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. S. B. Akkole	GATE / Preplacement Coaching
		ED Lab Incharge
		Students Mentor
		Dept. NAAC Criteria Sub Coordinator
		NBA Criteria Coordinator
		Participation in Funded Projects
2	Dr. R. R. Maggavi	GATE / Preplacement Coaching
		CN Lab Incharge
		Students Mentor
		Module Coordinator
		Research Center Coordinator
		Dept. NAAC Criteria Sub COordinator
		NBA Criteria Coordinator
		Innovations Club Coordinator
3	Prof. S. S. Malaj	GATE / Preplacement Coaching
		Adv.Comm. Lab Incharge
		Students Mentor
		Dept. NAAC Criteria Sub COordinator
		NBA Criteria Coordinator
		NIRF Coordinator
		Conference Coordinator
04	Prof. S. S. Kamate	GATE / Preplacement Coaching
		VLSI Lab Incharge
		Students Mentor
		Module Coordinator
		IEEE Coordinator
		Dept. NAAC Criteria Sub Coordinator
		NBA Criteria Coordinator
		Project Coordinator
05	Porf. D. M. Kumbhar	GATE / Preplacement Coaching
		AC Lab Incharge
		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
06	Prof. S. S. Patil	GATE / Preplacement Coaching
		ARM & ES Lab Incharge
		Students Mentor
		Class Teacher
		NBA Criteria Coordinator
		AICTE Activity Coordinator
		Admission Coordinator
		Module Coordinator
07	Prof. D. B. Madihalli	GATE / Preplacement Coaching
		DSD Lab Incharge
		Students Mentor
		NBA Coordinator
		News & Publicity Coordinator
		NBA Criteria Coordinator
		Website Coordinator
		VTU LIC Coordinator
08	Prof. P. V. Patil	GATE / Preplacement Coaching
		HDL Lab Incharge
		Students Mentor
		NBA Criteria Coordinator
		T&P Cell Coordinator
		Alumni Coordinator
09	Prof. S. S. Ittannavar	GATE / Preplacement Coaching
		DSP Lab Incharge
		Students Mentor
		EMS/ IA Coordinator
		News Letter / Technical Magazine
		ISTE Coordinator
		AICTE Coordinator
10	Prof. B. P. Khot	GATE / Preplacement Coaching
		MC Lab Incharge
		Students Mentor
		Dept. Time Table Coordinator & Meeting Coordinator
		Class Teacher
		NBA Criteria Coordinator
		AICTE Activity Coordinator

CONTENTS

FACULTY POSITION

S.N.	Category	No. in position	Average experience
1	Teaching faculty.	10	16.15Y
2	Technical supporting staff.	03	20.67Y
3	Helper staff	02	21.08Y

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 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	Dr. S. B. Akkole	Ph.D	Communication	LMISTE	27Y.07M	9480422508
2	Dr. R. R. Maggavi	Ph.D	E&C	LMISTE	17Y.09M	9480275583
3	Smt.S.S.Kamate	M.Tech	Digital Electronics	LMISTE	19Y.04M	9008696825
4	Smt. S. S. Malaj	M.E.	E & TC	LMISTE	24Y.11M	9731795803
5	Sri. D.M. Kumbhar	M.Tech	Electronics	LMISTE	18Y.02M	09373609880
6	Sri. Sachin .S. Patil	M.Tech	VLSI & Embedded	LMISTE	18Y.00M	9448102010
7	Sri .D.B. Madihalli	M.Tech	Industrial Electronics	LMISTE	14Y.11M	9902854324
8	Sri.P.V.Patil	M.Tech	VLSI & Embedded	LMISTE	9Y.08M	9731104059
9	Sri.S.S.Ittannavar	M.Tech	DSP	LMISTE	9Y.03M	9964299498
10	Smt. B. P. Khot	M.Tech	Microelectronics & Control Systems	LMISTE	6Y.03M	9964019501

TECHNICAL SUPPORTING STAFF

S.N.	Name	Qualification	Experience (in years)
1.	Sri. P. S. Desai	DEC	22Y-.00M
2.	Sri. V. V. Guruwodeyar	DEC	30Y-09 M
3.	Sri. A. K.Talawar	DEC	
4	Sri.M.A.Attar	DEC	12Y-02M

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

VI SEMESTER

Sl. No	Course and Course code		Course Title	Teaching Department	Teaching Hours /Week			Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P					
1	PCC	18EC61	Digital Communication		3	2	--	03	40	60	100	4
2	PCC	18EC62	Embedded Systems		3	2	--	03	40	60	100	4
3	PCC	18EC63	Microwave & Antennas		3	2	--	03	40	60	100	4
4	PEC	18XX64X	Professional Elective -1		3	--	--	03	40	60	100	3
5	OEC	18XX65X	Open Elective –A		3	--	--	03	40	60	100	3
6	PCC	18ECL66	Embedded Systems Laboratory		--	2	2	03	40	60	100	2
7	PCC	18ECL67	Communication Laboratory		--	2	2	03	40	60	100	2
8	MP	18ECMP68	Mini-project		--	--	2	03	40	60	100	2
9	Internship	--	Internship	To be carried out during the vacation/s of VI and VII semesters and /or VII and VIII semesters.								
				TOTAL	**15**	**10**	**6**	**24**	**320**	**480**	**800**	**24**

Note: PCC: Professional core, PEC: Professional Elective, OE: Open Elective, MP: Mini-project.

Professional Elective -1

Course code under 18XX64X	Course Title
18EC641	Operating System
18EC642	Artificial Neural Networks
18EC643	Object Oriented Programming using C++
18EC644	Digital System Design using Verilog
18EC645	Nanoelectronics

Open Elective –A

(i) 18EC651 Signal Processing (ii)18EC652 Sensors &Signal Conditioning

Students can select any one of the open electives offered by other Departments except those that are offered by the parent Department (Please refer to the list of open electives under 18XX65X).
Selection of an open elective shall not be allowed if,

- The candidate has studied the same course during the previous semesters of the programme.
- The syllabus content of open elective is similar to that of the Departmental core courses or professional electives.
- A similar course, under any category, is prescribed in the higher semesters of the programme.

Registration to electives shall be documented under the guidance of Programme Coordinator/ Advisor/Mentor.

Mini-project work:
Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multidisciplinary Mini- project can be assigned to an individual student or to a group having not more than 4 students.
CIE procedure for Mini-project:
(i) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide.
The CIE marks awarded for the Mini-project work, shall be based on the evaluation of project report, project presentation skill and question and answer session in the ratio 50:25:25.The marks awarded for the project report shall be the same for all the batch mates.
(ii) Interdisciplinary: Continuous Internal Evaluation shall be group wise at the college level with the participation of all the guides of the college.
The CIE marks awarded for the Mini-project, shall be based on the evaluation of project report, project presentation skill and question and answer session in the ratio 50:25:25.The marks awarded for the project report shall be the same for all the batch mates.
SEE for Mini-project:
(i) Single discipline: Contribution to the Mini-project and the performance of each group member shall be assessed individually in the semester end examination (SEE) conducted at the department.
(ii) Interdisciplinary: Contribution to the Mini-project and the performance of each group member shall be assessed individually in semester end examination (SEE) conducted separately at the departments to which the student/s belong to.
Internship: All the students admitted to III year of BE/B.Tech shall have to undergo mandatory internship of 4 weeks during the vacation of VI and VII semesters and /or VII and VIII semesters. A University examination shall be conducted during VIII semester and the prescribed credit shall be included in VIII semester. Internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take-up/complete the internship shall be declared fail and shall have to complete during subsequent University examination after satisfying the internship requirements.

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

ACADEMIC CALENDER

S J P N Trust's
Hirasugar Institute of Technology, Nidasoshi.
Inculcating Values, Promoting Prosperity
Approved by AICTE, Recognized by Govt. of Karnataka and Affiliated to VTU Belagavi.
Recognized Under Section 2(f) of UGC Act, 1956.
Accredited at 'A' Grade by NAAC, Programmes Accredited by NBA: CSE, ECE, EEE & ME.

IQAC
File I-11
2021-22 (Even)
Rev: 00

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

Date	Events
04-04-2022	Commencement of VI/VIII Semester Classes
07-04-2022	World Health Day
22-04-2022	World Earth Day
26-04-2022	World Intellectual Property Day
09-05-2022 to 11-05-2022	First Internal Assessment for VI Semester
09-05-2022 to 10-05-2022	First Internal Assessment for VIII Semester
12-05-2022	Feedback-I on Teaching-Learning
16-05-2022	Display of 1st I.A. Marks and submission of Feedback-I to office
30-05-2022 to 31-05-2022	Second Internal Assessment for VIII Semester
31-05-2022	Anti-Tobacco Day
02-06-2022	Feedback-II on Teaching-Learning of VIII Semester
05-06-2022	World Environment Day
06-06-2022	Display of 2nd I.A. Marks and submission of Feedback-II to office of VIII Semester
09-06-2022 to 11-06-2022	Second Internal Assessment for VI Semester
13-06-2022	Feedback-II on Teaching-Learning of VI Semester
14-06-2022	World Blood Donor Day
15-06-2022	Display of 2nd I.A. Marks and submission of Feedback-II to office of VI Semester
21-06-2022	International Yoga Day
27-06-2022 to 28-06-2022	Third Internal Assessment for VIII Semester
30-06-2022	Display of Final IA Marks of VIII Semester
30-06-2022	Last working day of VIII Semester
11-07-2022 to 13-07-2022	Third Internal Assessment for VI Semester
14-07-2022 to 15-07-2022	Lab Internal Assessment for VI Semester
16-07-2022	Display of Final IA Marks of VI Semester
16-07-2022	Last working day of VI Semester
21-07-2022	Project Exhibition
27-07-2022	Graduation Day
18-07-2022 to 29-07-2022	Practical Examination of VI Semester
01-08-2022 to 20-08-2022	Theory Examination of VI Semester
04-07-2022 to 20-07-2022	Theory Examination of VIII Semester
22-07-2022 to 30-07-2022	Internship Viva Voce/Project Viva for VIII Semester

April- 2022

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

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

May-2022

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

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

June-2022

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

July-2022

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

Dr. B. V. Madiggond
Dean (Acad)

Dr. S. C. Kamate
Principal

Subject Title	**Digital Communication**		
Subject Code	18EC61	**IA Marks**	40
Number of Lecture Hrs / Week	04 L	**Exam Marks**	60
Total Number of Lecture Hrs	50	**Exam Hours**	03

FACULTY DETAILS:		
Name: Prof. S S Ittannavar	**Designation:** Assistant Professor	**Experience:**9 yrs
No. of times course taught:09	**Specialization:** Digital Signal Processing	

1.0 Prerequisite Subjects:

Sl. No	Branch	Semester	Subject
01	ECE	IV	Signals and Systems
02	ECE	V	Digital Signal Processing

2.0 Course Objectives

1. To acquire the knowledge of Digital Communication system, sampling theory and recovery of transmitted signal.
2. To design system based on digital modulation.
3. To have idea about different types of coding techniques.
4. To impart knowledge of quantization and Encoder.
5. To make the students understand that how to detect the signal in presence of noise.

3.0 Course Outcomes

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

	Course Outcome	RBT Level	POs
CO1	Associate and apply the concepts of Band pass sampling to well specified signals and channels.	L3	PO1,PO2,PO3,PO4,PO5, PO6,PO8, PO10,PO11,PO12
CO2	Analyze and compute performance parameters and transfer rates for low pas and band pass symbol under ideal and corrupted non band limited channels.	L3	PO1,PO2,PO3,PO4,PO5, PO6,PO8, PO10,PO11,PO12
CO3	Test and validate symbol processing and performance parameters at the receiver under ideal and corrupted band limited channels.	L3	PO1,PO2,PO3,PO4,PO5, PO6,PO8, PO10,PO11,PO12
CO4	Demonstrate by simulation and emulation that band pass signals subjected to corrupted and distorted symbols in a band limited channel, can be demodulated and estimated at receiver to meet specified performance criteria.	L3	PO1,PO2,PO3,PO4,PO5, PO6,PO8, PO10,PO11,PO12
CO5	Explain different spread spectrum modulation techniques.	L3	PO1,PO2,PO3,PO4,PO5, PO6,PO8, PO10,PO11,PO12
Total Hours of instruction		**50**	

4.0 Course Content

Course Content:

Module-1	RBT Level
Band pass Signal to Equivalent Low pass: Hilbert Transform, Pre- envelopes, Complex envelopes, Canonical representation of band pass signals, Complex low pass representation of band pass systems, Complex representation of band pass signals and systems (Text 1: 2.8, 2.9, 2.10, 2.11, 2.12, 2.13). **Line codes:** Unipolar, Polar, Bipolar (AMI) and Manchester code and their power spectral densities (Text 1: Ch 6.10). Overview of HDB3, B3ZS, B6ZS (Ref. 1: 7.2). **10Hours**	L1, L2, L3
Module-2	
Signaling over AWGN Channels- Introduction, Geometric representation of signals, Gram-Schmidt Orthogonalization procedure, Conversion of the continuous AWGN channel into a vector channel, Optimum receivers using coherent detection: ML Decoding, Correlation receiver, matched filter receiver (Text 1: 7.1, 7.2, 7.3, 7.4). **10Hours**	L1, L2, L3
Module-3	
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 (Relevant topics in Text 1 of 7.6, 7.7). Frequency shift keying techniques using Coherent detection: BFSK generation, detection and error probability (Relevant topics in Text 1 of 7.8). 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) (Text 1: 7.11, 7.12. 7.13). **10Hours**	L1, L2, L3

Module-4	
Communication through Band Limited Channels: Digital Transmission through Band limited channels: Digital PAM Transmission through Band limited Channels, Signal design for Band limited Channels: Design of band limited signals for zero ISI–The Nyquist Criterion (statement only), Design of band limited signals with controlled ISI-Partial Response signals, Probability of error for detection of Digital PAM: Probability of error for detection of Digital PAM with Zero ISI, Symbol–by–Symbol detection of data with controlled ISI (Text 2: 9.1, 9.2, 9.3.1, 9.3.2). Channel Equalization: Linear Equalizers (ZFE, MMSE), Adaptive Equalizers (Text 2: 9.4.2). **10Hours**	L1, L2, L3
Module-5	
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 (Text 2: 11.3.1, 11.3.2, 11.3.3, 11.3.4, 11.3.5, 11.4.2). **10Hours**	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.

Reference Books

1. Ian A Glover and Peter M Grant, "Digital Communications", Pearson Education, Third Edition, 2010, ISBN 978-0-273-71830-7.
2. B.P.Lathi and Zhi Ding, "Modern Digital and Analog communication Systems", Oxford University Press, 4th Edition, 2010, ISBN: 978-0-198-07380-2.

Additional Study material & e-Books

1. NPTEL notes and Videos
2. VTU online notes.

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

Internal Assessment: 30 Marks
Three IA will be conducted and average of best of two will be accounted.

Scheme of Evaluation for Internal Assessment (30 Marks)
(a) Internal Assessment test in the same pattern of the main examination.
(b) Assignment- 10Marks

SCHEME OF EXAMINATION:
Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 20marks**.**
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module
- The students will have to answer 5 full questions, selecting one full question from each module.

