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.

DEPARTMENT VISION

To be a centre of excellence in teaching and learning to produce the competent & socially responsible professionals in the domain of Electrical & Electronics Engineering.

DEPARTMENT MISSION

I. To educate students with core knowledge of Electrical and Electronics Engineering to excel in their professional career.

II. To develop problem solving skills, professional skills and ethical values among the students for the betterment of mankind.

III. To prepare technically competent and socially responsible Electrical Engineer to serve the future needs of the society.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs):

Graduates of the program will be able to

PEO1: Achieve successful professional career in Electrical Engineering and allied disciplines.

PEO2: Pursue higher studies and continuously engage in upgrading the professional skills.

PEO3: Demonstrate professional & ethical values, effective communication skills and teamwork to solve issues related to profession, society and environment.

PROGRAM OUTCOMES (POs):

Engineering Graduates will be able to:

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.

PROGRAM SPECIFIC OUTCOMES (PSOs) :

PSO1: Apply knowledge & competencies to analyze & design Electrical & Electronics Circuits, Controls and Power Systems, Machines & Industrial Drives.

PSO2: Use Software/Hardware tools for the design, simulation and analysis of Electrical and Electronics Systems.

Contents of IV-SEM

1.0 Student Help Desk

Sl. No	Coordination Work	Contact Person	
		Faculty	Instructor
01	Attestations	Dr. B. V. Madiggond	-
02	Exam forms signature, Overall department administration, Counseling/interaction with Parents/Students.		
03	Research Centre Coordinator, Academic Coordinator		
04	Project Coordinator, KSCST Coordinator, Hobby & Mini Project Coordinator	Prof. S. D. Hirekodi	-
05	Mentorship Coordinator, GATE Coaching Coordinator	Prof. H. R. Zinage	-
06	Dept. Association Coordinator	Prof. M. P. Yenagimath	-
07	Website Coordinator, Professional Body (ISTE & IEEE) Coordinator, Alumni Coordinator	Prof. O. B. Heddurshetti	-
08	AICTE/VTU/NIRF Coordinator, Dept. News & Publicity Coordinator, AICTE Activity Coordinator	Prof. A. U. Neshti	-
10	Library Coordinator	Prof. A. U. Neshti	Shri. S. B. Beelur
11	IA & EMS Coordinator	Prof. K. B. Negalur	-
12	Seminar Coordinator, News letter/Technical Magazine Coordinator	Prof. S. G. Huddar	-
13	Dispensary	Dr. Arun G. Bullannavar, Contact No. 9449141549	
Class Teacher			
15	4th Semester	Prof. A. U. Neshti	Shri. S. B. Beelur
16	6th Semester	Prof. O. B. Heddurshetti	Shri. V. M. Mutalik
17	8th Semester	Prof. H. R. Zinage	Shri. R. S. Bardol

2.0 Departmental Resources

Department of Electrical and Electronics Engineering was established in the year 1996 and is housedin a total area of **1339 Sq. Mtrs.**

2.1 Faculty Position

S.N.	Category	No. in position	Average experience
1	Teaching faculty	10	17 Y
2	Technical supporting staff	3	25 Y
3	Helper	2	19 Y

2.2 Major Laboratories

SL. No.	Name of the laboratory	Area in Sq. Mtrs	Amount Invested (Rs)
01	Electronics Lab	71	4,49,488.00
02	Operational Amplifier & Linear Integrated Lab		1,29,776.00
03	Power Electronics Lab	92	7,85,162.00
04	Control Systems Lab		2,14,127.00
05	Power System Simulation Lab	71	17,95,111.00
06	Computer Aided Electrical Drawing Lab		6,50,988.40
07	Microcontroller Lab / Digital Signal Processing Lab	72	5,94,122.00
09	Electrical Machines Lab	200	14,85,725.0
10	Relay & High Voltage Lab	94	11,72,383.00
11	Basic Electrical Engg. Lab	96	42,321.00
	Total	**696**	73,19,203.40

3.0 Faculty Details

S.N.	Faculty Name	Designation	Qualification	Area of specialization	Professional membership	Industry Experience (in years)	Teaching Experience (in years)	Contact Nos.
01	Dr. B. V. Madiggond	HOD/Prof.	Ph. D	Power Electronics	LMISTE, YHAI	-	29	9343454993
02	Prof. V. B. Dhere	Asst. Prof.	M. Tech, (Ph. D)	Electronics & Telecommunication	LMISTE, IMPARC	4	25	9886597573
03	Prof. S. D. Hirekodi	Asst. Prof.	M. Tech.	Power Electronics	LMISTE	1	22	9480849338
04	Prof. H. R. Zinage	Asst. Prof.	M. Tech.	Power System	LMISTE	-	22	9480849335
05	Prof. M. P. Yenagimath	Asst. Prof.	M. Tech (Ph. D)	VLSI & ES	LMISTE	1	16.5	9341449466
06	Prof. O. B. Heddurshetti	Asst. Prof.	M. Tech.	Power Electrics	LMISTE	1	15	9448420509
07	Prof. A. U. Neshti	Asst. Prof.	M. Tech.	Digital Electronics	ISTE	-	14	9538223362
08	Prof. K. B. Neglur	Asst. Prof.	M. Tech.	Industrial Electronics	LMISTE	-	09	9886644507
09	Prof. S. G. Huddar	Asst. Prof.	M. Tech.	Power System Engg.	LMISTE	-	09	9742066852
10	Prof. P. I. Savadatti	Asst. Prof.	M. Tech.	Digital Electronics	-	-	07	9964315436

4.0 Institute Academic Calendar

	S J P N Trust's **Hirasugar Institute of Technology, Nidasoshi.** *"Inculcating Values, Promoting Prosperity"* Approved by AICTE, New Delhi, Permanently Affiliated to VTU, Belagavi Recognized under 2(f) & 12B of UGC Act, 1956 Accredited at 'A' Grade by NAAC & Programmes Accredited by NBA:CSE & ECE	IQAC File I-11 2022-23 (Even) Rev: 01

CALENDAR OF EVENTS OF II & IV SEMESTER FOR THE ACADEMIC YEAR 2022-23 (Even)

Date	Events
17-05-2023 to 03-06-2023	Commencement of IV Sem Intra-inter Institutional Internship for Lateral Entry Students
25-05-2023 to 05-06-2023	Commencement of II Sem Commencement of II Sem Classes Induction Program for II Sem
05-06-2023	Commencement of IV Sem Classes
05-06-2023	World Environmental Day
21-06-2023	International Yoga Day
01-07-2023 to 07-07-2023	Banamahostava Week
03-07-2023 to 05-07-2023	First Internal Assessment for II & IV Semester Feedback –I on Teaching-Learning
08-07-2023	Display of First Internal Assessment Marks
14-07-2023	Co-curricular & Extracurricular Activities for II Sem Students
20-07-2023 to 21-07-2023	First Lab Internal Assessment for IV Sem (PCC+AEC)
03-08-2023 to 05-08-2023	Second Internal Assessment for II & IV Semester Feedback –II on Teaching-Learning
08-08-2023	Display of Second Internal Assessment Marks
04-09-2023 to 06-09-2023	Third Internal Assessment for II Sem
07-09-2023 to 09-09-2023	Lab Internal Assessment for II Sem (IC)
09-09-2023	Last working day for II Semester Display of Final I.A. Marks for II Sem
11-09-2023 to 13-09-2023	Third Internal Assessment for IV Sem
14-09-2023 to 16-09-2023	Second Lab Internal Assessment for IV Sem (PCC+AEC) Lab Internal Assessment for IV Sem (IPCC)
16-09-2023	Last working day for IV Semester Display of Final I.A. Marks for IV Sem
11-09-2023 to 20-09-2023	Practical Exam/ Viva Voce for II Sem
19-09-2023 to 30-09-2023	Practical Exam/ Viva Voce for IV Sem
21-09-2023 to 21-10-2023	Theory Exams for II Sem
03-10-2023 To 20-10-2023	Theory Exams for IV Sem
25-10-2023	Commencement of III & V Semester

May -2023

S	M	T	W	T	F	S
		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			

June -2023

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	

29-Bakrid

July -2023

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					

29-Moharam

Aug -2023

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		

15-Independence Day

Sept -2023

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

19-Ganesh Chaturthi, 28-Id Milad

Oct -2023

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				

2- Gandhi Jayanti

18.05.23

Dr. R.R. Maggavi
IQAC Coordinator

Dr. S. C. Kamate
Principal

5.0 Department Academic Calendar

S J P N Trust's
Hirasugar Institute of Technology, Nidasoshi.
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EEE | COE | 2022-23 (Even) | Rev: 00

DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGG.

CALENDAR OF EVENTS FOR THE IV SEMESTER 2022-23 (Even)

Date	Events
17-05-2023	Commencement of IV Semester
17-05-2023 to 03-06-2023	Intra- inter Institutional Internship for Lateral Entry Students
19-05-2023	*Box-Cricket*
02-06-2023	*Parent-Teacher Meeting for second year students.*
05-06-2023	Commencement of IV Semester Classes
05-06-2023	World Environment Day
09-06-2023	*Farewell function to final year students.*
16-06-2023	*Industrial Visits.*
21-06-2023	International Yoga Day
23-06-2023	*Quiz Competition.*
30-06-2023	*Story telling Competition.*
01-07-2023 to 07-07-2023	Banamahostava Week
01-07-2023	*Hobby Project competition for 2nd and 3rd year students.*
03-07-2023 to 05-07-2023	First Internal Assessment of IV Semester Feedback -I on Teaching Learning
08-07-2023	Display of First Internal Assessment Marks
20-07-2023 to 21-07-2023	First Lab Internal Assessment for IV Sem (PCC+AEC)
03-08-2023 05-08-2023	Second Internal Assessment of IV Semester Feedback -II on Teaching Learning
08-08-2023	Display of First Internal Assessment Marks
11-09-2023 13-09-2023	Third Internal Assessment of IV Semester Feedback -II on Teaching Learning
14-09-2023 to 16-09-2023	Second Lab Internal Assessment for IV Semester (PCC+AEC) Lab Internal Assessment for IV Semester (IPCC)
16-09-2023	Last working day for IV Semester Display of Final IA Marks for IV Semester
19-09-2023 to 30-09-2023	Practical Exam/Viva voce for IV Semester
03-10-2023 to 20-10-2023	Theory Exams for IV Semester
25-10-2023	Commencement of III & V Semester

May-2023

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			

01-Karmika Dinacharane (Labor Day)

June-2023

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	

29-Bakrid

July-2023

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					

29-Moharam

August-2023

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		

15- Independence Day

September-2023

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

19- Ganesh Chaturthi, 28-Id Milad

October-2023

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				

02-Gandhi Jayanthi

Shri. M. P. Yenagimath
EESSA Coordinator

Dr. B. V. Madiggond
HOD

Dr. S. C. Kamate
Principal

5.1 Scheme of Teaching & Examination

Scheme of Teaching and Examinations 2021
Outcome-Based Education(OBE) and Choice Based Credit System (CBCS)

IV SEMESTER

Sl. No	Course and Course Code	Course Title	Teaching Department (TD) and Question Paper Setting Board	Teaching Hours /Week				Examination				Credits
				Theory Lecture	Tutorial	Practical/ Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
				L	T	P	S					
1	BSC 21MAT41	Complex Analysis, Probability and Statistical Methods	Maths	2	2	0		03	50	50	100	3
2	IPCC 21EE42	Digital System Design	EE	3	0	2		03	50	50	100	4
3	IPCC 21EE43	Microcontroller	EE	3	0	2		03	50	50	100	4
4	PCC 21EE44	Electric Motors	EE	2	2	0		03	50	50	100	3
5	AEC 21BE45	Biology for Engineers	BT, CHE, PHY	2	0	0		02	50	50	100	2
6	PCC 21EEL46	Electrical Machines Laboratory - II	EE	0	0	2		03	50	50	100	1
7	HSMC 21KSK37/47	Samskrutika Kannada	HSMC	0	2	0		01	50	50	100	1
	HSMC 21KBK37/47	Balake Kannada										
		OR										
	HSMC 21CIP37/47	Constitution of India & Professional Ethics										
8	AEC 21EE48X	Ability Enhancement Course- IV	TD and PSB: Concerned department	If offered as theory Course: 0	2	0		01	50	50	100	1
				If offered as lab. course: 0	0	2		02				
9	UHV 21UH36/49	Universal Human Values	Any Department	0	2	0		01	50	50	100	1
10	INT 21INT49	Inter/Intra Institutional Internship	Evaluation By the appropriate authorities	Completed during the intervening period of II and III semesters by students admitted to first year of BE./B.Tech and during the intervening period of III and IV semesters by Lateral entry students admitted to III semester.				--	100	--	100	2
								Total	**550**	**450**	**1000**	**22**

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

1	NCMC 21MATDIP41	Additional Mathematics - II	Maths	02	02	--	--	--	100	--	100	0

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

21KSK37/47 Samskrutika Kannada is for students who speak, read and write Kannada and 21KBK37/47 Balake Kannada is for non-Kannada speaking, reading, and writing students.

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

Non – credit mandatory course (NCMC):

Additional Mathematics - II:

(1) Lateral entry Diploma holders admitted to III semester of B.E./B.Tech., shall attend the classes during the IV semester to complete all the formalities of the course and appear for the Continuous Internal Evaluation (CIE). 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 an F grade. In such a case, the student has to fulfill the course requirements during subsequent semester/s to earn the qualifying CIE marks. These courses are slated for CIE only and has no SEE.

(2) Additional Mathematics I and II shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses shall be mandatory for the award of degree.

(3) Successful completion of the course Additional Mathematics II shall be indicated as satisfactory in the grade card. Non-completion of the courses Additional Mathematics II shall be indicated as Unsatisfactory.

Ability Enhancement Course - IV

21EEP481	Microcontroller Based Projects	21EEL483	Scilab for Electrical and Electronic Measurements
21EEL482	Scilab for Electric Motors	21EEL484	Simulation of Op-Amp Circuits

Internship of 04 weeks during the intervening period of IV and V semesters; 21INT68 Innovation/ Entrepreneurship/ Societal Internship.

(1) All the students shall have to undergo a mandatory internship of 04 weeks during the intervening period of IV and V semesters. The internship shall be slated for CIE only and will not have SEE. The letter grade earned through CIE shall be included in the VI semester grade card. The internship shall be considered as a head of passing and shall be considered for vertical progression and for the award of degree. Those, who do not take up / complete the internship shall be considered under F(fail) grade and shall have to complete subsequently after satisfying the internship requirements.

