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

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	Prof. 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

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 Comm. & 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 Lacks**		

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.04M	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, MSc. (Ph.D)	12Y-03M
4.	Sri. M. A. Attar	DEC	12Y-02M

CONTENTS

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)

IVSEMESTER

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	BSC	18MAT41	Complex Analysis, Probability and Statistical Methods	Mathematics	2	2	--	03	40	60	100	3
2	PCC	18EC42	Analog Circuits		3	2	--	03	40	60	100	4
3	PCC	18EC43	Control Systems		3	0	--	03	40	60	100	3
4	PCC	18EC44	Engineering Statistics & Linear Algebra		3	0	--	03	40	60	100	3
5	PCC	18EC45	Signals & Systems		3	0	--	03	40	60	100	3
6	PCC	18EC46	Microcontroller		3	0	--	03	40	60	100	3
7	PCC	18ECL47	Microcontroller Laboratory		--	2	2	03	40	60	100	2
8	PCC	18ECL48	Analog Circuits Laboratory		--	2	2	03	40	60	100	2
9	HSMC	18KVK39/49	Vyavaharika Kannada (Kannada for communication)	HSMC	--	2	--	--	100	--	100	1
		18KAK39/49	Aadalitha Kannada (Kannada for Administration)									
		OR										
		18CPC39/49	Constitution of India, Professional Ethics and Cyber Law		1	--	--	03	40	60		
					Examination is by objective type questions							
				TOTAL	**17**	**10**	**04**	**24**	**420**	**480**	**900**	**24**
					OR	**OR**		**OR**	**OR**	**OR**		
					18	**08**		**27**	**360**	**540**		

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

18KVK39/49 Vyavaharika Kannada (Kannada for communication) is for non-kannada speaking, reading and writing students and 18KAK39/49 Aadalitha Kannada (Kannada for Administration) is for students who speak, read and write kannada.

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

10	NCMC	18MATDIP41	Additional Mathematics – II	Mathematics	02	01	--	03	40	60	100	0

((a)The mandatory non – credit courses Additional Mathematics I and II prescribed for III and IV semesters respectively, to the lateral entry Diploma holders admitted to III semester of BE/B.Tech programs, shall attend the classes during the respective semesters to complete all the formalities of the course and appear for the University examination. In case, any student fails to register for the said course/ fails to secure the minimum 40 % of the prescribed CIE marks, he/she shall be deemed to have secured F grade. In such a case, the student have to Fulfill the requirements during subsequent semester/s to appear for SEE.
(b) These Courses shall not be considered for vertical progression, but completion of the courses shall be mandatory for the award of degree.

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

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

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

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 IV SEMESTER (EVEN)

Date	Events
23-05-2022	Commencement of IV Semester Classes
31-05-2022	Anti-Tobacco Day
05-06-2022	World Environment Day
14-06-2022	World Blood Donor Day
16-06-2022 to 18-06-2022	HSIT-FEST
21-06-2022	International Yoga Day
27-06-2022 to 29-06-2022	First Internal Assessment for IV Semester
30-06-2022	Feedback-I on Teaching-Learning
05-07-2022	Display of 1st I.A. Marks and submission of Feedback-I to office
21-07-2022	Project Exhibition
25-07-2022 to 27-07-2022	Second Internal Assessment for IV Semester
28-07-2022	Feedback-II on Teaching-Learning of IV Semester
29-07-2022	Graduation Day
02-08-2022	Display of 2nd I.A. Marks and submission of Feedback-II to office of IV Semester
13-08-2022	TECHNOVISION -2K22
29-08-2022 to 30-08-2022	Lab Internal Assessment for IV Semester
01-09-2022 to 03-09-2022	Third Internal Assessment for IV Semester
03-09-2022	Last working day of IV Semester
07-09-2022	Display of Final IA Marks of IV Semester
05-09-2022 to 13-09-2022	Practical Examination of IV Semester
16-09-2022 to 08-10-2022	Theory Examination of IV Semester

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-Ramaza

June-2022

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

July-2022

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

August-2022

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

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

September-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	

17/5/22
Dr. B. V. Madiggond
Dean (Acad)

12/5/22
Dr. S. C. Kamate
Principal

Subject Title	COMPLEX ANALYSIS, PROBABILITY AND STATISTICAL METHODS		
Subject Code	18MAT41	IA Marks	40
Number of Lecture Hrs / Week	04	Exam Marks	60
Total Number of Lecture Hrs	45	Exam Hours	03
CREDITS – 03			

FACULTY DETAILS:		
Name: Prof. S. S. Thabaj	**Designation:** Asst. Professor	**Experience:** 10
No. of times course taught: 03	**Specialization:** Mathematics	

1.0 Prerequisite Subjects:

Sl. No	Branch	Semester	Subject
01	Electronics & Communication Engineering	III	Engineering Mathematics-III

2.0 Course Objectives

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

3.0 Course Outcomes

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

	Course Outcome	POs
CO1	Use the concepts of analytic function and complex potentials to solve the problems arising in Electromagnetic field theory.	1,2,3,12
CO2	Utilize conformal transformation and complex integral arising in aerofoil theory, fluid flow Visualization and image processing.	1,2,3,12
CO3	Apply discrete and continuous probability distributions in analyzing the probability models arising in engineering field.	1,2,3,12
CO4	Make use of the correlation and regression analysis to fit a suitable mathematical model for the Statistical data.	1,2,3,12
CO5	Construct joint probability distributions and demonstrate the validity of testing the hypothesis.	1,2,3,12
Total Hours of instruction		**45**

4.0 Course Content

MODULE-I

Calculus of complex functions: Review of function of a complex variable, limits, continuity, and differentiability. Analytic functions: Cauchy-Riemann equations in Cartesian and polar forms and consequences.

Construction of analytic functions: Milne-Thomson method-Problems. **(09 Hours)**

MODULE-II

Conformal transformations: Introduction Discussion of transformations $w = z^2, w = e^z, w = z + \frac{1}{z}$ ($z \neq 0$).Bilinear transformations- Problems.

Complex integration: Line integral of a complex function-Cauchy's theorem and Cauchy's integral formula and Problems. **(09 Hours)**

MODULE-III

Probability Distributions: Review of basic probability theory. Random variables (discrete and continuous), Probability mass/density functions. Binomial, Poisson, exponential and normal distributions- problems

(No derivation for mean and standard deviation)-Illustrative examples. **(09 Hours)**

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

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

5.0 Relevance to future subjects

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

6.0 Relevance to Real World

SL. No	Real World Mapping
01	Calculus of complex functions is used to solve engineering problems. For examples will be drawn from a variety of engineering problems, including heat transfer, vibrations, dynamics, fluid mechanics, etc.
02	Probability Distributions used to design and Analysis of algorithm, interpreting data, Machine learning and artificial intelligence
03	Sampling Theory are used in design engineering, Sensors, image scanning, electricity generation & Quality of the products

7.0 Gap Analysis and Mitigation

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

8.0 Books Used and Recommended to Students

Text Books

1. B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers, 44th Edition, 2017.
2. E. Kreyszig: Advanced Engineering Mathematics, John Wiley & Sons, 10th Edition,2016
3. Srimanta Pal et al: Engineering Mathematics, Oxford University Press , 3rd Edition,2016

Reference Books

1. N.P.Bali and Manish Goyal: A Text Book of Engineering Mathematics, Laxmi Publishers, 2014.
2. B.V.Ramana: "Higher Engineering Mathematics" Tata McGraw-Hill, 2006.
3. C. Ray Wylie,Louis C.Barrett: Advanced Engineering ,Mathematics, McGraw-Hill ,6th Edition 1995
4. S.S.Sastry: Introductory Methods of Numerical Analysis, Prentice Hall of India 4th Edition 2010
5. Chandrika Prasad and Reena Garg : Advanced Engineering ,Mathematics, Khanna Publishing, 2018
6. H. K. Dass and Er. RajnishVerma: "Higher Engineerig Mathematics", S. Chand publishing, 1st edition, 2011.

Additional Study material & e-Books

1. N.P.Bali & Manish.Goyal, A Text book of Engineering Mathematics, 7th edition, Laxmi Publications.

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

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

10.0 Magazines/Journals Used and Recommended to Students

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

11.0 Examination Note

Internal Assessment: 50 Marks
Conducting 3 I.A tests and average of the same for final 50 marks IA and reduces to 30 marks.
10 marks for assignments & quiz.

Scheme of Evaluation for Internal Assessment (30 Marks)
(a) Assignment: 10 Marks.
(b) Internal Assessment test in the same pattern as that of the main examination (Average of the three Tests):30 marks.
Internal Assessment: 40 Marks

SCHEME OF EXAMINATION:
Question paper pattern:
Note: -The SEE question paper will be set for 100 marks and the marks will be proportionately reduced to 60.

1. The question paper will have **ten** full questions carrying equal marks.
2. Each full question consisting of **20** marks.
3. There will be **two** full questions (with a **maximum** of **four** sub questions) from each module.
4. Each full question will have sub question covering all the topics under a module.
5. The students will have to answer **five** full questions, selecting **one** full question from each module.

