



### **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 by 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**

To educate students with core knowledge of electrical and electronics engineering by developing problem solving skills, professional skills, social awareness to excel in their career.

### **PROGRAM EDUCATIONAL OBJECTIVES (PEO's) :**

1. Posses successful careers in Electrical Sciences & apply the knowledge of mathematics & Engineering fundamentals to analyze & formulate the solution to solve real time problems.
2. Excel in academics, industry, entrepreneurship, administrative services through lifelong learning.
3. Exhibit professional & ethical values, effective communication skills, teamwork skills, multidisciplinary approach & an ability to realize engineering issues to broader social context.

### **PROGRAM OUTCOMES (PO's) :**

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 modelling 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 (PSO's) :**

1. An ability to demonstrate knowledge & competencies to analyze & design electrical & electronics circuits, control and power systems, machines & industrial drives.
2. An ability to use software tools for the design, simulation and analysis of electrical and electronics systems.

**Contents of III-SEM**

S N	TOPIC
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5	Institute Academic Calendar
6	Department Academic Calendar
7	Scheme of Teaching & Examination III- Semester
	<b>Theory – Course Plans , Question Bank &amp; Assignment Questions</b>
	17MAT31- Engineering Mathematics-III-M-3
	17EE32-Electric Circuit Analysis-ECA
	17EE33-Transformers & Generators-T&G
	17EE34-Analog Electronic Circuits-AEC
	17EE35- Digital System Design-DSD
	17EE36-Electrical & Electronic Measurements -EEM
	<b>Laboratory – Course Plan and Viva Questions</b>
	17EEL37-Electrical Machine's Laboratory-IM/C Lab-1
	17EEL38-Electronics Lab- EC Lab
	17KL/CPH39/49-Kannada, Constitution of India Professional ethics and human rights

**1.0 Student Help Desk**

SL. No	Particulars	Contact Person	
		Faculty	Instructor
1	Attestations	Dr. B. V. Madiggond	--
2	Exam forms signature, Overall department administration, Counseling/interaction with parents.		--
3	Research Centre Coordinator	Dr. S.B.Hadadi	--
4	Academic Coordinator	Prof. S.B.Patil	--
5	Online submission of exam form/revaluation form to VTU, IA coordinator, Wall Magazine	Prof. S S Birade	Shri.V.N.Kamate Shri.S.B.Beelur
6	Department Association Coordinator	Prof. S. B. Patil, Prof.A.U.Neshti	--
7	Dept NBA Coordinator	Prof.M.P.Yanagimath	--
8	AICTE/VTU,NIRF	Prof. K. B Negalur	Sri. R. S. Bardol
9	Dept.TP Cell Coordinator	Prof. O. B. Heddurashetti	Sri. V. N. Kamate
10	Dept Alumni, Internship, III Cell Coordinator	Prof. P M Murari	--
11	Dept Robovidya, Website, IEEE, ISTE coordinator	Prof. S.G.Huddar	Sri. V.M.Mutalik, Shri.R.S.Bardol, Shri.V.N.Kamate
12	Department Library Coordinator	Prof. Amit U Nesthi	Sri.S.B.Beelur
13	Department News Letter Coordinator	Prof. S.B.Patil	Sri.V.M.Mutalik
14	Project Coordinator	Prof. M.P.Yanagimath	--
15	Seminar Coordinator	Prof. M.P.Yanagimath	--
16	Dept meeting Coordinator	Prof.H.R.Zinage	--

**HIRASUGAR INSTITUTE OF TECHNOLOGY NIDASOSHI**

SL. No	Particulars	Contact Person	
		Faculty	Instructor
13	Electrical Maintenance	Prof.S.D.Hirekodi	--
14	Warden HIT Ladies Hostel	Prof.H.R.Zinage	--
15	Chief Alumini Coordinator	Prof.O.B.Heddurshetti	--
16	Extra Curricular/Sports/Cultural activates Institute industry Engineering Coordinator	Prof.A.U.Neshti	--
17	Institute level III cell Convener, OBC cell Convener	Prof.P.M.Murari	--
18	Examination committee member, News/Publicity committee member	Prof.S.S.Birade	--
19	SC/ST cell Convener, Entrepreneurship cell Coordinator, Discipline cell Coordinator	Prof. K. B. Negalur	--
20	IEEE, News/Publicity committee member	Prof.S.G.Huddar	-
19	Dispensary	Dr. Arun G. Bullannavar	Contact No. 9449141549

## 2.0 Departmental Resources

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

## 2.1 Faculty Position

S.N.	Category	No. in position	Average experience
1	Teaching faculty	13	16
2	Technical supporting staff	4	20
3	Helper	2	15

## 2.2 Major Laboratories

SN	Name of the Laboratory	Carpet Area (Sq.mt)	Total investment till date
1.	Electronics Lab	92	576516.80
2.	Operational Amplifiers & Linear IC Lab	72	111537.00
3.	Power Electronics Lab	92	770111.00
4.	Microcontroller Lab	72	582174.00
5.	DSP Lab		
6.	Control System Lab	72	212755.00
7.	Electrical Machines Lab	200	807672.00
8.	Relay & HV Lab	138	603254.00
9.	Power System Simulation Lab	71	1126601.00
10.	Computer Aided Electrical Drawing Lab	71	650988.43
<b>Grand Total :</b>			<b>5441609.00</b>

**3.0 Teaching Faculty Details**

S.N.	Faculty Name	Designation	Qualification	Area of specialization	Professional membership	Industry Experience (in years)	Teaching Experience (in years)	Contact Nos.
1.	Dr.B.V.Madiggond	HOD/Prof	Ph.D	Power Electronic	LMISTE, YH AI	-	25	9343454993
2.	Dr. Hadadi S. B.	Prof.	Ph. D	Power System	IEEE, LMISTE	2	22	9916374020
3.	Prof. S. B. Patil	Asst. Prof.	M. Tech	Power & Energy System	LMISTE	-	33	8050234360
4.	Prof.V.B.Dhere	Asst.Prof	M.Tech, (Ph.D)	Electronics & Telicommunication	LMISTE, IMPARC	4	21	9886597573
5.	Prof. S. D. Hirekodi	Asst. Prof.	M. Tech.	Power Electronics	LMISTE	1	18	9480849338
6.	Prof. H. R. Zinage	Asst. Prof.	M. Tech	Power System	LMISTE	-	18	9480849335
7.	Prof. M. P. Yanagimath	Asst. Prof.	M.Tech (Ph.D)	VLSI & ES	LMISTE	1	13	9341449466
8.	Prof. O. B. Heddurshetti	Asst. Prof.	M. Tech.	Power Electrics	LMISTE	1	11	9448120509
9.	Prof. A. U. Neshti	Asst. Prof.	M. Tech.	Digital Electronics	LMISTE	-	10	9538223362
10.	Prof. P. M. Murari	Asst. Prof.	M. Tech.	PS & PE	LMISTE	-	07	9739733001
11.	Prof. S. S. Birade	Asst. Prof.	M. Tech.	VLSI Design & ES	LMISTE	-	06	9945105480
12.	Prof. K. B. Negalur	Asst. Prof.	M. Tech.	Industrial Electronics	LMISTE	-	05	9886644507
13.	Prof. S. G. Huddar	Asst. Prof.	M. Tech.	Power System	LMISTE	-	05	9742066852

4.0 Institute Academic Calendar

	S J P N Trust's <b>Hirasugar Institute of Technology, Nidasoshi.</b> <i>Inculcating Values, Promoting Prosperity</i> Approved by AICTE New Delhi, Recognized by Govt. of Karnataka and Affiliated to VTU Belagavi.	Institute File I-11 2018-19 (Odd) Rev: 0
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CALENDAR OF EVENTS FOR THE ACADEMIC YEAR 2018-19


Date	Events																																																		
01-08-2018	Commencement of III/V Sem Classes	<b>August-2018</b> <table border="1"> <tr><td>S</td><td>M</td><td>T</td><td>W</td><td>T</td><td>F</td><td>S</td></tr> <tr><td></td><td></td><td></td><td>1</td><td>2</td><td>3</td><td>4</td></tr> <tr><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td></tr> <tr><td>12</td><td>13</td><td>14</td><td>15</td><td>16</td><td>17</td><td>18</td></tr> <tr><td>19</td><td>20</td><td>21</td><td>22</td><td>23</td><td>24</td><td>25</td></tr> <tr><td>26</td><td>27</td><td>28</td><td>29</td><td>30</td><td>31</td><td></td></tr> </table> 15- Independence day, 22-Bakrid	S	M	T	W	T	F	S				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31								
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08-09-2018 & 09-09-2018	Indoor Games																																																		
10-09-2018 to 12-09-2018	First Internal Assessment of III/V/VII Sem																																																		
14-09-2018 & 15-09-2018	Feed Back-1																																																		
15-09-2018	Engineers Day	<b>September-2018</b> <table border="1"> <tr><td>S</td><td>M</td><td>T</td><td>W</td><td>T</td><td>F</td><td>S</td></tr> <tr><td></td><td></td><td></td><td></td><td></td><td></td><td>1</td></tr> <tr><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td></tr> <tr><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td><td>14</td><td>15</td></tr> <tr><td>16</td><td>17</td><td>18</td><td>19</td><td>20</td><td>21</td><td>22</td></tr> <tr><td>23</td><td>24</td><td>25</td><td>26</td><td>27</td><td>28</td><td>29</td></tr> <tr><td>30</td><td></td><td></td><td></td><td></td><td></td><td></td></tr> </table> 13- Ganesh Chaturthi , 21-Moharam	S	M	T	W	T	F	S							1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30						
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17-09-2018	Display of First Internal Assessment Marks & Submission of Feedback-1 report to office																																																		
22-09-2018	EDP Activities																																																		
02-10-2018	Gandhi Jayanti & Swachh Bharat Abhiyan																																																		
15-10-2018 to 17-10-2018	First Internal Assessment of I Sem Second Internal Assessment of III/V/VII Sem																																																		
22-10-2018 & 23-10-2018	Feed Back-2																																																		
25-10-2018	Submission of Feedback-2 Report to Office																																																		
25-10-2018	Display of Second Internal Assessment Marks																																																		
28-10-2018	Compensatory Working Day of Connecting Holiday 20-10-2018 (Half Day)																																																		
01-11-2018	Kannada Rajyotsava	<b>October-2018</b> <table border="1"> <tr><td>S</td><td>M</td><td>T</td><td>W</td><td>T</td><td>F</td><td>S</td></tr> <tr><td></td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td></tr> <tr><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td></tr> <tr><td>14</td><td>15</td><td>16</td><td>17</td><td>18</td><td>19</td><td>20</td></tr> <tr><td>21</td><td>22</td><td>23</td><td>24</td><td>25</td><td>26</td><td>27</td></tr> <tr><td>28</td><td>29</td><td>30</td><td>31</td><td></td><td></td><td></td></tr> </table> 2- Gandhi Jayanti, 8- Mahalaya Amavasya, 18- Ayudha Pooja, 19- Vijayadashami, 24- Valmiki Jayanti	S	M	T	W	T	F	S		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31										
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18-11-2018	Compensatory Working Day of Connecting Holiday 07-11-2018																																																		
16-11-2018 to 18-11-2018	Second Internal Assessment of I Sem Third Internal Assessment of III/V/VII Sem																																																		
22-11-2018 to 24-11-2018	Lab Internal Assessment of III/V/VII Sem																																																		
28-11-2018	Display of Third & Final Internal Assessment Marks(III/V/VII Sem)																																																		
30-11-2018	Last Working Day of III/V Sem																																																		
04-12-2018	Last Working Day of VII Sem																																																		
03-12-2018 to 14-12-2018	Practical Exams of III/V Sem																																																		
17-12-2018 to 18-01-2019	Theory Exams of III/V Sem																																																		
06-12-2018 to 14-12-2018	Practical Exams of VII Sem																																																		
17-12-2018 to 18-01-2019	Theory Exams of VII Sem	<b>November-2018</b> <table border="1"> <tr><td>S</td><td>M</td><td>T</td><td>W</td><td>T</td><td>F</td><td>S</td></tr> <tr><td></td><td></td><td></td><td></td><td>1</td><td>2</td><td>3</td></tr> <tr><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td></tr> <tr><td>11</td><td>12</td><td>13</td><td>14</td><td>15</td><td>16</td><td>17</td></tr> <tr><td>18</td><td>19</td><td>20</td><td>21</td><td>22</td><td>23</td><td>24</td></tr> <tr><td>25</td><td>26</td><td>27</td><td>28</td><td>29</td><td>30</td><td></td></tr> </table> 1- Kannada Rajyotsava, 6- Naraka Chaturdashi, 8- Balipadyami, 21- Id-e-Milad, 26- Kanakadasa Jayanthi	S	M	T	W	T	F	S					1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30								
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04-02-2019 to 18-02-2019	Theory Exams of I Sem																																																		
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Dr. Shilpa Shrigiri  
IQAC Co-ordinator



Dr. S C Kamate  
PRINCIPAL

Hirasugar Institute of Technology  
NIDASOSHI-591 236

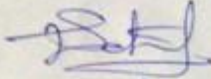


S J P N Trust's  
**Hirasugar Institute of Technology, Nidasoshi.**  
*Inculcating Values, Promoting Prosperity*  
 Approved by AICTE New Delhi, Recognized by Govt. of Karnataka and Affiliated to VTU Belagavi.


DLPT/111
File I
COE
2018-19 (odd)

**CALENDAR OF EVENTS FOR THE ACADEMIC YEAR 2018-19**

Date	Events	Calendar																																																								
01-08-2018	Commencement of III/V Sem Classes	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr><th colspan="7">August-2018</th></tr> <tr><th>S</th><th>M</th><th>T</th><th>W</th><th>T</th><th>F</th><th>S</th></tr> <tr><td></td><td></td><td></td><td>1</td><td>2</td><td>3</td><td>4</td></tr> <tr><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td></tr> <tr><td>12</td><td>13</td><td>14</td><td>15</td><td>16</td><td>17</td><td>18</td></tr> <tr><td>19</td><td>20</td><td>21</td><td>22</td><td>23</td><td>24</td><td>25</td></tr> <tr><td>26</td><td>27</td><td>28</td><td>29</td><td>30</td><td>31</td><td></td></tr> </table> <p>15- Independence day, 22-Bakrid</p>	August-2018							S	M	T	W	T	F	S				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31								
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26-08-2018	Women's Equality Day																																																									
28-08-2018	Guest Lecture on "Role of Youths for Nation Building"																																																									
05-09-2018	Teachers Day, "Student as a Teacher"	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr><th colspan="7">September -2018</th></tr> <tr><th>S</th><th>M</th><th>T</th><th>W</th><th>T</th><th>F</th><th>S</th></tr> <tr><td></td><td></td><td></td><td></td><td></td><td></td><td>1</td></tr> <tr><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td></tr> <tr><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td><td>14</td><td>15</td></tr> <tr><td>16</td><td>17</td><td>18</td><td>19</td><td>20</td><td>21</td><td>22</td></tr> <tr><td>23</td><td>24</td><td>25</td><td>26</td><td>27</td><td>28</td><td>29</td></tr> <tr><td>30</td><td></td><td></td><td></td><td></td><td></td><td></td></tr> </table> <p>13- Ganesh Chaturthi, 21-Moharam</p>	September -2018							S	M	T	W	T	F	S							1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30						
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08-09-2018 to 09-09-2018	Indoor Games																																																									
10-09-2018 to 12-09-2018	First Internal Assessment of III/V/VII Sem																																																									
15-09-2018	Engineers Day "EESSA INNAGURATION" & MOU with IIESCOM																																																									
14-09-2018 & 15-09-2018	Feed Back - 1																																																									
17-09-2018	Display of First Internal Assessment Marks & Submission of Feed Back -1 to Office																																																									
22-09-2018	EDP Activities																																																									
21-09-2018	Event - "Mock Press"	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr><th colspan="7">October -2018</th></tr> <tr><th>S</th><th>M</th><th>T</th><th>W</th><th>T</th><th>F</th><th>S</th></tr> <tr><td></td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td></tr> <tr><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td></tr> <tr><td>14</td><td>15</td><td>16</td><td>17</td><td>18</td><td>19</td><td>20</td></tr> <tr><td>21</td><td>22</td><td>23</td><td>24</td><td>25</td><td>26</td><td>27</td></tr> <tr><td>28</td><td>29</td><td>30</td><td>31</td><td></td><td></td><td></td></tr> </table> <p>2- Gandhi Jayanti, 8- Mahalaya Amavasya, 18-Ayudha Pooja, 19- Vijayadashami, 24- Valmiki Jayanti</p>	October -2018							S	M	T	W	T	F	S		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31										
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02-10-2018	Gandhi Jayanti & Swachh Bharat Abhiyan																																																									
05-10-2018	Event - "Group Discussion"																																																									
10-10-2018	Sports : Carrom , Table-Tennis and Box Cricket																																																									
15-10-2018 to 17-10-2018	First Internal Assessment of I Sem Second Internal Assessment of III/V/VII Sem																																																									
22-10-2018 & 23-10-2018	Feed Back -2																																																									
25-10-2018	Display of Second Internal Assessment Marks & Submission of Feed Back - 2 to Office																																																									
28-10-2018	Compensatory working Day of Connecting Holiday	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr><th colspan="7">November-2018</th></tr> <tr><th>S</th><th>M</th><th>T</th><th>W</th><th>T</th><th>F</th><th>S</th></tr> <tr><td></td><td></td><td></td><td></td><td>1</td><td>2</td><td>3</td></tr> <tr><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td></tr> <tr><td>11</td><td>12</td><td>13</td><td>14</td><td>15</td><td>16</td><td>17</td></tr> <tr><td>18</td><td>19</td><td>20</td><td>21</td><td>22</td><td>23</td><td>24</td></tr> <tr><td>25</td><td>26</td><td>27</td><td>28</td><td>29</td><td>30</td><td></td></tr> </table> <p>1- Kannada Rajyotsava, 6- Naraka Chaturdashi, 8- Balipadyami, 21- Id-e-Milad, 26- Kanakadasa Jayanthi</p>	November-2018							S	M	T	W	T	F	S					1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30								
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01-11-2018	Kannada Rajyotsava																																																									
09-11-2018	Event - "Pick and Speak"																																																									
16-11-2018 to 18-11-2018	Second Internal Assessment of I Sem Third Internal Assessment of III/V/VII Sem																																																									
18-11-2018	Compensatory working Day of Connecting Holiday (07-11-2018)																																																									
22-11-2018 to 24-11-2018	Lab Internal Assessment of III/V/VII Sem																																																									
28-11-2018	Display of Third & Final Internal Assessment Marks(III/V/VII Sem)	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr><th colspan="7">December -2018</th></tr> <tr><th>S</th><th>M</th><th>T</th><th>W</th><th>T</th><th>F</th><th>S</th></tr> <tr><td></td><td></td><td></td><td></td><td></td><td></td><td>1</td></tr> <tr><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td></tr> <tr><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td><td>14</td><td>15</td></tr> <tr><td>16</td><td>17</td><td>18</td><td>19</td><td>20</td><td>21</td><td>22</td></tr> <tr><td>23</td><td>24</td><td>25</td><td>26</td><td>27</td><td>28</td><td>29</td></tr> <tr><td>30</td><td></td><td></td><td></td><td></td><td></td><td></td></tr> </table> <p>25- Christmas</p>	December -2018							S	M	T	W	T	F	S							1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30						
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30-11-2018	Last Working Day of III / V Sem																																																									
04-12-2018	Last Working Day of VII Sem																																																									
03-12-2018 to 14-12-2018	Practical Exams of III / V Sem																																																									
06-12-2018 to 14-12-2018	Practical Exams of VII Sem																																																									
17-12-2018 to 18-01-2019	Theory Exams of III / V / VII Sem																																																									



S.B. Radhi  
E.E.S.S.A. Coordinator



H. O. B.  
Electrical & Electronics Engg  
Hirasugar Institute of Technology  
NIDASOSHI-591228

**5.1 Scheme Of Teaching & Examination**

**III SEMESTER**

Sl. No.	Subject Code	Title of the Subject	Teaching Dept.	Teaching Hrs / Week		Examination				
				Theory	Practical	Duration (Hrs)	Marks			
							SEE Marks	CIE Marks	Total	Credits
01	17MAT31	Engineering Mathematics-III	E&EE	4	-	3	60	40	100	4
02	17EE32	Electric Circuit Analysis	E&EE	4	-	3	60	40	100	4
03	17EE33	Transformers and Generators	E&EE	4	-	3	60	40	100	4
04	17EE34	Analog Electronic Circuits	E&EE	4	-	3	60	40	100	4
05	17EE35	Digital System Design	E&EE	4	-	3	60	40	100	3
06	17EE36	Electrical and Electronic Measurements	E&EE	3	-	3	60	40	100	4
07	17EEL37	Electronics Laboratory	E&EE	01-Hour Instruction 02-Hour Practical		3	60	40	100	2
08	17EEL38	Electrical Machines Laboratory -1	E&EE	01-Hour Instruction 02-Hour Practical		3	60	40	100	2
09	17KL/CPH39/49	Kannada, Constitution of India Professional ethics and human rights	Humanities	01		01	30	20	50	1
<b>TOTAL</b>				<b>24</b>	<b>06</b>	<b>25</b>	<b>510</b>	<b>340</b>	<b>850</b>	<b>28</b>



Subject Title	Engineering Mathematics-III		
Subject Code	17MAT31	IA Marks	40
Number of Lecture Hrs / Week	04	Exam Marks	60
Total Number of Lecture Hrs	50	Exam Hours	03
CREDITS – 04			

**FACULTY DETAILS:**

Name: Prof. S. A. Patil	Designation: Asst. Professor	Experience: 08
No. of times course taught: 07	Specialization: Mathematics	

**1.0 Prerequisite Subjects:**

Sl. No	Branch	Semester	Subject
01	Mechanical Engineering	II	Engineering Mathematics-II

**2.0 Course Objectives**

The objectives of this course is to introduce students to the mostly used analytical and numerical methods in the different engineering fields by making them to learn Fourier series, Fourier transforms and Z-transforms, statistical methods, numerical methods to solve algebraic and transcendental equations, vector integration and calculus of variations..

