YMCA University of Science & Technology, Faridabad
Department of Electrical Engineering

Date: 12/7/17

MINUTES OF THE SIXTH BOARD OF STUDIES (UG, PG & RESEARCH) MEETING SCHEDULED TO BE HELD ON 11TH JULY, 2017 AT 3:45 AM IN THE CHAIRPERSON OFFICE OF ELECTRICAL ENGG. DEPARTMENT, YMCAUST FARIDABAD

Members Present:- Dr. Sandeep Grover, Dr. P R Sharma, Dr Rajesh Kr Ahuja, Dr.Poonam Singhal, Dr. Sakshi Kalra, Dr. Rashmi Aggarwal.

Aplologies For Absence:- Dr. Sukumar Mishra (Outside Expert), Dr. Madhusudan (Outside Expert)

Dr. Rajesh Kr. Ahuja, Chairman (BOS) Chaired the meeting and welcomed all the members to the sixth BOS meeting. Dr. Sakshi Kalra, Member secretary-BOS also welcomed and introduced the members of BOS.

After the brief introduction, the agenda items listed were taken up for discussion and the following resolutions were passed.

The following agenda items were discussed.

ITEM No. 1 BOS 6

To Approve the minutes of the last meeting of BOS 5

BOS confirmed the minutes of the fifth meeting

ITEM No. 2 BOS 6

To approve the Scheme & Syllabus for B.Tech (Electrical Engg.) Programme under CBCS--- Electrical Engineering Department.

The enclosed scheme and syllabus of B.Tech (Electrical Engg.) Programme under CBCS--- Electrical Engineering Department was discussed and approved with the minor modifications.

ITEM No. 3 BOS 6

To decide about the syllabus and schemes to be followed by the affiliating colleges under YMCAUST, Faridabad for the session 2017-2018.

The house noted that the matter has already been approved by Hon'ble VC Sir. (Copy attached)

ITEM No. 4 BOS 6

To approve the list of examiners for B.Tech & M.Tech Programme------ Electrical Engineering Department.

Enclosed list of Examiners has been approved.

Meeting attended with vote of thanks to the chair.

Respectfully submitted

Dr. Sakshi Kalra

Member Secretary –BOS

Prof (Dr).Rajesh Kr.Ahuja

Chairman-BOS

Copy to:-1. Hon'ble Vice –Chancellor for kind information please

2. Dean Faculty of Engg. And Technology

SCHEME & SYLLABUS
(Choice Based Credit Scheme)

for

B.TECH. COURSE

in

ELECTRICAL ENGINEERING

(w.e.f. Session 2017-2018)

DEPARTMENT OF ELECTRICAL ENGINEERING

YMCA UNIVERSITY OF SCIENCE AND TECHNOLOGY
FARIDABAD

VISION

YMCA University of Science and Technology aspires to be a nationally and internationally acclaimed leader in technical and higher education in all spheres which transforms the life of students through integration of teaching, research and character building.

MISSION

- To contribute to the development of science and technology by synthesizing teaching, research and creative activities.
- To provide an enviable research environment and state-of-the-art technological exposure to its scholars.
- To develop human potential to its fullest extent and make them emerge as world class leaders in their professions and enthuse them towards their social responsibilities.

Department of Electrical Engineering

VISION

Electrical Engineering Department congregates the challenges of new technological advancements to provide comprehensively trained, career focused ,morally strong accomplished graduates, cutting edge researchers by experimental learning which contribute to ever changing global society and serve as competent engineers.

MISSION

- To commit excellence in imparting knowledge through incubation and execution of high quality innovative educational programs.
- To develop the Research oriented culture to build national capabilities for excellent power management.
- To inculcate and harvest the moral values and ethical behavior in the students through exposure of self -discipline and personal integrity.
- To develop a Centre of research and education generating knowledge and technologies which lay ground work in shaping the future in the field of electrical engineering.

Department of Electrical Engineering

About the Program of Electrical Engineering Department

YMCA University of Science & Technology, Faridabad established in 2009, formerly known as YMCA Institute of Engineering, Faridabad, established in year 1969 as a Joint Venture of Govt. of Haryana and National Council of YMCA of India with active assistance from overseas agencies of West Germany to produce highly practical oriented personnel in specialized field of engineering to meet specific technical manpower requirement of industries. Electrical Engineering Department started in 1969 and has been conducting B.Tech. Course in Electrical Engineering of 4-Years duration since 1997. Students are admitted through centralized counseling nominated by state govt. in 1st Year and 2nd year through lateral entry entrance test. Besides under graduate degree courses, it is also running M.Tech. Electrical Engg. Course (in specialization of Power System) and Ph.D. All courses are duly approved by AICTE/ UGC. The Electrical Engineering Department has been well known for its track record of employment of the pass out students since its inception.

The Department has three storey building with 6 class rooms, 8 laboratory, one workshop, 7 offices, 01 Smart class room and shared Conference Hall. It has excellent faculty with 2 Professors, 02 Associate Professors and 10 Assistant Professors. At present, 6 faculty members are PhD in various specializations. The various syllabi of UG/PG courses in Electrical Engineering Department, has been prepared with active participation from Industry. The Department is organizing number of expert lectures from industry experts for students in every semester. Seven month training is mandatory for every B.Tech Student. Emphasis has been given on project work and workshop for skill enhancement of students. Choice based credit system allows students to study the subjects of his/her choice from a number of elective courses /audit courses.

With regards,

Dr Rajesh Ahuja

Chairman (EE)

Department of Electrical Engineering

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO-1:
To produce competent electrical engineering graduates with a strong foundation in design, analytics and problem solving skills for successful professional careers in industry, research and public service..

PEO-2:
To provide a stimulating research environment so as to motivate the students for higher studies and innovation in the specific and allied domains of electrical engineering.

PEO-3:
To encourage the graduates to practice the profession following ethical codes, social responsibility and accountability

PEO- 4:
To train students to communicate effectively in multidisciplinary environment.

PEO- 5:
To imbibe an attitude in the graduates for life-long learning process.

PROGRAM OUTCOMES

Engineering Graduates will be able to:

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs):

1. To impart State-of-Art knowledge in the field of Electrical Engineering and hand on application based practical training with regular Academic and Industry interaction.

2. To incorporate research and innovation projects towards assimilation of global technology in order to meet needs of automation and articulate an higher education system of ethics and mindset for a realistic education.

YMCA UNIVERSITY OF SCIENCE AND TECHNOLOGY, FARIDABAD
SYNOPSIS OF
SCHEME OF STUDIES & EXAMINATIONS
4 YEARS BACHELOR OF TECHNOLOGY PROGRAMME IN
ELECTRICAL ENGINEERING
SEMESTER I – VIII
(w.e.f. Session 2017-18)

B. TECH SCHEME CREDITS CALCULATIONS

S.No.	Category of Courses	Contact Hours	Credits
1.	Programme Core Courses (PCC)	101	85
2.	Ability Enhancement Compulsory Courses (AECC)	10	8
3.	Skill Enhancement Courses (SEC)	50	35
4.	Discipline Specific Elective Courses (DSE)	15	15
5.	General elective Courses (GEC)	9	9
6.	Basic Science Courses (BSC)	29	26
7.	Basic Engineering Courses (BEC)	22	17
8.	Mandatory Audit Courses (MAC)	4	0
9.	Massive Open Online Courses (MOOCS)	0	4
	Total	**240**	**199**

Note: 1. MOOCS course will be opted by students any time during from III to VI semester of their B. Tech programme.

SEMESTER WISE SUMMARY OF THE PROGRAMME

S.No.	Semester	No. of Contact Hours	Marks	Credits
1.	I	35	900	26
2.	II	32	850	26
3.	III	37	900	30
4.	IV	35	850	25
5.	V	32	800	25
6.	VI	31	850	25
7.	VII	1 Semester	700	10
8.	VIII	38	1050	28
	Total	**240**	**6900**	**195**
	Total with MOOCS			**199**

Note: Four credits for the MOOCS course are to be earned in any semester from III to VI.

PROGRAMME CORE COURSES (PCC)

S.No.	Name of the Course	No. of Contact Hours	No. of Credits	Semester
1.	Analog Electronics	4	4	III
2.	Electrical Engineering Materials & Semiconductor Devices	4	4	III
3.	Electrical Measurements & Instrumentation	3	3	III
4.	Network Analysis & Synthesis	4	4	III
5.	Electrical Machines-I	4	4	III
6.	Analog Electronics Lab	2	1	III
7.	Electrical Machines Lab-I	2	1	III
8.	Network Analysis & Synthesis lab	2	1	III
9.	EMMI Lab	2	1	III
10.	Power System –I	4	4	IV
11.	Digital Electronics	3	3	IV
12.	Electric & Magnetic Fields	4	4	IV
13.	Power Electronics-I	4	4	IV
14.	Electrical Machines-II	4	4	IV
15.	Electrical Machines-II Lab	2	1	IV
16.	Digital Electronics Lab	2	1	IV
17.	Power Electronics Lab-I	2	1	IV
18.	Control Systems	4	4	V
19.	Power Electronics-II	4	4	V
20.	Electrical Machines-III	3	3	V
21.	Power Systems-II	4	4	V
22.	Electrical Machines Lab-III	2	1	V
23.	Power System Lab	2	1	V
24.	Power Electronics Lab-II	2	1	V
25.	Control Systems Lab	2	1	V
26.	Power System Operations & Control	4	4	VI
27.	Power System Protection	3	3	VI
28.	Data Structures	3	3	VI
29.	Digital Signal Processing Lab	2	1	VI
30.	Micro Processor & Application Lab	2	1	VI
31.	Data Structures lab	2	1	VI
32.	Solid State Drives	3	3	VIII
33.	HVDC & FACTS	3	3	VIII
34.	Electric Drives Lab	2	1	VIII
35.	Electrical Simulation Lab	2	1	VIII
	Total	**101**	**85**	

ABILITY ENHANCEMENT COMPULSARY COURSES (AECC)

S.No.	Name of Course	No. of Contact Hours	Credits	Semester
1.	Environmental Science	3	3	I
2.	Essentials of Communications	3	3	II
3.	Language Lab	2	1	II
4.	Seminar	2	1	VII
	Total	**10**	**8**	

SKILL ENHANCEMENT COURSES (SEC)

S.No.	Name of Course	No. of Contact Hours	Credits	Semester
1.	Workshop I	6	3	I
2.	Workshop II	6	3	II
3.	Workshop III	6	3	III
4.	Workshop IV	6	3	IV
5.	Workshop V	6	3	V
6.	Workshop VI	6	3	VI
7.	Industrial Training	One semester	10	VII
8.	Workshop VII	6	3	VIII
9.	Project	8	4	VIII
	Total	**50**	**35**	

DISCIPLINE SPECIFIC ELECTIVE (DSE)

S.No.	Name of Course	No. of Contact Hours	No. of Credits	Semester
1.	Discipline Specific Elective I	3	3	VI
2.	Discipline Specific Elective II	3	3	VI
3.	Discipline Specific Elective III	3	3	VIII
4.	Discipline Specific Elective IV	3	3	VIII
5.	Discipline Specific Elective V	3	3	VIII
	Total	**15**	**15**	

GENERAL ELECTIVE COURSE (GEC)

S.No.	Name of Course	No. of Contact Hours	No. of Credits	Semester
1.	General Elective Course I	3	3	V
2.	General Elective Course II	3	3	VI
3.	General Elective Course III	3	3	VIII
	Total	**9**	**9**	

BASIC SCIENCE COURSES (BSC)

S.No.	Name of Course	No. of Contact Hours	No. of Credits	Semester
1.	Physics-I	4	4	I
2.	Mathematics-I	4	4	I
3.	Chemistry	3	3	I
4.	Physics Lab-I	2	1	I
5.	Chemistry Lab	2	1	I
6.	Physics-II	4	4	II
7.	Mathematics-II	4	4	II
8.	Physics Lab-II	2	1	II
9.	Numerical Methods	4	4	III
	Total	**29**	**26**	

BASIC ENGINEERING COURSES (BEC)

S.No.	Name of Course	No. of Contact Hours	No. of Credits	Semester
1.	Elements of Electronics Engineering	3	3	I
2.	Basics of Mechanical Engineering	3	3	I
3.	Basics of Mechanical Engineering Lab	2	1	I
4.	Electrical Technology	3	3	II
5.	Fundamentals of Computers & Programming with C	3	3	II
6.	Electrical Technology Lab	2	1	II
7.	Fundamentals of Computers & Programming with C Lab	2	1	II
8.	Engineering Drawing	4	2	II
	Total	**22**	**17**	

GENERAL ELECTIVE COURSES- I, II and III (Semester- V, VI and VIII respectively)

Students have to select three different General Elective Courses-I, II &III from the given list:

Courses offered by Computer Engineering Department

S.No.	Name of Course	No. of Contact Hours	Credits
1.	Intelligent Systems	3	3
2.	Cyber laws and Security	3	3
3.	Soft Computing	3	3
4.	Web Technology and Information Retrieval	3	3
5.	Intellectual Property and Rights	3	3

Courses offered by Electrical Engineering Department

S.No.	Name of Course	No. of Contact Hours	Credits
1.	Installation Testing & Maintenance of Electrical Equipments	3	3
3.	Utilization of Electrical Power & Traction	3	3

Courses offered by Mechanical Engineering Department (Not for Mechanical Engineering students):

S.No.	Name of Course	No. of Contact Hours	Credits
1.	Industrial Engineering	3	3
2.	Quality Management	3	3
3.	Automobile Engineering	3	3
4.	CAM and Automation	3	3
5.	Manufacturing Processes	3	3
6.	Power Plant Engineering	3	3

Courses offered by Electronics Engineering Department

S.No.	Name of Course	No. of Contact Hours	Credits
1.	Microprocessor and Interfacing	3	3
2.	Digital Signal Processing	3	3
3.	Instrumentation and Control	3	3
4.	Data Communication and Networking	3	3

Courses offered by HAS Department

S.No.	Name of Course	No. of Contact Hours	Credits
1.	Soft Skills for Engineers	3	3
2.	Maths –III	3	3

Courses offered by MBA Department

S.No.	Name of Course	No. of Contact Hours	Credits
1.	Human Resource Management	3	3
2.	Financial Management	3	3
3.	Marketing Management	3	3
4.	Entrepreneur Development	3	3
5.	Principles of Management and Economics	3	3

MANDARORY AUDIT COURSES (MAC-I and MAC-II) (Semester- III and IV respectively)

S.No.	Name of Course	No. of Contact Hours	Credits
1.	German- I	2	0
2.	German –II (With German – I as prerequisite)	2	0
3.	French – I	2	0
4.	French –II (With French – I as prerequisite)	2	0
5.	Sanskrit – I	2	0
6.	Sanskrit – II (With Sanskrit– I as prerequisite)	2	0
7.	Personality Development	2	0
8.	Interview and Group Discussion Skills	2	0
9.	Yoga and Meditation	2	0
10.	Art of Living/ Living Skills	2	0
11.	Contribution of NSS towards Nation/Role of NSS	2	0
12.	Physical Education	2	0

Note: Students will have to select any two out of the list.