12.0 Course Delivery Plan

Course Delivery Plan:

MODULE	LECTURE NO.	CONTENT OF LECTURE	% OF PORTION
1	1	**Band pass signal to equivalent low pass**: Hilbert Transform, Pre-envelopes.	20
	2	Complex envelopes, Canonical representation of band pass signals.	
	3	Complex low pass representation of band-pass systems.	
	4	Complex representations of band pass signals and systems.	
	5	**Line codes:** Unipolar, Polar and problems.	
	6	Bipolar (AMI) and Manchester code and problems.	
	7	Power spectral density of Unipolar form.	
	8	Power spectral density of polar form.	
	9	Power spectral density of Bipolar (AMI) and Manchester code form.	
	10	Overview of HDB3, B3ZS, B6ZS.	40
2	11	Signaling over AWGN channels.	
	12	Detection and Estimation Introduction.	
	13	Geometric representation of signals.	
	14	Gram-Schmidt Orthogonalization procedure.	
	15	Problems on Gram-Schmidt Orthogonalization procedure.	
	16	Conversion of the continuous AWGN channel into a vector channel.	
	17	Optimum receivers using coherent detection	
	18	ML Decoding.	
	19	Correlation receiver.	
	20	Matched filter receiver.	

3	21	**Digital Modulation Techniques:** Digital modulation formats.	60
	22	Phase shift Keying techniques using coherent detection: BPSK, generation, and detection and Error probability.	
	23	Phase shift Keying techniques using coherent detection: QPSK generation, and detection and Error probability.	
	24	M-ary PSK, M-ary QAM.	
	25	**Frequency shift keying techniques using Coherent detection:** BFSK generation, detection.	
	26	BFSK error probability.	
	27	**Non coherent orthogonal modulation techniques:** BFSK.	
	28	DPSK Symbol representation.	
	29	Problems on DPSK.	
	30	DPSK Block diagrams treatment of Transmitter and Receiver, Probability of error (Without derivation)	
4	31	**Communication through Band Limited Channels:** Digital Transmission through Band limited channels.	80
	32	Inter Symbol Interference.	
	33	Eye diagrams.	
	34	Signal design for Band limited ideal channel with zero ISI.	
	35	Nyquist Criterion (statement only), Sinc and Raised pulse shaping.	
	36	Signal design for Band limited channel with controlled ISI.	
	37	Correlative coding, DB and MDB, Precoding.	
	38	Basic Concepts of Equalization for non ideal channels – ZFE.	
	39	MMSE, (without derivations).	
	40	Adaptive Equalizers (Block diagram only).	
5	41	**Principles of Spread Spectrum:** Concept of Spread Spectrum.	100
	42	Direct Sequence/SS, Frequency Hopped SS, Processing Gain.	
	43	Interference and probability of error statement only.	
	44	PN sequences for Spread Spectrum – M- sequences with Properties.	
	45	Problems on PN Sequence.	
	46	Gold, Kasami sequences with basic properties.	
	47	Direct sequence spread spectrum system concepts.	
	48	Frequency Hopped Spread spectrum system concepts.	
	49	Spread Spectrum Synchronization (block diagram treatment).	
	50	CDMA based on IS-95	

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 Band pass signal to equivalent low pass and Line codes.	Students study the Topics and write the Answers. Get practice to solve university questions.	Module 1 of the syllabus	2	Individual Activity. Printed solution expected.	Text Book 1, Reference book 1, 2 of the reference list. Website of the Reference list.
2	Assignment 2: University Questions on Detection and Estimation methods.	Students study the Topics and write the Answers. Get practice to solve university questions.	Module 2 of the syllabus	4	Individual Activity. Printed solution expected.	Text Book 1, of the reference list. Website of the Reference list.
3	Assignment 3: University Questions on digital modulation techniques.	Students study the Topics and write the Answers. Get practice to solve university questions.	Module 3 of the syllabus	5	Individual Activity. Printed solution expected.	Text Book 1, of the reference list. Website of the Reference list.
4	Assignment 4: University Questions on ISI, Eye diagrams and equalizers.	Students study the Topics and write the Answers. Get practice to solve university questions.	Module 4 of the syllabus	6	Individual Activity. Printed solution expected.	Text Book 2, Reference book 2 of the reference list. Website of the Reference list.
5	Assignment 5: University Questions on Spread spectrum modulation.	Students study the Topics and write the Answers. Get practice to solve university questions.	Module 5 of the syllabus	6	Individual Activity. Printed solution expected.	Text Book 2, of the reference list. Website of the Reference list.

14.0 University Result

Examination	FCD	FC	SC	% Passing
August-2021	**33**	**02**	**00**	**100**

Prepared by	Checked by		
Prof. S. S. Ittannavar	Dr. R. R. Maggavi	HOD	Principal

Subject Title	**Embedded Systems**		
Subject Code	18EC62	**IA Marks**	40
Number of Lecture Hrs / Week	05 L	**Exam Marks**	60
Total Number of Lecture Hrs	50	**Exam Hours**	03
			CREDITS – 04

FACULTY DETAILS:		
Name: Prof. Sachin S Patil	**Designation:** Asst. Professor	**Experience:** T-16.09, I-02.3Yrs
No. of times course taught: 05	**Specialization:** VLSI & Embedded System Design	

1.0 Prerequisite Subjects:

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

2.0 Course Objectives

1. Familiarize basic architecture of 32 bit ARM microcontroller.
2. Program ARM Cortex M3 Microcontroller using Assembly Level Language.
3. Use Exceptions and Interrupts in ARM Cortex M3 Microcontroller Programs.
4. Understand interfacing of ARM Cortex M3 Microcontroller with memory and peripheral chips involving system design.

3.0 Course Outcomes

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

	Course Outcome	**POs**
CO310.1	Describe the architectural features and instructions of 32 bit microcontroller ARM Cortex M3.	PO1-8,12
CO310.2	Apply the knowledge gained for Programming ARM Cortex M3 for different applications.	PO1-8,12
CO310.3	Understand the basic hardware components and their selection method based on the characteristics and attributes of an embedded system.	PO1-8,12
CO310.4	Develop the hardware /software co-design and firmware design approaches.	PO1-8,12
CO310.5	Explain the need of real time operating system for embedded system applications.	PO1-8,12
Total Hours of instruction		50

4.0 Course Content

Content	**RBT**
Module-1 **10Hours** **ARM-32 bit Microcontroller:** Thumb-2 technology and applications of ARM, Architecture of ARM Cortex M3, Various Units in the architecture, Debugging support, General Purpose Registers, Special Registers, exceptions, interrupts, stack operation, reset sequence (Text 1: Ch 1, 2, 3)	L1,L2

Module-2 **10Hours** **ARM Cortex M3 Instruction Sets and Programming:** Assembly basics, Instruction list and description, useful instructions, Assembly and C language Programming (Text 1: Ch-4, Ch-5, Ch-10 (10.1, 10.2, 10.3, 10.5 only))	L1,L2,L3
Module-3 **10Hours** **Embedded System Components:** Embedded Vs General computing system, Classification of Embedded systems, Major applications and purpose of ES. Core of an Embedded System including all types of processor /controller, Memory, Sensors, Actuators, LED, 7 segment LED display, Optocoupler, relay, Piezo buzzer, Push button switch, Communication Interface (onboard and external types), Embedded firmware, Other system components. (Text 2: All the Topics from Ch-2 and Ch-3, excluding 2.3 & 3.4 (stepper motor), 2.3 & 3.8 (keyboard) and 2.3 & 3.9 (PPI) sections).	L1,L2
Module-4 **10Hours** **Embedded System Design Concepts:** Characteristics and Quality Attributes of Embedded Systems, Operational and non-operational quality attributes, Embedded Systems-Application and Domain specific, Hardware Software Co-Design and Program Modelling (excluding UML), Embedded firmware design and development (excluding C language). (Text 2: Ch-3, Ch-4, Ch-7 (Sections 7.1, 7.2 only), Ch-9 (Sections 9.1, 9.2, 9.3.1, 9.3.2 only)	L1,L2,L3
Module-5 **10Hours** **RTOS and IDE for Embedded System Design:** Operating System basics, Types of operating systems, Task, process and threads (Only POSIX Threads with an example program), Thread preemption, Preemptive Task scheduling techniques, Task Communication, Task synchronization issues – Racing and Deadlock, Concept of Binary and counting semaphores (Mutex example without any program), How to choose an RTOS, Integration and testing of Embedded hardware and firmware, Embedded system Development Environment – Block diagram (excluding Keil), Disassembler/decompiler, simulator, emulator and debugging techniques (Text 2: Ch-10 (Sections 10.1, 10.2, 10.3, 10.5.2 , 10.7, 10.8.1.1, 10.8.1.2, 10.8.2.2, 10.10 only), Ch 12, Ch-13 (a block diagram before 13.1, 13.3, 13.4, 13.5, 13.6 only)	L1,L2,L3

5.0 Relevance to future subjects

Sl No	Semester	Subject	Topics
01	VIII	Project work	Microcontroller based projects
02	Higher	Embedded system	Design and Programming

6.0 Relevance to Real World

SL.No	Real World Mapping
01	Microcontroller based system design
02	Model creation for analysis
03	Development of a software applications

7.0 Gap Analysis and Mitigation

SL. No	Delivery Type	Details
01	Tutorial	Topic: ARM application development tutor
02	NPTEL	ARM Cortex M3 Microcontroller Application

8.0 Books Used and Recommended to Students

Text Books
1. Joseph Yiu, "The Definitive Guide to the ARM Cortex-M3", 2nd Edition, Newnes, (Elsevier), 2010.
2. Shibu K V, "Introduction to Embedded Systems", Tata McGraw Hill Education Private Limited, 2009
Reference Books
Additional Study material & e-Books
3. ARM Cortex M3 Microcontroller data sheet

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

Website and Internet Contents References
4) https://vtu.ac.in 5) http://www.bookspar.com/engineering-vtu 3) http://www.rejinpaul.com/2014/10/vtu-ece-notes-vtu-ece-1st-2nd-3rd-4th-5th-6th-7th-8th-semester-lecture-notes-download-link.htmlhttp://www.vlab.co.in/ 4) https://www.youtube.com

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

Scheme of Evaluation for Internal Assessment (30 Marks)
(c) Class work, Assignment, Technical quiz : 10Marks.
(d) Internal Assessment test Average of Three tests): 30marks.

SCHEME OF EXAMINATION:
Two questions to be set from each Module (Module1 to Module5).
Student has to answer one full question each from five modules 20 marks each of Total 100marks.

12.0 Course Delivery Plan

Module	Lecture No.	Content of Lecturer	% of Portion
Module 1:	1	**ARM-32 bit Microcontroller:** Thumb-2 technology and applications of ARM	20
	2	Architecture of ARM Cortex M3	
	3	Various Units in the architecture	
	4	Debugging support	
	5	General Purpose Registers	
	6	Special Registers	
	7	Exceptions	
	8	Interrupts	
	9	Stack operation	
	10	Reset sequence	

Module 2:	11	**ARM Cortex M3 Instruction Sets and Programming:** Assembly basics, , ,	40
	12	Assembly basics	
	13	Instruction list and description	
	14	Instruction list and description	
	15	Instruction list and description	
	16	useful instructions	
	17	useful instructions	
	18	Assembly and C language Programming	
	19	Assembly and C language Programming	
	20	Assembly and C language Programming	
Module 3:	21	**Embedded System Components:** Embedded Vs General computing system, Classification of Embedded systems	60
	22	Major applications and purpose of ES	
	23	Core of an Embedded System including all types of processor /controller	
	24	Memory, Sensors	
	25	Actuators, LED, 7 segment LED display	
	26	Opto-coupler, relay	
	27	Piezo buzzer	
	28	Push button switch	
	29	Communication Interface (onboard and external types),	
	30	Embedded firmware, Other system components	
Module 4:	31	**Embedded System Design Concepts:** Characteristics and Quality Attributes of Embedded Systems	80
	32	Characteristics and Quality Attributes of Embedded Systems	
	33	Operational and non-operational quality attributes	
	34	Operational and non-operational quality attributes	
	35	Embedded Systems-Application and Domain specific	
	36	Embedded Systems-Application and Domain specific	
	37	Hardware Software Co-Design and Program Modelling (excluding UML)	
	38	Hardware Software Co-Design and Program Modelling (excluding UML)	
	39	Embedded firmware design and development (excluding C language)	
	40	Embedded firmware design and development (excluding C language)	
Module 5:	41	**RTOS and IDE for Embedded System Design:** Operating System basics, Types of operating systems	100
	42	Task, process and threads (Only POSIX Threads with an example program)	
	43	Task Communication	
	44	Task synchronization issues – Racing and Deadlock	
	45	Concept of Binary and counting semaphores (Mutex example without any program)	
	46	How to choose an RTOS, Integration and testing of Embedded hardware and firmware	
	47	Embedded system Development Environment – Block diagram (excluding Keil),	
	48	Disassembler/decompiler	
	49	Simulator, emulator	
	50	Debugging techniques	

13.0 QUESTION BANK

Module I

1. What is the ARM Cortex-M3 processor?
2. Briefly explain the THUMB-2 technology.
3. List the Cortex-M3 processor applications.
4. What is built-in nested vectored interrupt controller?

5. Explain bus interface technique of Cortex-M3.
6. What are the advantages of using the Cortex-M3?
7. Explain in briefly Instruction set of ARM.
8. What is General purpose register? Explain GPRs of ARM Cortex-M3.
9. With brief explanation list the SFRs?
10. Write a note on Exceptions & Interrupts.
11. Describe the stack Memory operations.

Module II

12. Explain ARM Cortex-M3 assembly basics.
13. With example explain 16-bit branch instructions.
14. List 16-bit Data processing instructions.
15. Why is there Rotate right but no Rotate left?
16. Write note on a. MSR and MRS b. SDIV and UDIV c. UBFX and SBFX d. LDRD and STRD.
17. With Cortex-M3 predefined memory map diagram, explain memory systems.
18. What are Bit-band operations.
19. What is Endian mode?
20. With ARM development tools diagram explain Cortex-M3 programming flow.
21. Write a program to display "Hello World".
22. Write a program to control the speed and direction of stepper motor.

Module III

23. Explain the components of a typical embedded system in detail.
24. What is ASIC? Explain the role of ASIC in Embedded system Design?
25. What is the difference between Microprocessor and Microcontroller? Explain the role of Microprocessors and Microcontrollers in embedded system design?
26. What is the difference between RISC and CISC processors? Give an example for each.
27. What is the difference between: a. PLD and ASIC b. PROM and EPROM c. RAM and ROM.
28. What is sensor? Explain its role in embedded system design? Illustrate with example.
29. What is Actuator? Explain its role in embedded system design? Illustrate with example.
30. What is Embedded Firmware? What are the different approaches available for embedded firmware development?
31. Explain the difference between I2C and SPI communication Interface.
32. Compare the operation of ZigBee and Wi-Fi network.
33. Explain the role of watchdog timer in embedded system.

Module IV

34. Explain the different characteristics of embedded systems in detail.
35. What is operational quality attribute? Explain the important operational quality attributes to be considered in any embedded system design.
36. What is non-operational quality attribute? Explain the important non-operational quality attributes to be considered in any embedded system design.