(2) Innovation/ Entrepreneurship Internship shall be carried out at industry, State and Central Government /Non-government organizations (NGOs), micro, small and medium enterprise (MSME), Innovation centers or Incubation centers, etc. Innovation need not be a single major breakthrough, it can also be a series of small or incremental changes. Innovation of any kind can also happen outside of the business world.

Entrepreneurship internships offers a chance to gain hands on experience in the world of entrepreneurship and helps to learn what it takes to run a small entrepreneurial business by performing intern duties with an established company. This experience can then be applied to future business endeavours. Start-ups and small companies are a preferred place to learn the business tactics for future entrepreneurs as learning how a small business operates will serve the intern well when he/she manages his/her own company. Entrepreneurship acts as a catalyst to open the minds to creativity and innovation. Entrepreneurship internship can be from several sectors, including technology, small and medium-sized sectors, and service sector.

(3) Societal or social internship.

Urbanization is increasing on a global scale; and yet, half the world's population still resides in rural areas and is devoid of many things that urban population enjoy. Rural internship, is a work-based activity in which students will have a chance to solve/reduce the problems of the rural place for better living.

As proposed under the AICTE rural internship programme, activities under Societal or social internship, particularly in rural areas, shall be considered for 40 points under AICTE activity point programme.

Course Title	**Complex Analysis, Probability and Statistical Methods**		
Course Code	21MAT41	**CIE Marks**	50
Teaching Hrs / Week (L:T:P)	2:2:0	**SEE Marks**	50
Total Number of Contact Hrs	40	**Total Marks**	100
Credits	03	**Exam Hours**	03

FACULTY DETAILS:		
Name: Prof. S. A. Patil	**Designation:** Asst. Professor	**Experience:** 13
No. of times course taught: 01		**Specialization:** Mathematics

1.0 Prerequisite Subjects:

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

2.0 Course Objectives

1. Provide insight into applications of complex variables, conformal mapping arising in potential theory, quantum mechanics, heat conduction and field theory.
2. Special functions familiarize the Power series solution required to analyze the Engineering Problems.
3. To have insight into Statistical methods, Correlation and regression analysis.
4. To develop probability distribution of discrete and continuous random variables, Joint probability distribution occurs 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 an analytic function and complex potentials to solve the problems arising in electromagnetic field theory. Utilize conformal transformation and complex integral arising in aerofoil theory, fluid flow visualization and image processing.	1,2,3,12
CO2	Obtain Series Solutions of Ordinary Differential Equation.	1,2,3,12
CO3	Make use of the correlation and regression analysis to fit a suitable mathematical model for the statistical data.	1,2,3,12
CO4	Apply discrete and continuous probability distributions in analyzing the probability models arising in the engineering field.	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	**40**

4.0 Course Content

Module-1

Complex Analysis: 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.

Complex integration: Line integral of a complex function-Cauchy's theorem and Cauchy's integral formula and Problems. **(RBTL: L1, L2 and L3) (8 Hours)**

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

Module-2

Special functions: Series solution of Bessel's differential equation leading to $Jn(x)$ Bessel's function of the first kind, Properties, Orthogonality of Bessel's functions. Series solution of Legendre's differential equation leading to $Pn(x)$-Legendre polynomials. Rodrigue's formula (without proof), problems.

(RBTL: L1, L2 and L3) (8 Hours)

Self Study: Recurrence Relations.

Module-3

Statistical Methods: Correlation and regression-Karl Pearson's coefficient of correlation and rank correlation -problems. Regression analysis- lines of regression –problems.

Curve Fitting: Curve fitting by the method of least squares- fitting the curves of the form-.

$y = ax + b, y = ax^b$ *and* $y = ax^2 + bx + c$ **(RBTL: L1, L2 and L3) (8 Hours)**

Self Study: Angle between two regression lines, problems. Fitting of the curve $y = ab^x$

.

Module-4

Probability Distributions: Review of basic probability theory. Random variables (discrete and continuous), Probability mass and density functions. Mathematical expectation, mean and variance. Binomial, Poisson and normal distributions- problems (Derivations for mean and Standard Deviation for Binomial and Poisson distributions only)Illustrative examples. **(RBTL: L1, L2 and L3) (8 Hours)**

Self Study: exponential distribution.

Module-5

Joint probability distribution: Joint Probability distribution for two discrete random variables, expectation covariance and correlation.

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.

Self Study: Point estimation and interval estimation. **(RBTL: L1, L2 and L3) (8 Hours)**

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	Probability Distributions used to design and Analysis of algorithm, interpreting data, Machine learning and artificial intelligence
02	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. Advanced Engineering Mathematics, E. Kreyszig: John Wiley & Sons, 10th Ed. (Reprint), 2016.
2. B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers, 44th Edition, 2017.
Reference Books
1. Advanced Engineering, Mathematics C. Ray Wylie, Louis C. Barrett McGraw-Hill 6th Edition 1995.
2. B.V.Ramana: "Higher Engineering Mathematics" Tata McGraw-Hill, 11th Edition, 2010.
3. N.P.Bali and Manish Goyal: A Text Book of Engineering Mathematics, Laxmi Publishers, 2014.
4. Chandrika Prasad and Reena Garg : Advanced Engineering ,Mathematics, Khanna Publishing, 2018

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

Assessment Details (both CIE and SEE)

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

Continuous Internal Evaluation:

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

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

Two assignments each of 10 Marks
4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)
6. At the end of the 13th week of the semester

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

Semester End Examination:
Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**
1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

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

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.	Cauchy-Riemann equation in Polar form	
	4.	construction of analytic functions by Milne-Thomson method	
	5.	Properties of Cauchy-Riemann equation	
	6.	Line integral of a complex function	
	7.	Cauchy's theorem	
	8.	Cauchy's integral formula and problems.	
Module 2	9.	Series solution of Bessel's differential equation leading to $J_n(x)$	20
	10.	Bessel's function of the first kind, Properties	
	11.	Orthogonality of Bessel's functions	
	12.	Series solution of Legendre's differential equation leading to $P_n(x)$	
	13.	Problems	
	14.	Legendre polynomials	
	15.	Rodrigue's formula (without proof), problems.	
	16.	Problems	
Module 3	17.	Correlation-regression Karl Pearson's coefficient of correlation	20
	18.	rank correlation	
	19.	Problems	
	20.	Regression analysis- lines of regression (without proof) –problems	
	21.	Curve fitting by the method of least squares, of the form $y = ax + b$	
	22.	Curve fitting by the method of least squares: $y = ax^2 + bx + c$	
	23.	Problems.	
	24.	Curve fitting by the method of least squares $y = ax^b$	
Module 4	25.	Random variables (discrete and continuous)	
	26.	Probability mass/density functions	

	27.	Mathematical expectation, mean and variance of Binomial distribution.	20
	28.	Problems	
	29.	Mathematical expectation, mean and variance of Poisson distribution.	
	30.	Problems	
	31.	Normal distributions.	
	32.	Problems	
Module 5	33.	Joint Probability distribution for two discrete random variables	20
	34.	Expectation, covariance and correlation	
	35.	Sampling & Sampling distributions	
	36.	standard error, test of hypothesis for means and proportions	
	37.	confidence limits for means	
	38.	Problems.	
	39.	student's t-distribution	
	40.	Chi-square distribution as a test of goodness of fit.	

13.0 QUESTION BANK

Module-1:

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 $x^3 + y^3 + 3xy(x - y)$
6. Determine the analytic function Whose imaginary part is $r^2\cos 2\theta$
7. Determine the analytic function Whose real part is $\frac{2\cos x \cos hy}{\cos 2x + \cos h2y}$
8. Find the analytic function $f(z) = u + iv$ given $u - v = e^x(\cos y - \sin y)$
9. If $f(z)$ analytic show that $\left[\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2}\right]|f(z)|^2 = 4|f'(z)|^2$
10. State & prove Cauchy integral Theorem.
11. Verify Cauchy's theorem for the function $f(z) = z^2$ where c is the square having vertices (0,0) ,(1,0),(1,1) & (0,1)
12. Evaluate $\int \frac{e^z}{z+i\pi}\, dz$ over each of the following contours C, a) $|z| = 2\pi$, b) $|z| = \pi/2$, c) $|z - 1| = 1$
13. State & prove Cauchy integral Theorem.

Module-2: **Special Functions**

1. S.T. i) $J_{1/2} = \sqrt{2/\pi x}\ \sin x$, ii) $J_{-1/2} = \sqrt{2/\pi x}\ \cos x$.
2. Express $f(x) = x^4+3x^3-x^2+5x-2$ in terms of Legendary's polynomials.
3. Obtain the series solution of Bessel's differential equation in the form $y = AJn(x) + BJn(x)$
4. Establish the Rodrigue's formula for Legendre polynomials. S.T. i) Pn(1)=1, ii) $Pn(-1) = (-1)^n$
5. Express $f(x) = x^3+2x^2-x-3$ in terms of Legendre polynomials
6. Express $f(x) = x^3 + 4x^2 - 2x + 10$ in terms of Legendre polynomials.
7. If α and β are two distict roots of $J_n(x) = 0$, then prove that $\int_0^1 x J_n(\alpha x) J_n(\beta x) dx = 0$ if $\alpha \neq \beta$

Module-3: 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

5. 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

6. 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.

7. 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

8. 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

9. 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

10. 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-4: 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. 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 $p[0 \leq z \leq 1.83] = 0.4664$ & $p[0 \leq z \leq 1.33] = 0.4082$.
7. 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.
8. 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.
9. 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)

10. 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
11. 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 at least 7 of them will live up to 70.

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.
2. 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.
3. 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]
4. 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?
5. 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.
6. 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?
7. 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
8. 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.
9. A coin was tossed 400 times & the head turned up 216 times. Test the hypotheses that the coin is in biased at 5% level significance.
10. A die was thrown 1200 times & the number 6 was obtained 236 times. Can the die be considered fair at level of significance?
11. The joint probability distribution for two random variables X and Y is as given below.

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.

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

Subject Title	**DIGITAL SYSTEM DESIGN**		
Subject Code	21EE42	**CIE Marks**	50
Number of Lecture Hrs / Week(L:T:P:S)	3:0:2:0	**SEE Marks**	50
Total Number of Lecture Hrs	40 hours theory+8 Lab slots	**Exam Hours**	03
CREDITS – 04			

FACULTY DETAILS:		
Name: Prof. P.I.Savadatti	**Designation:** Asst Professor	**Experience:** 07
No. of times course taught: 01	**Specialization:** Digital Electronics	

1.0 Prerequisite Subjects:

Sl. No	Branch	Semester	Subject
01	Electrical &Electronics Engineering	I/II	Basic Electronics

2.0 Course Objectives

Upon completion of this course, a student should be able to:

- Illustrate simplification of Algebraic equations using Karnaugh Maps and Quine-McCluskyTechniques.
- Design combinational logic circuits..
- Design Decoders, Encoders, Digital Multiplexer, Adders, Subtractors and Binary Comparators.
- Describe Latches and Flip-flops, Registers and Counters.
- Analyze Mealy and Moore Models.
- Develop state diagrams, Synchronous Sequential Circuits and to understand the basics of various Memories

3.0 Course Outcomes

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

	Course Outcome	RBT Level	POs
C205.1	Develop simplified switching equation using Karnaugh Maps and QuineMcClusky techniques.	L5	PO1,PO2,PO3
C205.2	Design Multiplexer, Encoder, Decoder, Adder, Subtractors and Comparator as digital combinational control circuits.	L5	PO1,PO2,PO3
C205.3	Design flip flops, counters, shift registers as sequential control	L5	PO1,PO2,PO3
C205.4	Develop Mealy/Moore Models and state diagrams for the given clocked sequential circuits.	L5	PO1,PO2,PO3
C205.5	Explain the functioning of Read only and Read/Write Memories, Programmable ROM, EPROM and Flash memory.	L2	PO1,PO2,PO3
Total Hours of instruction		**40**	

4.0 Course Content

MODULE-1:

Principles of Combinational Logic: Definition of combinational logic, canonical forms, Generation of switching equations from truth tables, Karnaugh maps-3,4,5 variables, Incompletely specified functions (Don‘t care terms) Simplifying Max term equations, Quine-McCluskey minimization technique, Quine-McCluskey using don‘t care terms, Reduced prime implicants Tables

MODULE-2:

Analysis and Design of Combinational logic: General approach to combinational logic design,Decoders, BCD decoders, Encoders, digital multiplexers, Using multiplexers as Boolean function generators, Adders and subtractors, Cascading full adders, Look ahead carry, Binary comparators.

MODULE-3:

Flip-Flops: Basic Bistable elements, Latches, Timing considerations, The master-slave flip-flops (pulsetriggeredflip-flops): SR flip-flops, JK flip-flops, Edge triggered flip- flops, Characteristic equations.

MODULE-4:

Flip-Flops Applications: Registers, binary ripple counters, synchronous binary counters, Counters basedon shift registers, Design of a synchronous counter, Design of a synchronous mod-n counter using clockedT, JK, D and SR flip-flops.

MODULE-5:

Sequential Circuit Design: Mealy and Moore models, State machine notation, Synchronous Sequential circuit analysis, Construction of state diagrams, counter design.**Memories:** Read only and Read/Write Memories, Programmable ROM, EPROM, Flash memory.

Sl. NO	Experiments
1	Simplification, realization of Boolean expressions using logic gates/Universal gates.
2	Realization of Half/Full adder and Half/Full Subtractors using logic gates.
3	Realization of parallel adder/Subtractors using 7483 chip- BCD to Excess-3 code conversion and Vice - Versa.
4	Realization of Binary to Gray code conversion and vice versa.
5	Design and testing Ring counter/Johnson counter.
6	Design and testing of Sequence generator.
7	Realization of 3 bit counters as a sequential circuit and MOD – N counter design using 7476, 7490, 74192.
8	Verifying its logic operation and obtaining its truth table of flip –flops: RS and JK.

5.0 Relevance to future subjects

Sl No	Semester	Subject	Topics
01	V	Microcontroller	--
02	VII	Embedded systems	--

6.0 Relevance to Real World

SL.No	Real World Mapping
01	Embedded Systems
02	Computer field

7.0 Gap Analysis and Mitigation

Sl. No	Delivery Type	Details
02	NPTEL videos	Practical exposure regarding designing of digital circuit.

