

**ANNA UNIVERSITY, CHENNAI**  
**UNIVERSITY DEPARTMENTS**  
**B.E. COMPUTER SCIENCE AND ENGINEERING**  
**RUSA**  
**REGULATIONS – 2018**  
**I - VIII SEMESTERS CURRICULA AND I - III SYLLABI**

**SEMESTER I**

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	EL	CREDITS
<b>THEORY</b>									
1.	HS6151	Technical English I	HS	4	4	0	0	3	5
2.	PH6151	Engineering Physics	BS	5	3	0	2	3	5
3.	MA6151	Mathematics I	BS	4	3	1	0	3	5
4.	CS6101	Programming with C	HC	7	2	1	4	3	6
5.	CS6102	Computational Thinking	HC	4	0	0	4	3	3
<b>TOTAL</b>				<b>24</b>	<b>12</b>	<b>2</b>	<b>10</b>	<b>15</b>	<b>24</b>

**SEMESTER II**

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	EL	CREDITS
<b>THEORY</b>									
1.	HS6251	Technical English II	HS	4	4	0	0	3	5
2.	CY6251	Engineering Chemistry	BS	5	3	0	2	3	5
3.	MA6251	Discrete Mathematics	BS	4	3	1	0	3	5
4.	GE6251	Engineering Graphics	ES	6	2	0	4	3	5
5.	CS6103	Application Development Practices	HC	5	1	0	4	3	4
<b>TOTAL</b>				<b>24</b>	<b>13</b>	<b>1</b>	<b>10</b>	<b>15</b>	<b>24</b>

### SEMESTER III

SI. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	EL	CREDITS
<b>THEORY</b>									
1.	CS6104	Data Structures and Algorithms	HC	8	3	1	4	3	7
2.	CS6105	Digital Fundamentals and Computer Organization	HC	8	3	1	4	3	7
3.	MA6351	Probability and Statistics	BS	4	3	1	0	3	5
4.	EE6351	Basics of Electrical and Electronics Engineering	ES	8	4	0	4	3	7
5.		Open Elective I	OE	3	3	0	0	-	3
<b>TOTAL</b>				<b>31</b>	<b>16</b>	<b>3</b>	<b>12</b>	<b>12</b>	<b>29</b>

### SEMESTER IV

SI. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	E L	CREDITS
<b>THEORY</b>									
1.	CS6106	Database Management Systems	HC	7	3	0	4	3	6
2.	CS6107	Computer Architecture	HC	5	3	0	2	3	5
3.	CS6108	Operating Systems	HC	7	3	0	4	3	6
4.		Mathematics Soft Core I	MSC	4/7	3	1/0	0/4	3	5/6
5.		Open Elective II	OE	3	3	0	0	-	3
<b>TOTAL</b>				<b>26/29</b>	<b>15</b>	<b>1/0</b>	<b>10/14</b>	<b>12</b>	<b>25/26</b>

### SEMESTER V

SI. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	EL	CREDITS
<b>THEORY</b>									
1.	CS6109	Compiler Design	HC	7	3	0	4	3	6
2.	CS6110	Object Oriented Analysis and Design	HC	7	3	0	4	3	6
3.	CS6111	Computer Networks	HC	7	3	0	4	3	6
4.		Mathematics Soft Core II	MSC	4/7	3	1/0	0/4	3	5/6
5.		Professional Soft Core I	PSC	3/7	3	0	0/4	3	4/6
<b>TOTAL</b>				<b>28/35</b>	<b>15</b>	<b>1/0</b>	<b>12/20</b>	<b>15</b>	<b>27/30</b>

### SEMESTER VI

SI. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	EL	CREDITS
<b>THEORY</b>									
1.		Professional Soft Core II	PSC	3/7	3	0	0/4	3	4/6
2.		Professional Soft Core III	PSC	3/7	3	0	0/4	3	4/6
3.		Professional Soft Core IV	PSC	3/7	3	0	0/4	3	4/6
4.		Professional Elective I	PE	3	3	0	0	3	4
5.	CS6611	Creative and Innovative Project	EEC	4	0	0	4	3	3
<b>TOTAL</b>				<b>16/28</b>	<b>12</b>	<b>0</b>	<b>12/16</b>	<b>15</b>	<b>19/25</b>

**SEMESTER VII**

<b>Sl. No</b>	<b>COURSE CODE</b>	<b>COURSE TITLE</b>	<b>CATEGORY</b>	<b>CONTACT PERIODS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>	<b>CREDIT S</b>
<b>THEORY</b>									
1.		Professional Elective II	PE	3	3	0	0	3	4
2.		Professional Elective III	PE	3	3	0	0	3	4
3.		Professional Elective IV	PE	3	3	0	0	3	4
4.		Professional Elective V	PE	3	3	0	0	3	4
<b>TOTAL</b>				<b>12</b>	<b>12</b>	<b>0</b>	<b>0</b>	<b>12</b>	<b>16</b>

**SEMESTER VIII**

<b>Sl. No</b>	<b>COURSE CODE</b>	<b>COURSE TITLE</b>	<b>CATEGORY</b>	<b>CONTACT PERIODS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>	<b>CREDIT S</b>
<b>THEORY</b>									
1.		Professional Elective VI	PE	3	3	0	0	3	4
2.		Professional Elective VII	PE	3	3	0	0	3	4
3.	CS6811	Project Work	EEC	12	0	0	12	9	9
<b>TOTAL</b>				<b>18</b>	<b>6</b>	<b>0</b>	<b>12</b>	<b>15</b>	<b>17</b>

**MINIMUM NO OF CREDITS TO BE ACQUIRED:185**

### HUMANITIES AND SOCIAL SCIENCES (HS)

SI. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	E L	CREDITS
<b>THEORY</b>									
1.	HS6151	Technical English I	HS	4	4	0	0	3	5
2.	HS6251	Technical English II	HS	4	4	0	0	3	5

### BASIC SCIENCES (BS)

SI. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	EL	CREDITS
<b>THEORY</b>									
1.	PH6151	Engineering Physics	BS	5	3	0	2	3	5
2.	MA6151	Mathematics I	BS	4	3	1	0	3	5
3.	MA6251	Discrete Mathematics	BS	4	3	1	0	3	5
4.	CY6251	Engineering Chemistry	BS	5	3	0	2	3	5
5.	MA6351	Probability and Statistics	BS	4	3	1	0	3	5

### ENGINEERING SCIENCES (ES)

SI. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	EL	CREDITS
<b>THEORY</b>									
1.	GE6251	Engineering Graphics	ES	6	2	0	4	3	5
2.	EE6351	Basics of Electrical and Electronics Engineering	ES	8	4	0	4	3	7

### HARD CORE (HC)

SI. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	EL	CREDITS
<b>THEORY</b>									
1.	CS6101	Programming with C	HC	7	2	1	4	3	6
2.	CS6102	Computational Thinking	HC	4	0	0	4	3	3
3.	CS6103	Application Development Practices	HC	5	1	0	4	3	4
4.	CS6105	Digital Fundamentals and Computer Organization	HC	8	3	1	4	3	7
5.	CS6104	Data Structures and Algorithms	HC	8	3	1	4	3	7
6.	CS6110	Object Oriented Analysis and Design	HC	7	3	0	4	3	6
7.	CS6109	Compiler Design	HC	7	3	0	4	3	6
8.	CS6108	Operating Systems	HC	7	3	0	4	3	6
9.	CS6106	Data Base Management Systems	HC	7	3	0	4	3	6
10.	CS6111	Computer Networks	HC	7	3	0	4	3	6
11.	CS6107	Computer Architecture	HC	5	3	0	2	3	5

### MATHEMATICS SOFTCORE (MSC)

SI. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	EL	CREDITS
<b>THEORY</b>									
1.	MA6201	Linear Algebra	MSC	4	3	1	0	3	5
2.	CS6201	Graph Theory	MSC	4	3	1	0	3	5
3.	EC6201	Signals and Systems	MSC	7	3	0	4	3	6
4.	CS6202	Theory of Computation	MSC	4	3	1	0	3	5

### PROFESSIONAL SOFTCORES (PSC)

SI. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	EL	CREDITS
<b>THEORY</b>									
1.	CS6301	Machine Learning	PSC	7	3	0	4	3	6
2.	CS6302	Programming Paradigms	PSC	3	3	0	0	3	4
3.	CS6303	Distributed Systems	PSC	3	3	0	0	3	4
4.	CS6304	Software Engineering	PSC	3	3	0	0	3	4
5.	CS6305	Microprocessors	PSC	7	3	0	4	3	6
6.	CS6306	Parallel Programming	PSC	7	3	0	4	3	6
7.	CS6307	Advanced Algorithms	PSC	7	3	0	4	3	6
8.	CS6308	Java Programming	PSC	7	3	0	4	3	6

### PROFESSIONAL ELECTIVES (PE) TRACK - 1

SI. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	EL	CREDITS
<b>THEORY</b>									
1.	CS6001	Data Mining	PE	3	3	0	0	3	4
2.	CS6002	Soft Computing	PE	3	3	0	0	3	4
3.	CS6003	Big Data Analytics	PE	3	3	0	0	3	4
4.	CS6004	Information Visualization	PE	3	3	0	0	3	4
5.	CS6005	Deep Learning Techniques	PE	3	3	0	0	3	4

**PROFESSIONAL ELECTIVES (PE)  
TRACK - 2**

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	EL	CREDITS
<b>THEORY</b>									
1.	CS6006	Cloud Computing	PE	3	3	0	0	3	4
2.	CS6007	Information Security	PE	3	3	0	0	3	4
3.	CS6008	Cryptography and Network Security	PE	3	3	0	0	3	4
4.	CS6009	Mobile Networks	PE	3	3	0	0	3	4
5.	CS6010	Wireless and Sensor Networks	PE	3	3	0	0	3	4

**PROFESSIONAL ELECTIVES (PE)  
TRACK - 3**

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	EL	CREDITS
<b>THEORY</b>									
1.	CS6011	GPU Computing	PE	3	3	0	0	3	4
2.	CS6012	Embedded Systems	PE	3	3	0	0	3	4
3.	CS6013	Unix Internals	PE	3	3	0	0	3	4
4.	CS6014	IoT and Smart Appliances	PE	3	3	0	0	3	4
5.	CS6015	Multicore Architectures	PE	3	3	0	0	3	4



**PROFESSIONAL ELECTIVES (PE)  
TRACK - 4**

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	EL	CREDITS
<b>THEORY</b>									
1.	CS6016	Graphics and Multimedia	PE	3	3	0	0	3	4
2.	CS6017	Human Computer Interaction	PE	3	3	0	0	3	4
3.	CS6018	Image Processing	PE	3	3	0	0	3	4
4.	CS6019	Augmented Reality and Virtual Reality	PE	3	3	0	0	3	4
5.	CS6020	Digital Signal Processing	PE	3	3	0	0	3	4

**PROFESSIONAL ELECTIVES (PE)  
TRACK - 5**

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	EL	CREDITS
1.	CS6021	Software Testing & Quality Assurance	PE	3	3	0	0	3	4
2.	CS6022	Software Project Management	PE	3	3	0	0	3	4
3.	CS6023	Software Test Automation	PE	3	3	0	0	3	4
4.	CS6024	Test Driven Development	PE	3	3	0	0	3	4
5.	CS6025	Supply Chain Management	PE	3	3	0	0	3	4

**PROFESSIONAL ELECTIVES (PE)  
TRACK - 6**

SI. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	EL	CREDITS
1.	CS6026	Game Theory	PE	3	3	0	0	3	4
2.	CS6027	Modeling and Simulation	PE	3	3	0	0	3	4
3.	CS6028	Queuing Theory and Performance Evaluation of Computer Systems	PE	3	3	0	0	3	4
4.	CS6029	Social Network Analysis	PE	3	3	0	0	3	4
5.	CS6030	Natural Language Processing	PE	3	3	0	0	3	4

**PROFESSIONAL ELECTIVES (PE)  
TRACK - 7**

SI. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	EL	CREDITS
1.	CS6031	Database Tuning	PE	3	2	0	0	3	3
2.	CS6032	Software Defined Networks	PE	3	2	0	0	3	3
3.	CS6033	Storage Area Networks	PE	3	2	0	0	3	3
4.	CS6034	Service Oriented Architecture	PE	3	2	0	0	3	3
5.	CS6035	Entrepreneurship Development	PE	3	2	0	0	3	3

**EMPLOYABILITY ENHANCEMENT COURSES (EEC)**

SI. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	EL	CREDITS
<b>THEORY</b>									
1.	CS6611	Creative and Innovative Project	EEC	4	0	0	4	3	3
2.	CS6811	Project Work	EEC	12	0	0	12	9	9

**SUMMARY**

Category of Courses	HS	BS	ES	OE	HC	MSC	PSC	PE	EEC	Total
Minimum Credits to be earned	10	25	12	6	62	10	20	28	12	185

MODULE	RHETORICAL FUNCTIONS	PRIMARY FOCUS RHETORICAL FUNCTION: INTRODUCING SELF, THE LINGUISTIC ACT OF NARRATING	PRIMARY OUTCOME
MODULE 1	SELF-INTRODUCTION . THE LINGUISTIC ACT OF NARRATING	<p><b>Oral Fluency:</b> Introducing oneself-introducing friend/family (connecting campus)- <b>Reading:</b> biographies (subject based) reading strategies-skimming-scanning-predicting-</p> <p><b>Language Focus-</b> Use of present and past tense forms of verbs-(Degrees of Comparison) - <b>Lexical Development:</b> Adjectives-learning topic related vocabulary (approximately 30)-</p> <p><b>Writing:</b> short biographies with the given details of (related to specific branches of engineering) <b>Listening:</b> listening to speeches by specialists from various branches of engineering and completing activities such as answering questions , identifying the main ideas of the listening text, style of the speaker (tone and tenor) and making inferences.</p>	<p>At the end of the module, students should be able to:</p> <ul style="list-style-type: none"> <li>Introduce oneself for at least 2 minutes with minimal intrusive errors and breaks.</li> <li>Write a paragraph by listing information chronologically</li> </ul>
		<b>SUGGESTED ACTIVITIES</b>	<b>SUGGESTED EVALUATION METHODS</b>
		<ul style="list-style-type: none"> <li>Lectures on the Communicative aspects of language use.</li> <li>Practical-Listening, Speaking and Writing</li> </ul>	<ul style="list-style-type: none"> <li>Quizzes</li> <li>Assignments</li> <li>Small Group Work</li> </ul>

			<b>12 0 0 9</b>
<b>MODULE 2</b>	<b>COMPARING AND CONTRASTING</b>	<p><b>Oral Fluency:</b> Comparing and Contrasting (e.g. Facebook and Whatsapp)- <b>Language Focus:</b> verbal phrases- compound nouns(noun strings)-simple present and present perfect , future tense-</p> <p><b>Lexical Development:</b> Discourse Analysis-lexical links- related to the function of comparing and contrasting-lexical items related to the reading texts -<b>Reading:</b> texts on comparing and contrasting concepts in engineering and technology (e.g. Computers and Artificial intelligence)</p> <p><b>Listening:</b> gap-filling exercises -<b>Writing:</b> Definitions(short and long)- paragraph writing especially comparing and contrasting discourse</p>	<p>At the end of the module, students should be able to:</p> <ul style="list-style-type: none"> <li>▪ Compare and contrast products/ concepts both in speech and writing</li> </ul>
		<b>SUGGESTED ACTIVITIES</b>	<b>SUGGESTED EVALUATION METHODS</b>
		<ul style="list-style-type: none"> <li>• Lectures on the Communicative aspects of language use.</li> <li>• Practical-Listening, Speaking and Writing</li> </ul>	<ul style="list-style-type: none"> <li>• Quizzes</li> <li>• Assignments</li> <li>• Small Group Work</li> </ul>
			<b>12 0 0 9</b>

