functioning of different sub systems, such as processor, Input/output and memory.	L1,L2,L3	PO1-8,12
CO3	Describe the architectural features and instructions of 32-bit microcontroller ARM Cortex M3.	L1,L2,L3	PO1-8,12
CO4	Apply the knowledge gained for Programming ARM Cortex M3 for different applications.	L1,L2,L3	PO1-8,12
Total Hours of instruction		**24**	

4.0 Course Content

Conduct the following experiments by writing Assembly Language Program (ALP) using ARM Cortex M3 Registers using an evaluation board/simulator and the required software tool.

PART-A

1. Write an ALP to i) multiply two 16-bit binary numbers. ii) add two 64-bit numbers.
2. Write an ALP to find the sum of first 10 integer numbers.
3. Write an ALP to find factorial of a number.
4. Write an ALP to add an array of 16-bit numbers and store the 32-bit result in internal RAM.
5. Write an ALP to find the square of a number (1 to 10) using look-up table.
6. Write an ALP to find the largest/smallest number in an array of 32 numbers.
7. Write an ALP to arrange a series of 32-bit numbers in ascending/descending order.
8. i) Write an ALP to count the number of ones and zeros in two consecutive memory locations.
   ii) Write an ALP to scan a series of 32-bit numbers to find how many are negative.

PART-B

Conduct the following experiments on an ARM CORTEX M3 evaluation board using evaluation version of Embedded 'C' & Keil µvision-4 tool/compiler.

9. Interface a Stepper motor and rotate it in clockwise and anti-clockwise direction.
10. Interface a DAC and generate Triangular and Square waveforms.
11. Display the Hex digits 0 to F on a 7-segment LED interface, with a suitable delay in between.
12. Interface a simple Switch and display its status through Relay, Buzzer and LED.

5.0 Relevance to future subjects

Sl. No	Semester	Subject	Topics
01	VIII	Project work	Microprocessor based projects
02	Higher	Microcontroller	Instruction set, Addressing modes, Interrupts, Interfacing

6.0 Relevance to Real World

SL.No	Real World Mapping
1	Microprocessor based components
2	Model creation for analysis
3	Development of a software applications

7.0 Gap Analysis and Mitigation

Sl. No	Delivery Type	Details
01	Tutorial	Topic:
02	NPTEL	**ARM Cortex-M3** Assembly Application

8.0 Books Used and Recommended to Students

Joseph Yiu, "**The Definitive Guide to the ARM Cortex-M3**", 2nd Edition, Newnes, (Elsevier), 2010.

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

Website and Internet Contents References
7) https://nptel.co.in
8) https://vtu.ac.in
9) http://www.bookspar.com/engineering-vtu
10) http://www.slideshare.net/farohalolya/8086-microprocessor-lab-manual
11) https://www.youtube.com/results?search_query=microprocessor

10.0 Magazines/Journals Used and Recommended to Students

Sl.No	Magazines/Journals	website
1	IEEE	http://ieeexplore.ieee.org/Xplore/home.jsp
2	PC World	http://www.pcworld.com/article/146957/components/article.html

11.0 Examination Note

CIE for the practical component of IPCC:

- On completion of every experiment/program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day. The 15 marks are for conducting the experiment and preparation of the laboratory record, the other 05 marks shall be for the test conducted at the end of the semester.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to 15 marks.
- The laboratory test (duration 03 hours) at the end of the 15th week of the semester /after completion of all the experiments (whichever is early) shall be conducted for 50 marks and scaled down to 05 marks.

Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for 20 marks.

12.0 Course Delivery Plan

Experiments	% of portion
PART-A 1. Write an ALP to i) multiply two 16-bit binary numbers. ii) add two 64-bit numbers.	8
2. Write an ALP to find the sum of first 10 integer numbers.	16
3. Write an ALP to find factorial of a number.	25
4. Write an ALP to add an array of 16-bit numbers and store the 32-bit result in internal RAM.	33
5. Write an ALP to find the square of a number (1 to 10) using look-up table.	42
6. Write an ALP to find the largest/smallest number in an array of 32 numbers.	50
7. Write an ALP to arrange a series of 32-bit numbers in ascending/descending order.	58
8. i) Write an ALP to count the number of ones and zeros in two consecutive memory locations. ii) Write an ALP to Scan a series of 32-bit numbers to find how many are negative.	67
PART-B	
9. Interface a Stepper motor and rotate it in clockwise and anti-clockwise direction.	75
10. Interface a DAC and generate Triangular and Square waveforms.	84
11. Display the Hex digits 0 to F on a 7-segment LED interface, with a suitable delay in between.	92
12. Interface a simple Switch and display its status through Relay, Buzzer and LED.	100

13.0 University Result

Examination	S+	S	A	B	C	D	E	F	% of passing
First Time Introduced	-	-	-	-	-	-	-	-	-

14.0 VIVA BANK

1. What do you mean by pipelined architecture of CPU?
2. What are components of CPU.
3. Describe the different instruction formats of ARM cortex M3.
4. Draw the register organization of ARM cortex M3 and explain typical applications of each register.
5. Explain internal architecture of ARM cortex M3.
6. How many address line does ARM cortex M3 supports.
7. What is little endian, big endian concept.
8. What is the function of address latch enable?
9. How to convert number from binary to hexadecimal.

10. What is positive logica? What is negative logic?
11. How to convert number from hexadecimal to octal.
12. How to convert number from decimal to hexadecimal.
13. What is word? And double word?
14. What is assembler?
15. What is loader?
16. What is linker?
17. Explain stack operation how it works, explain with PUSH,POP instruction.

Prepared by	Checked by		
Prof. S.R. Malluramath	Prof. S. S. Patil	HOD	Principal

Subject Title	**COMPUTER NETWORKS**		
Subject Code	21EC53	**CIE 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. M. C. Sarsamba	**Designation:** Professor	**Experience:20**Yrs	
No. of times course taught: 05		**Specialization**:Microelectronics and control systems	

1.0 Prerequisite Subjects:

Sl. No	Branch	Semester	Subject
01	Electronics & Communication Engineering	I	Computer Organization & Architecture
02	Electronics & Communication Engineering	VI	Operating system

2.0 Course Objectives

1. Understand the layering architecture of OSI reference model and TCP/IP protocol suite.
2. Understand the protocols associated with each layer.
3. Learn the different networking architectures and their representations.
4. Learn the functions and services associated with each layer.

3.0 Course Outcomes

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

	Course Outcome	RBT	POs
C401.1	Understand the concepts of networking thoroughly	L3	PO1 to PO12
C401.2	Identify the protocols and services of different layers.	L3	PO1 to PO12
C401.3	Distinguish the basic network configurations and standards associated with each network	L3	PO1 to PO12
C401.4	Understand the concepts of TCP/IP protocol suite.	L3	PO1 to PO12
C401.5	Discuss and analyse the various applications that can be implemented on networks	L3	PO1 to PO12
Total Hours of instruction		**40**	

4.0 Course Content

Module-1	RBT Level
Introduction: Data communication: Components, Data representation, Data flow, Networks: Network criteria, Physical Structures, Network types: LAN, WAN, Switching, The Internet. (1.1,1.2, 1.3 (1.3.1to 1.3.4 of Text). **Network Models: TCP/IP Protocol Suite:** Layered Architecture, Layers in TCP/IP suite, Description of layers, Encapsulation and Decapsulation, Addressing, Multiplexing and Demultiplexing, The OSI Model: OSI Versus TCP/IP. (2.2, 2.3 of Text) **Data-Link Layer: Introduction:** Nodes and Links, Services, Two Categories of link, Sublayers, Link Layer addressing: Types of addresses, ARP (9.1, 9.2 (9.2.1, 9.2.2))	L1, L2L3.
Module-2	
Data Link Control (DLC) services: Framing, Flow and Error Control. (11.1 of Text) Media Access Control: Random Access: ALOHA, CSMA, CSMA/CD, CSMA/CA. (12.1 of Text). **Connecting Devices:** Hubs, Switches, Virtual LANs: Membership, Configuration, Communication between Switches, Advantages. (17.1,17.2 of text) **Wired and Wireless LANs:** Ethernet Protocol, Standard Ethernet. (13.1, 13.2 (13.2.1 to 13.2.5 of Text) Introduction to wireless LAN: Architectural Comparison, Characteristics, Access Control. (15.1 of Text)	L1, L2, L3
Module-3	
Network Layer: Introduction, Network Layer services: Packetizing, Routing and Forwarding, Other services, Packet Switching: Datagram Approach, Virtual Circuit Approach, IPV4 Addresses: Address Space, Classful Addressing, Classless Addressing, DHCP, Network Address Resolution (18.1(excluding 18.1.3), 18.2, 18.4 of Text) **Network Layer Protocols:** Internet Protocol (IP): Datagram Format, Fragmentation, Options, Security of IPv4 Datagrams. (19.1of Text), IPv6 addressing and Protocol (22.1 and 22.2). Unicast Routing: Introduction, **Routing Algorithms:** Distance Vector Routing, Link State Routing, Path vector routing. (20.1, 20.2 of Text)	L1, L2, L3
Modul-4	
Transport Layer: Introduction: Transport Layer Services, Connectionless and Connection oriented Protocols, Transport Layer Protocols: Simple protocol, Stop and wait protocol, Go-BackN Protocol, Selective repeat protocol, Piggybacking (23.1, 23.2.1, 23.2.2, 23.2.3, 23.2.4, 23.2.5 of Text) **Transport-Layer Protocols in the Internet**: User Datagram Protocol: User Datagram, UDP Services, UDP Applications, Transmission Control L1, L2, L3 Protocol: TCP Services, TCP Features, Segment, Connection, State Transition diagram, Windows in TCP, Error control, TCP congestion control. (24.2, 24.3.1, 24.3.2, 24.3.3, 24.3.4, 24.3.6, 24.3.8, 24.3.9 of Text) ***Note: Exclude FSMs for CIE and SEE**	L1, L2, L3
Module- 5	
Application Layer: Introduction: providing services, Application- layer paradigms, Standard Client – Server Protocols: Hyper Text Transfer Protocol, FTP: Two connections, Control Connection, Data Connection, Electronic Mail: Architecture, Domain Name system: Name space, DNS in internet, Resolution, DNS Messages, Registrars, DDNS, security of DNS. (25.1, 26.1.2, 26.2, 26.3, 26.6 of Text) Quality of Service (30.1, 30.2.) Network Security (31.1)	L1, L2

5.0 Relevance to future subjects

Sl No	Semester	Subject	Topics
01	VIII	Project work	Computer communication network based projects.
02	Higher study M.Tech	Computer network engineering	Wireless Ad hoc Networks, Network ProgrammingNetwork Routing Algorithm

6.0 Relevance to Real World

SL.No	Real World Mapping
01	Building a Digital Communication Network
02	Efficient Data Transmission and Management
03	User-Friendly Applications and Services

7.0 Gap Analysis and Mitigation

SL. No	Delivery Type	Details
01	Seminar/Invited talk	Emerging Technologies:The syllabus appears to focus on traditional networking technologies and protocols. It does not include coverage of emerging technologies such as Internet of Things (IoT), 5G networks, software-defined networking (SDN), and network virtualization.