8.0 Books Used and Recommended to Students

Text/Reference Books				
1	Digital Logic Applications and Design	John M Yarbrough	Cengage Learning	2011
2	Digital Principles and Design	Donald D Givone	McGraw Hill Education	2002
3	Digital design	M. Morris Mano	Prentice Hall of India	3 rd Edition
4	Fundamentals of logic design	Charles H Roth,JR	Cengage Learning	5th Edition,

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

Website and Internet Contents References
1. NPTEL Videos 2. www.wikipedia.com

10.0 Magazines/Journals Used and Recommended to Students

Sl.No	Magazines/Journals	website
1	Electronics for you	https://electronicsforu.com/
2	Newelectronics	http://www.newelectronics.co.uk/digital-magazine/

11.0 Examination Note

Assessment Details (both CIE and SEE)

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

CIE for the theory component of IPCC

Two Tests each of 20 Marks (duration 01 hour)

First test at the end of 5th week of the semester

- Second test at the end of the 10th week of the

semesterTwo assignments each of 10 Marks

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

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

CIE for the practical component of IPCC

- On completion of every experiment/program in the laboratory, the students shall be evaluated and marksshall be awarded on the same day. The15 marks are for conducting the experiment and preparation of the laboratory record, the other 05 marks shall be for the test conducted at the end of the semester.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of allexperiments' write-ups are added and scaled down to 15 marks.
- The laboratory test (duration 03 hours) at the end of the 15th week of the semester /after completion ofall the experiments (whichever is early) shall be conducted for 50 marks and scaled down to 05 marks.

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

SEE for IPCC

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

- The question paper will have ten questions. Each question is set for 20 marks.
- There will be 2 questions from each module. Each of the two questions under a module (with a maximumof 3 sub-questions), should have a mix of topics under that module.
- The students have to answer 5 full questions, selecting one full question from each module.

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

- The minimum marks to be secured in CIE to appear for SEE shall be the 12 (40% of maximum marks- 30) in the theory component and 08 (40% of maximum marks -20) in the

practical component. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included. The maximum of 04/05 questions to be set from the practical component of IPCC, the total marks of all questions should not be more than the 20 marks.

- SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify the SEE. Marks secured will be scaled down to 50.

12.0 Course Delivery Plan

MODULE	Lect. No.	Content of Lecture	% of Portion
Principles of Combinational Logic: MODULE-1	1	Introduction &definition of combinational & canonical forms	20
	2	Generation of switching equations from truth tables,Examples	
	3	Karnaughmaps-3, 4 and 5 variables.	
	4	Incompletely specified functions (Don't care terms). examples	
	5	Simplifying Max term equations	
	6	Quine-McCluskey minimization technique	
	7	Quine-McCluskey using don't care terms	
	8	Reduced Prime Implicants table	
Analysis and Design of Combinational logic MODULE-2	9	General approach to combinational logic design	20
	10	Decoders , BCD decoders	
	11	Encoders	
	12	Digital multiplexers	
	13	using multiplexers as Boolean function generators	
	14	Adders and Subtractors	
	15	Cascading full adders/ lookahead carry	
	16	Binary comparators	
Flip-Flops: MODULE-3	17	Basic Bistable element.	20
	18	Latches	
	19	Timing considerations	
	20	The master-slave Flip-Flop	
	21	SR Flip flops	
	22	JK Flip flops	
	23	Edge triggered flip flops	
	24	Characteristic equations	
Flip-Flops Applications MODULE-4	25	Registers,	20
	26	Binary Ripple Counter	
	27	Synchronous Binary counters,	
	28	Counters based on Shift Registers	
	29	Design of a synchronous counter,	
	30	Design of a synchronous mod-n counter using clocked T flip-flops.	
	31	JK and D flip flop	
	32	SR flip flops	
Sequential	33	Mealy & Moore model	20

Circuit Design & Memories: MODULE-5	34	State Machine Notation	
	35	Synchronous Sequential Circuit Analysis	
	36	Construction of state Diagrams	
	37	Counter design.	
	38	Read only and Read/Write Memories,	
	39	Programmable ROM	
	40	EPROM and Flash memory	

13.0 Assignments, Quiz

Sl. No.	Title	Outcome expected	Allied study	Week No.	Individual / Group activity	Reference: book/website /Paper
1	Assignment-1: Principles of combinational logic	Student will be able to develop simplified switching equation	Module-1	4	Individual	Book no 1,2
2	Assignment2:Analysis and design of Combinational Logic	Student will be able to design combinational circuits	Module-2	7	Individual	Book no 1,2
3	Assignment3:flip flops	Student will be able to design flip flops	Module-3	10	Individual	Book no 1,2
4	Assignment4:flip flops applications	Student will be able to design a counters	Module-4	13	Individual	Book no 1,2
5	Assignment5: Sequential Circuit Design & Memories:.	Student will be able to design Sequential Circuit & explain Memories	Module-5	15	Individual	Book no 1,2

14.0 QUESTION BANK

MODULE-1

1. What is combinational Logic circuit? Explain.
2. Write the following minterm canonical formulas in algebraic form and construct truth tables
   $f(w,x,y,z)=\sum m(1,3,7,8,9,14,15)$
3. Explain canonical form of Boolean equations with an example.
4. Explain Karnaugh map representation in detail & discuss the merits & demerits.
5. Explain the definition of combinational logic circuit**.**
6. Transform each of the following canonical expression in to its other canonical form in decimal notation
   a. $f(x,y,z)= \Pi M(0,3,4)$ b. $f(x,y,z)= \sum m(1,3,5)$ c.$(a,b,c,d)= \sum m(1,2,4,6,9,15)$
   d. $f(w,x,y,z)= \sum m(0,1,2,3,7,9,11,12,15)$
7. Express each of the following functions by a Maxterm Canonical formulae
   a. $f(x,y,z)=(y+z')\ (xy'+z)$
   b. $f(x,y,z)=x+x'z'(y+z)$
8. Using K-maps, determine all the prime implicants of each of the following functions. In each case, indicate the essential prime implicants
   a. $f(w,x,y,z)= \sum m(0,1,2,5,6,7,8,9,10,13,14,15)$

b. f(w,x,y,z)= ΠM(0,2,3,8,9,10,12,14)
c. f(w,x,y,z)=w′y′z+w′yz+x′y′z′+wx′y+w′x′yz′

9. Using k-maps, determine all the minimal sums and minimal products for each of the following Boolean functions
   a. f(a,b,c,d)= ΠM(0,4,5,7,8,911,12,13,15)
   b. f(x,y,z)= ∑m(0,1,2,3,4,6,7)
   c. f(x,y,z)= ΠM(1,4,5,6)
   d. f(w,x,y,z)= ∑m(0,1,6,7,8,14,15)
   e. f(w,x,y,z)= ΠM(1,3,4,5,10,11,12,14)
10. Give two simplified irredundant expressions for
    a.F(w,x,y,z)= ∑(0,4,5,7,8,9,13,15)
    b.Design a combinational logic ckt whose i/p is a 4-bit binary number and whose o/p is the 2's complement of the i/p number. Implement by using suitable logic
11. Using the Quine-McCluskeymethod,obtain all the prime implicates for each of the following Boolean functions
    a. f(w,x,y,z)= ∑(0,2,3,4,8,10,12,13,14
    b. f(w,x,y,z)= ∑(7,9,12,13,14,15)+dc(4,11)
    c. f(w,x,y,z)= ΠM(1,3,6,10,11,12,14,15,17,19,20,22,24,29)
12. Simplify f(a,b,c,d)= ∑(2,3.4.5,13,15)+dc(8,9,10,11) taking least significant as map-entered variable. Dec-2011

MODULE- 2

1. What is decoder? What are its advantages? Design a decimal decoder, which converts information from BCD to decimal
2. Construct 4 to 16 line decoder using 2-4 decoders
3. Using AND/NAND gates along with a 3-8-line decoder realize the pairs of expressions with minimum i/ps
   a. f1(a,b,c)= ΠM(0,3,5,6,7)
   b. f2(a,b,c)= ΠM(2,3,4,5,7)
4. Construct 16:1 MUX using 4 to 1 line MUX
   a. Realize each of the following Boolean expressions using an 8 to 1 line Multiplexer where w,x,y appear on select lines S2,S1,S0 respectively
   b. f(w,x,y,z)= ∑m(1,2,6,7,9,11,12,14,15)
   c. f(w,x,y,z)= ∑m(2,5,6,7,9,12,13,15)
   Realize the Boolean expression. f(w,x,y,z)= ∑m(4,5,7,8,10,12,15) Using a 4 to 1 line MUX and external
   Gates with I) Let w and x appear on the select lines S1 and S0 respectively II) y and z appear on the select lines S1 and S0 respectively.
5. Design full adder and full subtractor. Implement using gates
6. What is a multiplexer? With neat sketch, describe 4:1MUX.Implement the given Boolean functions by using multiplexer chip
   a. F1 (A,B,C)= ∑m(1,2,4,7)
   b. F2 (A,B,C)= ∑m(3,5,6,7)
7. With neat block diagram explain carry look ahead adder in detail.
8. Design 2 bit comparator circuit using logic gates.
9. Design & implement 4 bit look ahead carry adder.
10. Implement 16:1 multiplexer using 4:1 multiplexer
11. Implement full subtractor using 3-8 line decoder with the decoder having high outputs &

active low enable inputs

12. What is magnitude comparator? Write the truth table & logic diagram of a 1-bit comparator.

MODULE- 3:

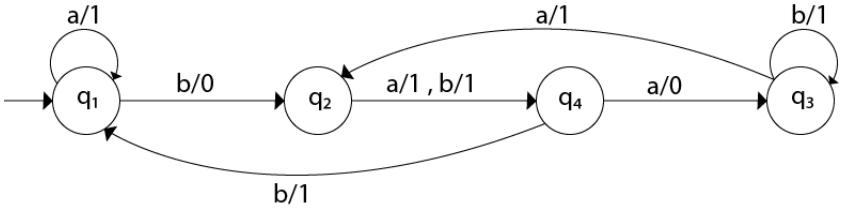
1. Design a switch debouncer using SR and $\overline{S}$ $\overline{R}$ latch.
2. Explain the operation of SR latch.
3. Explain the operation of the master-slave JK f/f and SR f/f along with its circuit diagram.
4. Explain the working of SR f/f by using NOR gates.
5. What is race around condition in f/f? Discuss in brief.
6. Difference between f/fs and latches and its definition.
7. What is edge triggered f/fs .Explain positive edge triggered D f/fs.With neat timing diagrams
8. Explain negative edge triggered D f/fs using NAND gates and timing diagrams.
9. What is propagation delay?
10. Explain with neat timing diagrams S $\overline{R}$ latch?
11. Write the next state tables and characteristic equations for SR,JK,D and T f/f.

MODULE- 4:

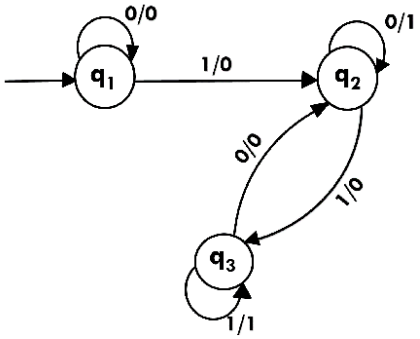
1. Write the next state tables and characteristic equations for SR, JK, D and T flip flop.
2. What is a register? Explain with neat diagrams all the types of register.
3. Explain Universal shift register.
4. With a neat logic diagram and timing waveforms explain synchronous binary counters.
5. Design synchronous mod-6 counter using JK and D flip flop.
6. Design a counter that has a repeated sequence of 06 states listed 0→3→4→0→5→6diagram.
7. Design mod-3 counter using JK flip flop. Sketch the waveforms for outputs when clock is applied and verify its operation.

MODULE-5:

1.Explain with neat diagram Mealy machine.
2.Explain with neat diagram Moore network.
3.Explain different types of sequential networks?
4.Convert the following Mealy machine into equivalent Moore machine.



5.Convert the following Mealy machine into equivalent Moore machine.



6. Convert the following Moore machine into its equivalent Mealy machine.

Prepared by	Checked by		
			
Prof. P.I.Savadatti	**Prof. M. P. Yenagimath**	**HOD**	**Principal**

Subject Title	**Microcontroller**		
Subject Code	21EE43	**CIE Marks**	50
Number of Lecture Hrs / Week (L:T:P:S)	3:0:2:0	**SEE Marks**	50
Total Number of Lecture Hrs	40 hours Theory + 13 Lab Slots	**Exam Hours**	03
		CREDITS – 04	

FACULTY DETAILS:		
Name: Shri: Mahesh Yenagimath	**Designation:** Asst. Professor	**Experience:**17
No. of times course taught:01	**Specialization:** VLSI and Embedded System	

1.0 Prerequisite Subjects:

Sl. No	Branch	Semester	Subject
01	Electrical and Electronics Engineering	III	Digital System Design

2.0 Course Objectives

1. To explain the internal organization and working of Computers, microcontrollers and embedded Processors.
2. Compare and contrast the various members of the 8051 family.
3. To explain the registers of the 8051 microcontroller, manipulation of data using registers and MOVinstructions.
4. To explain in detail the execution of 8051 Assembly language instructions and data types.
5. To explain loop, conditional and unconditional jump and call, handling and manipulation of I/O instructions.
6. To explain different addressing modes of 8051, arithmetic, logic instructions, and programs.
7. To explain develop 8051C programs for time delay, I/O operations, I/O bit manipulation, logic.
8. To explain writing assembly language programs for data transfer, arithmetic, Boolean and logical instructions.
9. To explain writing assembly language programs for code conversions.
10. To explain writing assembly language programs using subroutines for generation of delays, counters,configuration of SFRs for serial communication and timers.
11. To perform interfacing of stepper motor and DC motor for controlling the speed.
12. To explain generation of different waveforms using DAC interface.