<b>MODULE 3</b>	<b>STATING PROBLEMS AND EXPRESSING SOLUTIONS</b>	<p><b>Oral Fluency:</b> Small Group Discussion (e.g. The changing face of the software Industry)-  <b>Language Focus</b>-sentence level linguistics (construction of function-based sentences)-  past continuous and present perfect continuous and future tenses-  <b>Lexical Development</b>-learning vocabulary related to content and function (approximately 30)-  <b>Reading:</b> passages discussing problems and solutions (e.g. automation in the software industry and employment opportunities in the next decade)-  <b>Listening:</b> TED talks &amp; discussions-  <b>Writing:</b> lengthy paragraphs- (e.g. What does the future hold for the software industry?)-  Formal letter writing- highlighting problems and offering solutions.</p>	<p>At the end of the module, students should be able to:</p> <ul style="list-style-type: none"> <li>• Participate in small group discussions effectively.</li> <li>• Write extended paragraphs</li> <li>• Listen and comprehend long talks</li> </ul>
		<b>SUGGESTED ACTIVITIES</b>	<b>SUGGESTED EVALUATION METHODS</b>
		<ul style="list-style-type: none"> <li>• Lectures on the Communicative aspects of language use.</li> <li>• Practical-Listening, Speaking and Writing</li> </ul>	<ul style="list-style-type: none"> <li>• Quizzes</li> <li>• Assignments</li> <li>• Small Group Work</li> </ul>
<b>MODULE 4</b>	<b>EXPRESSING CAUSAL RELATIONS</b>	<p><b>Oral Fluency</b>- speaking skills practice in small groups. (e.g. uses and abuses of the mobile phone) <b>Language Focus:</b> use of passive voice forms of verbs – past participle forms (sentence construction for expressing causal relations)-  <b>Lexical Development:</b> specialized vocabulary to establish causal relations-  <b>Reading:</b> texts on cause and effect functions- texts on process description-  <b>Listening:</b> filling a table, introduction to graphic presentations (pie charts, tables, pictograms) -  <b>Writing:</b> data interpretation</p>	<p>At the end of the module students should be able to:</p> <ul style="list-style-type: none"> <li>• Write two paragraphs describing and interpreting visual data (charts, tables etc.)</li> <li>• Read and comprehend texts expressing causal relations</li> </ul>

		and making inferences	
		<b>Suggested Activities</b>	<b>Suggested Evaluation Methods</b>
		<ul style="list-style-type: none"> <li>Lectures on the Communicative aspects of language use.</li> <li>Practical-Listening, Speaking and Writing</li> </ul>	<ul style="list-style-type: none"> <li>Quizzes</li> <li>Assignments</li> <li>Small Group Work</li> </ul>
			<b>12 0 0 9</b>
<b>MODULE 5</b>	<b>EXTENDED SPEECH</b>	<b>Oral Fluency:</b> making mini presentations (e.g. the working of an algorithm)- <b>Language Focus</b> -passive voice and use of phrases - <b>Lexical Development:</b> specialist vocabulary related to theme-cohesive ties related to process description (sequential expressions)- <b>Reading</b> - Pie chart/Table /Bar chart interpretation - <b>Listening</b> – drawing a flowchart – <b>Writing:</b> channel conversion– diagram to written forms	At the end of the module, students should be able to : <ul style="list-style-type: none"> <li>Make short presentations</li> <li>Read and interpret visual data</li> <li>Write a process description</li> </ul>
		<b>SUGGESTED ACTIVITIES</b>	<b>SUGGESTED EVALUATION METHODS</b>
		<ul style="list-style-type: none"> <li>Lectures on the Communicative aspects of language use.</li> <li>Practical-Listening, Speaking and Writing</li> </ul>	<ul style="list-style-type: none"> <li>Quizzes</li> <li>Assignments</li> <li>Small Group Work</li> </ul>

**EVALUATION METHOD TO BE USED:**

Sl. no	Category of Courses	Continuous Assessment	Mid –Semester Assessment	End Semester
1.	Theory	40	20	40

PH6151	ENGINEERING PHYSICS				L	T	P	EL	CREDITS
					3	0	2	3	5
Prerequisites for the course: None									
OBJECTIVES: <ul style="list-style-type: none"><li>To introduce the basic concepts of physics.</li><li>To develop critical thinking through problem solving related to physics</li><li>To identify, analyze and implement possible applications with the goal of achieving the most efficient and effective usage of conceptual physics.</li></ul>									
MODULE I :					L	T	P	EL	
					3	0	2	3	
Elasticity – Stress-strain diagram – cantilever – bending moment – Young’s modulus determination – twisting couple.									
SUGGESTED ACTIVITIES : <ul style="list-style-type: none"><li>In Class activity: Simple harmonic motion</li><li>Practical - Nonuniform bending: Determination of Young’s modulus.</li><li>EL: Cantilever, Torsional pendulum, Simple harmonic oscillations</li></ul>									
SUGGESTED EVALUATION METHODS: <ul style="list-style-type: none"><li>Tutorial problems</li><li>Assignment problems</li><li>Quizzes</li></ul>									
MODULE II :					L	T	P	EL	
					3	0	2	3	
Torsional pendulum - rigidity modulus - moment of inertia - simple harmonic motion - Wave equation – waves on a string – wave power & intensity – sound waves – decibels.									
SUGGESTED ACTIVITIES : <ul style="list-style-type: none"><li>Flipped classroom and activity</li><li>In class activity: Derivation and Simplification</li><li>EL – Practical Problems - Waves – Resonance – Doppler effect of sound – standing waves in a string</li><li><b>Practical – Torsional Pendulum: Determination of rigidity modulus of wire and moment of inertia of disc.</b></li></ul>									
SUGGESTED EVALUATION METHODS: <ul style="list-style-type: none"><li>Tutorial problems</li><li>Assignment problems</li><li>Quizzes</li></ul>									

<b>MODULE III :</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
	<b>3</b>	<b>0</b>	<b>2</b>	<b>3</b>
Noise in physical systems – noise mechanisms – ultrasonics: production – magnetostriction and piezoelectric methods – detection of ultrasonic waves– acoustic grating – ultrasonic interferometer.				
<b>SUGGESTED ACTIVITIES :</b> <ul style="list-style-type: none"> <li>• EL: Piezoelectric effect, acoustic grating</li> <li>• In class activity: Ultrasonic oscillator construction</li> <li>• Practical - Ultrasonic interferometer: Determination of velocity of sound and compressibility of liquids.</li> </ul>				
<b>SUGGESTED EVALUATION METHODS:</b> <ul style="list-style-type: none"> <li>• Tutorial problems</li> <li>• Assignment problems</li> <li>• Quizzes</li> </ul>				
<b>MODULE IV :</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
	<b>3</b>	<b>0</b>	<b>2</b>	<b>3</b>
Thermal expansion – thermal stress – bimetals – heat transfer in solids & thermal conductivity - compound media – Forbe's and Lee's disc method: theory and experiment.				
<b>SUGGESTED ACTIVITIES :</b> <ul style="list-style-type: none"> <li>• Flipped Class room</li> <li>• EL: Thermal expansion, bimetals, Compound media, Thermal conductivity</li> <li>• Practical – Lee's disc: Determination of thermal conductivity of a bad conductor.</li> </ul>				
<b>SUGGESTED EVALUATION METHODS:</b> <ul style="list-style-type: none"> <li>• Tutorial problems</li> <li>• Assignment problems</li> <li>• Quizzes</li> </ul>				
<b>MODULE V :</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
	<b>3</b>	<b>0</b>	<b>2</b>	<b>3</b>
Double and multiple slits interference – diffraction gratings – thin films – antireflection coating – Newton's rings, air-wedge and their applications – Michelson interferometer – The diffraction limit.				
<b>SUGGESTED ACTIVITIES :</b> <ul style="list-style-type: none"> <li>• Applications in class discussion</li> <li>• EL – Thin films, antireflection coating, Air-wedge, Interferometry</li> <li>• Practical – Air-wedge: Determination of thickness of thin sheet/wire.</li> </ul>				
<b>SUGGESTED EVALUATION METHODS:</b> <ul style="list-style-type: none"> <li>• Tutorial problems</li> <li>• Assignment problems</li> <li>• Quizzes</li> </ul>				



<b>MODULE VI:</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
	<b>3</b>	<b>0</b>	<b>2</b>	<b>3</b>
Lasers – Principles and applications – Einstein’s coefficients – laser resonator - semiconductor laser				
<b>SUGGESTED ACTIVITIES :</b> <ul style="list-style-type: none"> <li>• Introduction in class</li> <li>• EL: Laser theory, principles, industrial applications, fiber optics</li> <li>• Flipped Classroom for further study</li> <li>• Practical – Compact disc: Determination of width of groove using laser</li> </ul>				
<b>SUGGESTED EVALUATION METHODS:</b> <ul style="list-style-type: none"> <li>• Tutorial problems</li> <li>• Assignment problems</li> <li>• Quizzes</li> </ul>				
<b>MODULE VII:</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
	<b>3</b>	<b>0</b>	<b>2</b>	<b>3</b>
Optical fibers – propagation of light in optical fibers – acceptance angle – numerical aperture – fiber optical communication system – fiber optic sensors.				
<b>SUGGESTED ACTIVITIES :</b> <ul style="list-style-type: none"> <li>• Combinations of in Class &amp; Flipped class rooms</li> <li>• Practical: Optical fiber: Determination of numerical aperture and acceptance angle.</li> <li>• EL: Fiber optics &amp; sensors</li> </ul>				
<b>SUGGESTED EVALUATION METHODS:</b> <ul style="list-style-type: none"> <li>• Tutorial problems</li> <li>• Assignment problems</li> <li>• Quizzes</li> </ul>				
<b>MODULE VIII:</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
Wave - particle duality - The Schrodinger equation - time dependent and independent equations - expectation values - particle in a box.				
<b>SUGGESTED ACTIVITIES :</b> <ul style="list-style-type: none"> <li>• Illustration of potential wells and tunneling phenomena in class</li> <li>• Flipped classroom</li> <li>• EL – Wave - particle duality, Schrodinger equation, Particle in a box problem (1D, 2D, 3D)</li> </ul>				
<b>SUGGESTED EVALUATION METHODS:</b> <ul style="list-style-type: none"> <li>• Tutorial problems</li> <li>• Assignment problems</li> <li>• Quizzes</li> </ul>				

<b>MODULE IX:</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
	<b>3</b>	<b>0</b>	<b>2</b>	<b>3</b>
Crystal structures and packing factor (SC, BCC, FCC, Diamond) – Bragg's law – determination of crystal structures.				
<b>SUGGESTED ACTIVITIES :</b> <ul style="list-style-type: none"> <li>• Mostly in Class</li> <li>• EL - Mini project for constructing crystal structures using softballs, Crystal structure parameters</li> <li>• Practical: Crystal structures: Classification and packing factor, Modelling of Diamond crystal structure</li> </ul>				
<b>SUGGESTED EVALUATION METHODS:</b> <ul style="list-style-type: none"> <li>• Assignment problems</li> <li>• Project demonstration and presentation (crystal structures)</li> </ul>				
<b>MODULE X:</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
	<b>3</b>	<b>0</b>	<b>4</b>	<b>3</b>
Density of states – Fermi-Dirac statistics – Population of the conduction and valence bands - Fermi level – single crystal growth – epitaxy - process of integrated circuit production.				
<b>SUGGESTED ACTIVITIES :</b> <ul style="list-style-type: none"> <li>• Combination of in class &amp; Flipped</li> <li>• EL – Crystal growth techniques and IC process</li> <li>• Practical: Post office box: Determination of band gap of a semiconductor</li> <li>• Practical: Solution growth of crystal</li> </ul>				
<b>SUGGESTED EVALUATION METHODS:</b> <ul style="list-style-type: none"> <li>• Tutorial problems</li> <li>• Assignment problems</li> <li>• Quizzes</li> </ul>				

#### REFERENCE BOOKS:

1. Richard Wolfson, "Essential University Physics", Second Edition, Addison-Wesley, 2012.
2. Narciso Garcia and Arthur Damask, "Physics for Computer Science Students", Springer-Verlag, 1991.
3. Neil Gershenfeld, "The Physics of Information Technology", Cambridge University Press, 2000.
4. Harris Benson, "University Physics", Wiley India, 2004.
5. P.A. Tipler and G.P. Mosca, "Physics for Scientists and Engineers with Modern Physics", W.H. Freeman, 2007.

#### OUTCOMES:

**Upon completion of the course, the students will be able to:**

- Apply appropriate concepts of physics to solve problems.
- Acquire knowledge on the basics of properties of matter, optics, lasers, crystals.
- Appreciate the importance of physics of materials for various engineering applications.

**EVALUATION METHOD TO BE USED:**

Sl. no	Category of Courses	Continuous Assessment	Mid – Semester Assessment	End Semester
1.	Theory Integrated with Practical	15(T) + 25 (P)	20	40

MA6151 MATHEMATICS –I		L	T	P	EL	CREDITS
		3	1	0	3	5
<b>OBJECTIVES:</b> <ul style="list-style-type: none"> <li>To gain proficiency in calculus computations.</li> <li>To make the student acquire sound knowledge of techniques in solving ordinary differential equations that model engineering problems.</li> <li>To familiarize the student with functions of several variables.</li> <li>To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.</li> </ul>						
<b>MODULE I SINGLE VARIABLE FUNCTIONS</b>		<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>	
		3	1	0	3	
Representation of functions - New functions from old functions - Limit of a function - Limits at infinity -Continuity.						
<b>SUGGESTED ACTIVITIES :</b> <ul style="list-style-type: none"> <li>Problem solving sessions</li> </ul>						
<b>SUGGESTED EVALUATION METHODS:</b> <ul style="list-style-type: none"> <li>Tutorial problems</li> <li>Assignment problems</li> <li>Quizzes</li> </ul>						
<b>MODULE II DIFFERENTIAL CALCULUS</b>		<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>	
		3	1	0	3	
Derivatives - Differentiation rules – intermediate theorem - Rolle's theorem- Maxima and Minima of functions of one variable.						
<b>SUGGESTED ACTIVITIES :</b> <ul style="list-style-type: none"> <li>Problem solving sessions</li> <li>Applications in real life problems</li> </ul>						
<b>SUGGESTED EVALUATION METHODS:</b> <ul style="list-style-type: none"> <li>Tutorial problems</li> <li>Assignment problems</li> <li>Quizzes</li> </ul>						

<b>MODULE III</b>	<b>FUNCTIONS OF SEVERAL VARIABLES</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
		<b>3</b>	<b>1</b>	<b>0</b>	<b>3</b>
Partial derivatives – Homogeneous functions and Euler’s theorem – Total derivative – Differentiation of implicit functions – Change of variables – Jacobians					
<b>SUGGESTED ACTIVITIES :</b> <ul style="list-style-type: none"> <li>• Problem solving sessions</li> <li>• Applications in real life problems</li> </ul>					
<b>SUGGESTED EVALUATION METHODS:</b> <ul style="list-style-type: none"> <li>• Tutorial problems</li> <li>• Assignment problems</li> <li>• Quizzes</li> </ul>					
<b>MODULE IV</b>	<b>MULTI VARIABLE DIFFERENTIAL CALCULUS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
		<b>3</b>	<b>1</b>	<b>0</b>	<b>3</b>
Partial differentiation of implicit functions – Taylor’s series for functions of two variables – Maxima and minima of functions of two variables – Lagrange’s method of undetermined multipliers.					
<b>SUGGESTED ACTIVITIES :</b> <ul style="list-style-type: none"> <li>• Problem solving sessions</li> <li>• Flipped Class room</li> </ul>					
<b>SUGGESTED EVALUATION METHODS:</b> <ul style="list-style-type: none"> <li>• Tutorial problems</li> <li>• Assignment problems</li> <li>• Quizzes</li> </ul>					
<b>MODULE V</b>	<b>INTEGRAL CALCULUS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
		<b>3</b>	<b>1</b>	<b>0</b>	<b>3</b>
Definite and Indefinite integrals - Substitution rule - Techniques of Integration - Integration by parts					
<b>SUGGESTED ACTIVITIES :</b> <ul style="list-style-type: none"> <li>• Problem solving sessions</li> </ul>					
<b>SUGGESTED EVALUATION METHODS:</b> <ul style="list-style-type: none"> <li>• Tutorial problems</li> <li>• Assignment problems</li> <li>• Quizzes</li> </ul>					
<b>MODULE VI</b>	<b>MORE ON INTEGRAL CALCULUS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
		<b>3</b>	<b>1</b>	<b>0</b>	<b>3</b>
Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals					
<b>SUGGESTED ACTIVITIES :</b> <ul style="list-style-type: none"> <li>• Problem solving sessions</li> </ul>					