GRADING SCHEME

Marks %	Grade	Grade points	Category
90-100	O	10	Outstanding
80<marks<90	A+	9	Excellent
70<marks< 80	A	8	Very good
60<marks< 70	B+	7	Good
50<marks< 60	B	6	Above average
45<marks< 50	C	5	Average
40<marks< 45	P	4	Pass
<40	F	0	Fail
	Ab	0	Absent

Percentage calculation= CGPA * 9.5

MINIMUM CREDITS TO BE EARNED FOR DIFFERENT COURSE FOR QUALIFYING FOR THE B.TECH IN ELECTRICAL ENGINEERING

S.N.	Category of Courses	Abbreviation	Credits Offered		Minimum Credits to be Earned
1.	Programme Core Course	PCC	(≥ 80)	85	85
2.	Ability Enhancement Compulsory Course	AECC	(≥ 06)	8	08
3.	Skill Enhancement Course	SEC	(≥ 32)	35	35
4.	Discipline Specific Electives	DSE	(≥ 15)	15	12
5.	General Elective Course	GEC	(≥ 06)	09	03
6.	Basic Science Course	BSC	(≥ 20)	26	26
7.	Basic Engineering Course	BEC	(≥ 15)	17	17
8.	Mandatory Audit Course	MAC	0	0	0
9.	Massive Open Online Courses	MOOCS	4	4	4
	TOTAL		**≥178**	**199**	**190**

YMCA UNIVERSITY OF SCIENCE AND TECHNOLOGY, FARIDABAD
PROPOSED SCHEME OF INSTRUCTION
B.TECH 1st YEAR (SEMESTER -I) (ALL BRANCHES) COURSE STRUCTURE

Course Notation	Course Code	Course Title	L	T	P	Credits	Sessional	External	Category Code
C	HAS-101C	Physics-I	4	-	-	4	25	75	BSC
C	HAS-103C	Mathematics-I	4	-	-	4	25	75	BSC
A	HAS-105C	Chemistry	3	-	-	3	25	75	BSC
B	HAS-109C	Interactive English	3	-	-	3	25	75	AECC
B	EE-101C	Basic Electrical Engineering	3	-	-	3	25	75	BEC
A	HAS-107C	Environmental Science	3	-	-	3	25	75	AECC
B	CE-101C	Fundamentals of Computer & Programming with C	3	-	-	3	25	75	BEC
A	EC-101C	Elements of Electronics Engg.	3	-	-	3	25	75	BEC
A	ME-101C	Basics of Mechanical Engg.	3	-	-	3	25	75	BEC
B	ME-152C	Engineering Drawing	-	-	4	2	30	70	BEC
C	HAS-151C	Physics Lab-I	-	-	2	1	15	35	BSC
B	CE-151C	Fundamentals of Computer & Programming with C Lab	-	-	2	1	15	35	BEC
A	HAS-155C	Chemistry Lab	-	-	2	1	15	35	BSC
B	EE-151C	Basic Electrical Engineering Lab	-	-	2	1	15	35	BEC
A	ME-151C	Basics of Mechanical Engg Lab	-	-	2	1	15	35	BEC
B	HAS-159C	Language lab	-	-	2	1	15	35	AECC
C	WS-161C	Workshop-I	-	-	6	3	30	70	SEC

Note: Exams duration will be as under

a. Theory exams will be of 03 hours duration.
b. Practical exams will be of 02 hours duration
c. Workshop exam will be of 03 hours duration

YMCA UNIVERSITY OF SCIENCE AND TECHNOLOGY, FARIDABAD
PROPOSED SCHEME OF INSTRUCTION
B.TECH 1st YEAR (SEMESTER -II) (ALL BRANCHES) COURSE STRUCTURE

Course Notation	Course Code	Course Title	L	T	P	Credits	Sessional	External	Category Code
C	HAS-102C	Physics-II	4	-	-	4	25	75	BSC
C	HAS-104C	Mathematics-II	4	-	-	4	25	75	BSC
A	HAS-109C	Interactive English	3	-	-	3	25	75	AECC
B	HAS-105C	Chemistry	3	-	-	3	25	75	BSC
A	EE-101C	Basic Electrical Engineering	3	-	-	3	25	75	BEC
B	HAS-107C	Environmental Science	3	-	-	3	25	75	AECC
A	CE-101C	Fundamentals of Computer & Programming with C	3	-	-	3	25	75	BEC
B	EC-101C	Elements of Electronics Engg.	3	-	-	3	25	75	BEC
B	ME-101C	Basics of Mechanical Engg.	3	-	-	3	25	75	BEC
C	HAS-152C	Physics Lab-II	-	-	2	1	15	35	BSC
A	CE-151C	Fundamentals of Computer & Programming with C Lab	-	-	2	1	15	35	BEC
B	HAS-155C	Chemistry Lab	-	-	2	1	15	35	BSC
A	EE-151C	Basic Electrical Engineering Lab	-	-	2	1	15	35	BEC
B	ME-151C	Basics of Mechanical Engg Lab	-	-	2	1	15	35	BEC
A	HAS-159C	Language lab	-	-	2	1	15	35	AECC
A	ME-152C	Engineering Drawing	-	-	4	2	30	70	BEC
C	WS-162C	Workshop- II	-	-	6	3	30	70	SEC

Note: Exams duration will be as under

a. Theory exams will be of 03 hours duration.
b. Practical exams will be of 02 hours duration
c. Workshop exam will be of 03 hours duration

Important Notes:
Significance of the Course Notations used in this scheme: -
C = These courses are common to both the groups Group-A and Group -B.
A = Other compulsory courses for Group-A.
B = Other compulsory courses for Group-B.

Students will study either
Group A (HAS-105C, HAS-107C, EC-101C, ME-101C, HAS-155C, ME-151C)
OR
Group B (EE-101C, HAS-109C, CE-101C, ME-152C, CE-151C, HAS-159C, EE-151C)

Total Marks in Semester-I for Group - A/B = 850/900
Total Marks in semester-II for Group -A/B = 900/850
Total Marks = 1750

Nomenclature of Category Code:

BSC- Basic Science Course

AECC- Ability Enhancement Compulsory Course

BEC- Basic Engineering Course

SEC-Skill Enhancement Course

Note: For workshop syllabus, Institutes need to choose Group I/II for Semester 1/2.

YMCA UNIVERSITY OF SCIENCE AND TECHNOLOGY, FARIDABAD
SCHEME OF STUDIES & EXAMINATIONS
B.TECH 2nd YEAR (SEMESTER – III)
ELECTRICAL ENGINEERING (2017-18)

Sl. No.	Course code.	Course Title	L	T	P	Credits	CAT code
1	MA-201C	Mathematics – III	4	0	0	4	BSC
2	EC-231C	Analog Electronics	3	1	0	4	PCC
3	EE-201C	Electrical Engineering Materials & Semiconductor Devices	3	0	0	3	PCC
4	EE-203C	Electrical Measurements & Instrumentation	4	0	0	4	PCC
5	EE-205C	Network Analysis & Synthesis	3	1	0	4	PCC
6	EE-207C	Electrical Machines-I	3	1	0	4	PCC
7	EC-251C	Analog Electronics Lab	0	0	2	1	PCC
8	EE-257C	Electrical Machines Lab-I	0	0	2	1	PCC
9	EE-255C	Network Analysis & Synthesis lab	0	0	2	1	PCC
10	EE-253C	EMMI Lab	0	0	2	1	PCC
11	EE-261C	Workshop	0	0	6	3	SEC
		Total	**20**	**3**	**14**	**30**	

YMCA UNIVERSITY OF SCIENCE AND TECHNOLOGY, FARIDABAD
SCHEME OF STUDIES & EXAMINATIONS
B.TECH 2nd YEAR (SEMESTER – IV)
ELECTRICAL ENGINEERING (2017-18)

Sl. No.	Course code.	Course Title	L	T	P	Credits	CAT code
1	EE-202C	Power System -I	3	1	0	4	PCC
2	EC-232C	Digital Electronics	3	0	0	3	PCC
3	EE-204C	Electric & Magnetic Fields	3	1	0	4	PCC
4	EE-206C	Power Electronics-I	4	0	0	4	PCC
5	EE-208C	Electrical Machines-II	3	1	0	4	PCC
6	EE-258C	Electrical Machines-II Lab	0	0	2	1	PCC
7	EC-252C	Digital Electronics Lab	0	0	2	1	PCC
8	EE- 256C	Power Electronics Lab-I	0	0	2	1	PCC
9	EE -268C	Workshop-IV	0	0	6	3	SEC
10	AC	Mandatory Audit Course-I	2	0	0	0	MAC
11		MOOC	4	0	0	4	MOOCs
		Total	**22**	**3**	**12**	**29**	

YMCA UNIVERSITY OF SCIENCE AND TECHNOLOGY, FARIDABAD
SCHEME OF STUDIES & EXAMINATIONS
B.TECH 3rd YEAR (SEMESTER – V)
ELECTRICAL ENGINEERING (2017-18)

Sl.No.	Course code.	Course Title	L	T	P	Credits	CAT code
1	EE-301C	Control Systems	3	1	0	4	PCC
	EE-303C	Power Electronics-II	3	1	0	4	PCC
2	EE-305C	Electrical Machines-III	3	0	0	3	PCC
3	EE-307C	Power Systems-II	3	1	0	4	PCC
4	MB-321C	Engineering Economics & Industrial Management	3	0	0	3	GEC
5	EE-355C	Electrical Machines Lab-III	0	0	2	1	PCC
6	EE-357C	Power System Lab	0	0	2	1	PCC
7	EE-353C	Power Electronics Lab-II	0	0	2	1	PCC
8	EE-351C	Control system lab	0	0	2	1	DEC
9	EE-369C	Workshop-V	0	0	6	3	SEC
		Total	15	3	14	25	

YMCA UNIVERSITY OF SCIENCE AND TECHNOLOGY, FARIDABAD
SCHEME OF STUDIES & EXAMINATIONS
B.TECH 3rd YEAR (SEMESTER – VI)
ELECTRICAL ENGINEERING (2017-18)

Sl.No.	Course Code	Course Title	L	T	P	INT.	Examination		Total Marks	Credits
							Theory	Practical		
1	EE-302C	Power System Operations & Control	3	0	0	25	75	-	100	3
2	EE-304C	Power System Protection	3	1	0	25	75	-	100	4
3		Elective-I	3	0	0	25	75	-	100	3
4		Elective-II	3	0	0	25	75	-	100	3
5	CS-306C	Data Structures	3	0	0	25	75	-	100	3
6	EC-355C/ EE- 352C	Digital Signal Processing Lab/ Design of Electrical Systems Lab	0	0	2	15	-	35	50	1
7	EC-358C	Micro Processor & Application Lab	0	0	2	15	-	35	50	1
8	CS-356C	Data Structures lab	0	0	2	15	-	35	50	1
9	EE-364C	Workshop-VI	0	0	6	30	-	70	100	3
10	AC-101C	Mandatory Audit Course- II	2	0	0	25	75	-	100	0
11	OE-390	General Elective – I	3	0	0	25	75	-	100	3
		TOTAL	**20**	**1**	**12**	**250**	**525**	**175**	**950**	**25**

YMCA UNIVERSITY OF SCIENCE AND TECHNOLOGY, FARIDABAD
SCHEME OF STUDIES & EXAMINATIONS
B.TECH 4TH YEAR (SEMESTER – VII)
ELECTRICAL ENGINEERING (2017-18)

