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 V-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	3rd Semester	Prof. A. U. Neshti	Shri. S. B. Beelur
16	5th Semester	Prof. O. B. Heddurshetti	Shri. V. M. Mutalik
17	7th 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	8	18 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. Yanagimath	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

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

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CALENDAR OF EVENTS FOR THE ACADEMIC YEAR 2022-23 (Odd)

Date	Events
19-09-2022	Commencement of Classes for VII Semester
24-09-2022	NSS Foundation Day
02-10-2022	Gandhi Jayanthi
10-10-2022	Commencement of Classes for V Semester
24-10-2022 to 30-10-2022	Traffic Week
27-10-2022 to 29-10-2022	First Internal Assessment for VII Semester
31-10-2022	Feedback -I on Teaching-Learning for VII Semester
31-10-2022	National Integration Day
31-10-2022	Commencement of Classes for III Semester
01-11-2022	Kannad Rajyothsava
03-11-2022	Display of 1st Internal Assessment Marks and submission of Feedback-I of VII Semester to office
09-11-2022 to 18-11-2022	Environment Awareness Month
22-11-2022	World's Aids Day
26-11-2022	First Assignment Submission of III Semester (PCC + IPCC)
28-11-2022 to 30-11-2022	Second Internal Assessment for VII Semester & First Internal Assessment for III (PCC + IPCC) /V Semester
01-12-2022	Feedback –II on Teaching-Learning for VII Semester & Feedback – I on Teaching-Learning for III/V Semester
06-12-2022	Display of 2nd Internal Assessment Marks and submission of Feedback-II of VII Semester & Display of 1st Internal Assessment Marks and submission of Feedback-I of III/V Semester to office
10-12-2022	Human Rights Day
10-12-2022	Sports Day
23-12-2022 & 24-12-2022	First Lab Internal Assessment for III Semester (PCC+AEC)
26-12-2022 & 27-12-2022	Lab Internal Assessment for VII Semester
29-12-2022 to 31-12-2022	Third Internal Assessment for VII Semester & Second Internal Assessment for III (PCC + IPCC) /V Semester
31-12-2022	Last working day for VII Semester
02-01-2023	Feedback –II on Teaching-Learning for III/V Semester
05-01-2023	Display of Final IA Marks of VII Semester
05-01-2023	Display of 2nd Internal Assessment Marks and submission of Feedback-II of III/V Semester to office
07-01-2023	Second Assignment Submission of III Semester (PCC + IPCC)
12-01-2023	National Youth Day
15-01-2023	NSS Day
20-01-2023 & 21-01-2023	Lab Internal Assessment for V Semester
23-01-2023 to 25-01-2023	Third Internal Assessment for V Semester
26-01-2023	Republic Day
27-01-2023	Last working day for V Semester
30-01-2023 to 01-02-2023	Second Lab Internal Assessment for III Semester (PCC+IPCC+AEC)
31-01-2023	Display of Final IA Marks of V Semester
06-02-2023 to 08-02-2023	Third Internal Assessment for III Semester (PCC)
11-02-2023	Last working day for III Semester
14-02-2023	Display of Final IA Marks of III Semester

September-2022

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October-2022

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30	31					

04- Mahanavami, Ayudhapooja 05- Vijayadashami
24- Naraka Chaturdashi, 26- Balipadyami Deepavalli

Novemner-2022

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27	28	29	30			

01- Kannada Rajyothsava, 11- Kanakadasa Jayanti

December-2022

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January-2023

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29	30	31				

14-Makara Sankranti, 26- Republic Day

February-2023

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26	27	28				

18- Mahashivaratri

19/9/22
Dr. B. V. Madiggond
Dean (Academics)

19/9
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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DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGG.

CALENDAR OF EVENTS FOR THE ACADEMIC YEAR 2022-23 (Odd)

Date	Events
19-09-2022	Commencement of Classes for VII Semester
24-09-2022	NSS Foundation Day
01-10-2022	*Awareness Program on "How to carryout Literature Survey"*
02-10-2022	Gandhi Jayanthi
10-10-2022	Commencement of Classes for V Semester
24-10-2022 to 30-10-2022	Traffic Week
27-10-2022 to 29-10-2022	First Internal Assessment for VII Semester
31-10-2022	Feedback -I on Teaching-Learning for VII Semester
31-10-2022	National Integration Day
31-10-2022	Commencement of Classes for III Semester
01-11-2022	Kannad Rajyothsava
03-11-2022	Display of 1st Internal Assessment Marks and submission of Feedback-I of VII Semester to office
04-11-2022	*Inauguration of EESSA Activities for the AY 2022-23 & Welcome function to 3rd Sem Students*
09-11-2022 to 18-11-2022	Environment Awareness Month
12-11-2022	*Awareness Program on "PPT Preparation, Presentation and E-mail Etiquette"*
18-11-2022	*MOCK Press Event*
22-11-2022	World's Aids Day
26-11-2022	First Assignment Submission of III Semester (PCC + IPCC)
28-11-2022 to 30-11-2022	Second Internal Assessment for VII Semester & First Internal Assessment for III (PCC + IPCC) /V Semester
01-12-2022	Feedback –II on Teaching-Learning for VII Semester & Feedback – I on Teaching-Learning for III/V Semester
02-12-2022	*Seminar/ Guest lecture by Alumni/Resource person from industry*
05-12-2022 to 09-12-2022	*Five days workshop on "Python Programming for Electrical Engineers"*
06-12-2022	Display of 2nd Internal Assessment Marks and submission of Feedback-II of VII Semester & Display of 1st Internal Assessment Marks and submission of Feedback-I of III/V Semester to office
10-12-2022	Human Rights Day
10-12-2022	Sports Day
16-12-2022	*'Pick & Speak' Competition*
23-12-2022 & 24-12-2022	First Lab Internal Assessment for III Semester (PCC+AEC)
26-12-2022 & 27-12-2022	Lab Internal Assessment for VII Semester
29-12-2022 to 31-12-2022	Third Internal Assessment for VII Semester & Second Internal Assessment for III (PCC + IPCC) /V Semester
31-12-2022	Last working day for VII Semester
02-01-2023	Feedback –II on Teaching-Learning for III/V Semester
05-01-2023	Display of Final IA Marks of VII Semester
05-01-2023	Display of 2nd Internal Assessment Marks and submission of Feedback-II of III/V Semester to office
06-01-2023	*Industrial Visit to III & V Sem students*
07-01-2023	Second Assignment Submission of III Semester (PCC + IPCC)
12-01-2023	National Youth Day
15-01-2023	NSS Day
20-01-2023 & 21-01-2023	Lab Internal Assessment for V Semester
23-01-2023 to 25-01-2023	Third Internal Assessment for V Semester
26-01-2023	Republic Day
27-01-2023	Last working day for V Semester
30-01-2023 to 01-02-2023	Second Lab Internal Assessment for III Semester (PCC+IPCC+AEC)
31-01-2023	Display of Final IA Marks of V Semester
06-02-2023 to 08-02-2023	Third Internal Assessment for III Semester (PCC)
11-02-2023	Last working day for III Semester
14-02-2023	Display of Final IA Marks of III Semester

September-2022

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October-2022

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23	24	25	26	27	28	29
30	31					

04- Mahanavami, Ayudhapooja 05- Vijayadashami
24- Naraka Chaturdashi,
26- Balipadyami Deepavalli

Novemner-2022

S	M	T	W	T	F	S
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01- Kannada Rajyothsava, 11- Kanakadasa Jayanti

December-2022

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4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
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January-2023

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8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

14-Makara Sankranti, 26- Republic Day

February-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				

18- Mahashivaratri

Shri. M. P. Yenagimath	Dr. B. V. Madiggond	Dr. S. C. Kamate
EESSA Coordinator	**HOD**	**Principal**

5.1 Scheme of Teaching & Examination

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

V SEMESTER

Sl. No	Course and Course code		Course Title	Teaching Department	Teaching Hours /Week			Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P					
1	PCC	18 EE51	Management and Entrepreneurship	EEE	3	0	--	03	40	60	100	3
2	PCC	18 EE52	Microcontroller	EEE	3	2	--	03	40	60	100	4
3	PCC	18 EE53	Power Electronics	EEE	3	2	--	03	40	60	100	4
4	PCC	18 EE54	Signals and Systems	EEE	3	--	--	03	40	60	100	3
5	PCC	18 EE55	Electrical Machine Design	EEE	3	--	--	03	40	60	100	3
6	PCC	18 EE56	High Voltage Engineering	EEE	3	--	--	03	40	60	100	3
7	PCC	18 EEL57	Microcontroller Laboratory	EEE	--	2	2	03	40	60	100	2
8	PCC	18 EEL58	Power Electronics Laboratory	EEE	--	2	2	03	40	60	100	2
9	HSMC	18CIV59	Environmental Studies	Civil/ Environmental [Paper setting: Civil Engineering Board]	1	--	--	02	40	60	100	1
				TOTAL	**18**	**10**	**4**	**26**	**360**	**540**	**900**	**25**

Note: PCC: Professional Core, HSMC: Humanity and Social Science.

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

Subject Title	MANAGEMENT AND ENTREPRENEURSHIP		
Subject Code	18EE51	CIE Marks	40
Number of Lecture Hrs / Week	03	SEE Marks	60
Total Number of Lecture Hrs	40	Exam Hours	03
			CREDITS – 03

FACULTY DETAILS:		
Name: Prof: Sujata. G. Huddar	**Designation:** Asst. Professor	**Experience:08**Years
No. of times course taught:01	**Specialization:** Power system Engineering	

1.0 Prerequisite Subjects:

Sl. No	Branch	Semester	Subject
--	--	--	--

2.0 Course Objectives

1 To introduce the field of management, task of the manager, importance of planning and types of planning, staff recruitment and selection process.
2 To discuss the ways in which work is allocation, structure of organizations, modes of communication and importance of managerial control in business.
3 To explain need of coordination between the manager and staff, the social responsibility of business and leadership.
4 To explain the role and importance of the entrepreneur in economic development and the concepts of entrepreneurship.
5 To explain various types of entrepreneurs and their functions, the myths of entrepreneurship and the factors required for capacity building for entrepreneurs
6 To discuss the importance of Small Scale Industries and the related terms and problems involved.
7 To discuss methods for generating new business ideas and business opportunities in India and the importance of business plan.
8 To introduce the concepts of project management and discuss capitol building process.
9 To explain project feasibility study and project appraisal and discuss project financing
10 To discuss about different institutions at state and central levels supporting business enterprises.

3.0 Course Outcomes

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

	Course Outcome	RBT Leve	Pos
C301.1	Explain the field of management, task of the manager, planning and steps in decision making.	L2	1,2,6-12
C301.2	Discuss the structure of organization, importance of staffing, leadership styles, modes of communication techniques of coordination and importance of managerial control in business.	L2	1,2,6-12
C301.3	Explain the concepts of entrepreneurship and a businessman's social responsibilities towards different groups.	L2	1,2,6-12
C301.4	Explain the social responsibility of business and leadership and discuss role of SSI's in the development of country and state/central level, institutions/agencies supporting business enterprises.	L2	1,2,6-12
C301.5	Discuss the concepts of project management, capital budgeting, project feasibility studies, need for project report and new control techniques	L2	1,2,6-12
Total Hours of instruction		**40**	

4.0 Course Content

Module-1

Management: Definition, Importance – Nature and Characteristics of Management, Management Functions, Roles of Manager, Levels of Management, Managerial Skills, Management &Administration, Management as a Science, Art &Profession**.**

Planning: Nature, Importance and Purpose Of Planning, Types of Plans, Steps in Planning, Limitations of Planning, Decision Making – Meaning, Types of Decisions- Steps in Decision Making.

Module-2

Organizing and Staffing: Meaning, Nature and Characteristics of Organization – Process of Organization, Principles of Organization, Departmentalization, Committees – meaning, Types of Committees, Centralization Versus Decentralization of Authority and Responsibility, Span of Control (Definition only), Nature and Importance of Staffing, Process of Selection and Recruitment.

Directing and Controlling: Meaning and Nature of Directing-Leadership Styles, Motivation Theories Communication – Meaning and Importance, Coordination- Meaning and Importance, Techniques of Coordination. Controlling – Meaning, Steps in Controlling

Module-3

Social Responsibilities of Business: Meaning of Social Responsibility, Social Responsibilities of Business towards Different Groups, Social Audit, Business Ethics and Corporate Governance.

Entrepreneurship:

Definition of Entrepreneur, Importance of Entrepreneurship, concepts of Entrepreneurship, Characteristics of successful Entrepreneur, Classification of Entrepreneurs, Intrapreneur – An Emerging Class, Comparison between Entrepreneur and Intrapreneur, Myths of Entrepreneurship, Entrepreneurial Development models, Entrepreneurial development cycle, Problems faced by Entrepreneurs and capacity building for Entrepreneurship.

Module-4

Modern Small Business Enterprises: Role of Small Scale Industries, Concepts and definitions of SSI Enterprises, Government policy and development of the Small Scale sector in India, Growth and Performance of Small Scale Industries in India, Sickness in SSI sector, Problems for Small Scale Industries, Impact of Globalization on SSI, Impact of WTO/GATT on SSIs, Ancillary Industry and Tiny Industry(Definition only).

Institutional Support for Business Enterprises: Introduction, Policies & Schemes of Central–Level Institutions, State-Level Institutions.

Module-5

Project Management: Meaning of Project, Project Objectives & Characteristics, Project Identification Meaning & Importance; Project Life Cycle, Project Scheduling, Capital Budgeting, Generating an Investment

Project Proposal, Project Report-Need and Significance of Report, Contents, Formulation, Project Analysis Market, Technical, Financial, Economic, Ecological, Project Evaluation and Selection, Project Financing, Project Implementation Phase, Human & Administrative aspects of Project Management, Prerequisites for Successful Project Implementation. New Control Techniques- PERT and CPM, Steps involved in developing the network, Uses and Limitations of PERT and CPM.

5.0 Relevance to future subjects

Sl No	Semester	Subject	Topics
01	VIII	Project work	Project building

6.0 Relevance to Real World

Sl No	Real World Mapping
01	Planning in an industry
02	Various organizational structures
03	Development of a project cases

7.0 Gap Analysis and Mitigation

Sl No	Delivery Type	Details
01	Activity	Group discussion on a trending topic to build communication skills.

8.0 Books Used and Recommended to Students

Text Books				
1.	Principles of Management	P.C. Tripathi, P.N.Reddy	McGraw Hill,	6th Edition, 2017
2.	Entrepreneurship Development and Small Business Enterprises	Poornima M. Charanthimath	Pearson	2nd Edition,2014
Reference Books				
1. Dynamics of Entrepreneurial Development and Management Vasant Desai Himalaya Publishing House 2007 2. Essentials of Management: An International, Innovation and Leadership perspective Harold Koontz, Heinz Weihrich McGraw Hill 10th Edition 2016				
Additional Study material & e-Books				
1. Iyer, P.P., Engineering Project Management with Case Studies, Vikas Publishing, New Delhi, 2009. 2. Zikmund, W.G., Business Research Methods, 5th Edition, New York, The Dryden Press, Harcount Publishers, 1997. **3.** M Govindarajan and S. Natarajan, Principles of Management, Eastern Economy Edition, 2005.				