<b>SUGGESTED EVALUATION METHODS:</b>					
<ul style="list-style-type: none"><li>• Tutorial problems</li><li>• Assignment problems</li><li>• Quizzes</li></ul>					
<b>MODULE VII</b>	<b>MULTIPLEINTEGRALS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
		<b>3</b>	<b>1</b>	<b>0</b>	<b>3</b>
Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves					
<b>SUGGESTED ACTIVITIES :</b>					
<ul style="list-style-type: none"><li>• Problem solving sessions</li><li>• Flipped Class room</li></ul>					
<b>SUGGESTED EVALUATION METHODS:</b>					
<ul style="list-style-type: none"><li>• Tutorial problems</li><li>• Assignment problems</li><li>• Quizzes</li></ul>					
<b>MODULE VIII</b>	<b>VOLUME INTEGRALS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
		<b>3</b>	<b>1</b>	<b>0</b>	<b>3</b>
Triple integrals – Volume of solids – Change of variables in double and triple integrals.					
<b>SUGGESTED ACTIVITIES :</b>					
<ul style="list-style-type: none"><li>• Problem solving sessions</li></ul>					
<b>SUGGESTED EVALUATION METHODS:</b>					
<ul style="list-style-type: none"><li>• Tutorial problems</li><li>• Assignment problems</li><li>• Quizzes</li></ul>					
<b>MODULE IX</b>		<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
		<b>3</b>	<b>1</b>	<b>0</b>	<b>3</b>
Methods of variation of parameters – Method of undetermined coefficients -					
<b>SUGGESTED ACTIVITIES :</b>					
<ul style="list-style-type: none"><li>• Problem solving sessions</li></ul>					
<b>SUGGESTED EVALUATION METHODS:</b>					
<ul style="list-style-type: none"><li>• Tutorial problems</li><li>• Assignment problems</li><li>• Quizzes</li></ul>					
<b>MODULE X:</b>		<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
		<b>3</b>	<b>1</b>	<b>0</b>	<b>3</b>
Homogenous Equation of Euler's And Legendre's Type – System of Simultaneous Linear Differential Equations with Constant Coefficients.					
<b>SUGGESTED ACTIVITIES :</b>					
<ul style="list-style-type: none"><li>• Problem solving sessions</li></ul>					

**SUGGESTED EVALUATION METHODS:**

- Tutorial problems
- Assignment problems
- Quizzes

**OUTCOMES:**

**Upon completion of the course, the students will be able to:**

- Use both the limit definition and rules of differentiation to differentiate functions.
- Apply differentiation to solve maxima and minima problems.
- Evaluate integrals both by using Riemann sums and by using the Fundamental Theorem of Calculus.
- Apply integration to compute multiple integrals, area, volume, integrals in polar coordinates, in addition to change of order and change of variables.
- Evaluate integrals using techniques of integration, such as substitution, partial fractions and integration by parts.
- Determine convergence/divergence of improper integrals and evaluate convergent improper integrals.
- Apply various techniques in solving differential equations.

**TEXTBOOKS:**

1. James Stewart, "Calculus with Early Transcendental Functions", Cengage Learning, New Delhi, 2008.
2. Narayanan S. and Manicavachagom Pillai T. K., "Calculus" Volume I and II, S. Viswanathan Publishers Pvt. Ltd., Chennai, 2007.
3. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43<sup>rd</sup> Edition, 2014.

**REFERENCES:**

1. Ramana B.V., "Higher Engineering Mathematics", Tata McGraw Hill Co. Ltd., New Delhi, 11<sup>th</sup> Reprint, 2010.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley and Sons, 9<sup>th</sup> Edition, New Delhi, 2014.
3. Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 3<sup>rd</sup> Edition, 2007.
4. Bali N., Goyal M. and Watkins C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt. Ltd.), New Delhi, 7<sup>th</sup> Edition, 2009.
5. Greenberg M.D., "Advanced Engineering Mathematics", Pearson Education, New Delhi, 2<sup>nd</sup> Edition, 5<sup>th</sup> Reprint, 2009.
6. Peter V.O'Neil, "Advanced Engineering Mathematics", Cengage Learning India Pvt., Ltd, New Delhi, 2007.

**EVALUATION METHOD TO BE USED:**

Sl. no	Category of Courses	Continuous Assessment	Mid – Semester Assessment	End Semester
1.	Theory	40	20	40

<b>CS6101</b>	<b>PROGRAMMING WITH C</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>	<b>CREDITS</b>
		<b>2</b>	<b>1</b>	<b>4</b>	<b>3</b>	<b>6</b>
<b>Prerequisites for the course: None</b>						
<b>OBJECTIVES:</b> <ul style="list-style-type: none"> <li>To learn programming using a structured programming language.</li> <li>To implement programs using basic features of C.</li> <li>To learn to use C pointers and dynamically allocated memory techniques.</li> <li>To learn advanced features of the C programming language</li> <li>To be able to use file operations in C</li> </ul>						
<b>MODULE I :</b>		<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>	
		<b>2</b>	<b>1</b>	<b>4</b>	<b>3</b>	
Notion of memory, addresses, variables, instructions, execution of instructions. Operating system commands, file editing, compiling, linking, executing a program.						
<b>SUGGESTED ACTIVITIES :</b> <ul style="list-style-type: none"> <li>Practical - Use of operating system commands and file editing operations.</li> </ul>						
<b>SUGGESTED EVALUATION METHODS:</b> <ul style="list-style-type: none"> <li>Exercises on the use of operating system commands and file editing operations.</li> </ul>						
<b>MODULE II :</b>		<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>	
		<b>2</b>	<b>1</b>	<b>4</b>	<b>3</b>	
Data types - constants, variables - arithmetic operators - expressions - basic input/output. Relational, logical, increment, decrement operators. Bitwise, assignment, conditional operators.						
<b>SUGGESTED ACTIVITIES :</b> <ul style="list-style-type: none"> <li>EL - Programs using integer type, arithmetic operators and basic input/output.</li> <li>EL - Programs using other data types and operators.</li> <li>Practical - Demonstration of programs using integer type, arithmetic operators and basic input/output.</li> <li>Practical - Demonstration of programs using other data types and operators.</li> </ul>						
<b>SUGGESTED EVALUATION METHODS:</b> <ul style="list-style-type: none"> <li>Programs on integer type, arithmetic operators, basic input output.</li> </ul>						

<b>MODULE III :</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
	<b>2</b>	<b>1</b>	<b>4</b>	<b>3</b>
Statements and blocks - Selection - if-else construct - iteration - while - for constructs. The constructs else-if, switch, do-while, break, continue, enum. Pseudocode, Programming style.				
<b>SUGGESTED ACTIVITIES :</b> <ul style="list-style-type: none"> <li>• EL: Programs using if-else, while, for.</li> <li>• EL: Programs using else-if, switch, do-while, break, continue, enum. Use of pseudocode, programming style.</li> <li>• Practical: Demonstration of programs using if else, while, for.</li> <li>• Practical: Use of pseudocode. Demonstration of programs using else-if, switch, do-while, break, continue, enum, programming style.</li> </ul>				
<b>SUGGESTED EVALUATION METHODS:</b> <ul style="list-style-type: none"> <li>• Programs using if else, while, for.</li> </ul>				
<b>MODULE IV :</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
	<b>4</b>	<b>2</b>	<b>8</b>	<b>6</b>
Array, declaration, initialization. Multi dimensional arrays. Strings and character arrays, string operations on arrays.				
<b>SUGGESTED ACTIVITIES :</b> <ul style="list-style-type: none"> <li>• EL - Programs using arrays and operations on arrays.</li> <li>• Practical - Demonstration of programs using arrays and operations on arrays.</li> <li>• EL - Programs implementing string operations on arrays.</li> <li>• Practical - Demonstration of programs implementing string operations on arrays.</li> </ul>				
<b>SUGGESTED EVALUATION METHODS:</b> <ul style="list-style-type: none"> <li>• Evaluation: Programs using arrays and operations on arrays.</li> <li>• Evaluation: Programs using strings and use of string library functions.</li> <li>• Evaluation: Programs implementing string operations on arrays.</li> </ul>				
<b>MODULE V :</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
	<b>4</b>	<b>2</b>	<b>8</b>	<b>6</b>
Functions, definition, call, arguments, call by value. Call by reference. Recursion. Call stack. Header files, static variables, external variables.				
<b>SUGGESTED ACTIVITIES :</b> <ul style="list-style-type: none"> <li>• EL - Programs using functions.</li> <li>• Practical - Demonstration of programs using functions.</li> <li>• EL - Programs using recursion.</li> <li>• Practical - Demonstration of programs using recursion.</li> </ul>				
<b>SUGGESTED EVALUATION METHODS:</b> <ul style="list-style-type: none"> <li>• Evaluation: Programs using functions.</li> <li>• Evaluation: Programs using recursion.</li> </ul>				
<b>MODULE VI:</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
	<b>6</b>	<b>3</b>	<b>12</b>	<b>9</b>
Pointers and arrays - address arithmetic. Dynamic Memory Allocation - Two dimensional arrays and pointers. Pointers and strings, string library functions. Pointers to functions.				



<b>SUGGESTED ACTIVITIES :</b>				
<ul style="list-style-type: none"> <li>• EL - Programs using pointers and arrays, address arithmetic.</li> <li>• Practical - Demonstration of programs using pointers and arrays, address arithmetic..</li> <li>• EL - Programs using Dynamic Memory Allocation, two dimensional arrays and pointers.</li> <li>• Practical - Demonstration of programs using Dynamic Memory Allocation, two dimensional arrays and pointers.</li> <li>• EL - Programs using Pointers and strings..</li> <li>• Practical - Demonstration of programs using pointers and strings.</li> </ul>				
<b>SUGGESTED EVALUATION METHODS:</b>				
<ul style="list-style-type: none"> <li>• Evaluation: Programs on pointers and arrays, address arithmetic..</li> <li>• Evaluation: Programs using Dynamic Memory Allocation, two dimensional arrays and pointers.</li> <li>• Evaluation: Programs using pointers and strings.</li> </ul>				
<b>MODULE VII:</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
	<b>4</b>	<b>2</b>	<b>8</b>	<b>6</b>
Structures, Structures and arrays. Pointers to structures, Self referential structures. Enumeration types, Unions, bit fields, typedefs.				
<b>SUGGESTED ACTIVITIES :</b>				
<ul style="list-style-type: none"> <li>• EL - Programs using structures and arrays.</li> <li>• Practical - Demonstration of programs using Structures and arrays.</li> <li>• EL - Programs using Pointers to structures, Self referential structures.</li> <li>• Practical - Demonstration of programs using pointers to structures, Self referential structures.</li> </ul>				
<b>SUGGESTED EVALUATION METHODS:</b>				
<ul style="list-style-type: none"> <li>• Evaluation: Programs using Structures and arrays.</li> <li>• Evaluation: Programs using pointers to structures, self referential structures.</li> </ul>				
<b>MODULE VIII:</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
	<b>2</b>	<b>1</b>	<b>4</b>	<b>3</b>
Files - binary, text - open, read, write, random access, close. Preprocessor directives. Command line arguments.				
<b>SUGGESTED ACTIVITIES :</b>				
<ul style="list-style-type: none"> <li>• EL - Programs using file operations in real-world applications.</li> <li>• Practical - Demonstration of real-world application using file operations.</li> </ul>				
<b>SUGGESTED EVALUATION METHODS:</b>				
<ul style="list-style-type: none"> <li>• Evaluation: Demonstration of real-world application.</li> </ul>				

#### TEXT BOOKS:

1. Reema Thareja, "Programming in C", 2<sup>nd</sup> ed., Oxford University Press, 2016.
2. Brian W. Kernighan and Dennis M. Ritchie, "The C Programming Language", Pearson Education, 1988.
3. Brian W. Kernighan and Rob Pike, "The Practice of Programming" (Chap 1), Pearson Education, 1999.

**REFERENCES:**

1. Pradip Dey and Manas Ghosh, "Computer Fundamentals and Programming in C", 2<sup>nd</sup> ed., Oxford University Press, 2013.
2. Yashavant Kanetkar, "Let us C", 15<sup>th</sup> ed., BPB Publications, 2017.
3. Paul J. Deitel and Harvey Deitel, "C How to Program", 7<sup>th</sup> ed., Pearson Education, 2013.

**OUTCOMES:**

**Upon completion of the course, the students will be able to:**

- Apply appropriate programming constructs to solve problems.
- Write C programs for simple applications.
- Use C pointers and dynamically allocated memory to solve complex problems.
- Know advanced features of the C programming language.
- Apply file operations to develop solutions for real-world problems.

**EVALUATION METHOD TO BE USED:**

Continuous assessment	Mid term	End Semester
40 (P)	20	40

CS6102      COMPUTATIONAL THINKING	L	T	P	EL	CREDITS
	0	0	4	3	3
<b>Prerequisites for the course: None</b>					
<b>OBJECTIVES:</b> <ul style="list-style-type: none"> <li>• To formulate problems in a way that enables the use of a computer to solve them.</li> <li>• To logically organize and analyze data.</li> <li>• To automate solutions through algorithmic thinking.</li> <li>• To identify, analyze and implement possible solutions with the goal of achieving the most efficient and effective combination of steps and resources.</li> <li>• To generalize and transfer this problem solving process to wide variety of problems.</li> </ul>					
<b>MODULE I :</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>	
	0	0	4	3	
Algorithmic thinking - creating oral algorithms for everyday tasks - Data abstraction and representation - Abstraction and translation of everyday data for use on a computer.					
<b>SUGGESTED ACTIVITIES :</b> <ul style="list-style-type: none"> <li>• Explore algorithm design by creating oral algorithms.</li> <li>• Abstract the essential details of everyday objects.</li> <li>• Translate the description of everyday objects into data types and variables.</li> </ul>					

<b>SUGGESTED EVALUATION METHODS:</b>				
<ul style="list-style-type: none"> <li>Evaluation of the oral algorithms and computer data.</li> </ul>				
<b>MODULE II :</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
	<b>0</b>	<b>0</b>	<b>12</b>	<b>9</b>
Decomposing a complex problem - Strategies for decomposition and algorithm design - Divide and conquer - Simple program implementations.				
<b>SUGGESTED ACTIVITIES :</b>				
<ul style="list-style-type: none"> <li>Decompose a complex problem into discrete steps,</li> <li>Design a simple algorithm for solving the problem.</li> <li>External learning: Study of different strategies for decomposition and algorithm design.</li> <li>Examine sample input and expected output and develop strategies to decompose the problem.</li> <li>Use decomposition to break the problem into smaller problems and algorithmic design to plan a solution strategy.</li> <li>External learning: Simple program implementations.</li> </ul>				
<b>SUGGESTED EVALUATION METHODS:</b>				
<ul style="list-style-type: none"> <li>Whiteboard presentations of the decomposition and algorithm.</li> <li>Evaluation of the developed strategies.</li> <li>Demonstration of the implemented programs.</li> </ul>				
<b>MODULE III :</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
	<b>0</b>	<b>0</b>	<b>8</b>	<b>6</b>
Overall data representation, abstraction, analysis and algorithm design. Program implementations.				
<b>SUGGESTED ACTIVITIES :</b>				
<ul style="list-style-type: none"> <li>Examples of Data representation, abstraction, analysis and algorithm design.</li> <li>Programming implementation.</li> </ul>				
<b>SUGGESTED EVALUATION METHODS:</b>				
<ul style="list-style-type: none"> <li>Whiteboard presentations of the Data analysis and Algorithm design.</li> <li>Demonstration of the programming implementations.</li> </ul>				
<b>MODULE IV:</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
	<b>0</b>	<b>0</b>	<b>8</b>	<b>6</b>
Measuring the complexity of an algorithm - sorting algorithms - the notion of unsolvable problems. Programming illustrations.				
<b>SUGGESTED ACTIVITIES :</b>				
<ul style="list-style-type: none"> <li>Develop algorithms for sorting and determine the complexity of the algorithm and how it scales as the number of items to sort increases.</li> <li>Implement the different algorithms and measure how they scale.</li> <li>Determine which algorithms are more efficient, whether or not all algorithms are calculable given enough time.</li> </ul>				
<b>SUGGESTED EVALUATION METHODS:</b>				
<ul style="list-style-type: none"> <li>Determine complexity of algorithms and how they scale with number of items.</li> <li>Demonstration using appropriate programs.</li> </ul>				