3.0 Course Outcomes

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

	Course Outcome	Cognitive Level	POs
C217.1	Outline the 8051 architecture, registers, internal memory organization, addressing modes.	L_1,L_2,L_3,L_4	PO1, PO2, PO8, PO10, PO12
C217.2	Discuss 8051 addressing modes, instruction set of 8051, accessing data and I/O port programming.	L_1,L_2,L_3,L_4	PO1, PO2, PO3, PO8, PO10, PO12
C217.3	Develop 8051C programs for time delay, I/O operations, I/O bit manipulation, logic and arithmeticoperations, data conversion and timer/counter programming.	L_1,L_2,L_3,L_4	PO1, PO2, PO3, PO8, PO10, PO12
C217.4	Summarize the basics of serial communication and interrupts, also develop 8051 programs for serial datacommunication and interrupt programming.	L_1,L_2,L_3,L_4	PO1, PO2, PO3, PO8, PO10, PO12
C217.5	Program 8051to work with external devices for ADC, DAC, Stepper motor control, DC motor control.	L_1,L_2,L_3,L_4	PO1, PO2, PO3, PO8, PO10, PO12
Total Hours of instruction		**40**	

4.0 Course Content

MODULE – 1
8051 Microcontroller Basics: Inside the Computer, Microcontrollers and Embedded Processors, Block Diagram of 8051, PSW and Flag Bits, 8051 Register Banks and Stack, Internal Memory Organization of 8051, IO Port Usage in 8051, Types of Special Function Registers and their uses in 8051, Pins of 8051. Memory Address Decoding, 8031/51 Interfacing With External ROM And RAM.8051 Addressing Modes.

MODULE – 2
Assembly Programming and Instruction of 8051: Introduction to 8051 assembly programming, Assembling and running an 8051 program, Data types and Assembler directives Arithmetic, logic instructions and programs, Jump, loop and call instructions, IO port programming.

MODULE - 3
8051 Programming in C: Data types and time delay in 8051C, IO programming in 8051C, Logic operations in 8051 C, Data conversion program in 8051 C, Accessing code ROM space in 8051C, Data serialization using 8051C.
8051 Timer Programming in Assembly and C: Programming 8051 timers, Counter programming, Programming timers 0 and 1 in 8051 C.

MODULE – 4
8051 Serial Port Programming in Assembly and C: Basics of serial communication, 8051 connection to RS232, 8051 serial port programming in assembly, serial port programming in 8051 C.
8051 Interrupt Programming in Assembly and C: 8051 interrupts, Programming timer, external hardware, serial communication interrupt, Interrupt priority in 8051/52, Interrupt programming in C.

MODULE – 5
Interfacing: LCD interfacing, Keyboard interfacing. ADC, DAC and Sensor Interfacing: ADC 0808 interfacing to 8051, Serial ADC Max1112 ADC interfacing to 8051, DAC interfacing, Sensor interfacing and signal conditioning.
Motor Control: Relay, PWM, DC and Stepper Motor: Relays and opt isolators, stepper motor interfacing, DC motor interfacing and PWM.
8051 Interfacing with 8255: Programming the 8255, 8255 interfacing, C programming for 8255.

Sl. NO	Experiments
1	Data transfer – Program for block data movement, sorting, exchanging, finding largest element in an array.
2	Arithmetic instructions: Addition, subtraction, multiplication and division. Square and cube.
3	Counters
4	Boolean and logical instructions (bit manipulation).
5	Conditional call and return instructions.
6	Code conversion programs – BCD to ASCII, ASCII to BCD, ASCII to decimal, Decimal to
7	Programs to generate delay, Programs using serial port and on-chip timer/counters.
Note: Single chip solution for interfacing 8051 is to be with C Programs for the following experiments.	
8	Stepper motor interface.
9	DC motor interface for direction and speed control using PWM.
10	Alphanumerical LCD panel interface.
11	Generate different waveforms: Sine, Square, Triangular, Ramp using DAC interface.
12	External ADC and Temperature control interface.
13	Elevator interface.

5.0 Relevance to future subjects

Sl No	Semester	Subject	Topics
01	VIII	Project work	Automation

6.0 Relevance to Real World

SL.No	Real World Mapping
01	8051 chips are used in a wide variety of control systems, telecom applications
02	Robotics as well as in the automotive industry.

7.0 Gap Analysis and Mitigation

Sl. No	Delivery Type	Details
01	Tutorial	Additional programs related real world interfacing.

8.0 Books Used and Recommended to Students

Text Books: Suggested Learning Resources
(1) The 8051 Microcontroller and Embedded Systems Using Assembly and C, Muhammad Ali Mazadi, Pearson, 2nd Edition, 2008.
(2) The 8051 Microcontroller, Kenneth Ayala, Cengage, 3rd Edition, 2005.
(3) Microcontrollers: Architecture, Programming, Interfacing and System Design, Raj Kamal, Pearson, 1st Edition, 2012.

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

Website and Internet Contents References
1) http://www.circuitstoday.com/8051-microcontroller
2) http://learn.mikroe.com/ebooks/8051programming/chapter/what-is-8051-standard/

10.0 Magazines/Journals Used and Recommended to Students

Sl.No	Magazines/Journals	website
1	International journal of innovative research in technology	www.ijirt.org/master/publishedpaper/IJIRT.
2	Science Direct	www.sciencedirect.com/science/book

11.0 Examination Note

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

CIE for the theory component of IPCC

- Two Tests each of 20 Marks (duration 01 hour)
- First test at the end of 5th week of the semester
- Second test at the end of the 10th week of the semester
- Two assignments each of 10 Marks
- First assignment at the end of 4th week of the semester
- Second assignment at the end of 9th week of the semester

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

CIE for the practical component of IPCC

- On completion of every experiment in the laboratory, the students shall be evaluated and marks shall be awarded on the same day. The15 marks are for conducting the experiment and preparation of the laboratory record, the other 05 marks shall be for the test conducted at the end of the semester.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to 15 marks.
- The laboratory test (duration 03 hours) at the end of the 15th week of the semester /after completion of all the experiments (whichever is early) shall be conducted for 50 marks and scaled down to 05 marks.
- Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for 20 marks.

SEE for IPCC

- Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (duration 03 hours)
- The question paper will have ten questions. Each question is set for 20 marks.
- There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.
- The students have to answer 5 full questions, selecting one full question from each module.
- The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only.
- Questions mentioned in the SEE paper shall include questions from the practical component.
- The minimum marks to be secured in CIE to appear for SEE shall be the 12 (40% of maximum marks30) in the theory component and 08 (40% of maximum marks -20) in the practical component. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included. The maximum of 04/05 questions to be set from the practical component of IPCC, the total marks of all questions should not be more than the 20 marks.
- SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify in the SEE. Marks secured will be scaled down to 50.

12.0 Course Delivery Plan

Module No.	Lecture No.	Content of Lecture	% of Portion
1	1	Inside the Computer	20
	2	Microcontrollers and Embedded Processors	
	3	Block Diagram of 8051	
	4	PSW and Flag Bits	
	5	8051 Register Banks and Stack	
	6	Internal Memory Organization of 8051	
	7	IO Port Usage in 8051, Types of Special Function Registers and their uses in 8051	
	8	Pins Of 8051. Memory Address Decoding	
	9	8031/51 Interfacing With External ROM And RAM	
	10	8051 Addressing Modes	
	11	Introduction to 8051 assembly programming	20
	12	Assembling and running an 8051 program	
	13	Data types and Assembler directives	
	14	Arithmetic instructions	

2	15	Logic and Jump instructions	
	16	loop and call instructions	
	17	Programs	
	18	Programs	
	19	Programs	
	20	IO port programming.	
3	21	Data types	20
	22	time delay in 8051C	
	23	IO programming in 8051C	
	24	Logic operations in 8051 C	
	25	Data conversion program in 8051 C	
	26	Accessing code ROM space in 8051C	
	27	Data serialization using 8051C	
	28	Programming 8051 timers	
	29	Counter programming	
	30	Programming timers 0 and 1 in 8051 C	
4	31	Basics of serial communication	20
	32	8051 connection to RS232,	
	33	8051 serial port programming in assembly,	
	34	serial port programming in 8051 C.	
	35	8051 interrupts	
	36	Programming timer	
	37	External hardware	
	38	Serial communication interrupt	
	39	Interrupt priority in 8051/52	
	40	Interrupt programming in C	
5	41	LCD interfacing	20
	42	Keyboard interfacing	
	43	ADC 0808 interfacing to 8051	
	44	Serial ADC Max1112 ADC interfacing to 8051	
	45	DAC interfacing, Sensor interfacing and signal conditioning	
	46	Relays and opt isolators	
	47	stepper motor interfacing	
	48	DC motor interfacing and PWM	
	49	Programming the 8255, 8255 interfacing	
	50	C programming for 8255	

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 8051 Microcontroller Basics	Students study history of the 8051 and features of other 8051 family members and the internal architecture of the 8051.	Module 1	2	Individual Activity.	Text book no.1
2	Assignment 2: University Questions on Assembly programming and instructions of 8051, Timer programming in Assembly and C	Students study the importance of 8051 addressing modes, accessing data and I/O port programming, arithmetic, logic instructions, and programs.	Module 2	4	Individual Activity.	Text book no.1
3	Assignment 3: University Questions on 8051 programming in C and timer programming in assembly and C.	Students able to develop 8051C programs for time delay, I/O operations, I/O bit manipulation, logic and arithmetic operations, data conversion and data serialization	Module 3	6	Individual Activity.	Text book no.1

4	Assignment 4: University Questions on 8051 serial port programming and interrupt programming in assembly and C	Students able to discuss the hardware connection of the 8051 chip, its timers, serial data communication and interfacing of 8051 to the RS232.	Module 4	8	Individual Activity.	Text book no.1
5	Assignment 5: University Questions on Interfacing, ADC, DAC and sensor interfacing, Motor control: Relay, PWM, DC and stepper motor, 8051 interfacing with 8255.	Students able to interface 8051 with real-world devices such as LCDs and keyboards, ADC, DAC chips and sensors etc.	Module 5	10	Individual Activity.	Text book no.1

14.0 QUESTION BANK

Module 1: 8051 Microcontroller Basics

1) With a neat block diagram, explain architecture of 8051.
2) With neat schematic interface 8K external data to 8051
3) Explain the memory organization in 8051 controller.
4) Describe each bit of PSW register in detail.
5) What you meant by stack? Explain stack pointer operation.
6) Explain the internal RAM section of 8051 microcontroller with required diagram.
7) Describe interfacing of 8051 with external RAM and ROM.
8) Explain all the addressing modes of 8051 with examples.
9) Show the pin diagram of 8051. Explain functionality of all the pins.
10) Describe different special function registers and their uses in 8051.

Module 2: Assembly programming and instruction of 8051

1) Explain the following instructions with suitable examples.
2) i) SWAP ii) MOVX iii) XCHD iv) DAA. Differentiate between LJMP, AJMP and SJMP instructions.
3) Differentiate between JMP and call instruction. Explain with suitable examples the different ranges associated with call instructions.
4) Differentiate between LJMP, AJMP and SJMP instructions.
5) Explain the following instructions of 8051 with examples.
6) i) XCHD A,@Ri ii)RLA iii) MOVC A, @A+DPTR iv) CJNE A,iram addr, rel addr
7) Describe data type and assembler directives of 8051.
8) Explain different types of conditional and unconditional jump instructions with examples.
9) Why do the PUSH and POP instructions in a subroutine need to be equal in number?
10) Correct the following instructions, If found to have any wrong syntax. Explain the operation of corrected instructions.
    i) MOV #C, 0A ii) MOV A, RS1 iii) MOV A, @R7 iv)MOV 0346H, @R0 v)XCHG B, @R3
11) Show the stack contents, SP contents and contents of any registered affected after each step of the following sequence of operations.

```
MOV SP, #70H
MOV R5, #30H
MOV A, #44H
ADD A, R5
MOV R4, A
PUSH 4
PUSH 5
POP  4.
```

12) What does the following program do? What is the final result in Accumulator? Give the results in terms of functionality.

```
start:  MOV A, R3
        RLA
        ANL A, #0AAH
        PUSH ACC
        MOV A, R3
```

```
RRA
ANL A, #55H
MOV R3, A
POP ACC
ORL 03H, A
STMP $
END
```

Module 3: 8051 programming in C. 8051 Timer programming in Assembly and C

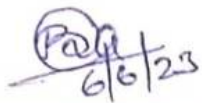
1) Write an ALP to perform the following operation $Z=(X_1+Y_1) * (X_2+Y_2)$. X_1, X_2, Y_1, Y_2 are 8-bit hexadecimal numbers stored in RAM locations. Write a subroutine for the addition and assume that each addition result with 8-bit number.
2) Write an ALP to subtract 37FEH from F845H and save the result in 9600H memory location.
3) Find the period of the machine cycle in each of the different 8051 based systems. i) 11.0592MHz ii) 16 MHz iii) 20MHz. With crystal frequency of 16 MHz, write a program to generate delay of 5ms.
4) Write an ALP to toggle all the bits of P1 for every 300ms. Assume crystal frequency as 22MHz.
5) Write an ALP to load accumulator with the value B6H and complement the content of A 200 times.
6) Write an ALP to subtract two 16 bit numbers.
7) Write a program to find Largest number in a given array of 8 numbers.
8) Write an ALP to toggle all the bits of P1 for every 300ms. Assume crystal frequency as 22MHz.
9) Explain the bit status of TMOD special function register of 8051 timers. And also explain its various modes.
10) Assume XTAL = 11.0592 MHz, Write a program to generate a square wave of 50 Hz frequency on pin P1.3.

Module 4: 8051 serial port programming in assembly and C. 8051 Interrupt programming in assembly and C

1) Describe different types of interrupts of 8051 with their vector address. Also show the sequence of events that take place on the occurrence of an interrupt.
2) Describe the different types of interrupts with their vector address.
3) Explain briefly the asynchronous serial communication format. And also indicate steps of programming 8051 to transmit a character serially.
4) Write an ALP to transfer the message "VTU" serially continuously at 9600 baud rate, 8-bit data, 1 stop bit.
5) Explain SCON register with its bit pattern. What is the significance of using SBUF register in serial communication?
6) Explain the functions of the pins of 9-pin (DB-9) RS 232 connector. Also describe about RS232 handshaking signals.
7) Write a program to send the data message "EESSA" of the length 5 character at a baud rate 2400, 8 bit data, 1 stop bit serially.
8) Describe serial, parallel, simplex, half duplex and full duplex data transfer.
9) What is serial communication? How serial communication is carried out with RS232 in 8051?

Module 5: Interfacing, ADC, DAC and sensor interfacing, Motor control: Relay, PWM, DC and stepper motor, 8051 interfacing with 8255

1) Draw the pin diagram of ADC0804 with pin description.
2) Interface LCD with 8051 and also write an ALP to display message "DONE".
3) How to Interface DAC with 8051. Explain with figure.
4) Show the H bridge operation in DC motor interfacing.
5) Describe the keyboard interfacing with 8051 along with diagram.
6) Describe DAC interface with diagram and also write C program to generate square wave.
7) Interface 8051 to a stepper motor. And also write an ALP to rotate stepper motor.
8) Interface a 2*4 keys keyboard to 8051 and write an ALP to send the keycode to port P1, whenever a key is pressed.
9) Show the interfacing circuit and functional pins of LCD.
10) Describe 8255 interfacing with 8051 with neat diagram.