8.0 Books Used and Recommended to Students

Text Books
1.**Forouzan, "Data Communications and Networking" , 5th Edition, McGraw Hill, 2013, ISBN: 1-25-906475-3.**
Reference Books
1. James J Kurose, Keith W Ross, Computer Networks, Pearson Education. 2. Wayarles Tomasi, Introduction to Data Communication and Networking, Pearson Education. 3. Andrew Tanenbaum, "Computer networks", Prentice Hall. 4. William Stallings, "Data and computer communications", Prentice Hall
Additional Study material & e-Books
1. "Computer Networking: Principles, Protocols and Practice" by Olivier Bonaventure 2. "TCP/IP Illustrated, Volume 1: The Protocols" by W. Richard Stevens

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

Website and Internet Contents References
1. NOC:Computer Networks and Internet Protocol, IIT Kharagpur by Prof. Soumya Kanti Ghosh, Prof. Sandip Chakrabortyhttps://nptel.ac.in/courses/106105183 2. Data Link Layer - Flow and Error Control https://youtu.be/TrgZ7_L525w 3. IP Routing https://youtu.be/IfzGf4kI2a8 4. Data Link Layer – Ethernet https://youtu.be/WXiGbQa-5F4Computer Networking: Principles, Protocols and Practice: This is an online textbook and resource that covers computer networking principles and practices. (Website: http://www.computer-networks.org/) 5. NetworkLessons.com: This website offers a collection of networking lessons, articles, and tutorials on various networking topics. (Website: https://networklessons.com/)

10.0 Magazines/Journals Used and Recommended to Students

Sl.No	Magazines/ Journals	Website
1	IEEE	IEEE Open Journal of the Communications Society - This open-access journal covers a wide range of topics in communication systems and networks. (Website: https://ieeeaccess.ieee.org/communications/) IEEE Open Journal of the Computer Society - This open-access journal focuses on computer science topics, including computer networks and communications. (Website: https://ieeeaccess.ieee.org/computer-science/)

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)

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..Scheme of Evaluation for Internal Assessment (40 Marks)

12.0 Course Delivery Plan

Module	Lecture No.	Content of Lecturer	% of Portion
Module- 1 Introduction& Network Data-Link Layer Models	1	Data communication: Components, Data representation, Data flow	20
	2	Networks: Network criteria, Physical Structures	
	3	Network types: LAN, WAN, Switching, The Internet.	
	4	Protocol Layering: Scenarios, Principles, Logical Connections	
	5	TCP/IPProtocol Suite: Layered Architecture	
	6	Layers in TCP/IP suite, Description of layers, Encapsulationand Decapsulation	
	7	Addressing, Multiplexing and Demultiplexing, The OSI Model: OSI Versus TCP/IP.	
	8	Introduction: Nodes and Links, Services, Two Categories' of link, Sublayers, Link Layer addressing: Types of addresses, ARP	
Module- 2 Connecting Devices:	9	Data Link Control (DLC) services:	20
	10	Framing, Flow and Error Control.	
	11	Media Access Control: Random Access:	
	12	ALOHA, CSMA, CSMA/CD, CSMA/CA	
	13	Hubs, Switches	
	14	Virtual LANs: Membership	
	15	Configuration	
	16	Communication between Switches, Advantages	
Module -3 Network Layer: Network Layer Protocols:	17	Introduction, Network Layer services: Packetizing, Routing and Forwarding	20
	18	Other services, Packet Switching: Datagram Approach,	
	19	Virtual Circuit Approach, IPV4 Addresses: Address Space, Classful Addressing,	
	20	Classless Addressing, DHCP, Network Address Resolution	
	21	Internet Protocol (IP): Datagram Format, Fragmentation,	
	22	Options, Security of IPv4 Datagrams. Introduction,	
	23	Routing Algorithms: Distance Vector Routing,	
	24	Link State Routing, Path vector routing	
Module -4 Transport Layer Transport-Layer Protocols in the Internet	25	Introduction: Transport Layer Services, Connectionless and Connection oriented Protocols,	20
	26	Transport Layer Protocols: Simple protocol, Stop and wait protocol,	
	27	Go-BackN Protocol, Selective repeat protocol, Piggybacking	
	28	User Datagram Protocol: User Datagram, UDP Services	
	29	UDP Applications, Transmission Control	
	30	Protocol: TCP Services, TCP Features	
	31	Segment, Connection, State Transition diagram	
	32	Windows in TCP, Error control, TCP congestion control.	

Module 5: Application Layer	33	Introduction: providing services, Application- layer paradigms	20
	34	StandardClient –Server Protocols	
	35	World wide web, Hyper Text Transfer Protocol	
	36	FTP: Two connections,Control Connection	
	37	Data Connection, Electronic Mail: Architecture	
	38	Wed Based Mail, Telnet: Local versus remote logging.Domain Name system	
	39	Name space, DNS in internet, Resolution,DNS Messages, Registrars	
	40	DDNS, security of DNS, Quality of Service, Network Security	

13.0 QUESTION BANK

Module 1: Introduction &Network Models

1. What are the key components of data communication systems?
2. Explain the concept of data representation in the context of networking.
3. What are the criteria for evaluating a network's performance?
4. Differentiate between LAN and WAN.
5. Describe the concept of protocol layering and its significance.
6. Compare the TCP/IP model with the OSI model.
7. What is encapsulation and decapsulation in networking?
8. Discuss the concept of multiplexing and demultiplexing in networking.
9. What is the purpose of the Address Resolution Protocol (ARP)?
10. How does data flow through the layers of the TCP/IP Protocol Suite?

Module 2: Connecting Devices:

1. Define the data-link layer and its role in network communication.
2. Explain the sublayers of the data-link layer.
3. What are the different types of link-layer addresses, and how are they used?
4. Describe the services provided by Data Link Control (DLC).
5. Discuss the framing, flow control, and error control in the data-link layer.
6. Explain the concept of media access control (MAC).
7. Compare ALOHA, CSMA, CSMA/CD, and CSMA/CA as random access methods.
8. What are the characteristics of Ethernet Protocol?
9. Describe the key differences between wired and wireless LANs.
10. Discuss the access control methods used in wireless LANs.

Module 3: Network Layer: Network Layer Protocols

1. What are the services provided by the network layer in a communication network?
2. Explain the differences between packetizing, routing, and forwarding in the network layer.
3. Describe the Datagram Approach and Virtual Circuit Approach in packet switching.

4. Discuss the concept of IPV4 addresses, including classful and classless addressing.
5. How does DHCP (Dynamic Host Configuration Protocol) work?
6. What is Network Address Resolution, and how does it function?
7. Explain the forwarding of IP packets based on destination address and label.
8. Describe the Internet Protocol (IP) Datagram format.
9. What is fragmentation in the IP protocol?
10. Discuss the security considerations for IPv4 datagrams.

Module 4: Transport Layer Transport-Layer Protocols in the Internet

1. What services does the transport layer provide in a network?
2. Differentiate between connectionless and connection-oriented transport layer protocols.
3. Explain the principles of Simple Protocol, Stop-and-Wait Protocol, Go-Back-N Protocol,
4. Describe the User Datagram Protocol (UDP) and its services.
5. Discuss the characteristics of Transmission Control Protocol (TCP).
6. Explain the concept of segments in TCP.
7. What is a TCP state transition diagram, and how is it used?
8. Describe the concept of windowing in TCP and its role in flow control.
9. How does TCP handle error control?
10. Discuss the principles of TCP congestion control.

Module 5: Application Layer

1. What services are provided by the application layer in network communication?
2. Explain the client-server paradigms in the application layer.
3. Describe the Hyper Text Transfer Protocol (HTTP) and its role in the World Wide Web.
4. Discuss the two connections used in FTP and their purposes.
5. Explain the architecture of electronic mail (email).
6. What is Web-Based Mail, and how does it work?
7. Compare local and remote logging in Telnet.
8. Describe the Domain Name System (DNS) and its name space.
9. How does DNS resolution work in the Internet?
10. Discuss the security considerations for DNS, including DDNS and DNS messages.

13.0 University Result

Examination	FCD	FC	SC	% Passing
2022	0	29	0	100
2021	0	33	1	100

Prepared by	Checked by		
Dr. M. C. Sarsamba	Prof. B. P. Khot	HOD	Principal

Subject Title	**Electromagnetic waves**		
Subject Code	21EC54	**CIE Marks**	50
Number of Lecture Hrs /	03	**SEE Marks**	50
Total Number of Lecture	40	**Exam Hours**	03
		CREDITS – 03	

FACULTY DETAILS:

Name: Prof S. S. Kamate	**Designation:** Asst. Professor	**Experience: 21yrs.**
No. of times course taught: 15	**Specialization:** Digital Electronics	

1.0 Prerequisite Subjects:

Sl. No	Branch	Semester	Subject
01	ECE	I/II	Physics

2.0 Course Objectives

The objectives of this course is to introduce students to the mostly used analytical and numerical methods in the different engineering fields by making them to Electric and Magnetic fields, Maxwell's equations and wave propagation concepts

1. Study the different coordinate systems, Physical significance of Divergence, Curl and Gradient.
2. Understand the applications of Coulomb's law and Gauss law to different charge distributions and the applications of Laplace's and Poisson's Equations to solve real time problems on capacitance of different charge distributions.
3. Understand the physical significance of Biot-Savart's, Amperes's Law and Stokes' theorem for different current distributions.
4. Infer the effects of magnetic forces, materials and inductance.
5. Know the physical interpretation of Maxwell' equations and applications for Plane waves for their behavior in different media.
6. Acquire knowledge of Poynting theorem and its application of power flow.