<ul style="list-style-type: none"> <li>Determine which algorithms are computable given enough time.</li> </ul>				
<b>MODULE V:</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
	<b>0</b>	<b>0</b>	<b>4</b>	<b>3</b>
Enhancing the clarity of a program - documentation, style, idioms.				
<b>SUGGESTED ACTIVITIES :</b> <ul style="list-style-type: none"> <li>External Learning: Study the best practices of documentation, style, idioms, etc that are used to ensure the code can be understood and maintained over a long period.</li> <li>Use these practices in the documentation of earlier programs.</li> </ul>				
<b>SUGGESTED EVALUATION METHODS:</b> <ul style="list-style-type: none"> <li>Documentation of given programs.</li> </ul>				
<b>MODULE VI:</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
	<b>0</b>	<b>0</b>	<b>9</b>	<b>9</b>
Application of computational thinking to simple real world problems - program implementation of decomposed modules.				
<b>SUGGESTED ACTIVITIES :</b> <ul style="list-style-type: none"> <li>Application to simple real world problems.</li> </ul>				
<b>SUGGESTED EVALUATION METHODS:</b> <ul style="list-style-type: none"> <li>Evaluation of the solutions to the real world problems</li> </ul>				

#### REFERENCES:

- Exploring Computational Thinking.  
<https://edu.google.com/resources/programs/exploring-computational-thinking/>

#### OUTCOMES:

**Upon completion of the course, the students will be able to:**

- Abstract out details of data and represent them appropriately.
- Create appropriate algorithms to solve specified problems.
- Confidently deal with complexity and open-ended problems.
- Apply the computational thinking skills to real world problems.
- Use best practices for documentation that can ensure long term maintenance.

#### EVALUATION METHOD TO BE USED:

Continuous assessment	Mid term	End Semester
60	40	-

HS6251		TECHNICAL ENGLISH II		L	T	P	EL	C
				4	0	0	3	5
<b>MODULE 1</b>	<b>GIVING INSTRUCTIONS AND MAKING RECOMMENDATIONS</b>	<p><b>Oral Fluency:</b> giving oral instructions and recommendations to carry out short processes. (e.g. how to maintain a smart phone)-</p> <p><b>Language Focus:</b> use of imperatives and modal verbs (linguistic acts of instructing and recommending)-<b>Lexical Development:</b> learning content-related vocabulary-derivatives-functional variations (use of affixes)-stress shift-<b>Reading Comprehension:</b> language of advertising-(features)-passages discussing the uses of any particular product-<b>Listening-</b> to a product description and listing the uses of the product-<b>Writing-</b> designing an advertisement (language component of about 70-100 words)</p>		<p>At the end of the module, students should be able to:</p> <ul style="list-style-type: none"> <li>• Give instructions and make recommendations</li> <li>• Articulate sounds in English with appropriate stress shift in accordance with the meaning and grammar of words</li> </ul>				

		<b>SUGGESTED ACTIVITIES</b>	<b>SUGGESTED EVALUATION METHODS</b>
		<ul style="list-style-type: none"> <li>Lectures on the Communicative aspects of language use.</li> <li>Practical-Listening, Speaking and Writing</li> </ul>	<ul style="list-style-type: none"> <li>Quizzes</li> <li>Assignments</li> <li>Small Group Work</li> </ul>
			<b>12 0 0 9</b>
<b>MODULE 2</b>	<b>ASKING AND ANSWERING QUESTIONS</b>	<p><b>Oral Fluency:</b> short conversations (informal) in academic institutions – Group discussions – Role play Activity -<b>Language Focus:</b> speech acts (illocutionary force; making inferences) study of language in context- framing questions (asking &amp; answering questions) - <b>Lexical Development</b>-learning specialist vocabulary related to reading texts- <b>Reading</b>-dialogues and interviews (e.g. interviews with famous personalities)-<b>Writing:</b> dialogue writing-introduction to e-mail writing (personal)</p>	<p>At the end of the module, students should be able to:</p> <ul style="list-style-type: none"> <li>Participate in conversations in informal contexts</li> <li>Learn to use specialist vocabulary in appropriate contexts.</li> </ul>
		<b>SUGGESTED ACTIVITIES</b>	<b>SUGGESTED EVALUATION METHODS</b>
		<ul style="list-style-type: none"> <li>Lectures on the Communicative aspects of language use.</li> <li>Practical-Listening, Speaking and Writing</li> </ul>	<ul style="list-style-type: none"> <li>Quizzes</li> <li>Assignments</li> <li>Small Group Work</li> </ul>
			<b>12 0 0 9</b>

<b>MODULE 3</b>	<b>ASKING AND ANSWERING QUESTIONS</b>	<p><b>Oral Fluency:</b> making power point presentations (modus operandi to be given)-debating skills-<b>Language Focus-</b> use of adjectival and adverbial forms-<b>Lexical Development:</b> content related vocabulary -Use of abbreviations and acronyms-<b>Reading</b>-passages on making presentations and making notes - preparation of slides-<b>Writing</b> - practice in note making and note taking- <b>Listening</b> – watching a presentation and completing a worksheet</p>	<p>At the end of the module, students should be able to:</p> <ul style="list-style-type: none"> <li>• Make professional Power Point Presentations</li> <li>• Use note making and note taking skills effectively</li> </ul>
		<b>SUGGESTED ACTIVITIES</b>	<b>SUGGESTED EVALUATION METHODS</b>
		<ul style="list-style-type: none"> <li>• Lectures on the Communicative aspects of language use.</li> <li>• Practical-Listening, Speaking and Writing</li> </ul>	<ul style="list-style-type: none"> <li>• Quizzes</li> <li>• Assignments</li> <li>• Power Point Presentations</li> <li>• Small Group Work</li> </ul>
			<b>12 0 0 9</b>
<b>MODULE 4</b>	<b>ELABORATING ON ONE'S QUALIFICATIONS AND ACHIEVEMENTS</b>	<p><b>Oral Fluency:</b> Oral Fluency: SWOT analysis- <b>Role Play:</b> going abroad for work assignments-<b>Language Focus:</b> active voice-use of punctuation marks-simple past and simple present perfect tenses-<b>Lexical Development:</b> specialist vocabulary (letter writing)-<b>Reading</b> – vision statement-work summary-job application-statement of purpose- <b>Listening:</b> listening to a talk and making notes- <b>Writing-</b> applying for a job (letter&amp; e-mail) - bio data/resume</p>	<p>At the end of the module, students should be able to:</p> <ul style="list-style-type: none"> <li>• Write a job application and draw a suitable bio data forms</li> <li>• Read and understand the purposes of different types of writing</li> </ul>

		<b>SUGGESTED ACTIVITIES</b>	<b>SUGGESTED EVALUATION METHODS</b>
		<ul style="list-style-type: none"> <li>Lectures on the Communicative aspects of language use.</li> <li>Practical-Listening, Speaking and Writing</li> </ul>	<ul style="list-style-type: none"> <li>Quizzes</li> <li>Assignments</li> <li>Power Point Presentations</li> <li>Small Group Work</li> </ul>
			<b>12 0 0 9</b>
<b>MODULE 5</b>	<b>WRITING PROJECT REPORTS</b>	<p><b>Oral Fluency:</b> Asking and answering questions (e.g. discussion on training received in school/imaginary training programme) <b>Language Focus:</b> direct and indirect forms of narration-use of simple past and past continuous tense forms of verbs-use of modal verbs-formation of questions (interrogative and yes/no type of questions)-passive voice-<b>Lexical Development:</b> factual vs. emotive use of vocabulary-reporting verbs-<b>Reading:</b> industry /internship report-<b>Writing:</b> report on a training programme (model to be provided)-<b>Listening:</b> to a report and completing a worksheet</p>	<p>At the end of the module, students should be able to:</p> <ul style="list-style-type: none"> <li>Ask and answer different types of questions</li> <li>Write a purpose-oriented, factual, report</li> </ul>
		<b>SUGGESTED ACTIVITIES</b>	<b>SUGGESTED EVALUATION METHODS</b>
		<ul style="list-style-type: none"> <li>Lectures on the Communicative aspects of language use.</li> <li>Practical-Listening, Speaking and Writing</li> </ul>	<ul style="list-style-type: none"> <li>Quizzes</li> <li>Assignments</li> <li>Power Point Presentations</li> <li>Small Group Work</li> </ul>
			<b>12 0 0 9</b>



## **METHODS TO BE USED DURING CLASSROOM TEACHING**

The following methods would be used to achieve programme objectives.

### **For language skills development:**

1. Focus on fluency first for students with limited proficiency. Students would first develop the confidence to express themselves without being inhibited by errors.
2. Guided activities for speaking and writing with vocabulary and information provided as input.
3. Focus on simplicity and clarity than on the use of unnecessarily complex sentences and high- sounding words. Focus on clear organization of any spoken or written message.
4. Adequate preparation time given for demonstration of skills.
5. Sensitivity to issues of shyness and introversion and avoiding coercive methods.
6. Use of relevant techno- social topics on which students have opinion.
7. Use of listening and reading to improve vocabulary.
8. Peer evaluation using feedback templates to allow students to practice in small groups on their own. A session with 30 students needs to allow adequate opportunity to all students.
9. Teacher correction of individual writing scripts with feedback.

### **FOR COMMUNICATION SKILLS DEVELOPMENT:**

1. Focus on essential and time- tested principles of communication that are applicable in most contexts.
2. Avoiding formulae but providing basic templates that can be adapted to situations.
3. Avoiding complex behavioral theories or pop psychology as communication guides.
4. Using situations that students would typically encounter on campus and later at work.
5. Gradual building of confidence by progressing from communication in front of small groups to communication in front of larger groups.

## **ASSESSMENT**

Skills other than speaking would be tested using a paper and pencil test. Speaking skills will be tested using a verbal test.

### **TEXTBOOK:**

1. ENGLISH Today: Technical Communication for Science, Engineering and Technology. Board of Editors, Department of English, Anna University. Orient Black Swan (Volumes 1&2) 2017.

### **REFERENCES:**

1. Learning to Communicate: Dr. V. Chellammal, Allied Publishers, 2002.
2. English for Technical Communication: N.P. Sudharshana, C. Savitha, Cambridge University Press, 2016.

**EVALUATION METHOD TO BE USED:**

Sl. no	Category of Courses	Continuous Assessment	Mid –Semester Assessment	End Semester
1.	Theory	40	20	40

CY6251	ENGINEERING CHEMISTRY	L	T	P	EL	CREDITS
		3	0	2	3	5
<b>OBJECTIVES:</b> <ul style="list-style-type: none"><li>To develop an understanding about fundamentals of polymer chemistry, preparation and properties of polymers</li><li>To acquire knowledge in photochemistry and spectroscopy</li><li>To understand the concepts of surface chemistry and catalysis.</li><li>To impart basic knowledge on chemical thermodynamics.</li><li>To get acquainted with the basic concepts of nano chemistry.</li><li>To understand the chemistry of the fabrication of integrated circuits</li><li>To know the types of specialty materials used in the electronics/electrical industry.</li></ul>						
<b>MODULE I :</b>		L	T	P	EL	
		3	0	2	3	
Polymer Chemistry: Introduction: Functionality; Classification of Polymers- Natural and Synthetic, Thermoplastic and Thermosetting. Types and Mechanism of Polymerization: Addition (Free Radical, Cationic, Anionic and Living); Condensation and Copolymerization. Piezo and pyro electric polymers; Photoresists – Positive and negative.						
<b>SUGGESTED ACTIVITIES :</b> <ul style="list-style-type: none"><li>In Class activity for Functionality and Mechanism of polymerisation</li><li>Practical – Thermal free radical polymerisation of styrene/MMA</li></ul>						
<b>SUGGESTED EVALUATION METHODS:</b> <ul style="list-style-type: none"><li>Tutorial : Deduce type of polymer from monomers with different functionalities</li><li>Assignment : Predicting mechanism of polymerization for few important monomers</li><li>Quizzes</li></ul>						
<b>MODULE II :</b>		L	T	P	EL	
		3	0	2	3	
Properties of Polymers: T <sub>g</sub> , Tacticity, Degree of Polymerization & Molecular Weight - Weight Average, Number Average and Polydispersity Index. Techniques of Polymerization: Bulk, Emulsion, Solution and Suspension						
<b>SUGGESTED ACTIVITIES :</b> <ul style="list-style-type: none"><li>Flipped classroom and activity</li><li>Proofs and Simplification in class</li><li>Practical – Determination of molecular weight of PVA using Ostwald viscometer</li></ul>						

<b>SUGGESTED EVALUATION METHODS:</b>				
<ul style="list-style-type: none"> <li>• Tutorial problems</li> <li>• Assignment problems</li> <li>• Quizzes</li> </ul>				
<b>MODULE III :</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
	<b>3</b>	<b>0</b>	<b>2</b>	<b>3</b>
Photochemistry: Electromagnetic Radiation - Laws of Photochemistry - Grotthuss-Draper Law, Stark-Einstein Law and Lambert-Beer Law. Photo Processes - Internal Conversion, Inter-System Crossing, Fluorescence, Phosphorescence, Chemiluminescence and Photo-Sensitization.				
<b>SUGGESTED ACTIVITIES :</b>				
<ul style="list-style-type: none"> <li>• Evaluate quantum efficiency for different systems</li> <li>• Photo Processes – in class and EL based on that</li> <li>• Practical – Estimation of sodium in water sample by flame photometry</li> </ul>				
<b>SUGGESTED EVALUATION METHODS:</b>				
<ul style="list-style-type: none"> <li>• Tutorial problems</li> <li>• Assignment problems</li> <li>• Quizzes</li> </ul>				
<b>MODULE IV :</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
	<b>3</b>	<b>0</b>	<b>2</b>	<b>3</b>
Spectroscopy: Absorption of Radiation-Electronic, Vibrational and Rotational Transitions. Width and Intensities of Spectral Lines. Spectrophotometric Estimation Of Iron. UV-Vis and IR Spectroscopy-Principles, Instrumentation (Block Diagram) and Applications				
<b>SUGGESTED ACTIVITIES :</b>				
<ul style="list-style-type: none"> <li>• Flipped Class room</li> <li>• Types of electronic/vibrational transitions for different molecules – in class and EL based on that</li> <li>• Practical – Estimation of iron in water sample by spectrophotometry</li> </ul>				
<b>SUGGESTED EVALUATION METHODS:</b>				
<ul style="list-style-type: none"> <li>• Tutorial problems</li> <li>• Assignment problems</li> <li>• Quizzes</li> </ul>				
<b>MODULE V :</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
	<b>3</b>	<b>0</b>	<b>2</b>	<b>3</b>
Adsorption-Types of Adsorption-Adsorption of Gases on Solids- Adsorption from Solutions- Types of Isotherms – Freundlich Adsorption Isotherm, Langmuir Adsorption Isotherm. Industrial Applications of Adsorption.				
<b>SUGGESTED ACTIVITIES :</b>				
<ul style="list-style-type: none"> <li>• Industrial applications in class</li> <li>• EL – Adsorption of gases on solids</li> <li>• Practical – Adsorption of acetic acid/oxalic acid on charcoal – verification of Freundlich's adsorption isotherm.</li> </ul>				