**3.0 Course Outcomes**

On completion of this course, students are able to:

	Course Outcome	POs
CO1	Know the use of periodic signals and Fourier series to analyze circuits and system communications	1,2,3
CO2	Explain the general linear system theory for continuous-time signals and digital signal processing using the Fourier Transform and z-transform.	1,2,3
CO3	Employ appropriate numerical methods to solve algebraic and transcendental equations	1,2,3
CO4	Apply Green's Theorem, Divergence Theorem and Stokes' theorem in various applications in the field of electro-magnetic and gravitational fields and fluid flow problems.	1,2,3
CO5	Determine the extremals of functional and solve the simple problems of the calculus of variations.	1,2,3
<b>Total Hours of instruction</b>		<b>50</b>



#### 4.0 Course Content

MODULES	RBT Levels	No. Of Hours
<b>MODULE-I</b> <b>Fourier series:</b> Periodic functions, Dirichlet's condition, Fourier Series of Periodic functions with period $2\pi$ and with arbitrary period $2c$ , Fourier series of even and odd functions, Half range Fourier Series, practical Harmonic analysis-Illustrative examples from engineering field.	L1 & L2	10
<b>MODULE-II</b> <b>Fourier Transforms:</b> Infinite Fourier transform, Fourier Sine and Cosine transforms, inverse Fourier transforms <b>Z-transform:</b> Difference equations, basic definition, z-transform-definition, Standard z-transforms, Damping rule, Shifting rule, Initial value and final value theorems (without proof) and problems, Inverse Z-transform. Applications of z-transforms to solve difference equations.	L1 & L2	10
<b>MODULE-III</b> <b>Statistical Methods:</b> Review of measures of central tendency and dispersion. Correlation-Karl Pearson's coefficient of correlation-problems. Regression analysis- lines of regression (without proof) –problems <b>Curve fitting:</b> Curve fitting by the method of least squares, Fitting of the curves of the form $y = ax + b$ , $y = ax^2 + bx + c$ & $y = ae^{bx}$ <b>Numerical Methods:</b> Numerical solution of algebraic and transcendental equations by: Regular-Falsi method and Newton –Raphson method	L1 & L2	10
<b>MODULE-IV</b> <b>Finite differences:</b> Forward and backward differences, Newton's forward and backward interpolation formulae Divided differences-Newton's divided difference formula. Lagrange's interpolation formula and inverse interpolation formula.(all formulae without proof)-Problems. <b>Numerical integration:</b> Simpson's $(1/3)^{\text{th}}$ and $(3/8)^{\text{th}}$ rules, Weddle's rule (without proof) – Problems	L1 & L2	10
<b>MODULE-V</b> <b>Vector integration:</b> Line integrals-definition and problems, surface and volume integrals-definition, Green's theorem in a plane, Stokes and Gauss divergence theorem (without proof) and problems. <b>Calculus of Variations:</b> Variation of function and Functional, variational problems, Euler's equation, Geodesics, hanging chain, problems	L2 & L3	10

#### 5.0 Relevance to future subjects

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



## 6.0 Relevance to Real World

SL.No	Real World Mapping
01	Numerical methods are used to solve engineering problems. For examples will be drawn from a variety of engineering problems, including heat transfer, vibrations, dynamics, fluid mechanics, etc.
02	Special functions are used to wave propagation and scattering, fiber optics, heat conduction in solids, and vibration phenomena.
03	In signal processing, sampling is the reduction of a continuous signal to a discrete signal. A common example is the conversion of a sound wave (a continuous signal) to a sequence of samples (a discrete-time signal).

## 7.0 Gap Analysis and Mitigation

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

## 8.0 Books Used and Recommended to Students

Text Books
1) 'B.S. Grewal, Higher Engineering Mathematics, 43 <sup>rd</sup> Edition 2015, Khanna Publishers.
2) E. Kreyszig: Advanced Engineering Mathematics, John Wiley & Sons, 10th Ed., 2015.
Reference Books
a) 1 N P Bali and Manish Goyal, "A text book of Engineering mathematics" , Laxmi publications, 7 <sup>th</sup> Edition, 2010.
2. B.V.Ramana "Higher Engineering Mathematics" Tata McGraw-Hill, 2006.
3. H. K Dass and Er. RajnishVerma , "Higher Engineerig Mathematics", S. Chand Publishing, 1st Edition, 2011.
Additional Study material & e-Books
1. N.P.Bali & Manish.Goyal, A Text book of Engineering Mathematics, 7 <sup>th</sup> edition, Laxmi Publications.

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

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

## 10.0 Magazines/Journals Used and Recommended to Students

Sl. No	Magazines/Journals	website
1	+ Plus Magazine	<a href="https://plus.maths.org/issue44">https://plus.maths.org/issue44.</a>
2	Mathematics Magazine	<a href="http://www.mathematicsmagazine.com">www.mathematicsmagazine.com</a>



## 11.0 Examination Note

### Internal Assessment: 40 Marks

Theoretical aspects as well as relevant sketches should be drawn neatly.

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

(a) Internal Assessment test in the same pattern as that of the main examination

(All the three Internal Tests marks considered): 30Marks.

(b) Assignments: 10 Marks

### SCHEME OF EXAMINATION:

#### Question paper pattern:

**Note: - The SEE question paper will be set for 100 marks and the marks will be proportionately reduced to 60.**

- The question paper will have **ten** full questions carrying equal marks.
- Each full question consisting of **20** marks.
- There will be **two** full questions (with a **maximum** of **three** sub 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

Module	Lecture No.	Content of Lecturer	% of Portion
MODULE-1	1	Introduction, Periodic functions, Dirichlet's conditions	20
	2	Fourier series of periodic functions of period $2\pi$	
	3	Fourier series of periodic functions of arbitrary period $2c$	
	4	Problems	
	5	Fourier series of even functions	
	6	Fourier series of odd functions	
	7	Problems	
	8	Half range Fourier series	
	9	Practical harmonic analysis	
	10	Problems	
MODULE-2	11	Introduction, Infinite Fourier transform	20
	12	Fourier sine transforms	
	13	Fourier cosine transforms	
	14	Inverse transforms	
	15	z-transform-definition	
	16	Standard z-transforms	
	17	Damping rule, Shifting rule	
	18	Initial value and final value theorems (without proof) and problems	
	19	Inverse z-transform	
	20	Applications of z-transforms to solve difference equations	
MODULE-3	21	Introduction, Statistical Methods: Review of measures of central tendency and dispersion	20
	22	Correlation-Karl Pearson's coefficient of correlation	
	23	Problems	
	24	Regression analysis- lines of regression (without proof) –problems	
	25	Curve fitting by the method of least squares, of the form, form $y= ax+b,$	
	26	Curve fitting by the method of least squares: $y= a+bx+cx^2$	



	27	Curve fitting by the method of least squares $y = ae^{bx}$	
	28	Numerical solutions: Numerical solution of algebraic and transcendental equations.	
	29	Regular-Falsi method	
	30	Newton –Raphson method	
<b>MODULE-4</b>	31	Introduction, Finite differences: Forward & backward differences	<b>20</b>
	32	Newton’s forward and backward interpolation formulae	
	33	Problems	
	34	Divided differences- Newton’s divided difference formula	
	35	Problems	
	36	Lagrange’s interpolation & inverse interpolation formula	
	37	Problems	
	38	Numerical integration: Simpson’s one third rule	
	39	Simpson’s three eighth rule	
	40	Weddle’s rule (without proof) Problems	
<b>MODULE-5</b>	41	Introduction, Line integrals-definition and problems	<b>20</b>
	42	Surface and volume integrals-definition,	
	43	Green’s theorem in a plane	
	44	Stokes theorem (without proof) problems.	
	45	Gauss divergence theorem (without proof) problems	
	46	Calculus of Variations: Variation of function and Functional, variation problems	
	47	Euler’s equation	
	48	Problems	
	49	Geodesics	
	50	Hanging chain, problems	

### 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	Students study the Topics and write the Answers. Get practice to solve university questions.	Module 1 of the syllabus	2	Individual Activity.	Book 1, of the reference list. Website of the Reference list
2	Assignment 2: University Questions	Students study the Topics and write the Answers. Get practice to solve university questions.	Module 2 of the syllabus	4	Individual Activity.	Book 1, 2 of the reference list. Website of the Reference list
3	Assignment 3: University Questions	Students study the Topics and write the Answers. Get practice to solve university questions.	Module 3 of the syllabus	6	Individual Activity.	Book 1, 2 of the reference list. Website of the Reference list



4	Assignment 4: University Questions	Students study the Topics and write the Answers. Get practice to solve university questions.	Module 4 of the syllabus	8	Individual Activity.	Book 1, 2 of the reference list. Website of the Reference list
5	Assignment 5: University Questions	Students study the Topics and write the Answers. Get practice to solve university questions.	Module 5 of the syllabus	10	Individual Activity.	Book 1, 2 of the reference list. Website of the Reference list

## 14.0 QUESTION BANK

### Module-I: Fourier series:

- 1) Obtain a Fourier series to represent  $e^{-ax}$  from  $(-\pi, \pi)$
- 2) Expand  $f(x) = x \sin x$ ,  $0 < x < 2$ , in a Fourier series.
- 3) For a function  $f(x)$  defined by  $f(x) = |x|$ ,  $-\pi < x < \pi$ , obtain a Fourier series. Deduce that  $\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \frac{1}{7^2} = \frac{\pi^2}{8}$
- 4) Find the Fourier series for the function  $f(x) = \frac{\pi-x}{2}$  in  $(0, 2\pi)$ . Hence deduce that  $\frac{\pi}{4} = 1 - \frac{1}{3} + \frac{1}{5} - \dots$
- 5) Find the Fourier series to represent  $f(x) = x+x^2$  from  $x=-\pi$  to  $x=\pi$  and deduce that  $\frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \frac{1}{4^2} = \frac{\pi^2}{12}$
- 6) Expand  $f(x) = e^{-x}$  as a Fourier series in the interval  $(-1, 1)$
- 7) Obtain Fourier series for the function  $f(x) = \begin{cases} \pi x, & 0 \leq x \leq 1 \\ \pi(2-x), & 1 \leq x \leq 2 \end{cases}$  and deduce that  $\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \frac{1}{7^2} = \dots$
- 8) Develop  $f(x)$  in Fourier series in the interval  $(-2, 2)$  if  $f(x) = \begin{cases} 0, & -2 < x < 0 \\ 1, & 0 < x < 2 \end{cases}$
- 9) Find the half range cosine series for the function  $f(x) = x^2$  in the range  $0 \leq x \leq 1$
- 10) Find the complex form of the Fourier series of the periodic function  $f(x) = \cos ax$ , in  $-\pi < x < \pi$ .
- 11) The following table gives the variation of periodic current over a period

t sec	0	T/6	T/3	T/2	2T/3	5T/6	T
A amp	1.98	1.30	1.05	1.30	-0.88	-0.25	1.98

Show that there is a direct current part of 0.75 amp in the variable current and obtain the amplitude of the first harmonic.

- 12) Obtain the Fourier series for the function

$$f(x) = \begin{cases} 1 - \frac{2x}{\pi} & -\pi \leq x \leq 0 \\ 1 + \frac{2x}{\pi} & 0 \leq x \leq \pi \end{cases} \quad \text{Hence deduce that } \frac{\pi^2}{8} = \frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \dots$$

- 13) Obtain the Fourier expansion of  $f(x) = 2x - x^2$  in  $0 \leq x \leq 2$
- 14) Obtain the constant term and the coefficient of the first sine and cosine terms in the Fourier expansion of  $y$  as given below.

x	0	1	2	3	4	5
y	9	18	24	28	26	20



### Module-II: Fourier Transforms:

1) Find the Fourier transform of

$$f(x) = \begin{cases} 1, & |x| < 1 \\ 0, & |x| > 1 \end{cases} \quad \text{Hence evaluate } \int_0^{\infty} \frac{\sin x}{x} dx$$

2) Find the Fourier transform of the function

$$f(x) = \begin{cases} x, & |x| \leq \alpha \\ 0, & |x| > \alpha \end{cases} \quad \text{Where } \alpha \text{ is a positive constant?}$$

3) Find the Fourier transform of  $\cos ax^2$

4) Find the Fourier sine transform of  $e^{-ax/x}$

5) Find the Fourier sine and cosine transform of  $f(x) = \begin{cases} 1, & 0 \leq x < a \\ 0, & x \geq a \end{cases}$

6) Find the finite Fourier sine and cosine transform of  $f(x) = 2x, \quad 0 < x < 4$ .

7) Find the cosine transform of  $f(x) = \frac{1}{1+x^2}$

8) Find the Fourier sine transform of  $e^{-|x|}$

9) Find the Fourier transform of  $f(x) = \begin{cases} a^2 - x^2, & |x| < a \\ 0, & |x| > a \end{cases}$  and Evaluate  $\int_0^{\infty} \frac{\sin x - x \cos x}{x^3} dx$ .

10) Find the Fourier sine transform of  $f(x) = \frac{e^{-ax}}{x}, \quad a > 0$ .

11) Find the Fourier cosine transform of  $f(x) = \begin{cases} x, & 0 < x < 1 \\ 2 - x, & 1 < x < 2 \\ 0, & x > 2 \end{cases}$ .

12) Find the Fourier transform of  $f(x) = e^{-|x|}$  and Evaluate  $\int_0^{\infty} \frac{x \sin mx}{1+x^2} dx$ .

13) Find the Fourier transform of  $f(x) = e^{-|x|}$  and Evaluate  $\int_0^{\infty} \frac{x \sin mx}{1+x^2} dx$ .

### Z- Transformation:

1. P.T.  $z_T(n^2) = \frac{z^2+z}{(z-1)^3}$

2. P.T.  $z_T(n^3) = \frac{z^3+4z^2+2}{(z-1)^4}$

3) P.T.  $z_T(\cos \theta) = \frac{z(z-\cos \theta)}{z^2-2z \cos \theta+1}$

4) P.T.  $z_T(\sin \theta) = \frac{(z \sin \theta)}{z^2-2z \cos \theta+1}$

5) P.T.  $z_T(a^n \cos n \theta) = \frac{z(z-a \cos \theta)}{z^2-2az \cos \theta+a^2}$

6) Find the Z-transform of  $\cos hn \theta$  &  $\sin hn \theta$ .

7) Find the Z-transform of  $(n+1)^2$

8) Using the inversion integral method find the inverse Z-transform of  $\frac{3z}{(z-1)(z-2)}$

9) Solve  $y_{n+2} + 6y_{n+1} + 9y_n = 2^n, \quad y_{n+2} + 6y_{n+1} + 9y_n = 2^n$  with  $y_0 = y_1 = 0$  using Z-transform

10) Solve the difference equation  $y_{n+2} + 2y_{n+1} + y_n = n$  with  $y_0 = y_1 = 0$  using Z-Transform.

11) Obtain the z-transform of  $\cos n \theta$  and  $\sin n \theta$

12) Find the Inverse z-transform of  $\frac{2z^2+3z}{(z+2)(z-4)}$ .

13) If  $\bar{u}(z) = \frac{2z^2+3z+12}{(z-1)^4}$ , find the value of  $u_0, u_1, u_2, u_3$ .

14) Solve the difference equation  $u_{n+2} + 6u_{n+1} + 9u_n = 2^n, \quad u_0 = u_1 = 0$ .



**Module-III: Statistical Methods:**

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

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

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

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

- 3) Compute the rank correlation coefficient for the following data

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

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

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

**Curve Fitting and Optimization:**

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

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

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

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

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

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

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

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

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

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

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

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

- 6) Find the co-efficient of correlation & regression of lines to the following data.

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

**Numerical Methods**

- Find the real root of the equation  $x \log_{10} x = 1.2$  by Regula-Falsi method correct to four decimal places.
- Find by Newton's method, the real root of the equation  $3x = \cos x + 1$ .
- Using the Newton's Raphson method, find a root of the following equations correct to the three decimal Places. i)  $3\sin x - 2x + 5 = 0$  near 3, ii)  $x \sin x + \cos x = 0$  which is near  $x = \pi$
- Find by Newton's method, the root of the equation  $\cos x = x e^x$ .
- Use Newton-Raphson method to find a real root of the equation  $\log x - \cos x = 0$



- 7) By applying Weddle's Rule evaluate  $\int_0^1 \frac{x}{1+x^2} dx$  by considering seven ordinates. Hence find the value of  $\log_e 2$
- 8) Evaluate  $\int_0^1 \frac{1}{1+x} dx$ , by using Simpson 1/3 rd rule, considering seven ordinates. Hence deduce the value of  $\log_e 2$ .
- 9) Find the interpolating formula that approximates to the function described by the following table

x	0	1	2	5
y	2	3	12	147

- 10) Find 'y' when  $x=0.26$  using appropriate interpolation formula to the following data,

X	0.10	0.15	0.20	0.25	0.30
Y	0.1003	0.1511	0.2027	0.2553	0.3093

- 11) If  $y(5)=150$ ,  $y(7)=392$ ,  $y(11)=1492$ ,  $y(13)=2366$ ,  $y(17)=5202$  then find  $y(9)$  by using Lagrange's Formula
- 12) Apply Lagrange's Inverse interpolation formula to find a root of the equation  $f(x)=0$  given that  $f(30) = -30$ ,  $f(34) = -13$ ,  $f(38) = 3$ ,  $f(42) = 18$ .

- 13) Use Newton's divided difference formula to find  $f(4)$  given

x	0	2	3	6
y	-4	2	14	158

#### Module-IV: Finite Differences:

- 1) The following table gives the distances in nautical miles of the visible horizon for the given heights in feet above the earth's surface

x:height	100	150	200	250	300	350	400
y:distance	10.63	13.03	15.04	16.81	18.42	19.90	21.27

Find the values of y when  $x=218$  feet and 410 feet

- 2) From the following table, estimate the number of students who obtained marks between 40 & 45

Marks	30-40	40-50	50-60	60-70	70-80
No. of students	31	42	51	35	31

- 3) In the table below the value of y are consecutive terms of a series of which 23.6 are the 6<sup>th</sup> term. Find The first & tenth terms of the series

x	3	4	5	6	7	8	9
y	4.8	8.7	14.5	23.6	36.2	52.8	73.9

- 4) Given the values

x	5	7	11	13	17
f(x)	150	392	1452	2366	5202

Find  $f(15)$  and  $f(19)$

- 6) Use Newton's divided difference formula to find  $f(x)$  given the data

x	0	2	3	6
f(x)	-4	2	14	158

- 7) Given the values

x	5	7	11	13	17
f(x)	150	392	1452	2366	5202

Evaluate  $f(9)$  using divided difference formula for unequal intervals.

- 8) Evaluate  $\int_0^1 \frac{dx}{1+x^2}$  by using Simpson's 1/3 rd rule taking four equal strips and hence find the value of  $\pi$



- 9) If  $y(1)=3$ ,  $y(3)=9$ ,  $y(4)=30$ ,  $y(6)=132$ , Find Lagrange's interpolation formula & hence find  $y$  at  $x=5$ .
- 12) Evaluate  $\int_0^6 \frac{dx}{1+x^2}$  by using  
i) Simpson's 1/3<sup>rd</sup> rule, ii) Simpson's 3/8<sup>th</sup> rule, iii) Weddle's rule.
- 13) Use Simpson's 1/3<sup>rd</sup> rule to find  $\int_0^{0.6} e^{-x^2} dx$  by taking seven ordinates.
- 14) Using Simpson's 3/8<sup>th</sup> rule, evaluate  $\int_0^{0.3} \sqrt{1-8x^3} dx$  by taking 7 ordinates.
- 15) Evaluate  $\int_0^{\frac{\pi}{2}} \sqrt{\cos\theta} d\theta$  using Weddle's rule

**Module-V: Vector Integration:**

- 1) If  $\vec{F} = x\mathbf{i} + y\mathbf{j} + z\mathbf{k}$  evaluate  $\oint \vec{F} \cdot d\vec{r}$  where  $c$  is the curve represented by  $x=t$ ,  $y=t^2$ ,  $z=t^3$ ,  $-1 \leq t \leq 1$
- 2) Find the total work done by the force represented by  $\vec{F} = 3xy\mathbf{i} - y\mathbf{j} + 2zx\mathbf{k}$  in the moving a particle round the circle  $x^2 + y^2 = 4$
- 3) Verify the Greens theorem  $\oint (xy + y^2)dx + x^2dy$  where  $c$  is the closed curve of the region bounded by  $y = x$  and  $y = x^2$
- 4) Find the area between the parabola  $y^2 = 4x$  and  $x^2 = 4y$  with the help of Greens theorem in a plane.
- 5) Verify the Stroke's theorem for the vector function  $\vec{F} = 2xy\mathbf{i} + (x^2 - y^2)\mathbf{j}$  over the circle  $x^2 + y^2 = 1$ ,  $z = 0$
- 6) Verify the Stroke's theorem for  $\vec{F} = y\mathbf{i} + z\mathbf{j} + x\mathbf{k}$  where  $S$  is upper half of the sphere  $x^2 + y^2 + z^2 = 1$  and  $C$  is its boundary.
- 7) Verify the Divergence theorem for  $\vec{F} = (x^2 - yz)\mathbf{i} + (y^2 - zx)\mathbf{j} + (z^2 - xy)\mathbf{k}$  Taken over the rectangular parallelepiped  $0 \leq x \leq a$ ,  $0 \leq y \leq b$ ,  $0 \leq z \leq c$ .
- 8) Verify the Gauss divergence theorem for  $\vec{F} = 4xz\mathbf{i} - y^2\mathbf{j} + yz\mathbf{k}$  over the unit cube.
- 9) Show that the Geodesics on a plane are straight line.
- 10) Find the Geodesics on a right circular cylinder of radius  $a$ .
- 11) Find the extremals of the functional  $\int_{x_0}^{x_1} \frac{(y')^2}{x^3} dx$
- 12) Evaluate  $\oint xy dx + xy^2 dy$  by Stoke's theorem where  $c$  is the square in  $xy$ -plane with  $(1, 0)$ ,  $(-1, 0)$ ,  $(0, 1)$  &  $(0, -1)$
- 13) Show that the shortest distance between any two points in a plane is a straight line.

**16.0 University Result**

Examination	FCD (S+, S, A)	FC (B)	SC (C, D, E)	% Passing
Jan 2018	09	12	26	87.04
Jan 2017	11	05	30	65.71

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



<b>Subject Title</b>	<b>ELECTRIC CIRCUIT ANALYSIS-(Core Subject)</b>		
<b>Subject Code</b>	17EE32	<b>CIE Marks</b>	40
<b>Number of Lecture Hrs / Week</b>	04	<b>SEE Marks</b>	60
<b>Total Number of Lecture Hrs</b>	50	<b>Exam Hours</b>	03
<b>Credits-04</b>			

**FACULTY DETAILS:**

<b>Name:</b> Prof. Pramod Murari	<b>Designation:</b> Asst.Professor	<b>Experience:</b> 7 Years
<b>No. of times course taught:</b> 02	<b>Specialization:</b> Power System & Power Electronics	

**1.0 Prerequisite Subjects:**

Sl. No	Branch	Semester	Subject
02	First Year	I/II	BEE

**2.0 Course Objectives**

1. To familiarize the basic laws, source transformations theorems and the methods of analyzing electrical circuits.
2. To explain the use of network theorems and the concept of resonance.
3. To familiarize the analysis of three-phase circuits, two port networks and networks with non sinusoidal inputs.
4. To explain the importance of initial conditions, their evaluation and transient analysis of R-L and R-C circuits.
5. To impart basic knowledge on network analysis using Laplace transforms.