3.0 Course Outcomes

	Course Outcome	RBT Levels	POs
C305.1	Evaluate problems on electrostatic force, electric field due to point, linear, volume charges by applying conventional methods and charge in a volume	L1, L2 & L3	1,2,3,10,12
C305.2	Apply Gauss law to evaluate Electric fields due to different charge distributions and Volume Charge distribution by using Divergence Theorem	L1, L2 & L3	1,2,3,10,12
305.3	Determine potential and energy with respect to point charge and capacitance using Laplace equation and Apply Biot-Savart's and Ampere's laws for evaluating Magnetic field for different current configurations	L1, L2 & L3	1,2,3,10,12

C305.4	Calculate magnetic force, potential energy and Magnetization with respect to magnetic materials and voltage induced in electric circuits	L1, L2 & L3	1,2,3,10, 12
C305.5	Apply Maxwell's equations for time varying fields, EM waves in free space and conductors and Evaluate power associated with EM waves using Poynting theorem	L1, L2 & L3	1,2,3,10,12
Total Hours of instruction			**40**

4.0 Course Content

MODULES	RBT Levels	No. of Hours
Module 1: **Coulomb's Law, Electric Field Intensity and Flux density** Experimental law of Coulomb, Electric field intensity, Field due to continuous volume charge distribution, Field of a line charge, Electric flux density Numerical Problems. **(Text: Chapter 2.1 to 2.5, 3.1).**	**L1, L2 & L3**	**8**
Module 2: **Gauss's law and Divergence** Gauss 'law, Application of Gauss' law to point charge, line charge, Surface charge and volume charge, Point (differential) form of Gauss law, Divergence. Maxwell's First equation (Electrostatics), Vector Operator ▼ and divergence theorem, Numerical Problems (**Text: Chapter 3.2 to 3.7).** **Energy, Potential and Conductors**: Energy expended or work done in moving a point charge in an electric field, The line integral, Definition of potential difference and potential, The potential field of point charge, Potential gradient, Numerical Problems **(Text: Chapter 4.1 to 4.4 and 4.6).** Current and Current density, Continuity of current. **(Text: Chapter 5.1, 5.2)**	**L1, L2 & L3**	**8**
Module 3 **Poisson's and Laplace's Equations**: Derivation of Poisson's and Laplace's Equations, Uniqueness theorem, Examples of the solution of Laplace's equation, Numerical problems on Laplace equation. **(Text: Chapter 7.1 to 7.3)** **Steady Magnetic Field**: Biot-Savart Law, Ampere's circuital law, Curl, Stokes' theorem, Magnetic flux and magnetic flux density, Basic concepts Scalar and Vector Magnetic Potentials, Numerical .problems. (**Text: Chapter 8.1 to 8.6)**	**L1, L2 & L3**	**8**
odule 4 **Magnetic Forces**: Force on a moving charge, differential current elements, Force between differential current elements, Numerical problems **(Text: Chapter 9.1 to 9.3).** **Magnetic Materials**: Magnetization and permeability, Magnetic boundary conditions, The magnetic circuit, Potential energy and forces on magnetic materials, Inductance and mutual reactance, Numerical problems **(Text: Chapter 9.6 to 9.7).** Faraday' law of Electromagnetic Induction –Integral form and Point form, Numerical problems **(Text: Chapter 10.1)**	**L1, L2 & L3**	**8**

Module 5 **Maxwell's equations** Continuity equation, Inconsistency of Ampere's law with continuity equation, displacement current, Conduction current, Derivation of Maxwell's equations in point form, and integral form, Maxwell's equations for different media, Numerical problems **(Text: Chapter 10.2 to 10.4)** **Uniform Plane Wave**: Plane wave, Uniform plane wave, Derivation of plane wave equations from **L1, L2,L3** Maxwell's equations, Solution of wave equation for perfect dielectric, Relation between E and H, Wave propagation in free space, Solution of wave equation for sinusoidal excitation, wave propagation in any conducting media (**γ, α, β, η**) and good conductors, Skin effect or Depth of penetration, Poynting's theorem and wave power, Numerical problems. **(Text: Chapter 12.1 to 12.4)**	**L1, L2 & L3**	**8**

5.0 Relevance to future subjects

Sl. No.	Semester	Subject	Topics
1.	VI	Microwave and Antennas	Antenna impedance
2.	VI/VII	Project work	Antennas and communication

6.0 Relevance to Real World

SL. No.	Real World Mapping
01	Learnt methods are used to solve some field related engineering problems.
02	Losses in propagation due to different media, impedance of an Antenna

7.0 Gap Analysis and Mitigation

Sl. No	Delivery Type	Details
01	Videos	Behavior of Electric and Magnetic Fields
02	NPTEL	Study Wave propagation

8.0 Books Used and Recommended to Students

Text Books

1) W.H. Hayt and J.A. Buck, ―Engineering Electromagnetics‖, 8th Edition, Tata McGraw- Hill, 2014, ISBN-978-93-392-0327-6.

Reference Books

1. Elements of Electromagnetics – Matthew N.O., Sadiku, Oxford university press, 4 thEdn.
2. Electromagnetic Waves and Radiating systems – E. C. Jordan and K.G. Balman, PHI, 2 ndEdn.
3. Electromagnetics- Joseph Edminister, Schaum Outline Series, McGraw Hill.
4. N. NarayanaRao, ―Fundamentals of Electromagnetics for Engineering‖, Pearson

Additional Study material & e-Books

1. Schaum's outline series "Electromagnetics" by Joseph A. Edminister.
2. VTU on line notes.

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

Website and Internet Contents References
01) https://nptel.co.in 02) http://m.noteboy.in/vtuflies/machine%20drawing.pdf 03) https://www.edx.org/school/iitbombayx?utm_source=bing&utm_medium=cpc&utm_term=iit-bombay&utm_campaign=partner-iit-bombay

10.0 Magazines/Journals Used and Recommended to Students

Sl. No	Magazines/Journals	website
1	AEM Journal.org	https://aemjournal.org/index.php/AEM
2	Electromagnetic Field Theory	https://empossible.net/academics/emp3302/
3	Journal of electromagnetic waves and applications	https://www.tandfonline.com/toc/tewa20/current

11.0 Examination Note

Assessment Details (both CIE and SEE)

Marks scored by the students will be proportionally scaled down to 50 marks

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

Continuous Internal Evaluation:

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 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.

12.0 Course Delivery Plan

MODULE	LECTURE NO.	CONTENT OF LECTURE	% OF PORTION
1	1	Basics- vector analysis	20
	2	Coordinate systems: Cartesian	
	3	Cylindrical	
	4	Spherical	
	5	Examples	
	6	Relation between coordinate systems	
	7	Experimental law of Coulomb.	
	8	Electric field intensity.	
	9	Field of a line charge.	
	10	Field due to continuous surface charge distribution	
	11	Field due to continuous volume charge distribution	
	12	Electric flux density	40
2	13	Gauss' law, Divergence.	
	14	Maxwell's First equation	
	15	Vector operator **del** and divergence theorem.	
	16	Energy expended in moving a point charge in an electric field	
	17	Definition of potential difference and Potential,	
	18	The potential field of a point charge and system of charges Potential	
	19	Current and current density.	
	20	Continuity of current	
	21	Examples	
3	22	Laplace's and Poisson's equations.	60
	23	Laplace's Equations	
	24	Uniqueness theorem	
	25	Examples of the solutions of Laplace's equations.	
	26	Biot-Savart law. Examples	
	27	Ampere's circuital law. Examples	
	28	Curl, Stokes' theorem. Examples	
	29	Magnetic flux and flux density. Examples	
	30	Scalar magnetic potentials. Examples	

4	31	Force on a moving charge and differential current element	80
	32	Force between differential current elements	
	33	Magnetization and permeability	
	34	Magnetic boundary conditions	
	35	Magnetic circuit and Examples	
	36	Potential energy and forces on magnetic materials	
	37	Examples	
	38	Examples	
5	39	Faraday's law & Examples	100
	40	Displacement current & Examples	
	41	Maxwell's equation in point form.	
	42	Maxwell's equation in Integral form.	
	43	Wave propagation in free space and dielectrics	
	44	Wave propagation in perfect dielectric	
	45	Wave propagation in free space and dielectrics	
	46	Propagation in good conductors. Examples	
	47	Poynting's theorem derivation	
	48	Wave power.	
	49	& Examples	
	50	Examples from question papers	

14.0 QUESTION BANK

MODULE -1

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1. State coulomb's law of force between any two point charges & state the units of force.
2. Define electric field intensity. Obtain an expression for the electric field intensity at a point which is at a distance of 'R' from a point Q.
3. State the units of electric field intensity E & explain the method of obtaining E at a point in Cartesian system, due to a point charge Q.
4. Obtain an expression for total electric field intensity at a point due to infinite number of point charges.
5. An empty metal paint can is placed on a marble table, the lid is removed, and both parts are discharged (honorably) by touching them to ground. An insulating nylon thread is glued to the center of the lid, and a penny, a nickel, and a dime are glued to the thread so that they are not touching each other. The penny is given a charge of +5 nC, and the nickel and dime are discharged. The assembly is lowered into the can so that the coins hang clear of all walls, and the lid is secured. The outside of the can is again touched momentarily to ground. The device is carefully disassembled with insulating gloves and tools. (a) What charges are found on each of the five metallic pieces? (b) If the penny had been given a charge of +5 nC, the dime a charge of -2 nC, and the nickel a charge of -1 nC, what would the final charge arrangement have been?
6. 2 A point charge of 12 nC is located at the origin. Four uniform line charges are located in the x = 0 plane as follows: 80 nC/m at y = -1 and -5 m, -50 nC/m at y ~ -2 and -4m. (a) Find D at P(O, -3,2). (b) How much electric flux crosses the plane y = -3, and in what direction? (c) How much electric flux leaves the surface of a sphere, 4m in radius, centered at qo, -3, O)?
7. The value of E at pep = 2, 4J = 40°, z = 3) is given as E = 100ap - 200a", + 300az. Vim. Determine the

incremental work required to move a 20-J..lC charge a distance of 6 J..lm in the direction of: (a) ap; (b) a",; (c) az; (d) E; (e) G = 2ax - 3ay + 4az.

8. Let E = 400ax - 300ay + 500az V 1m in the neighborhood of point P(6, 2, -3). Find the incremental work done in moving a 4-C charge a distance of I mm in the direction specified by: (a) ax + ay + az; (b) -2ax + 3ay - az.
9. If E = 120ap V 1m, find the incremental amount of work done in moving a 50-J..lC charge a distance of 2 mm from: (a) P(l, 2, 3) toward Q(2, 1,4); (b) Q(2, 1,4) toward P(I, 2, 3).
10. Find the amount of energy required to move a 6-C charge from the origin to P(3, 1, -1) in the field E = 2xax - 3y2ay + 4az Vim along the straight-line path x = -3z, y = x + 2z.