<b>SUGGESTED EVALUATION METHODS:</b>				
<ul style="list-style-type: none"> <li>Tutorial problems</li> <li>Assignment</li> <li>Quizzes</li> </ul>				
<b>MODULE VI:</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
	<b>3</b>	<b>0</b>	<b>2</b>	<b>3</b>
Catalysis: Characteristics and Types of Catalysts-Homogeneous and Heterogeneous, Auto Catalysis. Enzyme Catalysis - Factors Affecting Enzyme Catalysis, Michaelis - Menton Equation. Industrial Applications of Catalysts				
<b>SUGGESTED ACTIVITIES :</b>				
<ul style="list-style-type: none"> <li>Introduction in class</li> <li>Analysis in Class</li> <li>Flipped Classroom for further study</li> <li>Practical – Determination of rate constant of acid catalysed hydrolysis of an ester</li> </ul>				
<b>SUGGESTED EVALUATION METHODS:</b>				
<ul style="list-style-type: none"> <li>Tutorial problems</li> <li>Assignment</li> <li>Quizzes</li> </ul>				
<b>MODULE VII:</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
	<b>3</b>	<b>0</b>	<b>2</b>	<b>3</b>
Second Law: Entropy-Entropy of Phase Transitions; Free Energy- Gibbs-Helmholtz Equation; Clausius Clapeyron Equation; Van't Hoff Isotherm and Isochore. Chemical Potential; Gibbs-Duhem Equation- Variation of Chemical Potential with Temperature and Pressure.				
<b>SUGGESTED ACTIVITIES :</b>				
<ul style="list-style-type: none"> <li>Combinations of in Class &amp; Flipped class rooms</li> <li>Practical – Phase change in a solid.</li> <li>EL - HDL descriptions</li> </ul>				
<b>SUGGESTED EVALUATION METHODS:</b>				
<ul style="list-style-type: none"> <li>Tutorial problems</li> <li>Assignment problems</li> <li>Quizzes</li> </ul>				
<b>MODULE VIII:</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
	<b>3</b>	<b>0</b>	<b>2</b>	<b>3</b>
Nano chemistry - Basics-Distinction between Molecules, Nanoparticles and Bulk Materials; Size-Dependent Properties. Preparation of Nanoparticles – Sol-Gel and Solvo - thermal. Preparation of Carbon Nanotube by Chemical Vapour Deposition and Laser Ablation. Preparation of Nanowires by Electrochemical Deposition and Electro Spinning. Properties and Uses of Nanoparticles, Nanoclusters, Nanorods, Nanotubes and Nanowires.				
<b>SUGGESTED ACTIVITIES :</b>				
<ul style="list-style-type: none"> <li>Combinations of in Class &amp; Flipped class rooms</li> <li>EL – Properties and uses of Nanowires, nanoclusters, nanorods, nanowires</li> <li>Practical - Preparation of nano wire by electrospinning</li> </ul>				

<b>SUGGESTED EVALUATION METHODS:</b>				
<ul style="list-style-type: none"> <li>• Tutorial</li> <li>• Assignment</li> <li>• Quizzes</li> </ul>				
<b>MODULE IX:</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
	<b>3</b>	<b>0</b>	<b>2</b>	<b>3</b>
Fabrication of integrated circuits: Introduction – Fabrication – MOS – NMOS, PMOS, CMOS, Ga-As Technologies, Printed circuit boards-Fabrication (Single layer only) – Lamination, printing (photo and screen printing) and mechanical operation.				
<b>SUGGESTED ACTIVITIES :</b>				
<ul style="list-style-type: none"> <li>• Mostly in Class</li> <li>• EL - Mini project for Lamination by Hand lay up Technique</li> <li>• Practical – Determination of total, temporary and permanent hardness of water by EDTA method</li> </ul>				
<b>SUGGESTED EVALUATION METHODS:</b>				
<ul style="list-style-type: none"> <li>• Assignment problems</li> <li>• Project demonstration and presentation</li> </ul>				
<b>MODULE X:</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
	<b>3</b>	<b>0</b>	<b>2</b>	<b>3</b>
Specialty Materials: Dielectrics & insulating materials – Characteristics; Ceramics – Mica and glass; Magnetic materials – basis of magnetism – Soft and hard magnetic materials; Composites : Classification – Particulate, fibrous and laminated composites – Hybrid composites – Application of composites in electrical and electronic components; Semiconductors – Extensive and intensive; Metallic solids –Characteristics.				
<b>SUGGESTED ACTIVITIES :</b>				
Combination of in class & Flipped				
<b>SUGGESTED EVALUATION METHODS:</b>				
<ul style="list-style-type: none"> <li>• Tutorial</li> <li>• Assignment</li> <li>• Quizzes</li> </ul>				

#### **PREREQUISITES FOR THE COURSE:**

Laboratory facilities to carry out the experiments mentioned in each of the modules – Thermal free radical polymerisation of styrene/MMA, Determination of molecular weight of PVA using Ostwald viscometer, Estimation of sodium in water sample by flame photometry, Estimation of iron in water sample by spectrophotometry, Adsorption of acetic acid/oxalic acid on charcoal – verification of Freundlich's adsorption isotherm, Determination of rate constant of acid catalysed hydrolysis of an ester, Phase change in solid, Electrospinning, Total and temporary hardness.

## OUTCOMES

Upon completion of the course, the students will be able to:

- Identify the different types of polymers, polymerisation processes and some special properties and applications of polymers.
- Identify suitable adsorbents/ adsorption process and catalysts for pollution abatement and other industrial processes.
- Discuss the concepts involved in the absorption of radiation by materials and various photophysical processes, polymer chemistry, surface chemistry and catalysis.
- Point out the spectral techniques for qualitative and quantitative analysis & thermodynamics of various processes.
- Discuss the importance of the nano materials (and their superiority over conventional materials), feasibility of their preparation and uses
- Elaborate on various technologies for the fabrication of integrated circuits & specialty materials in the electronics/electrical industry

## TEXT BOOKS:

1. Jain P.C and Monika Jain, "Engineering Chemistry", Dhanpet Rai Publishing Company (P) Ltd., New Delhi, 2013.
2. Wong M.N., "Polymer for electronics and photonic applications", John Wiley, New York, 2006.

## REFERENCES:

1. Sivasankar B., "Engineering Chemistry", Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2012
2. Vairam S., Kalyani P., Suba Ramesh., "Engineering Chemistry", Wiley India Pvt Ltd., New Delhi., 2011.
3. Khanna O.P., "Material Science" NIH Publications, 2007.

## EVALUATION METHOD TO BE USED:

Continuous assessment	Mid term	End Semester
15(T) + 25 (P)	20	40

MA6251	DISCRETE MATHEMATICS	L	T	P	EL	CREDITS
		3	1	0	3	5
MODULE I	LOGIC	L	T	P	EL	
		3	1	0	3	
Propositional Logic – Propositional equivalences - Predicates and Quantifiers – Nested Quantifiers						
<b>SUGGESTED ACTIVITIES :</b>						
<ul style="list-style-type: none"><li>• Problem Solving sessions</li></ul>						
<b>SUGGESTED EVALUATION METHODS:</b>						
<ul style="list-style-type: none"><li>• Tutorial problems</li><li>• Assignment problems</li><li>• Quizzes</li></ul>						

<b>MODULE II PROOFS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
	<b>3</b>	<b>1</b>	<b>0</b>	<b>3</b>
Rules of inference - Introduction to proofs – Proof methods and strategy.				
<b>SUGGESTED ACTIVITIES :</b> <ul style="list-style-type: none"> <li>• Problem Solving sessions</li> <li>• Applications in real life problems</li> </ul>				
<b>SUGGESTED EVALUATION METHODS:</b> <ul style="list-style-type: none"> <li>• Tutorial problems</li> <li>• Assignment problems</li> <li>• Quizzes</li> </ul>				
<b>MODULE III COMBINATORICS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
	<b>3</b>	<b>1</b>	<b>0</b>	<b>3</b>
Mathematical induction – Strong induction and well ordering – The basics of counting - The pigeonhole principle- Permutations and Combinations				
<b>SUGGESTED ACTIVITIES :</b> <ul style="list-style-type: none"> <li>• Problem Solving sessions</li> <li>• Applications in real life problems</li> </ul>				
<b>SUGGESTED EVALUATION METHODS:</b> <ul style="list-style-type: none"> <li>• Tutorial problems</li> <li>• Assignment problems</li> <li>• Quizzes</li> </ul>				
<b>MODULE IV RECURRENCES</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
	<b>3</b>	<b>1</b>	<b>0</b>	<b>3</b>
Recurrence relations -Solving linear recurrence relations using generating functions – Inclusion - Exclusion Principle and its applications.				
<b>SUGGESTED ACTIVITIES :</b> <ul style="list-style-type: none"> <li>• Problem Solving sessions</li> <li>• Applications in real life problems</li> </ul>				
<b>SUGGESTED EVALUATION METHODS:</b> <ul style="list-style-type: none"> <li>• Tutorial problems</li> <li>• Assignment problems</li> <li>• Quizzes</li> </ul>				
<b>MODULE V GRAPH THEORY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
	<b>3</b>	<b>1</b>	<b>0</b>	<b>3</b>
Graphs and graph models – Graph terminology and special types of graphs – Matrix representation of graphs and graph isomorphism – Connectivity – Euler and Hamilton paths.				

<b>SUGGESTED ACTIVITIES :</b> <ul style="list-style-type: none"><li>• Problem Solving sessions</li><li>• Flipped class room</li><li>• Applications in real life problems</li></ul>					
<b>SUGGESTED EVALUATION METHODS:</b> <ul style="list-style-type: none"><li>• Tutorial problems</li><li>• Assignment problems</li><li>• Quizzes</li></ul>					
<b>MODULE VI</b>	<b>ALGEBRAIC STRUCTURE 1</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
		<b>3</b>	<b>1</b>	<b>0</b>	<b>3</b>
Algebraic systems – Semi groups and monoids – Groups - Subgroups - Homomorphisms					
<b>SUGGESTED ACTIVITIES :</b> <ul style="list-style-type: none"><li>• Problem Solving sessions</li><li>• Applications in real life problems</li></ul>					
<b>SUGGESTED EVALUATION METHODS:</b> <ul style="list-style-type: none"><li>• Tutorial problems</li><li>• Assignment problems</li><li>• Quizzes</li></ul>					
<b>MODULE VII</b>	<b>ALGEBRAIC STRUCTURE 2</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
		<b>3</b>	<b>1</b>	<b>0</b>	<b>3</b>
Normal subgroup and coset - Lagrange"s theorem – Definitions and examples of Rings and Fields					
<b>SUGGESTED ACTIVITIES :</b> <ul style="list-style-type: none"><li>• Problem Solving sessions</li><li>• Flipped Class room</li></ul>					
<b>SUGGESTED EVALUATION METHODS:</b> <ul style="list-style-type: none"><li>• Tutorial problems</li><li>• Assignment problems</li><li>• Quizzes</li></ul>					
<b>MODULE VIII</b>	<b>LATTICES</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
		<b>3</b>	<b>1</b>	<b>0</b>	<b>3</b>
Partial ordering – Posets – Lattices as Posets – Properties of lattices - Lattices as algebraic systems – Sub lattices					
<b>SUGGESTED ACTIVITIES :</b> <ul style="list-style-type: none"><li>• Problem Solving sessions</li><li>• Applications in real life problems</li></ul>					
<b>SUGGESTED EVALUATION METHODS:</b> <ul style="list-style-type: none"><li>• Tutorial problems</li></ul>					



<ul style="list-style-type: none"><li>• Assignment problems</li><li>• Quizzes</li></ul>					
<b>MODULE IX      BOOLEAN ALGEBRA</b>		<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
		<b>3</b>	<b>1</b>	<b>0</b>	<b>3</b>
Direct product and Homomorphism – Some special lattices – Boolean algebra					
<b>SUGGESTED ACTIVITIES :</b> <ul style="list-style-type: none"><li>• Problem Solving sessions</li><li>• Applications in real life problems</li></ul>					
<b>SUGGESTED EVALUATION METHODS:</b> <ul style="list-style-type: none"><li>• Tutorial problems</li><li>• Assignment problems</li><li>• Quizzes</li></ul>					

### OUTCOMES:

**Upon completion of the course, the students will be able to:**

- Identify techniques to test the logic of a program.
- Identify structures at many levels.
- Work with a class of functions which transform a finite set into another finite set which relates to input and output functions in Computer Science.
- Discuss the counting principles.
- Point out the properties of algebraic structures such as groups, rings and fields.

### TEXT BOOKS:

1. Kenneth H. Rosen, "Discrete Mathematics and its Applications", Tata McGraw Hill Pub. Co. Ltd., New Delhi, 7th Edition, Special Indian edition, 2011.
2. Tremblay J.P. and Manohar R, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw Hill Pub. Co. Ltd, New Delhi, 30th Reprint, 2011. 22.
3. Susanna S. Epp, "Discrete Mathematics with Applications" Cengage Learning, New Delhi, 8th Edition, 2016.

### REFERENCES:

1. Ralph. P. Grimaldi, "Discrete and Combinatorial Mathematics: An Applied Introduction", Pearson Education Asia, Delhi, 4th Edition, 2007.
2. Thomas Koshy, "Discrete Mathematics with Applications", Elsevier Publications, 2006. 3
3. Seymour Lipschutz and Mark Lipson, "Discrete Mathematics", Schaum's Outlines, Tata McGraw Hill Pub. Co. Ltd., New Delhi, 3rd Edition, 2010.