**3.0 Course Outcomes**

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

	Course Outcome	Cognitive Level	Pos
C202.1	Understand the basic concepts, basic laws and methods of analysis of DC and AC networks and reduce the complexity of network using source shifting, source transformation and network reduction using transformations.	U	1-2
C202.2	Solve complex electric circuits using network theorems.	U	1-2
C202.3	Discuss resonance in series and parallel circuits and also the importance of initial conditions and their evaluation.	U	1-2
C202.4	Synthesize typical waveforms using Laplace transformation.	U	1-2
C202.5	Solve unbalanced three phase systems and also evaluate the performance of two port networks.	U	1-2
<b>Total Hours</b>		<b>50</b>	

**4.0 Course Content**

**Module-1**

**Basic Concepts:** Active and passive elements, Concept of ideal and practical sources. Source transformation and Source shifting, Concept of Super-Mesh and Super node analysis. Analysis of networks by (i) Network reduction method including star – delta transformation, (ii) Mesh and Node voltage methods for ac and dc circuits with independent and dependent sources. Duality. **10 Hours**

**Revised Bloom's Taxonomy Level** L1 – Remembering, L2 – Understanding, L3 – Applying, L4 – Analysing.

**Module-2**

**Network Theorems:** Super Position Theorem, Reciprocity theorem, Thevenin's Theorem, and Norton's Theorem. Analysis of networks, with and without dependent ac and dc sources. **10 Hours.**



Revised Bloom's Taxonomy Level L1 – Remembering, L2 – Understanding, L3 – Applying, L4 – Analysing.

**Module-3**

**Resonant Circuits:** Analysis of simple series RLC and parallel RLC circuits under resonances. Problems on Resonant frequency, Bandwidth and Quality factor at resonance

**Transient Analysis:** Transient analysis of RL and RC circuits under dc and ac excitations: Behaviour of circuit elements under switching action, Evaluation of initial conditions. 10 Hours.

Revised Bloom's Taxonomy Level L2 – Understanding, L3 – Applying, L4 – Analysing, L5-Evaluating

**Module-4**

**Laplace Transformation:** Laplace transformation (LT), LT of Impulse, Step, Ramp, Sinusoidal signals and shifted functions. Waveform synthesis. Initial and Final value theorems. 10Hours.

Revised Bloom's Taxonomy Level L1 – Remembering, L2 – Understanding, L3 – Applying, L4 – Analysing.

**Module-5**

**Unbalanced Three phase systems:** Analysis of three phase systems, calculation of real and reactive powers.

**Two Port networks:** Definition, Open circuit impedance, Short circuit admittance and Transmission parameters and their evaluation for simple circuits. 10 Hours.

Revised Bloom's Taxonomy Level L1 – Remembering, L2 – Understanding, L3 – Applying, L4 – Analyzing.

**5.0 Relevance to future subjects**

Sl No	Semester	Subject	Topics
01	VI	Power system analysis and stability	Module 2 and Module 4
01	VII	Transmission and Distribution	Module 3

**6.0 Relevance to Real World**

SL.No	Real World Mapping
01	Electrical and Electronic circuits and components.

**7.0 Gap Analysis and Mitigation**

Sl. No	Delivery Type	Details
01	Practical	Finding magnitudes of currents & voltages of a simple electric networks through pspice software.

**8.0 Books Used and Recommended to Students**

Text Books
1.Engineering Circuit Analysis, William H Hayt et al, Mc Graw Hill, 8th Edition,2014
2.Network Analysis, M.E. Vanvalkenburg, Pearson, 3rd Edition,2014
3.Fundamentals of Electric Circuits, Charles K Alexander Matthew N O Sadiku, Mc Graw Hill, 5th Edition,2013
Reference Books
1. Engineering Circuit Analysis, J David Irwin et al, Wiley India, 10th Edition,2014
2.Electric Circuits Mahmood Nahvi Mc Graw Hill 5th Edition,2009
3.Introduction to Electric Circuits, Richard C Dorf and James A Svoboda, Wiley, 9th Edition,2015
4.Circuit Analysis; Theory and Practice, Allan H Robbins Wilhelm C Miller, Cengage, 5th Edition,2013
Additional Study material & e-Books
1. Network theory by Ganesh Rao
2. Network analysis by P M Chandrashekarajah
3. <a href="https://www.khanacademy.org/science/electrical-engineering/ee-circuit-analysis-topic">https://www.khanacademy.org/science/electrical-engineering/ee-circuit-analysis-topic</a>

**9.0 Relevant Websites (Reputed Universities and Others) for**



**Notes/Animation/Videos Recommended**

**Website and Internet Contents References**

- 1) <http://nptel.ac.in/courses/108102042/>
- 2) <http://nptel.ac.in/courses/108102042/#>
- 3) [http://videos.vtu.ac.in/video\\_groups.php?group=EDUSAT 2016](http://videos.vtu.ac.in/video_groups.php?group=EDUSAT 2016)
- 4) <https://www.docsity.com/en/subjects/electrical-circuit-analysis/>
- 5) <https://sites.google.com/site/eeenotes2u/courses/network-analysis>

**10.0 Magazines/Journals Used and Recommended to Students**

Sl.No	Magazines/Journals	website
1	IEEE transactions on circuit theory	<a href="http://ieeexplore.ieee.org/xpl/mostRecentIssue.jsp?punumber=8147">http://ieeexplore.ieee.org/xpl/mostRecentIssue.jsp?punumber=8147</a>
2	IRE Transactions on Circuit Theory	<a href="http://ieeexplore.ieee.org/xpl/mostRecentIssue.jsp?punumber=8148">http://ieeexplore.ieee.org/xpl/mostRecentIssue.jsp?punumber=8148</a>

**11.0 Examination Note (60:40) Pattern**

Assignment marks: 10 marks.

Question paper pattern IA exam:

Answer two full questions Q1 or Q2 and Q3 or Q4 (15marks each). Total 30 Marks.

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	Lecture No.	Content of Lecture	% of Portion
I	1.	<b>Basic Concepts:</b> Active and passive elements, Concept of ideal and practical sources.	20
	2.	Source transformation and Source shifting,	
	3.	Concept of Super-Mesh and Super node analysis.	
	4.	Analysis of networks by (i) Network reduction method including star – delta transformation.	
	5.	(ii) Mesh and Node voltage methods for ac and dc circuits with independent and dependent sources.	
	6.	Duality.	
	7.	Numerical	
	8.	Numerical	
	9.	Numerical	
	10.	Numerical	
II	11.	<b>Network Theorems:</b> Super Position Theorem,	20
	12.	Reciprocity theorem,	
	13.	Thevenin's Theorem,	
	14.	Norton's Theorem.	
	15.	Analysis of networks, with and without dependent ac and dc sources.	
	16.	Numerical	
	17.	Numerical	
	18.	Numerical	
	19.	Numerical	
	20.	Numerical	



III	21.	<b>Resonant Circuits:</b> Analysis of simple series RLC circuits under resonances.	20
	22.	Analysis of simple parallel RLC circuits under resonances.	
	23.	Problems on Resonant frequency, Bandwidth and Quality factor at resonance	
	24.	<b>Transient Analysis:</b> Transient analysis of RL and RC circuits under dc and ac excitations:	
	25.	Behaviour of circuit elements under switching action.	
	26.	Evaluation of initial conditions.	
	27.	Numerical	
	28.	Numerical	
	29.	Numerical	
	30.	Numerical	
IV	31.	<b>Laplace Transformation:</b> Laplace transformation (LT), LT of Impulse function.	20
	32.	LT of Step, Ramp functions	
	33.	LT of Sinusoidal signals and shifted functions.	
	34.	Waveform synthesis.	
	35.	Initial and Final value theorems.	
	36.	Numerical	
	37.	Numerical	
	38.	Numerical	
	39.	Numerical	
	40.	Numerical	
V	41.	<b>Unbalanced Three phase systems:</b> Analysis of three phase systems.	20
	42.	Calculation of real and reactive powers.	
	43.	<b>Two Port networks:</b> Definition, Open circuit impedance,	
	44.	Short circuit admittance and Transmission parameters.	
	45.	And their evaluation for simple circuits.	
	46.	Numerical	
	47.	Numerical	
	48.	Numerical	
	49.	Numerical	
	50.	Numerical	

### 13

### Assignments, Pop Quiz, Mini Project, Seminars

Sl.No.	Title	Outcome expected	Allied study	Week No.	Individual / Group activity	Reference: book/website /Paper
1	Assignment 1: University Questions on basic concepts	Students understand basic concepts in circuit theory & get practice to solve university questions.	Module 1 of the syllabus	2	Individual Activity. Written solution expected.	Book 1,2 of the text book list. & additional study material 1,2
2	Assignment 2: University Questions on Network theorems.	Students understand various network theorems get practice to solve university questions.	Module 2 of the syllabus	4	Individual Activity. Written solution expected.	Book 1,2 of the text book list. & additional study material 1,2



3	Assignment 3: University Questions on Resonant circuits and Transient analysis.	Students understand resonant circuits and Transient behavior of first and second order differential equations & get practice to solve university questions.	Module 3 of the syllabus	6	Individual Activity. Written solution expected.	Book 1,2 of the text book list. & additional study material 1,2
4	Assignment 4: University Questions on Laplace transformation	Students Laplace transformation of various signals & get practice to solve university questions.	Module 4 of the syllabus	8	Individual Activity. Written solution expected.	Book 1,2 of the text book list. & additional study material 1,2
5	Assignment 5: University Questions on Unbalanced three phase power system, two port networks and complex wave analysis.	Students study Unbalanced three phase power system and two port network analysis & get practice to solve university questions.	Module 5 of the syllabus	10	Individual Activity. Written solution expected.	Book 1,2 of the text book list. & additional study material 1,2

### 14.0 Assignment Questions

Assignment No	Questions	Marks
I	Q1. Determine the resistance between the terminals M and N of the network in fig 2 Q2. In the network shown in fig.4 find the PVS between A and B Q3. Use mesh analysis to find the voltage across 15A source in fig. 6 Q4. Use node analysis to find the current through 4 ohm resistor in fig8	5marks each
II	Q1. Find the current through 3 ohm resistor using superposition theorem in fig1 Q2. Find the current $I_x$ in j2 ohm impedance and verify reciprocity theorem in fig 3 Q3. Find thevenin equivalent of fig10 Q4. Find Norton Equivalent of fig12	5marks each
III	Q1. Determine V, $dV/dt$ and $d^2V/dt^2$ at $t=0+$ when the switch K is opened at $t=0$ in fig 3, $R=100\text{ohm}$ , $L=1\text{H}$ and $I=2\text{A}$ Q2. In the circuit a fig4 the switch is opened at $t=0$ find the values of V, $dV/dt$ and $d^2V/dt^2$ at $t=0+$ Q3. Determine $i, di/dt, d^2i/dt^2$ at $t=0+$ when the switch K is moved from position 1 to 2 at $t=0$ in network shown in fig5 Q4. In the network shown in fig6, K is changed from position a to b at $t=0$ , solve for $i, di/dt, d^2i/dt^2$ at $t=0+$ , Assume that capacitor is initially uncharged.	5marks each
IV	Q1. State and prove initial value and final value theorem. Q2. State and prove convolution theorem Q3. Define and obtain the Laplace transform of i)UNIT impulse function ii)UNIT ramp function iii)UNIT step function Q4. Obtain the Laplace transform of full wave rectified sine wave of amplitude 1 and period $\pi\text{sec}$ .	5marks each
V	Q1. Two 2port networks are connected in cascade obtain T-parameters of the interconnected network in terms of T parameters of the individual networks. Q2. A two port network in terms of Z-parameters is said to be symmetric if $Z_{11}=Z_{22}$ and reciprocal if $Z_{12}=Z_{21}$ . Obtain the corresponding conditions in terms of i) h Parameters ii) T-parameters using the relationship between different two-port parameters. Q3. Obtain ABCD parameters in terms of z-parameters and show that $AD-BC = 1$ Q4. Explain i) Z-parameters ii) Y-Parameters iii) Transmission parameters.	5marks each



15.0

QUESTION BANK

Module 1

1. Define the following i) Active & Passive elements ii) Independent & Dependent source iii) Power & Energy iv) Bilateral & Unilateral elements. v) Linear & Non-linear elements. vi) Ideal & Practical voltage sources. vii) Ideal & Practical current sources.
2. Explain the procedure for solving the given network using i) mesh analysis, ii) node analysis.
3. Obtain the expression for i) Star to delta & ii) delta to star transformation.
4. What do you mean by super node & super mesh? Explain with example.
5. Write the loop equations of the circuit and find  $V_x$  in fig.1.1
6. Determine the voltages at node 1 & 2 using nodal analysis in fig 1.2
7. Determine the current supplied by the battery in in fig.1.3.
8. Find the value of R & current through it, in fig.1.4. , when branch AD carries no current.
9. Calculate the power dissipated in  $3\Omega$  resistor in fig.1.5.using mesh current analysis.
10. Using source transformation technique, reduce the network given between the terminals AB to a single voltage source network for fig.1.6.
11. For the network shown in fig.1.7, obtain the single delta connected equivalent circuit.
12. For the network shown in fig.1.8 , find the equivalent resistance between AB.
13. Find the current through  $10\Omega$  &  $5\Omega$  resistor in the circuit shown in fig.1.9.
14. Find the current in 10 ohm resistor in fig.1
15. Reduce the network shown in fig 3 to a single voltage source in series with resistance by source transformation and source shifting.
16. Use mesh analysis to find the current through 4 ohm resistor for the circuit shown in fig 5
17. Find the voltages  $V_1, V_2, V_3, V_4$  and current in 1 ohm resistor in fig7

Module 2

1. State and prove superposition theorem.
2. By the superposition theorem calculate the current through  $(2+j3)\Omega$  impedance branch of the circuit shown in fig.3.1
3. Determine the current in  $1\Omega$  resistor across AB of the network shown in fig 3.2 using superposition theorem.
4. Find the current through 5 ohm resistor shown in fig 3.3 and hence verify reciprocity theorem.
5. Obtain the Thevenin's and Norton's equivalent circuits at terminals XY of the network shown in fig.4.1
6. Find the Thevenin's equivalent circuit at terminals a-b of the network shown in fig.4.2 and hence obtain the current through  $R=10\Omega$  resistor.
7. Obtain the Norton's equivalent circuit of the network shown in fig.4.3 at terminals A&B.
8. State and explain Thevenin's theorem using suitable example.
9. State and explain Norton's theorem using suitable example.
10. Find the current in  $3+j4$  ohm resistance in using superposition theorem in fig2
11. Find  $V_x$  and verify reciprocity theorem in fig 4
12. Using thevenin theorem find the current through  $R=2$  ohm in fig 9
13. Find thevenin equivalent of fig10
14. Using Norton theorem find current in 4ohm resistor in fig 11
15. Find Norton Equivalent of fig12

Module 3

1. What is resonance? What are its types?
2. Explain series resonance? Obtain the condition for resonance
3. Define quality factor and band width & obtain the relationship between them in a series resonance circuit.
4. In case if a series resonant circuit with frequency variation, obtain expression for i) $\omega_c$  at which maximum voltage occurs across C ii) $\omega_L$  at which maximum voltage occurs across L & show that  $\omega_L > \omega_c$
5. Derive the expression for the resonant frequency for a parallel resonance when  $R_L$  connected parallel to  $R_c$ . Also show that the circuit will resonate at all frequencies if  $R_L = R_c = \sqrt{L/C}$
6. Derive the following terms i) Resonance, ii) Bandwidth iii) Selectivity iv) Quality factor, v) Half power frequencies.
7. An RLC series circuit has an inductive coil of  $R\Omega$  and inductance L Henrys in series with a capacitance of C Farads. The circuit draws a maximum current of 15A, when connected to 230V, 50Hz supply. If the Q factor is 5, find the parameters of the circuit.
8. A series resonance circuit with  $R = 10\Omega, L = 0.1H$  &  $C = 50\mu F$  has an applied voltage  $V = 50\angle 0^\circ$  volts with a variable frequency, find the resonant frequency, the value of frequency at which maximum voltage occurs across inductor and the value of frequency at which maximum voltage occurs across capacitor.
9. For the circuit shown in fig5.1 determine resonance frequency and the input impedance.
10. Write the comparison between series and parallel resonant circuits
11. Determine RL and RC for the circuit shown in fig1 resonates at all frequencies.
12. Find the resistance of the circuit if circuit draws a current of 10mA at resonance with supply voltage of 50V Find also quality factor of circuit.
13. Define terms i) Resonance ii) Q factor iii) Half power frequencies iv) Bandwidth
14. Obtain an expression for the resonant frequency for the circuit shown in fig2
15. Establish the relationship between quality factor and bandwidth in series resonant circuit and thereby prove that  $Q = f_0/BW$



16. In a series RLC network under resonance, voltage across capacitor is 400V and impedance is 100ohm. Bandwidth is 75Hz with applied voltage of 70.7V. Find the R,L,C
17. A 220V, 100Hz AC source supplies a series RLC circuit with a capacitor and a coil. If the coil has 50 mili ohm resistance 5 mH inductance, find at a resonance frequency of 100Hz what is the value of capacitor. Also calculate the Q factor and half power frequencies of the circuit.
18. Why do we need to study initial conditions? Write the equivalent form of the elements in terms of the initial condition of the element.
19. Explain the procedure for evaluating initial conditions with suitable examples.
20. Explain the behavior of resistor, inductor and capacitor elements under transient conditions.
21. Show that the voltage across capacitor and inductor cannot change instantaneously.
22. In the network shown in fig 6.1 the switch K is changed from position a to b at  $t=0$ . A steady state having been established at position a, obtain the loop currents at  $t=0^+$
23. In the network shown in fig 6.2 the capacitor C1 is charged to voltage  $V_0 = 1000v$  and the switch K is opened at  $t=0$ . solve for  $d^2i_1/dt^2$  at  $t=0^+$
24. The network shown in fig 6.3 has the switch K opened at  $t=0$ . Solve for  $v$ ,  $dv/dt$ ,  $d^2v/dt^2$  at  $t=0^+$
25. Q1.Determine  $V$ ,  $dV/dt$  and  $d^2V/dt^2$  at  $t=0^+$  when the switch K is opened at  $t=0$  in fig 3,  $R=100ohm$ ,  $L=1H$  and  $I=2A$
26. Q2.In the circuit a fig4 the switch is opened at  $t=0$  find the values of  $V$ ,  $dV/dt$  and  $d^2V/dt^2$  at  $t=0^+$
27. Q3.Determine  $i$ ,  $di/dt$ ,  $d^2i/dt^2$  at  $t=0^+$  when the switch K is moved from position 1 to 2 at  $t=0$  in network shown in fig5
28. Q4.In the network shown in fig6, K is changed from position a to b at  $t=0$ , solve for  $i$ ,  $di/dt$ ,  $d^2i/dt^2$  at  $t=0^+$ , Assume that capacitor is initially uncharged.

#### 29. Module 4

1. State and prove initial value and final value theorem.
2. What are the limitations of initial and final value theorem.
3. State and prove convolution theorem
4. Define and obtain the Laplace transform of i)UNIT impulse function ii)UNIT ramp function iii)UNIT step function
5. Obtain the Laplace transform of full wave rectified sine wave of amplitude 1 and period  $\pi$ sec.
6. Determine the current expression  $V_o(t)$  in the circuit shown in fig.7.1, when the switch S is closed at  $t=0$ .The inductor is initially de-energized.
7. Find the response of current of a series R-L circuit consisting of  $R=4\Omega$ ,  $L=2H$ , when each of the following driving force voltages are applied
8. i) UNIT ramp voltage  $r(t-5)$  ii) UNIT impulse voltage  $\delta(t-5)$
9. iii) UNIT sep voltage  $U(t-5)$  Assume zero initial conditions.
10. For the circuit shown in fig.7.2 Find  $v_o(t)$  using convolution theorem.
11. A pulse voltage of magnitude 5 and duration 1 sec is applied to a series RC circuit having  $R=5\Omega$ ,  $C=0.2f$ . Calculate the current  $i(t)$  in the circuit using Laplace transform.

#### Module 5

1. Explain i) Z-parameters ii) Y-Parameters iii) Transmission parameters, iv) Hybrid parameters v) Inverse transmission parameter vi) inverse hybrid parameters.
2. Obtain relation between i)Y & Z parameters ii)Y & h parameters iii)Y & ABCD parameters iv)Z & h Parameters v)Z & T parameters vi)H & T parameters
3. Two 2port networks are connected in cascade obtain T-parameters of the inter connected network in terms of T parameters of the individual networks.
4. A two port network in terms of Z-parameters is said to be symmetric if  $Z_{11}=Z_{22}$  and reciprocal if  $Z_{12}=Z_{21}$ . Obtain the corresponding conditions in terms of i) h Parameters ii) T-parameters using the relationship between different two-port parameters.
5. Obtain ABCD parameters in terms of z-parameters and show that  $AD-BC = 1$
6. Find the relationship between the z-parameters and h-parameters of a two port network.
7. Define Z and Y parameters of a 2 port network.
8. Define Z- parameters. Express Z-parameters in terms of Y parameters.
9. Find Z and Y parameters for the two-port network shown in fig.8.1
10. Following are the hybrid parameters of the network given. Define the Y parameters for the network.  
$$\begin{bmatrix} \square_{11} & \square_{12} \\ \square_{21} & \square_{22} \end{bmatrix} = \begin{bmatrix} 5 & 2 \\ 3 & 6 \end{bmatrix}$$
11. Write explanation on star connected three phase network and delta connected three phase network.