Prepared by	Checked by		
			
Shri. M. P. Yenagimath	**Shri. M. P. Yenagimath**	**HOD**	**Principal**

Subject Title	**Electric Motors**		
Subject Code	21EE44	**CIE Marks**	50
Number of Lecture Hrs /	2:2:0:0	**SEE Marks**	50
Total Number of Lecture Hrs	40	**Exam Hours**	03
		CREDITS – 03	

FACULTY DETAILS:		
Name: Prof. Shivanand Hirekodi	**Designation:** Asst.Professor	**Experience:** 23Years
No. of times course taught:01 (including present)	**Specialization:** Power Electronics	

1.0 Prerequisite Subjects:

Sl. No	Branch	Semester	Subject
01	Electrical & Electronics Engineering	I/II	Basic Electrical Engineering

2.0 Course Objectives

1. To study the constructional features of Motors and select a suitable drive for specific application.
2. To study the constructional features of Three Phase and Single phase induction Motors.
3. To study different test to be conducted for the assessment of the performance characteristics of motors.
4. To study the speed control of motor by a different methods.
5. Explain the construction and operation of Synchronous motor and special motors..

3.0 Course Outcomes

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

	Course Outcome	RBT Level	POs
C218.1	Explain the characteristics, applications, losses and efficiency of different DC motors.	L2	PO 1,2,3,6,7,8,9,10,12
C218.2	Describe the testing methods of DC motors and performance characteristics of three phase Induction motors.	L3	PO 1,2,3,6,7,8,9,10,12
C218.3	Determine the performance parameters of three Induction motor using test data and circle diagram.	L3	PO 1,2,3,6,7,8,9,10,12
C218.4	Explain starting and speed control of three phase Induction motor and construction and working of different types of single phase Induction motors.	L2	PO 1,2,3,6,7,8,9,10,12
C218.5	Explain principle of operation of synchronous and other motors.	L2	PO 1,2,3,6,7,8,9,10,12
Total Hours of instruction		**40**	

4.0 Course Content

Module-1

DC Motors: Classification, Back emf, Torque equation, and significance of back emf, Characteristics of shunt, series & compound motors. Speed control of shunt, series and compound motors. Application of motors. DC motor starters – 3 point and 4 point. Losses and Efficiency- Losses in DC motors, power flow diagram, efficiency, condition for maximum efficiency.

8 hours

Module-2

Testing of DC Motors: Direct & indirect methods of testing of DC motors-Brake test, Swinburne's test, Retardation test, Hopkinson's test, Field's test, merits and demerits of tests.

Three Phase Induction Motors: Review of concept and generation of rotating magnetic field, Principle of operation, construction, classification and types; squirrel-cage, slip-ring (No question shall be set from the review portion). Slip, Torque equation, torque-slip characteristic covering motoring, generating and braking regions of operation, Maximum torque, Significance of slip.

8 hours

Module-3

Performance of Three-Phase Induction Motor: Phasor diagram of induction motor on no-load and on load, equivalent circuit, losses, efficiency, No-load and blocked rotor tests. Performance of the motor from the circle diagram and equivalent circuit. Cogging and crawling. High torque rotors-double cage and deep rotor bars. Equivalent circuit and performance evaluation of double cage induction motor. Induction motor working as induction generator.

8 hours

Module-4

Starting and Speed Control of Three-Phase Induction Motors: Need for starter. Direct on line, Star-Delta, and autotransformer starting. Rotor resistance starting. Speed control by voltage, frequency, and rotor resistance methods Single-Phase Induction Motor: Double revolving field theory and principle of operation. Construction and operation of split-phase, capacitor start, capacitor run, and shaded pole motors. Comparison of single phase motors and applications. 8 hours

Module-5

Synchronous Motor: Principle of operation, phasor diagrams, torque and torque angle, Blondel diagram, effect of change in load, effect of change in excitation, V and inverted V curves. Synchronous condenser, hunting and damping. Methods of starting synchronous motors. Other Motors: Construction and operation of Universal motor, AC servomotor, Linear induction motor, and stepper motors.

8 hours

5.0 Relevance to future subjects

Sl No	Semester	Subject	Topics
01	V	Electrical machine design	Circle Diagram, Torque equation, starters
02	VII&VIII	Seminar and project	Knowledge of Machine

6.0 Relevance to Real World

SL No	Real World Mapping
01	Industrial Drives for different mills, Process control industries.
02	Application of special motors

7.0 Gap Analysis and Mitigation

Sl. No	Delivery Type	Details
01	Lab and industrial visit.	Familiarization of real machine parts and its constructional features. Included animation slides demonstrating the working of various machines.
02	NPTEL	Video lectures

8.0 Books Used and Recommended to Students

Text Books and Reference Books
1. Electric Machines, D. P. Kothari, I. J. Nagrath, McGraw Hill, 4th edition, 2011.
2. Theory of Alternating Current Machines, Alexander Langsdorf, McGraw Hill, 2nd Edition, 2001.
3. Electric Machines, Ashfaq Hussain, Dhanpat Rai & Co, 2nd Edition, 2013.
Additional Study material & e-Books
1. Principles of Electric Machines and power Electronics P.C.Sen Wiley 2nd Edition, 2013
2. A text book of Electrical Technology Volume-II by B.L. Theraja, S Chand and Company
3. Electrical Technology by E. Hughes, Pearson, 12th Edition, 2016.

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

Website and Internet Contents References
1) http://www.electrical4u.com
2) www.nptel.com

10.0 Magazines/Journals Used and Recommended to Students

Sl.No	Magazines/Journals	website
1	Electric apparatus magazine	https://electricalapparatus.wordpress.com/2016/06/30/electric-generator-up-and-running/
2	E drive magazine	http://www.e-driveonline.com/main
3	Motor magazine	https://www.motor.com/newsletters

11.0 Examination Note

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

Continuous Internal Evaluation:

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

- First test at the end of 5th week of the semester
- Second test at the end of the 10th week of the semester
- Third test at the end of the 15th week of the semester

Two assignments each of 10 Marks

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

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks (duration 01 hours)** at the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks** (to have less stressed CIE, the portion of the syllabus should not be common / repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

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

12.0 Course Delivery Plan

Module No.	Lecture No.	Content of Lecture	% of Portion
1	1.	DC Motors: Classification, Back emf	20%
	2.	Torque equation, and significance of back emf,	
	3.	Characteristics of shunt, series & compound motors.	
	4.	Speed control of shunt, series and compound motors.	
	5.	Application of motors.	
	6.	DC motor starters – 3 point and 4 point.	
	7.	Losses and Efficiency- Losses in DC motors	
	8.	Power flow diagram, efficiency, condition for maximum efficiency.	
2	9.	Direct & indirect methods of testing of DC motors.	20%
	10.	Brake test, Swinburne's test.	
	11.	Retardation test.	
	12.	Hopkinson's test, Field's test, merits and demerits of tests.	
	13.	Review of concept and generation of rotating magnetic field, Principle of operation, construction, classification and types; squirrel-cage, slip-ring (No question shall be set from the review portion).	
	14.	Slip, Torque equation.	
	15.	Torque-slip characteristic covering motoring, generating and braking regions of operation.	
	16.	Maximum torque, Significance of slip.	
3	17.	Phasor diagram of induction motor on no-load and on load	20%
	18.	Equivalent circuit, losses, efficiency	
	19.	No-load and blocked rotor tests.	
	20.		
	21.	Performance of the motor from the circle diagram and equivalent circuit.	
	22.	Cogging and crawling. High torque rotors-double cage and deep rotor bars.	
	23.	Equivalent circuit and performance evaluation of double cage induction motor.	
	24.	Induction motor working as induction generator.	
4	25.	Need for starter. Direct on line, Star-Delta	20%
	26.	Autotransformer starting. Rotor resistance starting.	
	27.	Speed control by voltage, frequency methods	
	28.	Speed control by rotor resistance method	
	29.	Double revolving field theory and principle of operation	
	30.	Construction and operation of split-phase, capacitor start motors	
	31.	Construction and operation of capacitor run motors	
	32.	Construction and operation of shaded pole motors. Comparison of single phase motors and applications.	
5	33.	Principle of operation, phasor diagrams, torque and torque angle.	20%
	34.	Blondel diagram.	
	35.	Effect of change in load, effect of change in excitation.	
	36.	V and inverted V curves.	
	37.	Synchronous condenser, hunting and damping.	
	38.	Methods of starting synchronous motors.	
	39.	Construction and operation of Universal motor, AC servomotor.	
	40.	Linear induction motor and stepper motors.	

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: As per University Question paper pattern to attain COs and POs.	Students study the Topics and write the Answers. Get practice to solve university questions.	Module 1, 2 & 3 of the syllabus	9	Individual Submission in the standard format is expected	Book 1,2 of the textbooks list.
2	Assignment 1: As per University Question paper pattern to attain COs and POs.	Students study the Topics and write the Answers. Get practice to solve university questions.	Module 4,5 of the syllabus	12	Individual Submission in the standard format is expected	Book 1,2 of the textbooks list.

14.0 QUESTION BANK

Module 1

1. A series motor should never be started on no-load" justify the above statement with proper reasoning.
2. Explain the method of speed control of DC shunt machine by ward Leonard method.
3. Derive the standard torque equation for DC Motor.
4. A dc motor takes an armature current of 110A at 480V. The armature circuit resistance is 0.2 ohm. The machine has 6 poles and the armature is lap connected with 864 conductors. The flux per pole is 0.05wb. Calculate (a) speed and (b) gross torque developed by the motor.
5. What is back? Explain the significance of back emf.
6. Explain the working and performance, characteristic, advantage, disadvantage and application DC motor.
7. Discuss the characteristic of DC shunt, series and compound motor.
8. Discuss the speed control methods of dc shunt and series motor.
9. Draw the power flow diagram of a DC motor and derive the condition for maximum efficiency.
10. Explain with circuit diagrams, the armature control methods of DC series motors.

Module 2

1. Explain the Swinburne's test to predetermine the efficiency of d.c machine by computing mechanical losses and discuss merit and demerit of it.
2. With neat circuit diagram Explain the procedure to conduct Hopkinson's test. Show how the efficiency of motor and generator are calculated. What are advantage and disadvantage of this test?
3. Explain the principle of retardation test and how moment of inertia of dc machine can be' estimated and eliminated.
4. Briefly describe the field test applied to two similar dc series motor.
5. Mention the various methods of testing a DC machine and discuss on the limitations of each method.
6. With 3- ø flux wave diagram & vector diagram explain how you obtain rotating magnetic field in a 3- ø IM & also explain the production of torque.
7. What are different types of induction motors? Explain their uses.
8. Derive the equation for torque developed by an IM taking stator impedance into account. Draw a typical torque slip curve & deduce the condition for max torque.
9. Draw & explain the phasor diagram & equivalent circuit of a 3 ø IM.
10. Draw the complete torque slip characteristics of a 3- ø IM indicating all the regions & explain
11. Explain the torque-slip characteristics of 3- ø IM under the condition of variable frequency, constant V/F ratio.
12. The no load test on 60HP, 220V DC shunt motor gave the following results on no load test. Input current =13.25 amps, Field current=2.55 amps, Resistance of armature=0.032 ohm, Brush drop =2 Volts. Find the full load current and full load efficiency.
13. A retardation test is carried out on a 1000 rpm dc machine. The time taken for speed to fall from 1030 rpm to 970rpm is a) 40 Sec with no excitation ii) 20 sec with full excitation c) 9 sec with full

excitation and armature supplying an extra load of 10A at 225V. Calculate i) moment of inertia ii) Iron losses iii) Mechanical losses.

14. The following results were obtained during Hopkinson's test on two similar 230V machines, armature currents 37 A and 30A, field currents 0.85 A and 0.8A of motor and generator respectively .Calculate the efficiencies of machines if each has armature resistance of 0.33 ohm.
15. A 6 pole, 3 phase induction motor develops a maximum torque of 30 Nm at 960 rpm. Determine the torque exerted by motor at 5 % slip. The rotor resistance per phase is 0.6 ohm.
16. A 6 pole, 3 phase induction motor develops a maximum torque of 30 Nm at 960 rpm. Determine the torque exerted by motor at 5 % slip. The rotor resistance per phase is 0.6 ohm.

Module 3

1. Explain the phenomenon of cogging and crawling in a 3ph Induction Motor.
2. Discuss the working of deep bar and double cage Induction Motor.
3. With neat circuit diagram, explain no load and blocked rotor test conducted on 3ph Induction Motor to construct circle diagram.
4. Develop the approximate equivalent circuit of Induction Motor.
5. Derive condition for maximum power output of Induction Motor.
6. Discuss the no load and blocked rotor test of Induction Motor.
7. Draw a circle diagram for 20HP, 50Hz, 3ph star connected Induction Motor with following data. Motor: No load test: 400V, 9A, 0.2pf lag. Blocked rotor test: 200V, 50V, 0.4pf. Determine line current.
8. A 440V, 3ph, 8pole, 40kW, star connected three phase Induction Motor has the following parameters: Stator resistance (R_1)=0.1 ohm, stator reactance X_1=0.4 ohm, Equivalent rotor resistance referred to stator R_2=0.15 ohm, equivalent rotor reactance referred to stator X_2=0.44 ohm. The stator core loss is 1250 Watt while the mechanical loss is 1000W. It draws a no load current of 20A at a power factor of 0.9 lagging while running at speed of 727.5rpm. Calculate i) input line current and power factor ii) Torque developed iii)Output power. Use approximate equivalent circuit.
9. The cages of double cage Induction Motor have a standstill impedance of (3.5+1.5j) ohm and (0.6+7j) ohm. Full load slip is 6%. Find the starting torque in terms of full load torque. Neglect stator impedance and magnetizing current.

Module 4

1. Explain any three important methods, with suitable circuits, how speed control can be achieved in 3ph Induction Machine
2. With neat sketch explain the construction, working principle and application of i)split phase ii)capacitor start 1-ph Induction Motor
3. Explain the electronic starters for 3-ph Induction Motor.
4. Why starter is necessary to start IM? Explain in detail auto transformer method of starting a cage Induction Motor.
5. A 18650W, 4pole, 50Hz, 3-ph Induction Motor has friction and windage losses of 2.5% of the output. The FL slip is 4%. Compute for FL i)rotor copper loss ii)rotor input iii)the shaft torque
6. Explain double revolving field theory of 1-ph Induction Motor and prove that starting torque is zero.