12.0 Course Delivery Plan

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

MODULE 2	11	Conformal Transformations and discussion of transformations of $w = z^2$, $w = e^z$	40
	12	Discussion of Transformations: $w = z + (1 / z)$.	
	13	Bilinear transformations	
	14	Problems	
	15	Complex line integrals-Cauchy's theorem	
	16	Cauchy's integral formula	
	17	Problems	
	18	Residue, poles	
	19	Cauchy's Residue theorem	
	20	Problems	
MODULE 3	21	Random variables (discrete and continuous)	60
	22	Probability mass/density functions	
	23	Binomial distribution.	
	24	Problems	
	25	Poisson distribution.	
	26	Problems	
	27	Exponential distribution.	
	28	Problems.	
	29	Normal distributions.	
	30	Problems.	
MODULE 4	31	Statistical Methods: Review of measures of central tendency and dispersion	80
	32	Correlation-Karl Pearson's coefficient of correlation	
	33	Problems	
	34	Regression analysis- lines of regression (without proof) –problems	
	35	Curve fitting by the method of least squares, of the form, form $y= ax+b$,	
	36	Problems.	
	37	Curve fitting by the method of least squares: $y= a+bx+cx^2$	
	38	Problems.	
	39	Curve fitting by the method of least squares $y = ae^{bx}$	
	40	Problems	
MODULE 5	41	Joint Probability distribution for two discrete random variables	100
	42	Expectation, covariance.	
	43	Sampling & Sampling distributions	
	44	standard error, test of hypothesis for means and proportions	
	45	confidence limits for means	
	46	Problems.	
	47	student's t-distribution	
	48	Problems.	
	49	Chi-square distribution as a test of goodness of fit.	
	50	Problems	

13.0 QUESTION BANK

MODULE-1: Calculus of complex functions

1. Derive Cauchy-Riemann equations in the Cartesian form.
2. Derive Cauchy-Riemann equations in the Polar form.
3. P.T if f(z)= u+iv is an analytic then the family of curves u(x,y)=C1 , v(x,y)= C2, C1 & C2 being Constants, intersect each other orthogonally
4. S.T w = log z, $z \neq 0$ is analytic & find $\frac{dw}{dz}$.
5. Find the analytic function f(z) as a function of z given that the sum of its real & imaginary parts is

6. $x^3 + y^3 + 3xy(x - y)$
7. Determine the analytic function Whose imaginary part is $r^2\cos 2\theta$
8. Determine the analytic function Whose real part is $\frac{2cosxcoshy}{cos2x+cosh2y}$
9. Find the analytic function f(z)= u+iv given u-v= e^x(cosy-siny)
10. If $f(z)$ analytic show that $\left[\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2}\right]|f(z)|^2 = 4\left|f'(z)\right|^2$

MODULE-2: Conformal transformations

1. Discuss the conformal transformation of $w = z^2$
2. Discuss the conformal transformation of $w = e^z$
3. Find the bilinear transformation which map the points z= 1, i, -i under this transformation find the image of |z| <1.
4. Find the bilinear transformation which maps z = ∞,i,0 into w=-1,-i,1. Also find the pts of transformation
5. State & prove Cauchy integral Theorem.
6. Verify Cauchy's theorem for the function f(z)= z^2 where c is the square having vertices
7. (0,0) ,(1,0),(1,1) & (0,1)
8. Evaluate $\int \frac{e^z}{z+i\pi}\, dz$ over each of the following contours C, a) |z| =2π , b) |z| =π/2 , c) |z-1|=1
9. State & prove Cauchy integral Theorem.

MODULE-3: Probability Distributions

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

$X = x_i$	-2	-1	0	1	2	3
p(x)	0.1	K	0.2	2k	0.3	k

4. Find i) The value of K, ii) $p(x \leq 0)$, iii) $p(x > 1)$ iv) $p(-2 < x \leq 1)$
5. If 10% of the rivets produced by a machine are defective, find the probability that, out of 12 rivets chosen at random.
6. S.T mean & standard deviation of exponential distribution are equal.
7. In a test of 2000 electric bulbs, it was found that the life of a bulb is a normal variable with average life of 2040 hours & standard deviation of 60 hours. Estimate the number of bulbs to burn for i) More than 2150 hours , ii) less than 1950 hours , Given that $p[0 \leq z \leq 1.83] = 0.4664$ & $p[0 \leq z \leq 1.33] = 0.4082$.
8. 2% of the fusion manufactured by a firm are found to be defective .Find the probability that a box containing 200 fuses contains i) no defective fuse , ii) 3 or more defective fuses.
9. In length of a telephone conversation is an exponential vitiate with mean 3 minutes. Find the probability that call i) ends in less than 3 minutes , ii) takes between 3 to 5 minutes.
10. Suppose that the student IQ scores form a normal distribution with average 100 & standard deviation 20. Find the percentage of students whose (i) score less than 80 (ii) score more than 120 (iii) score falls between 80 & 120 (G T P(1)=0.3413)
11. In a certain town the duration of a shower is exponentially distributed with mean 5 minutes what is

    the probability that a shower will least for i) 10 minutes or more, ii) less than 10 minutes, iii) betn 10 min & 12 min
12. The probability that a person aged 60 years will live upto 70 is 0.65. what is the probability that out of 10 persons aged 60 atleast 7 of them will live upto 70.

MODULE-4: Statistical Methods

1) Find the correlation coefficient and regration lines of y and x and x and y for the following data

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

2) Find the coefficient of correlation for the following data.

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

3) Compute the rank correlation coefficient for the following data

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

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

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

Curve Fitting and Optimization:

1) Find the equation of the best fitting straight line for the data

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

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

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

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

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

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

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

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

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

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

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

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

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

MODULE-5: Joint probability distribution:

1. Explain the following terms i) Null hypothesis , ii) Level of significance , iii) Type I & II errors ,

iv) Confidence limits.

1. A sample of 100 days is taken from meteorological records of certain districts & 10 of them are found to be fussy. Find the 99.73 % confidence interval of the % of fussy days in the distinct.
2. A certain stimulus administered to each of the 12 patients resulted in the following blood pressure 5,2,8,-1,3,0,6,-2,1,5,0,4, can it be calculated that stimulus will increase the blood pressure ?

   [$t_{0.05}$ for 11d.f= 2.201]
3. A die was thrown 9000 times & a throw of 5 or 6 was obtained 3240 times. On the assumption of random throwing, do the data abdicate that the die is biased?
4. A random sample of 100 records deaths in past year showed an average life span of 71.8 years. Assuming a population standard deviation of 8.9 years, does the data indicated that average life span today is greater than 70 years? Use a 0.05 level of significance.
5. In 324 throws of a six faced die, an odd number turned up 181 times. Is it reasonable to think that the die is an unbiased one?
6. Four coins are tossed 100 times & the following results were obtained

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

   Fit a Binomial distribution for the data & test the goodness of fit given $\chi^2_{0.05} = 9.49$ for 4 d. f
7. Find the student's 't' for the following variable values in a sample of eight -4,-2,-2,0,2,2,3,3 taking the mean of the universe to be zero.
8. A coin was tossed 400 times & the head turned up 216 times. Test the hypotheses that the coin is in biased at 5% level significance.
9. A die was thrown 1200 times & the number 6 was obtained 236 times. Can the die be considered fair at level of significance?

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

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

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

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

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

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

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

Examination	Total Students	S+	S	A	B	C	D	E	F	% Passing
June/July 2020	34	1	15	18	0	0	0	0	0	100
June/July 2021	30	0	14	14	2	0	0	0	0	100

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

Subject Title	**ANALOG CIRCUITS**		
Subject Code	18EC42	**IA Marks**	40
Number of	03 L+02 T	**Exam Marks**	60
Total Number of Lecture Hrs	50	**Exam Hours**	03

FACULTY DETAILS:		
Name: Prof. D M Kumbhar	**Designation:** Assistant Professor	**Experience:15** yrs
No. of times course taught:02	**Specialization:** Digital Electronics	

1.0 Prerequisite Subjects:

Sl. No	Branch	Semester	Subject
01	ECE	I/II	Basic Electronics
02	ECE	III	Electronic Devices

2.0 Course Objectives

Course Learning Objectives: This course will enable students to:

• Explain various BJT parameters, connections and configurations.

• Design and demonstrate the diode circuits and transistor amplifiers.

• Explain various types of FET biasing, and demonstrate the use of FET amplifiers.

• Construct frequency response of FET amplifiers at various frequencies.

• Analyze Power amplifier circuits in different modes of operation.

• Construct Feedback and Oscillator circuits using FET.

3.0 Course Outcomes

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

Course Outcomes: At the end of this course students will demonstrate the ability to

• Understand the characteristics of BJTs and FETs.

• Design and analyze BJT and FET amplifier circuits.

• Design sinusoidal and non-sinusoidal oscillators.

• Understand the functioning of linear ICs.

• Design of Linear IC based circuits.