Sl.No.	Course code.	Course Title	L	T	P	Credits	CAT code
1	EE-401C	Industrial Training (Six Month, 5th June to 5th December)	8 Hr/Day			10	SEC
2	EE-403C	Comprehensive Exam				0	AECC
		Total				**10**	

YMCA UNIVERSITY OF SCIENCE AND TECHNOLOGY, FARIDABAD
SCHEME OF STUDIES & EXAMINATIONS
B.TECH 4TH YEAR (SEMESTER – VIII)
ELECTRICAL ENGINEERING (2017-18)

Sr. No.	Category	Course Code	Course Title	Hours Per Week			Internal Marks	Final Marks	Total	Credits
				L	T	P				
1	PCC	EE-402-C	Solid State Drives	3	0	0	25	75	100	3
2	PCC	EE-406-C	HVDC & FACTS	3	0	0	25	75	100	3
3	DSE		Elective-III	3	0	0	25	75	100	3
4	DSE		Elective –IV	3	0	0	25	75	100	3
5	DSE		Elective –V	3	0	0	25	75	100	3
6	AECC	EE-422-C	Seminar	0	0	2	50	-	50	1
7	PCC	EE-452-C	Electric Drives Lab	0	0	2	15	35	50	1
8	PCC	EE-456-C	Electrical Simulation Lab	0	0	2	15	35	50	1
9	SEC	EE-468-C	Project Workshop	0	0	6	30	70	100	3
10	SEC	EE-458-C	Major Project	0	0	8	30	70	100	4
11	GEC		General Elective-II	3	0	0	25	75	100	3
			Total	**18**	**0**	**20**	**290**	**660**	**950**	**28**

YMCA UNIVERSITY OF SCIENCE AND TECHNOLOGY, FARIDABAD
PROPOSED SCHEME OF INSTRUCTION
B.TECH 1st YEAR (SEMESTER -I) (ALL BRANCHES) COURSE STRUCTURE

Course Notation	Course Code	Course Title	L	T	P	Credits	Sessional	External	Category Code
C	HAS-101C	Physics-I	4	-	-	4	25	75	BSC
C	HAS-103C	Mathematics-I	4	-	-	4	25	75	BSC
A	HAS-105C	Chemistry	3	-	-	3	25	75	BSC
B	HAS-109C	Interactive English	3	-	-	3	25	75	AECC
B	EE-101C	Basic Electrical Engineering	3	-	-	3	25	75	BEC
A	HAS-107C	Environmental Science	3	-	-	3	25	75	AECC
B	CE-101C	Fundamentals of Computer & Programming with C	3	-	-	3	25	75	BEC
A	EC-101C	Elements of Electronics Engg.	3	-	-	3	25	75	BEC
A	ME-101C	Basics of Mechanical Engg.	3	-	-	3	25	75	BEC
B	ME-152C	Engineering Drawing	-	-	4	2	30	70	BEC
C	HAS-151C	Physics Lab-I	-	-	2	1	15	35	BSC
B	CE-151C	Fundamentals of Computer & Programming with C Lab	-	-	2	1	15	35	BEC
A	HAS-155C	Chemistry Lab	-	-	2	1	15	35	BSC
B	EE-151C	Basic Electrical Engineering Lab	-	-	2	1	15	35	BEC
A	ME-151C	Basics of Mechanical Engg Lab	-	-	2	1	15	35	BEC
B	HAS-159C	Language lab	-	-	2	1	15	35	AECC
C	WS-161C	Workshop-I	-	-	6	3	30	70	SEC

Note: Exams duration will be as under

a. Theory exams will be of 03 hours duration.
b. Practical exams will be of 02 hours duration
c. Workshop exam will be of 03 hours duration

YMCA UNIVERSITY OF SCIENCE AND TECHNOLOGY, FARIDABAD
PROPOSED SCHEME OF INSTRUCTION
B.TECH 1st YEAR (SEMESTER -II) (ALL BRANCHES) COURSE STRUCTURE

Course Notation	Course Code	Course Title	L	T	P	Credits	Sessional	External	Category Code
C	HAS-102C	Physics-II	4	-	-	4	25	75	BSC
C	HAS-104C	Mathematics-II	4	-	-	4	25	75	BSC
A	HAS-109C	Interactive English	3	-	-	3	25	75	AECC
B	HAS-105C	Chemistry	3	-	-	3	25	75	BSC
A	EE-101C	Basic Electrical Engineering	3	-	-	3	25	75	BEC
B	HAS-107C	Environmental Science	3	-	-	3	25	75	AECC
A	CE-101C	Fundamentals of Computer & Programming with C	3	-	-	3	25	75	BEC
B	EC-101C	Elements of Electronics Engg.	3	-	-	3	25	75	BEC
B	ME-101C	Basics of Mechanical Engg.	3	-	-	3	25	75	BEC
C	HAS-152C	Physics Lab-II	-	-	2	1	15	35	BSC
A	CE-151C	Fundamentals of Computer & Programming with C Lab	-	-	2	1	15	35	BEC
B	HAS-155C	Chemistry Lab	-	-	2	1	15	35	BSC
A	EE-151C	Basic Electrical Engineering Lab	-	-	2	1	15	35	BEC
B	ME-151C	Basics of Mechanical Engg Lab	-	-	2	1	15	35	BEC
A	HAS-159C	Language lab	-	-	2	1	15	35	AECC
A	ME-152C	Engineering Drawing	-	-	4	2	30	70	BEC
C	WS-162C	Workshop- II	-	-	6	3	30	70	SEC

Note: Exams duration will be as under

a. Theory exams will be of 03 hours duration.
b. Practical exams will be of 02 hours duration
c. Workshop exam will be of 03 hours duration

Important Notes:
Significance of the Course Notations used in this scheme: -
C = These courses are common to both the groups Group-A and Group -B.
A = Other compulsory courses for Group-A.
B = Other compulsory courses for Group-B.

Students will study either
Group A (HAS-105C, HAS-107C, EC-101C, ME-101C, HAS-155C, ME-151C)
OR
Group B (EE-101C, HAS-109C, CE-101C, ME-152C, CE-151C, HAS-159C, EE-151C)

Total Marks in Semester-I for Group - A/B = 850/900
Total Marks in semester-II for Group -A/B = 900/850
Total Marks = 1750

Nomenclature of Category Code:

BSC- Basic Science Course

AECC- Ability Enhancement Compulsory Course

BEC- Basic Engineering Course

SEC-Skill Enhancement Course

Note: For workshop syllabus, Institutes need to choose Group I/II for Semester 1/2.

HAS-101C PHYSICS I
B. Tech I Semester

No. of Credits: 4	Sessional:	25 Marks
L T P Total	Theory:	75 Marks
4 0 0 4	Total :	100 Marks
	Duration of Exam:	3 Hours

Pre –Requisite: None

Successive: Physics II, Engineering Mechanics, Material Science

Course Objective:

The objective of the course is to make the students familiar with topics of general physical optics like interference, diffraction, polarization, fiber optics, lasers. The second part of the syllabus consists of theory of relativity, electrostatics and electrodynamics.

Course Outcomes (COs): At the end of the course, the student shall be able to:

CO 1- Understand the basics of interference and diffraction.

CO 2- Understand the phenomenon of polarization and have elementary knowledge of lasers and fibre optics.

CO 3- Know the fundamentals of Electrostatics and Electrodynamics.

CO 4- Comprehend the basics of special theory of relativity.

Syllabus:

UNIT I **Interference:** Coherent sources, conditions for sustained interference, Analytical treatment of interference, Division of Wave-Front - Fresnel's Biprism, Division of Amplitude- Interference by a plane parallel film, Wedge-shaped film, Newton's Rings, Michelson Interferometer, applications (Resolution of closely spaced spectral lines, determination of wavelengths).

Diffraction: Difference between interference and diffraction Fraunhofer and Fresnel diffraction. Fraunhofer diffraction through a single slit, Plane transmission diffraction grating, absent spectra, dispersive power, resolving power and Rayleigh criterion of resolution.

UNIT II **Polarisation:** Polarised and unpolarised light, Uniaxial crystals, optic axis, double refraction, Nicol prism, quarter and half wave plates, Detection and Production of different types of polarized light, Polarimetry; Optical and specific rotation, Biquartz and Laurent's half shade polarimeter.

Laser and Fibre Optics: Spontaneous and Stimulated emission, Laser principle, Einstein's coefficients, characteristics of laser beam-concept of coherence, spatial and temporal coherence, He-Ne and semiconductor lasers (simple ideas), applications.

Propagation of light in optical fibres, numerical aperture, V-number, single and multimode fibres, Elementary idea of attenuation and dispersion, applications.

UNIT III **Electrostatics:** Dielectric polarization, dielectric relaxation process, types of polarization, relation between E,P and D, Gauss's law in the presence of a dielectric, Energy stored in a uniform electric field, dielectric losses and variation with frequency.

Electrodynamics: Maxwell's field equations –significance, differential and integral form, Maxwell's equations in different media- free space, dielectric and conductor.

UNIT IV **Special Theory of Relativity:** Inertial and non-inertial frames, Galilean transformations, Michelson's Morley Experiment, Postulates of Special Theory of Relativity, Lorentz transformations, Consequences of LT (length contraction and time dilation), addition of velocities, variation of mass with velocity, mass energy equivalence.

Text Books

1. Perspectives of Modern Physics - Arthur Beiser (TMH)
2. Optics – Ajoy Ghatak (TMH)
3. Modern Physics for Engineers – S.P.Taneja (R. Chand)
4. Engineering Physics – Satya Prakash (Pragati Prakashan)
5. Modern Engineering Physics – A.S.Vasudeva (S. Chand)
6. Engineering Physics (Vol-1)- S.L. Gupta (Dhanpat Rai)

Reference Books:

1. Fundamentals of Physics – Resnick & Halliday (Asian Book)
2. Introduction to Electrodynamics – D.J. Griffith (Prentice Hall)

HAS-103C MATHEMATICS I

B. Tech I Semester

No. of Credits: 4	Sessional:	25 Marks
L T P Total	Theory:	75 Marks
4 0 0 4	Total :	100 Marks
	Duration of Exam:	3 Hours

Pre –Requisite: None

Successive: Mathematics II, Numerical Methods, Operations Research

Course Objective:

To make students able to learn about matrices, rank, Eigen values and Eigen vectors and about the quadratic form of the matrices, Taylor's series, Macluarin's series, Asymptotes, Curvature, partial differentiation, Composite and Implicit functions, Maxima-Minima of functions of two variables, Differentiation under the integral sign, Double Integral, Triple Integral, Beta & Gamma functions, Scalar and Vector-point functions, gradient, divergence and curl of a vector, Green's theorem, Stoke's theorem, Gauss-Divergence theorem and their application.

Course Outcomes (COs): At the end of the course, the student shall be able to:

CO 1- Learn about matrices, rank, eigen values and eigen vectors and about the quadratic form of the matrices.

CO 2- Learn about Taylor's series, Macluarin's series , Asymptotes, Curvature, Students learn about partial differentiation, Composite and Implicit functions, Maxima-Minima of functions of two variables, Differentiation under the integral sign.

CO 3- Learn about Double integral, Triple integral, Beta & Gamma functions and their applications.

CO 4- Acquire knowledge about scalar and vector point function, gradient, divergence and curl ,Green's ,Divergence and Stoke's theorem and their applications.

Syllabus:

UNIT I **Matrices and its Applications:** Rank of Matrix, Normal form, Inverse using Gauss-Jordon method, Consistency of linear system of equations using Rank method, Linear and Orthogonal transformation, Linear-dependence and Linear-Independence of Vectors, Eigen-Values and its properties, Eigen-Vectors, Cayley-Hamilton theorem & its applications, Diagonalisation of Matrices, Similar Matrices, Quadratic Forms.

UNIT II **Applications of Derivatives:** Taylor's & Maclaurin's Series for one variable, Asymptotes, Curvature, Radius of Curvature for Cartesian, Parametric and Polar-curves, Radius of curvature at the Origin (by using Newton's method, by method of Expansion), Center of curvature.

Partial Differentiation and its Applications: Functions of two or more variables, Partial derivatives of I^{st} and higher order, Total differential and differentiability, Euler's theorem for Homogeneous functions, Derivatives of Composite and Implicit functions, Jacobians, Taylor's series for functions of two variables, Maxima-Minima of functions of two variables, Lagrange's Method of undetermined multipliers, Differentiation under the integral sign (Leibnitz rule).

UNIT III **Double and Triple Integrations:** Double integral, Change of Order of Integration, Double integral in Polar co-ordinates, Applications of double integral to find (i) Area enclosed by plane curves (ii) Volume of solids of revolution, Triple Integral, Change of variables, Volume of solids, Beta & Gamma functions and relation between them.

UNIT IV **Vector Calculus:** Differentiation of vectors, Scalar and Vector-point functions, Gradient of a scalar field and directional derivatives, Divergence and Curl of a vector field and their physical interpretations, Integration of vectors, line integral, Surface integral, Volume integral, Green's theorem, Stoke's theorem, Gauss-Divergence theorem(without proof) with their simple applications.