37. Explain the significance of the quality attributes Testability and Debug-ability in the embedded system design context.
38. Explain Time-to-market? What is its significance in product development?
39. Explain the Product Life Cycle Curve of an embedded product development.
40. Explain the role of embedded system in automotive domain.
41. Explain the different communication buses used in automotive application.
42. What is hardware software co-design? Explain the fundamental issues in hardware software co-design
43. What is the difference between Data Flow Graph (DFG) and Control Data Flow Graph (CDFG) model? Explain their significance in embedded system design.
44. Explain the different ' embedded firmware design' approaches in detail.
45. Explain the format of assembly language instruction.
46. What is relocatable code? Explain its significance in assembly programming.
47. Explain the limitations/drawbacks of 'Assembly language' based Embedded firmware development.
48. What is the difference between: a) C Vs Embedded C b) Compiler Vs Cross Compiler.

Module V

49. Explain the various process interaction model in detail.
50. What is Inter Process Communication (IPC)? Give an overview of different IPC mechanisms adopted by various operating systems.

52. Explain Race Condition in detail. In relation to the shared resource access.
53. What is Deadlock? What are the different conditions favouring deadlock?
54. What is priority inversion? What are the different techniques adopted for handling priority inversion?
55. Explain the sleep & wakeup mechanism for mutual exclusion.
56. Explain the different functional and non-functional requirements that needs to be evaluated in the selection of an RTOS.
57. Explain the major drawbacks of Out-of Circuit programming.
58. What is the difference between In System Programming(ISP) and In Application Programming (IAP).
59. Explain the various elements of an Embedded system development.
60. Explain the role of Integrated Development Environment (IDE) for Embedded Software Development.
61. What is the difference between Simulator and Emulator.
62. What is ROM emulation? Explain In Circuit Emulator (ICE) based debugging in detail.

Examination	FCD	FC	SC	% Passing
July/Aug 2019	11	18	16	100
July/Aug 2020	28	7	0	100
July/Aug 2021	33	02	00	100

Prepared by	Checked by		
Prof. Sachin S Patil	Prof. P V Patil	HOD	Principal

Subject Title	**MICROWAVES AND ANTENNAS**		
Subject Code	**18EC63**	**CIE Marks**	**40**
Number of Lecture Hrs / Week	**03+02(tutorial)**	**SEE Marks**	**60**
Total Number of Lecture Hrs	**40(08Hrs/Module)**	**Exam Hours**	**03**
		CREDITS – 04	

FACULTY DETAILS:		
Name: Prof. S.S. Kamate	Designation: Asst. Professor	Experience: 19.5 years
No. of times course taught:02	Specialization: M. Tech.(Digital Electronics)	

1.0 Prerequisite Subjects:

Sl. No	Branch	Semester	Subject
01	ECE	V	Electromagnetic Waves
02	ECE	IV	Principles of Communication Systems

2.0 Course Objectives

The course objective is to make students of ECE branch of engineering to understand the fundamentals of Microwaves and Antennas for Communication Engineering Applications.

3.0 Course Outcomes

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

	Course Outcome	RBT Level	PO's
C312.1	Describe the use and advantages of microwave transmission	L1, L2	1,2,3,10,12
C312.2	Analyze various parameters related to microwave transmission lines and waveguide	L1, L2	1,2,3,10,12
C312.3	Identify microwave devices for several applications	L1,L2,L3	1,2,3,10,12
C312.4	Analyze various antenna parameters necessary for building an RF system	L1, L2, L3,	1,2,3,10,12
C312.5	Recommend various antenna configurations according to the applications	L1, L2, L3	1,2,3,10,12
Total Hours of instruction		50	

4.0 Course Content

Modules	Teaching Hours	Bloom's Taxonomy (RBT) level
Module 1	10	L1, L2
Microwave Tubes: Introduction, Reflex Klystron Oscillator, Mechanism of Oscillations, Modes of Oscillations, Mode Curve (Qualitative Analysis only). (Text 1: 9.1, 9.2.) Microwave Transmission Lines: Microwave Frequencies, Microwave devices, Microwave Systems, Transmission Line equations and solutions, Reflection Coefficient and Transmission Coefficient,		

Standing Wave and Standing Wave Ratio, Smith Chart, Single Stub matching. (Text 2: 0.1, 0.2, 0.3, 3.1, 3.2, 3.3, 3.5, 3.6 Except Double stub matching)		

Module -2	10	L1, L2
Microwave Network theory: Symmetrical Z and Y-Parameters for Reciprocal Networks, S matrix representation of Multi-Port Networks. (Text 1: 6.1, 6.2, 6.3) Microwave Passive Devices: Coaxial Connectors and Adapters, Attenuators, Phase Shifters, Waveguide Tees, Magic tees. (Text 1: 6.4.2, 6.4.14, 6.4.15, 6.4.16)		
Module-3	10	L1, L2, L3
Strip Lines: Introduction, Micro Strip lines, Parallel Strip lines, Coplanar Strip lines, Shielded Strip Lines. (Text 2: Chapter 11) Antenna Basics: Introduction, Basic Antenna Parameters, Patterns, Beam Area, Radiation Intensity, Beam Efficiency, Directivity and Gain, Antenna Apertures, Effective Height, Bandwidth, Radio Communication Link, Antenna Field Zones & Polarization. (Text 3: 2.1- 2.11, 2.13,2.15)		
Module-4	10	L1, L2, L3,
Point Sources and Arrays: Introduction, Point Sources, Power Patterns, Power Theorem, Radiation Intensity, Field Patterns, Phase Patterns, Arrays of Two Isotropic Point Sources, Pattern Multiplication, Linear Arrays of n Isotropic Point Sources of equal Amplitude and Spacing.(Text 3: 5.1 – 5.11, 5.13) Electric Dipoles: Introduction, Short Electric Dipole, Fields of a Short Dipole (General and Far Field Analyses), Radiation Resistance of a Short Dipole, Thin Linear Antenna (Field Analyses), Radiation Resistances of Lambda/2 Antenna. (Text 3: 6.1 -6.6)		
Module-5	10	L1, L2, L3
Loop and Horn Antenna: Introduction, Small loop, Comparison of Far fields of Small Loop and Short Dipole, The Loop Antenna General Case, Far field Patterns of Circular Loop Antenna with Uniform Current, Radiation Resistance of Loops, Directivity of Circular Loop Antennas with Uniform Current, Horn antennas Rectangular Horn Antennas.(Text 3: 7.1-7.8, 7.19, 7.20) Antenna Types: Helical Antenna, Helical Geometry, Practical Design Considerations of Helical Antenna, Yagi-Uda array, Parabola General Properties, Log Periodic Antenna. (Text 3: 8.3, 8.5, 8.8, 9.5, 11.7)		

5.0 Gap Analysis and Mitigation

Sl. No	Delivery Type	Details
01	Tutorial	Topic: Antenna Simulation using Software's

6.0 Books Used and Recommended to Students

Text Books
1. Microwave Engineering – Annapurna Das, Sisir K Das TMH Publication, 2nd, 2010.
2. Microwave Devices and circuits- Liao, Pearson Education.
3. Antennas and Wave Propagation, John D. Krauss, Ronald J Marhefka and Ahmad S Khan,4th Special Indian Edition , McGraw- Hill Education Pvt. Ltd., 2010.
Reference Books

1. Microwave Engineering – David M Pozar, John Wiley India Pvt. Ltd. 3rdEdn, 2008.
2. Microwave Engineering – Sushrut Das, Oxford Higher Education, 2ndEdn, 2015.
3. Antennas and Wave Propagation – Harish and Sachidananda: Oxford University, Press, 2007.

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

Website and Internet Contents References
6) *nptel.ac.in*
7) *VTU e-learning notes*

8.0 Magazines/Journals Used and Recommended to Students

Sl. No	Magazines/Journals	website
1	Microwave Devices	*www.ieee.org*

9.0 Examination Note

Internal Assessment: 40 Marks
Three IA will be conducted and average of best of two will be accounted.
Scheme of Evaluation for Internal Assessment (40 Marks)
(e) Internal Assessment test in the same pattern as the main examination.
SCHEME OF EXAMINATION:
Two questions will be set from the syllabus covered.
Student has to answer one full question from Q:1 or Q: 2 and Q:3 or Q: 4.
Question 1or 2 1x25 = 25Marks
Question 3or 4 1x25 = 25Marks
Total = 50Marks
INSTRUCTION FOR Microwave and Antenna (18EC63) EXAMINATION
1. Four full questions will be given which consists of a,b,c,d sub sections.
2. Students have to answer either Q :1 or 2 and Q 3 or 4 completely.

Reduce test marks to 30
Assignment Marks = 10Marks
Total Internal Marks = 30Marks + 10 Marks
SCHEME OF EXAMINATION: 100 Marks, scaled down to 60 in VTU result sheet.
The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

10.0 Course Delivery Plan

Module No.	Lecture No.	Content of Lecture	% of Portion
	1	Limitation of Conventional Tubes	
	2	Reflex Klystron Oscillator	

1	3	V-I Characteristics	20
	4	Microwave Frequencies and Devices	
	5	Transmission Line equations	
	6	Reflection and Transmission Coefficients	
	7	Standing Waves	
	8	Smith Charts	
	9	Single Stub Matching	
	10	Numerical Problems.	

2	11	Microwave Network Theory	40
	12	Z-Y Parameters, and 'S' Parameters	
	13	Multiport Networks	
	14	Co-Axial connectors and Adapters	
	15	Attenuators	
	16	Phase Shifters	
	17	Wave guide Tees-E plane Tee	
	18	H-Plane Tee	
	19	Magic Tees	
	20	Numerical Problems	
3	21	Strip Lines-Introduction	60
	22	Micro-strip Lines	
	23	Parallel Strip Lines	
	24	Co-Planar strip Lines	
	25	Shielded Strip Lines	
	26	Antenna Basics	
	27	Antenna Apertures	
	28	Radio Communication Links	
	29	Antenna Zones	
	30	Numerical Problems	
4	31	Point Sources-Introduction	80
	32	Power Pattern and Power Theorem	
	33	Field Patterns and Phase Patterns	
	34	Pattern Multiplication	
	35	Antenna Arrays of n isotropic sources	
	36	Short Electric Dipole	
	37	Field and Radiation Resistance	
	38	Thin Linear Antenna	
	39	Lambda by two Antenna (λ/2)	
	40	Radiation Resistance of λ/2 antenna	
5	41	Loop Antennas-Small Loop	100
	42	Loop and Short Dipole antenna comparison	
	43	Loop Antenna-General Case	
	44	Circular Loop	
	45	Horn Antenna	
	46	Helical Antenna	
	47	Yagi-Uda Antenna	
	48	Parabolic Antenna	
	49	Log-Periodic Antenna	
	50	Numerical Problems	

11.0 QUESTION BANK

Module – 1

1. Explain the Velocity Modulation in reflex klystron using Apple-Gate diagram.
2. Explain Mode characteristics of Reflex Klystron with suitable diagram.
3. Explain mode curve in reflex klystron.
4. A two cavity klystron operates at frequency 10GHz, with dc beam voltage 300V, repeller space 0.1cm for 7/4 mode. Calculate P_{Rmax} and corresponding repeller voltage for a beam current of 20mA.
5. Explain microwave system with neat diagram
6. List four applications of transmission line
7. Draw the elementary section of transmission line and determine the transmission line equations in general form.
   or
8. Derive the Voltage and Current equations for a general transmission line.
9. A transmission line has following parameters:
   R=2Ω/m G=0.5m℧/m f=1GHz
   L=8 nH/m C=0.23pF.
   Calculate a) Characteristic impedance b) Propogation constant
10. Explain Standing wave ratio of transmission line with relevant equations and sketches.
11. Explain the relation between the reflection coefficient and SWR with the curve.
12. A transmission line has a characteristic impedance of 50+j0.01Ω & is terminated in a load impedance of 73-j42.5Ω.Calculate
    a) Reflection coefficient b) Standing Wave ratio
13. Explain the construction and working of Smith Chart.
14. Explain steps involved in finding Vmax, Vmin, SWR from the smith chart
15. Explain single stub matching process with the help of smith chart with necessary steps
16. Explain different methods of impedance matching foe a transmission line.

Module-2

1. Explain the need of S- parameters
2. Show that impedance and admittance matrices are same for reciprocal network.
3. Explain the Scattering matrix and Scattering Parameters
4. Explain the properties of S-Parameters
5. Two transmission lines of characteristic impedance Z_1 & Z_2 are joined at plane PP'. Express S-parameters in terms of impedances.
6. What are Multi-Port network? Derive the 'S' matrix.
7. Explain the coaxial connectors and adaptors.
8. Explain variable phase shifter with relevant sketches.
9. Explain precision type variable attenuator.
10. Explain the working of Phase Shifters.
11. Draw the construction of E-Plane and H-Plane tee and derive the 'S' matrix for both.
12. A 20mW signal is fed into one of collinear port 1 of a lossless H-plane T-junction.Calculate the power delivered through each port when other ports are terminated in matched load.
13. Explain Magic –T and obtain it's S-Matrix for both the planes.

Module-3

1. Explain the construction and field pattern of micro-strip line.
2. Derive expression for characteristic impedance of micro-strip line.
3. Explain coplanar and shielded strip line.
4. Explain ohmic skin losses and radiation losses in micro-strip lines
5. Write a note on antenna field zones.
6. An antenna has field pattern given by $E(\theta)= \cos^2\theta$ for $0\leq \theta\leq \prod/2$. Find the beam area and directivity.
7. Explain the losses in microstrip lines

8.Explain various terms related to antenna
a) beam width b)Radiation pattern c) directivity d) Gain & efficiency.
9.The effective apertures of transmitting and receiving antennas in a communication system are $8\lambda^2$ and $12\lambda^2$ respectively. With a separation of 1.5km between them. The EM wave travelling with frequency of 6MHz and the total input power is 25KW. Find the power received by the antenna.
10. Draw a radio link & explain various blocks.
11. Explain with suitable diagram, the concept of antenna polarization.

Module -4

1.Derive an expression and draw field pattern for an array of 2 isotropic point sources with same amplitude and phase spaced λ/2 apart.
2.Show that the radiation resistance of dipole antenna is 73ohm.
3. A source has cosine intensity radiation pattern given by U= Umcosθ for $0\leq \theta\leq \prod/2$ and $0\leq Ø\leq 2\prod$. Find the total power directivity.
4.Derive an expression for the far field components of short dipole.
5.Explain the principle of pattern multiplication with an example
6. Define power theorem.
7.Obtain the field pattern for a linear uniform array of isotropic antennas, satisfy the following n=5, d=λ/2, δ= -dr

Module -5

1.Write short notes on
i) Yagi uda antenna ii) parabolic reflector
2. Derive the expression for strength Eθ and HØ in case of small loop.
3.Explain the working and design considerations of Log-periodic antenna.
4.A 16 turn helical beam antenna has a circumference of λ and turn spacing λ/4. Find i) HPBW
ii) axial ratio iii) directivity.
5.Obtain the expression for radiation resistance of loop antenna
6.Compare thefields of small loop and short electric dipole
7.Explain yagi-uda array with the help of diagram.
8.Draw the structure of pyramidal horn antenna. Use the principle of equality of path length and bring out the optimum horn dimensions.