CO	Description	RBT Level	POs
C210. 1	Analysis of biasing types and small signal models of BJT and FET.	L1,L2,L3	
C210. 2	Study of MOSFET amplifier configuration and Oscillators.	L1,L2,L3	
C210. 3	Describe the construction and working principle of feedback amplifiers and Power amplifiers.	L1,L2,L3	
C210. 4	To understand Op-Amp with Negative Feedback and its general applications.	L1,L2,L3	
C210. 5	To understand working of DAC, Active Filters using OP-AMP and Timer circuits using 555.	L1,L2,L3	

4.0 Course Content

Module -1
BJT Biasing: Biasing in BJT amplifier circuits: The Classical Discrete circuit bias (Voltage divider bias), Biasing using a collector to base feedback resistor.
Small signal operation and Models: Collector current and transconductance, Base current and input resistance, Emitter current and input resistance, voltage gain, Separating the signal and the DC quantities, The hybrid Π model.
MOSFETs: Biasing in MOS amplifier circuits: Fixing VGS, Fixing VG, Drain to Gate feedback resistor.
Small signal operation and modelling: The DC bias point, signal current in drain, voltage gain, small signal equivalent circuit models, transconductance.
[Text 1: 3.5(3.5.1, 3.5.3), 3.6(3.6.1 to 3.6.6), 4.5(4.5.1, 4.5.2, 4.5.3), 4.6(4.6.1 to 4.6.6)] L1, L2, L3

Module -2
MOSFET Amplifier configuration: Basic configurations, characterizing amplifiers, CS amplifier with and without source resistance RS, Source follower.
MOSFET internal capacitances and High frequency model: The gate capacitive effect, Junction capacitances, High frequency model.
Frequency response of the CS amplifier: The three frequency bands, high frequency response,Low frequency response.
Oscillators: FET based Phase shift oscillator, LC and Crystal Oscillators (no derivation)
[Text 1: 4.7(4.7.1 to 4.7.4, 4.7.6) 4.8(4.8.1, 4.8.2, 4.8.3), 4.9, 12.2.2, 12.3.1, 12,3,2] L1, L2,L3

Module -3
Feedback Amplifier: General feedback structure, Properties of negative feedback, The Four Basic Feedback Topologies, The series-shunt, series-series, shunt-shunt and shunt-series amplifiers (Qualitative Analysis) **Output Stages and Power Amplifiers:** Introduction, Classification of output stages,, Class A output stage, Class B output stage: Transfer Characteristics, Power Dissipation, Power Conversion efficiency, Class AB output stage, Class C tuned Amplifier.
[Text 1: 7.1, 7.2, 7.3, 7.4.1, 7.5.1, 7.6 (7.6.1 to 7.6.3), 13.1, 13.2, 13.3(13.3.1, 13.3.2, 13.3.3, 13.4, 13.7)] L1, L2, L3

Module -4
Op-Amp with Negative Feedback and general applications
Inverting and Non inverting Amplifiers – Closed Loop voltage gain, Input impedance, Output impedance, Bandwidth with feedback. DC and AC Amplifiers, Summing, Scaling and Averaging Amplifiers, Instrumentation amplifier, Comparators, Zero Crossing Detector, Schmitt trigger.
[Text 2: 3.3(3.3.1 to 3.3.6), 3.4(3.4.1 to 3.4.5) 6.2, 6.5, 6.6 (6.6.1), 8.2, 8.3, 8.4] L1, L2,L3

Module -5
Op-Amp Circuits: DAC - Weighted resistor and R-2R ladder, ADC- Successive approximation type, Small Signal half wave rectifier, Active Filters, First and second order low-pass and highpass Butterworth filters, Band-pass filters, Band reject filters. 555 Timer and its applications: Monostable and a stable Multivibrators.
[Text 2: 8.11(8.11.1a, 8.11.1b), 8.11.2a, 8.12.2, 7.2, 7.3, 7.4, 7.5, 7.6, 7.8, 7.9, 9.4.1, 9.4.1(a),

9.4.3, 9.4.3(a)] **L1, L2,L3**

5.0 Relevance to future subjects

Sl No	Semester	Subject	Topics
01	VIII	Project work	Digital transmission of voice, video and data.
02	V	Analog Communication	AM. FM. PM, Noise Analysis
03	VI	Digital Communication	Digital Modulation schemes, Spread Spectrum techniques

6.0 Relevance to Real World

SL.No	Real World Mapping
01	Design of electronic circuits for different applications.
02	Hobby/Mini projects
03	Home appliances/ controlling of equipments.

7.0 Gap Analysis and Mitigation

Sl. No	Delivery Type	Details
01	Tutorial	Topic: Simulation software like Simulink, PSpice and Proteus.
02	NPTEL	Assembly Application

8.0 Books Used and Recommended to Students

Text Books

1. Microelectronic Circuits, Theory and Applications, Adel S Sedra, Kenneth C Smith, 6th Edition, Oxford, 2015.ISBN:978-0-19-808913-1
2. Op-Amps and Linear Integrated Circuits, Ramakant A Gayakwad, 4th Edition. Pearson Education, 2000. ISBN: 8120320581

Reference Books

1. Electronic Devices and Circuit Theory, Robert L Boylestad and Louis Nashelsky, 11th Edition, Pearson Education, 2013, ISBN: 978-93-325-4260-0.
2. Fundamentals of Microelectronics, Behzad Razavi, 2nd Edition, John Weily, 2015, ISBN 978-81-265-7135-2
3. J.Millman&C.C.Halkias—Integrated Electronics, 2nd edition, 2010, TMH. ISBN 0-07-462245-5

Additional Study material & e-Books

1. NPTEL notes and Videos
2. VTU on line notes.
3. Free software like PTDS,OPTYSIS and OPTISYM.

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

Website and Internet Contents References

1) https://nptel.co.in
2) http://m.noteboy.in/vtuflies/machine%20drawing.pdf

10.0 Magazines/Journals Used and Recommended to Students

Sl.No	Magazines/Journals	website

1	IEEE Xplorer	http://ieee.com
2	International Journal of Science and Technology	http://www.sciencedirect.com/science/journal/00207683
3	Journal of Communication Engineering	http://ieee.com

11.0 Examination Note

Internal Assessment: 50 Marks
Conducting 3 I.A tests and average of the same for final 50 marks IA and reduces to 30 marks.
10 marks for assignments & quiz.

Scheme of Evaluation for Internal Assessment (30 Marks)
(c) Class work, assignment: 10 Marks.
(d) Internal Assessment test in the same pattern as that of the main examination (Average of the three Tests):30 marks.
Internal Assessment: 40 Marks

INSTRUCTIONS FOR ES&LA (18EC42) IA EXAMINATION
1. Four full questions will be given which consists of a,b,c,d sub sections.
Students have to answer either Q :1 or 2 and Q 3 or 4 completely.
Three IA will be conducted and average of three will be accounted.

SCHEME OF EXAMINATION:
- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

12.0 Course Delivery Plan

Course Delivery Plan:

UNIT	LECTURE NO.	CONTENT OF LECTURE	% OF PORTION
1	1	The Classical Discrete circuit bias	20
	2	Voltage divider bias	
	3	Biasing using a collector to base feedback resistor	
	4	Small signal operation and Models: Collector current and transconductance	
	5	Base current and input resistance, Emitter current and input resistance,	
	6	Voltage gain, Separating the signal and the DC quantities, The hybrid II model.	
	7	MOSFETs: Biasing in MOS amplifier circuits	
	8	Small signal operation and modeling:	
2	09	MOSFET Amplifier configuration**:** Basic configurations	40
	10	MOSFET internal capacitances and High frequency model	
	11	The gate capacitive effect	
	12	High frequency model	
	13	Frequency response of the CS amplifier	
	14	Oscillators: FET based Phase shift oscillator	
	15	LC and Crystal Oscillators	
	16	Numerical Problems	
3	17	Feedback Amplifier: General feedback structure, Properties of negative feedback	60
	18	Feedback Topologies,	
	19	Series-shunt, series-series, shunt-shunt and shunt-series amplifiers	
	20	Output Stages and Power Amplifiers:	
	21	Class A output stage, Class B output stage	
	22	Transfer Characteristics, Power Dissipation	
	23	Class AB output stage	

	24	Class C tuned Amplifier	
4	25	Op-Amp with Negative Feedback and general applications	80
	26	Inverting and Non inverting Amplifiers – Closed Loop voltage gain,	
	27	Summing, Scaling and Averaging,	
	28	DC and AC Amplifiers	
	29	Instrumentation amplifier,	
	30	Comparators, Zero Crossing Detector	
	31	Active Filters First and second order low-pass and high pass filters.	
	32	Schmitt trigger	
5	33	Op-Amp Circuits: DAC	100
	34	Weighted resistor and R-2R ladder, ADC- Successive approximation	
	35	Small Signal half wave rectifier,	
	36	Active Filters,	
	37	First and second order low-pass and high pass	
	38	Butterworth filters	
	39	Band-pass filters, Band reject filters	
	40	555 Timer and its applications: Monostable and a stable Multivibrators.	

13.0 University Result

Examination	Total Students	S+	S	A	B	C	D	E	F	% Passing
June/July 2020	34	--	08	22	04	--	--	--	--	100
June/July 2021	30	--	13	13	03	01	--	--	--	100

Prepared by	Checked by		
Prof. D. M. Kumbhar	Dr. S. B. Akkole	HOD	Principal

Subject Title	CONTROL SYSTEMS		
Subject Code	18EC43	**CIE 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. S.S.Malaj	**Designation:** Asst. Professor	**Experience:** 23
No. of times course taught: 04	**Specialization:** E & TC	

1.0 Prerequisite Subjects:

Sl. No	Branch	Semester	Subject
01	Electronics and communication Engineering	III	Network analysis
02	Electronics and communication Engineering	I	Elements of Mechanical Engineering

2.0 Course Objectives

1. Describe the basic features, configurations,& application of control systems .
2. Study the knowledge & terminologies and definitions for the control systems.
3. Determine a mathematical model of electrical, mechanical & electromechanical systems.
4. Find time response of the systems from the transfer functions.
5. Find the transfer function by applying masons rule.
6. Analyze the stability of the system from the transfer function.