<b>GE6251 ENGINEERING GRAPHICS</b>		<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>	<b>CREDITS</b>
		<b>2</b>	<b>0</b>	<b>4</b>	<b>3</b>	<b>5</b>
<b>OBJECTIVES</b>						
<ul style="list-style-type: none"> <li>To develop in students, graphic skills for communication of concepts, ideas and design of engineering products and expose them to existing national standards related to technical drawings.</li> </ul>						
<b>MODULE I :</b>		<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>	
		<b>2</b>	<b>0</b>	<b>4</b>	<b>3</b>	
Importance of Graphics in Engineering Applications – Use of Drafting Instruments – BIS Conventions and Specifications – Size, Layout and Folding of Drawing Sheets – Lettering and Dimensioning.						
<b>SUGGESTED ACTIVITIES :</b>						
<ul style="list-style-type: none"> <li>Demonstration using CAD software to bring out the concepts presented in the subject</li> <li>Hands on practicals on open source software</li> </ul>						
<b>SUGGESTED EVALUATION METHODS:</b>						
<ul style="list-style-type: none"> <li>Quizzes</li> </ul>						
<b>MODULE II :</b>		<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>	
		<b>2</b>	<b>0</b>	<b>4</b>	<b>3</b>	
Basic Geometrical Constructions, Curves used in Engineering Practices - Conics –Construction of Ellipse,Parabola and Hyperbola by Eccentricity Method – Construction of Cycloid – Construction of Involute of Square and Circle – Drawing of Tangents and Normal to the above Curves.						
<b>SUGGESTED ACTIVITIES :</b>						
<ul style="list-style-type: none"> <li>Videos of application of Geometric curves in various domains</li> <li>Theory and mathematics in class</li> <li>EL – Practical Problems</li> <li>Practical –Construction of curves</li> </ul>						
<b>SUGGESTED EVALUATION METHODS:</b>						
<ul style="list-style-type: none"> <li>Tutorial problems</li> <li>Assignment problems</li> <li>Quizzes</li> </ul>						
<b>MODULE III :</b>		<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>	
		<b>2</b>	<b>0</b>	<b>4</b>	<b>3</b>	
Visualization Concepts and Free Hand Sketching: Visualization Principles – Representation of Three Dimensional Objects – Layout of Views - Free Hand Sketching of Multiple Views from Pictorial Views of Objects						
<b>SUGGESTED ACTIVITIES :</b>						
<ul style="list-style-type: none"> <li>Building models using various media</li> <li>Discussing uses of multiple views in various fields</li> <li>Practical - Construction of 3D views</li> </ul>						
<b>SUGGESTED EVALUATION METHODS:</b>						
<ul style="list-style-type: none"> <li>Tutorial problems</li> <li>Assignment problems</li> <li>Quizzes</li> </ul>						

<b>MODULE IV :</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
	<b>2</b>	<b>0</b>	<b>4</b>	<b>3</b>
Orthographic Projection- Principles - Principal Planes - First Angle Projection - Projection of Points. Projection of Straight Lines (only First Angle Projections) Inclined to Both the Principal Planes - Determination of True Lengths and True Inclinations by Rotating Line Method and Trapezoidal Method and Traces				
<b>SUGGESTED ACTIVITIES :</b> <ul style="list-style-type: none"> <li>Videos of application of projections in various domains</li> <li>Theory and mathematics in class</li> <li>EL – Practical Problems in orthographic projection of points</li> <li>Practical –Construction of curves</li> </ul>				
<b>SUGGESTED EVALUATION METHODS:</b> <ul style="list-style-type: none"> <li>Tutorial problems</li> <li>Assignment problems</li> <li>Quizzes</li> </ul>				
<b>MODULE V :</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
	<b>2</b>	<b>0</b>	<b>4</b>	<b>3</b>
Projection of Planes (Polygonal and Circular Surfaces) Inclined to both the Principal Planes by Rotating Object Method.				
<b>SUGGESTED ACTIVITIES :</b> <ul style="list-style-type: none"> <li>Videos of application of projections in various domains</li> <li>Theory and mathematics in class</li> <li>EL – Practical Problems in orthographic projection of planes</li> </ul>				
<b>SUGGESTED EVALUATION METHODS:</b> <ul style="list-style-type: none"> <li>Tutorial problems</li> <li>Assignment problems</li> <li>Quizzes</li> </ul>				
<b>MODULE VI:</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
	<b>2</b>	<b>0</b>	<b>4</b>	<b>3</b>
Projection of Simple Solids like Prisms, Pyramids, Cylinder, Cone and Truncated Solids when the Axis is Inclined to both the Principal Planes by Rotating Object Method and Auxiliary Plane Method.				
<b>SUGGESTED ACTIVITIES :</b> <ul style="list-style-type: none"> <li>Introduction in class</li> <li>Models making</li> <li>Videos/software demonstrations</li> </ul>				
<b>SUGGESTED EVALUATION METHODS:</b> <ul style="list-style-type: none"> <li>Tutorial problems</li> <li>Assignment problems</li> <li>Quizzes</li> </ul>				
<b>MODULE VII</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
	<b>2</b>	<b>0</b>	<b>4</b>	<b>3</b>
Sectioning of Solids in Simple Vertical Position when the Cutting Plane is Inclined to the one of the Principal Planes and Perpendicular to the other – Obtaining True Shape of Section.				
<b>SUGGESTED ACTIVITIES :</b> <ul style="list-style-type: none"> <li>Introduction in class</li> <li>Models</li> <li>Videos /software demonstrations</li> </ul>				

<b>SUGGESTED EVALUATION METHODS:</b>				
<ul style="list-style-type: none"> <li>• Tutorial problems</li> <li>• Assignment problems</li> <li>• Quizzes</li> </ul>				
<b>MODULE VIII</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
	<b>2</b>	<b>0</b>	<b>4</b>	<b>3</b>
Development of Lateral Surfaces of Simple and Sectioned Solids – Prisms, Pyramids Cylinders and Cones. Development of Lateral Surfaces of Solids with Cut-Outs and Holes.				
<b>SUGGESTED ACTIVITIES :</b>				
<ul style="list-style-type: none"> <li>• Development models in cardboard</li> <li>• Software demonstration</li> </ul>				
<b>SUGGESTED EVALUATION METHODS:</b>				
<ul style="list-style-type: none"> <li>• Tutorial problems</li> <li>• Assignment problems</li> <li>• Quizzes</li> </ul>				
<b>MODULE IX:</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
	<b>2</b>	<b>0</b>	<b>4</b>	<b>3</b>
Principles of Isometric Projection – Isometric Scale – Isometric Projections of Simple Solids and Truncated Solids - Prisms, Pyramids, Cylinders, Cones - Combination of Two Solid Objects in Simple Vertical Positions and Miscellaneous Problems.				
<b>SUGGESTED ACTIVITIES :</b>				
<ul style="list-style-type: none"> <li>• Videos</li> <li>• Demonstrations using Solid modeling software</li> </ul>				
<b>SUGGESTED EVALUATION METHODS:</b>				
<ul style="list-style-type: none"> <li>• Assignment problems</li> <li>• Quizzes</li> </ul>				
<b>MODULE X</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
	<b>2</b>	<b>0</b>	<b>4</b>	<b>3</b>
Perspective Projection of Simple Solids - Prisms, Pyramids and Cylinders by Visual Ray Method and Vanishing Point Method.				
<b>SUGGESTED ACTIVITIES :</b>				
<ul style="list-style-type: none"> <li>• Videos</li> <li>• Illustration using Advertisements</li> </ul>				
<b>SUGGESTED EVALUATION METHODS:</b>				
<ul style="list-style-type: none"> <li>• Tutorial problems</li> <li>• Assignment problems</li> <li>• Quizzes</li> </ul>				

**OUTCOMES:**

**Upon completion of the course, the students will be able to:**

- Perform free hand sketching of basic geometrical shapes and multiple views of objects.
- Draw orthographic projections of lines, planes and solids
- Obtain development of surfaces.
- Prepare isometric and perspective views of simple solids.

**TEXT BOOK:**

1. N.D.Bhatt and V.M.Panchal, "Engineering Drawing", Charotar Publishing House, 50th Edition, 2010.

**REFERENCES:**

1. K.R.Gopalakrishna., "Engineering Drawing" (Vol I&II combined) SubhasStores, Bangalore, 2007
2. Luzzader, Warren.J., and Duff,John M.,," Fundamentals of Engineering Drawingwith an introduction to Interactive Computer Graphics for Design and Production",Eastern Economy Edition, Prentice Hall of India Pvt Ltd, New Delhi, 2005
3. M.B.Shah and B.C.Rana, "Engineering Drawing", Pearson, 2nd Edition, 2009
4. K.Venugopal and V.Prabhu Raja, "Engineering Graphics", New Age International (P)Limited ,2008.
5. K. V.Natarajan, "A text book of Engineering Graphics", 28th Edition, Dhanalakshmi Publishers, Chennai, 2015.
6. BasantAgarwal and Agarwal C.M., "Engineering Drawing", Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.
7. N.S Parthasarathy and Vela Murali, " Engineering Drawing", Oxford University Press, 2015.

**Publication of Bureau of Indian Standards:**

1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets
2. IS 9609 (Parts 0 & 1) – 2001: Technical products Documentation – Lettering.
3. IS 10714 (Part 20) – 2001 & SP 46 – 2003: Lines for technical drawings.
4. IS 11669 – 1986 & SP 46 – 2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods.

**EVALUATION METHOD TO BE USED:**

Sl. no	Category of Courses	Continuous Assessment	Mid – Semester Assessment	End Semester
1.	Theory	40	20	40

CS6103    APPLICATION DEVELOPMENT PRACTICES	L	T	P	EL	TOTAL	CREDITS
	1	0	4	3	8	4
<b>OBJECTIVES:</b> <ul style="list-style-type: none"><li>To introduce students to programming languages and techniques associated with the world wide web and thereby create interest in programming even to students with little programming knowledge</li><li>To introduce tools for creating interactive web pages</li><li>To introduce the client-server architecture</li><li>To introduce databases</li></ul>						
<b>MODULE I :</b>		L	T	P	EL	
		1	0	4	3	
Design of webpages – Use of Cascading style sheets to style the way a webpage looks						
<b>SUGGESTED ACTIVITIES :</b> <ul style="list-style-type: none"><li>EL – Learn to use CSS</li></ul>						
<b>SUGGESTED EVALUATION METHODS:</b> <ul style="list-style-type: none"><li>Demonstration of designed webpages</li><li>Evaluation of the preparation done in learning CSS syntax</li></ul>						
<b>MODULE II :</b>		L	T	P	EL	
		1	0	4	3	
Incorporating multimedia into a webpage (Text / Audio / Image / Video / Animation)						
<b>SUGGESTED ACTIVITIES :</b> <ul style="list-style-type: none"><li>EL – Learn how to read information from a file/array and display on the webpage</li></ul>						
<b>SUGGESTED EVALUATION METHODS:</b> <ul style="list-style-type: none"><li>Demonstration of having incorporated multimedia in a webpage</li></ul>						
<b>MODULE III :</b>		L	T	P	EL	
		1	0	4	3	
Writing client side scripts using Javascript / Angular JS Client side validation						
<b>SUGGESTED ACTIVITIES :</b> <ul style="list-style-type: none"><li>EL – Learn to use Javascript / Angular JS</li></ul>						
<b>SUGGESTED EVALUATION METHODS:</b> <ul style="list-style-type: none"><li>Demonstration of using client side validation for designed web browsers</li></ul>						
<b>MODULE IV:</b>		L	T	P	EL	
		1	0	4	3	
Designing a static website using content management frameworks						
<b>SUGGESTED ACTIVITIES :</b> <ul style="list-style-type: none"><li>EL – Familiarity with any one content management framework</li></ul>						
<b>SUGGESTED EVALUATION METHODS:</b> <ul style="list-style-type: none"><li>Evaluation of the preparation done in getting familiarized with a content management framework</li></ul>						

<b>MODULE V :</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
	<b>1</b>	<b>0</b>	<b>4</b>	<b>3</b>
Understanding servers – Server login, Database connectivity				
<b>SUGGESTED ACTIVITIES :</b>				
<ul style="list-style-type: none"> <li>EL- Overview of databases</li> </ul>				
<b>SUGGESTED EVALUATION METHODS:</b>				
<ul style="list-style-type: none"> <li>Quiz on servers and overview of databases</li> </ul>				
<b>MODULE VI:</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
	<b>4</b>	<b>0</b>	<b>0</b>	<b>2</b>
Use queries for fetching from database Processing the results of queries File upload/download File streaming				
<b>SUGGESTED ACTIVITIES :</b>				
<ul style="list-style-type: none"> <li>EL - SQL queries to create table, select, update and insert</li> </ul>				
<b>SUGGESTED EVALUATION METHODS:</b>				
<ul style="list-style-type: none"> <li>Quiz on SQL queries</li> <li>Demonstration of the use of queries</li> </ul>				
<b>MODULE VII:</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
	<b>1</b>	<b>0</b>	<b>4</b>	<b>3</b>
Server side scripts and validation				
<b>SUGGESTED ACTIVITIES :</b>				
<ul style="list-style-type: none"> <li>EL – Learn how to write server side scripts</li> </ul>				
<b>SUGGESTED EVALUATION METHODS:</b>				
<ul style="list-style-type: none"> <li>Demonstration of the use server side scripts</li> </ul>				
<b>MODULE VIII:</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
	<b>1</b>	<b>0</b>	<b>4</b>	<b>3</b>
Development of web application				
<b>SUGGESTED ACTIVITIES :</b>				
<ul style="list-style-type: none"> <li>EL - Select an application for which webpage has to be developed. List the features to be included.</li> </ul>				
<b>SUGGESTED EVALUATION METHODS:</b>				
<ul style="list-style-type: none"> <li>Oral explanation of the web application to be developed</li> </ul>				
<b>MODULE IX:</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
	<b>1</b>	<b>0</b>	<b>4</b>	<b>3</b>
Development of web application				
<b>SUGGESTED ACTIVITIES :</b>				
<ul style="list-style-type: none"> <li>EL – Application of what was learnt in the previous weeks and develop the webpage</li> </ul>				
<b>SUGGESTED EVALUATION METHODS:</b>				
<ul style="list-style-type: none"> <li>Demonstration of developed web application</li> </ul>				

#### OUTCOMES:

Upon completion of the course, the students will be able to:

- Develop interactive websites
- Use of databases
- Understand and appreciate the use of the client-server architecture

**REFERENCES:**

1. Scobey, Pawan Lingras, "Web Programming and Internet Technologies An E-Commerce Approach", Second Edition, Jones & Bartlett Publishers, 2016.

**EVALUATION METHOD TO BE USED:**

Sl. no	Category of Courses	Continuous Assessment	Mid – Semester Assessment	End Semester
1.	Practical Integrated with Theory	40(P)	20(T)	40(P)

**CS6104****DATA STRUCTURES AND ALGORITHMS****Prerequisites for the course: NIL****OBJECTIVES:**

- To understand the concepts of linear and non-linear data structures
- To get an idea about suitability of data structure for an application
- To learn some fundamental algorithm design strategies
- To understand how the correctness of an algorithm can be proved
- To learn how to analyze an algorithm
- To understand the concept of NP-Completeness

CS6104	DATA STRUCTURES AND ALGORITHMS	L	T	P	EL	CREDITS
		3	1	4	3	7
MODULE I	INTRODUCTION	L	T	P	EL	
		4	1	0	4	
Abstract Data Types – Algorithm Properties – Overview on Proof of Correctness & Algorithm Analysis – Asymptotic Notations & Properties, Linear Search.						
<b>SUGGESTED ACTIVITIES :</b> <ul style="list-style-type: none"><li>• Workout on design of algorithms for some small simple problems, provide proof of correctness, and determine the complexity.</li><li>• EL - Study on average case analysis for some standard algorithms.</li></ul>						
<b>SUGGESTED EVALUATION METHODS:</b> <ul style="list-style-type: none"><li>• Assignment - Based on design, correctness and efficiency.</li></ul>						



<b>MODULE II</b>	<b>LINEAR DATA STRUCTURES</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
		<b>4</b>	<b>1</b>	<b>4</b>	<b>3</b>
Stack - Queue - Linked lists - Some applications based on linear data structures.					
<b>SUGGESTED ACTIVITIES :</b>					
<ul style="list-style-type: none"> <li>• EL – Converting an algorithm from recursive to non-recursive using stack.</li> <li>• Practical - An application based on linear data structure.</li> </ul>					
<b>SUGGESTED EVALUATION METHODS:</b>					
<ul style="list-style-type: none"> <li>• Programming exercises in the laboratory</li> <li>• Quizzes</li> </ul>					
<b>MODULE III</b>	<b>NON-LINEAR DATA STRUCTURES</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
		<b>4</b>	<b>1</b>	<b>4</b>	<b>3</b>
Trees - Graphs - Traversals - Threaded binary trees.					
<b>SUGGESTED ACTIVITIES :</b>					
<ul style="list-style-type: none"> <li>• EL - Applications of trees and graphs.</li> <li>• Practical - Implementing tree and graph traversals.</li> </ul>					
<b>SUGGESTED EVALUATION METHODS:</b>					
<ul style="list-style-type: none"> <li>• Assignment related to application</li> <li>• Programming exercises in the laboratory</li> <li>• Quizzes</li> </ul>					
<b>MODULE IV</b>	<b>DIVIDE &amp; CONQUER</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
		<b>4</b>	<b>1</b>	<b>4</b>	<b>3</b>
Strassen's Matrix Multiplication - Selection in Linear Time.					
<b>SUGGESTED ACTIVITIES :</b>					
<ul style="list-style-type: none"> <li>• EL – Merge Sort &amp; Quick Sort</li> <li>• Practical – Implementation of Merge Sort &amp; Quick Sort.</li> </ul>					
<b>SUGGESTED EVALUATION METHODS:</b>					
<ul style="list-style-type: none"> <li>• Programming exercises in the laboratory</li> <li>• Assignment problems</li> <li>• Quizzes</li> </ul>					
<b>MODULE V</b>	<b>GREEDY METHOD</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
		<b>4</b>	<b>1</b>	<b>4</b>	<b>3</b>
Greedy Strategy – Knapsack Problem - Spanning Trees –Single Source Shortest Path problems					
<b>SUGGESTED ACTIVITIES :</b>					
<ul style="list-style-type: none"> <li>• EL – Tree Vertex Splitting</li> <li>• Practical – Spanning Tree Implementation</li> </ul>					
<b>SUGGESTED EVALUATION METHODS:</b>					
<ul style="list-style-type: none"> <li>• Programming exercises in the laboratory</li> <li>• Quizzes</li> </ul>					