12.0 University Result

Examination	S+	S	A	B	C	D	E	% Passing
July/August 2021	--	21	13	--	--	--	--	97.00

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

Subject Title	**Python Application Programming**		
Subject Code	18EC646	**IA Marks**	40
Number of Lecture Hrs / Week	03 L	**Exam Marks**	60
Total Number of Lecture Hrs	40	**Exam Hours**	03

FACULTY DETAILS:		
Name: Prof. P.V.PATIL	**Designation:** Assistant Professor	**Experience:** 9.6 yrs
No. of times course taught:02	**Specialization:** VLSI Design &Embedded Systems	

1.0 Prerequisite Subjects:

Sl. No	Branch	Semester	Subject
01	ECE	I/II	Programming in C

2.0 Course Objectives

6. This course will enable students to Learn syntax and semantics and create Functions in Python.
7. This course will enable students to Handle Strings and Files in Python.
8. This course will enable students to Understands Lists, Dictionaries and regular expression in python.
9. This course will enable students to Implement object oriented programming concepts in Python
10. This course will enable students to Build web services, network and database program in Python.

3.0 Course Outcomes

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

	Course Outcome	RBT Level	POs
CO1	Examine Python syntax and semantics and be fluent in the use of python flow control and functions.	L3	PO1,PO2,PO3,PO4,PO5, PO6,PO8, PO10,PO11,PO12
CO2	Demonstrate proficiency in handling strings and File systems.	L3	PO1,PO2,PO3,PO4,PO5, PO6,PO8, PO10,PO11,PO12
CO3	Create run and manipulate Python programs using core data structures like Lists, Dictionaries and use regular expressions.	L3	PO1,PO2,PO3,PO4,PO5, PO6,PO8, PO10,PO11,PO12
CO4	Interpret the concepts of object oriented programming as used in python.	L3	PO1,PO2,PO3,PO4,PO5, PO6,PO8, PO10,PO11,PO12
CO5	Implement exemplary applications related to Network programming ,web services and database in python.	L3	PO1,PO2,PO3,PO4,PO5, PO6,PO8, PO10,PO11,PO12

Total Hours of instruction	40

4.0 Course Content

Course Content:

Module-1	RBT Level
Why should you learn to write programs, Variables, Expressions and statements, Conditional Execution, Functions 08 Hours	L1, L2, L3
Module-2	
Iteration , Strings , Files 08Hours	L1, L2, L3
Module-3	
Lists, Dictionaries, Tuples, Regular Expressions 08Hours	L1, L2, L3

Module-4	
Classes and Objects, Classes and Functions, Classes and Methods 08Hours	L1, L2, L3
Module-5	
Networked programs, Using Web services, Using Databases and SQL 08Hours	L1, L2, L3

5.0 Relevance to future subjects

Sl No	Semester	Subject	Topics
01	VIII	Project work	Embedded system

6.0 Relevance to Real World

SL. No	Real World Mapping
01	To design the most of the embedded systems

7.0 Gap Analysis and Mitigation

Sl. No	Delivery Type	Details
01	Tutorial	Python institute organization
02	NPTEL	Course: The joy of Python computing using Python

8.0 Books Used and Recommended to Students

Text Books

1. **Charles R. Severance, Python for Everybody: Exploring Data Using Python 3, 1 Edition, Create Space Independent Publishing Platform, 2016 (Chapters 1 – 13, 15).**
2. **Allen B. Downey, "Think Python: How to Think Like a Computer Scientist, 2ndEdition, Green Tea Press, 2015 (Chapters 15,16,17)**

Reference Books

1. Mark Lutz, "Programming Python", 4th Edition, O'Reilly Media, 2011.ISBN-13: 978-9350232873. 2. Wesley J Chun, "Core Python Applications Programming", 3rd Edition, Pearson Education India, 2015. ISBN-13: 978-9332555365. 3.

Reema Thareja, "Python Programming using problem solving approach", Oxford university press, 2017
Additional Study material & e-Books
4. NPTEL notes and Videos 5. VTU online notes.

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

Website and Internet Contents References
8) https://www.azdocuments.in/2021/05/python-application-programming-18ec646.html 9) https://www.vtupulse.com/cbcs-cse-notes/python-application-programming-17cs664-vtu-cbcs-notes

10.0 Magazines/Journals Used and Recommended to Students

Sl. No	Magazines/Journals	website
1	Python-Complete manual	https://www.magzter.com/GB/Papercut-Ltd/Python---Complete Manual/Technology/
2	Python-News and Articles	https://www.adminmagazine.com/tags/view/Programming/Python

11.0 Examination Note

Internal Assessment: 40 Marks
Three IA will be conducted and average of best of two will be accounted.

Scheme of Evaluation for Internal Assessment (30 Marks)
(f) Internal Assessment test in the same pattern of the main examination.
(g) Assignment- 10Marks

SCHEME OF EXAMINATION:
Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 20marks**.**
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module
- The students will have to answer 5 full questions, selecting one full question from each module.

12.0 Course Delivery Plan

Course Delivery Plan:

MODULE	LECTURE NO.	CONTENT OF LECTURE	% OF PORTION
1	1	Introduction to C programming	20
	2	Why should you learn to write programs	
	3	Variables	
	4	Expressions	

	5	statements	
	6	Conditional Execution	
	7	Functions	
	8	Related Programs	

2	9	Iteration	40
	10	Examples on Iterations	
	11	Iteration implementation programs	
	12	Strings	
	13	Examples on Strings	
	14	Strings implementation programs	
	15	Files	
	16	Files Example & implementation programs	
3	17	Lists	60
	18	Lists Example	
	19	Dictionaries	
	20	Dictionaries Example programs	
	21	Tuples	
	22	Tuples Example programs	
	23	Regular Expressions	
	24	Regular Expressions Example programs	
4	25	Classes and Objects	80
	26	Classes and Objects Example programs	
	27	Classes and Functions	
	28	Classes and Functions Example programs	
	29	Classes and Methods	
	30	Classes and Methods Example programs	
	31	Programs	
	32	Applications problems	
5	33	Networked programs	100
	34	Networked programs Example programs	
	35	Using Web services	
	36	Using Web services Example programs	
	37	Using Databases	
	38	Using Databases Example programs	
	39	Using SQL	
	40	Using SQL Example programs	

13.0 QUESTION BANK

Module I

1: What is the function of the secondary memory in a computer?
a) Execute all of the computation and logic of the program
b) Retrieve web pages over the Internet
c) Store information for the long term, even beyond a power cycle
d) Take input from the user

2: What is a program?

3: What is the difference between a compiler and an interpreter?

4: Which of the following contains "machine code"?
a) The Python interpreter
b) The keyboard
c) Python source file
d) A word processing document

5: What is wrong with the following code:

```
>>> primt 'Hello world!'
File "<stdin>", line 1
primt 'Hello world!'
^
SyntaxError: invalid syntax
>>>
```

6: Where in the computer is a variable such as "x" stored after the following Python line finishes?
x = 123
a) Central processing unit
b) Main Memory
c) Secondary Memory
d) Input Devices
e) Output Devices

7: What will the following program print out:
x = 43
x = x + 1
print(x)
a) 43
b) 44
c) x + 1
d) Error because x = x + 1 is not possible mathematically

8: Explain each of the following using an example of a hu- man capability: (1) Central processing unit, (2) Main Memory, (3) Secondary Memory, (4) Input Device, and (5) Output Device. For ex- ample, "What is the human equivalent to a Central Processing Unit"?

9: How do you fix a "Syntax Error"?

10: Write a program that uses input to prompt a user for their name and then welcomes them.
Enter your name: Chuck
Hello Chuck

11: Write a program to prompt the user for hours and rate per hour to compute gross pay.
Enter Hours: 35
Enter Rate: 2.75
Pay: 96.25
We won't worry about making sure our pay has exactly two digits after the decimal place for now. If you want, you can play with the built-in Python round function to properly round the resulting pay to two decimal places.

12: Assume that we execute the following assignment statements:
width = 17
height = 12.0
For each of the following expressions, write the value of the expression and the type (of the value of the expression).
1. width//2
2. width/2.0
3. height/3
4. 1 + 2 * 5
Use the Python interpreter to check your answers.

13: Write a program which prompts the user for a Celsius temperature, convert the temperature to Fahrenheit, and print out the converted temperature.

14: Rewrite your pay computation to give the employee 1.5 times the hourly rate for hours worked above 40 hours.
Enter Hours: 45
Enter Rate: 10
Pay: 475.0

15: Rewrite your pay program using try and except so that your program handles non-numeric input gracefully by printing a message and exiting the program. The following shows two executions of the program:
Enter Hours: 20
Enter Rate: nine
Error, please enter numeric input
Enter Hours: forty
Error, please enter numeric input

16: Write a program to prompt for a score between 0.0 and 1.0. If the score is out of range, print an error message. If the score is between 0.0 and 1.0, print a grade using the following table:

Score Grade

>= 0.9 A
>= 0.8 B
>= 0.7 C
>= 0.6 D
< 0.6 F

Enter score: 0.95
A
Enter score: perfect
Bad score
Enter score: 10.0
Bad score
Enter score: 0.75
C
Enter score: 0.5
F
Run the program repeatedly as shown above to test the various different values for

input.

17: What is the purpose of the "def" keyword in Python?
a) It is slang that means "the following code is really cool"
b) It indicates the start of a function
c) It indicates that the following indented section of code is to be stored for later
d) b and c are both true
e) None of the above

18: What will the following Python program print out?
```
def fred():
print("Zap")
def jane():
print("ABC")
jane()
fred()
jane()
```
a) Zap ABC jane fred jane
b) Zap ABC Zap
c) ABC Zap jane
d) ABC Zap ABC
e) Zap Zap Zap

19: Rewrite your pay computation with time-and-a-half for over- time and create a function called computepay which takes two parameters (hours and rate).
Enter Hours: 45
Enter Rate: 10
Pay: 475.0

20: Rewrite the grade program from the previous chapter using a function called computegrade that takes a score as its parameter and returns a grade as a string.
Score Grade
>= 0.9 A
>= 0.8 B
>= 0.7 C
>= 0.6 D
< 0.6 F
Enter score: 0.95
A
Enter score: perfect
Bad score

Enter score: 10.0
Bad score
Enter score: 0.75
C
Enter score: 0.5
F
Run the program repeatedly to test the various different values for input.

Module II

1: Write a program which repeatedly reads numbers until the user enters "done". Once "done" is entered, print out the total, count, and average of the numbers. If the user enters anything other than a number, detect their mistake using try and except and print an error message and skip to the next number.
Enter a number: 4
Enter a number: 5
Enter a number: bad data
Invalid input
Enter a number: 7

Enter a number: done
16 3 5.333333333333333

2: Write another program that prompts for a list of numbers as above and at the end prints out both the maximum and minimum of the numbers instead of the average.

3: Take the following Python code that stores a string: str = 'X-DSPAM-Confidence:**0.8475**' **Use find and string slicing to extract the portion of the string after the colon character and then use the float function to convert the extracted string into a floating point number.**

4: Read the documentation of the string methods at https://docs.python.org/library/stdtypes.html#string-methods You might want to experiment with some of them to make sure you understand how they work. strip and replace are particularly useful. The documentation uses a syntax that might be confusing. For example, in find(sub[, start[, end]]), the brackets indicate optional arguments. So sub is required, but start is optional, and if you include start, then end is optional.

5: Write a program to read through a file and print the contents of the file (line by line) all in upper case. Executing the program will look as follows:
python shout.py
Enter a file name: mbox-short.txt
FROM STEPHEN.MARQUARD@UCT.AC.ZA SAT JAN 5 09:14:16 2008
RETURN-PATH: <POSTMASTER@COLLAB.SAKAIPROJECT.ORG>
RECEIVED: FROM MURDER (MAIL.UMICH.EDU [141.211.14.90])
BY FRANKENSTEIN.MAIL.UMICH.EDU (CYRUS V2.3.8) WITH LMTPA;
SAT, 05 JAN 2008 09:14:16 -0500

6: Write a program to prompt for a file name, and then read through the file and look for lines of the form: X- DSPAM-Confidence: 0.8475 **When you encounter a line that starts with "X-DSPAM-Confidence:"pull apart the line to extract the floating-point number on the line. Count these lines and then compute the total of the spam confidence values from these lines. When you reach the end of the file, print out the average spam confidence.**
Enter the file name: mbox.txt
Average spam confidence: 0.894128046745
Enter the file name: mbox-short.txt
Average spam confidence: 0.750718518519
Test your file on the *mbox.txt* and *mbox-short.txt* files.

7: Sometimes when programmers get bored or want to have a bit of fun, they add a harmless *Easter Egg* to their program. Modify the program that prompts the user for the file name so that it prints a funny message when the user types in the exact file name "na na boo boo". The program should behave normally for all other files which exist and don't exist. Here is a sample execution of the program:
python egg.py
Enter the file name: mbox.txt
There were 1797 subject lines in mbox.txt
python egg.py
Enter the file name: missing.tyxt
File cannot be opened: missing.tyxt
python egg.py
Enter the file name: na na boo boo
NA NA BOO BOO TO YOU - You have been punk'd!
We are not encouraging you to put Easter Eggs in your programs; this is just an exercise.

Module III

1: Find all unique words in a file Shakespeare used over 20,000 words in his works. But how would you determine that? How would you produce the list of all the words that Shakespeare used? Would you download all his work, read it and track all unique words by hand? Let's use Python to achieve that instead. List all unique words, sorted in alphabetical order, that are stored in a file romeo.txt containing a subset of Shakespeare's work. Create a list of unique words, which will contain the final result. Write a program to open the file romeo.txt and read it line by line. For each line, split the line into a list of words using

the split function. Foreach word, check to see if the word is already in the list of unique words. If the word is not in the list of unique words, add it to the list. When the program completes, sort and print the list of unique words in alphabetical order.
Enter file: romeo.txt
['Arise', 'But', 'It', 'Juliet', 'Who', 'already', 'and', 'breaks', 'east', 'envious', 'fair', 'grief', 'is', 'kill', 'light', 'moon', 'pale', 'sick', 'soft', 'sun', 'the', 'through', 'what', 'window', 'with', 'yonder']

2: Minimalist Email Client. MBOX (mail box) is a popular file format to store and share a collection of emails. This was used by early email servers and desktop apps. Without getting into too many details, MBOX is a text file, which stores emails consecutively. Emails are separated by a special line which starts with From (notice the space). Importantly, lines starting with From: (notice the colon) describes the email itself and does not act as a separator. Imagine you wrote a minimalist email app, that lists the email of the senders in the user's Inbox and counts the number of emails. Write a program to read through the mail box data and when you find line that starts with "From", you will split the line into words using the split function. We are interested in who sent the message, which is the second word on the From line.