Text Books/ Reference Books:

1. Advanced Engineering Mathematics, Erwin Kreyzig
2. B.S.Grewal, Higher Engg. Mathematics, Khanna Publications.
3. Advanced Engineering Mathematics, Dr.Babu Ram, Pearsons publications.
4. Engineering Mathematics Seventh Edition by John Bird, Published by Newnes.
5. Advanced Engineering Mathematics, K.A.Stroud, Dexter Booth, Published by Palgrave.

HAS-105C CHEMISTRY
B. Tech I/II Semester

No. of Credits: 3		Sessional:	25 Marks
L T P Total		Theory:	75 Marks
3 0 0 3		Total :	100 Marks
		Duration of Exam:	3 Hours

Pre –Requisite: None

Successive: Material Science

Course Objective:

To illustrate the basic understanding of Analytical chemistry and to improve the reasoning ability of the student towards chemistry in everyday life, enhance the basic knowledge for the theoretical aspect of engineering chemistry. To make students aware about the various applications of chemical sciences in engineering.

Course Outcomes (COs): At the end of the program the students acquired knowledge about:

CO 1- Illustrate the basic parameters of water, different water softening processes and effect of hard water in industries.

CO 2- Describe the basic properties and application of various polymers as an engineering material.

CO 3- Demonstrate the mechanism, physical and chemical properties of lubricants and their applications.

CO 4- Apply instrumental techniques of chemical analysis.

Syllabus:

UNIT I **Polymers and Polymerization:** Introduction & Classification of polymers. effect of structure on properties of polymers, Bio degradable polymers, preparation, properties and technical application of thermo–plastics (PVC, PE, Teflon)& thermosets (PF,UF), elastomers (SBR,BUNA-N), Silicones, Introduction to polymeric composites.

Phaserule: Terminology, Derivation of Gibb's phase rule. One component system: water system, two components systems: Simple eutectic system (Pb – Ag), system with congruent melting point (Zn – Mg), Cooling curves.

UNIT II **Water and its Treatment:** Hardness of water and its determination, (EDTA method) units of hardness, alkalinity of water and its determination, Related

numerical problems, Problems associated with boiler feed water: scale and sludge formation, Priming and foaming, Boiler corrosion & Caustic embrittlement. Water softening Techniques: Lime-Soda treatment, Zeolite, Ion – exchange process, Mixed bed demineralization.

UNIT III **Corrosion and its Prevention:** Mechanism of Dry and wet corrosion (rusting of iron), types of corrosion, galvanic corrosion, differential aeration corrosion, stress corrosion. Factors affecting corrosion, preventive measures (proper design, Cathodic and Anodic protection, Protective coatings), Soil corrosion, Microbiological Corrosion.

Lubrication and Lubricants: Introduction, mechanism of lubrication, classification of lubricants. Additives for lubricants. Properties of lubricants (Flash & Fire point, Saponification number, Iodine value, Acid value, Viscosity and Viscosity index Aniline point, Cloud point and pour point).

UNIT IV **Fuels:** Definition and characteristics of a good fuel, Classification of fuels with suitable examples, Definition and determination of calorific value of a fuel with the help of bomb calorimeter, Proximate and Ultimate analysis of a fuel and its importance, Merits and demerits of gaseous fuel over other varieties of fuel, Composition properties and uses of (i) Water gas (ii) Oil gas (iii) Biogas (iv) LPG (v) CNG.

Books recommended

1. Engineering Chemistry , P.C. Jain, Monica Jain (DhanpatRai& Co)
2. Chemistry in Engineering &Tech , Vol. I & II , Kuriacose (TMH)
3. Instrumental methods of Chemical analysis, MERITT & WILLARD(EAST -WEST press)
4. Physical Chemistry , P.W Atkin (ELBS, OXFORD Press)
5. Physical Chemistry W.J.Moore (Orient Longman)

HAS-107C ENVIRONMENTAL STUDIES

B. Tech I/II Semester

No. of Credits: 3		Sessional:	25 Marks
L T P Total		Theory:	75 Marks
3 0 0 3		Total :	100 Marks
		Duration of Exam:	3 Hours

Pre –Requisite: None

Successive: None

Course Objective:

The prime objective of the course is to provide the students a detailed knowledge on the threats and challenges to the environment due to developmental activities. The students will be able to identify the natural resources and suitable methods for their conservation and sustainable development. The focus will be on awareness of the students about the importance of ecosystem and biodiversity for maintaining ecological balance. The students will learn about various attributes of pollution management and waste management practices. The course will also describe the social issues both rural and urban environment and environmental legislation.

Course Outcomes (COs): At the end of the program the students acquired knowledge about:

CO 1- Understand / evaluate / develop technologies on the basis of ecological principles and environmental regulations which in turn help in sustainable development. The students will also be able to introduce the thinking about environmental issues from an interdisciplinary perspective.

CO 2- Identify and relate about the renewable and non-renewable resources, their importance and ways of conservation to sustain human life on earth.

CO 3- Know about the concepts of ecosystem and its function in the environment, the need for protecting the producers and consumers in various ecosystems and their role in the food web.

CO 4- Recognize, relate and become sensitive to the effects of pollution and will be able to contribute his learning's towards their prevention or mitigation. The students will also be able to describe the social issues along with the trends of human population growth and the possible means to combat the challenges.

Syllabus:

UNIT I **The Multidisciplinary Nature of Environmental Studies:** Definition, scope and importance. Need for public awareness.

UNIT II **Natural Resources: Renewable and Non-Renewable Resources:** Natural resources and associated problems:

- Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.
- Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.
- Mineral resources: Use and exploitation, environmental effects of extracting and mineral resources, case studies.

  Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
- Energy resources: Growing energy needs, renewable and non- renewable energy sources, use of alternate energy sources. Case studies.
- Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.
- Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.

UNIT III **Ecosystems:**

- Concept of an ecosystem. Structure and function of an ecosystem. Producers, consumers and decomposers.
- Energy flow in the ecosystem. Ecological succession. Food chains, food webs and ecological pyramids.
- Introduction, types, characteristic features, structure and function of the following ecosystem:

  a) Forest ecosystem b) Grassland ecosystem c) Desert ecosystem d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).

UNIT IV **Biodiversity and its Conservation:**

- Introduction – Definition: genetic, species and ecosystem diversity.
- Biogeographical classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity at global, National and local levels.
- India as a mega-diversity nation. Hot-spots of biodiversity. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. Endangered and endemic species of India. Conservation of biodiversity: in-situ and ex-situ conservation of biodiversity.

UNIT V **Environmental Pollution:** Definition.

- Causes, effects and control measures of: Air pollution b) Water pollution c) Soil pollution d) Marine pollution e) Noise pollution f) Thermal pollution g) Nuclear hazards
- Solid waste Management: Causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. Pollution case studies. Disaster management: floods, earthquake, cyclone and landslides.

UNIT VI **Social Issues and the Environment:**

- From Unsustainable to Sustainable development Urban problems related to energy. Water conservation, rain water harvesting, watershed management. Resettlement and rehabilitation of people; its problems and concerns. Case studies.
- Environmental ethics: Issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies. Wasteland reclamation. Consumerism and waste products.
- Environment Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and Control of Pollution) Act
- Wildlife Protection Act. Forest Conservation Act. Issues involved in enforcement of environmental legislation
- Public awareness.

UNIT VII **Human Population and the Environment:** Population growth, variation among nations. Population explosion – Family Welfare Programme.

Environment and human health. Human Rights. Value Education. HIV/AIDS. Women and Child Welfare. Role of Information Technology in Environment and human health. Case Studies.

UNIT VIII **Field Work:**

- Visit to a local area to document environmental assets-river / forest / grassland / hill / mountain.
- Visit to a local polluted site – Urban / Rural / Industrial / Agricultural.
- Study of common plants, insects, birds.
- Study of simple ecosystems – pond, river, hill slopes, etc.

Text Books:

1. Perspectives in Environmental Studies by A. Kaushik and C. P. Kaushik, New age international publishers.
2. Environmental Studies by Benny Joseph, Tata McGraw Hill Co, New Delhi

Reference Books:

1. Environmental Science: towards a sustainable future by Richard T. Wright. 2008 PHL Learning Private Ltd. New Delhi.
2. Environmental Engineering and science by Gilbert M. Masters and Wendell P. Ela 2008 PHI Learning Pvt Ltd.
3. Environmental Science by Daniel B. Botkin& Edwards A. Keller, Wiley INDIA edition.
4. Fundamentals of Ecology by Odum, E.P., Barrick, M. and Barret, G.W. Thomson Brooks/Cole Publisher, California, 2005.

EC- 101C ELEMENTS OF ELECTRONICS ENGINEERING

B. Tech I/II Semester

No. of Credits: 3		Sessional:	25 Marks
L T P Total		Theory:	75 Marks
3 0 0 3		Total :	100 Marks
		Duration of Exam:	3 Hours

Pre –Requisite: None

Successive: Material Science, Mechatronics, Industrial Control

Course Objective:

Fundamental knowledge in the field of electronics will be provided in this course by emphasizing on the basic components and circuits like the diodes, BJTs, JFETS, MOSFETS etc. Such different types of circuitry components/circuits and their applications are introduced so as to complete the theoretical and practical basis on analog circuit design.

Course Outcomes (COs): At the end of the program the students acquired knowledge about:

CO 1- Basics of digital electronics, solving problems related to number systems and Boolean algebra, various flip flops.

CO 2- The semiconductors and diodes, transistors, amplifiers and their applications.

CO 3- Display devices like LCDs, LEDs and Optoelectronic devices.

CO 4- Electronic instruments like CRO, function generator and multimeter etc.

CO 5- Basics of Communication system and modulation techniques like AM, FM, PM etc.

Syllabus:

UNIT I **Semiconductor Physics:** Overview of Semiconductors, PN junction diode and Zener diode –Diode circuits: rectifiers (bridge type only), filters, clippers and clampers - BJT construction, operation, characteristics (CB, CE and CC configurations) and uses – JFET and MOSFET construction, operation, characteristics (CS configuration) and uses.

UNIT II **Digital Electronics:** Binary, Decimal, Octal and Hexadecimal number systems and conversions, Boolean Algebra, De Morgan's theorem, logic gates (AND, OR, NOT, NAND, NOR, XOR, XNOR),Combinational and sequential circuits, Introduction to flip-flops (S-R & J-K).

UNIT III **Electronics Instruments**: Role, importance and applications of general-purpose test instruments like Multimeter: Digital & Analog, Cathode Ray Oscilloscope (CRO), Function/Signal Generator.

UNIT IV **Optoelectronic Devices and Displays:** Photoconductive cell - photovoltaic cell - solar cell – photodiodes – phototransistors, Seven segment display: Common anode and Common cathode connections and applications.

LED DISPLAY: Construction, Working, Advantages, Disadvantages and Applications.

LCD DISPLAY: Types of liquid crystals; Types of LCD display:- Dynamic scattering and field effect type; Construction, Working, Advantages, Disadvantages and Applications.

UNIT V **Communication System:** Block diagram of a basic communication system – frequency spectrum - need for modulation - methods of modulation - principles of AM, FM, PM , pulse analog and pulse digital modulation – AM / FM transmitters & receivers (block diagram description only)

Text / Reference Books:

1. Sedra A S and Smith K C, "Microelectronic Circuits" 4th Ed., New York, Oxford University Press, New York (1997).

2. Tocci R J and Widmer N S, "Digital Systems – Principles and Applications", 8th Ed., Pearson Education India, New Delhi (2001).

3. Cooper and Helfrick, "Modern Electronic Instrumentation and Measuring Techniques", 4th print Prentice Hall of India, New Delhi (1996)

4. Boylestad and Nashelsky, "Electronic Devices and Circuit Theory", 8th Ed, Pearson Education India, New Delhi (2002).

5. Millman and Grabel, "Microelectronics", 2nd Ed. Tata McGraw-Hill (1999).

ME-101C BASICS OF MECHANICAL ENGINEERING

B. Tech I / II Semester

No. of Credits: 3		Sessional:	25 Marks
L T P Total		Theory:	75 Marks
3 0 0 3		Total :	100 Marks
		Duration of Exam:	3 Hours

Pre –Requisite: None

Successive: Thermodynamics, Mechanics of Solids, Manufacturing Process

Course Objective:

The main objective of teaching this course is to provide the basic knowledge of mechanical engineering.

Course Outcome (COs): At the end of the course, the student shall be able to:

CO 1- Understand the basics of thermodynamics and I.C. Engines.

CO 2- Understand the working of various power transmission devices and lifting machines.

CO 3- Understand the concept of stresses and strains.

CO 4- Understand the basics of manufacturing processes, operations of machine tools and measuring tools.

Syllabus:

UNIT I **Basic Concepts of Thermodynamics:** Macroscopic and Microscopic Approaches, Thermodynamic Systems, Surrounding and Boundary, Thermodynamic Properties – Intensive and Extensive, Thermodynamic Equilibrium, State, Path, Process and Cycle, Concept of Thermodynamic Work and Heat, Zeroth Law of Thermodynamics, Energy and First law of Thermodynamics, First law applied to non flow processes, Internal Energy and Enthalpy. Numerical Problems.

UNIT II **I.C. Engines:** Introduction, classification, Constructional details and working of 2 stroke & 4 stroke petrol engine & diesel engine, Otto, diesel and dual cycles, simple problems on Otto & diesel cycles.