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

Website and Internet Contents References
1) https://ocw.mit.edu/courses/sloan-school-of-management/15-390-new-enterprises-spring-2013/video-tutorials/lecture-1/
2) https://ocw.mit.edu/courses/sloan-school-of-management/15-390-new-enterprises-spring-2013/video-tutorials/lecture-2/
3) https://ocw.mit.edu/courses/sloan-school-of-management/15-390-new-enterprises-spring-2013/video-tutorials/lecture-4/
4) https://ocw.mit.edu/courses/sloan-school-of-management/15-390-new-enterprises-spring-2013/video-tutorials/lecture-5/

10.0 Magazines/Journals Used and Recommended to Students

Sl.No	Magazines/Journals	website
1	Academy of management journal	http://libguides.usc.edu.au
2	International journal of economics and financial review	http://www.sciencedirect.com/science/journal/00207683
3	International journal of human resource management.	http://libguides.usc.edu.au

11.0 Examination Note

Scheme of Evaluation for CIE (40 Marks)

Internal Assessment test will be done in the same pattern as that of the main examination.

Internal Assessment: 50 Marks, scaled down to 30marks

Assignment: 10 Marks

Scheme Of Examination: 100 Marks, scaled down to 60 in VTU result sheet.

The question paper will have ten questions.

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

12.0 Course Delivery Plan

Module	Lecture No.	Content of Lecturer	% of Portion
1	1.	**Management:** Definition, Importance – Nature and Characteristics of Management,	20
	2.	Management Functions, Roles of Manager,	
	3.	Levels of Management, Managerial Skills,	
	4.	Management & Administration, Management as a Science, Art & Profession	
	5.	**Planning:** Nature, Importance and Purpose Of Planning	
	6.	Types of Plans, Steps in Planning	
	7.	Limitations of Planning, Decision Making – Meaning	
	8.	Types of Decisions- Steps in Decision Making.	
2	9.	**Organizing:** Meaning, Nature and Characteristics of Organization – Process of Organization	20
	10.	Principles of Organization, Departmentalization	
	11.	Committees –meaning, Types of Committees, Centralization Vs Decentralization of Authority and Responsibility, Span of Control (Definition only)	
	12.	**Staffing:** Nature and Importance of Staffing, Process of Selection and Recruitment.	
	13.	**Directing:** Meaning and Nature of Directing-Leadership Styles	
	14.	Motivation Theories Communication – Meaning and Importance	
	15.	Coordination- Meaning and Importance, Techniques of Coordination	
	16.	**Controlling** – Meaning, Steps in Controlling.	
3	17.	**Social Responsibilities of Business:** Meaning of Social Responsibility	20
	18.	Social Responsibilities of Business towards Different Groups	
	19.	Social Audit, Business Ethics and Corporate Governance.	
	20.	**Entrepreneurship**: Definition of Entrepreneur, Importance of Entrepreneurship	
	21.	concepts of Entrepreneurship, Characteristics of successful Entrepreneur	
	22.	Classification of Entrepreneurs, Intrapreneur – An Emerging Class, Comparison between Entrepreneur and Intrapreneur	
	23.	Myths of Entrepreneurship, Entrepreneurial Development models, Entrepreneurial development cycle	
	24.	Problems faced by Entrepreneurs and capacity building for Entrepreneurship.	
4	25.	**Modern Small Business Enterprises:** Role of Small Scale Industries	20
	26.	Concepts and definitions of SSI Enterprises, Government policy and development of the Small Scale sector in India	
	27.	Growth and Performance of Small Scale Industries in India	
	28.	Sickness in SSI sector, Problems for Small Scale Industries	
	29.	Impact of Globalization on SSI, Impact of WTO/GATT on SSIs	
	30.	Ancillary Industry and Tiny Industry (Definition only).	
	31.	**Institutional Support for Business Enterprises:** Introduction, Policies & Schemes of Central–Level Institutions	
	32.	State-Level Institutions.	
5	33.	**Project Management:** Meaning of Project, Project Objectives & Characteristics	20
	34.	Project Identification- Meaning & Importance;	
	35.	Project Life Cycle, Project Scheduling, Capital Budgeting, Generating an Investment Project Proposal	
	36.	Project Report-Need and Significance of Report, Contents, Formulation	
	37.	Project Analysis-Market, Technical, Financial, Economic, Ecological	
	38.	Project Evaluation and Selection, Project Financing, Project Implementation Phase, Human & Administrative aspects of Project Management, Prerequisites for Successful Project Implementation.	
	39.	New Control Techniques- PERT and CPM	
	40.	Steps involved in developing the network, Uses and Limitations of PERT and CPM	

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 management& Planning.	Students study the Topic and write the Answers. Get practice to solve university questions.	module 1 of the syllabus	2	Individual Activity. Written answers are expected.	Book 1, of text book
2	Assignment 2: University Questions on organizing, staffing, directing & controlling.	Students study the Topic and write the Answers. Get practice to solve university questions.	module 2 of the syllabus	4	Individual Activity. Written answers are expected.	Book 1, of text book
3	Assignment 3: University Questions on Social responsibility & entrepreneurship	Students study the Topics and write the Answers. Get practice to solve university questions.	module 3 of the syllabus	6	Individual Activity. Written answers are expected.	Book 1, of text book
4	Assignment 4: University Questions on SSI's and institutional support	Students study the Topics and write the Answers. Get practice to solve university questions.	module4 of the syllabus	8	Individual Activity. Written answers are expected.	Book 2 of text book & reference book 2
5	Assignment 5: University Questions on Project management	Students study the Topics and write the Answers. Get practice to solve university questions.	module5 of the syllabus	10	Individual Activity. Written answers are expected.	Book 1, 2 of text book

14.0 QUESTION BANK

MODULE 1

1. Explain management –A science, art or profession? June 2010
2. Bring out the differences between management and administration. Jan 2010, Dec 2011
3. Define management and describe the functions of the management. June 2015 June 2010, Dec 2011
4. What are the roles of manager? Explain. June 2015
5. Explain various functions of management.
6. Explain the different levels of management. Dec 2012
7. Explain various roles of management.
8. Explain modern management approaches. Jan 2010, June 2010
9. Explain scientific management. Dec 2012
10. Is management is science or an art? Explain.
11. Explain various functional areas of management. Dec 2012
12. What is scientific management? Explain Taylor's scientific principles of management.
13. Explain contributions of FW Taylor's to the development of management thought. Dec 2011
14. Explain different milestones in development of management thought.
15. What are contributions of Henry Fayol? Explain.
16. Explain the principles of management.

17. Explain early management approaches. June 2015
18. Explain behavior approach to management.
19. Explain quantitative approach to management.
20. Explain the levels & Roles of Management.
21. What is contingency approach? Explain.
22. Define the term planning and explain its importance.
23. Explain the importance of planning. Mention its limitations. Dec 2011, Dec 2015
24. What are the major drawbacks in planning? Explain. Jan 2010
25. Explain the significance of planning and its influence on other managerial functions. July 2013
26. Explain principles of planning.
27. What are the planning premises? Explain the classification of planning premises with examples. Dec 2011/15
28. What are the key features of planning?
29. Explain steps involved in planning. Jan 2010, June 2010
30. Classify plans on the basis of hierarchy level at which plans are made. Jan 2014
31. Differentiate between strategic and operational plans. Dec 2012, Dec 2015
32. What are single use and standing plans? Explain with examples. Dec 2012
33. What are objectives? Explain characteristic of objectives.
34. Explain importance of objectives.
35. Define the objectives. Discuss the characteristics of business objectives. Dec 2011
36. Briefly explain the types of planning. Jan 2010, June 2010

MODULE 2

1. Define the term organization. Explain the purpose of organization. Dec 2011
2. Explain different types of organizations.
3. Explain the process of selection and recruitment. Dec 2015
4. Difference between formal and informal organization.
5. What is organizing? Explain the steps involved in organizing.
6. Explain the nature and purpose of an organization.
7. Explain the principles of organization. Dec 2012, Dec 2015, Jan 2010
8. What is an organization chart? What is line organization? Explain.
9. What is functional organization? Explain.
10. Differentiate between line and functional organization.
11. What is line and staff organization? Explain.
12. What are committees? Explain principles of committees. June 2010
13. What is committee organization?
14. What is directing? Explain the importance of directing.
15. Explain the behavioral approach of leadership style June 2015
16. Define the term leadership. Explain the qualities of a good leader.
17. Differentiate between managers and leaders.
18. Explain the nature and importance of staffing.
19. What are the various elements of staffing? Explain
20. Explain the techniques of selection.
21. Differentiate between recruitment and selection.
22. What is recruitment? Explain various sources of recruitment.
23. Explain the essentials of sound control system. June 2015
24. State and explain steps in controlling. Dec 2011
25. What is controlling? Explain its importance.
26. What are the different types of steps involved in controlling process? Dec 2012
27. Explain how controlling is related to planning.
28. Explain principles of controlling.
29. Discuss the process of controlling.
30. Briefly explain comparison of Maslow's and Herzberg theories of human motivation. Dec 2012, Jan 2010
31. What do you mean by charismatic leadership? July 2012
32. Differentiate between transactional and transformational leadership.
33. Differentiate between autocratic and democratic styles of leadership.
34. What are the various techniques of coordination? Jan 2010
35. List various theories of leadership.
36. Are leaders made born? Justify. Jan 2010
37. Give principles of directing. Differentiate between autocratic, participative and free-rein styles of leadership. June 2010

38. What is trait theory of leadership? Explain.
39. What is managerial grid? Explain.
40. What is contingency theory of leadership? Explain Fielder's model.
41. Define the term motivation and explain its importance.
42. What is two factor theory? Explain.
43. Discuss McGregor's theory X and theory Y. June 2010
44. Compare different theories of motivation.
45. What is communication? Explain its importance. Dec 2011
46. Explain different types of communication.
47. What are barriers to communication? Explain.
48. What is coordination? Explain the need of coordination.

MODULE 3

1. Define entrepreneurship. Explain the functions of entrepreneur. Jan 2010
2. Write and explain types of entrepreneur. July 2015
3. Who is an entrepreneur and how is he different from a businessman?
4. Differentiate entrepreneur and entrepreneurship. July 2014
5. Explain stages in entrepreneurial process. Dec 2011, Dec 2015
6. Tabulate the changing definition of entrepreneur and entrepreneurship.
7. Discuss the characteristics of entrepreneurs. Dec 2011
8. Discuss in detail how entrepreneurs view risk.
9. Describe the entrepreneurial process.
10. Describe role of entrepreneurs in economic development.
11. Discuss the evolution and growth of industrial entrepreneurship in India. Dec 2011
12. Describe the various problems faced by entrepreneurs in promotion of their units.
13. Discuss the scope of entrepreneurship in India.
14. Who are intrapreneur? Explain the difference between entrepreneurs and intrapreneur. Dec 2012
15. Explain evolution of entrepreneurship.
16. Explain the difference between entrepreneurs, intrapreneurs and managers. June 2010
17. Explain the types of entrepreneur.
18. What are the barriers of entrepreneurship? Jan 2010, June 2010, Dec 2012.
19. Define Micro, small and medium enterprises.

MODULE 4

1. What are the steps evolved in starting SSI? Explain one of them.
2. What are the objectives of SSI? Explain.
3. Briefly write about government support to small scale enterprises, during five year plans.
4. Write a note on SIDBI and NSIC.
5. What is TECSOK? Explain the services offered by it.
6. What are objectives and functions of KIADB? June 2012
7. Write a note on SIDBI and NSIC. Jan 2010
8. Explain the objectives and functions of TECSOK and KIADB. Dec 2011
9. Explain the role of KIADB and services offered by it. Explain various functional units of KIADB.
10. Explain assistance provided by KSIMC.
11. Explain the various assistance provided by TECSOK and KSSIDC. Dec 2012
12. Write a note on DIC single window agency.
13. Explain various types of assistances provided by KSFC.
14. Write a note a on Prime Minister's Rozgar Yojana.
15. Explain services offered by MSME.
16. What is SIDBI? Explain the services offered by it and various types of assistances provides to Small enterprise. Dec 2011
17. Write a note on TECSOK, KIADB, KSSIDC, KSIMC, KSFC. Jan 2010, June 2010, June 2015
18. Explain SIDO with its various activities. Jan 2010
19. Write a note on ICICI

MODULE 5

1. Define the term project. What are the features of a project?
2. Explain the project identification and project selection. July 2015
3. Explain the control variables of a project.
4. What is project management? What are the activities of project management?
5. Explain the need and significance of project report. Jan 2010, Dec 2011
6. What is a project report? Why is it needed?
7. Explain the factors which are to be considered for preparation of a good project report.
8. What is project identification? Explain the sources of information for project identification.
9. What is project selection? Explain factors influencing it.
10. Explain the planning commission guidelines for preparing a project report. Jan 2010, Dec 2011, July 2015
11. List the various components of a project report. What is project appraisal?
12. What do you mean by project feasibility study? Explain. July 2013
13. Explain market feasibility study.
14. What is financial feasibility study? Explain.
15. Explain the phase of project identification with sources. Jan 2010
16. Explain technical feasibility analysis.
17. What is economic feasibility analysis?
18. Differentiate between PERT and CPM
19. Explain network analysis. What are the various techniques used for network analysis.
20. Explain PERT. What re its advantages and disadvantages.
21. Explain CPM. What re its advantages and disadvantages.

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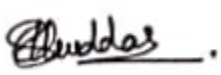	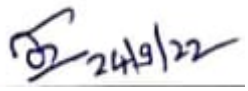		
Prof. S. G. Huddar	**Prof. S. D. Hirekodi**	**HOD**	**Principal**

Subject Title	**MICROCONTROLLER**		
Subject Code	18EE52	**CIE Marks**	40
Number of Lecture Hrs / Week	03:02:0	**SEE Marks**	60
Credits	04	**Exam Hours**	03

FACULTY DETAILS:		
Name: Prof. Mahesh Yenagimath	**Designation:** Asst. Professor	**Experience:** 16.5 years
No. of times course taught: 03		**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

- To explain the internal organization and working of Computers, microcontrollers and embedded processors.
- Compare and contrast the various members of the 8051 family.
- To explain the registers of the 8051 microcontroller, manipulation of data using registers and MOV instructions.
- To explain in detail the execution of 8051 Assembly language instructions and data types.
- To explain loop, conditional and unconditional jump and call, handling and manipulation of I/O instructions.
- To explain different addressing modes of 8051, arithmetic, logic instructions, and programs.
- To explain develop 8051C programs for time delay, I/O operations, I/O bit manipulation , logic, arithmetic operations and data conversion.

3.0 Course Outcomes

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

	Course Outcome	RBT Level	Pos
C302.1	Discuss the history, features, internal architecture and addressing modes of 8051.	L_1,L_2	PO1, PO2, PO8, PO10, PO12
C302.2	Write assembly level program using arithmetic, logic, jump and call instructions.	L_1,L_2,L_3	PO1, PO2, PO3, PO8, PO10, PO12
C302.3	Develop 8051C programs for time delay, I/O, logic, data conversion/serialization and timer operation.	L_1,L_2,L_3,L_4	PO1, PO2, PO3, PO8, PO10, PO12
C302.4	Develop 8051 serial port and interrupt programming in assembly and C.	L_1,L_2,L_3,L_4	PO1, PO2, PO3, PO8, PO10, PO12
C302.5	Interface 8051 with real-world devices such as LCD's, keyboards, ADC, DAC chips, sensors, motor control devices and with 8255.	L_1,L_2,L_3,L_4	PO1, PO2, PO3, PO8, PO10, PO12
Total Hours of instruction		**50**	

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.

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
1. The 8051 Microcontroller and Embedded Systems Using Assembly and C , Muhammad Ali Mazadi, Pearson , 2nd Edition, 2008.
Reference Books
1. The 8051 Microcontroller, Kenneth Ayala, Cengage Learning, 3rd Edition, 2005. 2. The 8051 Microcontroller and Embedded Systems, Manish K Patel, McGraw Hill,2014. 3. Microcontrollers: Architecture, Programming, Interfacing and System Design, RajKamal, Pearson, Ist Edition 2012.
Additional Study material & e-Books
1. Architecture and programming of 8051 microcontrollers by Milan verle- mikroelektronika-2010.