3: Rewrite the program that prompts the user for a list of numbers and prints out the maximum and minimum of the numbers at the end when the user enters "done". Write the program to store the numbers the user enters in a list and use the max() and min() functions to compute the maximum and minimum numbers after the loop completes.
Enter a number: 6
Enter a number: 2
Enter a number: 9
Enter a number: 3
Enter a number: 5
Enter a number: done
Maximum: 9.0
Minimum: 2.0

4: Write a program that categorizes each mail message by which day of the week the commit was done. To do this look for lines that start with "From", then look for the third word and keep a running count of each of the days of the week. At the end of the program print out the contents of your dictionary (order does not matter). Sample Line:
From stephen.marquard@uct.ac.za Sat Jan 5 09:14:16 2008
Sample Execution:
python dow.py
Enter a file name: mbox-short.txt
{'Fri': 20, 'Thu': 6, 'Sat': 1}

5: Write a program to read through a mail log, build a histogram using a dictionary to count how many messages have come from each email address, and print the dictionary.
Enter file name: mbox-short.txt
{'gopal.ramasammycook@gmail.com': 1, 'louis@media.berkeley.edu': 3,
'cwen@iupui.edu': 5, 'antranig@caret.cam.ac.uk': 1,
'rjlowe@iupui.edu': 2, 'gsilver@umich.edu': 3,
'david.horwitz@uct.ac.za': 4, 'wagnermr@iupui.edu': 1,
'zqian@umich.edu': 4, 'stephen.marquard@uct.ac.za': 2,
'ray@media.berkeley.edu': 1}

6: Add code to the above program to figure out who has the most messages in the file. After all the data has been read and the dictionary has been created, look through the dictionary using a maximum loop (see Chapter 5: Maximum and minimum loops) to find who has the most messages and print how many messages the person has.
Enter a file name: mbox-short.txt
cwen@iupui.edu 5
Enter a file name: mbox.txt
zqian@umich.edu 195

7: This program records the domain name (instead of the address) where the message was sent from instead of who the mail came from (i.e., the whole email address). At the end of the program, print out the contents of your dictionary.
python schoolcount.py
Enter a file name: mbox-short.txt
{'media.berkeley.edu': 4, 'uct.ac.za': 6, 'umich.edu': 7,

'gmail.com': 1, 'caret.cam.ac.uk': 1, 'iupui.edu': 8}

8: Revise a previous program as follows: Read and parse the "From" lines and pull out the addresses from the line. Count the number of messages from each person using a dictionary. After all the data has been read, print the person with the most commits by creating a list of (count, email) tuples from the dictionary. Then sort the list in reverse order and print out the person who has the most commits.
Sample Line:
From stephen.marquard@uct.ac.za Sat Jan 5 09:14:16 2008
Enter a file name: mbox-short.txt
cwen@iupui.edu 5
Enter a file name: mbox.txt
zqian@umich.edu 195

9: This program counts the distribution of the hour of the day for each of the messages. You can pull the hour from the "From" line by finding the time string and then splitting that string into parts using the colon character. Once you have accumulated the counts for each hour, print out the counts, one per line, sorted by hour as shown below. python timeofday.py
Enter a file name: mbox-short.txt
04 3
06 1
07 1
09 2
10 3
11 6
14 1
15 2
16 4
17 2
18 1
19 1

10: Write a program that reads a file and prints the *letters* in decreasing order of frequency. Your program should convert all the input to lower case and only count the letters a-z. Your program should not count spaces, digits, punctuation, or anything other than the letters a-z. Find text samples from several different languages and see how letter frequency varies between languages.

11: regular expression A language for expressing more complex search strings. A regular expression may contain special characters that indicate that a search only matches at the beginning or end of a line or many other similar capabilities. wild card A special character that matches any character. In regular expressions the wild-card character is the period.

12: Write a simple program to simulate the operation of the grep command on Unix. Ask the user to enter a regular expression and count the number of lines that matched the regular expression:
$ python grep.py
Enter a regular expression: ^Author
mbox.txt had 1798 lines that matched ^Author
$ python grep.py
Enter a regular expression: ^Xmbox.
txt had 14368 lines that matched ^X-
$ python grep.py
Enter a regular expression: java$
mbox.txt had 4175 lines that matched java$

13: Write a program to look for lines of the form:
New Revision: 39772
Extract the number from each of the lines using a regular expression and the findall() method. Compute the average of the numbers and print out the average as an integer.

Enter file:mbox.txt
38549
Enter file:mbox-short.txt
39756

Module IV

1. Explain what are Classes & Objects
2. Explain what are Classes & Objects programs in detail.
3. Explain what are Classes & Functions
4. Explain what are Classes & Functions programs in detail.
5. Explain what are Classes & methods
6. Explain what are Classes & methods programs in detail.

Module V

1: Change the socket program socket1.py to prompt the user for the URL so it can read any web page. You can use split('/') to break the URL into its component parts so you can extract the host name for the socket connect call. Add error checking using try and except to handle the condition where the user enters an improperly formatted or nonexistent URL.

2: Change your socket program so that it counts the number of characters it has received and stops displaying any text after it has shown 3000 characters. The program should retrieve the entire document and count the total number of characters and display the count of the number of characters at the end of the document.

3: Use urllib to replicate the previous exercise of (1) retrieving the document from a URL, (2) displaying up to 3000 characters, and (3) counting the overall number of characters in the document. Don't worry about the headers for this exercise, simply show the first 3000 characters of the document contents.

4: Change the urllinks.py program to extract and count paragraph (p) tags from the retrieved HTML document and display the count of the paragraphs as the output of your program. Do not display the paragraph text, only count them. Test your program on several small web pages as well as some larger web pages.

5: (Advanced) Change the socket program so that it only shows data after the headers and a blank line have been received. Remember that recv receives characters (newlines and all), not lines.

13.0 University Result

Examination	FCD	FC	SC	% Passing
First time Introduced No exam Previous	3	17	-	100

Prepared by	Checked by		
Prof. P.V.Patil	Dr.R.R.Maggavi	HOD	Principal

Subject Title	PROGRAMMING IN JAVA		
Subject Code	18CS653	IA Marks	40
Number of Lecture Hrs / Week	03	Exam Marks	60
Total Number of Lecture Hrs	40	Exam Hours	03
CREDITS – 04			

FACULTY DETAILS:		
Name: Prof. P.G Patil	**Designation:** Asst. Professor	**Experience:**09 Years
No. of times course taught:00	**Specialization:** Computer Science and Engineering	

1.0 Prerequisite Subjects:

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

2.0 Course Objectives

This course will enable students to

1. Learn fundamental features of object oriented language and JAVA.
2. Set up Java JDK environment to create, debug and run simple Java programs.
3. Learn object oriented concepts using programming examples.
4. Study the concepts of importing of packages and exception handling mechanism.
5. Discuss the String Handling examples with Object Oriented concepts

3.0 Course Outcomes

After studying this course, students will be able to

CO	Course Outcome	RBT Level	POs
C320.1	Explain the object-oriented concepts and JAVA.	L1, L2	1,2,3,8,10,12
C320.2	Develop computer programs to solve real world problems in Java.	L1, L2	1,2,3,8,10,12
C320.3	Develop simple GUI interfaces for a computer program to interact with users.	L1, L2	1,2,3,8,10,12
Total Hours of instruction		**50**	

4.0 Course Content

Module 1 **(8 Hours)**

An Overview of Java: Object-Oriented Programming, A First Simple Program, A Second Short Program, Two Control Statements, Using Blocks of Code, Lexical Issues, The Java Class Libraries, Data Types, Variables, and **Arrays:** Java Is a Strongly Typed Language, The Primitive Types, Integers, Floating-Point Types, Characters, Booleans, A Closer Look at Literals, Variables, Type Conversion and Casting, Automatic Type Promotion in Expressions, Arrays, A Few Words About Strings

Module 2 **(8Hours)**

Operators: Arithmetic Operators, The Bitwise Operators, Relational Operators, Boolean Logical Operators, The Assignment Operator, The ? Operator, Operator Precedence, Using Parentheses, **Control Statements:** Java" s Selection Statements, Iteration Statements, Jump Statements.

Module 3 **(8 Hours)**

Introducing Classes: Class Fundamentals, Declaring Objects, Assigning Object Reference Variables, Introducing Methods, Constructors, The this Keyword, Garbage Collection, The finalize( ) Method, A Stack Class, **A Closer Look at Methods and Classes:** Overloading Methods, Using Objects as Parameters, A Closer Look at Argument Passing, Returning Objects, Recursion, Introducing Access Control, Understanding static, Introducing final, Arrays Revisited, **Inheritance:** Inheritance, Using super, Creating a Multilevel Hierarchy, When Constructors Are Called, Method Overriding, Dynamic Method Dispatch, Using Abstract Classes, Using final with Inheritance, The Object Class.

Module 4 **(8 Hours)**

Packages and Interfaces: Packages, Access Protection, Importing Packages, Interfaces, **Exception Handling:** Exception-Handling Fundamentals, Exception Types, Uncaught Exceptions, Using try and catch, Multiple catch Clauses, Nested try Statements, throw, throws, finally, Java's Built-in Exceptions, Creating Your Own Exception Subclasses, Chained Exceptions, Using Exceptions.

(8 Hours)

Enumerations, Type Wrappers, I/O, Applets, and Other Topics: I/O Basics, Reading Console Input, Writing Console Output, The PrintWriter Class, Reading and Writing Files, Applet Fundamentals, The transient and volatile Modifiers, Using instanceof, strictfp, Native Methods, Using assert, Static Import, Invoking Overloaded Constructors Through this( ), **String Handling:** The String Constructors, String Length, Special String Operations, Character Extraction, String Comparison, Searching Strings, Modifying a String, Data Conversion Using valueOf( ), Changing the Case of Characters Within a String , Additional String Methods, StringBuffer, StringBuilder.

5.0 Relevance to future subjects

Sl No	Semester	Subject	Topics
01	VIII	Project work	Java

6.0 Relevance to Real World

SL.No	Real World Mapping
01	Development of a software applications

7.0 Gap Analysis and Mitigation

Sl. No	Delivery Type	Details
01	Tutorial	
02	NPTEL	

8.0 Books Used and Recommended to Students

Text Books
1. Herbert Schildt, Java The Complete Reference, 7th Edition, Tata McGraw Hill, 2007. (Chapters 2, 3, 4, 5, 6,7, 8, 9,10, 12,13,15)
Reference Books
1. Cay S Horstmann, "Core Java - Vol. 1 Fundamentals", Pearson Education, 10th Edition, 2016. 2. Raoul-Gabriel Urma, Mario Fusco, Alan Mycroft, "Java 8 in Action", Dreamtech Press/Manning Press, 1st Edition, 2014.
Additional Study material & e-Books
6. Programming in Java by Balguruswamy

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

Website and Internet Contents References
1. www.nptelvideos.com/**java**/**java**_video_lectures_tutorials.php 2. https://www.cse.**iit**b.ac.in/~nlp-ai/**java**lect_august2004.html 3. www.nptel.ac.in/courses/106105084/28

10.0 Magazines/Journals Used and Recommended to Students

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

11.0 Examination Note

Internal Assessment: 30+10=40 Marks

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

Scheme of Evaluation for Internal Assessment (30 Marks)

a) Internal Assessment test in the same pattern as that of the main examination (Average of the three Tests): 30marks.

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

Question Paper Pattern (IA):

1. Two main questions to be set from syllabus covered up to IA tests.
2. Student has to answer two full main questions and each question carries 15 marks, Total test marks are 30.
   a. Q.No I or Q.No II = 15 Marks
   b. Q.No III or Q.No IV = 15 Marks
   c. Total = 30 Marks

Question Paper Pattern and instructions (Main Exam):

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

12.0 Course Delivery Plan

Module	Lecture No.	Content of Lecturer	% of Portion
MODULE 1	1	Object-Oriented Programming, A First Simple Program, A Second Short Program,	20%
	2	Two Control Statements, Using Blocks of Code, Lexical Issues,	
	3	The Java Class Libraries, Data Types, Variables,	
	4	Arrays: Java Is a Strongly Typed Language, The Primitive Types, Integers	
	5	Floating-Point Types, Characters, Booleans, A Closer Look at Literals,	

	6	Variables, Type Conversion and Casting, Automatic Type Promotion in Expressions,	
	7	Arrays	
	8	A Few Words About Strings	
MODULE 2	9	Operators: Arithmetic Operators	20%
	10	The Bitwise Operators,	
	11	Relational Operators, Boolean Logical Operators	
	12	The Assignment Operator, The ? Operator	
	13	Operator Precedence, Using Parentheses	
	14	Control Statements: Java's Selection Statements	
	15	Iteration Statements	
	16	Jump Statements.	
MODULE 3	17	Introducing Classes: Class Fundamentals, Declaring Objects, Assigning Object Reference Variables,	20%
	18	Introducing Methods, Constructors, The this Keyword,	
	19	Garbage Collection, The finalize( ) Method, A Stack Class,	
	20	A Closer Look at Methods and Classes: Overloading Methods, Using Objects as Parameters, A Closer Look at Argument Passing, Returning Objects,	
	21	Recursion, Introducing Access Control, Understanding static, Introducing final	
	22	Arrays Revisited, Inheritance: Inheritance, Using super, Creating a Multilevel Hierarchy	
	23	When Constructors Are Called, Method Overriding, Dynamic Method Dispatch	
	24	Using Abstract Classes, Using final with Inheritance, The Object Class.	
MODULE 4	25	Packages, Access Protection, Importing Packages,	20%
	26	Interfaces,	
	27	Exception Handling: Exception-Handling Fundamentals, Exception Types, ,	
	28	Uncaught Exceptions, Using try and catch, Multiple catch Clauses,	
	29	Nested try Statements, throw, throws,	
	30	finally, Java's Built-in Exceptions,	
	31	Creating Your Own Exception Subclasses	
	32	Chained Exceptions, Using Exceptions.	
MODULE 5	33	I/O Basics, Reading Console Input, Writing Console Output,	20%
	34	The PrintWriter Class, Reading and Writing Files, Applet Fundamentals,	
	35	The transient and volatile Modifiers, Using instanceof, strictfp, Native Methods	
	36	Using assert, Static Import, Invoking Overloaded Constructors Through this( )	
	37	String Handling: The String Constructors, String Length, Special String Operations,	
	38	Character Extraction, String Comparison, Searching Strings	
	39	Modifying a String, Data Conversion Using valueOf( ), Changing the Case of Characters Within a String	
	40	Additional String Methods, StringBuffer, StringBuilder.	

13.0 Assignments, Pop Quiz, Mini Project, Seminars

Sl. No.	Title	Outcome expected	Allied study	Week No.	Individual / Group activity	Reference: book/website

						/Paper
1	Assignment 1: Some important University Questions on Module one.	Students study the Topics and write the Answers. Get practice to solve questions	Module one of the syllabus	3	Individual Activity. Witten solutions expected.	Text book
2	Assignment 2: Some important University Questions on Module two	Students study the Topics and write the Answers. Get practice to solve questions	Module two of the syllabus	6	Individual Activity. Witten solutions expected.	Text book
3	Assignment 3: Some important University Questions on module three.	Students study the Topics and write the Answers. Get practice to solve questions	Module three of the syllabus	9	Individual Activity. Witten solutions expected.	Text book
4	Assignment 4: Some important University Questions on and comprehensive questions module four.	Students study the Topics and write the Answers. Get practice to solve questions	Module four of the syllabus	11	Group Activity power point presentation	Text book and reference books
5	Assignment 5: Some important University Questions on and comprehensive questions module five.	Students study the Topics and write the Answers. Get practice to solve questions	Module five of the syllabus	13	Group Activity power point presentation	Text book and reference books

14.0 QUESTION BANK

Module 1:

1. Explain the features of Java.
2. Elucidate how Java is a platform independent language, with neat sketches
3. List and explain Java buzzwords.
4. Explain the process of creating and running Java programs.
5. Explain the structure of a Java program and its keywords with an example.
6. Write & demonstrate a Java program to initialize & display different types of integers & floating type variable.
7. Explain different access specifiers in Java & their scope.
8. Define type casting. Explain with an example.
9. Explain type conversion, with an example.
10. What is type casting? Illustrate with an example. What is meant by automatic type promotion?
11. How arrays are defined in Java? Explain with an example.