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MODULE -2

1. State and prove divergence theorem
2. Let D = 4xyax + 2(x2 + z2)ay + 4yzaz C/m2 and evaluate surface integrals to find the total charge enclosed in the rectangular parallelepiped 0 < x < 2, 0 < y < 3, 0 < z < 5m.
3. Two uniform line charges, each 20 nC/m, are located at y = I, z = ::!: I m. Find the total electric flux leaving the surface of a sphere having a radius of 2 m, if it is centered at: (a) A(3, 1,0); (b) B(3, 2, 0).
4. Given the electric flux der.sity, D = 2xyax + x2ay + 6z3az Cjm2: (a) use Gauss's law to evaluate the total charge enclosed in t.he volume 0 < x, y, z < a.
5. Determine work done in carrying a charge of 2C from B(1, 0,1) to A(08, 0.6, 0) in an electric field of E = yax + x ay V/m.along the short arc of the circle $x^2+ y^2=1$, z =1; along a straight line path.
6. A 15nC point charge is at origin in free space. Calculate V1 if point P is located at P(-2, 3, -1) and I) V =0V at (6, 5, 4) ii) V =0V at infinity.
7. Discuss current, current density and hence derive an expression for continuity equation.
8. The z =0, defines the the boundary between free space and dieelectric with dielectric contant 20. The E in free space is E = 10ax +20 ay + 40az V/m.
9. Derive an expression for electric potential due to a point charge.
10. Derive an expression for electric potential due to a infinite line charge.

MODULE -3

1. Explain Poisson's & Laplace's equations.
2. State & explain uniqueness theorem.
3. Given the potential field V = 4yz/ (x^2+ 1) ; Find V and ρat (1, 2, 3)
4. Use laplace equation to find the capacitance per unit length of co-axial cable of inner radius a m and outer b m. Assume V = Vo at r=a and V=0 at r=b.
5. Determine whether or not the following vectors represent a possible electric field
   i) E = 5Cosz az V/m
   ii) E = $(12yx^2-6z^2x)$ ax + $(4x^3+18zy^2)$ ay + $(6y^3-6zx^2)$ az
6. Explain properties of magnetic field.
7. Derive an expression for H due to infinite long straight conductor.
8. Derive an expression for H due to finite long straight conductor.

MODULE -4

1. An infinite filament on the z axis carries 20n mA in the az direction. Three uniform cylindrical current sheets are also present: 400 mAim at P = 1 cm, -250mA/m at P = 2cm, and -300mA/m at P = 3 em. Calculate Hq, at p = 0.5, 1.5,2.5, and 3.5 cm.
2. State and explain Magnetic flux & Magnetic density.
3. Derive an expression for force on a moving charge.
4. Derive an expression for force & torque on a closed circuit.
5. Explain the nature of magnetic materials.
6. What is Magnetization & Permeability?
7. Derive an expression for magnetic boundary conditions.

MODEL-5

1. Wet marshy soil is characterized by $\sigma = 10^{-2}$ s/m. $\varepsilon r = 15$ and ur = 1. At frequencies 60Hz and 10GHz. Indicate whether soil be considered as a conductor or dielectric.
2. What is displacement current and equation of continuity? Derive Maxwell's equation for Ampere's circuital law.
3. Obtain the solution of wave equation for a uniform (UPW) in free space.
4. Discuss uniform plane wave propagation in a good conducting media.
5. State and prove poynting theorem.
6. Derive an expression for depth of penetration
7. Find the depth of penetration at a frequency of 1.6MHz in aluminum, where $\sigma = 38.2$Ms/m and ur = 1. also find γ , λ and Vp.
8. A 800MHz plane wave travelling has an average poynting vector of 8mW/m2. I the medium is lossless with ur = 1.5 and $\varepsilon r = 6$. Find
   i) Velocity of the wave ii) wavelength iii) Impedance of the medium
   iv) r.m.s. Electric field E v) r.m.s magnetic field H.
9. For an electromagnetic wave propagating in free space prove that {IEI/IHI} = η

15.0 University Result

Examination	FCD	FC	SC	% Passing
Feb 2022	**4**	**09**	**12**	**86.20**
Feb 2023	05	10	25	**86.95**

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

Subject Title	**Communication Lab II**		
Subject Code	21ECL55	**Conduction of experiments (15)+ Laboratory Test (5)**	20
Number of Lecture Hrs/Week /	2(P)	**Exam Marks**	50
Total Number of Lecture Hrs	16 Lab Slots	**Test Hours**	03
CREDITS – 02			

FACULTY DETAILS:		
Name: Dr. S. S. Ittannavar	**Designation:** Associate Professor	**Experience:**11 years
No. of times course taught: 01	**Specialization:** Digital Signal Processing	

1.0 Prerequisite Subjects:

Sl. No	Branch	Semester	Subject
01	Students should have the knowledge of basic subjects	3/4	Communication system

2.0 Course Objectives

This laboratory course enables students to

- Design and demonstrate communication circuits for different digital modulation techniques.
- To simulate Source coding Algorithms using C/C++/ MATLAB code.
- To simulate Error correcting and detecting codes using C/C++/ MATLAB code.
- Simulate the networking concepts and protocols using C/C++/ Network simulation tool.
- Understand entropies and mutual information of different communication channels.

3.0 Course Outcomes

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

	Course Outcome	Cognitive Level	PO's
CO1	Design and test the digital modulation circuits and display the waveforms.	U	1,2,3,4,6,7,9, 10,11,12
CO2	To Implement the source coding algorithm using C/C++/ MATLAB code.	U	1,2,3,4,5,6,7, 9,10,11,12
CO3	To Implement the Error Control coding algorithms using C/C++/ MATLAB code.	U	1,2,3,4,5,6,7, 9,10,11,12
CO4	Illustrate the operations of networking concepts and protocols using C programming and network simulators.	U	1,2,3,4,5,6,7, 9,10,11,12
Total Hours of instruction		**26**	

4.0 Course Content

Practical Component		
Experiments	**Teaching Hours**	**Bloom's Taxonomy (RBT) level**
1. FSK generation and detection	02	L3
2. PSK generation and detection	02	L3
3. DPSK Transmitter and receiver	02	L3
4. QPSK Transmitter and Receiver	02	L3
5. Write a program to encode binary data using Huffman code and decode it.	02	L3
6. Write a program to encode binary data using a (7,4) Hamming code and decode it.	02	L3
7. Write a program to encode binary data using a ((3,1,2)/suitably designed) Convolution code and decode it.	02	L3
8. For a given data, use CRC-CCITT polynomial to obtain the CRC code. Verify the program for the cases a) Without error b) With error	02	L3
9. Write a program for congestion control using leaky bucket algorithm.	02	L3
10. Write a program for distance vector algorithm to find suitable path for transmission.	02	L3
11. Write a program for flow control using sliding window protocols.	02	L3
12. Configure a simple network (Bus/star) topology using simulation software **OR** Configure a simple network (Ring/Mesh) topology using simulation software.	02	L3
13. Configure and simulate simple Wireless Local Area network.	02	L3
14. Simulate the BER performance of (2, 1, 3) binary convolutional code with generator sequences g(1) =(1 0 1 1) and g(2) =(1 1 1 1) on AWGN channel. Use QPSK modulation scheme. Channel decoding is to be performed through Viterbi decoding. Plot the bit error rate versus SNR (dB), i.e. Pe,b versus Eb/N0. Consider binary input vector of size 3 lakh bits. Also find the coding gain.	02	L3
15. Simulate the BER performance of (7, 4) Hamming code on AWGN channel. Use QPSK modulation scheme. Channel decoding is to be performed through maximum-likelihood decoding. Plot the bit error rate versus SNR (dB), i.e. Pe,b versus Eb/N0. Consider binary input vector of size 5 lakh bits. Use the following parity check matrix for the (7, 4) Hamming code. Also find the coding gain. $H = \begin{bmatrix} 1 & 0 & 0 & 1 & 1 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 1 & 1 & 1 & 0 & 1 \end{bmatrix}$	02	L3
16. Simulate the BER performance of rate 1/3 Turbo code. Turbo encoder uses two recursive systematic encoders with G(D) and pseudo-random interleaver. Use QPSK modulation scheme. Channel decoding is to be performed through maximum a-posteriori (MAP) decoding algorithm. Plot the bit error rate versus SNR (dB), i.e. Pe,b versus Eb/N0. Consider binary input vector of size of around 3 lakh bits and the block length as 10384 bits. Also find the coding gain.	02	L3

5.0 Relevance to future subjects

Sl. No	Semester	Subject	Topics
01	VI	Mini Project	DC
02	VIII	Project Work	DC based projects

6.0 Relevance to Real World

SL.No	Real World Mapping
01	Analyze different signals in real time applications
02	Model creation for analysis

7.0 Gap Analysis and Mitigation

Sl. No	Delivery Type	Details
01	Tutorial	Topic: Solving different types of programs

8.0 Books Used and Recommended to Students

1. Lab Manual

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

Website and Internet Contents References

1. https://vemu.org/uploads/lecture_notes/19_12_2022_753995718.pdf
2. https://atria.edu/assets/ece/manuals/cnl.pdf
3. https://www.azdocuments.in/2021/05/communication-laboratory-18ecl67_23.html

10.0 Magazines/Journals Used and Recommended to Students

Sl.No	Magazines/Journals	website
1	IEEE Explorer	https://www.journals.elsevier.com/digital-signal-processing
2	International Journal of Science and Technology	https://signalprocessingsociety.org/
3	Journal of Communication Engineering	http://www.imanagerpublications.com/JournalIntroduction.aspx?journal=JournalonDigitalSignalProcessing

11.0 Examination Note

CIE for the practical component:

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

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

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

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

Semester End Evaluation (SEE):

SEE marks for the practical course is 50 Marks.

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

12.0 Course Delivery Plan

Experiments	% of portion
1. FSK generation and detection.	8
2. PSK generation and detection	16
3. DPSK Transmitter and receiver	25
4. QPSK Transmitter and Receiver	33
5. Write a program to encode binary data using Huffman code and decode it.	42
6. Write a program to encode binary data using a (7,4) Hamming code and decode it.	50
7. Write a program to encode binary data using a ((3,1,2)/suitably designed) Convolution code and decode it..	58
8. For a given data, use CRC-CCITT polynomial to obtain the CRC code. Verify the program for the cases a) Without error b) With error	67

9. Write a program for congestion control using leaky bucket algorithm.	75
10. Write a program for distance vector algorithm to find suitable path for transmission.	84
11. Write a program for flow control using sliding window protocols	92
12. Configure a simple network (Bus/star) topology using simulation software **OR** Configure a simple network (Ring/Mesh) topology using simulation software.	100

13.0 University Result

Examination	S+	S	A	B	C	D	E	F	% of passing
First Time Introduced	-	-	-	-	-	-	-	-	-

14.0 VIVA QUESTIONS

- State different types of Digital modulation techniques?
- What is shift keying?
- What is a binary modulation technique?
- Define ASK?
- Define FSK?
- Define PSK?
- Define QPSK and DPSK?
- Why QPSK is called quadrature shift keying?