<b>MODULE VI</b>	<b>DYNAMIC PROGRAMMING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
		<b>4</b>	<b>1</b>	<b>4</b>	<b>3</b>
Principles of Optimality - Matrix chain multiplication - Longest common subsequences					
<b>SUGGESTED ACTIVITIES :</b> <ul style="list-style-type: none"> <li>• EL – All Pair shortest path.</li> <li>• Practical - Implementation of All pair shortest path</li> </ul>					
<b>SUGGESTED EVALUATION METHODS:</b> <ul style="list-style-type: none"> <li>• Programming exercises in the laboratory</li> <li>• Quizzes</li> </ul>					
<b>MODULE VII</b>	<b>BACKTRACKING &amp; BRANCH AND BOUND</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
		<b>4</b>	<b>1</b>	<b>4</b>	<b>3</b>
Backtracking:8-Queens & Sum of subsets – Branch & Bound: 0/1 Knapsack					
<b>SUGGESTED ACTIVITIES :</b> <ul style="list-style-type: none"> <li>• Flipped class rooms</li> <li>• Practical - Implementations of sum of subset problem.</li> <li>• EL –Travelling Salesperson using Branch &amp; Bound</li> </ul>					
<b>SUGGESTED EVALUATION METHODS:</b> <ul style="list-style-type: none"> <li>• Programming exercises in the laboratory</li> <li>• Assignment problems</li> <li>• Quizzes</li> </ul>					
<b>MODULE VIII</b>	<b>MORE ON SORTING &amp; INDEXING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
		<b>5</b>	<b>1</b>	<b>4</b>	<b>3</b>
Heap Sort – External sorting – Hashing					
<b>SUGGESTED ACTIVITIES :</b> <ul style="list-style-type: none"> <li>• EL – Comparison of internal sorting algorithms</li> <li>• Practical – Implementation of Hash table</li> </ul>					
<b>SUGGESTED EVALUATION METHODS:</b> <ul style="list-style-type: none"> <li>• Programming exercises in the laboratory</li> <li>• Quizzes</li> </ul>					
<b>MODULE IX</b>	<b>STRING MATCHING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
		<b>2</b>	<b>1</b>	<b>2</b>	<b>2</b>
Naïve Algorithm – KMP Algorithm					
<b>SUGGESTED ACTIVITIES :</b> <ul style="list-style-type: none"> <li>• Tutorial</li> <li>• Practical – Implementation of KMP algorithm</li> </ul>					
<b>SUGGESTED EVALUATION METHODS:</b> <ul style="list-style-type: none"> <li>• Programming exercises in the laboratory</li> <li>• Quizzes</li> </ul>					

<b>MODULE X</b>	<b>NP-COMPLETENESS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
		<b>5</b>	<b>1</b>	<b>0</b>	<b>5</b>
Polynomial time verification – Theory of reducibility - NP Completeness proof for Vertex cover & Hamiltonian Cycle.					
<b>SUGGESTED ACTIVITIES :</b>					
EL – Study of proof for NP completeness on any two problems					
<b>SUGGESTED EVALUATION METHODS:</b>					
<ul style="list-style-type: none"> <li>Quizzes</li> </ul>					

#### TEXT BOOKS:

1. Ellis Horowitz and Sartaj Sahni, "Fundamentals of Data Structures", Galgotia, 1976.
2. Ellis Horowitz and Sartaj Sahni, "Fundamental of Computer Algorithms", Galgotia, 1985.
3. Thomas H Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, "Introduction to Algorithms", Third Edition, Prentice Hall, 2010.

#### REFERENCES:

1. Jean-Paul Tremblay and Paul G Sorenson, "An Introduction to Data Structures with Applications", Second Edition, Tata McGraw Hill, 1991.
2. Kenneth A. Berman and Jerome L Paul, "Algorithms", Cengage Learning India, 2010.

#### OUTCOMES:

**Upon completion of the course, the students will be able to:**

- Point out various representations of data structures
- Write functions to implement linear and non-linear data structure operations
- Suggest and use appropriate linear/non-linear data structure operations for solving a given problem
- Apply various algorithm design techniques and analysis
- Apply appropriate hash functions that result in a collision free scenario for data storage and retrieval
- Show how to prove a problem to be NP-Complete

#### Evaluation Pattern:

<b>Category of Course</b>	<b>Continuous Assessment</b>	<b>Mid – Semester Assessment</b>	<b>End Semester</b>
<b>Theory Integrated with Practical</b>	<b>15(T) + 25 (P)</b>	<b>20</b>	<b>40</b>

#### CO - PO Mapping:

	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>P10</b>	<b>PO11</b>	<b>PO12</b>
<b>CO1</b>	√											
<b>CO2</b>					√							
<b>CO3</b>	√	√	√									
<b>CO4</b>	√			√	√							
<b>CO5</b>	√	√			√							√
<b>CO6</b>	√	√	√									

**CS6105****DIGITAL FUNDAMENTALS AND COMPUTER ORGANIZATION**

Prerequisites for the course: None

**OBJECTIVES:**

- To learn Boolean algebra and simplification of Boolean functions
- To learn to design and analyze different combinational circuits
- To study the basics of synchronous sequential logic and analyze and design sequential circuits
- To understand the important components of a computer system and the basic organization
- To learn to write code in hardware definition languages for designing larger digital systems

CS6105 DIGITAL FUNDAMENTALS AND COMPUTER ORGANIZATION	L	T	P	EL	CREDITS
	3	1	4	3	7
<b>MODULE I :</b>					
	L	T	P	EL	
	3	1	4	3	
Number Systems – Binary, Octal, Hexadecimal – Representation of negative numbers - 1's and 2's Complements - Arithmetic Operations – Binary Codes.					
<b>SUGGESTED ACTIVITIES :</b>					
<ul style="list-style-type: none"> <li>• In Class activity for place - value systems</li> <li>• Practical – Abacus – Counting – Activity</li> </ul>					
<b>SUGGESTED EVALUATION METHODS:</b>					
<ul style="list-style-type: none"> <li>• Tutorial problems</li> <li>• Assignment problems</li> <li>• Quizzes</li> </ul>					
<b>MODULE II :</b>					
	L	T	P	EL	
	3	1	4	3	
Boolean Algebra – Theorems and Postulates - Functions – Truth Table - Logic Gates – Universal gates					
<b>SUGGESTED ACTIVITIES :</b>					
<ul style="list-style-type: none"> <li>• Flipped classroom and activity</li> <li>• Proofs and Simplification in class</li> <li>• EL – Practical Problems - Introduction to propositional problems using conjunction, disjunction and negation</li> <li>• Practical - Implementation of simple functions using gates</li> </ul>					
<b>SUGGESTED EVALUATION METHODS:</b>					
<ul style="list-style-type: none"> <li>• Tutorial problems</li> <li>• Assignment problems</li> <li>• Quizzes</li> </ul>					

<b>MODULE III :</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
	<b>3</b>	<b>1</b>	<b>4</b>	<b>3</b>
Canonical and Standard Forms – Minterms and Maxterms - Sum of Products and Product of Sums - Simplification of Boolean Functions - Karnaugh Map – 2,3,4 variables - NAND / NOR Implementations.				
<b>SUGGESTED ACTIVITIES :</b> <ul style="list-style-type: none"> <li>• EL - Exclusive OR function</li> <li>• Practical - Simplification and implementation of Boolean functions</li> </ul>				
<b>SUGGESTED EVALUATION METHODS:</b> <ul style="list-style-type: none"> <li>• Tutorial problems</li> <li>• Assignment problems</li> <li>• Quizzes</li> </ul>				
<b>MODULE IV :</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
	<b>6</b>	<b>1</b>	<b>8</b>	<b>3</b>
Combinational Circuits – Arithmetic Circuits - Half and Full Adders - Subtractors - Binary Parallel adder – Carry Look-ahead Adder - BCD Adder - Magnitude Comparator - Binary multiplier - Code Converters. Introduction to HDL.				
<b>SUGGESTED ACTIVITIES :</b> <ul style="list-style-type: none"> <li>• Flipped Class room</li> <li>• Introduction to HDL – in class and EL based on that</li> <li>• Practical - Implementation of the arithmetic circuits and getting started with HDL</li> </ul>				
<b>SUGGESTED EVALUATION METHODS:</b> <ul style="list-style-type: none"> <li>• Tutorial problems</li> <li>• Assignment problems</li> <li>• Quizzes</li> </ul>				
<b>MODULE V :</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
	<b>3</b>	<b>1</b>	<b>8</b>	<b>3</b>
Decoder, Encoder, Priority Encoder, Mux/Demux - Applications. HDL for these circuits.				
<b>SUGGESTED ACTIVITIES :</b> <ul style="list-style-type: none"> <li>• Applications in class</li> <li>• EL – HDL for these combinational circuits</li> <li>• Practical - Implementation of these circuits and HDL implementations</li> </ul>				
<b>SUGGESTED EVALUATION METHODS:</b> <ul style="list-style-type: none"> <li>• Tutorial problems</li> <li>• Assignment problems</li> <li>• Quizzes</li> </ul>				
<b>MODULE VI:</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
	<b>5</b>	<b>1</b>	<b>4</b>	<b>3</b>
R –S Latch - D Latch - Flip flops – SR, JK, T, D, Master /Slave FF, HDL for latches and flip flops - Analysis of clocked sequential circuits – Moore /Mealy models - Flip flop excitation tables - Design of clocked sequential circuits.				
<b>SUGGESTED ACTIVITIES :</b>				

<ul style="list-style-type: none"> <li>• Introduction in class</li> <li>• Analysis in Class</li> <li>• Flipped Classroom for further study</li> <li>• Practical - Implementation of Flip flops</li> </ul>				
<b>SUGGESTED EVALUATION METHODS:</b> <ul style="list-style-type: none"> <li>• Tutorial problems</li> <li>• Assignment problems</li> <li>• Quizzes</li> </ul>				
<b>MODULE VII:</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
	<b>3</b>	<b>1</b>	<b>4</b>	<b>3</b>
Registers – Shift Registers, Universal Shift Register Counters – Ripple Counters, Synchronous Counters, Ring Counter, Johnson Counter - HDL for counters and shift registers				
<b>SUGGESTED ACTIVITIES :</b> <ul style="list-style-type: none"> <li>• Combinations of in Class &amp; Flipped class rooms</li> <li>• Practical - Implementations of counters and shift registers</li> <li>• EL - HDL descriptions</li> <li>• EL - Mini project for designing and implementing a digital system using both hardware and software (HDL)</li> </ul>				
<b>SUGGESTED EVALUATION METHODS:</b> <ul style="list-style-type: none"> <li>• Tutorial problems</li> <li>• Assignment problems</li> <li>• Quizzes</li> </ul>				
<b>MODULE VIII:</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
	<b>3</b>	<b>1</b>	<b>4</b>	<b>3</b>
Practical Problems in Sequential design – Timing diagrams - Problems combining Combinational & Sequential Components – State reduction – State Assignment				
<b>SUGGESTED ACTIVITIES :</b> <ul style="list-style-type: none"> <li>• Timing diagrams in class</li> <li>• Flipped classroom</li> <li>• Practical - HDL descriptions to be continued</li> </ul>				
<b>SUGGESTED EVALUATION METHODS:</b> <ul style="list-style-type: none"> <li>• Tutorial problems</li> <li>• Assignment problems</li> <li>• Quizzes</li> </ul>				
<b>MODULE IX:</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
	<b>3</b>	<b>1</b>	<b>4</b>	<b>3</b>
Memory Systems – RAM, ROM, PLD, PLA and PAL - Design of digital systems				
<b>SUGGESTED ACTIVITIES :</b> <ul style="list-style-type: none"> <li>• Combination of in class &amp; Flipped</li> <li>• Practical - Project demonstration and presentation</li> </ul>				
<b>SUGGESTED EVALUATION METHODS:</b> <ul style="list-style-type: none"> <li>• Tutorial problems</li> <li>• Assignment problems</li> <li>• Quizzes</li> </ul>				

<b>MODULE X:</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
	<b>3</b>	<b>1</b>	<b>4</b>	<b>3</b>
Basic Components of a digital computer - Functions - Organization - Instruction Execution - Data path and control path				
<b>SUGGESTED ACTIVITIES :</b> <ul style="list-style-type: none"> <li>• Mostly in Class</li> <li>• Practical - Project demonstration and presentation</li> </ul>				
<b>SUGGESTED EVALUATION METHODS:</b> <ul style="list-style-type: none"> <li>• Tutorial problems</li> <li>• Assignment problems</li> <li>• Quizzes</li> </ul>				

#### TEXT BOOKS:

1. M. Morris Mano and Michael D. Ciletti, "Digital Design", V Edition, Pearson Education, 2013.
2. Charles H. Roth Jr, "Fundamentals of Logic Design", Fifth Edition, Jaico Publishing House, Mumbai, 2003.

#### REFERENCES:

1. John F. Wakerly, "Digital Design Principles and Practices", Fourth Edition, Pearson Education, 2007.
2. Donald D. Givone, "Digital Principles and Design", Tata McGraw Hill, 2003.
3. G. K. Kharate, "Digital Electronics", Oxford University Press, 2010.