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

Scheme of Evaluation for CIE (40 Marks)

- **Internal Assessment: 30 Marks**

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

- **Assignment: 10 Marks**

SCHEME OF EXAMINATION: 100 Marks, scaled down to 60 in VTU result sheet.

The question paper will have ten questions.

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

12.0 Course Delivery Plan

Module 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	
2	11	Introduction to 8051 assembly programming	20
	12	Assembling and running an 8051 program	
	13	Data types and Assembler directives	
	14	Arithmetic instructions	
	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	Students able to interface 8051 with real-world	Module 5	10	Individual Activity.	Text book no.1

	on Interfacing, ADC, DAC and sensor interfacing, Motor control: Relay, PWM, DC and stepper motor, 8051 interfacing with 8255.	devices such as LCDs and keyboards, ADC, DAC chips and sensors etc.				

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.
i) SWAP ii) MOVX iii) XCHD iv) DAA. Differentiate between LJMP, AJMP and SJMP instructions

2) Differentiate between JMP and call instruction. Explain with suitable examples the different ranges associated with call instructions.

3) Differentiate between LJMP, AJMP and SJMP instructions.

4) Explain the following instructions of 8051 with examples.
i) XCHD A,@Ri ii)RLA iii) MOVC A, @A+DPTR iv) CJNE A,iram addr, rel addr

5) Describe data type and assembler directives of 8051.

6) Explain different types of conditional and unconditional jump instructions with examples.

7) Why do the PUSH and POP instructions in a subroutine need to be equal in number?