Module 5

1. Describe the working principle of synchronous motor and why it is not self starting?
2. Write a note on V and inverted V curves of synchronous motor.
3. Explain the phenomenon of hunting in synchronous machine and method of reducing the same.
4. Explain how two or more alternators are made to share the load in propagation to their rating.
5. An alternator is supplying constant load. With suitable vector diagram and explain the effect of variation on excitation on armature current and load power factor.
6. Write a short note on synchronous condenser.

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	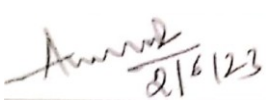		
Prof. S.D.Hirekodi	**Prof. Amit Neshti**	**HOD**	**Principal**

Subject Title	Biology for Engineers		
Subject Code	21BE45	CIA Marks	50
Number of Lecture Hrs / Week (L:T:P: S)	1:2:0:0 /2:0:0:0	SEE Marks	50
Total Number of Lecture Hrs	25	Exam Hours	02 Hour
CREDITS – 02			

FACULTY DETAILS:		
Name: Mr.S. B. Radder	**Designation:** Asst. Professor	**Experience:**1) 5 Years
No. of times course taught: 01	**Specialization:** Spectroscopy	

1.0 Prerequisite Subjects:

Sl. No	Branch	Semester	Subject
01	All Branch (Common)	IV	Fundamentals of Biology

2.0 Course Objectives

This course (**21BE45**) will enable students

1. To familiarize the students with the basic biological concepts and their engineering applications.
2. To enable the students with an understanding of biodesign principles to create novel devices and structures.
3. To provide the students an appreciation of how biological systems can be re-designed as substitute products fornatural systems.

3.0 Course Outcomes

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

	Course Outcome	Cognitive Level	POs
C105.1	Elucidate the basic biological concepts via relevant industrial applications and case studies.	L1,L2	1,8,12
C105.2	Evaluate the principles of design and development, for exploring novel bioengineering projects.	L1,L2	1,,8,12
C105.3	Corroborate the concepts of biomimetics for specific requirements.	L1,L2	1, 8,12
C105.4	Think critically towards exploring innovative biobased solutions for socially relevant problems.	L1,L2	1,8,12
C105.5	Future Trends in Bioengineering	L1,L2	1,8,12
	Total Hours of instruction	**25 Hours**	

4.0 Course Content

MODULE-1

BIOMOLECULES AND THEIR APPLICATIONS (QUALITATIVE):
Carbohydrates (cellulose-based water filters, PHA and PLA as bioplastics), Nucleic acids (DNA Vaccine for Rabies and RNA vaccines for Covid19, Forensics – DNA fingerprinting), Proteins

(Proteins as food – whey protein and meat analogs, Plant based proteins), lipids (biodiesel, cleaning agents/detergents), Enzymes (glucose-oxidase in biosensors, lignolytic enzyme in bio-bleaching).

05 Hours

MODULE-2

HUMAN ORGAN SYSTEMS AND BIO DESIGNS - 1 (QUALITATIVE):
Brain as a CPU system (architecture, CNS and Peripheral Nervous System, signal transmission, EEG, Robotic arms for prosthetics. Engineering solutions for Parkinson's disease).Eye as a Camera system (architecture of rod and cone cells, optical corrections, cataract, lens materials, bionic eye).Heart as a pump system (architecture, electrical signalling - ECG monitoring and heart related issues, reasons for blockages of blood vessels, design of stents, pace makers, defibrillators).

05 Hours

MODULE-3

HUMAN ORGAN SYSTEMS AND BIO-DESIGNS - 2 (QUALITATIVE):
Lungs as purification system (architecture, gas exchange mechanisms, spirometry, abnormal lung physiology - COPD, Ventilators, Heart-lung machine).Kidney as a filtration system (architecture, mechanism of filtration, CKD, dialysis systems). Muscular and Skeletal Systems as scaffolds (architecture, mechanisms, bioengineering solutions for muscular dystrophy and osteoporosis).

05 Hours

MODULE-4

NATURE-BIOINSPIRED MATERIALS AND MECHANISMS (QUALITATIVE):
Echolocation (ultrasonography, sonars), Photosynthesis (photovoltaic cells, bionic leaf). Bird flying (GPS and aircrafts), Lotus leaf effect (Super hydrophobic and self-cleaning surfaces), Plant burrs (Velcro), Shark skin (Friction reducing swim suits), Kingfisher beak (Bullet train). Human Blood substitutes - hemoglobin-based oxygen carriers (HBOCs) and perflourocarbons (PFCs).

05 Hours

MODULE-5

TRENDS IN BIOENGINEERING (QUALITATIVE):
Bioprinting techniques and materials, 3D printing of ear, bone and skin. 3D printed foods. Electrical tongue and electrical nose in food science, DNA origami and Biocomputing, Bioimaging and Artificial Intelligence for disease diagnosis. Self- healing Bioconcrete (based on bacillus spores, calcium lactate nutrients and biomineralization processes) and
Bioremediation and Biomining via microbial surface adsorption (removal of heavy metals like Lead, Cadmium, Mercury, Arsenic). 05 Hours

5.0 Relevance to future subjects

Sl No	Semester	Subject	Topics
01	Higher Semester	Information regarding Biology for Engineers	Basic fundamentals

6.0 Relevance to Real World

SL.No	Real World Mapping
01	Brain as a CPU system
02	Nucleic acids (DNA Vaccine for Rabies)
03	Nucleic acids (RNA vaccines for Covid19)
04	Nucleic acids (Forensics – DNA fingerprinting)
05	Lungs as purification system (architecture, gas exchange mechanisms, spirometry, abnormal lung physiology - COPD, Ventilators, Heart-lung machine).

7.0 Gap Analysis and Mitigation

Sl. No	Delivery Type	Details
01	Chalk and Talk	This delivery method is adapted to all modules.
02	Self prepared PPTs	The PPTs are also used in the discussions wherever necessary in the syllabus.
03	Self Prepared videos	Self prepared videos are also used for better understanding.
04	Experimental Demonstration	Experimental Demonstration is done to the students for better understanding of concepts.
05	Tutorial	Topic: Module I to Module V
06	NPTEL	Biology for Engineers Videos

8.0 Books Used and Recommended to Students

Suggested Text Books

Books (Title of the Book/Name of the author/Name of the publisher/Edition and Year)

1. Human Physiology, Stuart Fox, Krista Rompolski, McGraw-Hill eBook. 16th Edition, 2022
2. Biology for Engineers, Thyagarajan S., Selvamurugan N., Rajesh M.P., Nazeer R.A., Thilagaraj W., Barathi S., and Jaganthan M.K., Tata McGraw-Hill, New Delhi, 2012.
3. Biology for Engineers, Arthur T. Johnson, CRC Press, Taylor and Francis, 2011
4. Biomedical Instrumentation, Leslie Cromwell, Prentice Hall 2011.
5. Biology for Engineers, Sohini Singh and Tanu Allen, Vayu Education of India, New Delhi, 2014.
6. Biomimetics: Nature-Based Innovation, Yoseph Bar-Cohen, 1st edition, 2012, CRC Press.
7. Bio-Inspired Artificial Intelligence: Theories, Methods and Technologies, D. Floreano and C. Mattiussi, MIT Press, 2008.
8. Bioremediation of heavy metals: bacterial participation, by C R Sunilkumar, N Geetha A C Udayashankar Lambert Academic Publishing, 2019.
9. 3D Bioprinting: Fundamentals, Principles and Applications by Ibrahim Ozbolat, Academic Press, 2016.
10. Electronic Noses and Tongues in Food Science, Maria Rodriguez Mende, Academic Press, 2016
11. Blood Substitutes, Robert Winslow, Elsevier, 2005

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

1. VTU EDUSAT / SWAYAM / NPTEL / MOOCS / Coursera / MIT-open learning resource
2. https://nptel.ac.in/courses/121106008
3. https://freevideolectures.com/course/4877/nptel-biology-engineers-other-non-biologists
4. https://ocw.mit.edu/courses/20-020-introduction-to-biological-engineering-design-spring-2009
5. https://ocw.mit.edu/courses/20-010j-introduction-to-bioengineering-be-010j-spring-2006
6. https://www.coursera.org/courses?query=biology
7. https://onlinecourses.nptel.ac.in/noc19_ge31/preview
8. https://www.classcentral.com/subject/biology
9. https://www.futurelearn.com/courses/biology-basic-concepts

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

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

1. Group Discussion of Case studies
2. Model Making and seminar/poster presentations
3. Design of novel device/equipment like Cellulose-based water filters, Filtration system mimicking the kidney,Bioremediation unit for E-waste management, AI and ML based Bioimaging,

11.0 Examination Note

Assessment Details (both CIE and SEE)

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

Continuous Internal Evaluation:

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

- First test at the end of 5th week of the semester
- Second test at the end of the 10th week of the semester
- Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

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

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

- At the end of the 13th week of the semester

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

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

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

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question

papers for the subject (duration 03 hours)

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

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

The SEE question paper will be set for 100 marks and marks scored will be proportionately reduced to 50 marks

13.0 Course Delivery Plan

Module	Lecture No.	Content of Lecturer	Teaching Method	% of Portion
1	1	Carbohydrates (cellulose-based water filters, PHA and PLA as bioplastics),	Chalk and Talk, Power-point Presentation	20
	2	Nucleic acids (DNA Vaccine for Rabies and RNA vaccines for Covid19, Forensics – DNA fingerprinting)	Chalk and Talk, Power-point Presentation	
	3	Proteins (Proteins as food – whey protein and meat analogs, Plant based proteins),	Chalk and Talk, Power-point Presentation,	
	4	Lipids (biodiesel, cleaning agents /detergents)	Chalk and Talk, Power-point Presentation	
	5	Enzymes (glucose-oxidase in biosensors, lignolytic enzyme in bio-bleaching).	Chalk and Talk, Power-point Presentation	
2	6	Brain as a CPU system (architecture, CNS and Peripheral Nervous System, signal transmission, EEG).	Chalk and Talk, Power-point Presentation	
	7	Brain as a CPU system (Robotic arms for prosthetics. Engineering solutions for Parkinson's disease).	Chalk and Talk, Power-point Presentation	
	8	Eye as a Camera system (architecture of rod and cone cells, optical corrections, cataract, lens materials, bionic eye).	Chalk and Talk,	
	9	Heart as a pump system (architecture, electrical signalling - ECG monitoring and heart related issues)	Chalk and Talk, Power-point Presentation	
	10	Reasons for blockages of blood vessels, design of stents, pace makers, defibrillators).	Chalk and Talk, Power-point Presentation	
3	11	Lungs as purification system (architecture, gas exchange mechanisms, spirometry, abnormal lung physiology).	Chalk and Talk, Power-point Presentation	20
	12	Lungs as purification system (COPD, Ventilators, Heart-lung machine).	Chalk and Talk, Power-point Presentation	
	13	Kidney as a filtration system (architecture, mechanism of filtration, CKD, dialysis systems).	Chalk and Talk, Power-point Presentation	

	14	Muscular and Skeletal Systems as scaffolds (architecture, mechanisms).	Chalk and Talk, Power-point Presentation	
	15	Muscular and Skeletal Systems as scaffolds (bioengineering solutions for muscular dystrophy and osteoporosis).	Chalk and Talk, Power-point Presentation	
4	16	Echolocation (ultrasonography, sonars),	Chalk and Talk, Power-point Presentation	
	17	Photosynthesis (photovoltaic cells, bionic leaf).	Chalk and Talk, Power-point Presentation	
	18	Bird flying (GPS and aircrafts), Lotus leaf effect (Super hydrophobic and self-cleaning surfaces),	Chalk and Talk, Power-point Presentation	
	19	Plant burrs (Velcro), Shark skin (Friction reducing swim suits), Kingfisher beak (Bullet train).	Chalk and Talk, Power-point Presentation	
	20	Human Blood substitutes - hemoglobin-based oxygen carriers (HBOCs) and perflourocarbons (PFCs).	Chalk and Talk, Power-point Presentation	
5	21	Bioprinting techniques and materials, 3D printing of ear, bone and skin. 3D printed foods.	Chalk and Talk, Power-point Presentation	20
	22	Electrical tongue and electrical nose in food science,	Chalk and Talk, Power-point Presentation	
	23	DNA origami and Biocomputing, Bioimaging and Artificial Intelligence for disease diagnosis.	Chalk and Talk, Power-point Presentation	
	24	Self- healing Bioconcrete (based on bacillus spores, calcium lactate nutrients and biomineralization processes)	Chalk and Talk, Power-point Presentation	
	25	Bioremediation and Biomining via microbial surface adsorption (removal of heavy metals like Lead, Cadmium, Mercury, Arsenic).	Chalk and Talk, Power-point Presentation	

14.0 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 Section of Oscillations and Waves	Students study the Topics and write the Answers. Get practice to solve university questions.	Module 4 of the syllabus	10	Individual Activity. Printed solution expected.	Book 1, 2 of the reference list. Website of the Reference list
2	Assignment 2:	Students study the	Module	12	Individual	Book 1, 2 of

	University Questions on Modern Physics & Quantum Mechanics	Topics and write the Answers. Get practice to solve university questions.	5 of the syllabus		Activity. Printed solution expected.	the reference list. Website of the Reference list

15.0 QUESTION BANK

MODULE-1

1. What are Carbohydrates
2. Explain cellulose-based water filters
3. Explain PHA and PLA as bioplastics
4. Explain Nucleic acids
5. Write a note on DNA Vaccine for Rabies
6. Explain RNA vaccines for Covid19
7. Explain Forensics – DNA fingerprinting
8. Explain Proteins as food – whey protein and meat analogs
9. Explain Plant based proteins
10. What are lipids?
11. Explain biodiesel, cleaning agents/detergents
12. Explain uses of Enzymes in glucose-oxidase in biosensors, lignolytic enzyme in bio-bleaching.

MODULE-2

1. Explain Brain as a CPU system
2. Explain brain architecture, CNS and Peripheral Nervous System
3. Explain the signal transmission in brain
4. Explain EEG, Robotic arms for prosthetics.
5. Write a note on engineering solutions for Parkinson's disease
6. Explain Eye as a Camera system
7. Explain Heart as a pump system
8. Explain ECG monitoring and heart related issues, reasons for blockages of blood vessels, design of stents, pace makers, defibrillators.