#### OUTCOMES:

**Upon completion of the course, the students will be able to:**

- Simplify complex Boolean functions
- Design and analyze digital circuits with combinational and sequential components
- Implement digital circuits using MSI chips and PLDs
- Use HDL to build digital systems
- Point out the basic functionalities of the components of a digital computer and their organization

#### EVALUATION PATTERN:

Category of Course	Continuous Assessment	Mid – Semester Assessment	End Semester
Theory Integrated with Practical	15(T) + 25 (P)	20	40

#### CO - PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓		✓	✓				✓			
CO2	✓	✓	✓	✓	✓				✓			
CO3	✓	✓	✓	✓	✓				✓			
CO4	✓	✓	✓	✓	✓				✓			
CO5	✓	✓		✓			✓					

<b>MA6351 PROBABILITY AND STATISTICS</b>		<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>	<b>TOTAL CREDITS</b>
		<b>3</b>	<b>1</b>	<b>0</b>	<b>3</b>	<b>5</b>
<b>OBJECTIVES:</b> <ul style="list-style-type: none"> <li>To provide students with the basic concepts of probability theory</li> <li>To equip the students with essential tools for statistical analyses at the graduate level.</li> <li>To Foster understanding through real-world statistical applications.</li> </ul>						
<b>MODULE I RANDOM VARIABLES</b>			<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
			<b>3</b>	<b>1</b>	<b>0</b>	<b>3</b>
Discrete and continuous random variables – Moments – Moment generating functions						
<b>SUGGESTED ACTIVITIES :</b> <ul style="list-style-type: none"> <li>Problem Solving sessions</li> <li>Seminar by students</li> <li>Application in real life problems</li> </ul>						
<b>SUGGESTED EVALUATION METHODS:</b> <ul style="list-style-type: none"> <li>Tutorial problems</li> <li>Assignment problems</li> <li>Quizzes</li> </ul>						
<b>MODULE II DISTRIBUTIONS</b>			<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
			<b>4</b>	<b>2</b>	<b>0</b>	<b>3</b>
Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions						
<b>SUGGESTED ACTIVITIES :</b> <ul style="list-style-type: none"> <li>Problem Solving sessions</li> <li>Seminar by students</li> <li>Application in real life problems</li> </ul>						
<b>SUGGESTED EVALUATION METHODS:</b> <ul style="list-style-type: none"> <li>Tutorial problems</li> <li>Assignment problems</li> <li>Quizzes</li> </ul>						
<b>MODULE III TWO - DIMENSIONAL RANDOM VARIABLES</b>			<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
			<b>4</b>	<b>2</b>	<b>0</b>	<b>3</b>
Joint distributions – Marginal and conditional distributions						
<b>SUGGESTED ACTIVITIES :</b> <ul style="list-style-type: none"> <li>Problem Solving sessions</li> <li>Seminar by students</li> <li>Application in real life problems</li> </ul>						
<b>SUGGESTED EVALUATION METHODS:</b> <ul style="list-style-type: none"> <li>Tutorial problems</li> <li>Assignment problems</li> <li>Quizzes</li> </ul>						
<b>MODULE IV CORRELATION</b>			<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
			<b>4</b>	<b>2</b>	<b>0</b>	<b>3</b>
Covariance – Correlation and Linear regression						



<b>SUGGESTED ACTIVITIES :</b> <ul style="list-style-type: none"> <li>• Problem Solving sessions</li> <li>• Seminar by students</li> <li>• Application in real life problems</li> </ul>				
<b>SUGGESTED EVALUATION METHODS:</b> <ul style="list-style-type: none"> <li>• Tutorial problems</li> <li>• Assignment problems</li> <li>• Quizzes</li> </ul>				
<b>MODULE V TRANSFORMATION OF RANDOM VARIABLES</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
	<b>6</b>	<b>2</b>	<b>0</b>	<b>3</b>
Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).				
<b>SUGGESTED ACTIVITIES :</b> <ul style="list-style-type: none"> <li>• Problem Solving sessions</li> <li>• Seminar by students</li> <li>• Application in real life problems</li> </ul>				
<b>SUGGESTED EVALUATION METHODS:</b> <ul style="list-style-type: none"> <li>• Tutorial problems</li> <li>• Assignment problems</li> <li>• Quizzes</li> </ul>				
<b>MODULE VI TESTING OF HYPOTHESIS (Large Samples)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
	<b>6</b>	<b>2</b>	<b>0</b>	<b>3</b>
Sampling distributions - Estimation of parameters - Statistical hypothesis - Large sample test based on Normal distribution for single mean and difference of means.				
<b>SUGGESTED ACTIVITIES :</b> <ul style="list-style-type: none"> <li>• Problem Solving sessions</li> <li>• Seminar by students</li> <li>• Application in real life problems</li> </ul>				
<b>SUGGESTED EVALUATION METHODS:</b> <ul style="list-style-type: none"> <li>• Tutorial problems</li> <li>• Assignment problems</li> <li>• Quizzes</li> </ul>				
<b>MODULE VII TESTING OF HYPOTHESIS (Small Samples)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
	<b>6</b>	<b>2</b>	<b>0</b>	<b>3</b>
Tests based on t, Chi-square and F distributions for mean, variance and proportion - Contingency table (test for independent) - Goodness of fit.				
<b>SUGGESTED ACTIVITIES :</b> <ul style="list-style-type: none"> <li>• Problem Solving sessions</li> <li>• Seminar by students</li> <li>• Application in real life problems</li> </ul>				

<b>SUGGESTED EVALUATION METHODS:</b>				
<ul style="list-style-type: none"> <li>• Tutorial problems</li> <li>• Assignment problems</li> <li>• Quizzes</li> </ul>				
<b>MODULE VIII</b>	<b>DESIGN OF EXPERIMENTS</b>	<b>L</b>	<b>T</b>	<b>P</b>
		<b>6</b>	<b>2</b>	<b>0</b>
Analysis of variance – One way and two-way classification – Completely Random Design.				
<b>SUGGESTED ACTIVITIES :</b>				
<ul style="list-style-type: none"> <li>• Problem Solving sessions</li> <li>• Seminar by students</li> <li>• Application in real life problems</li> </ul>				
<b>SUGGESTED EVALUATION METHODS:</b>				
<ul style="list-style-type: none"> <li>• Tutorial problems</li> <li>• Assignment problems</li> <li>• Quizzes</li> </ul>				
<b>MODULE IX</b>	<b>STATISTICAL QUALITY CONTROL</b>	<b>L</b>	<b>T</b>	<b>P</b>
		<b>4</b>	<b>2</b>	<b>0</b>
Control charts for measurements (X and R charts) – Control charts for attributes (p, c and np charts)				
<b>SUGGESTED ACTIVITIES :</b>				
<ul style="list-style-type: none"> <li>• Problem Solving sessions</li> <li>• Seminar by students</li> <li>• Application in real life problems</li> </ul>				
<b>SUGGESTED EVALUATION METHODS:</b>				
<ul style="list-style-type: none"> <li>• Tutorial problems</li> <li>• Assignment problems</li> <li>• Quizzes</li> </ul>				

#### **OUTCOMES :**

**Upon completion of the course, the students will be able to:**

- Use statistical methodology and tools in the engineering problem-solving process
- Describe the properties of discrete and continuous distribution functions
- Use method of moments and moment generating functions
- Compute point estimation of parameters
- Apply the Central Limit Theorem
- Use statistical tests in testing hypotheses on data

#### **TEXT BOOKS:**

1. Milton. J. S. and Arnold. J.C., "Introduction to Probability and Statistics", Tata McGraw Hill, 4th Edition, 2007.
2. Johnson. R.A. and Gupta. C.B., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 7th Edition, 2007.
3. Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8th Edition, 2012.

**REFERENCES:**

1. Papoulis. A and Unnikrishnapillai. S., "Probability, Random Variables and Stochastic Processes ", Mc Graw Hill Education India , 4th Edition, New Delhi , 2010.
2. Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., "Probability and Statistics for Engineers and Scientists", Pearson Education, Asia, 8th Edition, 2007.
3. Ross, S.M., "Introduction to Probability and Statistics for Engineers and Scientists", 3rd Edition, Elsevier, 2004.
4. Spiegel. M.R., Schiller. J. and Srinivasan. R.A., "Schaum's Outline of Theory and Problems of Probability and Statistics", Tata McGraw Hill Edition, 2004.

**Evaluation Pattern:**

Category of Course	Continuous Assessment	Mid – Semester Assessment	End Semester
Theory	40	20	40

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓	✓	✓						✓	✓
CO2	✓	✓	✓	✓	✓							
CO3	✓	✓	✓	✓	✓							
CO4	✓	✓	✓	✓	✓							
CO5	✓	✓	✓	✓	✓							
CO6	✓	✓	✓	✓	✓							

EE6351 <b>BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING</b>	L	T	P	EL	TOTAL CREDITS
	4	0	4	3	7
Prerequisites for the course: None					
<b>OBJECTIVES :</b> <ul style="list-style-type: none"> <li>• To learn the steady state DC and AC characteristics of electric circuits</li> <li>• To understand the working of DC/AC motors, transformer and generators</li> <li>• To understand the functionality of basic electronic circuits namely amplifiers, filters, data converters and oscillators</li> <li>• To learn the design aspects of basic amplifier configurations and concepts of feedback techniques</li> </ul>					
<b>MODULE I :</b>	L	T	P	EL	
	2	0	4	3	
DC Electrical circuit - Fundamental laws– Steady State Solution of DC Circuits – Electrical measuring instruments.					

<b>SUGGESTED ACTIVITIES :</b> <ul style="list-style-type: none"> <li>• Computer simulation of DC circuits problems and solution</li> <li>• EL- Solving of complex electrical networks using circuit theorems</li> <li>• Practical – Basic electrical circuit measurements and verification of circuit theorems</li> </ul>				
<b>SUGGESTED EVALUATION METHODS:</b> <ul style="list-style-type: none"> <li>• Tutorial problems</li> <li>• Assignment problems</li> <li>• Quizzes</li> </ul>				
<b>MODULE II :</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
	<b>4</b>	<b>0</b>	<b>4</b>	<b>3</b>
Introduction to AC Circuits –Sinusoidal steady state analysis– Power and Power factor – Single Phase and Three Phase Balanced Circuits.				
<b>SUGGESTED ACTIVITIES :</b> <ul style="list-style-type: none"> <li>• Computer simulation of AC circuits problems and solution</li> <li>• EL- Solving of other engineering problems as electrical circuit equivalents</li> <li>• Practical – Three phase power measurements</li> </ul>				
<b>SUGGESTED EVALUATION METHODS:</b> <ul style="list-style-type: none"> <li>• Tutorial problems</li> <li>• Assignment problems</li> <li>• Quizzes</li> </ul>				
<b>MODULE III :</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
	<b>4</b>	<b>0</b>	<b>4</b>	<b>3</b>
Construction, Principle of Operation, Basic Equations and Applications of DC Generators, DC Motors				
<b>SUGGESTED ACTIVITIES :</b> <ul style="list-style-type: none"> <li>• EL- Survey of commonly used DC machines and their applications</li> <li>• Practical – Load test on DC motor and generator</li> </ul>				
<b>SUGGESTED EVALUATION METHODS:</b> <ul style="list-style-type: none"> <li>• Tutorial problems</li> <li>• Assignment problems</li> <li>• Quizzes</li> </ul>				
<b>MODULE IV :</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
	<b>4</b>	<b>0</b>	<b>4</b>	<b>3</b>
Operating principle of Transformers –Induction Motor – single phase and three phase operation, Stepper motor				
<b>SUGGESTED ACTIVITIES :</b> <ul style="list-style-type: none"> <li>• Study of utility power grid and the use of transformers</li> <li>• EL- Survey of commonly used AC machines and their applications</li> <li>• Practical – Load test on transformer and Induction motor</li> </ul>				

<b>SUGGESTED EVALUATION METHODS:</b>				
<ul style="list-style-type: none"> <li>Tutorial problems</li> <li>Assignment problems</li> <li>Quizzes</li> </ul>				
<b>MODULE V :</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
	<b>4</b>	<b>0</b>	<b>4</b>	<b>3</b>
Characteristics of PN Junction Diode, Half wave and Full wave Rectifiers, Zener Diode and its Characteristics – Voltage Regulation. Bipolar Junction Transistor – CB, CE, CC Configurations and Characteristics.				
<b>SUGGESTED ACTIVITIES :</b>				
<ul style="list-style-type: none"> <li>Practical - V- I characteristics of PN Junction and Voltage regulator characteristic of Zener Diode,</li> <li>Demonstration - Half wave and Full wave Rectifiers</li> </ul>				
<b>SUGGESTED EVALUATION METHODS:</b>				
<ul style="list-style-type: none"> <li>Tutorial problems</li> <li>Assignment problems</li> <li>Quizzes</li> </ul>				
<b>MODULE VI:</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
	<b>4</b>	<b>0</b>	<b>4</b>	<b>3</b>
Elementary Treatment of Small Signal Amplifier – Linear Amplifier, Biasing Requirement – Voltage Divider Biasing, Basic CE amplifier circuit - Small signal equivalent model - Small signal Voltage gain				
<b>SUGGESTED ACTIVITIES :</b>				
<ul style="list-style-type: none"> <li>Practical – CE amplifier Voltage Divider Biasing and verification of operating point, Verification of small signal voltage gain</li> </ul>				
<b>SUGGESTED EVALUATION METHODS:</b>				
<ul style="list-style-type: none"> <li>Tutorial problems</li> <li>Assignment problems</li> <li>Quizzes</li> </ul>				
<b>MODULE VII:</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
	<b>4</b>	<b>0</b>	<b>4</b>	<b>3</b>
Differential amplifier using BJT, Negative feedback amplifier – characteristics – topologies, Opamp - inverting amplifier - non inverting amplifier.				
<b>SUGGESTED ACTIVITIES :</b>				
<ul style="list-style-type: none"> <li>Practical - Opamp characteristics: Verification of inverting amplifier gain Verification of non inverting amplifier gain</li> </ul>				

<b>SUGGESTED EVALUATION METHODS:</b>				
<ul style="list-style-type: none"> <li>Tutorial problems</li> <li>Assignment problems</li> <li>Quizzes</li> </ul>				
<b>MODULE VIII:</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
	<b>4</b>	<b>0</b>	<b>4</b>	<b>3</b>
Opamp based circuit – Summer – Subtractor – Integrator – Differentiator, Opamp based Filters – Low pass, High pass, Band pass, Band reject.				
<b>SUGGESTED ACTIVITIES :</b>				
<ul style="list-style-type: none"> <li>Practical -Verification of opamp based arithmetic circuit Verification of frequency response characteristics of opamp based First order lowpass filter, First order highpass filter</li> </ul>				
<b>SUGGESTED EVALUATION METHODS:</b>				
<ul style="list-style-type: none"> <li>Tutorial problems</li> <li>Assignment problems</li> <li>Quizzes</li> </ul>				
<b>MODULE IX:</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
	<b>4</b>	<b>0</b>	<b>4</b>	<b>3</b>
Analog to Digital Converter – Flash ADC- Successive Approximation ADC, Digital to Analog Converter – Binary weighted DAC, Positive feedback – Ring oscillator.				
<b>SUGGESTED ACTIVITIES :</b>				
<ul style="list-style-type: none"> <li>Presentation / Assignment on Performance metrics of ADC Ring oscillator circuit architecture</li> </ul>				
<b>SUGGESTED EVALUATION METHODS:</b>				
<ul style="list-style-type: none"> <li>Tutorial problems</li> <li>Assignment problems</li> <li>Quizzes</li> </ul>				
<b>MODULE X:</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>EL</b>
	<b>4</b>	<b>0</b>	<b>4</b>	<b>3</b>
MOSFET – V-I characteristics, MOSFET small signal equivalent circuit, Common Source amplifier – Voltage gain – Frequency response characteristic.				
<b>SUGGESTED ACTIVITIES :</b>				
<ul style="list-style-type: none"> <li>Spice simulation - MOSFET V-I characteristic</li> </ul>				
<b>SUGGESTED EVALUATION METHODS:</b>				
<ul style="list-style-type: none"> <li>Assignment problems</li> <li>Quizzes</li> </ul>				

**OUTCOMES:**

**Upon completion of the course, the students will be able to:**

- Compute steady state solution of DC and AC electric circuits
- Analyze the characteristics of motors and transformers
- Design and analyze amplifiers
- Characterize the frequency response of BJT based amplifiers
- Realize arithmetic circuits, basic filter configurations using opamp
- Point out the characteristics of data converters

**TEXT BOOKS:**

1. J Nagarath and Kothari DP, "Electrical Machines", Tata McGraw Hill, 2010.
2. Donald .A. Neamen, "Electronic Circuit Analysis and Design", 3rd Edition, Tata McGraw Hill, 2010.

**REFERENCES:**

1. P.C. Sen, "Principles of Electric Machines and Power Electronics", John Wiley & Sons, 2<sup>nd</sup> Edition, 2007.
2. Leonard S Bobrow, "Foundations of Electrical Engineering", Oxford University Press, 2013.
3. Mahmood Nahvi and Joseph A. Edminister, "Electric Circuits", Schaum's Outline Series, McGraw Hill, 2002.
4. Del Toro, "Electrical Engineering Fundamentals", Pearson Education, New Delhi, 2007
5. A.E. Fitzgerald, David E Higginbotham and Arvin Grabel, "Basic Electrical Engineering", McGraw Hill Education (India) Private Limited, 2009.
6. David A. Bell, "Electronic Devices and Circuits", Oxford Higher Education Press, 5th Edition, 2010.
7. Adel .S. Sedra, Kenneth C. Smith, "Micro Electronic Circuits", 7<sup>th</sup> Edition, Oxford University Press, 2014.
8. Coughlin and Driscoll, "Operational Amplifiers and Linear Integrated Circuits", Prentice Hall, 1989.

**Evaluation Pattern:**

Category of Course	Continuous Assessment	Mid – Semester Assessment	End Semester
Theory Integrated with Practical	15(T) + 25 (P)	20	40

**CO - PO Mapping:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓		✓					✓			
CO2	✓	✓	✓	✓	✓				✓			
CO3	✓	✓	✓	✓	✓				✓			
CO4	✓	✓	✓	✓	✓	✓			✓			
CO5	✓	✓		✓		✓	✓		✓	✓		✓