8) 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

9) 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.
```

10) 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.

15.0 University Result

Examination	S	A	B	C	D	E	F	% Passing
2021-22	-	-	5	7	6	1	-	100
2020-21	-	-	1	9	10	-	9	69

Prepared by	Checked by		
22/9/2022	22/9/2022	9/22	
Prof. M. P. Yenagimath	Prof. M. P. Yenagimath	HOD	Principal

Subject Title	**POWER ELECTRONICS**		
Subject Code	18EE53	**CIE Marks**	40
Number of Lecture Hrs /Week(L:T:P)	03+02	**SEE Marks**	60
Total Number of Lecture Hrs	40	**Exam Hours**	03

FACULTY DETAILS:		
Name: Dr. Basavaraj V. Madiggond	**Designation:** Professor & HoD	**Experience:**29
No. of times course taught: 11	**Specialization:** Power Electronics	

1.0 Prerequisite Subjects:

Sl. No	Branch	Semester	Subject
01	Electrical and Electronics Engineering	I/II	Basic Electrical Engineering
02	Electrical and Electronics Engineering	III	Electric Circuit Analysis
03	Electrical and Electronics Engineering	III	Analog Electronic Circuits

2.0 Course Objectives

- To give an overview of applications of power electronics, different types of power semiconductor devices, their switching characteristics.
- To explain power diode characteristics, types, operation and the effects of power diodes on RL circuits.
- To explain the techniques for design and analysis of single phase diode rectifier circuits.
- To explain different power transistors, steady state and switching characteristics and limitations.
- To explain different types of thyristors, gate characteristics and gate control requirements.
- To explain the design, analysis techniques, performance parameters and characteristics of controlled rectifiers, DC- DC, DC -AC converters and Voltage controllers.

3.0 Course Outcomes

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

	Course Outcome	RBT Level	POs
CO 303.1	Explain application areas of power electronics, types of power electronic circuits and switches, their characteristics and specifications.	L1, L2	1,2,3,4,6,7,8 9,10 &12
CO 303.2	Explain different types of power diodes, its effects on RL circuits and operation and analysis of single phase diode rectifier circuits.	L1, L2, L3, L4	1,2,3,4,6,7,8 9,10 &12
CO 303.3	Explain steady state, switching characteristics and gate /base drive requirements of different power transistors and their comparison.	L1, L2, L3, L4	1,2,3,4,6,7,8 9,10 &12
CO 303.4	Discuss different types of thyristors, their operation, characteristics and firing circuits.	L1, L2, L3, L4	1,2,3,4,6,7,8 9,10 &12
CO 303.5	Discuss the principle of operation and analysis of controlled rectifiers, AC voltage controllers, DC – DC and DC –AC converters.	L1, L2, L3, L4	1,2,3,4,6,7,8 9,10 &12
Total Hours of instruction		**40**	

4.0 Course Content

Module-1

Introduction: Applications of Power Electronics, Types of Power Electronic Circuits, Peripheral Effects, Characteristics and Specifications of Switches.

Power Diodes: Introduction, Diode Characteristics, Reverse Recovery Characteristics, Power Diode Types, Silicon Carbide Diodes, Silicon Carbide Schottky Diodes, Freewheeling diodes, Freewheeling diodes with RL load.

Diode Rectifiers: Introduction, Diode Circuits with DC Source connected to R and RL load, Single-Phase Full-Wave Rectifiers with R load, Single-Phase Full-Wave Rectifier with RL Load.

Module-2

Power Transistors: Introduction, Power MOSFETs – Steady State Characteristics, Switching Characteristics, **Bipolar Junction Transistors** – Steady State Characteristics, Switching Characteristics, Switching Limits, **IGBTs**, MOSFET Gate Drive, BJT Base Drive, Isolation of Gate and Base Drives, Pulse transformers and Opto-couplers.

Module-3

Thyristors: Introduction, Thyristor Characteristics, Two-Transistor Model of Thyristor, Thyristor Turn- On, Thyristor Turn-Off, A brief study on Thyristor Types, Series Operation of Thyristors, Parallel Operation of Thyristors, *di/dt*Protection, *dv/dt*Protection, DIACs, Thyristor Firing Circuits, Unijunction Transistor.

Module-4

Controlled Rectifiers: Introduction, Single phase half wave circuit with RL Load, Single phase half wave circuit with RL Load and Freewheeling Diode, Single phase half wave circuit with RLE Load, Single-Phase Full Converters with RLE Load, Single-Phase Dual Converters and Principle of operation of Three- Phase duel Converters.

AC Voltage Controllers: Introduction, Principle of phase control & Integral cycle control, Single-Phase Full-Wave Controllers with Resistive Loads, Single- Phase Full-Wave Controllers with Inductive Loads, Three-Phase Full-Wave Controllers.

Module-5

DC-DC Converters: Introduction, principle of step down and step up chopper with RL load, performance parameters, DC-DC converter classification.

DC-AC Converters: Introduction, principle of operation single phase bridge inverters, three phase bridge inverters, voltage control of single phase inverters, Harmonic reductions, Current source inverters.

5.0 Relevance to future subjects

Sl No	Semester	Subject	Topics
01	VII	Industrial Drives and Applications	Motor drives and their control
02	VIII	FACTS and HVDC Transmission	Control and analysis of HVDC converters

6.0 Relevance to Real World

SL. No	Real World Mapping
01	UPS and SMPS
02	Inverters used for domestic and commercial purpose
03	Rectifier and inverter stations used in HVDC transmission system

7.0 Gap Analysis and Mitigation

Sl. No	Delivery Type	Details
01	Practical Assignment	Practical assignments may be given to the students based on real time problems to design converters as per the requirement.
02	Industrial Exposure	Industrial visits helps students get on hand and present developments in the field of Power Electronics.

8.0 Books Used and Recommended to Students

Text Books
1.Power Electronics: Circuits Devices and Applications, Mohammad H Rashid,4th Edition, 2014 .
Reference Books
1. Power Electronics: Converters, Applications and Design, Ned Mohan at el, 3rd Edition, 2014. 2. Power Electronics, Daniel W Hart, 1st Edition, 2011. 3. Elements of Power Electronics, Philip T Krein, Indian Edition, 2008. 4. Power Electronics by P.S. Bimbhra Khanna Publishers, 5th Edition, 2012
Additional Study material & e-Books
1. Power Electronics, J. S. Chitode

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

Website and Internet Contents References
1) www.rejinpaul.com/.../vtu-**eee-notes** 2) https://www.vssut.ac.in/lecture_notes/lecture1424354515.pdf 3) www.vtuupdates.com 4) www.nptelvideos.in/2012/11/power-electronics.html

10.0 Magazines/Journals Used and Recommended to Students

Sl. No	Magazines/Journals	website
1	International Journal of Power Electronics and Drives Systems	***iaesjournal.com/online/index.php/IJPEDS***
2	Journal of Power Electronics	www.jpe.or.kr/
3	IEEE Transactions on Power Electronics	***ieeexplore.ieee.org/***

11.0 Examination Note

Total CIE Marks : 40 Marks
Assignment marks: 10 Marks.
Question paper pattern IA exam:
Answer two full questions Q1 or Q2 and Q3 or Q4 (25marks each). Total 50 Marks. (Reduced to 30Marks)
Question paper pattern Main exam:
The question paper will have ten questions. Each full question is for 20 marks. There will be 2 full questions (with a maximum of four sub questions in one full question) from each module. Each full question with sub questions will cover the contents under a module. Students will have to answer 5 full questions, selecting one full question from each module.

12.0 Course Delivery Plan

Module No.	Lecture No.	Content of Lecture	% of Portion
I	1	**Introduction:** Applications of Power Electronics	20
	2.	Types of Power Electronic Circuits, Peripheral Effects	
	3.	Characteristics and Specifications of Switches	
	4.	**Power Diodes:** Introduction, Diode Characteristics	
	5.	Reverse Recovery Characteristics, Power Diode Types, Silicon Carbide Diodes, Silicon Carbide Schottky Diodes	
	6.	Freewheeling diodes ,Freewheeling diodes with RL load	

	7.	**Diode Rectifiers:** Introduction, Diode Circuits with DC Source connected to R and RL load	
	8.	Single-Phase Full-Wave Rectifiers with R load , Single-Phase Full-Wave Rectifier with RL Load	
II	9.	**Power Transistors:** Introduction, Power MOSFETs – Steady State Characteristics	**20**
	10.	Switching Characteristics	
	11.	**Bipolar Junction Transistors** – Steady State Characteristics	
	12.	Switching Characteristics, Switching Limits	
	13.	IGBTs, MOSFET Gate Drive	
	14.	BJT Base Drive	
	15.	Isolation of Gate and Base Drives	
	16.	Pulse transformers and Opto-couplers	
III	17.	**Thyristors:** Introduction, Thyristor Characteristics	**20**
	18.	Two-Transistor Model of Thyristor	
	19.	Thyristor Turn-On, Thyristor Turn-Off	
	20.	A brief study on Thyristor Types	
	21.	Series Operation of Thyristors, Parallel Operation of Thyristors	
	22.	di/dtProtection, dv/dtProtection	
	23.	DIACs, Thyristor Firing Circuits	
	24.	Unijunction Transistor	
IV	25.	**Controlled Rectifiers:** Introduction, Single phase half wave circuit with RL Load	**20**
	26.	Single phase half wave circuit with RL Load and Freewheeling Diode, Single phase half wave circuit with RLE Load	
	27.	Single-Phase Full Converters with RLE Load, Single-Phase Dual Converters	
	28.	Principle of operation of Three- Phase duel Converters	
	29.	**AC Voltage Controllers:** Introduction, Principle of phase control & Integral cycle control	
	30.	Single-Phase Full-Wave Controllers with Resistive Loads	
	31.	Single- Phase Full-Wave Controllers with Inductive Loads	
	32.	Three-Phase Full-Wave Controllers	
V	33.	**DC-DC Converters:** Introduction	**20**
	34.	Principle of step down and step up chopper with RL load	
	35.	Performance parameters	
	36.	DC-DC converter classification	
	37.	**DC-AC Converters:** Introduction, principle of operation single phasebridge inverters	
	38.	Three phase bridge inverters	
	39.	Voltage control of single phase inverters	
	40.	Harmonic reductions, Current source inverters	

13.0 Assignments

Sl. No.	Title	Outcome expected	Alliedstudy	WeekNo.	Individual / Group activity	Reference: book/website /Paper
1	Assignment 1: University Questions on introduction and types of power electronics.	Students will be able to explain the application areas of power electronics, types of power electronic circuits and switches, their characteristics and specifications	Module 1 of the syllabus	3	Individual Activity.	Text book 1 and reference book 1.

2	Assignment 2: University Questions on power diodes and types of diode rectifiers.	Students will be ableto Explain different types of power diodes, its effects on RL circuits and operation and analysis of singlephase diode rectifier circuits	Module2 of the syllabus	6	Individual Activity.	Text book 1 and reference book 1.
3	Assignment 3: University Questions on transistors	Students will be able to discuss steady state, switching characteristics and gate /base drive requirements of different power transistors and their comparison	Module3 of the syllabus	8	Individual Activity.	Text book 1 and reference book 1.
4	Assignment 4: University Questions on thyristors.	Students will be able to discuss different types of thyristors, their operation, characteristics and firing circuits.	Module4 of the syllabus	10	Individual Activity.	Text book 1 and reference book 1.
5	Assignment 5: University Questions on controlled rectifiers, AC voltage controllers, inverters and choppers.	Students will be able to discuss the principle of operation and analysis of controlled rectifiers, AC voltage controllers, DC – DC and DC – AC converters.	Module5 of the syllabus	12	Individual Activity.	Text book 1 and reference book 1.

14.0 QUESTION BANK

Module I

1 State important applications of power electronics.
2 Explain briefly the different types of power controllers and mention two applications foreach type of power controller.
3 With circuit diagram and waveforms of control signal and output voltage, explain thecontrol characteristics of S.C.R and MOSFET.
4 Discuss some of the important advantages and disadvantages of thyristorised powerconverters.
5 List the major types of power electronic circuits and mention in each case, the type ofinput supply given and the output we get.
6 Explain the control characteristics of power devices.
7 With the help of neat block diagram explain the power electronic converter.
8 What are the peripheral effects of power electronic circuits?
9 What are the types of diodes?
10 What is the effect of reverse recovery time?
11 What are the limitations of schottky diodes?
12 What is the time constant of RL circuit?
13 What is the resonant frequency of LC circuit?
14 What is freewheeling diode?
15 What is rectifier? What is the difference between a rectifier and converter?
16 What are the performance parameters of a rectifier?
17 What is form factor and ripple factor?
18 What is the efficiency of rectification?
19 What is transformer utilization factor?
20 What are displacement factor and input power factor?
21 What is the harmonic factor?
22 What is the difference between half wave and full wave rectifier?
23 What is the DC output voltage of half wave and full wave rectifier?

24 What are the advantages of three phase rectifiers over single phase rectifiers?
25 What are the differences between AC and DC filters?
26 What are the effects of source inductance on the output voltage of rectifier?
27 What is commutation of diodes?
28 A single phase bridge rectifier has a purely resistive load R=10Ω, the peak supply voltage Vm=170V and the supply frequency f=60Hz. Determine the average output voltage of the rectifier if the source inductance is negligible.

Module II

1 Draw and briefly explain the V-I characteristics of B.J.T.
2 Describe the switching characteristics of a BJT with the help of its equivalent circuit and wavediagrams.
3 Describe the input and output characteristics for a B.J.T.Show the region of the transistorcharacteristics where it acts like a switch
4 Define the following terms with respect to Transistor switch.a)Over drive factor b)Forced β
5 With a circuit diagram, explain 'antisaturation control' of BJT.
6 What the different types of base drive control circuits are as applied to power transistor? Explainany one in detail.
7 With a circuit diagram, explain 'proportional base drive control' of power transistor.
8 Explain the constructional details and working of n-channel enhancement type MOSFET.
9 Draw and briefly explain the transfer and drain characteristics of MOSFET.
10 Explain the constructional details and working of n-channel depletion type MOSFET.
11 Compare power MOSFETs with BJTs.
12 Draw and explain the switching characteristics of power MOSFET.
13 State the merits, limitations and area of application of the IGBT power switching devices.
14 With neat sketches, explain the switching characteristics of IGBT.
15 Give the structure, static characteristics and its applications of the device: IGBT.
16 Explain the typical gate drive circuit for MOSFET.
17 Discuss methods for providing isolation of gate/base circuits from power circuit, with circuitdiagrams.
18 What is di/dt and dv/dt? How devises are protected against di/dt and dv/dt?

Module III

1 Describe the different modes of operation of a thyristor, with the help of its static V-Icharacteristics
2 Explain the static characteristics of SCR and hence define i) forward break over voltage ii) Latching current iii) Holding current
3 With the help of two transistor model for an SCR, derive the expression for anode current.
4 Distinguish between latching current and holding current of a SCR.
5 Mention the different methods of turning on of an SCR. Explain gate triggering.
6 With neat diagram, explain the turn on and turn off characteristics of SCR.
7 Distinguish between i) Converter grade and inverter grade thyristors ii) Thyristor turn off timeand circuit turn off time.
8 Explain the gate characteristics of SCR with appropriate diagrams.
9 Explain the significance of di/dt and dv/dt ratings of SCR
10 Explain how snubber circuit is used for dv/dt protection of SCR.
11 Explain with the help of a circuit diagram and relevant waveforms, the principle of resistance – capacitance triggering of an SCR.
12 Explain the principle of synchronized UJT triggering of an SCR. Draw the waveforms at differentpoints.
13 Explain the working of 1-phase, half wave controlled rectifier with R-L load what will be the effectof connecting freewheeling diode?
14 What is a controlled rectifier? How the turn off of the SCR takes place in controlled rectifiers?
15 With a circuit diagram and waveforms, explain working of a 1-phas half controlled bride rectifier.Derive the expression for the average voltage across R-L load.
16 Draw the circuit diagram of single phase semi converter with RL load and explain the working withneat waveforms. Discuss the effect of connecting freewheeling diode to this circuit.
17 Discuss the role of a freewheeling diode in a converter circuit.
18 Draw the circuit diagram and explain with waveforms the working of 1-phase fully controlledbride rectifier with R-L load. Derive the expression for the average voltage across R-L load.
19 Explain the basic principle of inversion of a 1-phase full wave converter.
20 Draw the 3-phase half wave controlled rectifier circuit and explain with waveforms for an R-L load.Assuming continuous load current obtain an expression for the average output voltage.
21 Explain with the help of circuit diagram and relevant waveforms, the operation of 3-phase half controlled bride converter feeding a resistive load. Also derive the expression for average value of the output voltage.
22 Explain with the help of circuit diagram and relevant waveforms, the operation of 3-phase fully controlled bride converter feeding a resistive load. Also derive the expression for average value ofthe output voltage.

Module IV

1 Draw the circuit diagram and explain with waveforms the working of 1-phase fully controlledbride rectifier with R-L load. Derive the expression for the average voltage across R-L load.
2 Explain the basic principle of inversion of a 1-phase full wave converter.
3 Draw the 3-phase half wave controlled rectifier circuit and explain with waveforms for an R-L load.Assuming continuous load current obtain an expression for the average output voltage.
4 Explain with the help of circuit diagram and relevant waveforms, the operation of 3-phase half controlled bride converter feeding a resistive load. Also derive the expression for average value of the output voltage.
5 Explain with the help of circuit diagram and relevant waveforms, the operation of 3-phase fully controlled bride converter feeding a resistive load. Also derive the expression for average value ofthe output voltage.
6 What are AC voltage controllers? Explain two types of AC voltage controller.
7 What is an AC voltage controller? List some of its industrial applications. Enumerate its merits anddemerits.
8 Draw the circuit diagram of 1-phase AC voltage controller and explain the principle of phase control, with the help of relevant waveforms.
9 Describe the working of 1-phase AC voltage controller feeding an R-L load with the help ofwaveforms.