Prepared by	Checked by		
Dr. S. S. Ittannavar	Dr. M.C.Sarsamba	HOD	Principal

Subject Title	**Research Methodology & Intellectual Property Rights**		
Subject Code	21EC6	**IA Marks (20) +Assignments (10) + CIE Marks for Laboratory Component of IPCC(20)**	50
Number of Lecture Hrs/Week /	03(L)	**Exam Marks (appearing for)**	50(100)
Total Number of Lecture Hrs	25 Hours	**Exam Hours**	03
CREDITS – 02			

FACULTY DETAILS:		
Name: Prof. S. S. Malaj	**Designation:** Assistant Professor	**Experience:**24 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	1 & 2	Professional Skills in Writing English

2.0 Course Objectives

This course will enable students to :

1. Apply mesh and nodal techniques to solve an electrical network.
2. Solve different problems related to Electrical circuits using Network Theorems and Two port network.
3. Familiarize with the use of Laplace transforms to solve network problems.
4. Understand basics of control systems and design mathematical models using block diagram reduction, SFG, etc
5. Understand Time domain and Frequency domain analysis.
6. Familiarize with the State Space Model of the system.

3.0 Course Outcomes

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

	Course Outcome	Cognitive	PO's
CO1	To know the meaning of engineering research	U	1,2,3,4,6,7,9,10,
CO2	To know the procedure of Literature Review and Technical Reading.	U	1,2,3,4,5,6,7,9, 10,11,12
CO3	To know the fundamentals of patent laws and drafting procedure .	U	1,2,3,4,5,6,7,9, 10,11,12
CO4	Understanding the copyright laws and subject matters of copyrights and designs	U	1,2,3,4,5,6,7,9, 10,11,12
CO5	Understanding the basic principles of design rights .	U	1,2,3,4,5,6,7,9, 10,11,12
Total Hours of instruction		**25**	

4.0 Course Content

Theory		
Modules	**Teaching Hours**	**Bloom's Taxonomy (RBT) level**
Module 1		
Introduction: Meaning of Research, Objectives of Engineering Research, and Motivation in Engineering Research, Types of Engineering Research, Finding and Solving a Worthwhile Problem. Ethics in Engineering Research, Ethics in Engineering Research Practice, Types of Research Misconduct,Ethical Issues Related to Authorship.	08	L1,L2,L3
Module -2		
Literature Review and Technical Reading, New and Existing Knowledge, Analysis and Synthesis of Prior Art Bibliographic Databases, Web of Science, Google and Google Scholar, Effective Search: The Way Forward Introduction to Technical Reading Conceptualizing Research, Critical and Creative Reading, Taking Notes While Reading, Reading Mathematics and Algorithms, Reading a Datasheet. **Attributions and Citations**: Giving Credit Wherever Due, Citations: Functions and Attributes, Impact of Title and Keywords on Citations, Knowledge Flow through Citation, Citing Datasets, Styles for Citations, Acknowledgments and Attributions, What Should Be Acknowledged, Acknowledgments in, Books Dissertations, Dedication or Acknowledgments.	08	L1,L2,L3
Module-3		
Introduction To Intellectual Property: Role of IP in the Economic and Cultural Development of the Society,IP Governance, IP as a Global Indicator of Innovation, Origin of IP History of IP in India. Major Amendments in IP Laws and Acts in India. **Patents:** Conditions for Obtaining a Patent Protection, To Patent or Not to Patent an Invention. Rights Associated with Patents. Enforcement of Patent Rights. Inventions Eligible for Patenting. Non-Patentable Matters. Patent Infringements. Avoid Public Disclosure of an Invention before Patenting. Process of Patenting.Prior Art Search. Choice of Application to be Filed. Patent Application Forms. Jurisdiction of Filing Patent Application. Publication. Pre-grant Opposition. Examination. Grant of a Patent. Validity of Patent Protection. Post-grant Opposition. Commercialization of a Patent. Need for a Patent Attorney/Agent. Can a Worldwide Patent be Obtained. Do I Need First to File a Patent in India. Patent Related Forms. Fee Structure. Types of Patent Applications. Commonly Used Terms in Patenting. National Bodies Dealing with Patent Affairs. Utility Models. **Process of Patenting**. Prior Art Search. Choice of Application to be Filed. Patent Application Forms. Jurisdiction of Filing Patent Application. Publication. Pre-grant Opposition. Examination. Grant of a Patent. Validity of Patent Protection. Post-grant Opposition. Commercialization of a Patent. Need for a Patent Attorney/Agent. Can a Worldwide Patent be Obtained. Do I Need First to File a Patent in India. Patent Related Forms. Fee Structure. Types of Patent Applications. Commonly Used Terms in Patenting. National Bodies Dealing with Patent Affairs. Utility Models.	08	L1,L2,L3

Module-4		
Copyrights and Related Rights: Classes of Copyrights. Criteria for Copyright. Ownership of Copyright.Copyrights of the Author. Copyright Infringements. Copyright Infringement is a Criminal Offence. Copyright Infringement is a Cognizable Offence. Fair Use Doctrine. Copyrights and Internet. Non-Copyright Work. Copyright Registration. Judicial Powers of the Registrar of Copyrights. Fee Structure. Copyright Symbol. Validity of Copyright. Copyright Profile of India. Copyright and the word 'Publish'. Transfer of Copyrights to a Publisher. Copyrights and the Word 'Adaptation'. Copyrights and the Word 'Indian Work'. Joint Authorship. Copyright Society. Copyright Board. Copyright Enforcement Advisory Council (CEAC). International Copyright Agreements, Conventions and Treaties. Interesting Copyrights Cases. **Trademarks**: Eligibility Criteria. Who Can Apply for a Trademark. Acts and Laws. Designation of Trademark Symbols. Classification of Trademarks. Registration of a Trademark is Not Compulsory. Validity of Trademark. Types of Trademark Registered in India. Trademark Registry. Process for Trademarks Registration. Prior Art Search. Famous Case Law: Coca-Cola Company vs. Bisleri International Pvt. Ltd.	08	L1,L2,L3
Module-5		
Industrial Designs: Eligibility Criteria. Acts and Laws to Govern Industrial Designs. Design Rights. Enforcement of Design Rights. Non-Protectable Industrial Designs India. Protection Term. Procedure for Registration of Industrial Designs. Prior Art Search. Application for Registration. Duration of the Registration of a Design. Importance of Design Registration. Cancellation of the Registered Design. Application Forms. Classification of Industrial Designs. Designs Registration Trend in India. International Treaties. Famous Case Law: Apple Inc. vs. Samsung Electronics Co. **Geographical Indications**: Acts, Laws and Rules Pertaining to GI. Ownership of GI. Rights Granted to the Holders. Registered GI in India. Identification of Registered GI. Classes of GI. Non-Registerable GI. Protection of GI. Collective or Certification Marks. Enforcement of GI Rights. Procedure for GI Registration Documents Required for GI Registration. GI Ecosystem in India. **Case Studies on Patents.** Case study of Curcuma (Turmeric) Patent, Case study of Neem Patent, Case study of Basmati patent. **IP Organizations In India. Schemes and Programmes**	08	L1,L2,L3

5.0 Relevance to future subjects

Sl. No	Semester	Subject	Topics
01	VI	Mini Project	Any Mini-Project.
02	VIII	Project Work	Project

6.0 Relevance to Real World

SL.No	Real World Mapping
01	The students can gain knowledge of to patent or not patent an application.
02	The students can get knowledge of documents required for GI Registration.

7.0 Gap Analysis and Mitigation

Sl. No	Delivery Type	Details
01	Tutorial	Topic: Solving different types of problems.

8.0 Books Used and Recommended to Students

Text Books
1. Dipankar Deb • Rajeeb Dey, Valentina E. Balas "Engineering Research Methodology", ISSN 1868- 4394 ISSN 1868-4408 (electronic), Intelligent Systems Reference Library, ISBN 978-981-13- 2946-3 ISBN 978-981-13-2947-0 (eBook), https://doi.org/10.1007/978-981-13-2947-0
2. Intellectual Property A Primer for Academia by Prof. Rupinder Tewari Ms. Mamta Bhardwa
Reference Books
1. David V. Thiel "Research Methods for Engineers" Cambridge University Press, 978-1-107-03488- 4
2. Intellectual Property Rights by N.K.Acharya Asia Law House 6th Edition. ISBN: 978-93-81849-30-9

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

Website and Internet Contents References
https://onlinecourses.nptel.ac.in/noc23_ge36/preview
https://onlinecourses.nptel.ac.in/noc22_hs59/preview

10.0 Magazines/Journals Used and Recommended to Students

Sl.No	Magazines/Journals	website
1	International Journal of Methodology-AIJR Journals	https://journals.aijr.org/index.php/ijm
2	Journal of Intellectual Property Rights(JIPR)	http://op.niscair.res.in/index.php/JIPR

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). Astudent 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.

12.0 Course Delivery Plan

Module No.	Lecture No.	Content of Lecture	Teaching Method	% Of Portion
1	1	Meaning of Research	Chalk and talk	20
	2	Objectives of Engineering Research	Chalk and talk	
	3	Motivation in Engineering Research	Chalk and talk	
	4	Types of Engineering Research	Chalk and talk	
	5	Finding and Solving a Worthwhile Problem.	Chalk and talk	
	6	Ethics in Engineering Research	Chalk and talk	
	7	Ethics in Engineering Research Practice	Chalk and talk	
	8	Types of Research Misconduct, Ethical Issues Related to Authorship	Chalk and talk	
2	9	New and Existing Knowledge, Analysis and Synthesis of Prior Art Bibliographic Databases, Web of Science, Google and Google Scholar	Chalk and talk	20
	10	Effective Search: The Way Forward Introduction to Technical Reading Conceptualizing Researc, Critical and Creative Reading	Chalk and talk	
	11	Taking Notes While Reading, Reading Mathematics and Algorithms, Reading Mathematics and Algorithms	Chalk and talk	