3.0 Course Outcomes

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

	Course Outcome	RBT Level	POs
C211.1	Develop the mathematical model of mechanical and electrical Systems .	L1,L2,L3	1,2,3,4,5,12
C211.2	Develop transfer function for a given control system using block diagram reduction techniques and signal flow graph method	L1,L2,L3	1,2,3,4,5,12
C211.3	Determine the time domain specifications for first an d second order systems.	L1,L2,L3	1,2,3,4,5,12
C211.4	Deter mine the stability of a system in the time domain using Routh-Hurwitz criterion and Root locus technique.	L1,L2,L3	1,2,3,4,5,12
C211.5	Determine the stability of a system in the frequency domain using Nyquist and bode plots.	L1,L2,L3	1,2,3,4,5,12
Total Hours of instruction		**50**	

4.0 Course Content

Module 1	Teaching Hours	Bloom's Taxonomy (RBT) level
Introduction to Control Systems: Types of Control Systems, Effect of Feedback Systems, Differential equation of Physical Systems –Mechanical Systems, Electrical Systems, Electromechanical systems, Analogous Systems	**08**	**L1,L2,L3**
Module -2	**08**	**L1,L2,L3**
Block diagrams and signal flow graphs: Transfer functions, Block diagram algebra and Signal Flow graphs.		
Module-3	**08**	**L1,L2,L3**
Time Response of feedback control systems: Standard test signals, Unit step response of First and Second order Systems. Time response specifications, Time response specifications of second order systems, steady state errors and error constants. Introduction to PI, PD and PID Controllers (excluding design).		
Module-4	**08**	**L1,L2,L3**
Stability analysis: Concepts of stability, Necessary conditions for Stability, Routhstabilitycriterion, Relative stability analysis: more on the Routh stability criterion.Introduction to Root-Locus Techniques, The root locus concepts, Construction of rootloci. **Frequency domain analysis and stability:** Correlation between time and frequency response, Bode Plots, Experimental determination of transfer function.		
Module-5	**08**	**L1,L2,L3**
Introduction to Polar Plots, (Inverse Polar Plots excluded) Mathematical preliminaries, Nyquist Stability criterion, (System s with transportation lag excluded)Introduction to lead, lag and lead- lag compensating networks (excluding design). **Introduction to State variable analysis:** Concepts of state, state variable and state models for electrical systems, Solution of state equations.		

5.0 Relevance to future subjects

Sl No	Semester	Subject	Topics
01	VIII	Project work	Various process control systems.
02	IV	Microcontrollers.	Motor controllers
03	VI	Digital Communication	Sampling process & Signal reconstruction

6.0 Relevance to Real World

SL.No	Real World Mapping
01	Industrial drawings and design of various components
02	Model creation for analysis
03	Development of a mathematical models through software applications

7.0 Gap Analysis and Mitigation

Sl. No	Delivery Type	Details
01	Tutorial	Topic: control systems and types of control system.
02	NPTEL	Assembly Application

8.0 Books Used and Recommended to Students

Text Books
1 J. Nagarath and M.Gopal, "Control Systems Engineering", New Age International (P) Limited, Publishers, Fourth edition – 2005,ISBN:81-224-2008-7
Reference Books
1. "Modern Control Engineering ", K. Ogata, Pearson Education Asia/ PHI, 4th Edition, 2002.
2. "Automatic Control Systems", Benjamin C. Kuo, John Wiley India Pvt. Ltd., 8th Edition, 2008.
3. "Feedback and Control System", Joseph J Distefano III et al., Schaum's Outlines, TMH, 2nd Edition 2007.
Additional Study material & e-Books
1. Control systems: Ganesh Rao
2. A.P.Godse & U.A.Bakshi, "control systems", Technical Publications
3. Control systems by A.K.Jairath

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

Website and Internet Contents References
3) https://hareeshang.wordpress.com/tutorials/camd/
4) http://m.noteboy.in/vtuflies/machine%20drawing.pdf
5) https://www.edx.org/school/iitbombayx?utm_source=bing&utm_medium=cpc&utm_term=iit-bombay&utm_campaign=partner-iit-bombay
6) http://www.vlab.co.in/

10.0 Magazines/Journals Used and Recommended to Students

Sl. No	Magazines/Journals	website
1	Journal of Aircraft	http://arc.aiaa.org/loi/ja
2	International Journal of Solids and Structures	http://www.sciencedirect.com/science/journal/00207683
3	Journal of Manufacturing Science and Engineering	http://manufacturingscience.asmedigitalcollection.asme.org/issue.aspx?journalid=125&issueid=27340
4	American Fastener Journal	http://www.fastenerjournal.com/

11.0 Examination Note

Internal Assessment: 30 Marks
Conducting 3 I.A tests and average of the same for final 30 marks IA. 10 marks for assignments & quiz.

Scheme of Evaluation for Internal Assessment (30 Marks)
(e) Class work, assignment: 10 Marks.
(f) Internal Assessment test in the same pattern as that of the main examination (Average of the three Tests):30 marks.

SCHEME OF EXAMINATION:

- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

INSTRUCTION FOR Control System (18EC43) EXAMINATION

1. No restriction of timing for sketching and solving different problems and solutions. Duration is 3 hours.
2. It is desirable to do sketching of all the solutions
3. Drawing instruments may be used for sketching.

12.0 Course Delivery Plan

Module	Lecture No.	Content of Lecturer	% of Portion
1	1	Types of Control Systems, Effect of Feedback Systems,	20
	2	Differential equation of Physical Systems –Mechanical Systems,	
	3	Differential equation of Physical Systems –Mechanical Systems,	
	4	Differential equation of Physical Systems –Electrical Systems,	
	5	Differential equation of Physical Systems –Electrical Systems,	
	6	Electromechanical systems, Analogous Systems	
	7	Electromechanical systems, Analogous Systems	
	8	Electromechanical systems, Analogous Systems	
2	9	Transfer functions, Block diagram algebra and Signal Flow graphs.	40
	10	Transfer functions, Block diagram algebra and Signal Flow graphs.	
	11	Transfer functions,	
	12	Transfer functions,	
	13	Block diagram algebra	
	14	Block diagram algebra	
	15	Signal Flow graphs.	
	16	Signal Flow graphs.	
3	17	Standard test signals, Unit step response of First and Second order Systems.	60
	18	Standard test signals, Unit step response of First and Second order Systems.	
	19	Time response specifications, Timeresponse specifications of second order systems	
	20	response specifications of second order systems,	
	21	steady state errors and error constants.	
	22	steady state errors and error constants.	
	23	Introduction to PI, PD and PID Controllers	
	24	Introduction to PI, PD and PID Controllers	
4	25	Concepts of stability, Necessary conditions for Stability,.	80
	26	Concepts of stability, Necessary conditions for Stability,	
	27	Routh stability criterion, Relative stability analysis: more on the Routh stability criterion.	
	28	Introduction to Root-Locus Techniques, The root locus concepts, Construction of root loci.	
	29	Correlation between time and frequency response.	
	30	Correlation between time and frequency response,	
	31	Bode Plots, Experimental determination of transfer function.	
	32	Bode Plots, Experimental determination of transfer function.	100
5	33	Introduction to Polar Plots	
	34	Introduction to Polar	
	35	Mathematical preliminaries, Nyquist Stability criterion, (Systems with transportation lag excluded)	
	36	Introduction to lead, lag and lead- lag compensating networks (excluding design).	
	37	Concepts of state, state variable and state models for electrical systems	
	38	state variable and state models for electrical systems, Solution of state equations.	
	39	State variable and state models for electrical systems, Solution of state equations.	
	40	Solution of state equations.	

13.0 University Result

Examination	FCD	FC	SC	% Passing
MAY-2021	30	--	--	100 %
MAY-2020	34	--	--	100 %

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

Subject Title	**Engineering Statistics and Linear Algebra**		
Subject Code	**18EC44**	**IA Marks**	40
Number of Lecture Hrs / Week	03	**Exam Marks**	60
Total Number of Lecture Hrs	40	**Exam Hours**	03
			CREDITS – 03

FACULTY DETAILS:		
Name: Prof. D. B. Madihalli	**Designation:** Asst. Professor	**Experience:** 14.01 yrs.
No. of times course taught: 01	**Specialization:** Industrial Electronics	
	Prerequisite Subjects: set theory, probability	

1.0 Prerequisite Subjects:

Sl. No	Branch	Semester	Subject
01	Electronics & Communication Engineering	IV	Engineering Mathematics

2.0 Course Objectives

The purpose of this course is to make students well conversant with numerical methods to solve ordinary differential equations, complex analysis, sampling theory and joint probability distribution and stochastic processes arising in science and engineering.