10 Draw the circuit of a single phase AC voltage controller and explain the principle of On-OFF control, with the help of relevant waveforms. Derive the expression for the RMS output voltage in terms of the RMS supply voltage and the duty cycle of operation of the controller.
11 With the help of a suitable circuit diagrams and waveforms, explain the operation of 1-phase ACregulators using on/off control.
12 For AC voltage control, discuss the difference in performance between single phase unidirectional controller and bi-directional controller foe a resistive load with circuit diagrams and output voltage waveforms.
13 Derive an expression for RMS output voltage of 1-phase full wave controller having inductive loadfor discontinuous current mode.
14 Explain why short duration gating pulses are not suitable for bi-directional ac voltage controllers with inductive loads.
15 Compare the full wave and half wave AC controllers?

Module V

1 What is a chopper? What are its applications?
2 Explain the principle of operation of a chopper.
3 Describe the principle of a step down chopper with the help of schematic and waveforms forresistive load. Hence, derive an expression for average and rms output voltage.
4 Explain the principle of a step down chopper with the help of schematic and waveforms forinductive load. Hence, derive an expression for average and rms output voltage.
5 Explain the voltage control strategies used in choppers.
6 Describe the principle of a step up chopper with the help of schematic and waveforms forresistive load. Hence, derive an expression for average and rms output voltage.
7 Explain the performance parameters of choppers.
8 How are choppers classified? Explain with relevant waveforms the working of type A chopper.Give its applications.
9 What are two quadrant choppers? Briefly explain and state its use.
10 Draw the schematic circuit of class E four quadrant DC chopper and mention the devices thatprovide the path for current in the first and third quadrants of operation.
11 Explain the operation of impulse commutated thyristor chopper.
12 Giving neat circuit diagram and waveforms, explain the working of single phase half bridgeinverter with ‘R’ load.
13 With circuit diagram of half bridge transistor inverter, explain the operation. Sketch waveforms ofoutput voltage and current in devices, for a resistive load. Derive an expression for output RMS voltage.
14 Explain the performance parameters of inverters.
15 Explain single phase bridge inverter with relevant circuit diagram and waveforms. Assume an Rload.
16 Explain single phase bridge inverter with relevant circuit diagram and waveforms. Assume an R-Lload.
17 Explain the output voltage control of inverter by pulse width modulation
18 Write a note on voltage control of inverter by sinusoidal pulse width modulation technique.
19 Draw the circuit of a single phase, current source inverter employing power switching transistors.Explain the operation of the circuit.
20 Giving neat circuit diagram and waveforms, explain the working of single phase half bridgeinverter with ‘R’ load.
21 With circuit diagram of half bridge transistor inverter, explain the operation. Sketch waveforms ofoutput voltage and current in devices, for a resistive load. Derive an expression for output RMS voltage.

15.0 University Results

Examination	S	A	B	C	D	E	F	% of Passing
2021-22	-	01	02	09	05	-	01	94.44
2020-21	-	-	03	20	03	-	03	89.66

Prepared by	Checked by		
			
Dr. Basavaraj Madiggond	**Prof. M. P. Yenagimath**	**HOD**	**Principal**

Subject Title	**SIGNALS AND SYSTEMS**		
Subject Code	18EE54	**IA Marks**	40
Number of Lecture Hrs /	3:0:0	**Exam Marks**	60
Total Number of Lecture Hrs	40	**Exam Hours**	03
			Credits: 3

FACULTY DETAILS:		
Name: Prof. Amit U Neshti	**Designation:** Assistant Professor	**Experience: 13** yrs
No. of times course taught: 01	**Specialization:** Digital Electronics	

1.0 Prerequisite Subjects:

Sl. No	Branch	Semester	Subject
1	EEE	III	Transform Calculus , Fourier series and Numerical Techniques, Electrical Circuit Analysis

2.0 Course Objectives

1. To discuss arising of signals in different systems.
2. To classify the signals and define certain elementary signals.
3. To explain basic operations on signals and properties of systems.
4. To explain the use of convolution integral and convolution summation in analyzing theresponse of linear time invariant systems in continuous and discrete time domains.
5. To explain the properties of linear time invariant systems in terms of impulse responsedescription.
6. To explain determination of response of a given linear time invariant system and to provide ablock diagram representation to it.
7. To explain Fourier, transform representation of continuous time and discrete time non –periodicsignals and the properties of Fourier Transforms.
8. To explain the applications of Fourier transform representation to study signals and linear timeinvariant systems.
9. To explain the use of Z-transform in the complex exponential representation of discrete timesignals and the analysis of systems

3.0 Course Outcomes

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

CO	Course Outcome	Cognitive Level	POs
C304.1	Explain the classifications, basic operations of signals, Elementary signals and propertiesof systems.	L1,L2	1,2,3,6,7,8,12
C304.2	Apply convolution in both continuous and discrete domain for the analysis of systems given impulse response of a system.	L1,L2,L3	1,2,3,6,7,8,12
C304.3	Solve the continuous time and discrete time systems by variousmethods and their representation by block diagram.	L1,L2, L3,L4	1,2,3,6,7,8,12
C304.4	Perform Fourier analysis for continuous and discrete time, linear time invariant systems.	L1,L2, L3,L4	1,2,3,6,7,8,12
C304.5	Apply Z-transform and properties of Z transform for the analysis of discrete time systems.	L1,L2, L3	1,2,3,6,7,8,12
Total Hours of Instruction		**40**	

4.0 Course Content

Module-1

Introduction: Definitions of signals and a system, classification of signals, basic operations on signals.Elementary signals viewed as interconnections of operations, properties of systems**.**

Module-2

Time – Domain Representations for LTI Systems: Convolution, impulse response, properties, solution ofdifferential and difference equations, block diagram representation.

Module-3

The Continuous-Time Fourier Transform: Representation of a non -periodic signals: continuous-time Fourier transform (FT), Properties of continuous-time Fourier transform, Applications. Frequency response of LTI systems, Solutions of differential equations

Module-4

The Discrete-Time Fourier Transform: Representations of non-periodic signals: The discrete-time Fourier Transforms (DTFT), Properties of DTFT and applications. Frequency response of LTI system, Solutions of difference equations

Module-5

Z- Transforms: Introduction, Z-transform, properties of ROC, properties of Z-transforms, inversion of Z-transform methods - power series and partial expansion, Transforms analysis of LTI systems, transferfunction, stability and causality, unilateral Z-transform and its application to solve difference equations.

5.0 Relevance to future subjects

Sl No	Semester	Subject	Topics
01	VIII	Project work	DSP, Image Processing and Communication
02	V/VI	Digital Signal Processing	DFT,FFT

6.0 Relevance to Real World

Sl. No	Real World Mapping
01	Communication system, Remote sensing, aircraft landing system, Biomedical processing, Control system, auditory system

7.0 Gap Analysis and Mitigation

Sl. No	Delivery Type	Details
01	Seminar	Analysis of signal and system using matlab

8.0 Books Used and Recommended to Students

Text Books
1. **Simon Haykins and Barry Van Veen,** "Signals and Systems", 2nd Edition, 2008, Wiley India. ISBN 9971-51-239-4.
Reference Books
1. Fundamentals of Signals and Systems, Michael J. Roberts, Govind K Sharma , McGraw Hill, 2nd Edition, 2010 2. Signals and Systems, NagoorKani , McGraw Hill, 1st Edition 2010 3. Signals and Systems, A Primer with MATLAB Matthew N.O. Sadiku Warsame H.Ali CRC Press 1st Edition 4. Signals and Systems, Anand Kumar, PHI, 3rd Edition, 2015.

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

Website and Internet Contents References
01) https://www.azdocuments.in/2020/12/signals-and-systems-18ee54.html
02) https://www.vtupulse.com/vtu-question-papers/18ee54-signals-and-systems-question-papers/

10.0 Magazines/Journals Used and Recommended to Students

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

11.0 Examination Note

Scheme of Evaluation for CIE (40 Marks)

- **Internal Assessment: 30 Marks**

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

- **Assignment: 10 Marks**

SCHEME OF EXAMINATION: 100 Marks, scaled down to 60 in VTU result sheet.

The question paper will have ten questions.

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

12.0 Course Delivery Plan

Module	Lecture No.	Content of Lecture	% of portion
1	1	Definitions of a signal and a system, overview of system	20%
	2	Classification of signals	
	3	Basic Operations on signals	
	4	Elementary signals- I	
	5	Elementary signals- II	
	6	Properties of system I	
	8	Properties of system II and System Viewed as Interconnections of operation	
2	9	Introduction and convolution sum	20%
	10	Convolution sum and convolution integral	
	11	Properties of Impulse response I	
	12	Properties of Impulse response II	
	13	Solution of differential equations	
	14	Solution of difference equations	
	16	Block diagram representation and State variable representation	
3	17	Introduction, complex sinusoids and frequency response of LTI system	20%
	18	Representation of Continuous-time Fourier transform(CTFT)	
	19	Properties of CTFT I	
	20	Properties of CTFT II	
	21	Properties of CTFT III	
	22	Properties of CTFT IV	
	23	Applications. Frequency response of LTI systems, Solutions of differential equations	
	24	Numericals	
	25	Representation of Discrete-time Fourier transform(DTFT)	

4	26	Properties of DTFT I	20%
	27	Properties of DTFT II	
	28	Properties of DTFT III	
	29	Properties of DTFT IV	
	30	Applications. Frequency response of LTI systems, Solutions of differential equations	
	31	Numericals	
	32	Numericals	
5	33	Introduction and Z-transform	20%
	34	Properties of the Region of convergence	
	35	Properties of the Z-Transform	
	36	Inverse of the Z-Transform	
	37	Transform analysis of LTI systems I	
	38	Transform analysis of LTI systems II	
	39	Unilateral Z-transform	
	40	Unilateral Z-transform and its application to solve difference equations.	

13.0 Assignments, Pop Quiz, Mini Project, Seminars

Sl. No.	Title	Outcome expected	Allied study	Week No.	Individual / Group activity	Reference: book/website /Paper
1	Assignment 1: Questions on module 1	Students study the Topics and write the Answers. Get practice to solve numerical of university question papers.	Module 1 of the syllabus	3	Individual Activity. Printed solution expected.	Book 1, 2, 3, 4 & 5 of the reference list.
2	Assignment 2: Questions on module 2	Students study the Topics and write the Answers. Get practice to solve numerical of university question papers.	Module 2 of the syllabus	5	Individual Activity. Printed solution expected.	Book 1, 2, 3, 4 & 5 of the reference list.
3	Assignment 3: Questions on module 3	Students study the Topics and write the Answers. Get practice to solve numerical of university question papers.	Module 3 of the syllabus	8	Individual Activity. Printed solution expected.	Book 1, 2, 3, 4 & 5 of the reference list.
4	Assignment 4: Questions on module 4	Students study the Topics and write the Answers. Get practice to solve numerical of university question papers.	Module 4 of the syllabus	10	Individual Activity. Printed solution expected.	Book 1, 2, 3, 4 & 5 of the reference list.
5	Assignment 5: Questions on module 5	Students study the Topics and write the Answers. Get practice to solve numerical of university question papers.	Module 5 of the syllabus	12	Individual Activity. Printed solution expected.	Book 1, 2, 3, 4 & 5 of the reference list.

14.0 QUESTION BANK

MODULE -1

1. Define a signal and a system. Explain any five properties of a LTI system.
2. For each of the systems state whether system is linear, shift invariant, stable, causal, and invertible.
   i) y(n) = log x(n)
   ii) $y(n) = x(n^3)$
3. Check whether the fallowing signals are periodic or not .If periodic, determine their fundamental period.
   i) x(n) =cos (∏n/7) sin(∏n/3)
   ii) $x(t) = (2\cos^2(\pi t/2)-1)\sin(\pi t).\cos(\pi t)$
4. A rectangular pulse x (t) = { = A 0≤t≤T
   { = 0 elsewhere
   is applied in an integrator circuit. Find total energy of the output y(t) of the integrator.
5. Sketch the fallowing signals and determine their even and odd components and sketchi) r(t+2)-r(t+1)-r(t-2)+r(t-3) ii) u(n+2)-3u(n-1)+2u(n-5)
6. Find the periodicity the signal x[n] = cos [2∏n/5] +cos[2∏n/7]
7. Find and sketch the even and odd components of the fallowingi) $x[n]=e^{-(n/4)}$ u[n]
   ii) x(t)= { t 0≤t≤1
   2-t 1≤t≤2 }
8. Determine whether or not the fallowing signals are periodic. Find the period if they are
   Periodici)x(t)=u(t)+v(-t) where v(t)=sin(t).u(t)
   ii) cos (1/5)∏n. sin (1/3)∏n
9. For given x[n] ={0,0,0,1,2,3,2,1,0,0,0},plot x[-2-1], x[n/2].
10. Write the formal definition of a signal and system. With neat sketches for illustration, briefly describe the 5 commonlyused methods of classifying signals based on different features.
11. Explain the significance of time compression and expansion.
12. Determine whether fallowing signals are periodic or not if periodic then determine the fundamental period
    1. x(t) = cos (2t)+ sin(3t)
    2. x(n) = cos (1/5)∏n. sin (1/3)∏n
13. Determine the energy or power as applicable for the fallowing signalsi) $x[n] =[1/3]^n$ u[n] ii) $x[n] =e^{j((\pi/2)n+\pi/6)}$
14. Determine if the fallowing systems are time invariant or time variant.i) y(n) =x(n)+x(n-1)
    ii) y(n) =x(-n)

MODULE -2

1. The impulse response of a LTI system is given by h[n] = {1,2,1,-1}, Determine the response of the system for the inputand x[n] = {1,2,3,1} and sketch the output.
2. Find the convolution of two finite duration sequencesh[n]=a^n u[n] for all n
   x[n] =b^n u[n] for all n i)a=b ii)a≠b.
3. Find the step response of a system whose impulse response is given byh(t) =u(t+1)-u(t-1)
4. Determine y[n] if x[n]=n+2 for 0≤n≤3 and h[n] = a^n u[n] for all n
5. What do you mean by impulse response of an LTI system? How can the above be interpreted? Starting fromfundamentals deduce the equation for the response of an LTI system if the input sequence x(n) and the impulse response are given.
6. Determine the response of LTI system whose input and unit sample response is given as x(n)= n+1 for 0 < n < 2
   0 else
   h(n)= a^n u(n) for all n.
7. Given $x_1(n) =a^nu(n)$; IaI <1 and $x_2(n) = b^nu(n)$; IbI <1.Find $x_1(n)$ * $x_2(n)$if i) a≠b ii) a=b.

8. A LTI System has impulse response h(t)=tu(t) + (10-2t)u(t-5) - (10-t)u(t-10) Determine the output for each of following inputs.
   i)$x_1(t) = \delta(t+2) + \delta(t-5)$
   ii)$x_2(t) = 2\delta(t) + \delta(t-5)$
9. Determine whether the system shown below is memory-less, stable, Causal and time invariant.
   i) $y(n) = x(n) \sum \delta(n-2k)$
   ii) $y(t) = (d/dt)\, e^{-t}x(t)$
10. Prove that linear time invariant system is BIBO stable if and only if its impulse response h(n) is absolutely summable.
11. For impulse response $h(n) = e^{2t}\, u(t-1)$. Determine whether the corresponding system is i) Memoryless ii) Causal iii) Stable.
12. Determine the convolution of two given sequences x[n]={1,2,3,4} and h[n]={1,1,3,2}.
13. Given impulse response of system $h[n] = \beta^n\, u[-n]$ $\beta>1$, find the response of system for input u[-n].
14. Determine whether the system given by the fallowing relation is i) linear ii)time invariant iii) stable $y(n) = x[n] \sum \delta[n-2k]$
15. Explain Initial and final value theorem of an LTI system.
16. What do you mean by natural response of a system? Determine the natural response for the system described by the following difference equation.
    i)$y[n]-(9/16)y[n-2] = x[n-1]$ $y[-1]= -1$ $y[-2]= -1$.
    ii) $x(n)=n^2u(n)$
    iii) $x(n)=\cos n\Theta u(n)$

MODULE -3

1. Using convolution theorem find inverse Fourier transform of $x(w)=1/(a+jw)^2$
2. Define DTFT of a signal. Establish the relation between DTFT and a z transform of a signal.
3. The transfer function of a system is H[W]=16/(4+jw) find the time domain response y(t) for input x(t)=u(t).
4. State and prove the fallowing of fourier transform
   i) Time shifting property ii) Time differentiation property iii)Parsevals theorem.
5. Define and prove the fallowing for DTFS representation of signals.
   i)Modulation of signals ii)Convolution of two signal.

MODULE -4

1. Define and explain Nyquist sampling theorem with relevant figures.
2. An LTI system is described by $H(f) = 4/(2+j2\prod f)$ Find its response y(t) if the input is x(t) = u(t).
3. Show that the fourier transform of a train of impulses of unit height, separated byT secs is also a train of height $wo=2\prod/T$ separated by $wo=2\prod/T$
4. State and prove the sampling theorem for low pass signals. Give the significance of this theorem.
5. Derive the DTFS representations for a discrete time periodic signal x(n) using the mean square error (MSE) criterion.
6. Discuss the effect of a time shift and a frequency shift on the fourier representation

MODULE -5

1. Explain the properties of ROC of z-transform.
2. Determine z transform and ROC of the fallowing
   i)$x[n] = -\alpha^n\, u(n-1)$ ii)$x[n] = (1/3)^n \sin(\prod/4)n\, u(n)$
3. Find Z-transform and ROC of the fallowing
   i) $x(n) = (1/3)^n \sin(\Omega_0 n)u(n)$ ii) $x(n) = a^n \cos(\Omega_0 n)u(n)$ for $\Omega_0= 2$
4. Solve the linear constant coefficient difference equation using z-transform method.
   $y(n) - (3/2)y(n-1) + (1/2)y(n-2) = (1/4)^n\, u(n)$
5. Find the inverse Z-transform of the fallowing using power series method.
   i) $X(z) = (Z^2 + Z) / (Z^3-3Z^2+3Z-1)$; ROC IZI > 1.
   ii) $X(z) = \cos(z^{-2})$; I Z I > 0
6. A causal system has input x[n] and output y[n] .Use the transfer function to determine the impulse response of this system.
   $x[n]=\delta[n-1]-(1/8)\,\delta[n-2]$, $y[n]= \delta[n]-(3/4)\,\delta[n-1]$
7. By using the unilateral Z-transform solve the fallowing difference equation
   $y[n] + 3y[n-1] = x[n]$ with x[n]=u[n] and the initial condition y[-1] =1.
8. Obtain the sequence x[n] from the given transform by using convolution property

$X[Z] = Z^2/(Z-2)(Z-3)$

9. By using the unilateral Z-transform determine forced response, natural response, and complete response of the system described by using difference equation
   $y[n] - (1/2)y[n-1] = 2x[n]$ with input $x[n]=2(1/2)^n$ and initial condition $y(-1)=3$
10. By using partial fraction expansion method, find the inverse z-transform of H (Z)

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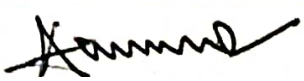		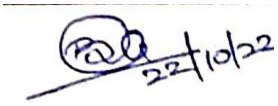	
Prof. A. U. Neshti	**Prof. M. P. Yenagimath**	**HOD**	**Principal**

Subject Title	ELECTRICAL MACHINE DESIGN		
Subject Code	18EE55	**IA Marks**	40
Number of Lecture Hrs / Week	04	**Exam Marks**	60
Total Number of Lecture Hrs	40	**Exam Hours**	03
CREDITS – 03			

FACULTY DETAILS:		
Name: Shri. Shivanand Hirekodi	**Designation:** Asst. Professor	**Experience:**21
No. of times course taught:04	**Specialization:** Power Electronics	