Sample circuits for the question bank given (fig3.3 to 8.1)

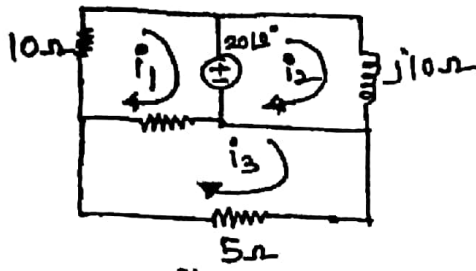


fig 3.3

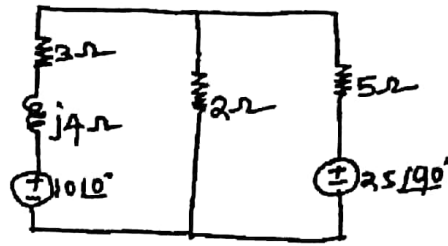


fig 3.4

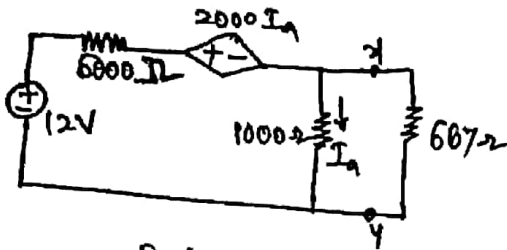


fig 4.1

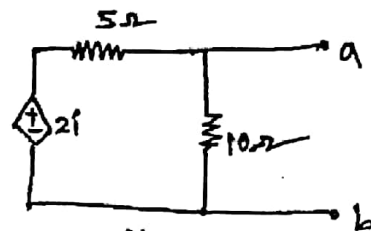


fig 4.2

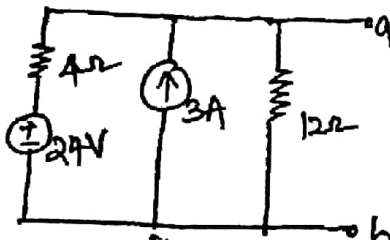


fig 4.3

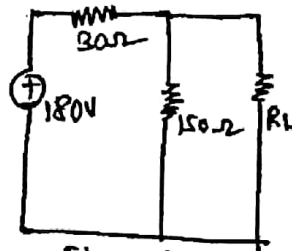


fig 4.4

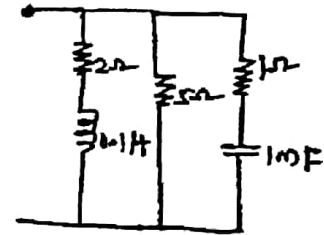


fig 5.1

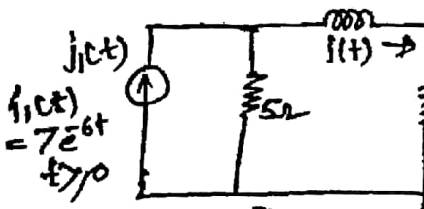


fig 6.2

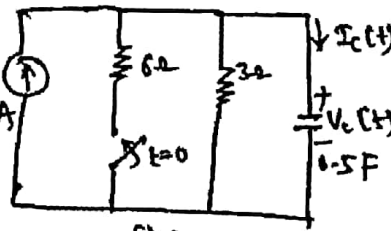


fig 6.1

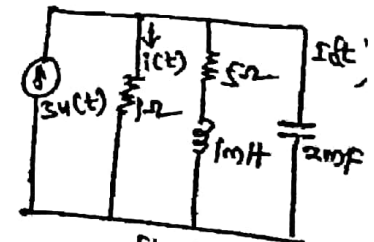


fig 6.3

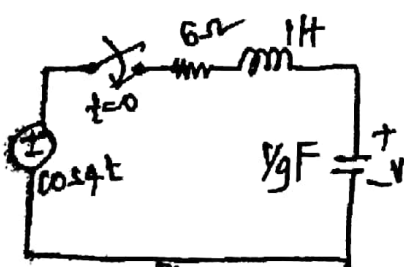


fig 7.1

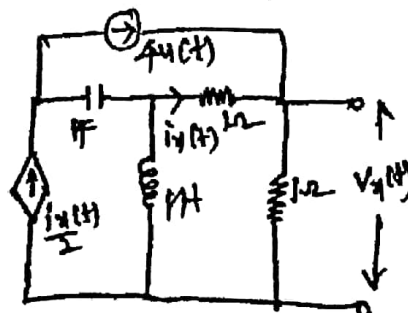


fig 7.2

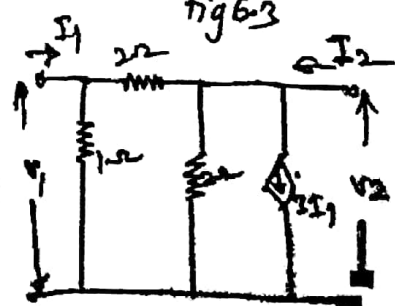


Fig 8.1



Circuits on network reduction techniques and KVL, KCL (fig 1-fig 8)

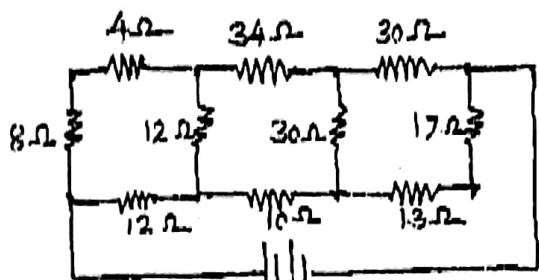


Figure 1 180V

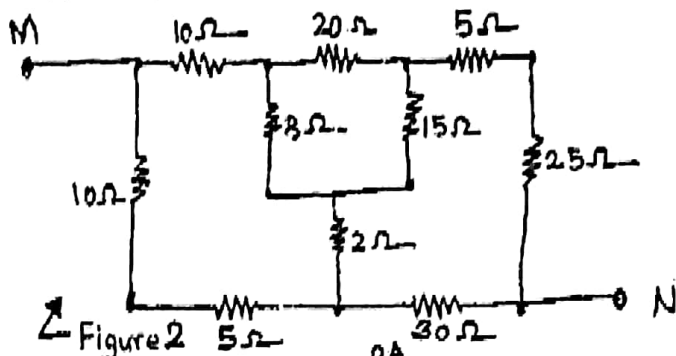


Figure 2

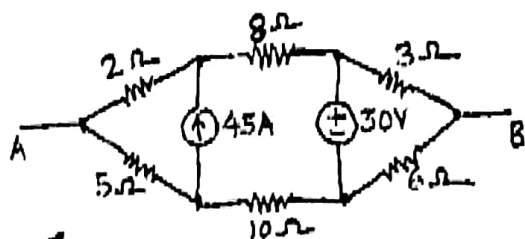


Figure 3

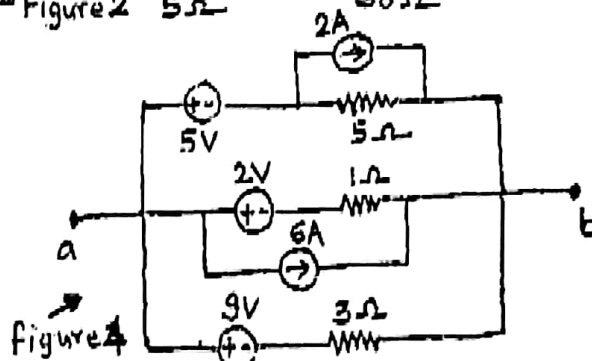


Figure 4

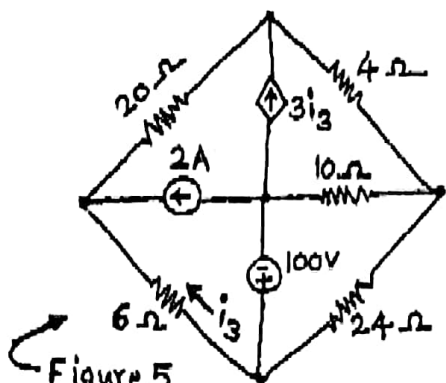


Figure 5

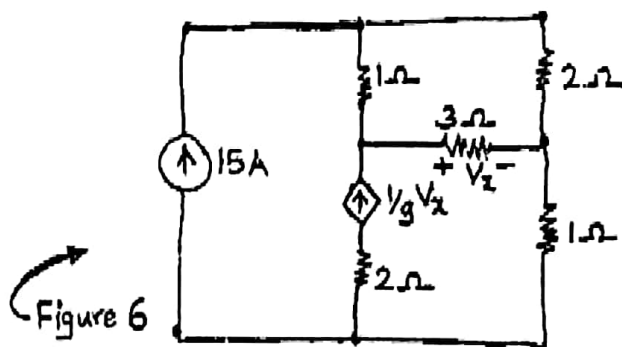


Figure 6

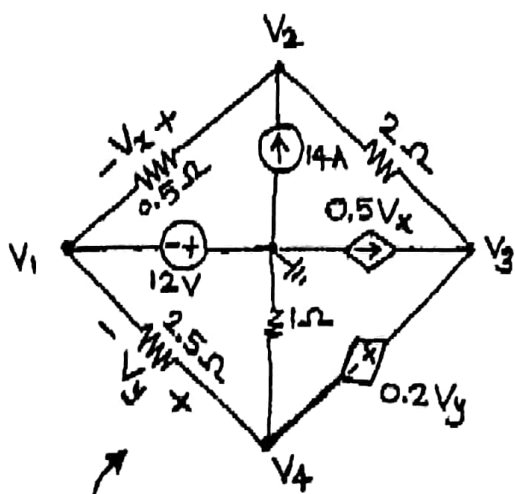


Figure 7

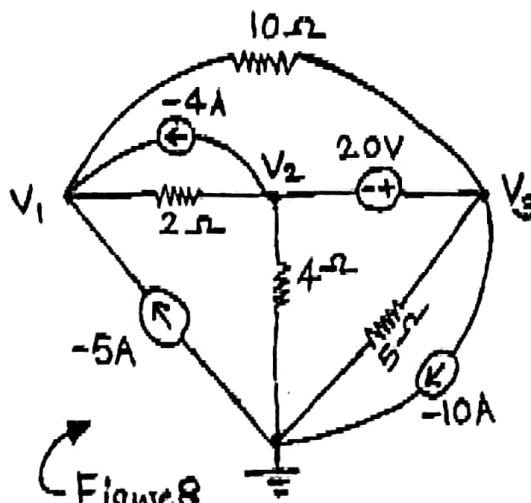


Figure 8



Sample Circuits on network theorems.(fig 1-fig12)

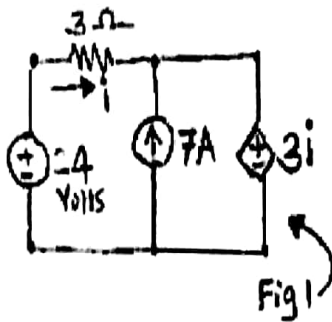


Fig 1

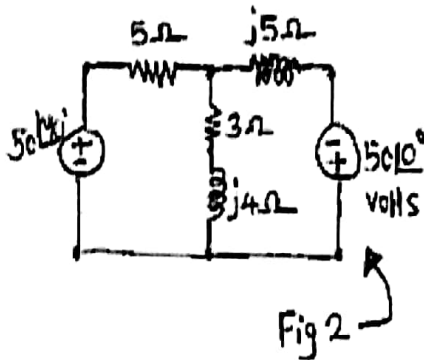


Fig 2

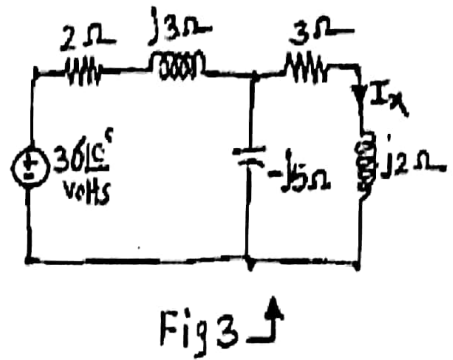


Fig 3

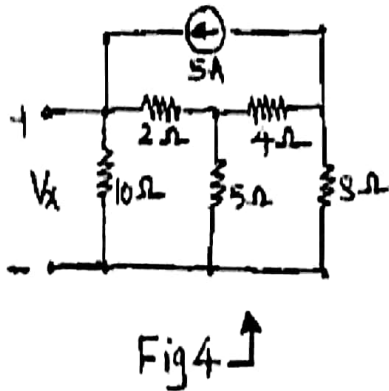


Fig 4

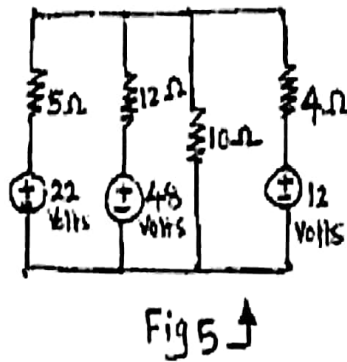


Fig 5

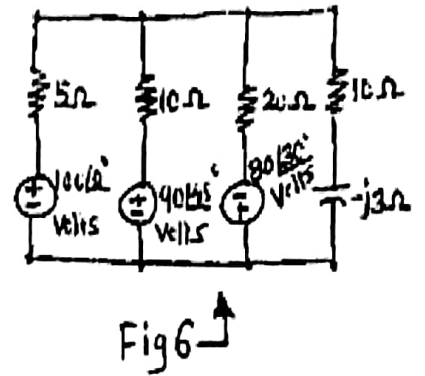


Fig 6

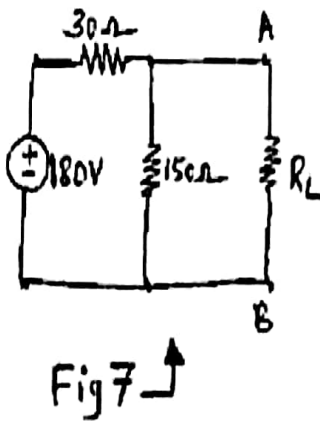


Fig 7

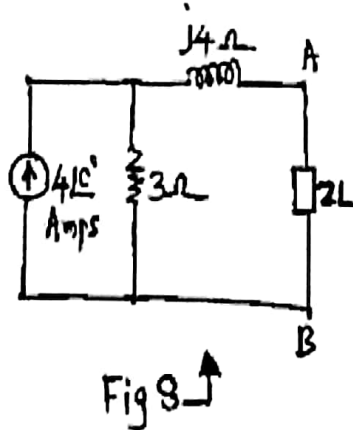


Fig 8

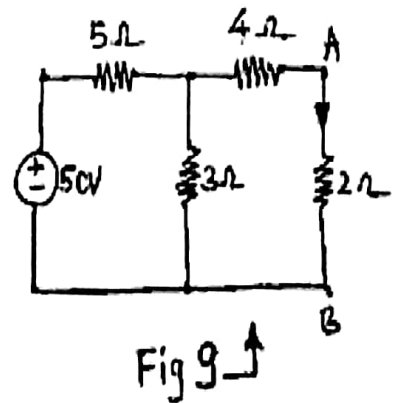


Fig 9

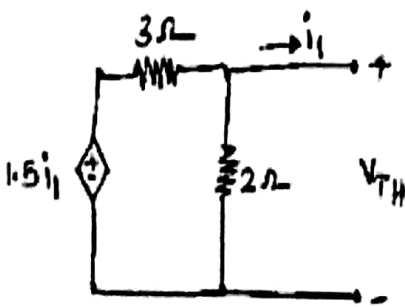


Fig 10

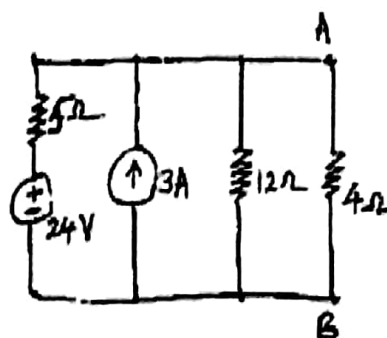


Fig 11

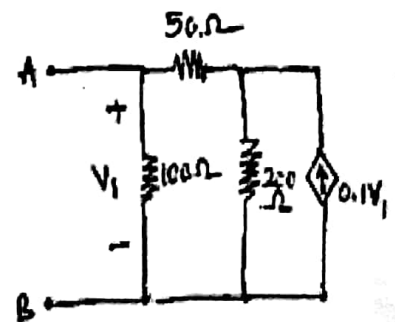
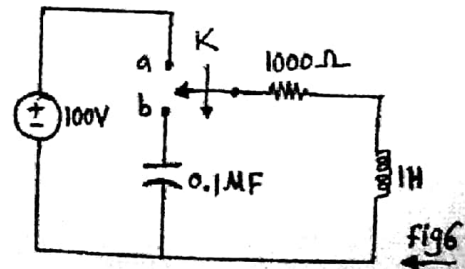
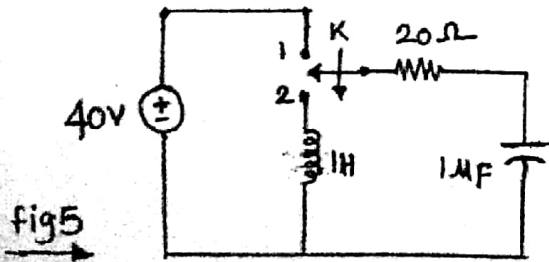
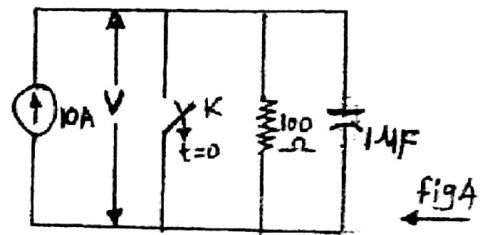
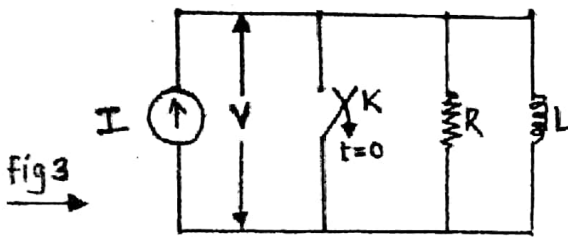
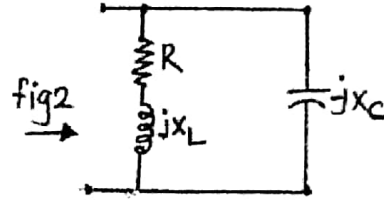
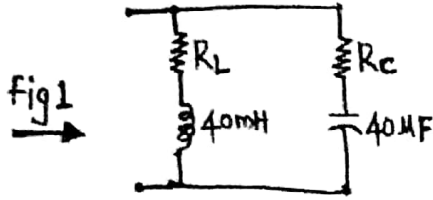


Fig 12



Sample networks on resonance, transient analysis



Prepared by	Checked by		
Prof. Pramod Murari	Prof. Sagar S Birade	HOD	Principal



<b>Subject Title</b>	<b>TRANSFORMER AND GENERATOR</b>		
<b>Subject Code</b>	17EE33	<b>IA Marks</b>	40
<b>Number of Lecture Hrs / Week</b>	05L	<b>Exam Marks</b>	60
<b>Total Number of Lecture Hrs</b>	65	<b>Exam Hours</b>	03
<b>CREDITS – 04</b>			

**FACULTY DETAILS:**

<b>Name:</b> Prof.Amit U Neshti	<b>Designation:</b> Asst.Professor	<b>Experience:</b> 09 years 6 Months
<b>No. of times course taught:</b> 01	<b>Specialization:</b> Digital Electronics	

**1.0 Prerequisite Subjects:**

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

**2.0 Course Objectives**

1. To understand the concepts of transformers and their analysis.
2. To suggest a suitable three phase transformer connection for a particular operation.
3. To understand the concepts of generator and to evaluate their performance.
4. To explain the requirement for the parallel operation of transformers and synchronous generators.

**3.0 Course Outcomes**

Having successfully completed this course, the student will be able

	Course Outcome	Cognitive Level	Pos
CO203.1	Explain the construction and operation and performance of transformers	L <sub>1</sub> L <sub>2</sub> L <sub>3</sub> L <sub>4</sub>	PO(1,2,3,4)
CO203.2	Explain different connections for the three phase operations, their advantages and applications.	L <sub>1</sub> L <sub>2</sub> L <sub>3</sub> L <sub>4</sub>	PO(1,2,3,4)
CO203.3	Explain the construction and operation of Synchronous machines and evaluate the regulation of synchronous machines by different methods.	L <sub>1</sub> L <sub>2</sub> L <sub>3</sub> L <sub>4</sub>	PO(1,2,3,4)
CO203.4	Analyze the operation of the synchronous machine connected to infinite machine.	L <sub>1</sub> L <sub>2</sub> L <sub>3</sub> L <sub>4</sub>	PO(1,2,3,4)
<b>Total Hours of instruction</b>			<b>50</b>

**4.0 Course Content**

**PART A  
Module-1**

**Single phase Transformers:** Operation of practical transformer under no – load and on – load with phasor diagrams. Equivalent circuit, Open circuit and Short circuit tests, calculation of equivalent circuit parameters and predetermination of efficiency commercial and all-day. Voltage regulation and its significance, Polarity test and sumpner test.

**Three-phase Transformers:** Introduction, Constructional features of three-phase transformers. Choice between single unit three-phase transformer and a bank of three single-phase transformers. Transformer connection for three phase operation – star/star, delta/delta, star/delta, zigzag/star and V/V, choice of connection. Phase conversion – Scott connection for three-phase to two-phase conversion. Labelling of three-phase transformer terminals, vector groups.

**Revised Bloom’s Taxonomy Level**

L1 – Remembering, L2 – Understanding, L3 – Applying, L4 – Analysing.

**Module-2**

**Parallel Operation of Transformers:** Necessity of Parallel operation, conditions for parallel operation – Single phase and three phase. Load sharing in case of similar and dissimilar transformers.

**Auto transformers and Tap changing transformers:** Introduction to auto transformer – copper economy, equivalent circuit, three phase auto connection and voltage regulation. Voltage regulation by tap changing – off circuit and on load.

**Revised Bloom’s Taxonomy Level**

L1 – Remembering L2 – Understanding, L3 – Applying, L4 – Analysing.



**Module-3**

**Transformers (continuation):** Tertiary winding Transformers: Necessity of tertiary winding, equivalent circuit and voltage regulation, tertiary winding in star/star transformers, rating of tertiary winding.

**Direct current Generator** – Armature reaction, Commutation and associated problems.

**Synchronous generators-** Armature windings, winding factors, emf equation. Harmonics – causes, reduction and elimination. Armature reaction, Synchronous reactance, Equivalent circuit.

**Revised Bloom's Taxonomy Level**

L1 – Remembering L2 – Understanding, L3 – Applying, L4 – Analysing.

**Module-4**

**Synchronous generators (continuation):** Generator load characteristic. Voltage regulation, excitation control for constant terminal voltage. Generator input and output. Parallel operation of generators and load sharing. Synchronous generator on infinite busbars – General load diagram, Electrical load diagram, mechanical load diagram, O – curves and V – curves. Power angle characteristic and synchronizing power. Effects of saliency, two-reaction theory, Direct and Quadrature reactance, power angle diagram, reluctance power, slip test.

**Revised Bloom's Taxonomy Level**

L1 – Remembering L2 – Understanding, L3 – Applying, L4 – Analysing.

**Module-5**

**Synchronous generators (continuation):** Open circuit and short circuit characteristics, Assessment of reactance- short circuit ratio, synchronous reactance, adjusted synchronous reactance and Potier reactance. Voltage regulation by EMF, MMF, ZPF and ASA methods.

**Performance of synchronous generators:** Capability curve for large turbo generators and salient pole generators. Starting, synchronizing and control. Hunting and dampers.