Module 2:

1. Discuss operators in Java.
2. What is jump statement? Explain with examples.
3. Explain : i) >>> ii)short circuit logical operators iii) for each
4. With an example explain the working of >> and >>> (unsigned right shift)
5. Write a Java program to print factorial of the number ‘n’ using for loop.
6. Write a program to calculate the average among the elements {8, 6, 2, 7} using for each in Java. How for each is different from for loop?
7. Write a Java program to sum only the first five elements of the array {1,2,3,4,5,6,7,8,9,10} using for each version of the for loop.
8. Write java program to sum only first five elements of the array using for each looping.
9. Explain the operation of the following operators with example. i) % ii) > > > iii) &&
10. How to declare two dimensional arrays in java? Explain with simple example.
11. Write a Java program to illustrate the use of multidimensional arrays.

Module 3:

1. Define inheritance. List the different types of inheritance. (Jan-2018)
2. Discuss the following terms with an example: i) super ii) final (Jan-2019)
3. Define inheritance. Explain the multilevel hierarchy with an example program,
4. Write a Java program to define an interface called Area which contains method called Compute( ) and calculate the areas of rectangle (ℓ * b) and triangle (1/2 * b * h) using classes Rectangle and Triangle.
5. With an example program explain the method overriding?
6. Compare and contrast method overloading and method overriding with suitable examples.
7. When constructors are called in the class hierarchy?
8. Distinguish between method overloading and overriding in Java, with suitable example.

Module 4:

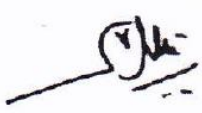
1. Explain package and its types and import command in Java with examples.
2. Describe the various levels of access protections available for packages and their implications.
3. Which is the alternative method to implement multiple inheritance in Java? Explain with an example.
4. Explain the role of interfaces while implementing multiple inheritance in Java.
5. Give the basic form of an exception handling block.
6. Define the role of Exception handling in software development.
7. What is an exception? Give an example for nested try statements.
8. Define exception. Explain the exception handling mechanism with an example.
9. Explain Java's built-in exceptions.
10. What is the importance of the clause finally?
11. Create a try block that is likely to generate three types of exception and incorporate necessary catch block to catch and handle them.
12. Write a Java program for illustrating the exception handling when a number is divided by zero and an array has a negative index value.

Module 5:

1. Write a note a PrintWriter Class.
2. With a neat diagram, explain the life cycle of Applet.
3. Write a note on Native Methods.
4. Write a note on Special String Operations.
5. Write a note on StringBuffer.
6. Write a note on StringBuilder.

15.0 University Result

Examination	Total Students	PASS (P)	FAIL (F)	% Passing
	41	40	01	97.5 %

Prepared by	Checked by		
			
Prof. P. G. Patil	Prof. M. G. Huddar	HOD	Principal

Subject Title	**NON-CONVENTIONAL ENERGY SOURCES**		
Subject Code	18ME651	**IA Marks(30)+Assignments(10)**	40
Number of Lecture Hrs / Week	3+0 hrs	**Exam Marks(appearing for)**	60 (100)
Total Number of Lecture Hrs	40	**Exam Hours**	03
CREDITS – 03			

FACULTY DETAILS:		
Name: Dr. M. M. Shivashimpi	**Designation:** Assistant Professor	**Experience:** 14 Years
No. of times course taught: 01	**Specialization:** Thermal Power Engineering	

1.0 Prerequisite Subjects:

Sl. No	Branch	Semester	Subject
01	Students should have the knowledge of basic subjects	I/II	**Mathematics, Physics and chemistry, EME**

2.0 Course Objectives

Students belonging to all branches of Engineering are made to learn certain fundamental topics related to energy sources and conversion systems. So that they will have a minimum understanding and working of energy systems, equipment and process.

3.0 Course Outcomes

Having successfully completed this course, the student will be able to understand construction and working mechanical systems.

CO'S	Course Outcome	Cognitive Level	POs
C317.1	Describe the environmental aspects of non-conventional energy resources. In Comparison with various conventional energy systems, their prospects and limitations.	L1,L2&L3	PO1, PO2,PO3
C317.2	Know the need of renewable energy resources, historical and latest developments.	L1,L2&L3	PO2, PO3
C317.3	Describe the use of solar energy and the various components used in the energy production with respect to applications like-heating, cooling, desalination, power generation, drying,	L1,L2&L3	PO1, PO2,PO3
C317.4	Appreciate the need of Wind Energy and the various components used in energy generation and know the classifications.	L1,L2&L3	PO2, PO3
C317.5	Understand the concept of Biomass energy resources and their classification, types of biogas Plants- applications	L1,L2&L3	PO1, PO2,PO3
C317.6	Compare Solar, Wind and bio energy systems, their prospects, Advantages and limitations.	L1,L2&L3	PO1, PO2,PO3
C317.7	Acquire the knowledge of fuel cells, wave power, tidal power and geothermal principles and applications.	L1,L2&L3	PO1, PO2,PO3
Total Hours of instruction		**40**	

4.0 Course Content

Module - 1

Introduction: Energy source, India‟s production and reserves of commercial energy sources, need for non- conventional energy sources, energy alternatives, solar, thermal, photovoltaic. Water power, wind biomass, ocean temperature difference, tidal and waves, geothermal, tar sands and oil shale, nuclear (Brief descriptions); advantages and disadvantages, comparison (Qualitative and Quantitative).

Solar Radiation: Extra-Terrestrial radiation, spectral distribution of extra terrestrial radiation, solar constant, solar radiation at the earth's surface, beam, diffuse and global radiation, solar radiation data. Measurement of Solar Radiation: Pyrometer, shading ring pyrheliometer, sunshine recorder, schematic diagrams and principle of working.

Module- 2

Solar Radiation Geometry: Flux on a plane surface, latitude, declination angle, surface azimuth angle, hour angle, and zenith angle, solar altitude angle expression for the angle between the incident beam and the normal to a plane surface (No derivation) local apparent time. Apparent motion of sum, day length, numerical examples. Radiation Flux on a Tilted Surface: Beam, diffuse and reflected radiation, expression for flux on tilted surface (no derivations) numerical examples.

Solar Thermal Conversion: Collection and storage, thermal collection devices, liquid flat plate collectors, solar air heaters concentrating collectors (cylindrical, parabolic, paraboloid) (Quantitative analysis); sensible heat storage, latent heat storage, application of solar energy water heating. Space heating and cooling, active and passive systems, power generation, and refrigeration. Distillation (Qualitative analysis) solar pond, principle ofworking, operational problems.

Module- 3

Performance Analysis of Liquid Flat Plate Collectors: General description, collector geometry, selective surface (qualitative discussion) basic energy-balance equation, stagnation temperature, transmissivity of the cover system, transmissivity–absorptivity product, numerical examples. The overall loss coefficient, correlation for the top loss coefficient, bottom and side loss coefficient, problems (all correlations to be provided). Temperature distribution between the collector tubes, collector heat removal factor, collector efficiency factor and collector flow factor, mean plate temperature, instantaneous efficiency (all expressions to be provided). Effect of various parameters on the collector performance; collector orientation, selective surface, fluid inlet temperature, number covers, dust.

Photovoltaic Conversion: Description, principle of working and characteristics, application.

Module- 4

Wind Energy : Properties of wind, availability of wind energy in India, wind velocity and power from wind; major problems associated with wind power, wind machines; Types of wind machines and their characteristics,horizontal and vertical axis wind mills, elementary design principles; coefficient of performance of a wind mill rotor, aerodynamic considerations of wind mill design, numerical examples.

Tidal Power: Tides and waves as energy suppliers and their mechanics; fundamental characteristics of tidal power, harnessing tidal energy, limitations.

Ocean Thermal Energy Conversion: Principle of working, Rankine cycle, OTEC power stations in the world, problems associated with OTEC.

Module- 5

Geothermal Energy Conversion: Principle of working, types of geothermal station with schematic diagram,geothermal plants in the world, problems associated with geothermal conversion, scope of geothermal energy.

Energy from Bio Mass: Photosynthesis, photosynthetic oxygen production, energy plantation, bio gasproduction from organic wastes by anaerobic fermentation, description of bio-gas plants, transportation of bio-gas, problems involved with bio-gas production, application of bio-gas, application of bio-gas in engines,advantages.

Hydrogen Energy: Properties of Hydrogen with respected to its utilization as a renewable form of energy, sources of hydrogen, production of hydrogen, electrolysis of water, thermal decomposition of water, thermo chemical production bio-chemical production.

5.0 Relevance to future subjects

Sl. No	Semester	Subject	Topics
01	VIII	Project work	Fundamental concepts
02	V/VI	Design of Machine Elements I/II	Fasteners, Keys and Joints, Rivets and Assembly drawings
03	III/IV	Power plant engineering, I C Engines, Energy Engineering.	Internal combustion engines, gas cycles, Turbines, Refrigeration & air conditioning.

6.0 Relevance to Real World

SL.No	Real World Mapping
01	Electricity generation, Energy harnessing.
02	Working and operation of wind, solar, biomass, geothermal, OTEC, Tidal power plants
03	Fuel cells and hydrogen energy.

7.0 Gap Analysis and Mitigation

Sl. No	Delivery Type	Details
01	NPTEL Tutorial	Topic: Non Conventional Energy resources, Renewable Energy, Environmental pollution.

8.0 Books Used and Recommended to Students

Text Books

1. Non-Convention EnergyResources, B H Khan, McGraw Hill Education(India) Pvt. Ltd. 3rd Edition.
2. Solar energy, Subhas P Sukhatme, Tata McGraw Hill, 2nd Edition,1996.
3. Non-Conventional EnergySources, G.D Rai, Khanna Publishers, 2003.

Reference Books

1. Renewable Energy Sources andConversion Technology, N.K.Bansal, Manfred Kleeman&MechaelMeliss, Tata McGraw Hill. 2004
2. Renewable EnergyTechnologies , Ramesh R & Kumar K U, Narosa Publishing HouseNew Delhi.
3. Conventional Energy Systems, K M, Non, Wheeler Publishing Co.Ltd., New Delhi, 2003.
4. Non-Conventional Energy, Ashok V Desai, Wiley Eastern Ltd, NewDelhi,2003.

Additional Study material & e-Books

NPTEL Videos, E- Books

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

Website and Internet Contents References

10) https://nptel.ac.in/courses/121/106/121106014/
11) https://nptel.ac.in/content/storage/121/106/121106014/MP4/mod03lec08.mp4
12) https://onlinecourses.nptel.ac.in/noc20_ph14/preview
13) https://www.youtube.com/watch?v=GExTwRNkQBg
https://www.youtube.com/watch?v=F2YsrxpQPwE
https://www.youtube.com/watch?v=DD0Y6Snxpdk
14) https://nptel.ac.in/content/storage2/courses/121106014/Week9/lecture27.pdf

https://nptel.ac.in/content/storage2/courses/108108078/pdf/chap7/teach_slides07.pdf
https://www.youtube.com/watch?v=-yYrc1-thxQ

10.0 Magazines/Journals Used and Recommended to Students

Sl. No	Magazines/Journals	website
1	Elsevier	https://www.journals.elsevier.com
2	Journal of Composite Materials	http://journals.sagepub.com
4	International Journal of Renewable Energy Research (IJRER)	http://www.ijrer.org

11.0 Examination Note

Internal Assessment (30 Marks)
Questions shall be answered in Internal Assessment books (blue book).Internal assessment book shall be submitted.

Scheme of Evaluation for Internal Assessment (30 Marks)
Internal Assessment test in the same pattern as that of the main examination (Better of the three Tests):30marks.
Assignments/Quiz (10 Marks)
Assignments for each module are to be submitted and evaluated for 10 marks for each. Average of five modules is to be considered.

SCHEME OF EXAMINATION: Two full questions (with a maximum of four sub questions) of twenty mark each to be set from each module. Each question should cover all the contents of the respective module. Students have to answer five full questions choosing one full question from each module. From each module out of two full questions one full question to be answered and each carries 20 Marks. Five full question to be answered 5x20 = 100 Marks. Later after evaluation total marks are reduced to 60 marks.

12.0 Course Delivery Plan

Module	Lecture No.	Content of Lecturer	% of Portion
1	1	Introduction: Energy source, India‟s production and reserves of commercial energy sources,	20%
	2	Need for non- conventional energy sources, energy alternatives, solar, thermal, photovoltaic.	
	3	Water power, wind biomass, ocean temperature difference, tidal and waves,	
	4	geothermal, tar sands and oil shale, nuclear (Brief descriptions);	
	5	advantages and disadvantages, comparison (Qualitative and Quantitative).	
	6	Solar Radiation: Extra-Terrestrial radiation, spectral distribution of extra terrestrial radiation, solar constant,	
	7	Solar radiation at the earth‟s surface, beam, diffuse and global radiation, solar radiation data.	
	8	Measurement of Solar Radiation: Pyrometer, shading ring pyrheliometer, sunshine recorder, schematic diagrams and principle of working.	
2	9	Solar Radiation Geometry: Flux on a plane surface, latitude, declination angle, surface azimuth angle, hour angle, zenith angle, solar altitude angle	40%
	10	expression for the angle between the incident beam and the normal to a plane surface (No derivation) local apparent time. Apparent motion of sum, day length, numerical examples.	
	11	Radiation Flux on a Tilted Surface: Beam, diffuse and reflected radiation, expression for flux on a tilted surface (no derivations) numerical examples.	
	12	Solar Thermal Conversion: Collection and storage, thermal collection devices, liquid flat plate collectors,	
	13	solar air heaters concentrating collectors (cylindrical, parabolic, paraboloid) (Quantitative analysis);	
	14	sensible heat storage, latent heat storage, application of solar energy water heating.	
	15	Space heating and cooling, active and passive systems, power generation, refrigeration.	
	16	Distillation (Qualitative analysis) solar pond, principle of working, operational problems.	
3	17	Performance Analysis of Liquid Flat Plate Collectors: General description,	60%
	18	collector geometry, selective surface (qualitative discussion)	

	19	basic energy-balance equation, stagnation temperature, transmissivity of the cover system, transmissivity – absorptivity product, numerical examples.	
	20	The overall loss coefficient, correlation for the top loss coefficient, bottom and side loss coefficient, problems (all correlations to be provided).	
	21	Temperature distribution between the collector tubes,	
	22	collector heat removal factor, collector efficiency factor and collector flow factor, mean plate temperature, instantaneous efficiency (all expressions to be provided).	
	23	Effect of various parameters on the collector performance; collector orientation, selective surface, fluid inlet temperature, number covers, dust.	
	24	Photovoltaic Conversion: Description, principle of working and characteristics, application.	
4	25	Wind Energy : Properties of wind, availability of wind energy in India, wind velocity and power from wind;	80%
	26	major problems associated with wind power, wind machines; Types of wind machines and their characteristics, horizontal and vertical axis wind mills,	
	27	elementary design principles; coefficient of performance of a wind mill rotor, aerodynamic considerations of wind mill design, numerical examples.	
	28	Tidal Power: Tides and waves as energy suppliers and their mechanics;	
	29	fundamental characteristics of tidal power, harnessing tidal energy,	
	30	limitations.	
	31	Ocean Thermal Energy Conversion: Principle of working, Rankine cycle,	
	32	OTEC power stations in the world, problems associated with OTEC.	
5	33	Geothermal Energy Conversion: Principle of working, types of geothermal station with schematic diagram, geothermal plants in the world,	100%
	34	problems associated with geothermal conversion, scope of geothermal energy	
	35	Energy from Bio Mass: Photosynthesis, photosynthetic oxygen production, energy plantation, bio gas production from organic wastes by anaerobic fermentation,	
	36	description of bio-gas plants, transportation of bio- gas, problems involved with bio-gas production,	
	37	application of bio-gas, application of bio-gas in engines, advantages.	
	38	Hydrogen Energy: Properties of Hydrogen with respected to its utilization as a renewable form of energy, sources of hydrogen,	
	39	production of hydrogen, electrolysis of water, thermal decomposition of water,	
	40	thermo chemical production bio-chemical production.	