- Understand and Analyze Single and Multiple Random Variables, and their extension to Random Processes.
- Familiarization with the concept of Vector spaces and orthogonality with a qualitative insight into applications in communications.
- Compute the quantitative parameters for functions of single and Multiple Random Variables and Processes.
- Compute the quantitative parameters for Matrices and Linear Transformations

3.0 Course Outcomes

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

	Course Outcome	RBT Level	POs
C212.1	Identify and associate Random Variables and Random Processes in Communication events.	L3	1,2 & 12
C212.2	Analyze and model the Random events in typical communication events to extract quantitative statistical parameters.	L3	1,2 & 12
C212.3	Analyze and model typical signal sets in terms of a basis function set of Amplitude, phase and frequency.	L3	1,2 & 12
C212.4	Explain vector spaces and its dimensions.	L3	1,2 & 12
C212.5	Compute determinants, diagonalize and singular value decomposition.	L3	1,2 & 12

4.0 Course Content

MODULE -1 : Single Random Variables: Definition of random variables, cumulative distribution function continuous and discrete random variables; probability mass function, probability density functions and properties; Expectations, Characteristic functions, Functions of single Random Variables, Conditioned Random variables. Application exercises to some special distributions: Uniform, Exponential, Laplace, Gaussian; Binomial, and Poisson distribution.

(Chapter 4 Text 1).

MODULE 2 : Multiple Random variables : Concept, Two variable CDF and PDF, Two Variable expectations (Correlation, orthogonality, Independent), Two variable transformation, Two Gaussian Random variables, Sum of two independent Random Variables, Sum of IID Random Variables – Central limit Theorem and law of large

numbers, Conditional joint Probabilities, Application exercises to Chi-square RV, Student-T RV, Cauchy and Rayleigh RVs.
(Chapter 5 Text 1)

MODULE 3: Random Processes : Ensemble, PDF, Independence, Expectations, Stationarity, Correlation Functions (ACF, CCF, Addition, and Multiplication), Ergodic Random Processes, Power Spectral Densities (Wiener Khinchin, Addition and Multiplication of RPs, Cross spectral densities), Linear Systems (output Mean, Cross correlation and Auto correlation of Input and output), Exercises with Noise. **(Chapter 6 Text 1)**

MODULE 4: Vector Spaces: Vector spaces and Null subspaces, Rank and Row reduced form, Independence, Basis and dimension, Dimensions of the four subspaces, Rank-Nullity Theorem, Linear Transformations
Orthogonality: Orthogonal Vectors and Subspaces, Projections and Least squares, Orthogonal Bases and Gram-Schmidt Orthogonalization procedure.
(Refer Chapters 2 and 3 Text 2)

MODULE 5: Determinants: Properties of Determinants, Permutations and Cofactors **Refer Chapter 4, Text 2**)
Eigen values and Eigen vectors: Review of Eigen values and Diagonalization of a Matrix, Special Matrices (Positive Definite, Symmetric) and their properties, Singular Value Decomposition.
(Refer Chapter 5, Text 2)

5.0 Relevance to future subjects

Sl. No	Semester	Subject	Topics
01	VIII	Project work	Communication
02	V/VI	Project work	Projects and Research

6.0 Relevance to Real World

SL. No	Real World Mapping
01	Analyze different type's variables.
02	Design of different types of systems with linear algebraic equations and vector space for better the communication

7.0 Gap Analysis and Mitigation

Sl. No	Delivery Type	Details
01	Tutorial	Topic: Random Variables and Determinants

8.0 Books Used and Recommended to Students

Text Books
1. Richard H Williams, "Probability, Statistics and Random Processes for Engineers" Cengage Learning, 1st Edition, 2003, ISBN 13: 978-0-534- 36888-3, ISBN 10: 0-534-36888-3. 2. Gilbert Strang, "Linear Algebra and its Applications", Cengage Learning, 4th Edition, 2006, ISBN 97809802327
Reference Books
1. Hwei P. Hsu, "Theory and Problems of Probability, Random Variables, and Random Processes" Schaums Outline Series, McGraw Hill. ISBN 10: 0-07- 030644-3. 2. K. N. HariBhat, K Anitha Sheela, Jayant Ganguly, "Probability Theory and Stochastic Processes for Engineers", Cengage Learning India, 2019, ISBN: Not in book
Additional Study material & e-Books
4. NPTEL notes and Videos 5. VTU on line notes

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

Website and Internet Contents References
01) https://nptel.ac.in/courses/111107106/https://nptel.ac.in/courses/117105085/
02) https://nptel.ac.in/courses/111106112/
03) https://nptel.ac.in/courses/111105041/

10.0 Magazines/Journals Used and Recommended to Students

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

11.0 Examination Note

Internal Assessment: 50 Marks
Conducting 3 I.A tests and average of the same for final 50 marks IA and reduces to 30 marks.
10 marks for assignments & quiz.

Scheme of Evaluation for Internal Assessment (30 Marks)
(g) Class work, assignment: 10 Marks.
(h) Internal Assessment test in the same pattern as that of the main examination (Average of the three Tests):30 marks.
Internal Assessment: 40 Marks

INSTRUCTIONS FOR ES&LA (18EC44) IA EXAMINATION
1. Four full questions will be given which consists of a,b,c,d sub sections.
Students have to answer either Q :1 or 2 and Q 3 or 4 completely.
Three IA will be conducted and average of three will be accounted.

SCHEME OF EXAMINATION:
- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

12.0 Course Delivery Plan

Course Delivery Plan:

MODULE	LECTURE NO.	CONTENT OF LECTURE	% OF PORTION
1	1	Definition of random variables	20
	2	cumulative distribution function continuous and discrete random variables	
	3	probability mass function, probability density functions and properties	
	4	Expectations Characteristic functions	
	5	Functions of single Random Variables	
	6	Conditioned Random variables. Application exercises to Some special distributions	
	7	Uniform, Exponential, Laplace Gaussian	
	8	Binomial, and Poisson distribution	
2	9	Concept, Two variable CDF and PDF .	40
	10	PDF Two Variable expectations (Correlation, orthogonality, Independent),	
	11	Two variable transformation	
	12	Two Gaussian Random variables	
	13	Sum of two independent Random Variables	
	16	Sum of IID Random Variables Central limit Theorem and law of large numbers	
	17	Conditional joint Probabilities	
	18	Application exercises to Chi-square RV, Student-T RV, Cauchy and Rayleigh RVs	
	19	Ensemble, PDF, Independence	
3	20	Expectations, Stationary	60
	21	Correlation Functions (ACF, CCF, Addition, and Multiplication)	
	22	Ergodic Random Processes, Power Spectral Densities	
	23	Wiener Khinchin, Addition and Multiplication of RPs, Cross spectral densities	
	24	Linear Systems (output Mean, Cross correlation and Auto correlation of Input and output)	
	25	Exercises with Noise	
4	26	Vector spaces and Null subspaces,	80
	27	Rank and Row reduced form	
	28	Independence, Basis and dimension	
	29	Dimensions of the four subspaces	
	30	Rank-Nullity Theorem, Linear Transformations	
	31	Orthogonal Vectors and Subspaces	
	32	Projections and Least squares	
	33	Orthogonal Bases and Gram- Schmidt Orthogonalization procedure	

5	34	Properties of Determinants Permutations	100
	35	Cofactors	
	36	Permutations and Cofactors	
	37	Review of Eigen values and Diagonalization of a Matrix	
	38	Special Matrices (Positive Definite, Symmetric)	
	39	Special Matrices properties	
	40	Singular Value Decomposition	

13.0 University Result

Examination	Total Students	S+	S	A	B	C	D	E	F	% Passing
June/July 2020	34	01	15	18	--	--	--	--	--	100
June/July 2021	30	--	14	14	02	--	--	--	--	100

Prepared by	Checked by		
Prof. D. B. Madihalli	Prof. S. S. Kamate	HOD	Principal

Subject Title	**SIGNALS AND SYSTEMS**		
Subject Code	18EC45	**CIE Marks**	40
Number of Lecture Hrs / Week	03	**SEE Marks**	60
Total Number of Lecture Hrs	40	**Exam Hours**	03

FACULTY DETAILS:		
Name: Prof. S.S. Kamate	**Designation:** Asst. Professor	**Experience:**19.5 yrs
No. of times course taught: 15	**Specialization:** M. Tech. Digital Electronics	

1.0 Prerequisite Subjects:

Sl. No	Branch	Semester	Subject
01	ECE	I, II & III	Engg. Mathematics

Course Objectives

1. Understand the mathematical description of continuous and discrete time signals and systems.
2. Analyze the signals in time domain using convolution difference/differential equations
3. Classify signals into different categories based on their properties.
4. Analyze Linear Time Invariant (LTI) systems in time and transform domains.
5. Build basics for understanding of courses such as signal processing, control system and communication.

3.0 Course Outcomes

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

	Course Outcome	Cognitive Level	POs
C213.1	Analyze different types of signals and systems.	L1,L2,L3	1-3, 10, 12
C213.2	Determine the linearity, causality, time-invariance and stability properties of continuous and discrete time systems	L1,L2,L3	1-3, 10, 12
C213.3	Evaluate the convolution sum and integral.	L1,L2,L3	1-3, 10, 12
C213.4	Represent continuous and discrete signals &systems in frequency domain using Fourier representations	L1,L2,L3	1-3, 10, 12
C213.5	Analyze discrete time signals and systems using Z-transforms	L1,L2,L3	1-3, 10, 12
Total Hours of instruction		40	

4.0 Course Content

Module -1 Introduction and classification of signals: **08 hours**

Definition of signal and systems, communication and control system as examples Classification of signals.