**Revised Bloom's Taxonomy Level**

L1 – Remembering, L2 – Understanding, L3 – Applying, L4 – Analysing

**5.0 Relevance to future subjects**

Sl No	Semester	Subject	Topics
01	IV	Electric motor,IDA	Principles of machine
02	VII&VIII	Seminar and project	Knowledge of machine

**6.0 Relevance to Real World**

SL.No	Real World Mapping
01	Off-highway Sector, Automotive Marine, Pump Drives
02	Energy Regeneration Material Handling Oil and Gas Mining and Drilling Industry (Hazardous Environment)

**7.0 Gap Analysis and Mitigation**

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

**8.0 Books Used and Recommended to Students**

Text Books
1. Electric Machines', D. P. Kothari, I. J. Nagrath Mc Graw Hill 4 <sup>th</sup> edition, 2011
2. Electrical Machines M.V. Deshpande PHI Learning 2013
3. Electric Machines R.K. Srivastava Cengage Learning 2 <sup>nd</sup> Edition, 2013



**Reference Books**

- 1.Principles of Electric Machines and power Electronics P.C.Sen Wiley 2<sup>nd</sup> Edition, 2013
- 2.Electrical Machines, Drives and Power systems Theodore Wildi Pearson 6<sup>th</sup> Edition, 2014.
- 3.Electric Machinery and Transformers Bhag S Guru at el Oxford University Press 3<sup>rd</sup> Edition, 2012
- 4.Theory of Alternating Current Machines Alexander Langsdorf Mc Graw Hill 2<sup>nd</sup> Edition, 2001

**Additional Study material & e-Books**

- 1.Electric machines by godse & bakshi

**9.0**

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

**Website and Internet Contents References**

- 1) <http://www.electrical4u.com>
- 2) [www.nptel.com](http://www.nptel.com)
- 3) <https://en.wikipedia.org/wiki/transformer>
- 4) <https://www.youtube.com/watch?v=LAtPHANefQo>
- 5) [www.electrical4u.com/transformer/](http://www.electrical4u.com/transformer/)
- 6) <http://www.electrical4u.com/working-principle-of-dc-generator-and-alternator/>
- 7) [www.ijset.net/journal/68.pdf](http://www.ijset.net/journal/68.pdf)
- 8) [www.electrical4u.com/dc generator](http://www.electrical4u.com/dc-generator)
- 9) [www.electrical4u.com/alternator](http://www.electrical4u.com/alternator)
- 10) [www.electrical4u.com/alternator](http://www.electrical4u.com/alternator)
- 11) [www.electrical4u.com/alternator](http://www.electrical4u.com/alternator)
- 11) <http://eeeinterviewtips.blogspot.in/2011/09/discuss-different-types-of-generator>

**10.0**

**Magazines/Journals Used and Recommended to Students**

Sl.No	Magazines/Journals	website
1	EC&M Magazines	<a href="http://ecmweb.com/ops-maintenance/generators">http://ecmweb.com/ops-maintenance/generators</a>
2	Oil & gas journal	<a href="https://www.sub-forms.com/dragon/init.do?site=PNW23_Ogogpenew">https://www.sub-forms.com/dragon/init.do?site=PNW23_Ogogpenew</a>
3	IPT Magazine	<a href="https://www.intelligent-power-today.com/">https://www.intelligent-power-today.com/</a>
4	Electric apparatus magazine	<a href="https://electricalapparatus.wordpress.com/2016/06/30/electric-generator-up-and-running/">https://electricalapparatus.wordpress.com/2016/06/30/electric-generator-up-and-running/</a>
5	E drive magazine	<a href="http://www.e-driveonline.com/main/">http://www.e-driveonline.com/main/</a>
6	Motor magazine	<a href="https://www.motor.com/newsletters/20110410/WebFiles/ID1_IonizingAmerica.html">https://www.motor.com/newsletters/20110410/WebFiles/ID1_IonizingAmerica.html</a>

**11.0**

**Examination Note**

Internal Assessment: 40 Marks

Scheme of Evaluation for Internal Assessment (40 Marks)

There are four questions each of 15 marks with option student has two answers any two full question.

Assignment : 10Marks

**SCHEME OF EXAMINATION:**

The question paper will have ten questions.

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



**12.0 Course Delivery Plan**

Mod ule No.	Lectur e No.	Content of Lecture	% of Portion
1	1.	<b>Single phase Transformers:</b> operation of practical transformer under no – load and on – load with phasor diagrams.	15.38%
	2.	Equivalent circuit,	
	3.	Open circuit and Short circuit tests, calculation of equivalent circuit parameters.	
	4.	Predetermination of efficiency commercial and all-day.	
	5.	Voltage regulation and its significance.	
	6.	<b>Three-phase Transformers:</b> Introduction, Constructional features of three-phase transformers.	
	7.	Choice between single unit three-phase transformer and a bank of three single-phase transformers.	
	8.	Transformer connection for three phase operation – star/star, delta/delta, star/delta, zigzag/star and V/V, choice of connection.	
	9.	Phase conversion – Scott connection for three-phase to two-phase conversion	
	10.	Labelling of three-phase transformer terminals, vector groups.	
2	11.	Polarity and sumpner test.	15.38%
	12.	<b>Parallel Operation of Transformers:</b> Necessity of Parallel operation, conditions for parallel operation – Single phase and three phase.	
	13.	Load sharing in case of similar	
	14.	Load sharing in case of dissimilar transformers	
	15.	Problems on load sharing	
	16.	<b>Auto transformers and Tap changing transformers:</b> Introduction to auto transformer – copper economy	
	17.	Auto transformer copper economy	
	18.	Equivalent circuit.	
	19.	Tap changing – off circuit	
	20.	Tap changing – on load.	
3	21.	<b>Transformers (continuation): Tertiary winding Transformers:</b> Necessity of tertiary winding.	19.230%
	22.	Equivalent circuit and voltage regulation.	
	23.	Tertiary winding in star/star transformers & Rating of tertiary winding.	
	24.	<b>Direct current Generator</b> Armature reaction.	
	25.	Commutation	
	26.	Problems	
	27.	<b>Synchronous generators-</b> Review of construction and operation of salient & non-salient pole synchronous generators (No question shall be set from the review portion).	
	28.	Armature windings, winding factors, emf equation.	
	29.	Harmonics – causes, reduction and elimination	
	30.	Armature reaction, Synchronous reactance, Equivalent circuit	
4	31.	<b>Synchronous generators (continuation):</b> Generator load characteristic.	9.615%
	32.	Voltage regulation, excitation control for constant terminal voltage.	
	33.	Generator input and output.	
	34.	Parallel operation of generators and load sharing.	
	35.	Synchronous generator on infinite busbars – General load diagram.	
	36.	Electrical load diagram, mechanical load diagram.	
	37.	O – curves and V – curves. Power angle characteristic and synchronizing power.	
	38.	Effects of saliency, two-reaction theory.	
	39.	Direct and Quadrature reactance, power angle diagram.	



5	40.	Reluctance power, slip test.	15.38%
	41.	Synchronous generators (continuation): Open circuit and short circuit characteristics.	
	42.	Assessment of reactance- short circuit ratio	
	43.	Synchronous reactance, adjusted synchronous reactance and Potier reactance.	
	44.	Voltage regulation by EMF method.	
	45.	Voltage regulation by MMF method.	
	46.	Voltage regulation by ZPF method.	
	47.	Voltage regulation by ASA method.	
	48.	Performance of synchronous generators: Capability curve for large turbo generators and salient pole generators.	
	49.	Starting, synchronizing and control.	
	50.	Hunting and dampers.	

### 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 single phase and three phase transformer.	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 2, 3 of the reference list. Website of the Reference list
2	Assignment 2: University Questions on autotransformer	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 2, 3 of the reference list. Website of the Reference list
3	Assignment 3: University Questions on dc generator	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 2, 3 of the reference list. Website of the Reference list
4	Assignment 4: University Questions on synchronous generator	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 2, 3 of the reference list. Website of the Reference list
5	Assignment 5: University Questions on synchronous generator	Students study the Topics and write the Answers. Get practice to solve university questions.	Module 5 of the syllabus	10	Individual Activity. Printed solution expected.	Book 2, 3 of the reference list. Website of the Reference list



## 14.0 Assignment Questions

Assignment No	Questions	Marks
1	1. Derive the EMF equation of a transformer. 2. Explain in brief Starting from fundamental develop the exact equivalent circuit and approximate equivalent circuit of a single phase transformer referred to primary? 3. Draw the phasor diagrams of single phase transformer with unity pf and lagging pf loads. 4. Draw the phasor diagrams of single phase transformer with unity pf and lagging pf loads.	5marks 5marks 5marks 5marks
2	64 What is an autotransformer? Derive an expression for the saving of copper when an autotransformer is used? Mention its applications? 2. What is an autotransformer? Discuss merits and demerits of autotransformer? 3. Discuss the equivalent circuit, three phase autotransformer connection and voltage Regulation. 4. Discuss the Voltage regulation by tap changing – off circuit and on load.	5marks 5marks 5marks 5marks
3	1. With the neat diagram explain the process of commutation in the d.c machine. 2. Explain the methods of improving the commutation. 3. Explain what is meant by critical field resistance in a d.c shunt generator and Explain the method of determining it. 4. Explain why interpoles and compensating winding are used in d.c machine.	5marks 5marks 5marks 5marks
4	1. Obtain expression for power angle equation of salient Pole synchronous generator Connected to infinite bus bar. Sketch this characteristic this characteristic and comment on it shape. 2. With neat circuit diagram, explain how an alternator is synchronized with bus bars. 3. Discuss the Electrical load diagram & mechanical load diagram. 4. Discuss the O – curves and V – curves of alternator.	5 Marks 5 Marks 5marks 5 marks
5	1. Why is alternator terminal voltage, when loading is not equal to the no load voltage. 2. Discuss Capability curve for large turbo generators and salient pole generators. 3. Discuss the Starting, synchronizing and control. 4. Discuss the Hunting and damper winding.	5Marks 5 Marks 5 Marks 5 Marks

## 15.0 QUESTION BANK

### Module 1

1. Explain with neat sketch the construction of single phase core type and shell type transformer?
2. Difference between shell and core type transformer?
3. Explain in brief the working principle of single phase transformer.
4. Derive the EMF equation of a transformer.
5. Explain in brief Starting from fundamental develop the exact equivalent circuit and approximate equivalent circuit of a single phase transformer referred to primary?
6. Draw the phasor diagrams of single phase transformer with unity pf and lagging pf loads.
7. Draw the phasor diagrams of single phase transformer with unity pf and lagging pf loads.
8. Explain how the flux in the core of transformer remains constant, from no load to full load. Develop the phasor diagram of an actual transformer when it is inductively loaded.
9. Explain in details OC and SC test (with circuit diagram) for determination of efficiency and regulation of single phase transformer.
10. What are the losses in a transformer? How to reduce these losses? Derive the condition for maximum efficiency? Efficiency and voltage regulation of transformer
11. Define all day efficiency and explain
12. Write a short note on efficiency and voltage regulation of transformer.
13. Discuss the ideal transformer & practical transformer under load and no load.
14. Explain the Necessary conditions for parallel operation of single phase transformers and then the three phase .
15. Explain the classification of polyphase connection of three phase transformer.
16. Discuss the Phase conversion – Scott connection for three-phase to two-phase conversion.
17. Discuss the Labeling of three-phase transformer terminals & vector groups.
18. Discuss the Equivalent circuit of three phase transformers.



### Module 2

- 1 Describe the necessity & Explain the Necessary conditions for parallel operation of single phase transformers and then the three phase.
- 2 Discuss the Load sharing in case of similar and dissimilar transformers.
- 3 What is an autotransformer? Derive an expression for the saving of copper when an autotransformer is used? Mention its applications?
- 4 What is an autotransformer? Discuss merits and demerits of autotransformer?
- 5 Discuss the equivalent circuit, three phase autotransformer connection and voltage regulation.
- 6 Discuss the Voltage regulation by tap changing – off circuit and on load.
- 7 Discuss the Necessity of tertiary winding, equivalent circuit and voltage regulation.
- 8 Discuss the tertiary winding in star/star transformers & rating of tertiary winding.

### Module 3

1. Explain the causes & effects of harmonics generated by transformers.
2. Explain the Current inrush in transformers & generation of noise in transformer.
3. Discuss the Objects of testing transformers & polarity test.
4. Explain With neat diagram explain in detail Sumpner's test for determining the efficiency and voltage regulation of transformer. Mention its advantages and disadvantages.
5. With neat diagram explain the phenomenon of armature reaction in d.c machine.
6. Develop an expression for demagnetizing and cross magnetizing armature ampere turns in a d.c generator.
7. With the neat diagram explain the process of commutation in the d.c machine.
8. Explain the methods of improving the commutation.
9. Explain what is meant by critical field resistance in a d.c shunt generator and explain the method of determining it.
10. Explain why interpoles and compensating winding are used in d.c machine.
11. List the advantage of stationary armature in synchronous machine.
12. Explain the essential difference between cylindrical and salient pole rotors used in large alternators.
13. List the advantage of chording of armature coils in synchronous machine. Derive the expression for pitch factor.
14. Define the breadth factor. Derive expression for it.
15. Derive an equation for emf induced in an alternator.
16. Write a short note on armature reaction in alternator.
17. Discuss the various measures adopted in a practice to make the waveform of large alternators to be closely sinusoidal.
18. Explain the Harmonics – causes, reduction and elimination in an alternator.
19. Discuss the Synchronous reactance & Equivalent circuit in an alternator.


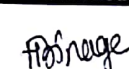
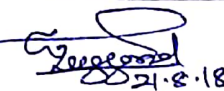

### Module 4

1. Discuss the Synchronous generator load characteristics.
2. An alternator is supplying constant load. With suitable vector diagram and explain the effect of variation on excitation on armature current and power factor.
3. Explain how two or more alternators are made to share the load in proportion to rating.
4. List the conditions to be fulfilled to connect two alternators in parallel.
5. With the usual notations derive an expression for synchronizing power and torque when two alternators are connected in parallel.
6. With. Neat circuit diagram, Derive an expression for the power output of salient Pole synchronous generator Draw variation of power versus load angle.
7. Derive an expression for mechanical power developed by salient pole synchronous motor Hence Explain what is meant by reluctance torque.
8. Obtain expression for power angle equation of salient Pole synchronous generator Connected to infinite bus bar. Sketch this characteristic this characteristic and comment on its shape.
9. With neat circuit diagram, explain how an alternator is synchronized with bus bars.
10. Discuss the Electrical load diagram & mechanical load diagram.
11. Discuss the O – curves and V – curves of alternator.
12. With neat circuit diagram explain the slip test salient Pole synchronous machine and indicate  $X_d$  and  $X_q$  can be determined from the test.



Module 5

1. Define "Regulation of alternator". Explain potier reactance method of finding the Regulation of alternator.
2. Define "Regulation of alternator". Explain ASA method of finding the Regulation of alternator. And compare with other known method.
3. Define "Regulation of alternator". Explain MMF or ampere turn's method of finding the Regulation of alternator.
4. Describe synchronous impedance method to determine the regulation of alternator for lagging and leading power factor.
5. Why is alternator terminal voltage, when loading is not equal to the no load voltage.
6. Discuss Capability curve for large turbo generators and salient pole generators.
7. Discuss the Starting, synchronizing and control.
8. Discuss the Hunting and damper winding.

Prepared by	Checked by		
		 21.8.18	
Prof.Amit U Neshti	Prof.H.R.Zinage	HOD	Principal



<b>Subject Title</b>	ANALOG ELECTRONIC CIRCUITS (Core Course)		
<b>Subject Code</b>	17EE34	<b>CIE Marks</b>	40
<b>Number of Lecture Hrs / Week</b>	04	<b>SEE Marks</b>	60
<b>Total Number of Lecture Hrs</b>	50	<b>Exam Hours</b>	03
<b>CREDITS – 04</b>			

<b>FACULTY DETAILS:</b>		
<b>Name:</b> Prof. Sagar S Birade	<b>Designation:</b> Asst. Professor	<b>Experience:</b> 06 Years
<b>No. of times course taught:</b> 05	<b>Specialization:</b> VLSI Design & Embedded Systems	

### 1.0 Prerequisite Subjects:

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

### 2.0 Course Objectives

1. Provide the knowledge for the analysis of diode and transistor circuits.
2. Develop skills to design the electronic circuits like amplifiers and oscillators.

### 3.0 Course Outcomes

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

	Course Outcome	Cognitive Level	Revised Bloom's Taxonomy Level	POs
CO204.1	Predict the output response of clipper and clamper circuits.	U	L1, L2, L3, L4	2,3
CO204.2	Design and compare biasing circuits for transistor amplifiers.	U, A	L2, L3, L4, L5	2,3
CO204.3	Explain the transistor switching.	U, A	L1, L2, L3, L4	2,3
CO204.4	Explain the concept of feedback, its types and design of feedback circuits	U, A	L1, L2, L3, L4	2,3
CO204.5	Design and analyze the power amplifier circuits and oscillators for different frequencies.	U, A	L1, L2, L3, L4	2,3
CO204.6	Perform design and analysis of FET and MOSFET amplifiers in the common source mode with fixed bias.	U, A	L1, L2, L3, L4	2,3
<b>Total Hours of instruction</b>			<b>50</b>	

### 4.0 Course Content

#### Module-1

**Diode Circuits:** Diode clipping and clamping circuits.

**Transistor biasing and stabilization:** Operating point, analysis and design of fixed bias circuit, self-bias circuit, Emitter stabilized bias circuit, voltage divider bias circuit, stability factor of different biasing circuits. Problems. Transistor switching circuits

**10 Hours**



**Module-2**

**Transistor at low frequencies:** BJT transistor modelling, CE fixed bias configuration, voltage divider bias, emitter follower, CB configuration, collector feedback configuration, analysis using h – parameter model, relation between h – parameters model of CE, CC and CB modes, Millers theorem and its dual.

10 Hours

**Module-3**

**Multistage amplifiers:** Cascade and cascode connections, Darlington circuits, analysis and design.  
**Feedback amplifiers:** Feedback concept, different types, practical feedback circuits, analysis and design of feedback circuits.

10 Hours

**Module-4**

**Power amplifiers:** Amplifier types, analysis and design of different power amplifiers.  
**Oscillators:** Principle of operation, analysis and derivation of frequency of oscillation of phase shift oscillator, Wien bridge oscillator, RF and crystal oscillator and frequency stability.

10 Hours

**Module-5**

**FETs:** Construction, working and characteristics of JFET and MOSFET. Biasing of JFET and MOSFET Analysis and design of JFET (only common source configuration with fixed bias) and MOSFET amplifiers

10 Hours

**5.0 Relevance to future subjects**

SI No	Semester	Subject	Topics
01	IV	Op Amp & Linear IC	Amplifiers, Oscillators
02	VIII	VLSI Circuits	MOSFET

**6.0 Relevance to Real World**

SI No	Real World Mapping
01	Design of various components like voltage regulator, oscillators etc.
02	Conduct investigations of complex Problems using basics of transistor parameters.
03	Development of prototype models.

**7.0 Gap Analysis and Mitigation**

SI No	Delivery Type	Details
01	Tutorial	Topic: Basic of diodes, transistors, transistor amplifiers, oscillators.
02	NPTEL	FET's & MOSFET

**8.0 Books Used and Recommended to Students**

Text Books
1. 'Electronic Devices and Circuit Theory' by Robert L Boylestad Louis Nashelsky Pearson 11th Edition, 2015.
2. Electronic Devices and Circuits by David A Bell Oxford University Press 5th Edition, 2008
Reference Books
1. Microelectronics Circuits Analysis and Design by Muhammad Rashid Cengage Learning 2nd Edition, 2014.
2. A Text Book of Electrical Technology, Electronic Devices and Circuits by B.L. Theraja, A.K. Theraja S. Chand Reprint, 2013
3. Electronic Devices and Circuits S.Salivahanan N.Suresh Mc Graw Hill 3rd Edition, 2013.
4. Fundamentals of Analog Circuits Thomas L Floyd Pearson 2nd Edition, 2012
Additional Study material & e-Books
1. Electronic Devices and Circuits Anil K. Maini Vasha Agarwal Wiley 1st Edition, 2009



## 9.0

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

Website and Internet Contents References
<a href="https://en.wikipedia.org/wiki/transistor_amplifier">https://en.wikipedia.org/wiki/transistor amplifier</a>
<a href="https://en.wikipedia.org/wiki/oscillators">https://en.wikipedia.org/wiki/oscillators</a>

## 10.0

### Magazines/Journals Used and Recommended to Students

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

## 11.0

### Examination Note

Assignment marks: 10 marks.

Question paper pattern IA exam:

Answer two full questions Q1 or Q2 and Q3 or Q4 (15marks each). Total 30 Marks.

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	Lecture No.	Content of Lecturer	% of Portion
MODULE 1	1, 2, 3	Diode Circuits: Diode clipping and clamping circuits.	20
	4, 5	Transistor biasing and stabilization: Operating point, analysis and design of fixed bias circuit	
	6	Self- bias circuit, Emitter stabilized bias circuit,	
	7, 8	Voltage divider bias circuit	
	9	Stability factor of different biasing circuits.	
	10	Transistor switching circuits Problems.	
MODULE 2	11	Transistor at low frequencies: BJT transistor modeling	20
	12,13	CE fixed bias configuration, voltage divider bias	
	14	emitter follower, CB configuration,	
	15	collector feedback configuration	
	16, 17	analysis using h – parameter model	
	18, 19	relation between h – parameters model of CE, CC and CB modes	
MODULE 3	20	Miller's theorem and its dual.	20
	21, 22	Multistage amplifiers: Cascade and cascode connections	
	23, 24, 25	Darlington circuits analysis and design	
	26, 27	Feedback amplifiers: Feedback concept, different types	
	28	Practical feedback circuits	
MODULE 4	29, 30	Analysis and design of feedback circuits.	20
	31	Power amplifiers: Amplifier types	
	32, 33	Analysis and design of different power amplifiers.	
	34, 35, 36	Oscillators: Principle of operation, analysis and derivation of frequency of oscillation of phase shift oscillator,	
	37, 38	Wien bridge oscillator	
MODULE 5	39, 40	RF and crystal oscillator and frequency stability.	20
	41, 42	FETs: Construction, working and characteristics of JFET and MOSFET.	
	43, 44, 45, 46	Biasing of JFET and MOSFET	
	47, 48, 49, 50	Analysis and design of JFET (only common source configuration with fixed bias) and MOSFET amplifiers	



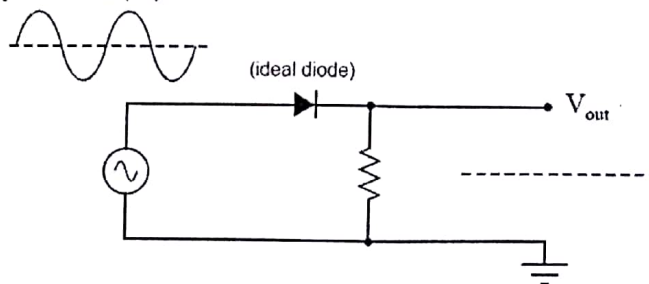
### 13.0 Assignments, Pop Quiz, Mini Project, Seminars

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 basics of diode circuits, transistors biasing.	Module 1 of the syllabus	3	Individual Activity.	
2	Assignment 2: Questions on module 2	Students study the transistors at low frequency and h-parameters.	Module 2 of the syllabus	5	Individual Activity.	
3	Assignment 3: Questions on module 3	Students study the multistage and feedback amplifiers.	Module 3 of the syllabus	8	Individual Activity.	
4	Assignment 4: Questions on module 4	Designing different oscillators.	Module 4 of the syllabus	10	Individual Activity.	
5	Assignment 5: Questions on module 5	Students Study FET's & MOSFET	Module 5 of the syllabus	12	Individual Activity.	