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 Energy Resources	Students study the Topics and prepare the multiple choice questioner with answer.	Module-1 of the syllabus	2	Group Activity. Each group should prepare minimum 05 questions expected.	Book 1, 2 of the reference list. Website of the Reference list
2	Assignment 2: University Questions on Solar Energy	Students study the Topics and explain solar energy.	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 on Solar energy	Students study the Topics and explain solar energy.	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 on Wind, Tidal and OTEC energy.	Students study the Topics and explainWind, Tidal and OTEC energy.	Module-4of the syllabus	8	Individual Activity.	Book 1, 2 of the reference list. Website of the Reference list
5	Assignment 5:	Students study the	Module-	10	Individual Activity.	Book 1, 2 of the

	University Questions on Geothermal, Biomass and Hydrogen energy.	Topics and explain Geothermal, Biomass and Hydrogen energy.	5 of the syllabus			reference list. Website of the Reference list

15.0 QUESTION BANK

Sample Questions	Questions
I	**Module 1** 1. What are the limitations of conventional energy sources? 2. What are the prospects of non conventional energy sources in India? 3. What are the renewable energy sources? Write its advantages and obstacles to implement these sources. 4. What are the methods of direct energy conversion? Describe in brief. 5. What are limitations of renewable energy sources? 6. Show on a map, wind power plants, solar power plants, tidal power plants, nuclear power plants hydro power plants and thermal power plants. 7. What are the convention and non-conventional sources? Write advantages of non-conventional energy sources. 8. What is need of renewable energy?
II	**Module 2** 9. Write a note on solar radiation on tilted surfaces. 10. Briefly explain different type of instruments used to measure solar radiation. 11. What is extraterrestrial , terrestrial radiation, solar radiation and solar flux 12. What are the challenges associated in the use of solar energy and give the Remedies and possible solutions. 13. Discuss energy requirement of rural consumers and state the possible alternative source of energy to meet the demand 14. Briefly describe Renewable Energy Scenario in India and world. 15. What is Environmental Aspects of Energy Utilization in renewable and non- renewable energy sources? 16. Enumerate the different types of concentrating type collectors.
III	**Module 3** 17. Enumerate the different types of concentrating type collectors. 18. With the help of a neat sketch describe a solar heating system using water heating solar collectors and state the advantages and disadvantages of this method. 19. How is the performance of flat plate collector evaluated? 20. Explain the construction and uses of evacuated tube collectors? 21. What are the factors effected on performance of solar flat plate collector? 22. What is solar cell, and applications of PV system? 23. Explain working principle of solar PV cells? What are the materials used for PV cells? 24. What are the various methods to store solar energy? Discuss in detail any two processes? 25. Draw neatly solar pond and explain each zone operation and how it is store energy? 26. What are the different types of photovoltaic cell? Explain each one?
IV	**Module 4** 27. What is wind power explain briefly? 28. Describe with a neat sketch the working of wind energy system with main components 29. How power extracted by wind turbine? 30. List out type of wind turbine and what are the wind power plants are grouped 31. Discuss the advantages and disadvantages of horizontal and vertical axis wind mill. What methods are used to overcome the fluctuate power generation of wind mill? 32. What are the rules for site selection of wind turbine and advantages and disadvantages of wind turbine? 33. How performance of the wind turbine is determined? Explain its operational characteristics. 34. What is tide? Explain tidal energy and its conversion with neat diagram 35. Explain the basic components of a tidal thermal power plant and state their advantages and disadvantages.. 36. What is the nature of tidal power extracted from single basin arrangement and double basin

	arrangement? 37. What are the wave energy conversion machines, explain any one conversion methods. 38. What is the basic principle of ocean thermal energy conversion ? What are the main types of OTEC power plants? Describe their working in brief.
V	**Module 5** 39. What are the geothermal power plants, explain binary cycle power plant with neat diagram 40. Draw schematic diagram of an alkaline water electrolytic hydrogen cell and explain 41. With a neat sketch explain biomass gasification? 42. What is biomass, bio-fuel , bio energy and biogas? 43. What are the methods used for biomass conversion to energy? Explain in brief.? 44. What are the factors affecting the generation of bio gas? 45. What are the constituents of biomass materials? Explain proximate and ultimate analysis. 46. What is fermentation, aerobic and anaerobic, hydrolysis explain each. 47. Compare fixed dome and float drum type bio digesters.

16.0 University Result

Examination	S+	S	A	B	C	D	E	F	% Passing
July/August 2021	0	0	01	18	04	01	0	0	100

Prepared by	Checked by		
Dr. M. M. Shivashimpi	Dr. K. M. Akkoli	HOD	Principal

Subject Title	**PLC and SCADA (Open Elective)**		
Subject Code	**18EE652**	**CIE Marks**	**40**
Number of Lecture Hrs / Week	**03**	**Exam Marks**	**60**
No of Credits	**03**	**Exam Hours**	**03**

FACULTY DETAILS:		
Name: Prof. Sagar S B	**Designation:** Asst. Prof.	**Experience:** 10 Years
No. of times course taught: 02	**Specialization:** VLSI Design & Embedded Systems	

1.0 Prerequisite Subjects:

Sl. No	Branch	Semester	Subject
01	Electrical &Electronics Engineering	I/II	Basic Electrical Engineering
02	Electrical &Electronics Engineering	I/II	Basic Electronics Engineering
03	Electrical &Electronics Engineering	III	Logic Design
04	Electrical &Electronics Engineering	V	Microcontrollers

2.0 Course Objectives

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

1. To explain advantages and disadvantages, main parts and their functions, basic sequence of operation of PLC.
2. To describe the hardware components: I/O modules, CPU, memory devices, other support devices and the functions of PLC memory map.
3. To describe program scan sequence, the communication of information to the PLC using different languages, internal relay instruction.
4. To explain identification of common operating modes found in PLCs, writing and entering the ladder logic programs.
5. To define the functions of Relays, Contactors, Motor Starters, Switches, Sensors, Output Control Devices, Seal-In Circuits and Latching Relays.
6. To explain conversion of relay schematics into PLC ladder logic programs and writing PLC programs directly from narrative descriptions.
7. To explain the functions of PLC counter instructions, applying combinations of counters and timers to control systems.
8. To describe the function of selectable timed interrupt and fault routine files and use of temporary end instruction.
9. To explain the execution of data transfer instructions, interruption of data transfer and data compare instructions.
10. To explain the basic operation of PLC closed-loop control system, various forms of mechanical sequencers and their operations.
11. To describe the operation of bit and word shift registers and develop programs that use shift registers.
12. To discuss the operation of various processes, structures of control systems and the method of communication between different industrial processes.

3.0 Course Outcomes

Sl No	Course Outcome	RBT Level	POs
1	Discuss history of PLC and describe the hardware components of PLC: I/O modules, CPU, memory devices, other support devices, operating modes and PLC programming.	L2,L3	1,2,3,5,8,9,10,12
2	Describe field devices Relays, Contactors, Motor Starters, Switches, Sensors, Output Control Devices, Seal-In Circuits, and Latching Relays commonly used with I/O module.	L2,L3	1,2,3,5,8,9,10,12
3	Analyze PLC timer and counter ladder logic programs and describe the operation of different program control instructions	L2,L3,L4	1,2,3,5,8,9,10,12
4	Discuss the execution of data transfer instructions, data compare instructions and the basic operation of PLC closed-loop control system.	L2,L3,L4	1,2,3,5,8,9,10,12
5	Describe the operation of mechanical sequencers, bit and word shift registers, processes and structure of control systems and communication between the processes.	L2,L3	1,2,3,5,8,9,10,12
Total Hours of instruction		**40**	

4.0 Course Content

Module-1

Programmable Logic Controllers: Introduction, Parts of a PLC, Principles of Operation, Modifying the Operation, PLCs versus Computers, PLC Size and Application.

PLC Hardware Components: The I/O Section, Discrete I/O Modules, Analog I/O Modules, Special I/O Modules, I/O Specifications, The Central Processing Unit (CPU), Memory Design, Memory Types, Programming Terminal Devices, Recording and Retrieving Data, Human Machine Interfaces (HMIs).

Basics of PLC Programming: Processor Memory Organization, Program Scan, PLC Programming Languages, Relay-Type Instructions, Instruction Addressing, Branch Instructions, Internal Relay Instructions, Programming Examine If Closed and Examine If Open Instructions, Entering the Ladder Diagram, Modes of Operation.

8 Hours

Module-2

Developing Fundamental PLC Wiring Diagrams and Ladder Logic Programs: Electromagnetic Control Relays, Contactors, Motor Starters, Manually Operated Switches, Mechanically Operated Switches, Sensors, Output Control Devices, Seal-In Circuits, Latching Relays, Converting Relay Schematics into PLC Ladder Programs, Writing a Ladder Logic Program Directly from a Narrative Description.

Programming Timers: Mechanical Timing Relays, Timer Instructions, On-Delay Timer Instruction, Off-Delay Timer Instruction, Retentive Timer, Cascading Timers.

8 Hours

Module-3

Programming Counters: Counter Instructions, Up-Counter, Down-Counter, Cascading Counters, Incremental Encoder-Counter Applications, Combining Counter and Timer Functions.

Program Control Instructions: Master Control Reset Instruction, Jump Instruction, Subroutine Functions, Immediate Input and Immediate Output Instructions, Forcing External I/O Addresses, Safety Circuitry, Selectable Timed Interrupt, Fault Routine, Temporary End Instruction, Suspend Instruction.

8 Hours

Module-4

Data Manipulation Instructions: Data Manipulation, Data Transfer Operations, Data Compare Instructions, Data Manipulation Programs, Numerical Data I/O Interfaces, Closed-Loop Control.

Math Instructions: Math Instructions, Addition Instruction, Subtraction Instruction, Multiplication Instruction, Division Instruction, Other Word-Level Math Instructions, File Arithmetic Operations.

8 Hours

Module-5

Sequencer and Shift Register Instructions: Mechanical Sequencers, Sequencer Instructions, Sequencer Programs, Bit Shift Registers, Word Shift Operations.

Process Control, Network Systems, and SCADA: Types of Processes, Structure of Control Systems, On/Off Control, PID Control, Motion Control, Data Communications, Supervisory Control and Data Acquisition (SCADA).

8 Hours

5.0 Relevance to future subjects

Sl No	Semester	Subject	Topics
01	VIII	VLSI Circuits & Design	Logic Functions
02	VIII	Project Work	Programming/automation Section.

6.0 Relevance to Real World

Sl No	Real World Mapping
01	Programming PLC for different applications.
02	Development of automation plants using PLC.

7.0 Gap Analysis and Mitigation

Sl No	Delivery Type	Details
01	NPTEL/ Video Tutorial	Temperature control, Bottle packing applications

8.0 Books Used and Recommended to Students

Text Books
1. **'Programmable Logic controllers'** by Frank D Petruzella, McGraw Hill, 4th Edition, 2011
Reference Books
1. Programmable Controllers, an Engineers Guide-E. A Paar, newness, 3rd edition, 2003. 2. Introduction to Programmable Logic Controllers, Gary Dunning Cengage 3rd Edition, 2006

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

Website and Internet Contents References
https://en.wikipedia.org/wiki/ladder_diagrams http://plc-scada-dcs.blogspot.in/2015/05/types-of-timers-in-plc-retentative-on.html#axzz4ofJCSOQG http://www.ecmweb.com/basics/basics-control-relays https://www.allaboutcircuits.com/textbook/digital/chpt-6/programmable-logic-controllers-plc

10.0 Magazines/Journals Used and Recommended to Students

Sl.No	Magazines/Journals	website
1	AEÜ - International Journal of Electronics and Communications	www.journals.elsevier.com/aeu

11.0 Examination Note

Scheme of Evaluation for CIE (40 Marks)

Internal Assessment: 30 Marks

Total of Three Internal Assessment tests will be conducted for 50 Marks each. Average of three tests is scaled downed to 30 Marks.

Assignment: 10 Marks

SCHEME OF EXAMINATION: 100 Marks, scaled down to 60 in VTU result sheet.
The question paper will have ten questions.

- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

12.0 Course Delivery Plan

Module	Lecture No.	Content of Lecturer	% of Portion
I	1	**Programmable Logic Controllers:** Introduction, Parts of a PLC, Principles of Operation.	20%
	2	Modifying the Operation, PLCs versus Computers, PLC Size and Application.	
	3	**PLC Hardware Components:** The I/O Section, Discrete I/O Modules, Analog I/O Modules.	
	4	Special I/O Modules, I/O Specifications, The Central Processing Unit (CPU), Memory Design.	
	5	Memory Types, Programming Terminal Devices, Recording and Retrieving Data, Human Machine Interfaces (HMIs).	
	6	**Basics of PLC Programming:** Processor Memory Organization, Program Scan, PLC Programming Languages.	
	7	Relay-Type Instructions, Instruction Addressing, Branch Instructions, Internal Relay Instructions.	
	8	Programming Examine If Closed and Examine If Open Instructions, Entering the Ladder Diagram, Modes of Operation.	
II	1	**Developing Fundamental PLC Wiring Diagrams and Ladder Logic Programs:** Electromagnetic Control Relays.	20%
	2	Contactors, Motor Starters, Manually Operated Switches, Mechanically Operated Switches.	
	3	Sensors, Output Control Devices, Seal-In Circuits, Latching Relays.	
	4	Converting Relay Schematics into PLC Ladder Programs, Writing a Ladder Logic Program Directly from a Narrative Description.	
	5	**Programming Timers:** Mechanical Timing Relays, Timer Instructions.	
	6	On-Delay Timer Instruction.	
	7	Off-Delay Timer Instruction.	
	8	Retentive Timer, Cascading Timers.	
III	1	**Programming Counters:** Counter Instructions, Up-Counter, and Down-Counter.	20%
	2	Cascading Counters.	
	3	Incremental Encoder-Counter Applications, Combining Counter and Timer Functions.	
	4	**Program Control Instructions:** Master Control Reset Instruction, Jump Instruction.	
	5	Subroutine Functions, Immediate Input and Immediate Output Instructions.	
	6	Forcing External I/O Addresses, Safety Circuitry.	
	7	Selectable Timed Interrupt, Fault Routine.	
	8	Temporary End Instruction, Suspend Instruction.	
IV	1	**Data Manipulation Instructions:** Data Manipulation, Data Transfer Operations.	20%
	2	Data Compare Instructions.	
	3	Data Manipulation Programs.	
	4	Numerical Data I/O Interfaces, Closed-Loop Control.	
	5	**Math Instructions:** Math Instructions, Addition Instruction.	