MODULE-3

1. Explain Lungs as purification system
2. Explain architecture, gas exchange mechanisms, spirometry, abnormal lung physiology
3. Explain COPD
4. Explain Ventilators, Heart-lung machine.
5. Explain kidney as a filtration system
6. Explain in detail kidney architecture, mechanism of filtration, CKD, dialysis systems.
7. Explain Muscular and Skeletal Systems as scaffolds

MODULE-4

1. Explain Echolocation
2. Explain Photosynthesis
3. How Bird flying is used in GPS and aircrafts
4. Explain Lotus leaf effect

5. Explain Plant burrs
6. Explain Shark skin
7. Explain Kingfisher beak.
8. Explain Human Blood substitutes
9. Explain hemoglobin-based oxygen carriers (HBOCs) and perflourocarbons (PFCs).

MODULE-5

1. Explain Bioprinting techniques and materials
2. Explain 3D printing of ear, bone and skin.
3. 3D printed foods.
4. Explain Electrical tongue and electrical nose in food science
5. Explain DNA origami and Biocomputing
6. Explain Bioimaging and Artificial Intelligence for disease diagnosis.
7. Explain Self- healing Bioconcrete
8. Bioremediation and Biomining via microbial surface adsorption

Subject Title	Universal Human Values-II: Understanding Harmony And Ethical Human Conduct		
Subject Code	21UHV49	**CIE Marks**	50
Teaching Hrs / Week	02	**SEE Marks**	50
Total Hrs of Pedogogy	20	**Exam Hours**	01
			CREDITS – 01

FACULTY DETAILS:		
Name: Prof. H R Zinage	**Designation:** Asst. Professor	**Experience: 22** Years
No. of times course taught: 01 Times	**Specialization:** Power System	

1.0 Prerequisite Subjects:

Sl. No	Branch	Semester	Subject
01	None	--	--

2.0 Course Objectives

This introductory course input is intended:

1. To help the students appreciate the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.

2. To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.

3. To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature.

This course is intended to provide a much-needed orientational input in value education to the young enquiring minds.

3.0 Course Outcomes

By the end of the course, students are expected to positively impact common graduate attributes like:

CO	Course Outcome	Cognitive Level	POs
C228.1	Holistic vision of life	L_2	PO6, PO7 PO8, PO10,PO12
C228.2	Socially responsible behaviour	L_2	PO6, PO7 PO8, PO10,PO12
C228.3	Environmentally responsible work	L_2	PO6, PO7 PO8, PO10,PO12
C228.4	Ethical human conduct	L_2	PO6, PO7 PO8, PO10,PO12
C228.5	Having Competence and Capabilities for Maintaining Health and Hygiene	L_2	PO6, PO7 PO8, PO10,PO12
C228.6	Appreciation and aspiration for excellence (merit) and gratitude for all	L_2	PO6, PO7 PO8, PO10,PO12
Total Hours of instruction		**20**	

4.0 Course Content

Module-1

Introduction to Value Education (4 hours) Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education) Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Happiness and Prosperity – Current Scenario, Method to Fulfil the Basic Human Aspirations

Module-2

Harmony in the Human Being (4 hours) Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to ensure self-regulation and Health

Module-3

Harmony in the Family and Society (4 hours) Harmony in the Family – the Basic Unit of Human Interaction, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Other Feelings, Justice in Human-to-Human Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order

Module-4

Harmony in the Nature/Existence (4 hours) Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence

Module-5

Implications of the Holistic Understanding – a Look at Professional Ethics (4 hours) Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value-based Life and Profession

5.0 Relevance to future subjects:

SL. No	Semester	Subject	Topics / Relevance
01	------	None	--------

6.0 Relevance to Real World

SL. No	Real World Mapping
01	Self enhancement, Openness to change, Self transcendence & Conservation.

7.0 Books Used and Recommended to Students

Text Books

a. The Textbook A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034- 47-1
b. The Teacher‟s Manual " Manual for A Foundation Course in Human Values and Professional Ethics", R R Gaur, R Asthana, G

Reference Books
1. JeevanVidya: EkParichaya, A Nagaraj, JeevanVidyaPrakashan, Amarkantak, 1999. 2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004. 3. The Story of Stuff (Book). 4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi 5. Small is Beautiful - E. F Schumacher. 6. Slow is Beautiful - Cecile Andrews 7. Economy of Permanence - J C Kumarappa 8. Bharat Mein Angreji Raj – Pandit Sunderlal 9. Rediscovering India - by Dharampal 10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi 11. India Wins Freedom - Maulana Abdul Kalam Azad 12. Vivekananda - Romain Rolland (English) 13. Gandhi - Romain Rolland (English) 14. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991 15. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, Limits to Growth – Club of Rome's report, Universe Books. 16. A Nagraj, 1998, Jeevan Vidya Ek Parichay, Divya Path Sansthan, Amarkantak. 17. P L Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers. 18. A N Tripathy, 2003, Human Values, New Age International Publishers . 19. SubhasPalekar, 2000, How to practice Natural Farming, Pracheen (Vaidik) KrishiTantraShodh, Amravati. 20. E G Seebauer & Robert L. Berry, 2000, Fundamentals of Ethics for Scientists & Engineers , Oxford University Press 21. M Govindrajran, S Natrajan & V.S. Senthil Kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd. 22. B P Banerjee, 2005, Foundations of Ethics and Management, Excel Books. 23. B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.

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

Web links and Video Lectures (e-Resources):
1. Value Education websites, https://www.uhv.org.in/uhv-ii, http://uhv.ac.in, http://www.uptu.ac.in 2. Story of Stuff, http://www.storyofstuff.com 7. https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw 8. https://fdp-si.aicte-india.org/8dayUHV_download.php 9. https://www.youtube.com/watch?v=8ovkLRYXIjE 10. https://www.youtube.com/watch?v=OgdNx0X923I 11. https://www.youtube.com/watch?v=nGRcbRpvGoU 12. https://www.youtube.com/watch?v=sDxGXOgYEKM

9.0 Magazines/Journals Used and Recommended to Students

Sl. No	Magazines/Journals
1	Al Gore, An Inconvenient Truth, Paramount Classics, USA
2	**Charlie Chaplin, Modern Times, United Artists, USA**
3	IIT Delhi, Modern Technology – the Untold Story
4	Gandhi A., Right Here Right Now, Cyclewala Productions.

10.0 Examination Note

Assessment Details (both CIE and SEE)

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

Continuous Internal Evaluation:

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

Two assignments each of **10 Marks**

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

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

Semester End Examination: Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (duration 01 hours)

1. The question paper will have 50 questions. Each question is set for 01 marks.
2. The students have to answer all the questions, selecting one full question from each module.

11.0 Course Delivery Plan

Module	Lecture No.	Content of Lecture	% of Portion
I	1	Right Understanding, Relationship and Physical Facility.	20%
	2	Understanding Value Education, Self-exploration as the Process for Value Education.	
	3	Continuous Happiness and Prosperity – the Basic Human Aspirations.	
	4	Happiness and Prosperity – Current Scenario, Method to Fulfill the Basic Human Aspirations.	
II	5	Harmony in the Human Being Understanding Human being as the Co-existence of the Self and the Body.	20%
	6	Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self.	
	7	Understanding Harmony in the Self, Harmony of the Self with the Body.	
	8	Programme to ensure self-regulation and Health.	
III	9	Harmony in the Family and Society, the Basic Unit of Human Interaction.	20%
	10	'Trust' – the Foundational Value in Relationship.	
	11	'Respect' – as the Right Evaluation, Other Feelings, Justice in Human-to-Human Relationship.	
	12	Understanding Harmony in the Society, Vision for the Universal Human Order.	
IV	13	Harmony in the Nature/Existence Understanding Harmony in the Nature.	20%

	14	Interconnectedness, self-regulation and Mutual Fulfillment among the Four Orders of Nature.	
	15	Realizing Existence as Co-existence at All Levels.	
	16	The Holistic Perception of Harmony in Existence.	
V	17	Implications of the Holistic Understanding – a Look at Professional Ethics Natural Acceptance of Human Values.	20%
	18	Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order.	
	19	Competence in Professional Ethics Holistic Technologies.	
	20	Strategies for Transition towards Value-based Life and Profession.	

12.0 QUESTION BANK

1. What is the state of liking and a holistic and all encompassing state of the mind that creates inner harmony?
   a. Prosperity
   b. **Happiness**
   c. Innateness
   d. Self-organized

2. What is called living with assumption for oneself as body and Living of human beingonly on the basis of physical facilities, and not with right understanding and relationship?
   a. Human Consciousness
   b. Happiness
   c. Right Understanding
   d. **Animal Consciousne**

3. Five basic guidelines for value education are Universal, Natural and verifiable, all encompassing, leading to harmony and
   1. Self exploration
   2. Education
   3. Right utilization
   4. **Rational**

4. What are the basic desires of every human being for which they are working.
   1. Physical facilities
   2. Realization and understanding
   3. Happiness and prosperity
   4. **Continuous happiness and prosperity**

5. When we participate in the larger order, this participation at different levels is known as our value. Values are outcome of
   1. Prosperity
   2. Happiness
   3. **Realization and understanding**
   4. Self exploration

6. Identify the solution which helps human being to transform from animal consciousness tohuman consciousness.
   1. **Right understanding**
   2. Realization
   3. Value education
   4. Physical facilities.

7. To maintain harmony we have to work at four levels of living .Identify second level of living.
   1. Self

2. **Family**
3. Nature
4. Society

8. Self exploration is a process which helps us to find out "What I am and What I reallywant to be ".Two mechanisms involved in self -exploration are
1. Realization and understanding
2. Natural and verifiable
3. **Natural acceptance and experimental validation**
4. Correctable and identifiable

9. Self exploration uses two mechanisms
1. **Natural acceptance and experiential validation**
2. Right Understanding and self exploration
3. Self investigation and self exploration
4. Natural acceptance and self investigation

10. Samridhi means
1. Happiness
2. Wealth
3. **Prosperity**
4. Health

11. What is the third level of living?
1. **Society**
2. Individual
3. Family
4. Nature

12. Developed nations are the live example of
1. **Prosperity**
2. Wealth
3. Happines
4. Health

13. The participation of human beings is seen in two forms
1. Prosperity and Work
2. Values and Understanding
3. Behavior and Wealth
4. **Behavior and Work**

14. What are the outcomes of realization and understanding?
1. Work
2. **Values**
3. Happiness
4. Health

15. We become …….. by exploring our svatva and living accordingly

a. **Svatantra**
b. Partantra
c. Wealthy.
d. Happy

16.Developed nations are the live example of health, wealth and wisdom. These three term scan be 16.combined to form a single term as

a. Developed
b. **Prosperous**
c. Harmony
d. Happy

17. Contents of self-exploration area

a. Desire and needs
b. Program and needs
c. Program and practical
d. **Desire and Program**

18. Value education is becoming important for students now a days because value educationhelps students to correctly identify our

a. Values
b. Key to success
c. **Aspirations**
d. Needs

19. Three results are obtained from realization and understanding. Two of them are assurance and satisfaction find third one

a. **Universality**
b. Acceptance
c. All-encompassing
d. Self-verification

20. The person who are lack of physical facility stands for

a. Samadhan viheen dukhi daridra
b. Sadhan viihin dukhi daridra
c. **Sadhan Viheen Dukhi Daridra**
d. Sadhan vimukh dukhi daridra

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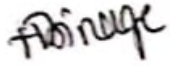	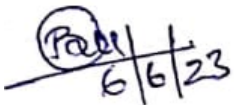	
Prof.H. R. Zinage	**HOD**	**Principal**

Subject Title	**ELECTRICAL MACHINES LABORATORY-2**		
Subject Code	21EEL46	**CIE Marks**	50
No of Practical Hrs / Week	02	**SEE Marks**	50
Total No Practical Hrs	28	**Exam Hours**	03
			CREDITS – 01

FACULTY DETAILS:		
Name: Prof. H R Zinage	**Designation:** Asst. Professor	**Experience: 22** Years
No. of times course taught: 01 Times	**Specialization:** Power System	

1.0 Prerequisite Subjects:

Sl. No	Branch	Semester	Subject
01	Electrical & Electronics Engineering	I	Basic Electrical Engineering
02	Electrical & Electronics Engineering	III	Electric Motors

2.0 Course Objectives

- To perform tests on dc machines to determine their characteristics.
- To control the speed of dc motor
- To conduct test for pre-determination of the performance characteristics of dc machines
- To conduct load test on single phase and three phase induction motor.
- To conduct test on induction motor to determine the performance characteristics.
- To conduct test on synchronous motor to draw the performance curves.

3.0 Course Outcomes

The student, after successful completion of the course, will be able to

CO	Course Outcome	Cognitive Level	POs
C219.1	Test dc machines to determine their characteristics.	L1-L4	PO1, PO2, PO9, PO10,PO12
C219.2	Change the speed of dc motor by selecting suitable method.	L1-L4	PO1, PO2, PO9, PO10,PO12
C219.3	Pre-determine the performance characteristics of dc machines by conducting suitable tests.	L1-L4	PO1, PO2, PO9, PO10,PO12
C219.4	Assess the performance of single phase and three phase induction motor by conducting load test.	L1-L4	PO1, PO2, PO9, PO10,PO12
C219.5	Experiment with induction motor to pre-determine the performance characteristics.	L1-L4	PO1, PO2, PO9, PO10,PO12
C219.6	Test on synchronous motor to draw the performance curves.	L1-L4	PO1, PO2, PO9, PO10,PO12
Total Hours of instruction		**28**	

4.0 Course Content

1. Load test on dc shunt motor to draw speed – torque and horse power – efficiency characteristics.
2. Field Test on dc series machines.
3. Speed control of dc shunt motor by armature and field control.
4. Swinburne's Test on dc motor.
5. Retardation test on dc shunt motor.
6. Regenerative test on dc shunt machines.
7. Load test on three phase induction motor.
8. No load and Blocked rotor test on three phase induction motor to draw (i) equivalent circuit and (ii) Circle diagram. Determination of performance parameters at different load conditions from (i) and (ii).
9. Load test on induction generator.
10. Load test on single phase induction motor to draw output versus torque, current, power and efficiency characteristics.

11. Conduct suitable tests to draw the equivalent circuit of single phase induction motor and determine performance parameters.
12. Conduct an experiment to draw V and Λ curves of synchronous motor at no load and load.

5.0 Relevance to future subjects

SL. No	Semester	Subject	Topics / Relevance
01	V	Electrical Machine Design	Performance characteristics of DC and synchronous Machines
02	VIII	Project work	Performance testing of Machines used in project work.