	12	Reading a Datasheet,Giving Credit Wherever Due	Chalk and talk	
	13	Citations: Functions and Attributes,Impact of itle and Keywords on Citations.	Chalk and talk	
	14	Knowledge Flow through Citation,Citing Datasets,Styles for Citations	Chalk and talk	
	15	Acknowledgemens and Attributions,What should be Acknowledged	Chalk and talk	
	16	Acknowledgments in, Books ,Dissertations, Dedication or Acknowledgments.	Chalk and talk	
3	17	Role of IP in the Economic and Cultural Development of the Society,I P Governance, IP as a Global Indicator of nnovation, Origin of IP History in India, Major Amendments in IP Laws and Acts in India.	Chalk and talk & NPTEL Video	20
	18	Conditions for Obtaining a Patent Protection, To Patent or Not to Patent an Invention,Rights Associated with Patents Enforcement of Patent Rights	Chalk and talk PPT	
	19	Inventions Eligible for Patenting. Non-Patentable Matters. Patent Infringements. Avoid Public Disclosure of an Invention before Patenting, Process of Patenting, Prior Art Search ,Choice of Application to be Filed Patent Application Forms	Chalk and talk PPT	
	20	Jurisdiction of Filing Patent Application. Publication. Pre-grant Opposition. Examination. Grant of a Patent. Validity of Patent Protection.	Chalk and talk	
	21	Post-grant Opposition. Commercialization of a Patent. Need for a Patent Attorney/Agent. Can a Worldwide Patent be Obtained.	PPT	
	22	Do I Need First to File a Patent in India. Patent Related Forms. Fee Structure. Types of Patent Applications.	Chalk and talk	
	23	Commonly Used Terms in Patenting. National Bodies Dealing with Patent Affairs. Utility Models. **Process of Patenting**. Prior Art Search, Choice of Application to be Filed. Patent Application Forms. Jurisdiction of Filing Patent Application. Publication,	PPT	
	24	Can a Worldwide Patent be Obtained. Do I Need First to File a Patent in India. Patent Related Forms. Fee Structure. Types of Patent Applications. Commonly Used Terms in Patenting. National Bodies Dealing with Patent Affairs. Utility Models	Chalk and talk	
4	25	**Copyrights and Related Rights**: Classes of Copyrights. Criteria for Copyright. Ownership of Copyright.Copyrights of the Author	PPT	20
	26	Copyright Infringements. Copyright Infringement is a Criminal Offence. Copyright Infringement is a Cognizable Offence	Chalk and talk	

	27	Fair Use Doctrine. Copyrights and Internet. Non-Copyright Work. Copyright Registration. Judicial Powers of the Registrar of Copyrights	PPT	
	28	Fee Structure. Copyright Symbol. Validity of Copyright. Copyright Profile of India. Copyright and the word 'Publish'.	Chalk and talk	
	29	Transfer of Copyrights to a Publisher. Copyrights and the Word 'Adaptation'. Copyrights and the Word 'Indian Work'. Joint Authorship. Copyright Society. Copyright Board.	Chalk and talk	
	30	Copyright Enforcement Advisory Council (CEAC). International Copyright Agreements, Conventions and Treaties. Interesting Copyrights Cases	Chalk and talk	
	31	**Trademarks**: Eligibility Criteria. Who Can Apply for a Trademark. Acts and Laws. Designation of Trademark Symbols. Classification of Trademarks. Registration of a Trademark is Not Compulsory. Validity of Trademark	Chalk and talk	
	32	Types of Trademark Registered in India. Trademark Registry. Process for Trademarks Registration. Prior Art Search. Famous Case Law: Coca-Cola Company vs. Bisleri International Pvt. Ltd.	Chalk and talk	
5	33	**Industrial Designs:** Eligibility Criteria. Acts and Laws to Govern Industrial Designs. Design Rights. Enforcement of Design Rights. Non-Protectable Industrial Designs India. Protection Term.	Chalk and talk	20
	34	Procedure for Registration of Industrial Designs. Prior Art Search. Application for Registration. Duration of the Registration of a Design. Importance of Design Registration	Chalk and talk	
	35	Cancellation of the Registered Design. Application Forms. Classification of Industrial Designs. Designs Registration Trend in India. International Treaties. Famous Case Law: Apple Inc. vs. Samsung Electronics Co.	Chalk and talk	
	36	**Geographical Indications**: Acts, Laws and Rules Pertaining to GI. Ownership of GI. Rights Granted to the Holders. Registered GI in India. Identification of Registered GI. Classes of GI.	Chalk and talk	
	37	Non-Registerable GI. Protection of GI. Collective or Certification Marks. Enforcement of GI Rights.	Chalk and talk YouTube Videos	
	38	**Case Studies on Patents.** Case study of Curcuma (Turmeric) Patent, Case study of Neem Patent	Chalk and talk	
	39	Case study of Basmati patent. **IP Organizations In India**	Chalk and talk	
	40	IP Organizations In India. Schemes and Programmes	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	S+	S	A	B	C	D	E	F	% of passing
First Time Introduced	← NA →								

15.0 QUESTION BANK

Module 1

Q1.What is the meaning of Research.

Q2.What are the objectives of Engineering Research.

Q3.List and explain the types of Engineering Research.

Q4.Explain Ethics in Engineering Research.

Q5.Explain types of Research Misconduct.

Q6.Explain Ethical Issues related to Authorship.

Module 2

Q1.ExplainSynthesis & Synthesis of Prior Art Bibliographic Databases.

Q2.Explain Web of Science and Google Scholar.

Q3.Explain Effective Research.

Q4.Explain Critical and Creative Reading.

Q5.Explain Reading Mathematics and Algorithms.

Q6.Explain styles for Citiations.

Q7.Desribe Dedication or Acknowledgements.

Module 3

Q8.Explain Role of IP in the economic & Culutural Development of Society.IP Governance.

Q9.Describe Major Amendments in IP Laws and Acts in India.

Q3.Write about Conditions for obtaining a patent protection.

Q4.Describe about how to avoid public disclosure of an Invention before patenting.

Q5.Explain validity of patent protection.

Q6.Explain post-grant opposition.

Q7.Describe types of patent applications.

Q8.Explain Choice of application to be filed.

Q9.Explain Utility models.

Q10.Describe types of patent applications.

Module 4

Q1.Explain Classes of Copy-Rights.

Q2.Explain Copyright Infringements.

Q3.Explain Fee structure.

Q4.Describe Copyright Profile in .India.

Q5.Explain International copyright agreements.

Q6.Who can apply for a trademark.Explain.

Q7.Explain process for trademarks registration.

Q8. Describe Types of Trademark Registered in India. Trademark Registry

Module 5

Q1.Explain Acts and Laws to govern Industrial Designs.

Q2.Describe procedure for registration of Industrial Designs.

Q3.Explain Importance of Design Registration.

Q4. Explain Classification of Industrial Designs.

Q5.Describe Collective or Certification Marks.

Q6. Explain GI Ecosystem in India.

Q7.Explain Case study of Neem Patent.

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

Subject Title	ENVIRONMENTAL STUDIES		
Subject Code	21CIV57	**IA Marks**	50
Number of Lecture Hrs /	01(L)+1(T)	**Exam Marks**	50
Total Number of Lecture	15	**Exam Hours**	01
CREDITS – 01			

FACULTY DETAILS:		
Name: Dr. M. S. Hanagadakar Dr. S. J. Walaki Dr. Tanuja S.B	Designation: i) Assoc. Professor ii) Asst. Professor iii) Asst. Professor	Experience: i) 19.0 ii) 6.0 iii)6.0
No. of times course taught: i) 09 ii) 03 iii)01	**Specialization:** i) Physical Chemistry ii) Organic Chemistry iii) Physical chemistry	

1.0 Prerequisite Subjects:

Fundamentals of Chemistry, Physics, Mathematics, Biology, Engineering, Anthropology, Sociology, (Social problems), Economics (production, consumption, and transfer of wealth), management, Ecology Knowledge are required.

2.0 Course Learning Objectives

1. Recognize major concepts in environmental sciences and demonstrate in-depth understanding of the environment.
2. Develop analytical skills, critical thinking, and demonstrate problem-solving skills using scientific techniques.
3. Demonstrate the knowledge and training for entering graduate or professional schools, or the job market.

3.0 Course Outcomes

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

Course Code	Course Outcome	RBT level	POs
C309.1	Understand the principles of ecology and environmental issues that apply to air, land, and water issues on a global scale.	L1,L2	1,2,3,6,7,9 ,10,12
C309.2	Develop critical thinking and/or observation skills, and apply them to the analysis of a problem or question related to the environment.	L1, L2	1,2,3,6,7,9, 10,12
C309.3	Demonstrate ecology knowledge of a complex relationship between biotic and abiotic components.	L1, L2	1,2,3,6,7,9, 10,12
C309.4	Apply their ecological knowledge to illustrate and graph a problem and describe the realities that managers face when dealing with complex issues.	L1, L2	1,2,3,6,7,9, 10,12
C309.5	Understand the principles of ecology and environmental issues that apply to air, land, and water issues on a global scale.	L1,L2	1,2,3,6,7,9, 10,12
Total Hours of instruction		**25**	

4.0 Course Content

Module-1

Ecosystems (Structure and Function): Forest, Desert, Wetlands, Riverine, Oceanic and Lake.

Biodiversity: Types, Value; Hot-spots; Threats and Conservation of biodiversity, Forest Wealth, and Deforestation.

Module -2

Advances in Energy Systems (Merits, Demerits, Global Status and Applications)**:** Hydrogen, Solar, OTEC, Tidal and Wind.

Natural Resource Management (Concept and case-studies): Disaster Management, Sustainable Mining, Cloud Seeding, and Carbon Trading.

Module -3

Environmental Pollution (Sources, Impacts, Corrective and Preventive measures, Relevant Environmental Acts, Case-studies)**:** Surface and Ground Water Pollution; Noise pollution; Soil Pollution and Air Pollution.

Waste Management & Public Health Aspects: Bio-medical Wastes; Solid waste; Hazardous wastes; E-wastes; Industrial and Municipal Sludge.

Module -4

Global Environmental Concerns:(Concept, policies and case-studies):Ground water depletion/recharging, Climate Change; Acid Rain; Ozone Depletion; Radon and Fluoride problem in drinking water; Resettlement and rehabilitation of people, Environmental Toxicology.

Module -5

Latest Developments in Environmental Pollution Mitigation Tools (Concept and Applications): G.I.S. & Remote Sensing, Environment Impact Assessment, Environmental Management Systems, ISO14001; Environmental Stewardship- NGOs.

Field work: Visit to an Environmental Engineering Laboratory or Green Building or Water Treatment Plant or Waste water treatment Plant; ought to be followed by understanding of process and its brief documentation.

5.0 Relevance to future subjects

Sl. No.	Semester	Subject	Topics
01	Common to all	Common to all engineering Subjects	Sustainable development, waste management, Pollution control, Energy systems, Environmental issues.

6.0 Relevance to Real World

Sl.No	Real World Mapping
01	All engineering applications / projects leading to the sustainable development, waste management, pollution control, to resolve global related issues.

7.0 Gap Analysis and Mitigation

Sl. No	Delivery Type	Details
01	NPTEL	http://nptel.ac.in/courses

8.0 Books Used and Recommended to Students

Text Books

1. Benny Joseph (2005), "Environmental Studies", Tata McGraw – Hill Publishing Company Limited.
2. R.J.Ranjit Daniels and Jagadish Krishnaswamy, (2009), "Environmental Studies", Wiley India Private Ltd., New Delhi.
3. R Rajagopalan, "Environmental Studies – From Crisis to Cure", Oxford University Press, 2005,
4. Aloka Debi, "Environmental Science and Engineering", Universities Press (India) Pvt. Ltd. 2012.