	6	Subtraction Instruction, Multiplication Instruction, Division Instruction.	
	7	Other Word-Level Math Instructions.	
	8	File Arithmetic Operations.	
V	1	**Sequencer and Shift Register Instructions:** Mechanical Sequencers, Sequencer Instructions.	20%
	2	Sequencer Programs, Bit Shift Registers.	
	3	Word Shift Operations.	
	4	**Process Control, Network Systems, and SCADA:** Types of Processes.	
	5	Structure of Control Systems, On/Off Control.	
	6	PID Control, Motion Control.	
	7	Data Communications.	
	8	Supervisory Control and Data Acquisition (SCADA).	

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:** Questions on Module 1	Students study the Topics and write the Answers. Get practice to solve university questions.	Module 1 of the syllabus	3	Individual Activity.	W Bolton Frank D Petruzella
2	**Assignment 2:** Questions on Module 2	Students study the Topics and write the Answers. Get practice to solve university questions.	Module 2 of the syllabus	5	Individual Activity.	Frank D Petruzella W Bolton
3	**Assignment 3:** Questions on Module 3	Students study the Topics and write the Answers. Get practice to solve university questions.	Module 3 of the syllabus	8	Individual Activity.	Frank D Petruzella
4	**Assignment 4:** Questions on module 4	Students study the Topics and write the Answers. Get practice to solve university questions.	Module 4 of the syllabus	10	Individual Activity.	Frank D Petruzella
5	**Assignment 5:** Questions on Module 5	Students study the Topics and write the Answers. Get practice to solve university questions.	Module 5 of the syllabus	12	Individual Activity.	Frank D Petruzella

14.0 QUESTION BANK

MODULE 1

1. Explain the internal architecture of PLC with neat diagram.
2. List six distinct advantages that PLCs offer over conventional relay-based control systems.
3. What is PLC? With a neat block diagram explain a PLC system.
4. Explain the internal architecture of PLC-CPU with neat diagram showing bus connections.
5. Draw the ladder diagram and instruction list (IL) programming for the following logic functions:
   a. OR NOT NOR AND.
6. Explain the main function of each of the following major components of a PLC:
   a. Processor module (CPU) **b.** I/O modules **c.** Programming device **d.** Power supply module.
7. The programmable controller operates in real time. What does this mean?
8. Compare the PLC and PC.
9. What is the function of a PLC input interface module?
10. Explain the function of the analog-to-digital (A/D) converter circuit used in analog input modules.
11. List four tasks performed by a discrete input module.

MODULE 2

1. Draw the ladder diagram for the basic & universal logic functions.

2. Represent the following Boolean equation using ladder diagram
   Y = (A . B + C) D' . E . F'
3. Explain latch ladder diagram with the help of an example.
4. Write truth tables for the Basic as well as Universal gates and verify them by drawing ladder diagrams for each gate.
5. When START button is pressed the lamp turns ON, after releasing the pushbutton the lamp still remains ON. When STOP button is pressed then lamp goes OFF.
6. When START button is pressed L1 and L2 lights are in ON condition. L2 goes to OFF condition as soon as push button is released but L1 remains ON.

MODULE 3

1. What is necessity of master control relay? Illustrate the action with relevant ladder diagrams.
2. With a neat ladder diagram and instruction list show how more than one master control relay can be used in a program.
3. Explain use of counter to extend the range of timer.
4. Explain with a real time example where the timer and counter are used together to achieve an output.
5. Write a ladder diagram for simple water packaging of 1 ltr.
6. Write a ladder diagram & instruction list needed to implement a system in which for output H to be ON, input A must be ON and both inputs C & D must be OFF. In addition one or more of inputs E, F and G must be OFF.
7. Design a ladder program for a system that gives an output when number of people in a store reaches 150, output is shown by using LED's FULL, if it is less than 150 then by VACANT.

MODULE 4

1. Explain the meaning of the following terms as they apply to a PID control:
   a. Process variable **b.** Set-point **c.** Error **d.** Control variable
2. Construct a non retentive timer program that will turn on a pilot light after a time-delay period. Use a thumbwheel switch to vary the preset time-delay value of the timer.
3. Write a program that will copy the value stored at address N7:56 into address N7:60.
4. Write a program that will cause a light to come on if a PLC counter value is less than 10 or more than 30.
5. Design a program that will add the values stored at N7:23 and N7:24 and store the result in N7:30 whenever input *A* is true, and then, when input *B* is true, will copy the data from N7:30 to N7:31.
6. Design a program that will implement the following arithmetic operation:
   • Use an MOV instruction and place the value 45 in N7:0 and 286 in N7:1.
   • Add the values together and store the result in N7:2.
   • Subtract the value in N7:2 from 785 and store the result in N7:3.
   • Multiply the value in N7:3 by 25 and store the result in N7:4.
   • Divide the value in N7:4 by 35 and store the result in F8:0.

MODULE 5

1. Why are PLC sequencers easier to program than PLC discrete outputs?
2. Compare the operation of an event-driven and a time-driven sequencer.
3. A bit shift register is said to operate in a synchronous manner. Explain what this means.
4. Compare the operation of a FIFO register and a LIFO register.
5. State the function of each of the following elements of a PLC motion control system:
   a. Programmable controller **b.** Motion module **c.** Servo drive **d.** Servo motor.
6. Compare manual, auto tune, and intelligent tuning of a PID controller.

16.0 University Result

Examination	No of students Appeared	No of students Passed	% Passing
2020-21	35	35	100%

Prepared by	Checked by		
06.04.22	6/4/2022	13/4/2022	
Prof. Sagar S Birade	Prof. M.P.Yenagimath	HOD	Principal

Subject Title	**EMBEDDED SYSTEMS LABORATORY**		
Subject Code	18ECL66	**IA Marks**	40
Number of Lecture Hrs / Week	1 Hr Tutorial +3 Hrs Lab	**Exam Marks**	60
Total Number of Lecture Hrs	50 Hrs	**Exam Hours**	03
			CREDITS – 04

FACULTY DETAILS:		
Name: Prof. Sachin S Patil	**Designation:** Asst. Professor	**Experience:** T-16.09Yrs, I-02.3Yrs
No. of times course taught: 04	**Specialization:** VLSI & Embedded Systems Design	

1.0 Prerequisite Subjects:

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

2.0 Course Objectives

This course will enable students to:

- Get familiarize with ARM Cortex-M3 instructions and DOS 21H interrupts and function calls.
- Develop and test assembly language programs to use instructions of ARM Cortex-M3.
- Get familiarize with interfacing of various peripheral devices with ARM Cortex-M3 controller for simple applications.

3.0 Course Outcomes

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

	Course Outcome	Cognitive Level	POs
C314.1	Understand the instruction set of 32 bit microcontroller ARM Cortex M3, and the software tool required for programming in Assembly and C language.	L1,L2,L3	PO1-8,12
C314.2	Develop assembly language programs using ARM Cortex M3 for different applications.	L1,L2,L3	PO1-8,12
C314.3	Develop C language programs using ARM Cortex M3 for different applications.	L1,L2,L3	PO1-8,12
C314.4	Interface external devices and I/O with ARM CortexM3.	L1,L2,L3	PO1-8,12
C314.5	Develop C language programs and library functions for embedded system applications.	L1,L2,L3	PO1-8,12
Total Hours of instruction		**48**	

4.0 Course Content

Laboratory Experiments:

PART-A: Conduct the following Study experiments to learn ALP using ARM Cortex M3 Registers using an Evaluation board and the required software tool.

1. ALP to multiply two 16 bit binary numbers.
2. ALP to find the sum of first 10 integer numbers.
3. ALP to find the number of 0's and 1's in a 32 bit data.
4. ALP to find determine whether the given 16 bit is even or odd.
5. ALP to write data to RAM

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

1. Display "Hello World" message using Internal UART.
2. Interface and Control a DC Motor.
3. Interface a Stepper motor and rotate it in clockwise and anti-clockwise direction.
4. Interface a DAC and generate Triangular and Square waveforms.
5. Interface a 4x4 keyboard and display the key code on an LCD.
6. Demonstrate the use of an external interrupt to toggle an LED On/Off.
7. Display the Hex digits 0 to F on a 7-segment LED interface, with an appropriate delay in between.
8. Measure ambient temperature using a sensor and SPI ADC IC.

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
01	Microprocessor based components
02	Model creation for analysis
03	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

Text Books
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
1) https://vtu.ac.in 2) http://www.bookspar.com/engineering-vtu 3) http://www.slideshare.net/farohalolya/8086-microprocessor-lab-manual 4) 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

Scheme of Evaluation for Internal Assessment (20 Marks)

(h) Lab work quiz : 10 Marks.

(i) Internal Assessment test: 10 Marks.

SCHEME OF EXAMINATION:

Two questions to be set each from Module.

Student has to answer both full questions. 100 marks Marks divided in three parts Write up 12marks, Conduction 56marks & Viva 12marks.

12.0 Course Delivery Plan

Experiment	Lecture No.	Content	% of Portion
		PART-A:	
1	**1**	ALP to multiply two 16 bit binary numbers.	6%
2	**2**	ALP to find the sum of first 10 integer numbers.	6%
3	**3**	ALP to find the number of 0's and 1's in a 32 bit data.	8%
4	**4**	ALP to find determine whether the given 16 bit is even or odd.	8%
5	**5**	ALP to write data to RAM	8%
		PART-B:	
1	**1**	Display "Hello World" message using Internal UART.	8%
2	**2**	Interface and Control a DC Motor.	8%
3	**3**	Interface a Stepper motor and rotate it in clockwise and anti-clockwise direction.	8%
4	**4**	Interface a DAC and generate Triangular and Square waveforms.	8%
5	**5**	Interface a 4x4 keyboard and display the key code on an LCD.	8%
6	**6**	Demonstrate the use of an external interrupt to toggle an LED On/Off.	8%
7	**7**	Display the Hex digits 0 to F on a 7-segment LED interface, with an appropriate delay in between.	8%
8	**8**	Measure ambient temperature using a sensor and SPI ADC IC.	8%

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

14.0 University Result

Examination	FCD	FC	SC	% Passing
July/Aug 2019	42	3	00	100
July/Aug 2020	28	7	0	100
July/Aug 2021	35	00	00	100

Prepared by	Checked by		
Prof. Sachin S Patil	Prof. P V Patil	HOD	Principal

Year / Semester	3rd Year/6th sem		**Academic Year**	2020 - 2021
Laboratory Title	**Communication Lab**		**Laboratory Code**	18ECL67
Total Contact Hours	40 Hours		**Duration of SEE**	1 Hr Tutorial + 2 Hrs Lab
IA Marks	30 Marks		**SEE Marks**	100 Marks
Lab Manual Author	1) Prof. D. M. Kumbhar 2) Prof. S. S. Ittannavar	**Sign -** **Sign -**	**Date**	

Objectives

1. To Design & demonstrate the digital modulation techniques.
2. To Demonstrate & measure the wave propagation in micro strip antennas.
3. To get the Characteristics of microstrip devices & measurement of its parameter.
4. To simulate the digital communication concepts and compute & display various parameters along with plots/Figures.

Description

1.0 Learning Objectives

1. Design, Demonstrate and Analyze analog systems for AM, FM
2. Demonstrate and Analyze pulse sampling and flat top sampling
3. To study and design TDM/FSK and PSK circuits and its applications.
4. To study and measurement of frequency, guide wavelength, VSWR using test bench.
5. To study and measurement of isolation, coupling using MIC

2.0 Course Learning Outcomes

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

1. Design and test circuits for analog modulation and demodulation schemes viz., AM, FM, etc.
2. Determine the characteristics and response of microwave waveguide.
3. Determine characteristics of microstrip antennas and devices & compute the parameters associated with it.
4. Design and test the digital and analog modulation circuits and display the waveforms.
5. Simulate the digital modulation systems and compare the error performance of basic digital modulation schemes.

Prerequisites

The Lab requires the student to have the following prerequisites:

1. Complete knowledge of TDM/FSK and PSK.circuits and its applications.
2. Complete knowledge of CRO, function generator and bread board connections.

Base Course

1. Complete understanding of the bread board connections, procedure to place an IC on the bread board and procedure to use connecting wires.

2. A training on the complete operation of the electronic equipments like CRO, DSO, Signal Generator, Power Supply, Inductance box , capacitance box , multimeter, voltmeter and ammeter.
3. Knowledge of MIC kit, test bench.

Introduction

1. This lab deals with the experiments which are used in most of the communicationsystems and electronic equipments.
2. In this lab we study the applications of digital communication in various fields of signalprocessing.
3. To study how operation of different types of microwave communication kits and various microwave components.

Resources Required

The lab should have:

1. Electronic Equipments : CRO-20MHz, DSO-25MHz.
2. Signal Generator :(1-10MHz).
3. Power Supply :(0-30V).
4. Dual Power Supply : +/_12V.
5. Multimeter, Ammeter.
6. Microwave test bench
7. MIC kits
8. Digital communication kits.
9. Consumable Components : Resistors, Capacitor, DRB,DCB, IC- 4051, IC-555,IC-4051, Diode-0A79, Connecting wires, Bread Board, CRO - probes.

General Instructions

1. Do not handle any equipment before reading the instructions /Instruction manuals.
2. Read carefully the power ratings of the equipment before it is switched ON otherwisethe equipment. damage
3. Observe type of sockets of the equipment to avoid mechanical damage.
4. Do not forcefully place connectors.
5. Strictly observe the instructions given by the Teacher/ Lab Instructor.

Contents

Expt. No.	Experiments	Date Planned	Date Conducted
PART-A (Experiments to be done using Hardware setup)			
1	Amplitude Modulation and Demodulation: i) Standard AM, ii) DSBSC (LM741 and LF398 ICs can be used)		
2	Frequency modulation and demodulation (IC 803 8/2206 can be used)		
3	Pulse sampling, flat top sampling and reconstruction		
4	Time Division Multiplexing and Demultiplexing of two band limited signals.		
5	FSK and PSK generation & Detection		

6	Measurement of frequency, guide wavelength, power, VSWR and attenuation in a microwave test bench		
7	Measurement of directivity and gain of Microstrip dipole and Yagi antenna.		
8	Determination of a. Coupling and isolation characteristics of a stripline (or microstrip) directional coupler. b. Resonance characteristics of a microstrip ring resonator and determination of dielectric constant of the substrate. c. Power division and isolation characteristics of a microstrip power divider.		
PART-B Following Experiments to be done using MATLAB.			
9	To Simulate NRZ, RZ, half-sinusoid & raised cosine pulses and generate eye diagram for binary polar signaling.		
10	Pulse code modulation and demodulation system.		
11	Computations of the Probability of bit error for coherent binary ASK, FSK and PSK for an AWGN Channel and compare them with their performance curves.		
12	Digital Modulation Schemes i) DPSK Transmitter and Receiver, ii) QP SK Transmitter and Receiver.		

Evaluation Scheme

1. Lab activity – Continues evaluation for each experiment – 30 Marks.
2. Internal exam at the end of semester – 10 Marks.
3. Sem End Exam – 100 Marks.

Reference

1) Digital communication by Simon haykin
2) Antenna and wave propogation by John. D.Kraus and K.D.Pras

Prepared by	Checked by		
Prof. D. M. Kumbhar Prof. S. S. Ittannavar	Dr. R. R. Maggavi	HOD	Principal