### 14.0 QUESTION BANK

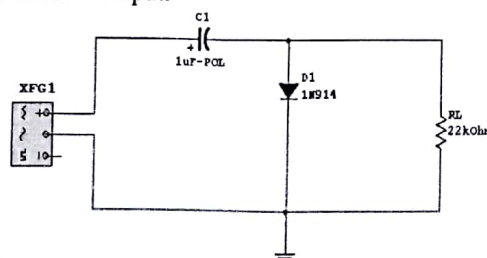
#### MODULE 1

1. What do you understand by 'reverse recovery time' of a diode? Explain.
2. Draw and explain the working of the clamper circuit which clamps the positive peak of a signal to zero volts.
3. Explain the different diode equivalent circuits with necessary approximations if any.
4. Define clipping circuit. Mention a few applications.
5. Draw the piece wise linear V-I characteristics of a PN junction diode. Give the circuit model for the ON state and OFF state.
6. How series clipper can be used to obtain
  - i) Clipping above the reference voltage  $V_R$
  - ii) Clipping below the reference voltage  $V_R$ .
7. Draw and explain a double diode clipper circuit which limits the output at two independent levels.
8. With neat diagram and waveforms explain the working of a negative clamper.
9. Explain diffusion capacitor and transition capacitance of a PN junction diode.
10. Sketch the output voltage waveform for the clipper circuit shown, considering ideal diode with no forward voltage drop, input is  $50\sin(\omega t)$ .



12.

13. Sketch the output waveform for the clamper circuit, consider a forward voltage drop of 0.7V for the diode, for 20 volts peak to peak sine wave input.



15.



### MODULE 2

1. Using exact hybrid model of a C-E transistor amplifier, obtain the expressions for current gain, voltage gain, output resistance and input resistance.
2. State and explain Miller's theorem.
3. Obtain an expression in terms of h- parameters for a transistor as a two port network. Using the above developed equations obtain the hybrid model of CE, CC and CB configurations.
4. Derive an expression for voltage gain and current gain of an amplifier circuit using BJT in CE configuration using approximate hybrid model.
5. What are the advantages of h-parameters?
6. A transistor is connected as a common emitter amplifier driving a load of  $10\text{K}\Omega$ . It is supplied by a source of  $1\text{K}\Omega$  internal resistance. The h parameters are  $h_{ie}=1.1\text{k}\Omega$ ,  $h_{fe}=50$ ,  $h_{re}=2.5\times 10^{-4}$  and  $h_{oe}=1/40\text{K}\Omega$ .
7. Find i) Current gain            iii) input impedance ii) Voltage gain            iv) output impedance  
Using complete or exact hybrid model equivalent model of a transistor, obtain the expressions for current gain, voltage gain, output impedance and input impedance.
8. Describe miller effect and derive an equation for miller input and output capacitances.
9. Discuss the factors that affect the low frequency response of a BJT-CE amplifier.

### MODULE 3

1. What are the advantages of negative feedback in an amplifier?
2. Explain positive feedback and negative feedback mentioning the merits and demerits of each.
3. Give the classification of multistage amplifier. Explain the various distortions in amplifiers.
4. Discuss the general characteristics of a negative feedback amplifier.
5. Explain the concept of 'feedback' in amplifiers.
6. Explain the working of any one type of feedback amplifier and list its characteristics.
7. Derive an expression for the input resistance with feedback amplifier employing voltage series feedback.

### MODULE 4

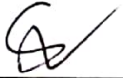



1. How is power amplifiers classified? Discuss them briefly.
2. Bring out the salient features of class A, class b, class c and class AB operation
3. What are classifications of power amplifiers based on the location of Q-point? Indicate the operating cycle in each case.
4. Explain the working of series fed directly coupled class A amplifier, with the help of neat circuit diagram.
5. Prove that the maximum efficiency of a series fed directly coupled class a amplifier is just 25%.
6. Explain with neat circuit diagram, the working of a transformer coupled class A power amplifier.
7. Prove that a transformer coupled class A amplifier has maximum power efficiency of 50%.
8. Draw the circuit diagram of a class B push pull amplifier and explain the operation with relevant waveforms.
9. Show that the maximum conversion efficiency of the class B push pull amplifier is 78.5%.
10. Show that even harmonics are absent in the output of a push pull amplifier.
11. Explain the three point method of calculating the second harmonic distortion.
12. Explain the working of complementary symmetry class B amplifier.
13. Derive the condition for maximum power dissipation of a class b amplifier. State the expression for maximum power dissipation.
14. What is cross over distortion? Explain.
15. What is harmonic distortion? How the output signal gets distorted due to the harmonic distortion.
16. What are the conditions for sustained oscillator or what is Barkhausen criterion?
17. What is Oscillator circuit? What are the classifications of Oscillators? What are the conditions for oscillation?
18. Define Piezoelectric effect. Draw the equivalent circuit of crystal oscillator.
19. What are sinusoidal oscillators? Explain any two sinusoidal oscillators?
20. Explain the concept involved in crystal oscillator with its characteristics?
21. With the help of a neat circuit diagram, explain transistor Colpitts oscillator. Write the expression for the frequency of oscillation.
22. With the help of a neat circuit diagram, explain transistor Hartley oscillator. Write the expression for the frequency of oscillation.
23. Explain the characteristics of quartz crystal. With a neat diagram explain the oscillator in parallel resonant circuits.
24. Explain the working of RC phase shift oscillator and derive an expression for frequency of oscillation.
25. Draw the wein bridge oscillator using BJT. Show that the gain of the amplifier must be at least 3 for the oscillations to occur.
26. Show that for the oscillations to start in an phase shift oscillator, the minimum  $h_{fe}$  value of a transistor should be



44.5.

**MODULE 5**

1. Explain the differences between FET and BJT.
2. Give the output characteristic of JFET and mark the salient regions on the graph.
3. Write the comparison between depletion type MOSFET and enhancement type MOSFET.
4. With neat sketch, explain basic construction of depletion type MOSFET.
5. Draw and explain transfer and drain characteristics of n-channel depletion type MOSFET.

Prepared by	Checked by		
		 21.3.18	
Prof. Sagar S Birade	Prof. P M Murari	HOD	Principal



<b>Subject Title</b>	<b>DIGITAL SYSTEM DESIGN</b>		
<b>Subject Code</b>	17EE35	<b>IA Marks</b>	20
<b>Number of Lecture Hrs /</b>	04	<b>Exam Marks</b>	80
<b>Total Number of Lecture</b>	50	<b>Exam Hours</b>	03

<b>FACULTY DETAILS:</b>		
<b>Name:</b> Prof. K B Negalur	<b>Designation:</b> Asst Professor	<b>Experience:</b> 06
<b>No. of times course taught:</b> 01	<b>Specialization:</b> Industrial Electronics	

### 1.0 Prerequisite Subjects:

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

### 2.0 Course Objectives

Upon completion of this course, a student should be:

- Able to simplify the given combinational logic expressions using various techniques & implementation using basic gates/ universal gates.
- Able to design decoders & encoders.
- Able to design combinational logic circuits like adders, subtractors, multiplexers, comparators.
- Able to explain the operation of various types of flip-flops.
- Able to explain the operation of shift registers & counters.
- Able to design counters using various types of flip-flops.
- Able to design mealy & Moore model, construction of state diagram & counter design.

### 3.0 Course Outcomes

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

	Course Outcome	Cognitive Level	POs
CO1	Design and analyze combinational & sequential circuits	U	1,2,12
CO2	Design circuits like adder, sub tractor, code converter etc.	U	1,2,3
CO3	Understand counters and sequence generators.	U	1,2,3
<b>Total Hours of instruction</b>			<b>50</b>

### 4.0 Course Content

#### MODULE-1:

**Principles of combinational logic:** Definition of combinational, canonical forms, generation of switching equations from truth tables, Karnaugh maps-3, 4 and 5 variables. In completely specified functions (Don't care terms). Simplifying max-term equations. Quine-McClusky minimization technique, Quine-McClusky using don't care terms, Reduced Prime Implicant tables, Map entered variables.

**10Hours**



**MODULE-2:**

Analysis and design of Combinational Logic: General approach, Decoders-BCD decoders, Encoders. Digital multiplexers-using multiplexers as Boolean function generators. Adders and Subtractors- Cascading full adders, Look ahead carry, Binary comparators. Design methods of building blocks of combinational logics. **10Hours**

**MODULE-3:**

**Sequential Circuits:** Basic Bistable element, Latches, SR latch, application of SR latch, A Switch debouncer, The SR latch, The gated SR latch. The gated D Latch, The Master-Slave Flip-Flops (Pulse-Triggered Flip-Flops):The master-slave SR Flip-Flops, The master-slave JK Flip-Flop, Edge Triggered Flip-flop: The Positive Edge-Triggered D Flip-Flop, Negative-Edge Triggered DFlip-Flop. Characteristic equations, Registers, Counters-Binary Ripple Counter, Synchronous Binary counters, Counters based on Shift Registers, Design of a Synchronous counters, Design of a Synchronous Mod-6 counters using clocked JK Flip- Flops Design of a Synchronous Mod-6 counter using clocked D,T, or SR Flip-Flops. **10 Hours**

**MODULE-4:**

**Sequential Design:** Introduction, Mealy and Moore models, State machine notation, Synchronous sequential circuit analysis and design. Construction of state Diagrams, Counters Design. **10 Hours**

**MODULE-5:**

**HDL:** Introduction, A brief history of HDL, Structure of HDL Module, Operators, Data types, Types of Descriptions, Simulation and synthesis, Brief comparison of VHDL and Verilog. **Data-Flow Descriptions:** High light so Data flow descriptions, Structure of data-flow Description, Data type-vectors. **10 Hours**

**5.0 Relevance to future subjects**

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

**6.0 Relevance to Real World**

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

**7.0 Gap Analysis and Mitigation**

Sl. No	Delivery Type	Details
01	Tutorial	Assignment problems will be solved in the tutorial classes to clear the concepts usage of appropriate formulas.
02	NPTTEL	Explained with Video Lectures will be used to clear the concepts



### 8.0 Books Used and Recommended to Students

Text/Reference Books				
1	Digital Logic Applications and Design	John M Yarbrough	Cengage Learning	2011
2	Digital Principles and Design	Donald D Givone	McGraw Hill Education	1 <sup>st</sup> Edition,
3	Logic and computer design Fundamentals	M. Morries Mano and Charles Kime	Pearson Learning	4 <sup>th</sup> Edition, 2014
4	Fundamentals of logic design	Charles H Roth, JR and Larry L.	Cengage Learning	6 <sup>th</sup> Edition,
5	Fundamentals of Digital Circuits	A. Anand Kumar	PHI	3 <sup>rd</sup> Edition,
6	Digital Logic Design and VHDL	A.A.Phadke S.M.Deokar	WileyIndia	1 <sup>st</sup> Edition,
7	Digital Circuits and Design	D.P.Kothari J.S.Dhillon	Pearson	FirstPrint
8	HDL Programming(VHDL and Verilog)	NazeihM. Botros	Cengage Learning	1 <sup>st</sup> Edition,
9	Circuit Design and Simulation with	VolneiAPedroni	PHI	2 <sup>nd</sup> Edition,

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

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

### 10.0 Magazines/Journals Used and Recommended to Students

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

### 11.0 Examination Note

Assignment marks: 10 marks.

**Question paper pattern IA exam:**

Answer two full questions Q1 or Q2 and Q3 or Q4 (15marks each). Total 30 Marks.

**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**

<b>MODULE</b>	<b>Lect. No.</b>	<b>Content of Lecture</b>	<b>% of Portion</b>
<b>MODULE-1</b>	1	Introduction to Logic gates, Boolean laws, Definition of combinational, canonical forms	20
	2,3	Generation of switching equations from truth tables, Examples	
	4,5	Karnaugh maps-2, 3 & 4 variables. Incompletely specified functions (Don't care terms). examples	
	6,7	Simplifying Max term equations, examples' Incompletely specified functions (Don't Care terms), examples	
	8	Quine-McCluskey minimization technique, Examples	
	9	Quine-McCluskey using don't care terms, Reduced Prime Implicant tables examples,	
	10	Map entered variables, Examples	
<b>MODULE-2</b>	11	General approach, Decoders-BCD, decoders	20
	12	Decoders examples	
	13	Expansion of decoders	
	14,15	Encoders, examples, Adders and Subtractors, Adders using Decoders & Subtractors	
	16	Cascading full adders, Look ahead carry	
	17,18	Digital multiplexers -using multiplexers as Boolean function generators.	
	19	Binary comparators	
	20	Design methods of building blocks of combinational logics, Examples.	
<b>MODULE-3</b>	21	Introduction to sequential circuits, Basic Bistable element, Latches, SR latch.	20
	22	Application of SR latch, A Switch debouncer, The gated SR latch. The gated DLatch	
	23	The Master-Slave Flip-Flops (Pulse-Triggered Flip-Flops): The master-slave SR Flip-Flops	
	24	The master-slave JK Flip-Flop	
	25,26	Edge Triggered Flip-flop: The Positive Edge-Triggered D Flip-Flop, Negative-Edge Triggered D Flip-Flop.	
	27	Examples	
	28,29	Characteristic equations Registers, Counters-Binary Ripple Counter, Synchronous Binary counters, Counters based on Shift Registers	
	30,31	Design of a Synchronous counters, Design of a Synchronous Mod-6 counters using clocked JK Flip-Flops	
<b>MODULE-4</b>	32	Introduction, Mealy model	20
	33,34	Moore Model examples	
	35	State Machine Notation	
	36, 37	Synchronous Sequential Circuit Analysis Construction of state Diagrams, examples	
	38	Introduction to state diagrams	
	39	Construction of state Diagrams	
	40	Worked examples	
<b>MODULE-5</b>	41	A Brief introduction of HDL, Structure of HDL Module	20
	42	Operators, Data types	



	43	Types of Descriptions	
	44	simulation and synthesis	
	45	Brief comparison of VHDL and Verilog	
	46	Highlights of Data-Flow Descriptions	
	47	Highlights of Data-Flow Descriptions	
	48	Structure of Data-Flow Description	
	49	Structure of Data-Flow Description	
	50	Data Type-Vectors	

**13.0 Assignments, Quiz**

Sl. No.	Title	Outcome expected	Allied study	Week No.	Individual / Group activity	Reference: book/website /Paper
1	Assignment-1: Questions on Principles of combinational logic	Student will be able to simplify the Boolean expression using different methods.	Module-1	4	Individual	1,2 & 7
2	Assignment-2: Questions on Analysis and design of Combinational Logic	Student will be able to understand the operation different combinational circuits	Module-2	7	Individual	1,2 & 7
3	Assignment-3: Questions on Sequential Circuits	Student will be able to understand operation different sequential circuits	Module-3	10	Individual	1
4	Assignment-4: Questions on Sequential Design	Student will be able to design a given sequential circuits	Module-4	13	Individual	1
5	Assignment-5: Questions on hardware Description Language.	Student will be able to understand & write HDL programs on digital circuits	Module-5	15	Individual	1

**14.0 Assignment Questions**

Assignment No	Questions	Marks
I	1) Simplify the following using K-map a. $f(a,b,c,d) = \sum m(0,2,3,5,8,10,11)$ b. $f(a,b,c,d) = \pi M(0,3,4,7,8,10,12,14) + d(2,6)$ c. $f(a,b,c,d) = \sum m(2,3,4,6,7,10,11,12)$ d. $f(a,b,c,d,e) = \sum m(3,7,8,10,11,12,14,15,17,19,21,23,25,27,29,31) + d(2,6,26,30)$ 2) Simplify the following using Quine-McCluskey method. a. $f(a,b,c,d) = \pi M(0,4,5,9).d(1,7,13)$ b. $f(a,b,c,d) = \sum m(0,2,3,5,8,10,11)$	20



	<p>c. <math>f(w,x,y,z) = \sum(0,2,3,4,8,10,12,13,14)</math>    d. <math>f(w,x,y,z) = \sum(7,9,12,13,14,15) + dc(4,11)</math></p> <p>3) Simplify the following using MEV</p> <p>a. <math>f(a,b,c,d) = \sum m(0,4,8,10,14,15)</math> using c as MEV variable.</p> <p>b. <math>f(a,b,c,d) = \sum m(0,4,8,10,14,15)</math> using a,b as MEV variable.</p> <p>c. <math>f(a,b,c,d) = \prod M(0,4,5,7,8,9,11,12,13,15)</math> using a,b as MEV variable.</p> <p>d. <math>f(x,y,z) = \sum m(0,1,2,3,4,6,7)</math> using z as MEV variable.</p>	
<b>II</b>	<p>1) Implement the multiple functions: <math>f_1(a,b,c,d) = \sum m(0,4,8,10,14,15)</math>  <math>f_2(a,b,c,d) = \sum m(3,7,9,13,15)</math> using 3:8 decoder.</p> <p>2) Design a full subtractor using 4:1 multiplexer.</p> <p>3) Design &amp; Implement 2-bit comparator.</p> <p>4) Explain 4-bit parallel adder with look ahead carry scheme.</p> <p>5) Implement 16:1 multiplexer using 4:1 multiplexer.</p>	20
<b>III</b>	<p>1) Explain with timing diagram, the working of SR latch as a switch debouncer.</p> <p>2) Explain the working of Master-Slave JK Flip-flop with functional table &amp; timing diagram. Show how race around condition of Master-Slave SR Flip-flop is overcome.</p> <p>3) Design a synchronous Mod-6 counter using JK and D f/f.</p> <p>4) Design a counter that has a repeated sequence of states listed <math>0 \rightarrow 3 \rightarrow 4 \rightarrow 0 \rightarrow 2 \rightarrow 7</math>.</p> <p>5) With the logic diagram explain Universal shift register.</p>	20
<b>IV</b>	<p>1) Construct a sequential logic circuit with a single input &amp; single output by obtaining the state table &amp; excitation table using JK flip-flop for the state diagram shown in fig.1</p> <p>2) Analyze the sequential circuit shown in fig.2 &amp; obtain the excitation table, transition table &amp; state table. Also write the state diagram.</p> <p>3) For the logic diagram shown in fig.3 i) Derive the excitation &amp; output equations ii) Write the next state equations iii) Construct the transition table iv) Draw the state diagram.</p> <p>4) A sequential network has one input &amp; one output, for the state diagram shown in fig.4, design sequential circuit using D-Flip-flop.</p>	20
<b>V</b>	<p>1) Write a data flow description of the full adder with enable. Draw the truth table of this adder and derive the Boolean function after minimization.</p> <p>2) Describe different types of HDL Description with suitable example.</p> <p>3) Implement a single bit comparator for all input combinations in VHDL.</p> <p>4) Write VHDL code for edge triggered JK flip flop with active low synchronous inputs.</p> <p>5) Write VHDL code using a process &amp; case statement to implement 4:1 multiplexer.</p>	20

**15.0**

**QUESTION BANK**

**MODULE-1**

1. What is combinational Logic circuit? Explain.
2. Write the following minterm canonical formulas in algebraic form and construct truth tables



- $f(w,x,y,z)=\sum m(1,3,7,8,9,14,15)$
3. Explain canonical form of Boolean equations with an example.
  4. Explain Karnaugh map representation in detail & discuss the merits & demerits.
  5. Explain the definition of combinational logic circuit.
  6. Transform each of the following canonical expression in to its other canonical form in decimal notation
    - a.  $f(x,y,z)=\prod M(0,3,4)$
    - b.  $f(x,y,z)=\sum m(1,3,5)$
    - c.  $f(a,b,c,d)=\sum m(1,2,4,6,9,15)$
    - d.  $f(w,x,y,z)=\sum m(0,1,2,3,7,9,11,12,15)$
  7. Express each of the following functions by a Maxterm Canonical formulae
    - a.  $f(x,y,z)=(y+z')(xy'+z)$
    - b.  $f(x,y,z)=x+x'z'(y+z)$
  8. Using K-maps, determine all the prime implicants of each of the following functions. In each case, indicate the essential prime implicants
    - a.  $f(w,x,y,z)=\sum m(0,1,2,5,6,7,8,9,10,13,14,15)$
    - b.  $f(w,x,y,z)=\prod M(0,2,3,8,9,10,12,14)$
    - c.  $f(w,x,y,z)=w'y'z+w'yz+x'y'z'+wx'y+w'x'yz'$
  9. Using k-maps, determine all the minimal sums and minimal products for each of the following Boolean functions
    - a.  $f(a,b,c,d)=\prod M(0,4,5,7,8,9,11,12,13,15)$
    - b.  $f(x,y,z)=\sum m(0,1,2,3,4,6,7)$
    - c.  $f(x,y,z)=\prod M(1,4,5,6)$
    - d.  $f(w,x,y,z)=\sum m(0,1,6,7,8,14,15)$
    - e.  $f(w,x,y,z)=\prod M(1,3,4,5,10,11,12,14)$
  10. Give two simplified irredundant expressions for
    - a.  $F(w,x,y,z)=\sum(0,4,5,7,8,9,13,15)$
    - b. Design a combinational logic ckt whose i/p is a 4-bit binary number and whose o/p is the 2's complement of the i/p number. Implement by using suitable logic
  11. Using the Quine-McCluskey method, obtain all the prime implicants for each of the following Boolean functions
    - a.  $f(w,x,y,z)=\sum(0,2,3,4,8,10,12,13,14)$
    - b.  $f(w,x,y,z)=\sum(7,9,12,13,14,15)+dc(4,11)$
    - c.  $f(w,x,y,z)=\prod M(1,3,6,10,11,12,14,15,17,19,20,22,24,29)$
  12. Simplify  $f(a,b,c,d)=\sum(2,3,4,5,13,15)+dc(8,9,10,11)$  taking least significant as map-entered variable. Dec-2011
  13. Determine the minimal sums and minimal products using MEV technique using a , b , c as MAP variable for the function  $f(a,b,c,d)=\sum m(3,4,5,7,8,11,12,13,15)$

## MODULE- 2

1. What is decoder? What are its advantages? Design a decimal decoder, which converts information from BCD to decimal
2. Construct 4 to 16 line decoder using 2-4 decoders
3. Using AND/NAND gates along with a 3-8-line decoder realize the pairs of expressions with minimum i/ps
  - a.  $f_1(a,b,c)=\prod M(0,3,5,6,7)$
  - b.  $f_2(a,b,c)=\prod M(2,3,4,5,7)$
4. Construct 16:1 MUX using 4 to 1 line MUX



- a. Realize each of the following Boolean expressions using an 8 to 1 line Multiplexer where w,x,y appear on select lines S<sub>2</sub>,S<sub>1</sub>,S<sub>0</sub> respectively
- b.  $f(w,x,y,z) = \sum m(1,2,6,7,9,11,12,14,15)$
- c.  $f(w,x,y,z) = \sum m(2,5,6,7,9,12,13,15)$   
Realize the Boolean expression.  $f(w,x,y,z) = \sum m(4,5,7,8,10,12,15)$  Using a 4 to 1 line MUX and external Gates with I) Let w and x appear on the select lines S<sub>1</sub> and S<sub>0</sub> respectively II) y and z appear on the select lines S<sub>1</sub> and S<sub>0</sub> respectively.
5. Design full adder and full subtractor. Implement using gates
6. What is a multiplexer? With neat sketch, describe 4:1MUX. Implement the given Boolean functions by using multiplexer chip
  - a.  $F1(A,B,C) = \sum m(1,2,4,7)$
  - b.  $F2(A,B,C) = \sum m(3,5,6,7)$
7. With neat block diagram explain carry look ahead adder in detail.
8. Design 2 bit comparator circuit using logic gates.
9. Design & implement 4 bit look ahead carry adder.
10. Implement 16:1 multiplexer using 4:1 multiplexer
11. Implement full subtractor using 3-8 line decoder with the decoder having high outputs & active low enable inputs
12. What is magnitude comparator? Write the truth table & logic diagram of a 1-bit comparator.