UNIT III **Simple Lifting Machines:** Definition of machine, velocity ratio, Mechanical advantage, Efficiency, Laws of machines, Reversibility of machine, Wheel and axle, Differential pulley block, Single, Double and Triple start worm and worm wheel, Simple and compound screw jacks, Problems.

UNIT IV **Basics of Power Transmission:** Transmission of mechanical power: introduction belt drives, gear drives, their advantages and disadvantages. Introduction to brakes and clutches.

UNIT V **Stresses and Strains:** Introduction, Concept & types of Stresses and Strains, Poisons ratio, stresses and Strains in simple and compound bars under axial loading, Stress– Strain diagrams, Hook's law, Elastic constants and Mechanical Properties of metals like mild steel and cast iron.

UNIT VI **Basics of Manufacturing Processes and Measurements:** Brief introduction to classification of different manufacturing processes: Primary shaping processes, metal cutting processes, joining processes, finishing processes and processes bringing change in properties, Working principle, parts and specification of commonly used machine tools in workshop such as Lathe, Shaper and Milling.

Measuring Instruments: introduction to slip gauges, Go and No Go gauges**,** dial gauges, vernier calliper, micrometer, sine bar, vernier height gauges.

Text Books:

1. Basics of Mechanical Engineering- R.K Rajput Laxmi Pub, Delhi.
2. Elements of Mechanical Engineering- D.S Kumar, S.K Kataria and Sons.
3. Engineering Thermodynamics- P.K Nag TMH, New Delhi.
4. Workshop Technology Vol I & II –Hazra & Chaudhary, Asian Book Comp., New Delhi.

Reference Books:

1. Engineering Thermodynamics- C.P Arora, Pub- TMH, New Delhi.
2. Manufacturing Science- Amitabha Ghosh & Ashok Kumar Malik, - East- West Press.
3 Manufacturing Process & Systems- Oswald, Munoz, John Wiley.
4 Workshop Technology Vol I, II & III- Chapman, WAJ, Edward Arnold.
5. Basics of Mechanical Engineering – Vineet Jain, Dhanpat Rai Publications
6. Automobile Engineering by Dr Kirpal Singh, standard Publishers Distributors

HAS-151C PHYSICS LAB - I
B. Tech I Semester

No. of Credits: 1	Sessional: 15 Marks
L T P Total	Practical: 35 Marks
0 0 2 2	Total : 50 Marks
	Duration of Exam: 2 Hours

Pre –Requisite: Physics - I

Successive: None

Course Objectives:

A physics lab reinforces the theory class with required physics lab experiments to stress the fundamental concepts of physics. Optical experiments, which will establish the fundamental interference, diffraction phenomena which will be clearly visualized with the experiment mentioned in the syllabus.

Course Outcomes (COs): After studying this course the students will be able to:

CO 1- The students are able to determine the wavelength of different colour using different instruments.

CO 2- The students are able to find the frequency using different apparatus and handle other fundamental apparatus.

CO 3- The students are able to understand optical experiments, which will establish the fundamentals of interference and diffraction phenomena.

List of Experiments:

1. To find the wavelength of sodium light by Newton's rings experiment.
2. To find the wavelength of sodium light by Fresnel's biprism experiment.
3. To find the wavelength of various colours of white light with the help of a plane transmission diffraction grating.
4. To find the refractive index and cauchy's constants of a prism by using spectrometer.
5. To find the wavelength of sodium light by Michelson interferometer.
6. To find the resolving power of a telescope.
7. To find the pitch of a screw using He-Ne laser.
8. To find the specific rotation of sugar solution by using a polarimeter.

9. To compare the capacitances of two capacitors by De'sauty bridge and hence to find the dielectric constant of a medium.
10. To find the flashing and quenching potentials of Argon and also to find the capacitance of unknown capacitor.
11. To study the photoconducting cell and hence to verify the inverse square law.
12. To find the temperature co-efficient of resistance by using platinum resistance thermometer and Callender and Griffith bridge.
13. To find the frequency of A.C. mains by using sonometer.
14. To find the velocity of ultrasonic waves in non-conducting medium by piezo-electric method.

Note :

(i) The experiments in Ist semester will be based mainly upon Optics, Electrostatics.

(ii) Students will be required to perform at least 10 experiments out of the list.

Reference Books:

1. Advanced Practical Physics – B.L. Worshnop and H.T. Flint (KPH)
2. Practical Physics – S.L.Gupta & V.Kumar (Pragati Prakashan).
3. Advanced Practical Physics Vol.I & II – Chauhan & Singh (Pragati Prakashan).

HAS-155C CHEMISTRY LAB
B. Tech I/II Semester

No. of Credits: 1		Sessional:	15 Marks
L T P Total		Practical:	35 Marks
0 0 2 2		Total :	50 Marks
		Duration of Exam:	2 Hours

Pre –Requisite: Chemistry

Successive: None

Course Objectives:

To apply fundamental knowledge of practical chemistry to engineering and technology.

Course Outcomes (COs): After studying this course the students will be able to:

CO 1- Find out hardness of water quantitatively.

CO 2- Analyse sample of water for many parameters.

CO 3- Analyse sample of lubricating oil for many parameters.

CO 4- Prepare polymeric resins in the laboratory.

List of Experiments:

15. Determination of Ca++ and Mg++ hardness of water using EDTA solution.
16. Determination of alkalinity of water sample.
17. Determination of dissolved oxygen (DO) in the given water sample
18. To find the eutectic point for a two component system by using method of cooling curve.
19. Determination of viscosity of lubricant by Red Wood Viscosity (No. 1 & N0. 2)
20. To determine flash point& fire point of an oil by Pensky Marten's flash point apparatus.
21. To Prepare Phenol formaldehyde and Urea formaldehyde resin.
22. To find out saponification no. of Oil
23. To determine TDS of Water samples of different sources.
24. Determination of concentration of KMnO4 solution spectrophotomererically
25. Determination of strength of HCl solution by titrating against NaOH solution conductometrically.
26. To determine amount of sodium and potassium in a, given water sample by flame photometer.
27. Estimation of total iron in an iron alloy.

Reference Books:

1. Advanced practical organic chemistry, O P Agarwal, (Krishna publishing).
2. Advanced practical inorganic chemistry, Gurdeep Raj, (Krishna publishing).
3. Advanced practical physical chemistry, J B Yadav, (Krishna publishing).

ME-151C BASICS OF MECHANICAL ENGINEERING LAB

B. Tech I/II Semester

No. of Credits: 1	Sessional:	15 Marks
L T P Total	Practical:	35 Marks
0 0 2 2	Total :	50 Marks
	Duration of Exam:	2 Hours

Pre –Requisite: Basics of Mechanical Engineering

Successive: Thermodynamics, Mechanics of Solids, Manufacturing Process

Course Objectives:

To understand the basics of mechanical engineering and by working models and experiments.

Course Outcomes (COs): After studying this course the students will be able to:

CO 1- Understand the basics of working of boilers, mountings and accessories.

CO 2- Understand the principle and working of two strokes and four strokes internal combustion engines.

CO 3- Understand the mechanisms of simple lifting machines.

CO 4 - Understand the mechanism of gear drive.

CO 5- Understand the use of various measuring devices.

List of Experiments:

1. To study the construction and working of Cochran and Babcock & Wilcox boilers.
2. To study the function and working of various mountings and accessories in a boiler.
3. To study the construction and working of 2 stroke & 4 stroke diesel engine.
4. To study the construction and working of 2 stroke & 4 stroke petrol engine.
5. To calculate the mechanical advantage, velocity ratio and efficiency of worm and worm wheel.
6. To calculate the mechanical advantage, velocity ratio and efficiency winch crab.
7. To study Simple screw jacks and compound screw jacks and determine their efficiency.
8. Measurement of diameter of shaft using (i) vernier caliper (ii) digital caliper (iii) vernier micrometer (iv) digital micrometer.
9. Measurement of angle of taper using sine bar.
10. To study the different types of gears.

HAS-102C PHYSICS II

B. Tech II Semester

No. of Credits: 4		Sessional:	25 Marks
L T P Total		Theory:	75 Marks
4 0 0 4		Total :	100 Marks
		Duration of Exam:	3 Hours

Pre –Requisite: Physics I

Successive: Engineering Mechanics, Material Science, Micro and Nano Manufacturing

Course Objective:

This course introduces basic principles of crystal structure along with the defects. Emphasis is placed on the shortcoming of classical physics at the turn of the century leading to the discoveries of the modern era. The concepts of quantum mechanics and solid state serve as the foundation stone for the course. Extensions of these topics will include the modern view of the atom, wave particle duality of light, distribution of atoms, magnetism and conductivity. Through this course students will able to understand the basics of Nanotechnology and Superconductivity.

Course Outcome (COs): At the end of the course, the student shall be able to:

CO 1- Understand the basics of crystal structure and defects in solids. They would also be able to comprehend Quantum Physics and its relevance in the modern era.

CO 2- Learn the fundamentals of Free electron theory and have an elementary idea of Nanoscience and Nanotechnology.

CO 3- Understand Band theory of solids and Photoconductivity.

CO 4- Comprehend magnetic properties of solids and superconductivity and their applications in the contemporary world.

.***Syllabus:***

UNIT I **Crystal Structure:** Space lattice, unit cell and translation vector, Miller indices, inter-planar spacing, simple crystal structure (NaCl and Diamond), Bragg's law, Laue method, powder method, Point defects in solids – Schottky and Frenkel defects.

Quantum Physics: Difficulties with Classical physics, Introduction to quantum mechanics-simple concepts. Black Body radiation, Planck's radiation law, de-Broglie hypothesis, phase velocity and group velocity. Schrodinger wave equations-time dependent and time independent, Particle in a one-dimensional

box, Elementary idea of Quantum Statistics (Bose-Einstein and Fermi-Dirac Statistics), distribution function.

UNIT II **Nanomaterials and Applications:** Basic principle of Nanoscience and Nanotechnology, synthesis of nanoparticles, techniques- ball milling, sputtering, plasma synthesis, properties of nanoparticles-mechanical, optical, magnetic and electronic; introduction to carbon nanotubes.

Free Electron Theory : Elements of classical free electron theory and its limitations, Drude's theory of conduction, quantum theory of free electrons. Fermi level, density of states. Fermi-Dirac distribution function, Concept of thermionic emission-Richardson equation.

UNIT III **Band Theory Of Solids:** Origin of energy bands, Kronig-Penny model (qualitative), E-K diagrams, Brillouin Zones, concept of effective mass and holes. Classification of solids into metals, semiconductors and insulators, Fermi energy and its variation with temperature, Hall Effect and its applications.

Photoconductivity & Photovoltaics: Photoconductivity in insulating crystal, variation with illumination, effect of traps, application of photoconductivity, photovoltaic cells, solar cell and its characteristics.

UNIT IV **Magnetic Properties of Solids:** Atomic magnetic moments, orbital diamagnetism, classical theory of paramagnetism, ferromagnetism- molecular fields and domains.

Superconductivity: Introduction (Experimental survey), Meissner effect, London equations, Hard and Soft superconductors, Elements of BCS Theory, Applications of superconductors

Text Books:

1. Perspectives of Modern Physics - Arthur Beiser (TMH)
2. Optics – Ajoy Ghatak (TMH)
3. Modern Physics for Engineers – S.P.Taneja (R. Chand)
4. Engineering Physics – Satya Prakash (Pragati Prakashan)
5. Modern Engineering Physics – A.S.Vasudeva (S. Chand)
6. Engineering Physics (Vol-2)- S.L. Gupta (Dhanpat Rai)

HAS-104C MATHEMATICS II

B. Tech II Semester

No. of Credits: 4		Sessional:	25 Marks
L T P Total		Theory:	75 Marks
4 0 0 4		Total :	100 Marks
		Duration of Exam:	3 Hours

Pre –Requisite: Mathematics I

Successive: Numerical Methods, Operations Research

Course Objective:

This course will give detailed view of exact differential equations, concept of obtaining suitable integrating factor, solution of ordinary differential equations with constant coefficients and variable coefficients. Application, Laplace transforms, Inverse Laplace transforms, solution of differential equations using laplace transforms, Partial Differential Equations, Lagrange's method, Charpit's method and Solution of homogeneous partial differential equations and application of partial differential equations to heat and wave equations, about infinite series, tests for checking convergence and divergence of infinite series. Checking the absolute convergence of alternating series.

Course Outcome (COs): At the end of the course, the student shall be able to:

CO 1- Acquire knowledge about many kinds of differential equations, different methods to find the solution of differential equations and applications of differential equations to solve boundary value problems and simultaneous equations.

CO 2- Acquire knowledge about Laplace transform, Inverse Laplace transform and its applications.

CO 3- Acquire knowledge about formation of partial differential equation, method to solve linear and non linear partial differential equation and method of separation of variable to solve heat and wave equation.

CO 4- Infinite series and different tests to check the convergence and divergence of Infinite series.

.***Syllabus:***

UNIT I **Ordinary Differential Equation and its Applications:** Exact differential equation of first order, Equations reducible to exact differential equation, differential equation of second and higher order, Complete solutions of linear differential equations(Complementary Function + Particular Integral), Method of variation of parameter to find Particular Integral, Cauchy's and Legendre's linear Equation,

Simultaneous linear equations with constant co-efficient, Application of linear differential equations to Electric circuits(LC,LCR circuit), Newton's law of cooling, Heat flow, Orthogonal trajectory.