1.0 Prerequisite Subjects:

Sl. No	Branch	Semester	Subject
01	Electrical & Electronics Engineering	III	Transformers and Generators
02	Electrical & Electronics Engineering	IV	Electric Motors

2.0 Course Objectives

1. To discuss design factors, limitations in design and modern trends in design and manufacturing of electrical machines.
2. To discuss the properties of electrical, magnetic and insulating materials used in the design of electrical machines
3. To derive the output equation of DC machine, single phase, three phase transformers, induction motor and synchronous machines.
4. To discuss the selection of specific loadings, for various machines
5. To discuss separation of main dimensions for different electrical machines
6. To discuss design of field windings for DC machines and synchronous machines.
7. To evaluate the performance parameters of transformer, induction motor.
8. To design of cooling tubes for the transformer for a given temperature rise.
9. To explain design of rotor of squirrel cage rotor and slip ring rotor.
10. To define short circuit ratio and discuss its effect on machine performance.

3.0 Course Outcomes

Having successfully completed this course, the student will be able

	Course Outcome	Cognitive Level	POs
C305.1	Discuss design factors, limitations, modern trends in design, manufacturing of electrical machines and properties of materials used in the electrical machines.	L_1,L_2	1,2,3,6,8,9,10,12
C305.2	Design different parts of DC machines.	L_1-L_4	1,2,3,6,8,9,10,12
C305.3	Design single phase and three phase transformers.	L_1-L_4	1,2,3,6,8,9,10,12
C305.4	Design three phase Induction motors.	L_1-L_4	1,2,3,6,8,9,10,12
C305.5	Design three phase Synchronous machines.	L_1-L_4	1,2,3,6,8,9,10,12
Total Hours of instruction		**40**	

4.0 Course Content

MODULE – 1

Fundamental Aspects of Electrical Machine Design: Design of Machines, Design Factors, Limitations in design, Modern Trends in design, manufacturing Techniques.

Electrical Engineering Materials: Desirabilities of Conducting Materials, Comparison of Aluminium and Copper wires. Ferromagnetic Materials: Soft Magnetic materials – Solid Core Materials, Electrical Sheet and Strip, Cold Rolled Grain Oriented Steel. Insulating Materials: Desirable Properties, Temperature Rise and Insulating Materials, Classification of Insulating materials based on Thermal Consideration. **08 Hours**

MODULE – 2

Design of dc machines: Output Equation, Choice of Specific Loadings and Choice of Number of Poles, Main Dimensions of armature, Design of Armature Slot Dimensions, Commutator and Brushes. Estimation of Ampere Turns for the Magnetic Circuit. Dimensions of Yoke, Main Pole and Air Gap. Design of Shunt and Series Field Windings. **08 Hours**

MODULE - 3

Design of transformers Output Equations of Single Phase and Three Phase Transformers, Choice of Specific Loadings, Expression for Volts/Turn, Determination of Main Dimensions of the Core, Estimation of Number of Turns and Conductor Cross Sectional area of Primary and Secondary Windings, No Load Current. Expression for the Leakage Reactance of core type transformer with concentric coils, and calculation of Voltage Regulation. Design of Tank and Cooling (Round and Rectangular) Tubes. **08 Hours**

MODULE - 4

Design of induction motors: Output Equation, Choice of Specific Loadings, Main Dimensions of Stator. Design of stator slots and Winding, Choice of Length Air Gap, Estimation of Number of Slots for Squirrel Cage Rotor. Design of Rotor Bars and End Ring. Design of Slip Ring rotor. Estimation of No Load Current and Leakage Reactance. **08Hours**

MODULE - 5

Design of synchronous machines: Output Equation, Choice of Specific Loadings, Short Circuit Ratio, Main Dimensions of Stator. Design of stator slots and Winding. Design of Salient and non- salient Pole Rotors. Magnetic Circuit and Field Winding.

08 Hours

5.0 Relevance to future subjects

Sl No	Semester	Subject	Topics
01	VIII	Industrial Drives & Applications	Selection of drives for different industrial applications.
02	VIII	Project work	Design of machines for different applications

6.0 Relevance to Real World

SL.No	Real World Mapping
01	Design of AC and DC machines for different sectors like Industry, Agriculture, Automotives etc.

7.0 Gap Analysis and Mitigation

Sl. No	Delivery Type	Details
01	Lab visit	To gain practical knowledge about Machine Designs
02	Industry /Field visit	To study design and manufacturing process of electrical machines.

8.0 Books Used and Recommended to Students

Text Book
1. A Course in Electrical Machine Design by A.K.Sawhney. 6 th edition,2013, Published by:Dhanpat Rai and Co.
Reference Books
1. Performance and Design Of AC Machines by M.G.Say. 3rd edition,2002, Published by:CBS Publisher 2. Design Data Handbook- by Sanmug Sundarm 1st edition,2011 Published by:New Age International.
Additional Study material & e-Books
1. Design of Electrical Machines by Nagnoor kani **2.** Design of Electrical Machines by V. N. Mittle, 4/e edition. 3. Principles of Electrical Machine Design, by R.K.Aggarwal.

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

Website and Internet Contents References
1. http://www.electrical4u.com 2. http://nptel.iitm.ac.in/courses/IITMADRAS/Electrical_Machines_I/index.php 3. http://nptel.iitm.ac.in/courses/IITMADRAS/Electrical_Machines_II July 2012 2 4. https://www.electrical4u.com/electrical-engineering-articles/generator/ 5 http://www.nptelvideos.in/2012/11/electrical-machines-i.html

10.0 Magazines/Journals Used and Recommended to Students

Sl.No	Magazines/Journals	website
1	E drive magazine	http://www.e-driveonline.com/main/
2	IEEE magazine & Journal	https://www.ieee.org/publications_standards/publications/journmag/journals_magazines.html
3	Machine design magazine	https://www.amazon.com/Machine-Design-Magazine-Electric-Reference/dp/B000KFWQKM
4	Journal pub	http://journalspub.com/journalspub/JournalsDetails.aspx?jid=95
5	Journal of engineering design	http://www.tandfonline.com/doi/abs/10.1080/09544829008901652

11.0 Examination Note

CIE: 40 MARKS

Internal assessment test will be done in the same pattern as that of the main examination. Internal assessment Test: 30 marks. Assignment: 10 marks

SEMESTER END QUESTION PAPER PATTERN: 100 Marks

- The question paper will have ten full questions carrying equal marks. Each full question consisting of 20 marks.
- There will be two full questions from each module.
- Each full question will have sub question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

12.0 Course Delivery Plan

Unit No.	Lecture No.	Content of Lecture	% Portion
I	1.	**Fundamental Aspects of Electrical Machine Design:** Design of Machines. Design Factors.	20
	2.	Limitations in design. Modern Trends in design & manufacturing Techniques.	
	3.	**Electrical Engineering Materials:** Desirabilites of Conducting Materials. Comparison of Aluminum and Copper wires.	
	4.	Ferromagnetic Materials: Soft Magnetic materials – Solid Core Materials. Electrical Sheet and Strip, Cold Rolled Grain Oriented Steel.	
	5.	Insulating Materials: Desirable Properties, Temperature Rise and Insulating Materials.	
	6.	Classification of Insulating materials based on Thermal Consideration.	
III	7.	**Design of Transformers:** Output equation of single phase and three phase transformers	20
	8.	Choice of specific loadings. Expression for volts/turn	
	9.	Determination of main dimensions of the core, Design of windings	
	10.	Window space factor and Window Dimensions.	
	11.	Design of yoke and overall dimensions.	
	12.	Numerical Examples	
	13.	Estimation of no load current and numerical examples	
	14.	Expression for leakage reactance and voltage regulation	
	15.	Design of tank and cooling tubes (round and rectangular)	
	16.	Numerical Examples.	
IV	17.	**Design of Three Phase Induction Motors:** Output equation	20
	18.	Choice of specific loadings, Main dimensions of stator	
	19.	Design of stator slots and Winding and numerical examples	
	20.	Choice of length of the air gap	
	21.	Estimation of number of slots for the squirrel cage rotor and numerical	
	22.	Design of Rotor bars and end ring and numerical examples	
	23.	Design of Slip ring induction motor and numerical examples	
	24.	Estimation of No load current and Leakage reactance	
V	25.	**Design of Three Phase Synchronous Machines:** Output equation	20
	26.	Choice of specific loadings, Short circuit ratio	
	27.	Design of main dimensions and numerical examples	
	28.	Design stator slots and windings and numerical examples	
	29.	Design of rotor of salient pole synchronous machines numerical examples	
	30.	Design of rotor of non-salient pole machine & numerical examples	
	31.	Magnetic circuits	
	32.	Design of the field winding	
II	33.	**Design of DC Machines:** Output equation, Choice of specific loadings	20
	34.	Choice of number of poles	
	35.	Design of Main dimensions of the DC machines	

	36.	Design of armature slot dimensions and numerical	
	37.	Commutators and brushes and numerical	
	38.	Magnetic circuit - estimation of ampere turns	
	39.	Design of yoke and pole	
	40.	Field windings – shunt, series and inter poles and numerical.	

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 design aspects and limitations of design.	Students study the Topics and write the Answers. Get practice to solve university questions.	Module 1 of the syllabus	2	Individual Activity. Printed solution expected.	Book 1 of the Text list.
2	Assignment 2: University Questions on design of Transformer.	Students study the Topics and write the Answers. Get practice to solve university questions.	Module 2 of the syllabus	4	Individual Activity. Printed solution expected.	Book 1 of the Text list.
3	Assignment 3: University Questions on of induction machine.	Students study the Topics and write the Answers. Get practice to solve university questions.	Module 3 of the syllabus	6	Individual Activity. Printed solution expected.	Book 1 of the Text list.
4	Assignment 4: Des of synchronous machine.	Students study the Topics and write the Answers. Get practice to solve university questions.	Module 4 of the syllabus	8	Individual Activity. Printed solution expected.	Book 1 of the Text list.
5	Assignment 5: University Questions on Design of dc machine.	Students study the Topics and write the Answers. Get practice to solve university questions.	Module 5 the syllabus	10	Individual Activity. Printed solution expected.	Book 1 of the Text list.

14.0 QUESTION BANK

MODULE I

1. Explain clearly the factors which impose limitations in the design of electrical machines.
2. What are the desirable properties of insulating materials? Explain the classification of insulating materials based on thermal consideration.
3. What are factors those limit the design of machine.
4. What are types of magnetic materials? Give Examples.

MODULE II

1. Define the term ‘output coefficient’ in case of d.c. machines. Explain on what factors its value depends and in what manner it varies.
2. Derive the output equation of DC Machine.
3. Define the terms ‘specific magnetic loading’ and ‘specific electric loading’, as applied to electrical Machines. Discuss various factors which influence the values of these quantities in the design of d.c. machines

4 Discuss the factors which govern the choice of number of poles in a d.c. machine
5 Find the main dimensions and the number of poles of a 37kW,230V,1400rpm shunt motor so that a square pole face is obtained. The average gap density is 0.5 wb/$m^2$and the ampere conductors per meter are 22000. The ratio of pole arc to pole pitch is 0.7 and the full load efficiency is 90 percent.
6 Calculate the reactance voltage induced per coil for single turn two layer winding with two conductors per slot, of a 250Kw,525V,6 pole lap wound dc generator driven at 220rpm.The no of armature conductors is 600. The inductance per coil is 0.0057 mH.The brush covers one segment. If the armature diameter is 1.6m and core length 0.3m, Determine flux density under the interpole. The length of interpole is 0.18m.
7 List the guide lines for selecting number of slots for DC Machine.
8 list factors for selection of armature diameter and core length.
9 Calculate the size of conductor and number of turns for the field of a 6 pole, 460V, DC shunt motor. The coil is to supply a mmf of 4000AT, at working temperature. The length of the inside turn is 0.74m, length available for winding is 0.13m, the space factor of the winding is 0.52, and the permissible dissipation from external surface excluding ends is 1200W/m^2. Solution should not be attempted by assuming winding depth. The resistivity of conductors is 0.02Ωm /mm^2. Keep 15% of applied voltage as reserve for speed control.
10 A 250KW, 500V, 600rpm, 6 pole DC generator is built with an armature diameter of 0.75m and a core length of 0.3m. The lap connected armature has 720 conductors. Using data obtained from this machine, determine the armature diameter, core length, number of armature slots, armature conductors and commutator segments for a 350KW, 440V, 720rpm, 6 pole DC generators. Assume a square pole face with ratio of pole –arc to pole pitch=0.66. The full load efficiency is 0.91 and the internal voltage drop is 4% of rated voltage. The diameter of commutator is 0.7 of armature diameter. The pitch of commutator segments should not be less than 4mm. The voltage between adjacent segments should not exceed 15V.

MODULE 3

1. Derive an output equation of a 3 phase transformer in terms of design constants and hence deduce the equation for the case of a single phase transformer.
2. Show that $E_t=k\sqrt{Q}$ for the transformer.
3. Determine the main dimensions of the core and window for a 500KVA, 6600/400V; 50Hz Single phase core type, oil immersed, self cooled transformer. Assume:Flux density= 1.2T, Current density=2.75A/mm^2, window space factor=0.32, volt/turn=16.8, type of core : cruciform, height of window=3 times window width. Also calculate the number of Turns and cross sectional area of conductors used for primary and secondary windings.
4. Calculate the no load current and power factor of a 3300/220V,50Hz,Single phase core type transformer with following data.Mean length of magnetic path =300cm, gross area of iron core =150cm^2, specific iron loss at 50Hz and 1.1T=2.1W/kg, Ampere turns / cm for transformer steel at 1.1T=6.2. The effect of joint is equivalent to an air gap of 1.0mm in the magnetic circuit. Density of iron=7.5 gm/cc, iron factor=0.92.
5 Calculate the main dimensions for a 250 KVA, 6600/400 volts, 50 Hz, 3 phase, mesh/star, core type, oil immersed, self cooled outdoor type, and power transformer. Assume suitable values for various design constants and specific magnetic loading.*(d = 18 cm; L = 50 cm; D = 33 cm)*
6 Explain the term, 'window space factor' as used for transformer design and state its importance in fixing the transformer output in relation to its working efficiency and the cost
7 Calculate the main dimensions and winding details of a 100 KVA, 2000/440 volts, 50 Hz, single phase, shell type, oil immersed, and self cooled transformer. The maximum flux density and current density are to be below 1.15 Tesla and 2.3 A/mm^2 respectively. The induced e.m.f. per turn is to be limited to 11.5 volts. The value of window space factor can be taken as 0.33 The ratio of window height to window width and ratio of core depth to width of central limb=2.5. The stacking factor is 0.9.
8 Derive an expression for the leakage reactance of the transformer with primary and secondary cylindrical coils of equal length, stating clearly the simplifying assumptions made.

MODULE 4

1. What are the various considerations in the selection of specific electric and magnetic loading, for the design of a 3 phase induction motor?
2. Derive the output equation of Induction Machine.
3. Discuss the factor for choice of specific magnetic and electric loading in induction machine.
4. Estimate the Stator Core Dimension's , Number of Stator Slots and Number of Stator Conductor's per Slot for a 100Kw, 3300Kv,50Hz,12 Pole Star Connected Slip Ring Induction Motor .Assume B_{av}=0.4Wb/$m^{2,}$ ac =25,000A/m , Efficiency=0.9, Power Factor =0.9 and Winding Factor =0.96=K_{ws}. Choose Main Dimension's to give Best Power Factor . The Slot Loading Should Not Exceed 500 Ampere Conductors.
5. Determine the main dimensions, turns per phase, number of slots, conductor cross section and slot area of a 250Hp, 3-phase, 50Hz, 400V, 1410 rpm, slip ring induction motor. Assume B_{av}=0.5wb/m^2, ac=30,000 A/m, effieciency= 0.9 and power factor=0.9, winding factor=0.955, current density=3.5 A/mm^2, the slot space factor is 0.4 and ratio of core length to pole pitch is 1.2. The machine is delta connected.
6. Discuss the factors for choice of length of air gap in induction machine.
7. Determine the approximate diameter and length of the stator core, the number of slots and the number c conductors per slot for a 15kw, 440V, 3 phase, 4 pole, 1425 r.p.m. induction motor.

   Assume the following values for various design parameters.

   Specific magnetic loading = 0.48 Tesla
   Specific electric loading = 25000 Amp. Conductors per meter
   Full load efficiency = 88 per cent
   Full load power factor = 0.88
8. Deduce for a 3 phase induction motor an expression showing the relationship between output, its ma dimensions, speed, the specific electric and magnetic loading, efficiency and power factor.
9. Discuss the affect of flat-topped air gap flux wave on the design calculations of induction motor.
10. Why magnetizing current of a 3 phase induction motor is much more in magnitude than that of a 3 phase transformer of the same power rating?

MODULE 5

1 Derive from the fundamental principles, an expression for the output coefficient of a 3 phase alternator in terms of specific magnetic and electric loadings.
2. Define Runaway Speed? Discuss the effect of Short Circuit Ratio on machine performance.
3. Find the Main Dimension's of 2500Kva, 187.5 Rpm, 50Hz, 3-Phase, 3Kv, Salient Pole Synchronous Generator. The Generator is to be a Vertical, Water Wheel type. Assume B_{av}=0.6Wb/m^2 and ac=34000A/m. Use Circular Poles with Ratio of Core length to pole Pitch=0.65. Specify the Type of Pole Construction Used if the Runaway Speed is About 2 Times Normal Speed.
4. Explain the term "short-circuit ratio" as applied in synchronous machines. How the value of short circuit ratio does affect the design of alternators?
5. Determine the main dimensions for a 1000KVA, 50 Hz, 3 phase 375 rpm alternator. The average air gap flux density is 0.55 Wb/mm^2 and the ampere conductors per metre are 28000. Use rectangular ploes and assume a suitable value for ratio of core length to pole pitch in order that bolted on pole construction is used for which the maximum permissible peripheral speed is 50 m/s. The runaway speed is 1.8 times the synchronous speed.

Prepared by	Checked by		
			
Shri S. D. Hirekodi.	**Shri. A. U. Neshti**	**HOD**	**Principal**

Subject Title	HIGH VOLTAGE ENGINEERING		
Subject Code	**18EE56**	**CIE Marks**	40
Number of Lecture Hrs / Week	03	**SEE Marks**	60
Credits	03	**Exam Hours**	03

FACULTY DETAILS:		
Name: Prof. O. B. Heddurshetti	**Designation:** Asst. Professor	**Experience:**16 years