### MODULE- 3:

1. Design a switch debouncer using SR and  $\bar{S} \bar{R}$  latch.
2. Explain the operation of SR latch.
3. Explain the operation of the master-slave JK f/f and SR f/f along with its circuit diagram.
4. Explain the working of SR f/f by using NOR gates.
5. What is race around condition in f/f? Discuss in brief.
6. Difference between f/fs and latches and its definition.
7. What is edge triggered f/fs. Explain positive edge triggered D f/fs. With neat timing diagrams
8. Explain negative edge triggered D f/fs using NAND gates and timing diagrams.
9. What is propagation delay?
10. Explain with neat timing diagrams  $S \bar{R}$  latch?
11. Write the next state tables and characteristic equations for SR,JK,D and T f/f.
12. What is a register? Explain with neat diagrams all the types of register.
13. Explain Universal shift register.
14. With a neat logic diagram and timing waveforms explain synchronous binary counters.
15. Explain with a neat diagram and timing waveforms Johnson counter and ring counter.
16. Design synchronous mod-6 counter using JK and D f/f.
17. Design a counter that has a repeated sequence of 06 states listed  $0 \rightarrow 3 \rightarrow 4 \rightarrow 0 \rightarrow 5 \rightarrow 6$  diagram.
18. Design mod-3 counter using JK f/f. Sketch the waveforms for o/p's when clock is applied and verify its operation.
19. Explain with neat waveforms working of 4 bit shift register. Modify same as Johnson's counter.
20. Design a 4-bit synchronous up/down counter.
21. Difference between combinational network and sequential network.

### MODULE-4:

1. Explain with neat diagram Mealy machine.
2. Explain with neat diagram Moore network.
3. Explain different types of sequential networks?



4. Differentiate between Mealy and Moore model.
5. What are excitation and transition expressions?
6. Write a note on Moore & Mealy models with respect to design of sequential circuits. Compare the two models.
7. Construct a Mealy state diagram that will detect a serial sequence of 10110. When the i/p pattern has been detected, cause an o/p Z to be asserted high.

**MODULE-5:**

1. Explain in brief History of HDL.
2. Explain the structure of VHDL module.
3. Explain the structure of Verilog module.
4. Explain operators with example.
5. Explain how data types are classified in HDL. Mention the advantages of VHDL data types over Verilog.
6. What is logic synthesis?
7. What is HDL? Why do you need it?
8. Describe different types of HDL Description with suitable example.
9. Differentiate between VHDL and Verilog HDL.
10. Explain the structure of data flow description style with example.
11. With illustrations briefly discuss
  - I. Signal declaration and assignment statements.
  - II. Concurrent signal assignment statements and.
  - III. Constant declaration and assignment statements.
12. For the multiplex circuit 4 i/p 1o/p, write signal declaration and assignment statements in VHDL. Assume 10 ns as propagation delay. Write your comments wherever it is applicable.
13. Write a data flow description of the full adder with enable. Draw the truth table of this adder and Derive the Boolean function after minimization.

**16.0 University Result**

Examination	S <sup>+</sup>	S	A	B	C	D	E	F	% Passing
Jan-2017	0	1	1	3	9	9	3	41	39.7

<b>Prepared by</b>	<b>Checked by</b>		
Prof. K B Negalur	Prof. Amit Neshti	HOD	Principal



<b>Subject Title</b>	Electrical & Electronics Measurements		
<b>Subject Code</b>	17EE36	<b>IA Marks</b>	40
<b>Number of Lecture Hrs / Week</b>	04	<b>Exam Marks</b>	60
<b>Total Number of Lecture Hrs</b>	50	<b>Exam Hours</b>	03
<b>CREDITS – 04</b>			

**FACULTY DETAILS:**

<b>Name:</b> Prof.Sujata.G.Huddar	<b>Designation:</b> Asst.Professor	<b>Experience:</b> 05
<b>No. of times course taught:</b> 02		<b>Specialization:</b> Power System Engineering

**1.0 Prerequisite Subjects:**

Sl. No	Branch	Semester	Subject
01	Electrical & electronics engineering	I/II	Basic electronics
02	Electrical & electronics engineering	III	Digital system design

**2.0 Course Objectives**

- To understand the concept of units and dimensions.
- To measure resistance, inductance, capacitance by use of different bridges.
- To study the construction and working of various meters used for measurement.
- To have the working knowledge of electronic instruments and display devices.

**3.0 Course Outcomes**

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

	Course Outcome	Cognitive Level	POs
CO206.1	Correct the dimensional equations of electrical parameters and Measure resistance, inductance and capacitance using bridges.	U,A	PO1, PO2, PO11, PO12
CO206.2	Discuss adjustments, calibration and errors in energy meters and Explain the construction and operation of power factor meter, frequency meter and phase sequence indicator.	U,A	PO1, PO2, PO11, PO12
CO206.3	Explain measurements magnetic parameters; iron loss, airgap flux, field strength and Explain the methods of extending the range of instruments and instrument transformers.	U	PO1, PO2, PO11, PO12
CO206.4	Discuss electronic and digital instruments used in measurements.	U	PO1, PO2, PO11, PO12
CO206.5	Discuss display and recording devices used in measurements.	U	PO1, PO2, PO11, PO12
<b>Total Hours of instruction</b>			<b>50</b>



## 4.0 Course Content

### Module-1

**Units and Dimensions:** Dimensional equations, problems.

**Measurement of Resistance:** Wheatstone's bridge, sensitivity, limitations. Kelvin's double bridge. Earth resistance measurement by fall of potential method and by using Megger.

**Measurement of Inductance and Capacitance:** Sources and detectors, Maxwell's inductance bridge, Maxwell's inductance and capacitance bridge, Hay's bridge, Anderson's bridge, Desauty's bridge, Schering bridge. Shielding of bridges. Problems. 10 Hours

**Revised Bloom's Taxonomy Level:** L1 – Remembering, L2 – Understanding, L3 – Applying.

### Module-2

**Measurement of Power, Energy, Power factor and Frequency:** Torque expression, Errors and minimization, UPF and LPF wattmeters. Measurement of real and reactive power in 3 phase circuits. Errors, adjustments and calibration of single and three phase energy meters, Problems. Construction and operation of single-phase and three phase dynamometer type power factor meter. Weston frequency meter and phase sequence indicator. 10Hours

**Revised Bloom's Taxonomy Level:** L1 – Remembering, L2 – Understanding, L3 – Applying, L4 – Analysing.

### Module-3

**Extension of Instrument Ranges:** Desirable features of ammeters and voltmeters. Shunts and multipliers. Construction and theory of instrument transformers, Desirable characteristics, Errors of CT and PT. Turns compensation, Illustrative examples, Silsbee's method of testing CT.

**Magnetic measurements:** Introduction, measurement of flux/ flux density, magnetising force and leakage factor. Hopkinson permeameter. Measurement of iron loss by wattmeter method. A brief discussion on measurement of air gap flux and field strength. 10Hours

**Revised Bloom's Taxonomy Level:** L1 – Remembering, L2 – Understanding, L3 – Applying, L4 – Analysing.

### Module-4

**Electronic and digital Instruments:** Introduction. Essentials of electronic instruments, Advantages of electronic instruments. True rms reading voltmeter. Electronic multimeters. Digital voltmeters (DVM) - Ramp type DVM, Integrating type DVM, Continuous – balance DVM and Successive - approximation DVM. Q meter. Principle of working of electronic energy meter (block diagram treatment), extra features offered by present day meters and their significance in billing. 10Hours

**Revised Bloom's Taxonomy Level:** L1 – Remembering, L2 – Understanding

### Module-5

**Display Devices:** Introduction, character formats, segment displays, Dot matrix displays, Bar graph displays. Cathode ray tubes, Light emitting diodes, Liquid crystal displays, Nixes, Incandescent, Fluorescent, Liquid vapour and Visual displays. Display multiplexing and zero suppression.

**Recording Devices:** Introduction, Strip chart recorders, Galvanometer recorders, Null balance recorders, Potentiometer type recorders, Bridge type recorders, LVDT type recorders, Circular chart and recorders. Magnetic tape recorders, Direct recording, Frequency modulation recording, Pulse duration modulation recording, Digital tape recording, Ultraviolet recorders. Biomedical recorders, Electro Cardio Graph (ECG), Electroencephalograph, Electromyograph. Noise in reproduction. 10Hours

**Revised Bloom's Taxonomy Level:** L1 – Remembering, L2 – Understanding.



### 5.0 Relevance to future subjects

Sl No	Semester	Subject	Topics
01	VIII	Project work	Students can apply the knowledge of different type's bridges & display devices to measure & display the data.

### 6.0 Relevance to Real World

SL.No	Real World Mapping
01	Fundamental knowledge of different systems of units & si system of units.
02	Basic knowledge of measurement of resistance, Inductance & capacitance.
03	Basic Knowledge of use different recording and display devices, Instrument transformers.

### 7.0 Gap Analysis and Mitigation

Sl. No	Delivery Type	Details
02	NPTEL&conducting Extra Classes.	Awareness towards to the use of different bridges, display & recording devices in labs.

### 8.0 Books Used and Recommended to Students

Text Books
<ul style="list-style-type: none"> <li>➤ Electrical and electronic Measurements and Instrumentation by A.K. Sawhney 10th Edition Dhanpat Rai and Co.</li> <li>➤ A Course in Electronics and Electrical Measurements and Instrumentation by J. B. Gupta 2013 Edition Katson Books.</li> </ul>
Reference Books
<ul style="list-style-type: none"> <li>➤ Electrical and electronic Measurements and Instrumentation by Er.R.K. Rajput 5th Edition 2012 S Chand.</li> <li>➤ Electrical Measuring Instruments and Measurements by S.C. Bhargava 2013BS Publications.</li> <li>➤ Modern Electronic Instrumentation and Measuring Techniques by Cooper D and A.D. Heifrick First Edition 2015 Pearson.</li> <li>➤ Electronic Instrumentation by H.S.Kalsi 3rd Edition 2010 Mc Graw Hill.</li> <li>➤ Electronic instrumentation and measurements by David A Bell Oxford University 3<sup>rd</sup> Edition, 2013.</li> </ul>
Additional Study material & e-Books
<ul style="list-style-type: none"> <li>➤ Electrical &amp; Electronic measurements by P.M.Chandrashekar.</li> </ul>

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

Website and Internet Contents References
<ol style="list-style-type: none"> <li>1) <a href="https://books.google.co.in/books?isbn=125902959X">https://books.google.co.in/books?isbn=125902959X</a></li> <li>2) <a href="http://NPTEL.com/">http://NPTEL.com/</a></li> <li>3) <a href="http://www.electrical4u.com">www.electrical4u.com</a></li> </ol>

### 10.0 Magazines/Journals Used and Recommended to Students

Sl.No	Magazines/Journals	website
1	IEEE Instrumentation & measurement magazine	<a href="http://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=5289">ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=5289</a>



2	Electrical & Electronic industry trade publications journals magazines	www.industryart.com › Industrial Publications
3	IEEE journals & magazines	https://www.ieee.org › Publications

## 11.0 Examination Note

### Internal Assessment: 40 Marks

There are four main questions of 15 Marks

Students have to answer any two full questions of each 15 Marks selecting from Q.No 1 & Q.No 2.

### Scheme of Evaluation for Internal Assessment (30 Marks)

(a) Internal Assessment test will be done in the same pattern as that of the main examination (Better of the two Tests):

### SCHEME OF EXAMINATION:

The question paper will have ten questions.

- Each full question is for 16 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	Lecture No.	Content of Lecture	% of Portion
1	1.	Dimensional equations, problems.	20%
	2.	Wheatstone's bridge, sensitivity, limitations.	
	3.	Kelvin's double bridge.	
	4.	Earth resistance measurement by fall of potential method.	
	5.	Earth resistance measurement by using Megger.	
	6.	Sources and detectors, Maxwell's inductance bridge.	
	7.	Maxwell's inductance and capacitance bridge.	
	8.	Hay's bridge, Anderson's bridge.	
	9.	Desauty's bridge, Schering bridge.	
	10.	Shielding of bridges, Problems.	
2	11.	Dynamometer Wattmeter, Torque expression, Errors and minimization.	20%
	12.	UPF and LPF wattmeters.	
	13.	Measurement of real and reactive power in 3 phase circuits.	
	14.	Errors, adjustments and calibration of single and three phase energy meters,	
	15.	meters,	
	16.	Problems.	
	17.	Construction and operation of single-phase and three phase dynamometer	
	18.	type power factor meter. Weston	
	19.	Weston frequency meter	
	20.	Phase sequence indicator.	
3	21.	<b>Extension of Instrument Ranges:</b> Desirable features of ammeters and voltmeters.	20%
	22.	Shunts and multipliers.	
	23.	Construction and theory of instrument transformers, Desirable characterizes.	
	24.	Errors of CT and PT, Turns compensation.	
	25.	Illustrative examples.	



	26.	Silsbee's method of testing CT.	
	27.	<b>Magnetic measurements:</b> Introduction, measurement of flux/ flux density,	
	28.	magnetising force and leakage factor.	
	29.	Hopkinson permeameter. Measurement of iron loss by wattmeter method.	
	30.	A brief discussion on measurement of air gap flux and field strength.	
4	31.	<b>Electronic and digital Instruments:</b> Introduction	20%
	32.	Essentials of electronic instruments, Advantages of electronic instruments.	
	33.	True rms reading voltmeter. Electronic multimeters.	
	34.	Digital voltmeters (DVM) - Ramp type DVM,	
	35.	Integrating type DVM, Continuous – balance DVM	
	36.	Successive - approximation DVM.	
	37.	Q meter	
	38.	Principle of working of electronic energy meter	
	39.	Extra features offered by present day meters and their significance in	
	40.	billing	
5	41.	<b>Display Devices:</b> Introduction, character formats, segment displays, Dot matrix displays, Bar graph displays.	20%
	42.	Cathode ray tubes, Light emitting diodes, Liquid crystal displays, Nixes,	
	43.	Incandescent, Fluorescent, Liquid vapour and Visual displays.	
	44.	Display multiplexing and zero suppression	
	45.	<b>Recording Devices:</b> Introduction, Strip chart recorders, Galvanometer recorders,	
	46.	Null balance recorders, Potentiometer type recorders, Bridge type recorders, LVDT type recorders,	
	47.	Circular chart and recorders. Magnetic tape recorders, Direct recording,	
	48.	Frequency modulation recording, Pulse duration modulation recording, Digital tape recording,	
	49.	Ultraviolet recorders. Biomedical recorders, Electro Cardio Graph (ECG),	
	50.	Electroencephalograph, Electromyography. Noise in reproduction.	

### 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 Units & dimensions, measurement of resistance, Inductance & capacitance.	Students are capable to explain measurement of resistance, inductance & capacitance by different bridges.	Module 1	2	Individual Activity. Written solution expected.	Book 1, 2,3 of the text book list. Website of the Reference list
2	Assignment 2: University Questions on Measurement of power, Energy, power factor & frequency.	Students understand the measurement of power, energy, power factor & frequency using different meters.	Module 2	4	Individual Activity. Written solution expected.	Book 1, 2, 3 of the text book list. Website of the Reference list
3	Assignment 3: University Questions on Extension of Instrument ranges & Magnetic measurements.	Students explain the extension of instrument ranges & magnetic measurements.	Module 3	6	Individual Activity. Written solution expected.	Book 1,2, 3 of the text book list. Website of the Reference list
4	Assignment 4:	Students understand	Module 4	8	Individual Activity.	Book 1, 2, 3 of



	University Questions on Electronic & digital instruments.	working of different Electronic & digital instruments.			Written solution expected.	the text book list. Website of the Reference list
5	Assignment 5: University Questions on Display devices & Recording devices.	Students are capable to elaborate working of different display & recording devices.	Module 5	10	Individual Activity. Written solution expected.	Book 1, 2, 3 of the text book list. Website of the Reference list

## 14.0 QUESTION BANK

### MODULE-1

1. Derive the dimensions of resistance, inductance & capacitance in LMTI systems?
2. Define the sensitivity of wheatstone's bridge & with neat sketch derive the expression for sensitivity of the bridge?
3. Classify resistance.
4. What is the range of medium resistance?
5. Name the methods used for low resistance measurement.
6. Name the methods used for medium resistance measurement
7. State the advantages of Wheatstone bridge method.
8. State the advantages of Kelvin double bridge method.
9. What are the constructional features of doctor ohmmeter?
10. Derive the balance equation for kelvin's double bridge?
11. Define megger.
12. Explain the measurement oh high resistance using megger?
13. What is the range of low resistance?
14. What is the range of medium resistance?
15. What ranges of resistance can be measured by using doctor ohmmeter.
16. How resistance is measured in direct deflection method.
17. How resistance is measured by using ohmmeter method.
18. State the balance equation used in bridge methods.
19. How the earth resistance is measured.
20. State the use of ac bridges.
21. State the balance equation used in ac bridges.
22. Name the bridge circuits used for the m/s of self-inductance.
23. Name the bridge circuits used for the m/s of capacitance.
24. Name the bridge circuits used for the m/s of mutual inductance.
25. Which type of detector is used in ac bridges?
26. Name the ac sources used in ac bridges.
27. In which cases audio frequency oscillators are used as ac source.
28. Name the sources of errors in ac bridge m/s.
29. State the advantages of Maxwell-wein bridge.
30. State the disadvantage of Maxwell-wein bridge.
31. State the disadvantages of Hay's bridge.
32. State the use of Wein bridge.
33. (i) Explain Kelvin's double bridge method for the measurement of low resistance.  
(ii) Explain how inductance in measured by using Maxwell's bridge.

### MODULE-2

1. Derive the torque equation of single phase electrodynamicometer type wattmeter?
2. What are the constructional parts of dynamometer type wattmeter?
3. State the disadvantages of Dynamometer type wattmeter.
4. Name the errors caused in Dynamometer type wattmeter.
5. How the errors caused by pc inductance is compensated.
6. How the errors caused by methods of connection is compensated
7. Name the methods used for power measurement in three phase circuits.
8. What are the special features to be incorporated for LPF wattmeter?
9. Name the methods used in Wattmeter calibration.
10. What are the types of energy meters?



11. Name the constructional parts of induction type energy meter?
12. How voltage coil is connected in induction type energy meter?
13. How current coil is connected in induction type energy meter?
14. Why Al disc is used in induction type energy meter.
15. What is the purpose of registering mechanism?
16. What is the purpose of braking mechanism?
17. Define creeping?
18. Explain the principle of operation of 10W power factor wattmeter?
19. If the reading on two wattmeter's in 3-phase balanced load are 836 & 224W the latter reading being obtained after the reversal of current coil connections calculate the power factor of the load?
20. Discuss the various adjustments required in energy meter for the accurate reading?
21. With neat sketch explain the construction & working of Weston frequency meter?

#### MODULE-3

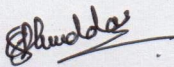
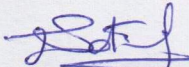
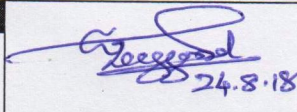

1. State the advantages of instrument transformers.
2. State the disadvantage of instrument transformers.
3. What are the constructional parts of current transformer?
4. Name the errors caused in current transformer.
5. Define ratio error.
6. What is shunt? How it is used to extend the range of an ammeter?
7. Write a note on turns compensation used in instrument transformers?
8. With neat circuit diagram explain silsbee's method of testing of CT?
9. Explain the wattmeter method of measuring the iron loss?
10. State the use of potential transformer.
11. Name the errors caused in potential transformer.
12. How the CT and PT are connected in the circuits.
13. What are the functional elements of an instrument?
14. What is meant by accuracy of an instrument?
15. Write the function of instrument transformer.
16. Why an ammeter should have a low resistance?

#### MODULE-4

1. With neat sketch explain the working of true RMS reading voltmeter?
2. With a neat diagram explain the working of an electronic multimeter?
3. What are the errors in the measurement of Q-factor of a coil? Explain
4. With a block diagram, explain the principle of working of electronic energy meter?
5. Discuss in detail the working of the successive approximation DVM?
6. With a neat diagram, explain the various methods of magnetic measurements?
7. With a neat diagram explain the construction and working of electrodynamic type instruments. Also derive its torque equation?
8. Explain with neat diagram the working of linear ramp type DVM?