Basic Operations on signals:

Amplitudescaling, addition, multiplication, differentiation, integration, time scaling, time shift and time reversal.

Elementary signals/Functions:

Exponential, sinusoidal, step,impulse and ramp functions. Expression of triangular, rectangular and other waveforms in terms of elementary signals.

Module-2 System Classification and properties: **08 hours**

Linear-nonlinear, Time variant-invariant, causal-noncausal, static-dynamic, stable-unstable, invertible.

Time domain representation of LTI System:

Impulse response, convolution sum, convolution integral. Computation of convolution sum and convolution integral using graphical method for unit step and unit step, unit step and exponential, exponential and exponential, unit step and rectangular, and rectangular and rectangular.

Module-3 LTI system Properties in terms of impulse response: **08 hours**
System interconnection, Memory less, Causal, Stable, Invertible and Deconvolution, and step response.
Fourier Representation of Periodic Signals:
CTFS properties and basic problems.

Module-4 Fourier Representation of aperiodic Signals: **08 hours**
Introduction to Fourier Transform & DTFT, Definition and basic problems.
Properties of Fourier Transform:
Linearity, Time shift, Frequency shift, Scaling, Differentiation and Integration, Convolution and Modulation, Parseval's theorem and problems on properties of Fourier Transform.

Module-5 The Z-Transforms: **08 hours**
Z transform, properties of the region of convergence, properties of the Z-transform, Inverse Z-transform, Causality and stability, Transform analysis of LTI systems.

5.0 Relevance to future subjects

Sl. No	Semester	Subject	Topics
01	VIII	Project work	DSP, Image processing and Communication
02	V/VI	Digital Signal Processing, Digital communication.	Projects and Research

6.0 Relevance to Real World

SL. No	Real World Mapping
01	Analyze different types of signals.
02	Design of different types of systems for better communication

7.0 Gap Analysis and Mitigation

Sl. No	Delivery Type	Details
01	Tutorial	Topic: Simulation using cadence design lab
02	NPTEL	Assembly Application

8.0 Books Used and Recommended to Students

Text Books

1. **Simon Haykins and Barry Van Veen,** "Signals and Systems", 2nd Edition, 2008, Wiley India. ISBN 9971-51-239-4.

Reference Books

1. **Michael Roberts,** "Fundamentals of Signals & Systems", 2nd edition, Tata McGraw-Hill, 2010, ISBN 978-0-07-070221-9.
2. **Alan V Oppenheim, Alan S, Willsky and A Hamid Nawab,** "Signals and Systems" Pearson Education Asia / PHI, 2nd edition, 1997. Indian Reprint 2002.
3. **H. P Hsu, R. Ranjan,** "Signals and Systems", Scham's outlines, TMH, 2006.
4. **B. P. Lathi,** "Linear Systems and Signals", Oxford University Press, 2005.
5. **Ganesh Rao and Satish Tunga,** "Signals and Systems",Pearson/Sanguine Technical Publishers.

Additional Study material & e-Books

1. NPTEL notes and Videos
2. VTU on line notes

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

Website and Internet Contents References
04) https://nptel.co.in
05) nptel.ac.in/downloads/117101055/
06) www.nptelvideos.in/2012/12/signals-and-system.html

10.0 Magazines/Journals Used and Recommended to Students

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

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 (40 Marks)

(i) Internal Assessment test in the same pattern as the main examination.

SCHEME OF EXAMINATION:

Two questions to 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 SIGNALS AND SYSTEMS (18EC45) 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.

12.0 Course Delivery Plan

MODULE	LECTURE NO.	CONTENT OF LECTURE	% OF PORTION
1	1.	Definitions of a signal and a system	20
	2.	Examples of signals and system	
	3.	Classification of signals- Continuous time and discrete time signals	
	4.	Classification of signals as even, odd	
	5.	Basic Operations on signals	
	6.	Periodic and non-periodic, deterministic and non-deterministic	
	7.	Energy and power	

	8.	Elementary signals: Continuous time	
	9.	Elementary signals: Discrete_ time	
	10.	Properties of systems	40
2	11.	Definition of impulse response	
	12.	Convolution sum and convolution integral	
	13.	Convolution sum using graphical method	
	14.	Computation of convolution integral using graphical method	
	15.	Properties of convolution	
3	16.	System interconnection, Problems on CT & DT signals	60
	17.	Deconvolution	
	18.	system properties in terms of impulse response,	
	19.	step response in terms of impulse response	
	20.	Introduction DTFS	
	21.	Properties DTFS	
	22.	Basic problems on DTFS	
	23.	Introduction to CTFS	
	24.	Properties CTFS	
4	25.	Fourier Transform - definition	80
	26.	FT of standard CT signals	
	27.	Properties and their significance	
	28.	DTFT- definition	
	29.	DTFT of standard discrete signals	
	30.	Properties and their significance,	
	31.	Sampling theorem and reconstruction of signals	
5	32.	Introduction to Z-transform,	100
	33.	properties of the Region of convergence	
	34.	Properties of the Z-Transform	
	35.	Inverse of the Z-Transform	
	36.	Long division method, Partial fraction method	
	37.	Transform analysis of LTI systems	
	38.	Finding impulse response	
	39.	Finding system function	
	40.	Check for causality and stability	

13.0 University Result

Examination	FCD	FC	SC	% Passing
August 2021	**29**			**100**
July 2020	**34**	**-**	**-**	**100**

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

Subject Title	**MICROCONTROLLER**		
Subject Code	18EC46	**IA Marks**	50
Number of Lecture Hrs / Week	03 L	**Exam Marks**	60
Total Number of Lecture Hrs	40	**Exam Hours**	03

FACULTY DETAILS:		
Name: Prof. Dr. R.R. Maggavi	**Designation:** Associate Professor	**Experience:** 18
No. of times course taught:08	**Specialization:** Digital Electronics	

1.0 Prerequisite Subjects:

Sl. No	Branch	Semester	Subject
01	ECE	III	Logic Design
02	ECE	II	Basic Electronics

2.0 Course Objectives

1. To understand the difference between a Microprocessor and a Microcontroller and Embedded Microcontrollers
2. To familiarize the basic Architecture of 8051 microcontroller.
3. To Program 8051 microcontroller using Assembly level language and C.
4. To understand the interrupt system of 8051 and use of interrupts.
5. To understand the operation and use of inbuilt Timers/Counters and serial port of 8051.
6. To Interface 8051 to external memory and I/O devices using its I/O ports.

3.0 Course Outcomes

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

	Course Outcome	RBT Level	POs
C214.1	Explain the difference between Microprocessor & Microcontroller Architecture of 8051 & Interfacing it to external memory.	L2	1,2,3,4,5,6,8, 10,11,12
C214.2	Write 8051 Assembly level programs using instruction set.	L2	1,2,3,4,5,6,8, 10,11,12
C214.3	Explain interfacing of 8051 with LEDs and Switches using the concepts of stack, subroutines concepts of Assembly level programming.	L3	1,2,3,4,5,6,8, 10,11,12
C214.4	Explain the Interrupt system, operation of Timers/Counters and serial port of 8051	L3	1,2,3,4,5,6,8, 10,11,12
C214.5	Write a Assembly language program to generate timings and waveforms using 8051 timers, to send & receive serial data using port and to generate external interrupt using switch.	L3	1,2,3,4,5,6,8, 10,11,12
Total Hours of instruction		**40**	

4.0 Course Content

Course Content:

Module-1	RBT Level
8051 Microcontroller: Microprocessor Vs Microcontroller, Embedded Systems, Embedded Microcontrollers, 8051 Architecture- Registers, Pin diagram, I/O ports functions, Internal Memory organization. External Memory (ROM & RAM) interfacing. **08Hours**	L1, L2
Module-2	
8051 Instruction Set: Addressing Modes, Data Transfer instructions, Arithmetic instructions, Logical instructions, Branch instructions, Bit manipulation instructions. Simple Assembly language program examples (without loops) to use these instructions. **08Hours**	L1, L2
Module-3	
8051 Stack, I/O Port Interfacing and Programming: 8051 Stack, Stack and Subroutine instructions. Assembly language program examples on subroutine and involving loops. Interfacing simple switch and LED to I/O ports to switch on/off LED with respect to switch status. **08Hours**	L1, L2, L3
Module-4	
8051 Timers and Serial Port: 8051 Timers and Counters – Operation and Assembly language programming to generate a pulse using Mode-1 and a square wave using Mode- 2 on a port pin. 8051 Serial Communication- Basics of Serial Data Communication, RS- 232 standard, 9 pin RS232 signals, Simple Serial Port programming in Assembly and C to transmit a message and to receive data serially. **08Hours**	L1, L2, L3
Module-5	
8051 Interrupts and Interfacing Applications: 8051 Interrupts. 8051 Assembly language programming to generate an external interrupt uses a switch, 8051 C programming to generate a square waveform on a port pin using a Timer interrupt. Interfacing 8051 to ADC-0804, DAC, LCD and Stepper motor and their 8051 Assembly language interfacing programming. **08Hours**	L1, L2, L3

5.0 Relevance to future subjects

Sl. No	Semester	Subject	Topics
01	VIII	Project work	Embedded Systems

6.0 Relevance to Real World

SL. No	Real World Mapping
01	Microcontroller is used to design the Embedded systems design.
02	Microcontroller is used to design the Real time system with specific application.