No. of times course taught: 04	**Specialization:**Power Electronics	

1.0 Prerequisite Subjects:

Sl. No	Branch	Semester	Subject
01	Electrical and Electronics Engineering	I/II	Basic Electrical Engineering
02	Electrical and Electronics Engineering	III	Electrical and Electronics Measurements
03	Electrical and Electronics Engineering	III	Transformers and Generators
04	Electrical and Electronics Engineering	V	Transmission and Distribution
05	Electrical and Electronics Engineering	V	Electrical Engineering Materials

2.0 Course Objectives

- To discuss conduction and breakdown in gases, liquid dielectrics.
- To discuss breakdown in solid dielectrics.
- To discuss generation of high voltages and currents and their measurement.
- To discuss overvoltage phenomenon and insulation coordination in electric power systems.
- To discuss non-destructive testing of materials and electric apparatus.
- To discuss high-voltage testing of electric apparatus

3.0 Course Outcomes

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

	Course Outcome	RBT level	POs
C306.1	Examine conduction and breakdown phenomenon in gases, liquid and solid dielectrics.	L2	1,2,3,8,12
C306.2	Illustratevarious techniques of generation of different formsof high voltages and currents.	L3	1,2,3,8,12
C306.3	Outline measurement techniques for high voltages and currents.	L3	1,2,3,8,12
C306.4	Analyze overvoltage phenomenon and insulation coordination in electric power systems.	L2	1,2,3,8,12
C306.5	Illustrate non-destructive testing of materials and electric apparatus and high-voltage testing of electric apparatus.	L2	1,2,3,8,12

4.0 Course Content

Module-1

Conduction and Breakdown in Gases: Gases as Insulating Media, Collision Process, Ionization Processes, Townsend's Current Growth Equation, Current Growth in the Presence of Secondary Processes, Townsend's Criterion for Breakdown, Experimental Determination of Coefficients α and γ, Breakdown in Electronegative Gases, Time Lags for Breakdown, Streamer Theory of Breakdown in Gases, Paschen's Law, Breakdown in Non-Uniform Fields and Corona Discharges.

Conduction and Breakdown in Liquid Dielectrics: Liquids as Insulators, Pure Liquids and Commercial Liquids, Conduction and Breakdown in Pure Liquids, Conduction and Breakdown in Commercial Liquids. **Breakdown in Solid Dielectrics:** Introduction, Intrinsic Breakdown, Electromechanical Breakdown, Thermal Breakdown. 10Hours
Revised Bloom's Taxonomy Level: L_1 – Remembering, L_2 – Understanding

Module-2
Generation of High Voltages and Currents: Generation of High Direct Current Voltages, Generation of High Alternating Voltages, Generation of Impulse Voltages, Generation of Impulse Currents, Tripping and Control of Impulse Generators. 10Hours
Revised Bloom's Taxonomy Level: L_1 – Remembering, L_2 – Understanding L_3 – Applying

Module-3
Measurement of High Voltages and Currents: Measurement of High Direct Current Voltages, Measurement of High AC and Impulse Voltages, Measurement of High Currents – Direct, Alternating and Impulse, Cathode Ray Oscillographs for Impulse Voltage and Current Measurements. 10Hours
Revised Bloom's Taxonomy Level: L_1 – Remembering, L_2 – Understanding L_3 – Applying

Module-4
Overvoltage Phenomenon and Insulation Coordination in Electric Power Systems:
National Causes for Overvoltages - Lightning Phenomenon, Overvoltage due to Switching Surges, System Faults and Other Abnormal, Principles of Insulation Coordination on High Voltage and Extra High Voltage Power Systems.
Revised Bloom's Taxonomy Level: L_1 – Remembering, L_2 – Understanding 10Hours

Module-5
Non-Destructive Testing of Materials and Electrical Apparatus: Introduction, Measurement of Dielectric Constant and Loss Factor, Partial Discharge Measurements.
High Voltage Testing of Electrical Apparatus: Testing of Insulators and Bushings, Testing of Isolators and Circuit Breakers, Testing of Cables, Testing of Transformers, Testing of Surge Arrestors, Radio Interference Measurements, Testing of HVDC Valves and Equipment. 10Hours
Revised Bloom's Taxonomy Level: L_1 – Remembering, L_2 – Understanding

5.0 Relevance to future subjects

Sl No	Semester	Subject	Topics
1	VII	Testing and Commissioning of Power System Apparatus	Switchgear and Protective Devices

6.0 Relevance to Real World

SL. No	Real World Mapping
01	Electric breakdown in gases, liquid and solid dielectrics.
02	High voltage AC, DC and impulse generation in power research laboratory for testing.
03	High voltage and current measurements in research laboratory for testing.
04	Overvoltage Phenomenon and Insulation Coordination in Electric Power Systems.
05	Non-destructive test techniques in high voltage engineering. High voltage tests on power system apparatus and switchgear such as circuit breakers, insulators, transformers and cables in site and research laboratory.

7.0 Gap Analysis and Mitigation

Sl. No	Delivery Type	Details
01	Practical Assignment	Practical assignments will be given to the students to study electric breakdown in gases, liquids and solid dielectrics and generation and measurement of different forms of high voltages in laboratory and testing of high voltage power system apparatus and switchgears.
02	Power point presentation	Topic related to High voltage engineering subject.

8.0 Books Used and Recommended to Students

Text Books
1. **High Voltage Engineering** by M. S. Naidu and Kamaraju- 5th Edition, McGraw Hill. 2013.
Reference Books
1.**High Voltage Engineering Fundamentals** by E.Kuffel and W.S. Zaengl, 2nd Edition, Newnes 2000. 2. **High Voltage Engineering** by C.L.Wadhwa, New Age International Private limited, 3rd Edition 2012. 3.**High-Voltage Test and Measuring Techniques** by Wolfgang Hauschild&Eberhard Lemke, Springer 1st Edn.2014. 4. **High Voltage Engineering by** Farouk A.M. Rizk , CRC Press ,1st Edition2014 .
Additional Study material & e-Books
1. High Volatge test and measuring techniques: Springer 2. High voltage and electrical insulation engineering by Ravindra Arora

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

Website and Internet Contents References
1)www.nptelviodes.in 2)www.freevideolectures.com

10.0 Magazines/Journals Used and Recommended to Students

Sl.No	Magazines/Journals	website
1	IET Digital library	***www.digital-library.theiet.org/content/journals/hve***
2	High Voltage Engineering	www.oriprobe.com/journals/gdyjs.html
3	IEEE Electrical Insulation engineering	***http://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=57***

11.0 Examination Note

Scheme of Evaluation for CIE (40 Marks)

- Internal Assessment test will be done in the same pattern as that of the main examination.

Internal Assessment: 50 Marks scaled down to 30 Marks

Assignment: 10 Marks

SCHEME OF EXAMINATION: 100 Marks, scaled down to 60 in VTU result sheet.

The question paper will have ten questions.

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

12.0 Course Delivery Plan

Module No.	Lecture No.	Content of Lecture	% of Portion
2	1	HV transformer, Need for cascade connection and working of transformers units connected in cascade.	20%
	2	Resonant Transformers. Tesla coil.	
	3	HV DC- voltage double circuits	
	4	Voltage Multiplier circuits: Cock croft- Walton type high voltage DC set	
	5	Calculation of high voltage regulation and ripple	
	6	Optimum number of stages for minimum voltage drop.	

	7	Introduction to standard lightning and switching impulse voltages, Analysis of single stage impulse generator-expression for Output impulse voltage	
	8	Multistage impulse generator- working of Marx impulse generator, Rating of impulse generator, Components of multistage impulse generator	
	9	Generation of switching impulse voltage, Generation of high impulse current	
	10	Tripping and Control of Impulse Generators.	
3	11	Series resistance micro ammeter for HV DC measurements	20%
	12	Generating voltmeter- Principle, construction	
	13	Standard sphere gap measurements of HV AC, HV DC and impulse voltages	
	14	Factors affecting the measurements	
	15	Electrostatic voltmeter-principle, construction	
	16	Chubb and Fortescue method for HV AC measurement	
	17	Resistance potential dividers	
	18	Capacitance dividers, Mixed RC potential dividers	
	19	Measurement of High Currents – Direct, Alternating and Impulse	
	20	Cathode Ray Oscillographs for Impulse Voltage and Current Measurements.	
1	21	Gases as Insulating Media, Collision Process	20%
	22	Ionization processes	
	23	Townsend's Current Growth Equation, Current Growth in the Presence of Secondary Processes, Townsend's Criterion for Breakdown.	
	24	Experimental Determination of Coefficients of α and γ, Breakdown in Electronegative Gases, Time Lags for Breakdown.	
	25	Streamer Theory of Breakdown in Gases.	
	26	Paschen's Law, Breakdown in Non-Uniform Fields and Corona Discharges.	
	27	Liquids as Insulators, Pure Liquids and Commercial Liquids, Conduction and Breakdown in Pure Liquids.	
	28	Conduction and Breakdown in Commercial Liquids	
	29	Breakdown in Solid Dielectrics:Introduction, Intrinsic Breakdown,	
	30	Electromechanical Breakdown, Thermal Breakdown.	
4	31	Natural Causes for Over voltages	20%
	32	Lightning Phenomenon	
	33	Overvoltage due to Switching Surges	
	34	Switching over voltages in EHV and UHV systems	
	35	System Faults and Other Abnormal conditions	
	36	Protection of Transmission lines against overvoltages.	
	37	Principles of Insulation Coordination: Surge Arresters	
	38	Protection of lines with Surge Arresters.	
	39	Insulation Coordination in EHV and UHV Systems	
	40	Measurement of Dielectric Constant and Loss Factor: Introduction	20%
	41	HV Schering Bridge	
	42	Transformer ratio arm bridges	
	43	Detectors in Dielectric Measurements	
	44	Partial Discharge Measurements: Introduction	
	45	Discharge detection using Straight Detectors and Balanced Detection method	
	46	Testing of Insulators and Bushings	
	47	Tests on isolators, circuit breakers	
	48	Tests on cables, Tests on transformers	
	49	Testing of Surge Arrestors, Radio Interference Measurements	
	50	Testing of HVDC Valves and Equipment	

13.0 Assignments

Sl. No	Title	Outcome expected	Allied study	Week No.	Individual / Group activity	Reference: book/website /Paper
1	Assignment 1: Questions onGeneration of High voltages and Currents.	Students will be able to explain different techniques of high voltage AC, DC and Impulse generation and solve examples.	Module 2 of the syllabus	5	Individual Activity.	Books 1, 2&3 of the book list
2	Assignment 2: Questions on Measurement of high voltages and currents	Students will be able to explain different techniques of high voltage and current measurements and solve examples.	Module 3 of the syllabus	7	Individual Activity.	Books 1, 2&3 of the book list.
3	Assignment 3: Questions on conduction and breakdown in gases, liquid and solid dielectrics.	Students will be able toexplain breakdown theories in different dielectrics, Paschen's law, Time lags of breakdown	Module 1 of the syllabus	10	Individual Activity.	Books 1, 2&3 of the book list.
4	Assignment 4: Questions onOvervoltage Phenomenon and Insulation Coordination in Electric Power Systems	Students will be able toexplainOvervoltage Phenomenon and Insulation Coordination in Electric Power Systems	Module 4 of the syllabus	12	Individual Activity.	Books 1, 2&3 of the book list
5	Assignment 5: Questions on non-destructive Testing of materials and HV testing of electrical apparatus	Students will be able to explain Non-destructive test techniques and testing of Transformer, Insulator,CB Cables and Surge Arrestors	Module 5 of the syllabus	16	Individual Activity.	Books 1, 2&3 of the book list

14.0 QUESTION BANK

Module 1:

1. What is ionization?Explain the different types of primary and secondary ionization processes of a gaseous insulation subjected to high voltage.
2. Explain Townsend's theory of gaseous breakdown. Derive the equations for the current growth and the Townsend's criterion for breakdown.
3. Explain in detail the streamer mechanism of breakdown in gases.
4. Explain briefly formative time lag and statistical time lag.
5. What are electronegative gaes? Why the breakdown strength of these gases higher is compared to that of other gases?
6. What is Paschen's law? How do you account for the minimum voltage for breakdown under a given 'pxd' condition?

7. Briefly explain "Cavitation and Bubble theory" in the context of liquid dielectric breakdown.
8. Discuss the electrical properties that determine the dielectric performance of liquid dielectrics?
9. What is "Stressed oil volume theory" and how does it explain breakdown in large volume of commercial dielectrics?
10. Explain the different mechanisms by which breakdown occurs in solid dielectrics in practice.
11. Explain the terms dielectric strength,electric field intensity and electron negativity related to breakdown process of gases.
12. Explain thermal breakdown in solid dielectrics and how it is more significant than other breakdown mechanisms.
13. Define Townsend's first and second ionization coefficients.Explain the Townsend's criterion for breakdown.
14. Explain the various factors which deteriorate the strength of dielectric materials used in various electrical equipments
15. Explain any two theories that explain breakdown in commercial liquid dielectrics.

Module 2:

1. Explain with diagrams, different types of rectifier circuits for producing high voltages.
2. Explain with circuit diagram, the working of simple voltage doubler circuit for generation of D.C high voltage.
3. Explain the different schemes for cascade connection of transformers for producing very high a.c. voltages.
4. loadWhy is a Cockcroft-Walton circuit preferred for voltage multiplier circuits? Explain its working with a schematic diagram.
5. Explain Cock Croft Walton voltage Multiplier circuit with neat circuit diagram. Show input and output wave form with certain.
6. Explain the no-load operation of a CockCroft- Walton voltage Multiplier circuit.
7. Derive expressions for ripple and voltage drop in cascaded voltage multiplier circuit.
8. State the chief advantages of resonant transformers.
9. What is tesla coil? How are damped high frequency oscillations obtained from a Tesla coil.
10. What is the principle of operation of a resonant transformers? How is it advantageous over the cascade connected transformers?
11. Define the front and tail times of an impulse wave. What are the tolerances allowed as per specification?
12. Give the different circuits that produce impulse waves, explain clearly their merits and demerits.
13. How will you specify impulse generator? Describe the working of a multistage Marx impulse generator with a neat sketch. How is the basic arrangement modified to accommodate the wave time control?
14. Explain the different methods of producing switching impulses in the test laboratories.
15. Outline the method of tripping a multistage impulse generator using three electrode gap arrangements.
16. What is trigatrongap? Explain its function and operation.
17. Define an impulse wave and show that the output voltage of impulse generation circuit is double exponential in nature.
18. Give the general equation of a standard impulse wave and explain the wave shape giving the percentage tolerances allowed for front, tail and the peak.
19. Discuss the components of a multistage impulse generator of less than 1MV.

Module 3:

1. Explain the working principle of series capacitor peak voltmeter based on Chubb-Fortesque method.
2. Briefly explain factors influencing spark over voltage of sphere gap.
3. Write a short note on MIX- RC potential dividers.
4. Explain the principle of measurement of high AC voltage using sphere gap & discuss the effect of atmosphere condition for its calibration.
5. Describe the construction & working of Electrostatic voltmeter. State its advantages & limitations.
6. Write a short note on the resistance dividers.
7. Draw a neat schematic diagram of generating voltmeter & explain its operation & discuss its applications.
8. Which are the four main sources of errors in the measurements of impulse voltages with potential dividers?
9. Explain the Chubb- Fortesque method for peak voltage measurement. Bring out the sources that contribute to the errors in the measurement.
10. Explain the importance of Sphere gap in Measurement of high voltages and high currents.
11. How Capacitance Potential Dividers are used for the impulse voltage measurements.

Module 4:

1. Explain the different theories of charge formation in clouds.

2. What are the mechanisms by which lighting strokes develop and induce overvoltages on overhead power lines.

3. Give the mathematical models for lighting discharges and explain them

4. What are the causes for switching and power frequency overvoltages? How are they controlled in power systems

5. What are the different methods employed for lightning protection of overhead lines?

6. What is a surge arrester? Explain its function as a shunt protective device.

7. What is meant by insulation co-ordination? How are the protective devices Chosen for optimal insulation level in a power system?

8. Explain the different aspects of insulation design and insulation co-ordination

Module 5:

1. What are partial discharges & how are they detected under power frequency operating conditions?
2. Discuss the method of balanced detection for locating partial discharges in electrical equipment.
3. Explain the method of measurement of capacitance and tan ∂ using H.V. Schering bride.
4. Why partial discharge tests are performed on H.V. cables? Describe partial discharge testing of cables.
5. Write a short note on Transformer ratio Arm Bridge.
6. Explain the method of measuring dielectric loss at power frequency using high voltage Schering Bridge.
7. Explain the partial discharge diction using straight detectors.
8. Define the following i) Disruptive discharge voltage ii) withstand voltage iii) 50% flash over voltage. iv)Creeping distance.
9. Explain the method of impulse testing of high voltage transformers. What is the procedure adopted for locating the failure.

10 Name and explain in brief different tests that are carried out on high voltage insulators.

11 What are the different power frequency tests done on insulators? Mention the procedure for testing.

12 Mention the different electrical tests done on isolators and circuit breakers.

13 Why is synthetic testing advantageous over the other testing methods for short circuit tests? Give the layout for synthetic testing.

14 What is the significance of impulse tests? Briefly explain the impulse testing of insulators.

Prepared by	Checked by		
			
Prof. O. B. Heddurshetti	**Prof. O. B. Heddurshetti**	**HOD**	**Principal**

Subject Title	**MICROCONTROLLER LABORATORY**		
Subject Code	18EEL57	**IA Marks**	40
No. of Practical hrs./Week	0:2:2	**Exam Marks**	60
Credits	02	**Exam Hours**	03

FACULTY DETAILS:		
Name: Prof. Mahesh Yenagimath	**Designation:** Asst. Professor	**Experience:** 16.5 Years
No. of times course taught: 03	**Specialization:** VLSI Circuits and Design	

1.0 Prerequisite Subjects:

Sl. No	Branch	Semester	Subject
01	Electrical & Electronics Engineering	V	Microcontrollers

2.0 Course Objectives

1. To explain writing assembly language programs for data transfer, arithmetic, Boolean and logical instructions.