UNIT II **Laplace-Transforms and its Applications:** Laplace-transforms of elementary functions, Elementary properties of Laplace-transforms, Existence conditions, Transforms of derivatives, Transforms of Integrals, Multiplications by t^n, division by t, Evaluation of integrals by Laplace –transforms, Second shifting Theorem , Inverse transforms, Convolution theorem, Applications to linear differential equations to solve boundary value problems with constants coefficients and simultaneous linear differential equations with constant coefficients.

UNIT III **Partial Differential Equation and its Application:** Formation of partial-differential equations. Lagrange's linear partial –differential equations. First order non-linear partial differential equations, Charpit's method. Homogeneous Partial-differential equation of second and higher order, Method of Separation of Variables and its applications to wave equation and one dimensional Heat equation.

UNIT IV **Infinite Series:** Convergence and divergence of Infinite series, Comparison Test, D'Alembert's Ratio Test, Gauss Test, Integral Test, Raabe's Test, Logarithmic Test, Cauchy's Root Test, Alternating Series, Conditional Convergence & Absolute Convergence.

Text/ Reference Books:

1. B.S. Grewal – Engineering Mathematics
2. Advanced Engineering Mathematics, Erwin Kreyzig
3. Advanced Engineering Mathematics, Dr. Babu Ram, Pearsons Publications.
4. Engineering Mathematics Seventh Edition by John Bird ,Published by Newnes.
5. Advanced Engineering Mathematics, K.A. Stroud, Dexter Booth, Published by Palgrave.

HAS-109C INTERACTIVE ENGLISH

B. Tech I/ II Semester

No. of Credits: 3		Sessional:	25 Marks
L T P Total		Theory:	75 Marks
3 0 0 3		Total :	100 Marks
		Duration of Exam:	3 Hours

Pre –Requisite: None

Successive: None

Course Objective:

To read and discuss text of a chosen Shakespearean tragedy and make students familiar with Romantic poetry in English literature so as to help the students enhance their understanding of value of literature in wider socio-historical context by evoking examples from Elizabethan England, the French revolution and Industrial revolution. Thereby to furnish examples from the literary canon to be first emulated and later critiqued in creative and critical writing. At the same time, to hone the skills of students in written communication by working on the vocabulary of students so they can express themselves clearly and persuasively.

Course Outcome (COs): At the end of the course, the student shall be able to:

CO 1- Students are conversant with representative texts of Shakespeare and Romantic poetry. They also understand the historical context of these literary works.

CO 2- Students are able to communicate effectively in corporate environment.

CO 3- Inculcate critical thinking and demonstrate an ability to articulate their thoughts coherently and creatively.

CO 4- Command a better vocabulary and express their thoughts clearly and precisely.

.Syllabus:

UNIT I **Literature:** Shakespeare's Macbeth(story adaptation of play); Romantic poetry- 'The Chimney Sweeper' by Blake, 'To Autumn' by John Keats, 'The Rainbow' by William Wordsworth, 'Ozymandias' by PB Shelley, 'The Rime of the Ancient Mariner' (text of 1834) –Part-I and Part-II by Samuel Coleridge, Historical context of Romantic poetry-French Revolution and Industrial revolution.

UNIT II **Functional English:** Report Writing- hypothesis-evidence-thesis, Proposals/Feasibility and Progress Reports/Memo/Letter formats; Essays/paragraphs; applications; description of objects, appliances, instruments, products, processes.

UNIT III **Critical thinking and Creative Writing:** Critical thinking; creative writing exercises; Seven Cs of writing/ Story composition/news reports/ feature writing/verse composition, Paraphrasing poems, comprehending Unseen Passages, writing biographies, art of interviewing, book reviews.

UNIT IV **Semantics and Syntax:** Antonyms, synonyms, homophones, words often confused, one word substitutes, word origins, sentence correction/error correction exercises in basic grammar.

References:

1. Shakespeare Readers. VolumeI. *Macbeth.* Scholastic India, 2016.
2. Michael Neill, David Schalkwyk. *The Oxford Handbook of Shakespearean Tragedy*. Oxford UP. 2016
3. Claire McEachern.*The Cambridge Companion to Shakespearean Tragedy.* Cambridge UP. 2013
4. RC Sharma and Krishna Mohan. 4th edition. *Business Correspondence and Report Writing*. McGraw Hill.
5. Bretag, Crossman, and Bordia. *Communictaion Skills.* TatMcGraw Hill.2012
6. A.C. Bradley and John Bayley. *Shakespearean Tragedy*. Penguin Books.1991

Other background readings:

1. Das, Manoj *Tales Told by Mystics*. Sahitya Akademi. New Delhi 2001
2. Usha Bande. Pointed Vision: An Anthology of Short Stories. Oxford UP. 2002
3. Reference material consisting of poems and material related to Romantic poetry to be circulated by the teacher consisting of introductory notes on French revolution and industrial revolution.

EE-101C BASIC ELECTRICAL ENGINEERING

B. Tech I / II Semester

No. of Credits: 3		Sessional:	25 Marks
L T P Total		Theory:	75 Marks
3 0 0 3		Total :	100 Marks
		Duration of Exam:	3 Hours

Pre –Requisite: None

Successive: Power Plant Engineering

Course Objectives:

The objective of this Course is to provide the students with an introductory and broad treatment of the field of *Electrical Engineering.*

.**Course Outcome (COs):** At the end of the course, the student shall be able to:

- **CO 1-** Analyze and solve the problems of DC Circuits and Network theorems
- **CO 2-** Solve problems related to AC circuits and Magnetic circuits
- **CO 3-** Examine the behaviour of poly phase system and power measurement
- **CO 4-** Understand the working principle, construction and applications of AC & DC machines

Syllabus:

UNIT I **DC Circuits:** Ohm's Law and Kirchhoff‟s Laws; Analysis of series, parallel and series-parallel circuits excited by independent voltage sources; Power and energy; *Electromagnetism*:- Faradays Laws, Lenz's Law, Fleming's Rules, Statically and dynamically induced EMF; Concepts of self inductance, mutual inductance and coefficient of coupling; Energy stored in magnetic fields; Hysteresis and Eddy current losses.

UNIT II **Network Theorems:** Superposition, Thevenin's and Norton's, Reciprocity, Compensation, Maximum Power transfer, Tellegan's and Millman's theorems, Application of theorems to dc and ac circuits.

UNIT III **AC Circuits:** *Single Phase A.C. Circuits :-*Generation of sinusoidal voltage-definition of average value, root mean square value, form factor and peak factor of sinusoidal voltage and current and phasor representation of alternating quantities; Analysis with phasor diagrams of R, L, C, RL, RC and RLC circuits; Real power, reactive power, apparent power and power factor, series, parallel and series- parallel circuits, Series and Parallel resonance, selectivity, bandwidth and Q factor, earthing

Three Phase A.C. Circuits:- Necessity and Advantages of three phase systems, Generation of three phase power, definition of Phase sequence, balanced supply and balanced load; Relationship between line and phase values of balanced star and delta connections; Power in balanced three phase circuits, measurement of power by two wattmeter method.

UNIT IV **Electrical Machines:**

Transformers: - Principle of operation and construction of single phase transformers (core and shell types). EMF equation, losses, efficiency and voltage regulation, Principle of operation of an Auto Transformer. Applications.

Synchronous Generators: - Principle of operation and constructional features, Applications

DC Machines:- Principle of Operation and constructional features, Classification and Applications.

Three Phase Induction Motor:- Principle of Rotating Magnetic Field, Principle of Operation of 3-Phase Induction Motor, Starting Methods and Applications of Three Phase Induction Motors.

Text Books:

1. Edward Hughes, Electrical Technology,10th Edition,ELBS 2010
2. Electrical Engg. Fundamentals. By V. Del Toro Prentice Hall
3. Electrical Technology, By H. Cotton, 7th Edition
4. Basic Electrical Engineering by Kothari & Nagrath TMH

CE-101C FUNDAMENTALS OF COMPUTER AND PROGRAMMING WITH C

B.Tech I/II Semester

No. of Credits: 3
L T P Total
3 0 0 3

Sessional: 25 Marks
Theory: 75 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Pre-Requisite: None

Successive: Kinematics of Machines and Operations Research

NOTE: Question paper has two parts. Part-1 has 10 questions each of 2 marks. It covers the entire syllabus. Attempt any four questions out of six from Part-2.

Course Objectives:

1. To understand the major components of computer system, programming languages and networking concepts.
2. To understand the basic building blocks of C language like variables, data types, managing I/O etc.
3. To understand the different statements like sequential, decision making, iterative such as if-else, loops and derived data types like arrays, structures etc.
4. To learn about the concept of Pointers and understand functions and file handling.

Course Outcomes (COs): After the successful completion of the course, student is able to:

CO 1- Learn the major components of computer system, programming language and Networking.

CO 2- Understand the building blocks of C language like variables, data types, managing I/O etc.

CO 3- Understand the different statements like sequential, decision making, iterative such as if-else, loops and derived data types like arrays and structures.

CO 4- Learn about the concept of Pointers and understand functions and file handling.

Syllabus:

UNIT I **An Overview of Computer System and Operating Systems:** Fundamentals: Hardware organization of a computer, CPU, Input/ Output Devices, Memories, Registers, Ports.

Different Number Systems:- Decimal Number System, Binary Number System, Octal Number System, Hexadecimal Number System, and their inter-conversions.

Operating System Basics: Introduction to Operating system, Functions of an Operating Systems, Classification of Operating Systems.

UNIT II **Basic Introduction to Programming Languages:** Machine Language, Assembly Languages, High level Languages, Types of high level languages, Complier, Interpreter, Assembler, Loader, Linker, Relationship between Compiler, Loader and Linker. Flowcharts.

UNIT III **Basic Introduction to Computer Networks:** LAN, MAN, WAN, OSI Reference model, Introduction to Internet and protocols: TCP/IP ref. model, Network connecting devices. Hypertext documents, HTTP, DNS, Network Security.

UNIT IV **An Overview of C:** Basic and Derived Data Types: Constants, Variables and Data types, operators and Expressions, managing I/O operations, Decision Making, branching and looping, Derived Data Types like Arrays, Strings.

Structure and Union in C: Defining structure, declaring variables, Accessing structure members, structure initialization, copying and comparing structures variables, operations on individual members, Array of structure, structure with structure, unions.

UNIT V **Pointers in C:** Introduction, Understanding Pointers, Accessing the address of a variable, Declaring Pointer Variables, Initialization of Pointer Variables, Pointer Expressions, Pointer Increments and Scale Factors, pointers and Arrays, Pointer and Character Strings, Pointers as Function Arguments, Pointers to Functions.

UNIT VI **File Management in C:** Defining and opening file, closing file, I/O operation on files, error handling during I/O operations.

Text Books:

1. Fundamental of Information Technology by A.Leon & M.Leon.
2. Let Us C by Yashwant Kanetkar.
3. Computer Fundamentals and Programming in C by A. K. Sharma, Universities Press.

Reference Books:

1. Programming in C by Schaum Series.
2. Computer Networks (4th Edition) by Andrew S. Tanenbaum
3. Digital Principles and Application by Donald Peach, Albert Paul Malvino
4. Operating System Concepts, (6th Edition) by Abraham Silberschatz, Peter Baer Galvin, Greg Gagne.

ME-152C PHYSICS LAB II
B. Tech II Semester

No. of Credits: 1		Sessional:	15 Marks
L T P Total		Practical:	35 Marks
0 0 2 2		Total :	50 Marks
		Duration of Exam:	2 Hours

Pre –Requisite: Physics I

Successive: None

Course Objectives:

To develop the domain knowledge in the fields of physics and to extend knowledge and processes used by physics have produced new and exciting technologies that are in everyday use.

Course Outcomes (COs): After studying this course the students will be able to:

CO 1- To demonstrate competency and understanding of the basic concepts found in core physics courses mechanics, quantum mechanics, magnetic properties, photoconductivity and modern physics.

CO 2- To utilize the scientific method for formal investigation and to demonstrate competency with experimental methods that are used to discover and verify the concepts related to content knowledge.

List of Experiments:

1. To find the low resistance by carey - Foster's bridge.
2. To find the resistance of a galvanometer by Thomson’s constant diffelction method using a post office box.
3. To find the value of high resistances by Substitution method.
4. To find the value of high resistances by Leakage method.
5. To study the characteristics of a solar cell and to find the fill factor.
6. To find the value of e/m for electrons by Helical method.
7. To find the ionisation potential of Argon/Mercury using a thyratron tube.
8. To study the variation of magnetic field with distance and to find the radius of coil by Stewart and Gee's apparatus.
9. To study the characteristics of (Cu-Fe, Cu-Constantan) thermo couple.
10. To find the value of Planck's constant by using a photo electric cell.
11. To find the value of co-efficient of self-inductance by using a Rayleigh bridge.
12. To find the value of Hall Co-efficient of semi-conductor.

13. To study the V-I characteristics of a p-n diode.
14. To find the band gap of intrinsic semi-conductor using four probe method.
15. To calculate the hysteresis loss by tracing a B-H curve.