7.0 Gap Analysis and Mitigation

Sl. No	Delivery Type	Details
01	Tutorial	Topic: Application of Microcontrollers in Real time Embedded systems.
02	NPTEL	Latest Controllers introduced.

8.0 Books Used and Recommended to Students

Text Books
1. "The 8051 Microcontroller and Embedded Systems – using assembly and C "-, Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D. McKinlay; PHI, 2006 / Pearson, 2006 2. "The 8051 Microcontroller Architecture, Programming & Applications", 2e Kenneth J. Ayala ;, Penram International, 1996 / Thomson Learning 2005.
Reference Books
1. "The 8051 Microcontroller", V. Udayashankar and MalikarjunaSwamy, TMH, 2009 2. Microcontrollers: Arch, Programming, Interfacing and System Design", Raj Kamal, "Pearson Edn, 2005
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) https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-ee42/ 2) http://everythingvtu.wordpress.com

10.0 Magazines/Journals Used and Recommended to Students

Sl. No	Magazines/Journals	website
1	IEEE Transactions on Embedded systems	ieeexplore.ieee.org
2	Microcontroller & Embedded design - Journal - Elsevier	www.journals.elsevier.com
3	International Journal Microcontrollers	ijdcn.co.in

11.0 Examination Note

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

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

SCHEME OF EXAMINATION:
Question paper pattern:
Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
• Each full question can have a maximum of 4 sub questions.
• There will be 2 full questions from each module covering all the topics of the module.
• Students will have to answer 5 full questions, selecting one full question from each module.
• The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

12.0 Course Delivery Plan

Course Delivery Plan:

MODULE	LECTURE NO.	CONTENT OF LECTURE	% OF PORTION
Module-1 8051 Microcontroller	1	Microprocessor Vs Microcontroller	20
	2	Embedded Systems	
	3	Embedded Microcontrollers	
	4	8051 Architecture- Registers,	
	5	Pin diagram	
	6	I/O ports functions	
	7	Internal Memory organization.	
	8	External Memory (ROM & RAM) interfacing.	
Module-2 8051 Instruction Set	9	Addressing Modes	40
	10	Data Transfer instructions,	
	11	Arithmetic instructions	
	12	Logical instructions	
	13	Branch instructions	
	14	Bit manipulation instructions	
	15	Simple Assembly language program examples (without loops) to use these instructions.	
	16	Simple Assembly language program examples	
Module-3 8051 Stack, I/O Port Interfacing and Programming	17	8051 Stack	60
	18	Stack and Subroutine instructions	
	19	Assembly language program	
	20	examples on subroutine	
	21	examples on subroutine and involving loops	
	22	Interfacing simple switch and to I/O ports	
	23	Interfacing simple LED to I/O ports	
	24	ALP to switch on/off LED with respect to switch status.	
Module-4 8051 Timers and Serial Port	25	8051 Timers and Counters	80
	26	Operation and Assembly language programming	
	27	ALP to generate a pulse using Mode-1	
	28	ALP tosquare wave using Mode- 2	
	29	8051 Serial Communication	

	30	Basics of Serial Data Communication, RS- 232 standard, 9 pin RS232 signals	
	31	Simple Serial Port programming in Assembly	
	32	C program to transmit a message and to receive data serially.	

Module-5 8051 Interrupts and Interfacing Applications	33	8051 Interrupts.	100
	34	8051 Assembly language programming to generate an external interrupt using a switch	
	35	8051 C programming using timer interrupts	
	36	8051 C programming to generate a square waveform on a port pin using a Timer interrupt	
	37	Interfacing 8051 to ADC-0804	
	38	Interfacing 8051 to DAC	
	39	LCD and their 8051 Assembly language interfacing programming.	
	40	Stepper motor and their 8051 Assembly language interfacing programming.	

13.0 University Result

Examination	FCD	FC	SC	% Passing
June/July 2021	-	-	-	100
June/July 2020	-	-	-	100

Prepared by	Checked by		
Dr. R.R.Maggavi	Prof. Sachin S. Patil	HOD	Principal

Subject Title	**MICROCONTROLLER LABORATORY**		
Subject Code	18ECL47	**IA Marks**	40
Number of Lecture Hrs / Week	2 Hr Tutorial + 2 Hrs Lab	**Exam Marks**	60
Total Number of Lecture Hrs	4	**Exam Hours**	03
CREDITS – 04			

FACULTY DETAILS:		
Name: Prof. Pramod V. Patil	**Designation:** Asst. Professor	**Experience:** 10Years
No. of times course taught: 06	**Specialization:** VLSI & Embedded System Design	

1.0 Prerequisite Subjects:

Sl. No	Branch	Semester	Subject
01	Electronics & Communication Engineering	I/II	Basic Electronics
02	Electronics & Communication Engineering	III	Digital Electronics

2.0 Course Objectives

This laboratory course enables students to
- Understand the basics of microcontroller and its applications.
- Have in-depth knowledge of 8051 assembly language programming.
- Understand controlling the devices using C programming.
- The concepts of I/O interfacing for developing real time embedded systems.

3.0 Course Outcomes

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

Sr. No.	Course Outcome	RBT Level	POs
C215.1	Write Assembly language programs in 8051 for solving simple problems that manipulate input data using different instructions of 8051.	L1,L2,L3	PO1 to PO12
C215.2	Interface different input and output devices to 8051 and control them using Assembly language programs.	L1,L2,L3	PO1 to PO12
C215.3	Interface the serial devices to 8051 and do the serial transfer using C programming.	L1,L2,L3	PO1 to PO12
Total Hours of instruction		**50**	

4.0 Course Content

Laboratory Experiments:

I. PROGRAMMING

1. Data Transfer: Block Move, Exchange, Sorting, Finding largest element in an array.
2. Arithmetic Instructions - Addition/subtraction, multiplication and division, square, Cube – (16 bits Arithmetic operations – bit addressable).
3. Counters.
4. Boolean & Logical Instructions (Bit manipulations).
5. Conditional CALL & RETURN.
6. Code conversion: BCD – ASCII; ASCII – Decimal; Decimal - ASCII; HEX - Decimal and Decimal - HEX.
7. Programs to generate delay, Programs using serial port and on-Chip timer/counter.

II. INTERFACING

1. Interface a simple toggle switch to 8051 and write an ALP to generate an interrupt which switches on an LED (i) continuously as long as switch is on and (ii) only once for a small time when the switch is turned on.
2. Write a C program to (i) transmit and (ii) to receive a set of characters serially by interfacing 8051 to a terminal.
3. Write ALPs to generate waveforms using ADC interface.
4. Write ALP to interface an LCD display and to display a message on it.
5. Write ALP to interface a Stepper Motor to 8051 to rotate the motor.
6. Write ALP to interface ADC-0804 and convert an analog input connected to it.

5.0 Relevance to future subjects

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

6.0 Relevance to Real World

Sl. No	Real World Mapping
01	Microcontroller 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: Lettering, Line, Methods of dimensioning
02	NPTEL	Assembly Application

8.0 Books Used and Recommended to Students

Text Books
1) "The 8051 Microcontroller and Embedded Systems – using assembly and C", Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D. McKinlay; PHI, 2006 / Pearson, 2006.
2) "The 8051 Microcontroller", Kenneth J. Ayala, 3rd Edition, Thomson/Cengage Learning.

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) https://nptel.ac.in/courses/108/105/108105102/

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 (40 Marks)
(a) Continuous Assessment (Journal Write up) : 30 marks.
(b) Internal Assessment Test 10 marks.
SCHEME OF EXTERNAL EXAMINATION:
Two questions to be set. Student has to answer both full questions. 100 Marks divided in three parts 15 write up marks, 70 Conduction marks & 15 Viva marks.

SCHEME OF EXAMINATION:

Conduct of Practical Examination:

- All laboratory experiments are to be included for practical examination.
- Students are allowed to pick one experiment from the lot.
- Strictly follow the instructions as printed on the cover page of answer script for breakup of marks.
- Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.