6.0 Relevance to Real World

SL. No	Real World Mapping
01	Electrical drives for various industrial applications.

7.0 Books Used and Recommended to Students

Text Books
1. Electric Machines', D. P. Kothari,I. J. Nagrath Mc Graw Hill 4th edition, 2011 2.Electrical Machines M.V. Deshpande PHI Learning 2013
Reference Books
1.Principles of Electric Machines and power Electronics P.C.Sen Wiley 2nd Edition, 2013

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

Website and Internet Contents References
1. http://www.electrical4u.com 2. www.nptel.com 3. https://www.youtube.com/watch?v=LAtPHANEfQo 4. www.electrical4u.com/testing-of-dc-machine/ 5. http://www.electrical4u.com/working-principle-of-three-phase-induction-motor/ 6. www.electrical4u.com/speed-control-of-three-phase-induction-motor 7. www.electrical4u.com/single-phase-induction-motor 8. www.electricaleasy.com/.../synchronous-motor

9.0 Magazines/Journals Used and Recommended to Students

Sl. No	Magazines/Journals	website
1	Electric motor magnize	https://www.mtwmag.com/electric-motor-technology-expected-witness-paradigm-shift-2025/
2	Electrical India magazine	https://www.intelligent-power-today.com/
3	Motor magazine	https://www.motor.com/newsletters/20110410/WebFiles/ID1_IonizingAmerica.html

10.0 Examination Note

CIE

Conduction of experiments, Viva Voce, Submission of records **30 Marks**
(Each expt 10 marks , scaled down to 30 marks)
Lab IA **20Marks**
(two tests for 100 marks each. Average scaled down to 20 marks)
Total **50 Marks**

SEE

One question can be set on any of the experiment
Write up **10 Marks**
Conduction, graph and results **30 Marks**
Viva – Voce **10 Marks**
Total **50 Marks**

11.0 Course Delivery Plan

Expt No	Name of the experiment	% of portion
1	Load test on dc shunt motor to draw speed – torque and horse power – efficiency characteristics.	8.33%
2	Speed control of dc shunt motor by armature and field control.	8.33%
3	Swinburne's Test on dc motor.	8.33%
4	Regenerative test on dc shunt machines.	8.33%
5	Load test on three phase induction motor.	8.33%
6	No load and Blocked rotor test on three phase induction motor to draw (i) equivalent circuit and (ii) circle diagram. Determination of performance parameters at different load conditions from (i) and (ii).	8.33%
7	Load test on single phase induction motor to draw output versus torque, current, power and efficiency characteristics.	8.33%
8	Conduct suitable tests to draw the equivalent circuit of single phase induction motor and determine performance parameters.	8.33%
9	Retardation test on dc shunt motor.	8.33%
10	Conduct an experiment to draw V and Λ curves of synchronous motor at no load and load.	8.33%
11	Field Test on dc series motor	8.33%
12	Load test on induction generator.	8.33%

12.0 QUESTION BANK

1. What will happen if a starting resistance is not provided while starting the dc shunt motor?
2. What you do to reverse the direction of dc shunt motor.
3. Does the direction of dc shunt motor get reversed if the armature current and field current both are reversed?
4. What are the limitations of armature control method for speed control of dc shunt motor.
5. Name the advantages of field control for controlling the speed of a dc shunt motor.
6. Why speed of a dc shunt is motor is practically constant?
7. Discuss, what will happen if the dc shunt motor running on no load has its shunt field winding opened accidentally.
8. Will dc shunt motor start on a.c supply?
9. What are aims of performing a load test on dc shunt motor?
10. Why does the speed of dc shunt motor falls slightly when it is loaded?
11. What can you say about the numerical value of efficiency obtained by Swinburn's test?
12. What is the advantage of Swinburn's test?
13. What are various losses that occur in dc generator?
14. Why Hopkinson's test is also known as regenerative test?
15. How Hopkinson's test is better than Swinburn's test.
16. Compare the power drawn from supply in case of Hopkinson's test and Swinburn's test.
17. What will happen if the shunt field winding of loaded dc shunt motor accidentally breaks?
18. What you mean by V and inverted V curve of synchronous motor.
19. Explain the working principle of three phase Induction Machine.
20. Mention the effects of slip on to the rotor parameters.
21. Draw an equivalent circuit of 3-phase IM, how is this circuit different compare to equivalent circuit of transformer.
22. What is the condition for maximum torque in case of 3-phase IM ?.

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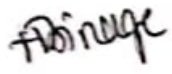		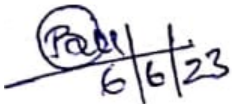	
Prof. H.R.Zinage	**Prof. A.U. Neshti**	**HOD**	**Principal**

Subject Title	**Simulation of Op-Amp Circuits**		
Subject Code	21EEL484	**CIE Marks**	50
Number of Lecture Hrs / Week (L:T:P)	0:0:2:0	**SEE Marks**	50
Total Number of Lecture Hrs	40	**Exam Hours**	02
CREDITS – 01			

FACULTY DETAILS:		
Name: Shri. Keshav B Negalur	**Designation:** Asst. Professor	**Experience:**09
No. of times course taught:01	**Specialization:** Industrial Electronics	

1.0 Prerequisite Subjects:

Sl. No	Branch	Semester	Subject
01	First year Engineering	I/II	Basic Electrical Engg.
02	First year Engineering	I/II	Basic Electronics.

2.0 Course Objectives

1. To conduct different experiments using OP-Amps.
2. To conduct experiments using Linear IC's.

3.0 Course Outcomes

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

	Course Outcome	Cognitive Level	POs
C217.1	To conduct experiment to determine the characteristic parameters of OP-Amp	L_1,L_4	1,2,3,6,8,9,10,12
C217.2	To design test the OP-Amp as Amplifier, adder, subtractor, differentiator and integrator.	L_1-L_4	1,2,3,6,8,9,10,12
C217.3	To design test the OP-Amp as oscillators and filters.	L_1-L_4	1,2,3,6,8,9,10,12
C217.4	Design and study of Linear IC's as multivibrator power supplies.	L_1-L_4	1,2,3,6,8,9,10,12
C217.5	Realization of R-2R ladder DAC and Two bit Flash ADC.	L_1-L_4	1,2,3,6,8,9,10,12
Total Hours of instruction		**40**	

4.0 Course Content

Sl. NO	Experiments
1	Design and Analysis of (i) Voltage Follower (ii) Inverting & Non – Inverting Amplifier
2	Design and Analysis of full wave rectifier and determine its performance parameters
3	Design and Analysis of frequency response of an Operational Amplifier under inverting and non - inverting configuration for a given gain.
4	Design and Analysis of Operational Amplifier based RC Phase Shift Oscillator.

5	Design and Analysis of an Operational Amplifier based Wein Bridge Oscillator.
6	Design and Analysis of Operational Amplifier based Schmitt Trigger.
7	Design and Analysis of Operational Amplifier based (i) Voltage Comparator circuit and (ii) Zero Crossing Detector.
8	Design and Analysis of Op-Amp based (i) Adder (ii) Subtractor (iii) Integrator and (iv) Differentiator
9	Design and Analysis of Frequency Response Characteristics Op-Amp based First Order Butterworth (i) Low Pass, (ii) High Pass Filters.
10	Design and Analysis of Frequency Response Characteristics Op-Amp based First Order Butterworth (i) Band Pass, (ii) Band Rejection Filters.
11	Design and Analysis of Op-Amp based Function Generator to generate Sine, Square and Triangular Signals of desired frequency.
12	Design and Analysis of Op-Amp based R – 2R ladder Digital to Analog Converter.
13	Design and Analysis of Op-Amp based two bit flash Analog to Digital Converter.
14	Design and Analysis of Three Op-Amp Instrumentation Amplifier.

5.0 Relevance to future subjects

Sl No	Semester	Subject	Topics
01	V	Power Electronics	Design of converters
02	VII	Project work	Design of power supplies, amplifiers and oscillators.

6.0 Relevance to Real World

SL.No	Real World Mapping
01	Design of rectifiers, amplifiers, oscillators, voltage regulators, filters for various applications in analog electronics domains.

7.0 Gap Analysis and Mitigation

Sl. No	Delivery Type	Details
01	Lab visit	To gain practical knowledge about analog electronics circuits and Op-amps.
02	Industry /Field visit	To study design and manufacturing process of electronic based gadgets, appliances etc.

8.0 Books Used and Recommended to Students

Text Books: Suggested Learning Resources
1. Electronic Devices and Circuit Theory by Robert L Boylestad Louis Nashelsky, Pearson, 11th Edition, 2015.
2. Electronic Devices and Circuits by David A Bell, Oxford University Press,5th Edition.
3. Op-Amps and Linear Integrated Circuits by Ramakant A Gayakwad, Pearson, 4thEdition.
4. Operational Amplifiers and Linear ICs by David A. Bell, Oxford, 3rd Edition 2011.
Additional Learning Resources
1. Analog Electronic Circuits- a simplified Approach by U.B. Mahadevaswamy Sanguine Technical Publication.

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

Website and Internet Contents References
https://www.electronicsforu.com https://www.electronics-tutorials.ws/opamp/opamp_1.html

10.0 Magazines/Journals Used and Recommended to Students

Sl. No	Magazines/Journals	website
1	AEÜ - International Journal of Electronics and Communications	https://www.scimagojr.com/journalsearch.php?q=17683&tip=sid
2	International Journal of Electronics and Communications	https://www.sciencedirect.com/journal/aeu-international-journal-of-electronics-and-communications

11.0 Examination Note

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

Continuous Internal Evaluation (CIE):
CIE marks for the practical course is 50 Marks.
The split-up of CIE marks for record/ journal and test are in the ratio 60:40

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

The Sum of scaled-down marks scored in the report write-up/journal and average marks of two tests is the total CIE marks scored by the student
Semester End Evaluation (SEE): SEE marks for the practical course is 50 Marks.
SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the University All laboratory experiments are to be included for practical examination.
(Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. OR based on the course requirement evaluation rubrics shall be decided jointly by examiners.
Students can pick one question (experiment) from the questions lot prepared by the internal /external examiners jointly.
Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.

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

12.0 Course Delivery Plan

Expt. No	Name of the Experiments	% of Portion
1	Design and Analysis of (i) Voltage Follower (ii) Inverting & Non – Inverting Amplifier	8.33%
2	Design and Analysis of full wave rectifier and determine its performance parameters	8.33%
3	Design and Analysis of frequency response of an Operational Amplifier under inverting and non - inverting configuration for a given gain.	8.33%
4	Design and Analysis of Operational Amplifier based RC Phase Shift Oscillator.	8.33%
5	Design and Analysis of an Operational Amplifier based Wein Bridge Oscillator.	8.33%
6	Design and Analysis of Operational Amplifier based Schmitt Trigger.	8.33%
7	Design and Analysis of Operational Amplifier based (i) Voltage Comparator circuit and (ii) Zero Crossing Detector.	8.33%
8	Design and Analysis of Op-Amp based (i) Adder (ii) Subtractor (iii) Integrator and (iv) Differentiator	8.33%
9	Design and Analysis of Frequency Response Characteristics Op-Amp based First Order Butterworth (i) Low Pass, (ii) High Pass Filters.	8.33%
10	Design and Analysis of Frequency Response Characteristics Op-Amp based First Order Butterworth (i) Band Pass, (ii) Band Rejection Filters.	8.33%
11	Design and Analysis of Op-Amp based Function Generator to generate Sine, Square and Triangular Signals of desired frequency.	8.33%
12	Design and Analysis of Op-Amp based R – 2R ladder Digital to Analog Converter.	8.33%
13	Design and Analysis of Op-Amp based two bit flash Analog to Digital Converter.	8.33%
14	Design and Analysis of Three Op-Amp Instrumentation Amplifier.	8.33%

14.0 QUESTION BANK

1. Sketch an op-amp inverting amplifier circuit. Also sketch a basic op-amp circuit connected to function as an inverting amplifier. Derive an equation for its voltage gain.
2. An op-amp non-inverting amplifier has resistors of R2= 22KΩ, and R3= 120Ω, Calculate the output voltage produced by a 75mV input.
3. An op-amp inverting amplifier is to have a voltage gain of 150. If R2 is 33KΩ, determine a suitable resistance value of R1.
4. Write equations for input impedance, output impedance and voltage gain for an inverting amplifier.
5. Sketch an op-amp difference amplifier circuit. Explain the operation of the circuit and derive an equation for the output voltage.
6. Two signals which each range from 0.1 V to 1 V are to be summed. Using a 741 op-amp, design a suitable inverting summing circuit.
7. An inverting amplifier with a +/- 12 V supply is to produce maximum possible output voltage and is to have a voltage gain of 33. Using 741 op-amps, design a suitable circuit.
8. Draw an all pass phase lag circuit. Sketch the input and output waveforms and the typical frequency response, and explain the circuit operation.
9. Write the equation for the voltage gain of a first order low pass active filter, and briefly discuss the circuit design procedure.

10. Sketch the circuit of a second order active high-pass filter. Briefly explain its operation.
11. Design a first order active low pass filter circuit with a cutoff frequency of 3 kHz.
12. Design a second order high pass filter circuit to have a cutoff frequency of 7 kHz. Estimate the highest signal that can be passed.Briefly explain the action of a dc voltage regulator. Write the equations for line regulation, load regulation and ripple rejection.
13. Briefly discuss the design procedure for a voltage follower regulator.
14. Sketch a regulator circuit using an LM317 IC voltage regulator. Explain the circuit operation, write the equation for output voltage, and discuss the required supply voltage.
15. With a neat sketch explain the operation of adjustable voltage regulator.

16. Sketch the circuit of a triangular/ rectangular waveform generator. Draw the output waveforms from the circuit showing their phase relationship and explain the circuit operation.
17. Discuss the design procedure for a triangular/ rectangular waveform generator and write the equations for calculating the component values.
18. Sketch the circuit of a phase shift oscillator that uses diodes for output amplitude stabilization. Explain how the amplitude stabilization circuit operates and show how a distortion control may be included.
19. Design a triangular/ rectangular waveform generator to have an output frequency of 1kHz, a triangular output amplitude of +/- 6 , and a square wave output amplitude of approximately +/ - 10 V.
20. Draw an op-amp inverting Schmitt trigger circuit. Sketch typical input output waveforms. Explain the circuit operation and the shape of the waveforms.
21. Discuss the design process for an op-amp inverting Schmitt trigger circuit, and write equations for calculating each component value.

Prepared by	Checked by		
		31/5/22	
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