Reference Books

1. Raman Sivakumar, "Principals of Environmental Science and Engineering", Second Edition, Cengage learning Singapore, 2005
2. P. Meenakshi, "Elements of Environmental Science and Engineering", Prentice Hall of India Private Limited, New Delhi, 2006
3. S.M. Prakash, "Environmental Studies", Elite Publishers Mangalore, 2007
4. Erach Bharucha, "Text Book of Environmental Studies", for UGC, University press, 2005
5. G.Tyler Miller Jr., "Environmental Science – working with the Earth", Tenth Edition, Thomson Brooks /Cole, 2004
6. G.Tyler Miller Jr., "Environmental Science – working with the Earth", Eleventh Edition, Thomson Brooks /Cole, 2006
7. Dr.Pratiba Sing, Dr.AnoopSingh and Dr.Piyush Malaviya, "Text Book of Environmental and Ecology", Acme Learning Pvt. Ltd. New Delhi.

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

Website and Internet Contents References

Web links and Video Lectures:

https://nptel.ac.in/courses/120/108/120108005/
https://nptel.ac.in/courses/120/108/120108002/
https://nptel.ac.in/courses/120/108/120108004/
https://nptel.ac.in/courses/105/102/105102089/
https://www.my-mooc.com/en/categorie/environmental-science
https://academicearth.org/environmental-studies/

10.0 Magazines/Journals Used and Recommended to Students

Sl.No	Magazines/Journals	website
1	Environmental-science	http://nlspub.ac.in/category/journals/journal-of-environmental-law-policy-and-development/
2	Environmental-research	https://www.journals.elsevier.com/environmental-research

11.0 Examination Note

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 01 hours)

Question paper pattern:

1. The Question paper will have 50 objective questions.
2. Each question will be for 01 marks
3. Students will have to answer all the questions on an OMR Sheet.
4. The Duration of the Exam will be 01 hour

12.0 Course Delivery Plan

Module No.	Lecture No.	Content of Lecturer	% of Portion
1	1	**Ecosystems** (Structure and Function):, Wetlands, Riverine	
	2	Forest and Desert	
	3	Oceanic and Lake	
	4	**Biodiversity:** Types, Value; Hot-spots; Threats and Conservation of biodiversity.	
	5	Forest Wealth, and Deforestation	**20**
2	6	**Advances in Energy Systems** (Merits, Demerits, Global Status and Applications)**:** Hydrogen,	
	7	Solar and OTEC	
	8	Tidal and Wind.	
	9	**Natural Resource Management** (Concept and case-studies): Disaster Management.	**20**
	10	Sustainable Mining, Cloud Seeding, and Carbon Trading.	
3	11	**Environmental Pollution** (Sources, Impacts, Corrective and Preventive measures, Relevant Environmental Acts, Case-studies)**:** Surface and Ground	
	12	Water Pollution and Noise pollution	
	13	Soil Pollution and Air Pollution.	**20**
	14	**Waste Management & Public Health Aspects:** Bio-medical Wastes; Solid waste	
	15	Hazardous wastes; E-wastes; Industrial and Municipal Sludge	
4	16	**Global Environmental Concerns:**(Concept, policies and case-studies):Ground water depletion/recharging.	
	17	Climate Change; Acid Rain and Ozone Depletion	
	18	Radon and Fluoride problem in drinking water	**20**
	19	Resettlement and rehabilitation of people	
	20	Environmental Toxicology.	
5	21	**Latest Developments in Environmental Pollution Mitigation Tools (Concept and Applications):** G.I.S. & Remote Sensing.	
	22	Environment Impact Assessment,	
	23	Environmental Management Systems, ISO14001, Environmental Stewardship-NGOs.	
	24	**Field work:** Visit to an Environmental Engineering Laboratory or Green Building or Water Treatment Plant or Waste water treatment Plant.	**20**
	25	Ought to be followed by understanding of process and its brief documentation.	

13.0 Assignments

Sl. No.	Title	Outcome expected	Allied study	Week No.	Individual / Group activity	Reference: book/website /Paper
1	Assignment 1: University Questions/ Write up	Students study the Topics and write the Answers. Get practice to solve university questions.	Module 1 of the syllabus	2	Individual Activity.	Book 1, of the reference list. Website of the Reference list
2	Assignment 2: University Questions/ Write up	Students study the Topics and write the Answers. Get practice to solve university questions.	Module 2 of the syllabus	4	Individual Activity.	Book 1, 2 of the reference list. Website of the Reference list
3	Assignment 3: University Questions/ Write up	Students study the Topics and write the Answers. Get practice to solve university questions.	Module 3 of the syllabus	6	Individual Activity.	Book 1, 2 of the reference list. Website of the Reference list
4	Assignment 4: University Questions/ Write up	Students study the Topics and write the Answers. Get practice to solve university questions.	Module 4 of the syllabus	8	Individual Activity.	Book 1, 2 of the reference list. Website of the Reference list
5	Assignment 5: University Questions/ Write up	Students study the Topics and write the Answers. Get practice to solve university questions.	Module 5 of the syllabus	10	Individual Activity.	Book 1, 2 of the reference list. Website of the Reference list

14.0 QUESTION BANK

Module-1

1. The term ‘Environment’ has been derived from the French word which means to encircle or surround

a) Environ b) Oikos c) geo d) Aqua

2. The objective of environmental education is

a) Raise consciousness about environmental conditions b) To teach environmentally appropriate behavior c) Create an environmental ethic d) All of the above

3. Which of the following conceptual spheres of the environment is having the least storage capacity for matter?

a) Atmosphere b) Lithosphere c) Hydrosphere d) Biosphere

4. Which of the following components of the environment are effective transporters of matter?

a) Atmosphere and Hydrosphere b) Atmosphere and Lithosphere

c) Hydrosphere and Lithosphere d) Biosphere and Lithosphere

5. Biosphere is

a) The solid shell of inorganic materials on the surface of the earth

b) The thin shell of organic matter on the surface of earth comprising of all the living things

c) The sphere which occupies the maximum volume of all of the spheres d) all of these.

6. Atmosphere consists of 79 per cent Nitrogen and 21 per cent Oxygen by

a) Volume b) weight c) Density d) All the three

7. Which of the following is a biotic component of an ecosystem?

a) Fungi b) solar light c) temperature d) humidity

8. In an ecosystem, the flow of energy is

a) Bi-directional b) Cyclic c) Unidirectional d) Multidirectional

9. Which Pyramid is always upright?

a) Energy b) biomass c) numbers d) food chain

10. In complex ecosystems the degree of species diversity is

a) Poor b) high c) medium d) none

Module-2

1. Which of the following is considered as an alternate fuel?

a) CNG b) Kerosene c) Coal d) Petrol

2. Solar radiation consists of

a) UV b) Visible light c) Infrared d) All of these

3. Reduction in usage of fuels cannot be brought about by

a) Using alternate fuels b) Changing lifestyles c) Reducing car taxes d) Both a) & b)

4. Which of the following is a hazard of a nuclear power plant?

a) Accident risk when tankers containing fuel cause spill

b) Radioactive waste of the power plant remains highly toxic for centuries

c) Release of toxic gases during processing d) All of these

5. The most important fuel used by nuclear power plant is

a) U – 235 b) U- 238 c) U – 245 d) U – 248

6. Biogas is produced by

a) Microbial activity b) Harvesting crop c) Both a) & b) d) None of these

7. Oil and Gas are preferred because of

a) Easy transportation b) Cheap c) Strong smell d) All of these

8. Biomass power generation uses

a) Crops b) Animal dung c) Wood d) All of these

9. Chernobyl nuclear disaster occurred in the year

a) 1984 b) 1952 c) 1986 d) 1987

10. Which of the following is not a renewable source of energy?

a) Fossil fuels b) Solar energy c) Tidal wave energy d) Wind energy

Module-3

1. Environmental pollution is due to

a) Rapid Urbanization b) deforestation c) Afforestation d) a & b

2. Which of the following are natural sources of air pollution?

a) Volcanic eruption b) solar flair c) earth quake d) all

3. Which of the following are biodegradable pollutants?

a) Plastics b) Domestic sewage c) detergent d) all

4. The liquid waste from baths and kitchens is called

a) Sullage b) Domestic sewage c) Storm waste d) Run off

5. Noise pollution can be minimized by

a) Urbanization b) Maintaining silence c) Reducing noise at source d) none

6. BOD Means

a) Biochemical oxygen demand b) chemical oxygen demand c) biophysical oxygen demand d) all

7. Which of the following industry generates colored waste?

a) Software industry b) Textile industry c) Biomedical industry d) none

8. Physical pollution of water is due to

a) Dissolved oxygen b) Turbidity c) pH d) none of these

9. Which of the following source is surface water?

a) Springs b) streams c) deep wells d) all

10. Deforestation can

a) Increase the rain fall b) Increase soil fertility c) Introduce silt in the rivers d) None of these

11. Which of the following is non point source of water pollution?

a) Factories b) Sewage treatment plant c) Urban and Sub-urban land d) all of the above

Module-4

1. Acid rain can be controlled by

a) Reducing $SO_2$and NO_2emissions. b) Reducing oxygen emission.

c) Increasing number of lakes. c) Increasing the forest cover.

2. Atmospheric oxidation of $SO_2$to $SO_3$is influenced by

a) Sunlight. b) Humidity c) presence of hydrocarbons d) all of these

3. Reduction in brightness of the famous Taj Mahal is due to

a) Global warming. b) Air pollution c) Ozone depletion d) Afforestation.

27. The Effect of Acid rain

a) Reduces soil fertility. b) increases atmospheric temperature.

c) Causing respiratory problems d) skin cancer

4. The process of movement of nutrients from the soil by the Acid rain iscalled

a) Transpiration. b) Evapo transpiration c) Leaching d) Infiltration.

5. Ozone layer is present in

a) Troposphere b) Stratosphere c) Mesosphere d) Thermosphere

6. Which of the following statements about ozone is true?

a) Ozone is a major constituent of photochemical smog

b) Ozone protects us from the harmful uv radiation of sun

c) Ozone is highly reactive d) All of the above

7. Major compound responsible for the destruction of stratospheric ozone layer is

a) Oxygen b) CFC c) Carbon dioxide d) Methane

8. Ozone layer thickness is measured in

a) PPM b) PPB c) Decibels d) Dobson units

9. Normal average thickness of stratospheric ozone layer across the globe is around

a) 200 DU b) 300 DU c) 400 DU d) 500 DU

10. Chloro Fluro Carbon's (CFC) are

a) Non toxic b) Non flammable c) Non carcinogenic d) All these

11. Ozone layers absorbs

a) UV rays b) infra red rays c) Cosmic rays d) CO

12. Which of the following is not an ill effect of acid rain?

a) Results in killing fish b) causes stone leprosy. c) Leaches nutrients from the soil. d) Causes cataract.