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12.0 Course Delivery Plan

Experiment	Lecture No.	Content	% of Portion
1	1	**1. Programs involving:** Data transfer instructions like: Block Move, Exchange, Sorting, Finding largest element in an array.	8
2	2	**2. Programs involving:** Arithmetic & logical operations like: Addition/subtraction, multiplication and division, square, Cube – (16 bits Arithmetic operations – bit addressable).	16
3	3	Counters.	24
4	4	Boolean & Logical Instructions (Bit manipulations).	32
5	5	Conditional CALL & RETURN.	40
6	6	Code conversion: BCD – ASCII; ASCII – Decimal; Decimal - ASCII; HEX - Decimal and Decimal - HEX.	48
7	7	Programs to generate delay, Programs using serial port and on-Chip timer/counter.	56
		II. INTERFACING	
1	1	1. Interface a simple toggle switch to 8051 and write an ALP to generate an interrupt which switches on an LED (i) continuously as long as switch is on and (ii) only once for a small time when the switch is turned on.	64
2	2	Write a C program to (i) transmit and (ii) to receive a set of characters serially by interfacing 8051 to a terminal.	72
3	3	Write ALPs to generate waveforms using ADC interface.	80
4	4	Write ALP to interface an LCD display and to display a message on it.	88
5	5	Write ALP to interface a Stepper Motor to 8051 to rotate the motor.	96
6	6	Write ALP to interface ADC-0804 and convert an analog input connected to it	100

13.0 University Result

Examination	Total Students	S+	S	A	B	C	D	E	F	% Passing
June-July 2020	34	--	07	21	06	--	--	--	--	100
June-July 2021	30	--	08	18	04	--	--	--	--	100

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

.Subject Title	ANALOG CIRCUITS LABORATORY		
Subject Code	18ECL48	**CIE Marks**	40
Number of Lecture Hrs / Week	02Hr Tutorial (Instructions) + 02 Hours Laboratory	**SEE Marks**	60
RBT Level	L1, L2, L3	**Exam Hours**	03

FACULTY DETAILS:		
Name: Prof. D. B. Madihalli	**Designation:** 1.Assistant Professor	**Experience:** 14.01 Years
No. of times course taught: 1	**Specialization:** Industrial Electronics	

1.0 Prerequisite Subjects:

Sl. No	Branch	Semester	Subject
01	ECE	III	Analog Electronics Circuits
02	ECE	III	Op-Amp

2.0 Course Objectives

This laboratory course will enable students to:

- Understand the circuit configurations and connectivity of BJT and FET amplifiers and study of frequency response.
- Design and test of analog circuits using OPAMPs
- Understand the feedback configurations of transistor and OPAMP circuits.
- Use of circuit simulation for the analysis of electronic circuits.

3.0 Course Outcomes

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

	Course Outcome	RBT Level	POs
C216.1	Design analog circuits using BJT/FETs and evaluate their performance characteristics.	L1, L2, L3	1,2,3,4,5,9,10,11,12
C216.2	Design analog circuits using OPAMPs for different applications.	L1, L2, L3	1,2,3,4,5,9,10,11,12
C216.3	Design and test of analog of configurations of transistor and op-amp circuits.	L1, L2, L3	1,2,3,4,5,9,10,11,12
C216.4	Understand the feedback configurations of transistor and op-amp circuits.	L1, L2, L3	1,2,3,4,5,9,10,11,12
C216.5	Simulate and analyze analog circuits that use ICs for different electronic applications.	L1, L2, L3	1,2,3,4,5,9,10,11,12
Total Hours of instruction		**40**	

4.0 Course Content

Laboratory Experiments:

1	Design and setup the Common Source JFET/MOSFET amplifier and plot the frequency response.
2	Design and set up the BJT common emitter voltage amplifier with and without feedback and determine the gain- bandwidth product, input and output impedances.
3	Design and set-up BJT/FET i) Colpitts Oscillator, and ii) Crystal Oscillator
4	Design active second order Butterworth low pass and high pass filters.
5	Design Adder, Integrator and Differentiator circuits using Op-Amp
6	Test a comparator circuit and design a Schmitt trigger for the given UTP and LTP values and obtain the hysteresis.
7	Design 4 bit R – 2R Op-Amp Digital to Analog Converter (i) using 4 bit binary input from toggle switches and (ii) by generating digital inputs using mod-16 counter.
8	Design Monostable and a stable Multivibrator using 555 Timer.
	PART-B : Simulation using EDA software (EDWinXP, PSpice, MultiSim, Proteus, Circuit Lab or any other equivalent tool can be used)
9	RC Phase shift oscillator and Hartley oscillator
10	Narrow Band-pass Filter and Narrow band-reject filter
11	Precision Half and full wave rectifier
12	Monostable and A stable Multivibrator using 555 Timer.

5.0 Relevance to future subjects

Sl. No	Semester	Subject	Topics
01	VIII	Project work	Analog Circuits based concept

6.0 Relevance to Real World

Sl. No	Real World Mapping
01	Design analog circuits using OPAMPs for different applications

7.0 Gap Analysis and Mitigation

Sl. No	Delivery Type	Details
01	Tutorial	Topic: Analog Circuits based concept

8.0 Books Used and Recommended to Students

Text Books
➢ David A Bell, "Fundamentals of Electronic Devices and Circuits Lab Manual, 5th Edition, 2009, Oxford University Press.
Reference Books
Nil
Additional Study material & e-Books
3. NPTEL notes and Videos 4. VTU Online notes.

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

Website and Internet Contents References
07) https://nptel.co.in

10.0 Magazines/Journals Used and Recommended to Students

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

11.0 Examination Note

Scheme of Evaluation for Internal Assessment (40 Marks)
(c) Continuous Assessment (Journal Write up) : 30 marks.
(d) Internal Assessment Test 10 marks.
SCHEME OF EXTERNAL EXAMINATION:
Two questions to be set. Student has to answer both full questions. 100 Marks divided in three parts 15 write up marks, 70 Conduction marks & 15 Viva marks.

12.0 Course Delivery Plan

Course Delivery Plan:

Experiment	Lecture No.	Content	% of Portion
1	1	Design and setup the Common Source JFET/MOSFET amplifier and plot the frequency response.	7
2	2	Design and set up the BJT common emitter voltage amplifier with and without feedback and determine the gain- bandwidth product, input and output impedances.	14
3	3	Design and set-up BJT/FET i) Colpitts Oscillator, and ii) Crystal Oscillator	21
4	4	Design active second order Butterworth low pass and high pass filters.	29
5	5	Design Adder, Integrator and Differentiator circuits using Op-Amp	36
6	6	Test a comparator circuit and design a Schmitt trigger for the given UTP and LTP values and obtain the hysteresis.	43
7	7	Design 4 bit R – 2R Op-Amp Digital to Analog Converter (i) using 4 bit binary input from toggle switches and (ii) by generating digital inputs using mod-16 counter.	50
8	8	Design Monostable and a stable Multivibrator using 555 Timer.	64
9	9	RC Phase shift oscillator and Hartley oscillator	72
10	10	Narrow Band-pass Filter and Narrow band-reject filter	86
11	11	Precision Half and full wave rectifier	93
12	12	Monostable and A stable Multivibrator using 555 Timer.	100

13.0 VIVA BANK

1. What are the advantages of integrated circuits?
2. What are the popular IC packages available
3. What is an operational amplifier
4. What is the Internal Structure of op-amp and explain each block in brief?
5. What are the characteristics of an ideal op-amp
6. What are the DC, AC Characteristics of OP-Amp?
7. What is input offset voltage?
8. Define input offset current.
9. Define CMRR of an opamp?
10. What is the effect of high frequency on its performance?
11. What is the need for frequency compensation in practical op-amps?
12. What are the frequency compensation methods?
13. Define slew rate.
14. Can we use IC 741 for high frequency applications?
15. Why slew rate is not infinite in Ideal op-amp?
16. What are the applications of op-amps?
17. What is an instrumentation amplifier and the need for?
18. What are the features of instrumentation amplifier?
19. What are the applications of V-I and I-V converters?
20. What do you mean by a precision diode?
21. What are the applications of precision diode?
22. What are the applications of Log amplifier?
23. What are the limitations of the basic differentiator circuit?
24. What are the limitations of the basic Integrator circuit?
25. What is a comparator?
26. What are the applications of comparator?
27. Why can't we use comparator to convert sin wave into square wave?
28. What is a Schmitt trigger?
29. What is a multivibrator?
30. What is monostable multivibrator?
31. What is an astable multivibrator?
32. What is a bistable multivibrator?
33. What is the op Amp based Mono stable multivibrator out put signal pulse width?
34. What is the op Amp based Astable multivibrator out put signal time period and frequency?
35. What are the requirements for producing sustained oscillations in feedback circuits? For sustained oscillations,
36. What are the different oscillators?
37. What is a filter?
38. What are the demerits of passive filters?
39. What are the advantages of active filters?
40. What are the various filters?
41. What is the use of high pass filter?
42. What Order of the filter represents?
43. Define cut off frequency?
44. Where PLL is widely used?
45. What are the basic building blocks of PLL?
46. What are the three stages through which PLL operates?
47. Define lock-in range, capture range, and Pull in time of a PLL:
48. What is a voltage controlled oscillator?
49. On what parameters does the free running frequency of VCO depend on?
50. Give the expression for the VCO free running frequency.
51. Mention some typical applications of PLL:

52. List the broad classification of ADCs.
53. List out the direct type ADCs.
54. List out some integrating type converters.
55. What is integrating type converter
56. Explain in brief the principle of operation of successive Approximation ADC.
57. What are the main advantages of integrating type ADCs?
58. Where are the successive approximation type ADC's used?
59. What is the main drawback of a dual slope ADC?
60. State the advantages of dual slope ADC.
61. Define conversion time.
62. Define resolution of a data converter.
63. What is meant by linearity?
64. What is monotonic DAC?
65. What is a sample and hold circuit? Where it is used?
66. Which samples an input signal and holds on to its last sampled value until the input is sampled again. This is mainly used in analog to digital conversion.
67. Explain the various types of digital to analog converters.

13.0 University Result

Examination	Total Students	S+	S	A	B	C	D	E	F	% Passing
June-July 2020	**34**	**--**	**12**	**20**	**02**	**-**	**-**	**-**	**-**	**100**
June-July 2021	**30**	**--**	**09**	**15**	**05**	**01**	**-**	**-**	**-**	**100**

Prepared by	Checked by		
Prof. D. B. Madihalli	Prof. S. S. Kamate	HOD	Principal