2. To explain writing assembly language programs for code conversions.
3. To explain writing assembly language programs using subroutines for generation of delays, counters, configuration of SFRs for serial communication and timers.
4. To perform interfacing of stepper motor and dc motor for controlling the speed.
5. To explain generation of different waveforms using DAC interface.

3.0 Course Outcomes

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

CO	Course Outcome	Cognitive Level	Pos
C307.1	Write assembly language programs for data transfer, arithmetic, Boolean and logical instructions.	L1, L2, L3, L4	PO1, PO2, PO5, PO9,PO10
C307.2	Write ALP for code conversions.	L1, L2, L3, L4	PO1, PO2, PO5, PO9,PO10
C307.3	Write ALP using subroutines for generation of delays, counters, configuration of SFRs for serial communication and timers.	L1, L2, L3, L4	PO1, PO2, PO5, PO9,PO10
C307.4	Perform interfacing of stepper motor and dc motor for controlling the speed.	L1, L2, L3, L4	PO1, PO2, PO5, PO9,PO10
C307.5	Generate different waveforms using DAC interface.	L1, L2, L3, L4	PO1, PO2, PO5, PO9,PO10
C307.6	Perform interfacing of LCD, Elevator, ADC and temperature controller to 8051.	L1, L2, L3, L4	PO1, PO2, PO5, PO9,PO10

4.0 Course Content

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 operations for 16 bit numbers.
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 ASCII, Hexa to decimal and decimal to hexa.
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 / Relevance
01	VIII	Project Work	Programming in C and Assembly language, interfacing

6.0 Relevance to Real World

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

7.0 Books Used and Recommended to Students

Text Books
1. The 8051 Microcontroller and Embedded Systems Using Assembly and C , Muhammad Ali Mazadi, Pearson , 2nd Edition, 2008.
Reference Books
1. The 8051 Microcontroller, Kenneth Ayala, Cengage Learning, 3rd Edition, 2005. 2. The 8051 Microcontroller and Embedded Systems, Manish K Patel, McGraw Hill,2014. 3. Microcontrollers: Architecture, Programming, Interfacing and System Design, RajKamal, Pearson, Ist Edition 2012.
Additional Study material & e-Books
1. Architecture and programming of 8051 microcontrollers by Milan verle- mikroelektronika-2010.

8.0 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/

9.0 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

10.0 Examination Note

CIE marks:

Scheme of Evaluation for CIE (40 Marks)

(a) Continuous Assessment: **24 marks**

(b) Internal Assessment test in the same pattern as that of the main examination: **16 marks.**

Write up- 3 marks
Conduction and Result- 10 marks
Viva Voce- 3 marks

Conduct of Practical SEE:

1. Students can pick one experiment from the questions lot prepared by the examiners.
2. Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.

11.0 Course Delivery Plan

Expt. No.	Aim of the Experiment	% of Portion
1	a) Write a program to move a block of internal memory. b) Write a program to exchange a block of internal memory. c) Write a program to move a block of external memory. d) Write a program to exchange a block of external memory. e) Write a program to find largest number in array. f) Write a program to find smallest number in the array. g) Write a program to arrange numbers in ascending order. h) Write a program to arrange numbers in descending order.	7.69
2	a) Write an ALP to find addition of two 8 bit numbers. b) Write an ALP to find subtraction of two 8 bit numbers. c) Write an ALP to find multiplication of two 8 bit numbers. d) Write an ALP to find division of two 8 bit numbers. e) Write an ALP to square of a 8 bit numbers. f) Write an ALP to cube of a 8 bit numbers. g) Write an ALP to find addition of two 16 bit numbers. h) Write an ALP to find subtraction of two 16 bit numbers. i) Write an ALP to square of a 16 bit numbers.	7.69
3	a) Write a program to generate Hex up counter. b) Write a program to generate Hex down counter. c) Write a program to generate BCD up counter d) Write a program to generate BCD down counter.	7.69
4	a)Write an ALP to compute the following. IF X=0; THEN NUM1 (AND) NUM2, IF X=1; THEN NUM1 (OR) NUM2, IF X=2; THEN NUM1 (XOR) NUM2, ELSE RES =00, RES IS 23H LOCATION Using logical instructions in byte level.	7.69
5	a) Write a program to toggle all the bits of port 1 by sending the values continuously using call and return instructions. b) Write an ALP to find factorial of a number using call and return instructions	7.69
6	a) Write a program to convert hexadecimal number to decimal number. b) Write a program to convert decimal number to hexadecimal number. c) Write a program to convert packed BCD number to ASCII number. d) Write a program to convert ASCII number to BCD number.	7.69
7	a) Write an ALP to toggle the content of port 0 continuously using timer delay in between. b) Write an ALP to transmit characters to a PC HyperTerminal using the serial port and display on the serial window.	7.69
8	a) Write a C program to rotate stepper motor in clockwise/anticlockwise direction.	7.69
9	a) Write a C program to show the on off control of DC motor.	7.69
10	a) Write a C program to send letters to LCD using delays.	7.69
11	a) Write a program to generate Square wave using DAC interface to 8051. b) Write a program to generate Ramp wave using DAC interface to 8051. c) Write a program to generate Triangular wave using DAC interface to 8051. d) Write a program to generate Sine wave using DAC interface to 8051.	7.69
12	a) Write a C program to interface ADC to measure temperature.	7.69
13	a) Write a C program to show control and operation of elevator using 8051.	7.69

12.0 QUESTION BANK

1. What are the differences between a microprocessor and microcontroller?
2. What are the features of MSP430?
3. Why MSP430 is best suited for Low power embedded systems?
4. List the salient features of 8051 microcontroller.
5. Define microcontroller and differentiate the RISC and CISC processors.
6. Explain the memory organization in 8051 controller.
7. Which bits in which registers must be set to give the serial data interrupt the highest priority?
8. Which port has no alternate functions?
9. Which ports are used for external memory access?
10. What is addressing mode? Explain different addressing modes with examples.
11. Specify memory area for bit level logical addressing modes with examples.
12. Write an assembly language program to add two input data's of 16-bit result in three different addressing Modes.
13. Explain the following instructions with suitable examples.
    i) SWAP ii) MOVX iii) XCHD iv) DAA
14. Write an assembly language program using 8051 mnemonics to convert 2 digits BCD to binary.
15. What is stack? Explain with examples the PUSH and POP instructions
16. What does the following instruction do/ "MOV A, 0F0H"
17. What does the following instruction do/ "MOV A, 1FH"
18. Write one instruction each using the following addressing modes:
    i) immediate ii) register iii) register indirect iv) direct
19. Write a program to generate a square wave with 75% duty cycle on bit P1.5.
20. Write a program to generate a square wave with 50% duty cycle on bit P2.7.
21. Explain the following instructions with their function byte and cycle used
    i) CJNE dest, source target ii) A call target
    iii) DJNZ R1, rel ; iv) SWAP A
22. Explain the different types of jump instructions in 8051.
23. What is interrupt? List different interrupts using 8051 with their ISR address.
24. Differentiate between JMP and call instruction. Explain with suitable examples the different ranges associated with call instructions.
25. How is the stack used in case of CALL instruction?
26. Show code for a nested loop to perform an action 1000 times.
27. Why o the PUSH and POP instructions in a subroutine need to be equal in number?
28. Why do we need subroutines?
29. When CALL is executed, how many bytes of stack are used?
30. Write a 8051 C program to toggle all bits of port P0 continuously. Use timer 0 generate the delay of 1 sec between each toggle.
31. Write a C program to toggle all bits of P0 and P2 continuously with 250m sec delay. Use inverting operator.
32. What is data serialization? Explain different types of examples.
33. Write an 8051C program to convert a given hex-data 0FF into its equivalent decimal data and display the Result digits on P0,P1 and P2.
34. Write an assembly language program to realize an exclusive OR gate. Assume P1.0 and P1.1 as inputs and P2.0 as output bit.
35. Explain Lcall and Scall instructions in 8051.
36. Give three factors that can affect time delay code size in 8051micoconroller.
37. Explain why various 8051 C compiles produce different hex file sizes.
38. Write an 8051 C program to count from 0-99 continuously.
39. Write a time delay function for 100ms.
40. Explain TMOD mod and TCON registers with its bit pattern.
41. How is the TMOD register modified to make each of the timers operate as counters?
42. What is the difference between the operation of timer and counter?

43. Which pins are used as external count pins?
44. How can an external frequency be counted using the 8051?
45. Which of the timer can be used as event counters?
46. Explain the importance of TI and RI flags.
47. What is the role of MODEM in serial communication?
48. What are the different type of modulation techniques used in MODEM.
49. Explain serial port of 8051
50. Explain the significance of SCOW register.
51. Distinguish between half duplex and full duplex mode of communication.
52. Distinguish between synchronous and asynchronous data transfer.
53. Which are the minimum signals required in serial data transfer?
54. What is the role of SBUF register in serial data transfer?
55. What is key bouncing? Hw it is eliminated?
56. What address in the interrupt vector table is assigned to Timer 1?
57. How many hardware interrupts hast the 8051.How are they activated?
58. Explain the salient features of an ADC.
59. Explain the registers and pins of LCD
60. Determine why it is important to employ some kind of debounce subroutine in a keyboard program.
61. Which pin connection of the 8051 has to be changed, if external program ROM is to be added to the system?
62. What is the maximum capacity of a data RAM that can be directly connected to 8051.

13.0 University Result

Examination	S	A	B	C	D	E	F	% Passing
2021-22	14	04	-	01	-	-	-	100
2020-21	12	13	03	01	-	-	-	100

Prepared by	Checked by		
22/9/2022	22/9/2022	26/9/22	
Prof. M. P. Yenagimath	Prof. M. P. Yenagimath	HOD	Principal

Subject Title	POWER ELECTRONICS LABORATORY		
Subject Code	18EEL58	CIE Marks	40
No of Practical Hrs/ Week(L:T:P)	0:2:2	SEE Marks	60
Total No of Practical Hrs	50	Exam Hours	03

FACULTY DETAILS:		
Name: Dr. B. V. Madiggond	**Designation:** Professor & HoD	**Experience:** 29 Years
No. of times course taught: 03	**Specialization:** Power Electronics	

1.0 Prerequisite Subjects:

Sl. No	Branch	Semester	Subject
01	Electrical and Electronics Engineering	I/II	Basic Electrical Engineering
02	Electrical and Electronics Engineering	III	Electric Circuit Analysis
03	Electrical and Electronics Engineering	III	Analog Electronic Circuit

2.0 Course Objectives

- To conduct experiments on semiconductor devices to obtain their static characteristics.
- To study different methods of triggering the SCR.
- To study the performance of single phase controlled full wave rectifier and ACVoltage controller with R and RL loads.
- To control the speed of a DC motor, universal motor and stepper motors.
- To study single phase full bridge inverter connected to resistive load.

3.0 Course Outcomes

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

CO	Course Outcome	RBT Level	POs
CO 308.1	Analyze the static characteristics of semiconductor devices to discusstheir performance.	L1, L2, L3, L4, L5	1,2,9,10
CO 308.2	Experiment with different methods of triggering the SCR.	L1, L2, L3, L4, L5	1,2,9,10
CO 308.3	Verify the performance of single phase controlled full wave rectifier and AC voltage controller with different types of load conditions.	L1, L2, L3, L4, L5	1,2,9,10
CO 308.4	Determine the speed control of a stepper motor, universal motor andDC motors using different types of converter.	L1, L2, L3, L4, L5	1,2,9,10
CO 308.5	Experiment with single phase MOSFET/IGBT based PWM inverter.	L1, L2, L3, L4, L5	1,2,9,10
Total Hours of instruction		**42**	

4.0 Course Content

Sl. No.	Experiments
1	Static Characteristics of SCR.
2	Static Characteristics of MOSFET and IGBT.
3	Characteristic of TRIAC.
4	SCR turn on circuit using synchronized UJT relaxation oscillator.
5	SCR digital triggering circuit for a single phase controlled rectifier and ac voltage regulator.
6	Single phase controlled full wave rectifier with R load, R –L load, R-L-E load with and without freewheeling diode.
7	AC voltage controller using TRIAC and DIAC combination connected to R and RL loads.
8	Speed control of DC motor using single semi converter.
9	Speed control of stepper motor.
10	Speed control of universal motor using ac voltage regulator.
11	Speed control of a separately excited D.C. Motor using an IGBT or MOSFET chopper.
12	Single phase MOSFET/IGBT based PWM inverter.

5.0 Relevance to future subjects

SL. No	Semester	Subject	Topics / Relevance
01	VIII	Project work	Use of Power semiconductor devices, power converters for different applications

6.0 Relevance to Real World

SL. No	Real World Mapping
01	UPS and SMPS
02	Inverters used for domestic and commercial purpose
03	Rectifier and inverter stations used in HVDC transmission system

7.0 Books Used and Recommended to Students

Text Books
1. Power Electronics: Circuits Devices and Applications, Mohammad H Rashid,4th Edition, 2014 .
Reference Books
1. Power Electronics: Converters, Applications and Design, Ned Mohan at el, 3rd Edition, 2014. 2. Power Electronics, Daniel W Hart, 1st Edition, 2011. 3. Elements of Power Electronics, Philip T Krein, Indian Edition, 2008.
Additional Study material & e-Books
1. Power Electronics, J. S. Chitode

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

Website and Internet Contents References
1) www.rejinpaul.com/.../vtu-**eee-notes**
2) https://www.vssut.ac.in/lecture_notes/lecture1424354515.pdf
3) www.vtuupdates.com
4) www.nptelvideos.in/2012/11/power-electronics.html

9.0 Magazines/Journals Used and Recommended to Students

Sl. No	Magazines/Journals	website
1	International Journal of Power Electronics and Drives Systems	***iaesjournal.com/online/index.php/IJPEDS***
2	Journal of Power Electronics	***www.jpe.or.kr/***
3	IEEE Transactions on Power Electronics	***ieeexplore.ieee.org/***

10.0 Examination Note

Internal Assessment:

Scheme of Evaluation for CIE (40 Marks)

(a) Internal Assessment test in the same pattern as that of the main examination: 16 marks.
Writeup-03 marks, Conduction-10 marks, Viva-Voce-03 marks

(b) Continuous assessment for laboratory experiments: 24 marks.

SCHEME OF EXAMINATION: 100 Marks, scaled down to 60 in VTU result sheet.

One question is to be set for100marks.

a) Write-up: 15% of Maximum marks b) Conduction: 70% of Maximum marks

c) Viva-voce: 15% of Maximum marks

11.0 Course Delivery Plan

Expt No	Lecture / Practical No	Name of the Experiment	% of Portion
1	1	Static Characteristics of SCR.	8.33
2	2	Static Characteristics of MOSFET and IGBT.	8.33
3	3	Characteristic of TRIAC.	8.33
4	4	SCR turn on circuit using synchronized UJT relaxation oscillator.	8.33
5	5	SCR digital triggering circuit for a single phase controlled rectifier and ac voltage regulator.	8.33
6	6	Single phase controlled full wave rectifier with R load, R –L load, R-L-E load with and without freewheeling diode.	8.33
7	7	AC voltage controller using TRIAC and DIAC combination connected to R and RL loads.	8.33
8	8	Speed control of DC motor using single semi converter.	8.33
9	9	Speed control of stepper motor.	8.33
10	10	Speed control of universal motor using ac voltage regulator.	8.33
11	11	Speed control of a separately excited D.C. Motor using an IGBT or MOSFET chopper.	8.33
12	12	Single phase MOSFET/IGBT based PWM inverter.	8.33

12.0 QUESTION BANK

1. Sketch the V-I characteristics of an SCR without gate current and with gate current.
2. What is the advantage of SCR over power Transistor?
3. What is the constructional difference in an inverter Thyristor and converter grade Thyristor?
4. List the methods of turning ON of SCR.
5. Define latching current, Holding current, Break over voltage. Show these on the V-I characteristics of SCR.
6. What is the turn-on time of a Thyristor?
7. What is the turn-off time of a Thyristor?
8. Why is SCR called as latching device?
9. Why pulse triggering of SCR is preferred over single or DC triggering?
10. List the important ratings of SCR.
11. What purpose a resistor in series with gate serves?
12. Sketch the characteristics of Triac.
13. What are the terminals of Triac?
14. Explain the operation of Triac in different modes.
15. In which modes is the Triac more sensitive?
16. What are the applications of Triac?
17. What is a MOSFET?
18. What are the types of MOSFET?
19. What are the differences between enhancement type and depletion type MOSFET?
20. What is pinch-off voltage of MOSFETs?
21. What is threshold voltage of MOSFET?
22. What are the transfer characteristics of MOSFET?
23. What are the output characteristics of MOSFET?
24. Why do the MOSFETs not require negative gate voltage during turn-off?
25. What is the turn-on time of a MOSFETs and IGBTs?
26. What is the turn-off time of a MOSFETs and IGBTs?
27. What do you mean by commutation?
28. Distinguish between natural commutation and forced commutation.
29. How are the forced turn-off methods classified?
30. State the conditions under which a load carrying SCR can be successfully commutated.
31. What are the purposes of commutation circuit?
32. What is forced commutation?
33. What are the different methods of commutation schemes?
34. What is DC chopper?
35. What is pulse width modulation control of a chopper?
36. What is frequency modulation control of a chopper?
37. What do you mean by auxiliary commutation?
38. What do you mean by permanent magnet stepper motor?
39. What do you mean by half step and full step motor?
40. What are applications of stepper motor?
41. What are various means of speed control of a induction motor?
42. What is a duty cycle?
43. What is the purpose of a converter in dc drives?
44. What are the parameters to be varied for speed control of separately excited dc motors?
45. What do you mean by line commutation?
46. What is one-quadrant DC drive?

47. What is two-quadrant DC drive?
48. What is four-quadrant DC drive?
49. What are the advantages of UJT triggering circuit?
50. What is a converter?
51. What is the principle of ac-dc conversion?
52. What are the performance parameters of rectifier?
53. What is the difference between a half controlled and fully controlled converter?
54. In a fully controlled single phase bridge, why does negative part of the input voltage cycle appear across load, if load is inductive but not with resistive load.

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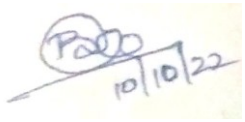		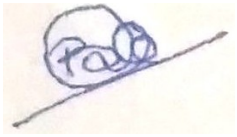	
Dr. B. V. Madiggond	**Prof. M. P. Yenagimath**	**HOD**	**Principal**