#### MODULE-5:

- 1 Explain LED and LCD displays?
- 2 Write a short note on Nixie tube?
- 3 Write a short note on strip chart recorder?
- 4 With a neat sketch explain the working of X-Y recorder?
- 5 Write the features of EEG?
- 6 With the help of neat block diagram explain ECG machine. Write important features of ECG machine?
- 7 What is power requirement of LCD?
- 8 What is LVDT?
- 9 List the advantages and disadvantages of LVDT.
- 10 What is thermocouple?
- 11 What are the advantages and disadvantages of LVDT?
- 12 With neat sketch explain dot matrix display

Prepared by	Checked by		
		 24.8.18	
Prof.Sujata Huddar	Prof.S.B.Patil	HOD	Principal



<b>Subject Title</b>	<b>ELECTRICAL MACHINES LABORATORY - 1</b>		
<b>Subject Code</b>	17EEL37	<b>IA Marks</b>	40
<b>No. of Lecture hrs./Week</b>	03	<b>Exam Marks</b>	60
<b>Total No. of Lecture Hrs</b>	42	<b>Exam Hours</b>	03
<b>CREDITS – 02</b>			

#### FACULTY DETAILS:

<b>Name:</b> Prof. Amit.U.Neshti	<b>Designation:</b> Asst. Professor	<b>Experience:</b> 9 Years 6 Months
<b>No. of times course taught:</b> 03 Times	<b>Specialization:</b> Digital Electronics	
<b>Name:</b> Prof. P. M.Murari	<b>Designation:</b> Asst. Professor	<b>Experience:</b> 7 Years
<b>No. of times course taught:</b> 01Times	<b>Specialization:</b> Power system & Power Electronics	

### 1.0 Prerequisite Subjects:

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

### 2.0 Course Objectives

- Conducting of different tests on transformers and synchronous machine and evaluation of their Performance.
- Verify the parallel operation of two single phase transformers of different KVA rating.
- Study the connection of single phase transformers for three phase operation and phase conversion.
- Study of synchronous generator connected to infinite bus.

### 3.0 Course Outcomes

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

CO	Course Outcome	Cognitive Level	POs
CO207.1	Conduct different tests on transformers and synchronous generators and evaluate their performance.	Ap, A, E, C	PO1, PO2, PO4, PO5
CO207.2	Connect and operate two single phase transformers of different KVA rating in parallel.	Ap, A, E, C	PO1, PO2, PO4, PO5
CO207.3	Connect single phase transformers for three phase operation and phase conversion.	Ap, A, E, C	PO1, PO2, PO4, PO5
CO207.4	Assess the performance of synchronous generator connected to infinite bus.	Ap, A, E, C	PO1, PO2, PO4, PO5
<b>Total Hours of instruction</b>			<b>42</b>

### 4.0 Course Content

1. Open Circuit and Short circuit tests on single phase step up or step down transformer and Predetermination of Efficiency and regulation (ii) Calculation of parameters of equivalent circuit.
2. Sumpner's test on similar transformers and determination of combined and individual transformer efficiency.
3. Parallel operation of two dissimilar single-phase transformers of different kVA and determination of load sharing and analytical verification given the Short circuit test data.
4. Polarity test and connection of 3 single-phase transformers in star – delta and determination of efficiency and regulation under balanced resistive load.
5. Comparison of performance of 3 single-phase transformers in delta –delta and V – V(open delta) connection under load.
6. Scott connection with balanced and unbalanced loads.
7. Separation of hysteresis and eddy current losses in single phase transformer.
8. Voltage regulation of an alternator by EMF and MMF methods.
9. Voltage regulation of an alternator by ZPF method.
10. Slip test – Measurement of direct and quadrature axis reactance and predetermination of Regulation of salient pole synchronous machines.
11. Performance of synchronous generator connected to infinite bus, under constant power and variable excitation & vice - versa.
12. Power angle curve of synchronous generator.



### 5.0 Relevance to future subjects

SL. No	Semester	Subject	Topics / Relevance
01	IV	Machine Lab-2	Fundamentals of EML 1
02	IV	Electric motors	Fundamentals of EML 1

### 6.0 Relevance to Real World

SL. No	Real World Mapping
01	Energy Regeneration Material Handling Oil and Gas Mining and Drilling Industry (Hazardous Environment)
02	Off-highway Sector, Automotive Marine, Pump Drives

### 7.0 Books Used and Recommended to Students

Text Books
1. Electric Machines', D. P. Kothari, I. J. Nagrath Mc Graw Hill 4th edition, 2011
2. Electrical Machines M.V. Deshpande PHI Learning 2013
3. Electric Machines R.K. Srivastava Cengage Learning 2nd Edition, 2013
Reference Books
1. Principles of Electric Machines and power Electronics P.C. Sen Wiley 2nd Edition, 2013
2. Electrical Machines, Drives and Power systems Theodore Wildi Pearson 6th Edition, 2014.
3. Electric Machinery and Transformers Bhag S Guru at el Oxford University Press 3rd Edition, 2012
4. Theory of Alternating Current Machines Alexander Langsdorf Mc Graw Hill 2nd Edition, 2001
Additional Study material & e-Books
Electric machines by godse & bakshi

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

Website and Internet Contents References
1) <a href="http://www.electrical4u.com/transformer/">www.electrical4u.com/transformer/</a>
2) <a href="http://www.electrical4u.com/working-principle-of-dc-generator-and-alternator/">http://www.electrical4u.com/working-principle-of-dc-generator-and-alternator/</a>
3) <a href="http://www.ijset.net/journal/68.pdf">www.ijset.net/journal/68.pdf</a>
4) <a href="http://www.electrical4u.com/dc-generator">www.electrical4u.com/dc-generator</a>
5) <a href="http://www.electrical4u.com/alternator">www.electrical4u.com/alternator</a>

### 9.0 Magazines/Journals Used and Recommended to Students

Sl.No	Magazines/Journals	website
1	EC&M Magazines	<a href="http://ecmweb.com/ops-maintenance/generators">http://ecmweb.com/ops-maintenance/generators</a>
2	Oil & gas journal	<a href="https://www.sub-forms.com/dragon/init.do?site=PNW23_OGogpenew">https://www.sub-forms.com/dragon/init.do?site=PNW23_OGogpenew</a>
3	IPT Magazine	<a href="https://www.intelligent-power-today.com/">https://www.intelligent-power-today.com/</a>
4	Electric apparatus magazine	<a href="https://electricalapparatus.wordpress.com/2016/06/30/electric-generator-up-and-running/">https://electricalapparatus.wordpress.com/2016/06/30/electric-generator-up-and-running/</a>

### 10.0 Examination Note

#### Internal Assessment:

Question can appear on any of experiment.

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

Internal Assessment test in the same pattern as that of the main examination (10marks).

Write up	3 Marks
Conduction	5 Marks
Viva – Voce	2 Marks



Continuous Evaluation :

- |   |          |
|---|----------|
| 1. Journal  | 10 Marks |
| 2. Attendance   | 5 marks  |
| 3. a) Involvement of students in conduction of experiment (5) | 15 marks |
| b) Viva voce(5)   |          |
| c) Discipline in conduction of experiment(5)                  |          |

40 Marks

**SCHEME OF EXAMINATION:**

One question can be set on any of the experiment

- |             |          |
|-------------|----------|
| Write up    | 9 Marks  |
| Conduction  | 42 Marks |
| Viva – Voce | 9 Marks  |

Total 60 Marks

### 11.0 Course Delivery Plan

Expt. No.	Aim of the Experiment	% of Portion
1	Open Circuit and Short circuit tests on single phase step up or step down transformer and predetermination of (i) Efficiency and regulation (ii) Calculation of parameters of equivalent circuit.	8.33
2	Sumpner's test on similar transformers and determination of combined and individual transformer efficiency.	8.33
3	Parallel operation of two dissimilar single-phase transformers of different kVA and determination of load sharing and analytical verification given at the Short circuit test data.	8.33
4	Polarity test and connection of 3 single-phase transformers in star – delta and determination of efficiency and regulation under balanced resistive load.	8.33
5	Comparison of performance of 3 single-phase transformers in delta –delta and V – V(open delta) connection under load.	8.33
6	Scott connection with balanced and unbalanced loads.	8.33
7	Separation of hysteresis and eddy current losses in single phase transformer.	8.33
8	Voltage regulation of an alternator by EMF and MMF methods.	8.33
9	Voltage regulation of an alternator by ZPF method.	8.33
10	Slip test – Measurement of direct and quadrature axis reactance and predetermination of regulation of salient pole synchronous machines.	8.33
11	Performance of synchronous generator connected to infinite bus, under constant power and variable excitation & vice - versa.	8.33
12	Power angle curve of synchronous generator.	8.33

### 12.0 QUESTION BANK

- 1) Define Transformer?
- 2) Mention different classifications of Transformer?
  1. Give the constructional details of the core & winding part of the transformer,
  2. Compare core type & shell type transformers.
  3. Power transformer are designed to give good
    - a. all day efficiency b) power efficiency
  4. Distribution transformer are designed to give good
    - b. all day efficiency b) power efficiency
5. Transformer is "Constant flux Machine" True/False, Justify
6. Give the classification of transformers in details.
7. Draw the phasor diagram for single phase transformer considering,
  - a. Resistive Load b) Inductive Load c) Capacitive Load
8. Draw the Exact & approximate Equivalent Electric Circuit of single phase transformer
9. What do you mean by the term "Voltage Regulation of Transformer?"
10. Give the expression for the Voltage regulation in terms of approximate voltage drop.



11. Give the condition for maximum power efficiency of the transformer, Use the condition to decide the KVA load to be applied on the transformer to give maximum efficiency.
12. Give the comparison between Power efficiency & Energy efficiency.
13. Give the importance of Energy efficiency in case of Distribution Transformer & that of Power efficiency in case of Power transformer.
14. Mention & justify the conditions for parallel operation of the transformers.
15. Write the expressions for power shared by two unequal voltage ratios transformer.
16. What is zero voltage regulation, Give the condition for the same?
17. What do you mean by Testing of transformers, why is it required?
18. Give the comparison between OC, SC & Back to Back Test.
19. What do you mean by predetermination of Efficiency & Regulation of transformers?
20. Give the procedural details of finding efficiency & regulation of the transformers at different load condition.
21. Write the voltage current relationships at primary & secondary of star Delta transformer.
22. Mention the applications where 2-phase supply is required, Explain how 3-phase to 2-phase conversion is achieved in case of Scott connection.
23. How are alternators classified?
24. Name the types of alternator based on their rotor construction.
25. Why do cylindrical alternators operate with steam turbines?
26. Which type of synchronous generators are used in hydro-electric plants and why?
27. What are the advantages of salient pole type construction used for synchronous machines?
28. Why is stator core of alternator laminated?
29. How does electrical degree differ from mechanical degree?
30. What is distributed winding?
31. Why short pitch is preferred over full pitch winding?
32. Define winding factor.
33. Why alternators rated in KVA and not in MW?
34. What are the causes of changes in voltage in alternators when loaded?
35. What you meant by armature reaction in alternators/
36. What is meant by synchronous impedance of a alternator?
37. What you mean by synchronous reactance ?
38. What is meant by load angle of an alternator?
39. Upon what factor does load angle depend?
40. Define the terminal voltage of alternator.
41. What is the necessity for predetermination of voltage regulation?
42. How synchronous impedance is calculated from OCC and SCC?
43. Why is EMF method called as pessimistic method?
44. In what way does ampere turn method differ from emf method?
45. State the conditions to be satisfied before connecting two alternators in parallel.
46. How synchronous scope is used for synchronizing alternators?
47. List the factors that affect the load sharing in parallel operating generators?
48. How the change in excitation does affect the load sharing?
49. What is meant by infinite bus bars?
50. Why MMF method is called as optimistic method?
51. Why is the resistance of field winding of a d.c shunt generator kept low?
52. What will happen if a d.c machine is operated below the rated speed?
53. What do you understand by the external characteristics of a d.c generator?
54. What you mean by V and inverted V curve of synchronous motor.

Prepared by	Checked by		
		 30.8.18	
Prof. Pramod Murari	Prof. A.U.Neshti	HOD	Principal



<b>Subject Title</b>	<b>ELECTRONICS LABORATORY</b>		
<b>Subject Code</b>	17EEL38	<b>CIE Marks</b>	40
<b>Number of Lecture Hrs / Week</b>	03	<b>SEE Marks</b>	60
<b>Total Number of Lecture Hrs</b>	42	<b>Exam Hours</b>	03
<b>CREDITS – 04</b>			

**FACULTY DETAILS:**

<b>Name:</b> Prof. Sagar S Birade	<b>Designation:</b> Asst. Professor	<b>Experience:</b> 06 Years
<b>No. of times course taught:</b> 03	<b>Specialization:</b> VLSI Design & Embedded Systems	

**FACULTY DETAILS:**

<b>Name:</b> Prof. O. B. Heddurshetti	<b>Designation:</b> Asst. Professor	<b>Experience:</b> 12 Years
<b>No. of times course taught:</b> 01	<b>Specialization:</b> Power Electronics	

**1.0 Prerequisite Subjects:**

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

**2.0 Course Objectives**

1. To design and test half wave and full wave rectifier circuits.
2. To design and test different amplifier and oscillator circuits using BJT.
3. To study the simplification of Boolean expressions using logic gates.
4. To realize different Adders and Subtractors circuits.
5. To design and test counters and sequence generators.

**3.0 Course Outcomes**

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

	Course Outcome	Cognitive Level	Revised Bloom's Taxonomy Level	POs
CO204.1	Design and test rectifier circuits with and without capacitor filters.	U, A	L1, L2, L3, L4	1,2,4,5
CO204.2	Determine h-parameter models of transistor for all modes.	U, A	L2, L3, L4, L5	1,2,4,5
CO204.3	Design and test BJT and FET amplifier and oscillator circuits.	U, A	L1, L2, L3, L4	1,2,4,5
CO204.4	Realize Boolean expressions, adders and subtractors using gates.	U, A	L1, L2, L3, L4	1,2,4,5
<b>Total Hours of instruction</b>			<b>50</b>	

**4.0 Course Content**

1. Design and Testing of Full wave – centre tapped transformer type and Bridge type rectifier circuits with and without Capacitor filter. Determination of ripple factor, regulation and efficiency.
2. Static Transistor characteristics for CE, CB and CC modes and determination of h parameters.
3. Frequency response of single stage BJT and FET RC coupled amplifier and determination of half power points, bandwidth, input and output impedances.
4. Design and testing of BJT - RC phase shift oscillator for given frequency of oscillation.



5. Determination of gain, input and output impedance of BJT Darlington emitter follower with and without bootstrapping.
6. Simplification, realization of Boolean expressions using logic gates/Universal gates.
7. Realization of half/Full adder and Half/Full Subtractors using logic gates.
8. Realization of parallel adder/Subtractors using 7483 chip- BCD to Excess-3 code conversion & Vice -Versa.
9. Realization of Binary to Gray code conversion and vice versa.
10. Design and testing Ring counter/Johnson counter.
11. Design and testing of Sequence generator.
12. Realization of 3 bit counters as a sequential circuit and MOD – N counter design using 7476, 7490, 74192, 74193.

#### 5.0 Relevance to future subjects

SL. No	Semester	Subject	Topics / Relevance
01	V	Power Electronics	Rectifiers, MOSFETs, FETs
02	VIII	Project work	Designing of components for project

#### 6.0 Relevance to Real World

SL. No	Real World Mapping
01	Design of various components
02	Conduct investigations of complex Problems
03	Development of prototype models

#### 7.0 Books Used and Recommended to Students

##### Text Books

1. 'Electronic Devices and Circuit Theory', Robert L Boylestad Louis Nashelsky Published by Pearson 11<sup>th</sup> Edition 2015.
2. Fundamentals of Analog Circuits Thomas L Floyd Pearson 2nd Edition, 2012.
3. Electronic Devices and Circuits S.Salivahanan N.Suresh Mc Graw Hill 3rd Edition, 2013
4. Electronic Devices and Circuits Anil K. Maini Vasha Agarwal Wiley 1st Edition, 2009

##### Reference Books

1. Integrated Electronics, Analysis and Digital Circuits and Systems Jacob Millman et al Mc Graw Hill 2<sup>nd</sup>

##### Additional Study material & e-Books

1. "Digital Integrated Electronics" by H. Taub and D. Schilling
2. <https://www.aec.at/futurelab/en/>

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

##### Website and Internet Contents References

- <http://www.audiomisc.co.uk/Electronics/audio/BasicAnalogue.pdf>  
<http://www.electricvlab.com/downloads/manual-vtu-analog-electronics.pdf>

#### 9.0 Magazines/Journals Used and Recommended to Students

Sl.No	Magazines/Journals	website
1	AEÜ - International Journal of Electronics and Communications	<a href="http://www.journals.elsevier.com/aeu">www.journals.elsevier.com/aeu</a>
2	Electronics for you	<a href="https://electronicsforu.com/">https://electronicsforu.com/</a>



### 10.0 Examination Note

**Internal Assessment:**

Theoretical aspects as well as relevant circuits should be drawn neatly for questions asked in Internal Assessments

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

- (a) Internal Assessment test in the same pattern as that of the main examination: 20marks.
- (b) Continuous Assessment: 20mark

**Scheme of Examination:**

- One question to be set from list of experiments for 20 Marks
- Write up- 3 marks
- Conduction and Result- 14 marks
- Viva Voce- 3 marks
- Continuous assessment/ Journal Writing- 20 marks

### 11.0 Course Delivery Plan

Expt No	Pract No	Name of the Experiment	% Of Portion
1	1	Design and Testing of Full wave – centre tapped transformer type and Bridge type rectifier circuits with and without Capacitor filter. Determination of ripple factor, regulation and efficiency.	8.33%
2	2	Static Transistor characteristics for CE, CB and CC modes and determination of h parameters.	8.33%
3	3	Frequency response of single stage BJT and FET RC coupled amplifier and determination of half power points, bandwidth, input and output impedances.	8.33%
4	4	Design and testing of BJT - RC phase shift oscillator for given frequency of oscillation.	8.33%
5	5	Determination of gain, input and output impedance of BJT Darlington emitter follower with and without bootstrapping.	8.33%
6	6	Simplification, realization of Boolean expressions using logic gates/Universal gates.	8.33%
7	7	Realization of half/Full adder and Half/Full Subtractors using logic gates.	8.33%
8	8	Realization of parallel adder/Subtractors using 7483 chip- BCD to Excess-3 code conversion & Vice -Versa.	8.33%
9	9	Realization of Binary to Gray code conversion and vice versa.	8.33%
10	10	Design and testing Ring counter/Johnson counter.	8.33%
11	11	Design and testing of Sequence generator.	8.33%
12	12	Realization of 3 bit counters as a sequential circuit and MOD – N counter design using 7476, 7490, 74192, 74193.	8.33%

### 12.0 QUESTION BANK

<ol style="list-style-type: none"> <li>1. What is a rectifier?</li> <li>2. Why do you need a rectifier?</li> <li>3. What is the meaning of ripple?</li> <li>4. What are the different filter configurations available to remove these ripples?</li> <li>5. What is the value of ripple factor for a Full wave rectifier? Is this different for a Bridge rectifier?</li> <li>6. What is the value of efficiency for a Full wave rectifier? Is this different for a Bridge rectifier?</li> <li>7. Write the equation for the ripple factor of a full wave rectifier with C – filter.</li> <li>8. Write the equation for V<sub>dc</sub> of a full wave rectifier with C – filter.</li> </ol>	<ol style="list-style-type: none"> <li>27. What decides the maximum signal handling capacity of the FET RC coupled amplifier?</li> <li>28. What are power amplifiers?</li> <li>29. How are power amplifiers different from conventional Voltage or Current amplifiers?</li> <li>30. Define the efficiency of a power amplifier.</li> <li>31. What are the efficiencies of R-C Coupled Class A, Single ended Class A and Class B power amplifiers?</li> <li>32. What are the disadvantages of Class B power amplifiers with center tapped transformer?</li> <li>33. What is cross –over distortion? What is the reason for this distortion?</li> <li>34. How this distortion can be eliminated? Explain.</li> </ol>
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<p>9. What is an amplifier? 10. What kind of bias should be applied for the transistor to act as an amplifier? 11. What are the bias conditions for transistor to be in (a) Saturation region? (b) Cut – off region? (c) Active region? 12. What is early effect? Is it an advantage or a disadvantage? 13. Mention different types of transistor biasing methods. 14. Which biasing method provides stabilization against variations in <math>I_{CO}</math>, <math>\beta</math>, <math>V_{BE}</math>? 15. What are the different methods of coupling amplifier stages? 16. What is the advantage of RC Coupling? 17. Write an expression for the mid – band voltage gain for a single stage RC coupled amplifier 18. Which are the components that affect the lower cut – off frequency? 19. Which are the components that affect the upper cut – off frequency? 20. Does the Emitter by – pass capacitor have any effect on the cut – off frequencies? Which cut – off frequency will it affect? 21. Write an expression for the voltage gain of the amplifier in the low frequency region in terms of mid-band gain and lower cut – off frequency 22. Write an expression for the voltage gain of the amplifier in the high frequency region in terms of mid-band gain and upper cut – off frequency. 23. What are the merits and de-merits of the R–C Coupled amplifier? 24. What are the classifications of Field effect transistors? 25. Write the symbols for an N – Channel JFET and a P – Channel JFET. 26. What are the advantages of Field effect transistors?</p>	<p>35. What are ‘complimentary symmetry’ transistors? 36. Write the applications of Power amplifier. 37. What is an oscillator? What kind of feedback is used in oscillator circuits? 38. What are the conditions to be satisfied in order to produce oscillations? What are these conditions called? 39. Write other versions of Hartley oscillator circuits. 40. What are Relaxation Oscillators? 41. Why LC oscillators are not suitable for Audio frequencies? 42. What is a half adder? 43. What is a full adder? 44. What are the applications of adders? 45. What is a half subtractor? 46. What is a full subtractor? 47. What are the applications of subtractors? 48. Obtain the minimal expression for above circuits. 49. Realize a full adder using two half adders 50. Realize a full subtractors using two half subtractors 51. What is the internal structure of 7483 IC? 52. What do you mean by code conversion? 53. What are the applications of code conversion? 54. How do you realize a subtractor using full adder? 55. What is a ripple Adder? What are its disadvantages? 56. What are code converters? 57. What is the necessity of code conversions? 58. What is gray code? 59. Realize the Boolean expressions for a) Binary to gray code conversion b) Gray to binary code conversion 60. What is the necessity for sequence generation? 61. What are PISO, SIPO, and SISO with respect to shift register? 63. Differentiate between serial data &amp; parallel data 64. What is the significance of Mode control bit? 65. What is a ring counter? 66. What is a Johnson counter? 67. How many Flip-flops are present in IC 7495?</p>
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Prepared by	Checked by	 21.8.18	
Prof. Sagar S Birade	Prof. K. B. Negalur	HOD	Principal