13. Formation of ozone layer is explained by

a) Rosenmund reaction b) Henderson's reaction c) Chapman's reaction. d) Perkin's reaction

14. Each Chlorine free Radical can destroy the following number of ozone molecules.

a) 1000 b) 10,000 c) 1, 00, 000 d) 100

15. Which of the following statements about ozone is true?

a) Ozone is a major constituent of photochemical smog b) Ozone is highly reactive

c) Ozone protects us from the harmful UV radiation of sun. d) All of these

Module-5

1. Sustainable development means

a) Meeting present needs without compromising on the future needs b) Progress in human well beings

c) Balance between human needs and the ability of Earth to provide the resources d) All the above

2. The most important remedy to avoid negative impact due to industrialization is

a) Industry should be closed b) Don't allow new industrial units

c) Industry should treat all the wastes generated by it before disposal

d) Industries should be shifted far away from human habit tats.

3. Mining means

a) To conserve & preserve minerals b) To check pollution due to mineral resources

c) To extract minerals and ores d) None

4. E.I.A. can be expanded as

a) Environment & Industrial Act b) Environment & Impact Activities

c) Environmental Impact Assessment d) Environmentally Important Activity

5. E.I.A. is related to

a) Resource conservation b) Efficient equipment/process

c) Waste minimization d) All of the above

6. In order to protect the health of people living along the adjoining areas of roads, one should.

a) Plant trees alongside of the roads b) Not allow diesel driven vehicles

c) Shift them (people) to other places d) None of the above

7. The pollution caused by transportation/vehicular activities depends on

a) Type of the vehicle's engine b) Age of the vehicle

c) Traffic congestion d) All of the above

8. Sustainable development will not aim at

a) Social economic development which optimizes the economic and societal benefits available in the present, without spoiling the likely potential for similar benefits in the future

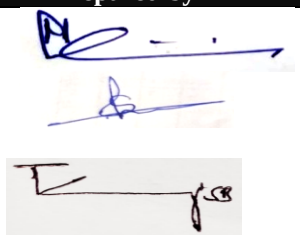
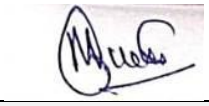
b) Reasonable and equitably distributed level of economic well being that can be perpetuated continually

c) Development that meets the needs of the present without compromising the ability of future generations

d) Maximizing the present day benefits through increased resource meet their own needs consumption

10. Which of the following is a key element of EIA?

a) Scoping b) Screening c) Identifying and evaluating alternatives d) all of these

Prepared by	Checked by		
			
Dr. M. S. Hanagadakar Dr. S. J. Walaki Dr. Tanuja. S.B	Dr. M. S. Hanagadakar	**HOD**	**Principal**

Subject Title	**IoT (Internet of Things) Lab**		
Subject Code	**21EC581**	**CIE Marks**	50
Number of Lecture Hrs/Week /	02 Hours Laboratory	**SEE Marks**	50
RBT Level	L1, L2, L3	**Exam Hours**	03
CREDITS – 01			

FACULTY DETAILS:		
Name: Prof. D M Kumbhar	**Designation:** Assistant Professor	**Experience :Teach- 16** years (Ind 07years)
No. of times course taught: 01	**Specialization:** Digital Electronics	

1.0 Prerequisite Subjects:

Sl. No	Branch	Semester	Subject
01	ECE	I	C programming
02	ECE	III	Basic electrical & electronics
03	ECE	III	Transducers

2.0 Course Objectives

This laboratory course enables students to

- To impart necessary and practical knowledge of components of Internet of Things.
- To develop skills required to build real-life IoT based projects.

3.0 Course Outcomes

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

	Course Outcome	Cognitive Level	PO's
CO308.1	Understand internet of Things and its hardware and software components	U	1,2,3,4,5,6,7,8,9,10,11,12
CO308.2	Interface I/O devices, sensors & communication modules	U	1,2,3,4,5,6,7,8,9,10,11,12
CO308.3	Remotely monitor data and control devices	U	1,2,3,4,5,6,7,8,9,10,11,12
CO308.4	Develop real life IoT based projects	U	1,2,3,4,5,6,7,8,9,10,11,12
Total Hours of instruction		**40**	

4.0 Course Content

Laboratory Experiments:

1	i) To interface LED/Buzzer with Arduino/Raspberry Pi and write a program to 'turn ON' LED for 1 sec after every 2 seconds. ii) ii) To interface Push button/Digital sensor (IR/LDR) with Arduino/Raspberry Pi and write a program to 'turn ON' LED when push button is pressed or at sensor detection.
2	i) To interface DHT11 sensor with Arduino/Raspberry Pi and write a program to print temperature and humidity readings. ii) ii) To interface OLED with Arduino/Raspberry Pi and write a program to print temperature and humidity readings on it.
3	To interface motor using relay with Arduino/Raspberry Pi and write a program to 'turn ON' motor when push button is pressed
4	To interface Bluetooth with Arduino/Raspberry Pi and write a program to send sensor data to smartphone using Bluetoot
5	To interface Bluetooth with Arduino/Raspberry Pi and write a program to turn LED ON/OFF when '1'/'0' is received from smartphone using Bluetoot
6	Write a program on Arduino/Raspberry Pi to upload temperature and humidity data to thingspeak cloud
7	Write a program on Arduino/Raspberry Pi to retrieve temperature and humidity data from thingspeak cloud.
8	To install MySQL database on Raspberry Pi and perform basic SQL queries.
9	Write a program on Arduino/Raspberry Pi to publish temperature data to MQTT broker.
10	Write a program to create UDP server on Arduino/Raspberry Pi and respond with humidity data to UDP client when requested.
11	Write a program to create TCP server on Arduino/Raspberry Pi and respond with humidity data to TCP client when requested.
12	Write a program on Arduino/Raspberry Pi to subscribe to MQTT broker for temperature data and print it.

5.0 Relevance to future subjects

Sl. No	Semester	Subject	Topics
01	VII/VIII	Project work	All experiments

6.0 Relevance to real world

SL No	Real World Mapping
01	Control of various devices using Iot e.g. Motor, Fan Control

7.0 Gap Analysis and Mitigation

Sl. No	Delivery Type	Details
01	Tutorial	Topic: Simulation software like Arduino IDE.
02	NPTEL	IoT appliance control

8.0 Books Used and Recommended to Students

Text Books
1. Vijay Madisetti, Arshdeep Bahga, Internet of Things. "A Hands on Approach", University Press
2. Dr. SRN Reddy, Rachit Thukral and Manasi Mishra, "Introduction to Internet of Things: A practical Approach", ETI Labs
3. Pethuru Raj and Anupama C Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press
4. Jeeva Jose, "Internet of Things", Khanna Publishing House, Delhi
5. Adrian McEwen, "Designing the Internet of Things", Wiley
6. Raj Kamal, "Internet of Things: Architecture and Design", McGraw Hill

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

Website and Internet Contents References
12) https://nptel.co.in
13) https://robocraze.com/blogs/post
14) https://www.geeksforgeeks.org
15) https://lastminuteengineers.com

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

- Semester End Evaluation (SEE): SEE marks for the practical course is 50 Marks.
- SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the University
- All laboratory experiments are to be included for practical examination.
- (Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. OR based on the course requirement evaluation rubrics shall be decided jointly by examiners.
- Students can pick one question (experiment) from the questions lot prepared by the internal /external examiners jointly.

- Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.
- General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks.
- SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)
- Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.
- The duration of SEE is 03 hours

12.0 Course Delivery Plan

Experiment	Lecture No.	Content	% of Portion
1	1	iii) To interface LED/Buzzer with Arduino/Raspberry Pi and write a program to 'turn ON' LED for 1 sec after every 2 seconds. iv) ii) To interface Push button/Digital sensor (IR/LDR) with Arduino/Raspberry Pi and write a program to 'turn ON' LED when push button is pressed or at sensor detection.	7
2	2	iii) To interface DHT11 sensor with Arduino/Raspberry Pi and write a program to print temperature and humidity readings. iv) ii) To interface OLED with Arduino/Raspberry Pi and write a program to print temperature and humidity readings on it.	14
3	3	To interface motor using relay with Arduino/Raspberry Pi and write a program to 'turn ON' motor when push button is pressed	21
4	4	To interface Bluetooth with Arduino/Raspberry Pi and write a program to send sensor data to smartphone using Bluetoot	29
5	5	To interface Bluetooth with Arduino/Raspberry Pi and write a program to turn LED ON/OFF when '1'/'0' is received from smartphone using Bluetoot	36
6	6	Write a program on Arduino/Raspberry Pi to upload temperature and humidity data to thingspeak cloud	43
7	7	Write a program on Arduino/Raspberry Pi to retrieve temperature and humidity data from thingspeak cloud.	50
8	8	To install MySQL database on Raspberry Pi and perform basic SQL queries.	64
9	9	Write a program on Arduino/Raspberry Pi to publish temperature data to MQTT broker.	72
10	10	Write a program to create UDP server on Arduino/Raspberry Pi and respond with humidity data to UDP client when requested.	86
11	11	Write a program to create TCP server on Arduino/Raspberry Pi and respond with humidity data to TCP client when requested.	93
12	12	Write a program on Arduino/Raspberry Pi to subscribe to MQTT broker for temperature data and print it.	100

13.0 VIVA BANK

1. What is IoT? / What is the Internet of Things?
2. What are the most important characteristics or features of IoT?
3. How does the IoT (Internet of Things) affect our everyday lives?
4. What industries can be benefitted from IoT?
5. What are the different types of components used in IoT?
6. What is Raspberry Pi?
7. What are the key advantages of IoT?
8. What are the different types of sensors used in IoT?
9. What is PWM or Pulse Width Modulation?
10. What is Arduino used in IoT?
11. What are the different types of communication models used in IoT?
12. What is the basic difference between an IoT device and a normal sensor device?
13. What are the various wireless communications boards available in Raspberry Pi?
14. What functions are used to read analog and digital data from a sensor in Arduino?
15. What are the different available models in Raspberry Pi used in IoT?
16. Define Arduino
17. List mostly used sensors types in IoT
18. Mention applications of PWM in IoT
19. What are the functions used to read analog and digital data from a sensor in Arduino?
20. What is Bluetooth Low Energy?
21. Define Micro Python
22. Differentiate between Arduino and Raspberry pi
23. List available models in Raspberry Pi

13.0 University Result

NEW SCHME

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