Text/ Reference Books:

1. Advanced Practical Physics – B.L. Worshnop and H.T. Flint (KPH)
2. Practical Physics – S.L.Gupta &V. Kumar (Pragati Prakashan)
3. Advanced Practical Physics Vol. I& II – Chauhan & Singh (Pragati Prakashan)

CE-151C FUNDAMENTALS OF COMPUTER AND PROGRAMMING WITH C LAB

B. Tech I/II Semester

No. of Credits: 1		Sessional:	15 Marks
L T P Total		Practical:	35 Marks
0 0 2 2		Total :	50 Marks
		Duration of Exam:	2 Hours

Pre –Requisite: FOCP

Successive: KOM, OR

Course Objectives:

1. To understand the basic building blocks of C language like variables, data types, managing I/O etc.
2. To understand the different statements like sequential, decision making, iterative such as if-else, loops and derived data types like arrays, structures etc.
3. To learn about the concept of Pointers and understand functions and file handling.

Course Outcomes (COs): After studying this course the students will be able to:

CO 1- Implement the different statements like sequential, decision making, iterative such as if-else, loops and derived data types like arrays and structures.

CO 2- Implement the concept of Pointers and understand functions, file handling.

List of Experiments:

1. Write a Program to calculate sum of two numbers
2. Write a Program to calculate Simple Interest.
3. Write a Program to find larger among two numbers
4. Write a Program to find largest among three numbers
5. Write a Program to calculate roots of a quadratic equation
6. Write a Program to print 1 to 10 using loop
7. Write a Program to print even numbers from 2 to 100
8. Write a Program to print sum of digits of a number
9. Write a Program to print the reverse of a number entered by user

10. Write a Program to print table of a number
11. Write a Program to print the Fibonacci series
12. Write a Program to calculate factorial of a number
13. Write a Program to find a^b
14. Write a Program to check if number is Prime
15. Write a Print first n terms of Fibonacci Series
16. Write a Program to find largest and smallest element in an array
17. Write a Program to find sum of two 2-D arrays
18. Write a Program to multiply two 2-D arrays
19. Write a Program to use inbuilt string functions.
20. Write a Program to check whether entered string is palindrome
21. Write a Program to calculate factorial of a number using functions
22. Write a Program to find factorial using recursion
23. Write a Program to find length of a string using pointers
24. Write a Program to calculate marks using array of structures.
25. Write a Program to copy the contents of one file to another file

Reference Books:

1. Let Us C by Yashwant Kanetkar
2. Fundamentals of Computers and Programming with C by A. K. Sharma Dhanpat Rai publications
3. Test your C Skills by Yashwant Kanetkar

EE-151C BASIC ELECTRICAL ENGINEERING LAB

B. Tech I/II Semester

No. of Credits: 1		Sessional:	15 Marks
L T P Total		Practical:	35 Marks
0 0 2 2		Total :	50 Marks
		Duration of Exam:	2 Hours

Pre –Requisite: Basic Electrical Engineering

Successive: Nil

List of Experiments:

1. To verify KCL and KVL.
2. To verify Thevenin's & Norton's theorems.
3. To verify maximum power transfer theorem.
4. To verify Superposition theorems.
5. To study frequency response of a series R-L-C circuit and determine resonant frequency & Q- factor for various Values of R, L, C.
6. To study frequency response of a parallel R-L-C circuit and determine resonant frequency & Q -Factor for various values of R, L, C.
7. To find inductance of coil without core and with iron core.
8. To perform polarity test on single phase transformer.
9. To perform O.C. and S.C. test on single phase transformer.
10. To study various type of electrical instruments
11. To measurement of power and power factor in a three phase system by two wattmeter method.

HAS-159C LANGUAGE LAB
B. Tech I/II Semester

No. of Credits: 1	Sessional: 15 Marks
L T P Total	Practical: 35 Marks
0 0 2 2	Total : 50 Marks
	Duration of Exam: 2 Hours

Pre –Requisite: Interactive English

Successive: None

Course Objectives:

To guide the students to improve their conversational and linguistic skills including better command over spoken English. Introduce students to various scenarios to help them opt for appropriate responses on interpersonal level.

Course Outcomes (COs): The students will be trained to respond better to new scenarios that demand good communication skills.

1. The students will be able to resolve potential conflicts by avoiding communication gaps and overcoming barriers.
2. Students will learn to use skills effectively for enhancing performance and even improving upon their power to persuade.

Corporate Interaction & Communication

1. Presentations
2. Listening Skills & Language Lab (Practical) Interviews of Isaac Asimov, Richard Feynman, Steve Jobs and other scientists and technocrats. Other inspiring speeches on social issues as well as related to the corporate world and industry; Audio/Video Lessons and Observation
3. Group Discussions, Corporate Dialogue: Conflict-Resolution exercises; Role Play; Mock-interviews.
4. Internal Assessment: based on participation, short presentation & performance in interactive exercises: competence gauged through participation in various events organized in the classroom and at university level throughout the semester.

***Recommended*:**

1. Language Lab Software

ME-152C ENGINEERING DRAWING

B. Tech I/II Semester

No. of Credits: 2

L	T	P	Total
0	0	4	4

Sessional: 30 Marks
Practical: 70 Marks
Total : 100 Marks
Duration of Exam: 3 Hours

Pre-Requisite: None

Successive: Machine Drawing, Computer Aided Design

Course Objectives:

To understand the basic principles of engineering drawing and graphics and to apply the same to draw different types of projections.

Course Outcomes (COs): At the end of the course, the student shall be able to:

CO 1- Understand the basic principles of projections of points and lines.

CO 2- Understand the different orientations and projections of planes.

CO 3 - Understand projections and sectioning of solids in different orientations.

CO 4- Grasp the concepts of development of surfaces.

CO 5- Understand and draw orthographic and isometric view of an object.

Syllabus:

UNIT I **Introduction and Projections of Points:** Importance and scope of Engineering Drawing, Instruments, Lettering, Types of lines, Dimensioning, Different methods of projections, B.I.S Specifications, Introduction to AutoCAD.

Introduction to plane of projection, reference & auxiliary planes, projection of points in different quadrants.

UNIT II **Projection of Lines:** Projection of lines parallel to reference planes, perpendicular to reference planes, inclined to one reference plane and parallel to the other, inclined to both the reference planes, traces, true inclinations & true lengths of the lines.

UNIT III **Projection of Planes:** Parallel to one reference plane, inclined to one plane but perpendicular to the other, inclined to both reference planes.

UNIT IV **Projections and Sectioning of Solids :** Projection of Polyhedra, solids of revolution-in simple positions with axis perpendicular to a plane, with axis parallel to both planes, with axis parallel to one plane and inclined to the other.

Projection of section of prisms, pyramids, cylinders and cones with axis perpendicular to one reference plane and parallel to the other reference plane.

UNIT V **Development of Surfaces:** Development of simple object with and without sectioning.

UNIT VI **Orthographic and Isometric Projections:** Orthographic projections of simple machines components and Nuts, Bolted Joints, Screw threads.

Introduction to isometric projections, Isometric scale, Isometric projections/ views of plane figures like prisms, pyramids, cylinders and cones.

Text Books:

1. Machine Drawing - N D Bhatt and V M Panchal, Charotar Publishing House.
2. A Text Book of Machine Drawing - P S Gill Pub.: S K Kataria & Sons.
3. Engineering Graphics with Auto CAD 2002 - James D.Bethune, Pearson Education.
4. A Text Book of Machine Drawing by Laxmi Narayana and Mathur, M/s. Jain Brothers, New Delhi.
5. Machine Drawing by N Sidheshwar, Kannaieh, V S Sastry, TMH., New Delhi.
6. Fundamentals of Engineering Drawing by Luzaddder: PHI.
7. Fundamentals of Engineering Drawing by French and Vierk; Mc Graw Hill.

WS- 161C/ WS- 162C **WORK SHOP-1/II**

B. Tech I/ II- Semester

No. of Credits: 3	Internal: 30 Marks
L T P Total	External: 70 Marks
0 0 6 6	Total : 100 Marks
	Duration of Exam: 3 Hours

MECHANICAL WORKSHOP (Group –I)

Course Outcomes (COs): After studying this course the students would:

CO 1- Have exposure to mechanical workshop layout and safety aspects.

CO 2- Understand the functions of various machines and cutting tools used in machine shop.

CO 3- Practice real time job preparation using various operations related to machine shop such as filing, drilling, milling & turning.

CO 4 - Practice job preparation in welding shop.

CO 5 - Learn to use different measuring tools like vernier caliper, vernier height gauge and micrometer.

CO 6 - Practice job preparation in sheet metal shop.

List of Exercises:

Fitting, sheet metal and welding workshop:

1. To study layout, safety measures and different engineering materials (mild steel, medium carbon steel, high carbon steel, high speed steel and cast iron etc) used in workshop.
2. To study and use of different types of tools, equipments, devices & machines used in fitting, sheet metal and welding section.
3. To determine the least count of vernier calliper, vernier height gauge, micrometer and take different reading over given metallic pieces using these instruments.
4. To study and demonstrate the parts, specifications & operations performed on lathe machine.
5. To study and demonstrate the parts, specifications & operations performed on milling machine.
6. To study and demonstrate the parts, specifications & operations performed on shaper machine.
7. To prepare a job involving different type of filing practice exercise in specified dimensions.
8. To prepare a job involving multi operational exercise (drilling, counter sinking, tapping, reaming, hack sawing etc.)
9. To prepare a multi operational sheet metal job (self secured single groove joint/ hasp & stay etc.).
10. To practice striking an arc, straight short bead, straight continuous bead and re-start of electrode in flat position by arc welding on given M.S. plate as per size.
11. To practice tack weld of two close plate in flat position by arc welding on given M.S. plate as per size.
12. To practice close butt joint in flat position by arc welding on given M.S. plate as per size.

NOTE: - At least nine exercises should be performed from the above list; remaining three may either be performed from above list or designed by the concerned institution as per the scope of the syllabus and facilities available in institute.

WS- 161C/ WS- 162C **Workshop- I/II**

No. of Credits: 3

L T P Total **Internal: 30 Marks**
0 0 6 6 **External: 70 Marks**
Total: 100 Marks
Duration of Exam: 3 Hours

(Group –II)
PART-A
Computer Engineering Workshop

Course Outcomes (COs):

After the completion of the course the student will be able to:

CO1- Acquire skills in basic engineering practice.
CO2- Have working knowledge of various equipments used in workshop.
CO3- Have hands on experience about various machines and their components.
CO4- Obtain practical skills of basic operation and working of tools used in the workshop.

1. To study and demonstrate Block diagram of Digital Computer System and brief explanation of each unit.
2. To demonstrate History/ Generation/ classifications and different types of Personnel Computer.
3. To study and demonstrate internal parts of a Computer System (Card level) and other peripheral devices and explanation of POST & BIOS.
4. To study and demonstrate primary memory and secondary memory.
5. To demonstrate CPU Block diagram and other Peripheral chips, Mother Board/ Main Board and its parts, Connectors, Add On Card Slots etc.
6. To study working of various types of monitors: CRT type, LCD type & LED type.
7. To study Keyboard and Mouse: Wired, Wireless, Scroll & Optical with detail working.
8. To study Printers: Dot Matrix Printers, Daisy wheel Printers, Ink-Jet Printers and Laser Jet Printers with detailed working explanation.
9. Assembly / Installation and Maintenance of Personnel Computer Systems: Practical exercise on assembly of Personnel Computer System, Installation of Operating System: Windows & Linux etc, Installation of other Application Softwares and Utility Softwares, Fault finding in Personnel Computers: Software or Hardware wise, Virus: Introduction, its Types & Removal techniques, Data Backup and Restore, Data Recovery Concepts, Typical causes of Data loss.

10. To demonstrate networking concepts: Introduction of Connecting devices: Hub, Switch & Router etc, Networking Cable preparation: Normal & Cross Cables, Data Transferring Techniques from one Computer System to another Computer System, Configuration of Switch/ Routers etc.

PART-B
Electrical Workshop

1. Introduction of Electrical Safety precautions, Electrical Symbols, Electrical Materials, abbreviations commonly used in Electrical Engg. and familiarization with tools used in Electrical Works.
2. To make a Straight Joint & Tee joint on 7/22 PVC wire and Britannia Joint on GI wire.
3. To study fluorescent Tube Light, Sodium Lamp and High Pressure Mercury Vapour Lamp.
4. To study different types of earthing and protection devices e.g. MCBs, ELCBs and fuses.
5. To study different types of domestic and industrial wiring and wire up a circuit used for Stair case and Godown wiring.
6. To make the connection of fan regulator with lamp to study the effect of increasing and decreasing resistance in steps on the lamp.
7. To fabricate half wave and full wave rectifiers with filters on PCB.
8. Maintenance and Repair of Electrical equipment i,e Electric Iron , Electric Toaster , Water heater, Air coolers and Electric Fans etc.
9. To study soldering process with simple soldering exercises.
10. To make the connection of a three core cable to three pin power plug and connect the other cable end by secured eyes connection using 23/0.0076”or 40/0.0076” cable.

PART- C
Electronics Workshop

1. To study and demonstrate basic electronic components, Diode, Transistor, Resistance, Inductor and capacitor.
2. To study and demonstrate resistance color coding, measurement using color code and multimeter and error calculation considering tolerance of resistance.
3. To study and demonstrate Multimeter and CRO- front panel controls, description of block diagram of CRT and block diagram of CRO.

4. To study and demonstrate Vp(peak voltage),Vpp(peak to peak voltage), Time, frequency and phase using CRO.
5. Introduction to function generator. Functions of front panel controls and measurement of different functions on CRO.
6. To study and demonstrate variable DC regulated power supply, function of controls and DC measurement using multimeter and CRO.
7. Soldering practice on wire mesh or a resistance decade board includes fabrication, soldering, lacing, harnessing forming and observation.
8. Testing of components using multimeter and CRO like diode, transistor, resistance capacitor, Zener diode and LED.
9. To study and demonstrate rectification, half wave, Full wave and bridge rectifier. Fabrication, assembly and waveform observation.
10. To design and fabricate a printed circuit board of a Zener regulated/ series regulated power supply and various measurements, testing of power supply.

Note: At least 8 exercises are to be performed from each part by the students.

YMCA UNIVERSITY OF SCIENCE AND TECHNOLOGY, FARIDABAD
SCHEME OF STUDIES & EXAMINATIONS
B.TECH 2nd YEAR (SEMESTER – III)
ELECTRICAL ENGINEERING (2017-18)

Sl. No.	Course code.	Course Title	L	T	P	Credits	CAT code
1	MA-201C	Mathematics – III	4	0	0	4	BSC
2	EC-231C	Analog Electronics	3	1	0	4	PCC
3	EE-201C	Electrical Engineering Materials & Semiconductor Devices	3	0	0	3	PCC
4	EE-203C	Electrical Measurements & Instrumentation	4	0	0	4	PCC
5	EE-205C	Network Analysis & Synthesis	3	1	0	4	PCC
6	EE-207C	Electrical Machines-I	3	1	0	4	PCC
7	EC-251C	Analog Electronics Lab	0	0	2	1	PCC
8	EE-257C	Electrical Machines Lab-I	0	0	2	1	PCC
9	EE-255C	Network Analysis & Synthesis lab	0	0	2	1	PCC
10	EE-253C	EMMI Lab	0	0	2	1	PCC
11	EE-261C	Workshop	0	0	6	3	SEC
		Total	**20**	**3**	**14**	**30**	

DETAILED SYLLABUS

MA-201C	MATHEMATICS-III	BSC	4– 0–0	4 Credits

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

CO1	Apply z-transform to solve linear difference equations.
CO2	Evaluate Fourier series and transform
CO3	Understand and use complex variables and functions integrals.
CO4	Understand the probability distributions and Linear Programming Techniques

Detailed syllabus

UNIT-I Fourier Series
Introduction, Dirichlet Conditions, Fourier Series and its Coefficients for a given range, Even, odd functions and Fourier Series, Half-range Series, problems, Parseval Identity, Complex form of Fourier Series.

UNIT-II Fourier Transforms
Fourier Integral representation, Fourier integrals, Fourier transforms, Sine, Cosine transforms, inverse transforms, Illustrations, Properties, Parseval Identity, evaluation of certain real integrals

UNIT-III Z-Transforms
Z-transforms – illustrations and properties, initial and final value theorems, Convolution theorem, Inverse z-transforms, solution of difference equations using z-transforms.

UNIT-IV Complex Variables
Introduction, analytic functions, CR equations, harmonic functions, harmonic conjugate, properties, complex integration – line integrals in complex plane, Cauchy's theorem (with simple proof), Cauchy's theorem for multiple connected domains, Cauchy's integral formula, Taylor's and Laurent's theorems, series expansions, Zeros and singularities, classification, Residues, Residue Theorem, Evaluation of real integrals using residue theorem –3 types of integrals, conformal mapping, elementary transformations, examples, Bilinear transformations, cross ratios, problems.

UNIT-V Probability Distributions : Conditional probability, Bayes theorem and its applications, expected value of a random variable. Properties and application of Binomial, Poisson and Normal distributions.**(Qualitative only)**
Linear Programming: Linear programming problems formulation, solving linear programming problems using (i) Graphical method(corner point, iso cost/iso profit) (ii) Simplex method (iii) BIG M method (iv) Duality concept and Dual simplex method.

Reading:

1. Erwyn Kreyszig: Advanced Engineering Mathematics, John Wiley and Sons, 8th Edition.
2. B. S. Grewal: Higher Engineering Mathematics, Khanna Publications, 2016.
3. R. K. Jain & S. R. K. Iyengar: Advanced Engineering Mathematics, Narosa Publishing House, 2008
4. Handy A. Taha, Operations Research ,9th Edition,Pearson Publishing House

EE-201C	ELECTRICAL ENGINEERING MATERIALS AND SEMICONDUCTOR DEVICES	PCC	3–0– 0	3 Credits

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

CO1	Be able to select materials for design and construction
CO2	Be able to apply core concepts of Materials Science to solve engineering problems.
CO3	Be knowledgeable of contemporary issues relevant to Materials Science and Engineering
CO4	Be able to design and conduct experiments, and to analyze data
CO5	Understand the importance of life-long learning.

Detailed syllabus

UNIT-I- Conducting Materials:
Review of energy bands, description of materials, drift velocity, collision time, Mean free path, mobility, conductivity, relaxation time, factors affecting conductivity of materials, types of thermal conductivity, Wiedmann-Franz law, super conductivity, effect of magnetic field, conducting materials, applications.

UNIT-II- Dielectric Materials:
Behaviour of dielectric materials in static electric field, Dipole moments, Polarization, Dielectric constant, Polarizability, Susceptibility, mechanisms of polarization, behaviour in alternating field, dielectric loss, loss tangent, types of dielectric & insulating materials, electrostriction, Piezo-electricity, Applications.

UNIT-III- Magnetic Materials:
Permeability, Magnetic susceptibility, magnetic moment, Magnetization, Dipole moment, types of magnetic materials, Magnetostriction, eddy current & hysteresis losses, applications.

UNIT-IV- Semiconductors:
Review of Si and Ge as semiconducting materials, Continuity Equation, P-N junction, Drift & Diffusion, Diffusion & Transition capacitances of P-N junction.

UNIT-V- Construction And Characteristics Of Devices:
Brief introduction to Planar Technology for device fabrication, metal -semiconductor junctions (ohmic and non-ohmic), breakdown mechanisms in p-n junction, zener diode, electrical and optical excitation in diodes, LED, solar cells and photo-detectors.

UNIT-VI- Bipolar And Mos Devices:
BJT, UJT, JFET, MOSFETS

UNIT-VII- Power Devices:
Thyristor, Diac, Triac, GTO, IGBT, VMOS

Reading:

1. Electrical Engineering Materials: A.J. Dekker; PHI.
2. Solid State Electronic Devices: StreetMan & Banerjee; Pearson.
3. Electronic Devices & Circuits: Millman & Halkias; MGH.
4. Electronic Devices & Circuit Theory: Boylestad & Nashelsky; Pearson.
5.Semiconductor devices: Jaspreet Singh; John Wiley

EE-203C	ELECTRICAL MEASUREMENTS AND INSTRUMENTATION	PCC	4–0– 0	4 Credits

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

CO1	Compare performance of MC, MI and Dynamometer types of measuring instruments, Energy meters and CRO
CO2	Determine the circuit parameters using AC and DC bridges
CO3	Compute the errors in CTs and PTs
CO4	Select transducers for the measurement of temperature, displacement and Strain
CO5	Understand operating principles of electronic measuring instruments

Detailed syllabus

UNIT-I Measuring System Fundamentals
Absolute standards (International, Primary, Secondary, and Working standards),True Value, Errors(Gross, Systematic and Random); Static Characteristic of instruments(Accuracy, Precision, Sensitivity, Resolution and threshold).Classification of Instruments (based upon mode of measurement- Indicating , Recording and Integrating Instruments), Generalized Instrument (block diagram and description of various blocks), the three forces in an electromechanical indicating instrument (deflecting controlling and damping forces and the interplay between them), Comparison between gravity and spring(Qualitative Study)

UNIT-II Analog Ammeters and Voltmeters
PMMC and MI Instruments, Construction, Torque Equation, Range Extension, Effect of temperature, Classification, Errors, Advantages and Disadvantages.

UNIT-III Analog Wattmeters, Power Factor Meters and Energy Meter
Power and Power Factor, Electrodynamometer type wattmeter, power factor meter, Construction, theory, Shape of scale, torque equation, Advantages and disadvantages, active and reactive power measurement in single phase, Measurement in three phase. Single phase induction type energy meters, construction, theory, Operation, lag adjustments, Max Demand meters/indicators, Measurement of VAH and VARh.

UNIT-IV DC and AC Bridges
Measurement of resistance, Wheatstone Bridge, Kelvin's Bridge, Kelvin's Double Bridge, Measurement of inductance, Capacitance, Maxwell's Bridge, Desauty Bridge, Anderson Bridge, Schering Bridge, Wien Bridge, Applications and Limitations.

UNIT-V Instrument Transformers
Current Transformer and Potential Transformer - construction, theory, phasor diagram, errors, testing and applications.

UNIT-VI Transducers
Measurement of Temperature, RTD, Thermistors, LVDT, Strain Gauge, Piezoelectric Transducers, Digital Shaft Encoders, Tachometer, Hall effect sensors.

UNIT-VII Electronic Instruments

Electronic Display Device, Digital Voltmeters, Digital Energy meter, CRO, measurement of voltage and frequency, Lissajous Patterns, Plotting B-H curve of a magnetic material, Wave Analyzers, Harmonic Distortion Analyzer. Digital Energy Meter.

Reading:

1. W.D. Coopers and Helfrick, Modern Electronic instrumentation and Measurements Techniques, Prentice Hall of India Pvt. Ltd,
2. E.W. Gowlding and F.C.Widdis, Electrical Measurements and Measuring Instruments 5/e, Wheeler Publications.
3. U. A. Bakshi, A. V. Bakshi: Electrical Measurements and Instrumentation, Technical Publications.
4. A. K. Sawhney: A course in Electrical Measurements Electronic Measurements Instrumentation, Edition 11, Dhanpat Rai and Sons,
5. J. B. Gupta: A course in Electrical and Electronic Measurements and Instrumentation, 13/E, Kataria and Sons.

EE-205C	**NETWORK ANALYSIS AND SYNTHESIS**	**PCC**	**3– 1– 0**	**4 Credits**

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

CO1	Students will be able to solve the Network problems using differential equation approach and transform methods. They will also able to synthesize LC, RC & RL networks
CO2	Understand the fundamental concepts of network analysis and synthesis of two-port passive networks.
CO3	Understand the basic concepts of filters and designing of passive filters

Detailed syllabus

UNIT-I- Introduction
Introduction to lumped element electrical systems,Dual networks,Solution to some typical problems,Thevenin's and Norton theorem, equivalent circuits. Analogus system Electrical analogus to mechanical translational and rotational system. f-v analogy, f-I analogy.

UNIT-II- Transients:
Transient response of simple R - L, R - C and R - L - C series and parallel circuits using classical differential equation approach and Laplace Transform method. Response of RL, RC, RLC circuits for impulse and pulse and non sinusoidal periodic functions, excitations using Laplace Transform method.

UNIT-III- Network Functions : Terminal pairs or Ports, Network functions for one-port and two-port networks, poles and zeros of Network functions, Restrictions on pole and zero Locations for driving point functions and transfer functions, Time domain behaviour from the pole-zero plot.

UNIT-IV- Characteristics And Parameters Of Two Port Networks : Relationship of two-port variables, short-circuit Admittance parameters, open circuit impedance, parameters, Transmission parameters, hybrid parameters, relationships between parameter sets, Inter-connection of two port networks.

UNIT-V- Topology
Principles of network topology, graph matrices, network analysis using graph theory.

UNIT-VI- Types Of Filters And Their Characteristics: Filter fundamentals, high-pass, low-pass, band-pass, and band-reject Filters.

UNIT-VII- Network Synthesis:
Positive real functions, synthesis of one port and two port networks, elementary ideas of Active networks.

Reading:

1. Introduction to modern Network Synthesis: Van Valkenburg; John Wiley
2. Basic circuit theory: DasoerKuh; McGraw Hill.
3. A Course in Electrical Circuit Analysis by Soni& Gupta; Dhanpat Rai Publication.
4. Circuit Analysis: G.K. Mithal; Khanna Publication.
5. Networks and Systems: D.Roy Choudhury; New Age International.

EE-207C	Electrical Machines-I	PCC	3–1–0	4 Credits

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

CO1	Understand the construction and principle of operation of DC machines, single phase and three phase transformers and auto transformers.
CO2	Analyze the effect of armature reaction and the process of commutation.
CO3	Analyze parallel operation of DC Generators, single phase and three phase transformers
CO4	Evaluate performance of DC machines and transformers

Detailed syllabus

UNIT-I DC Machines:
Constructional details, Simplex and multiplex lap and wave windings; Methods of excitation, characteristics of saturated and un-saturated series, shunt, cumulatively and differentially compound excited machines operating as motors and generators; Armature reaction, demagnetizing and cross magnetizing ampere turns, compensating windings, commutation, interpoles.

Speed control methods of D.C. shunt & series motors, losses and efficiency; 3 point starter, 4-point Starter for D.C. motors and design of 3-point starter.
Testing of D.C. machines: No-load test, Direct load test, Hopkinson's and Field's test, Retardation test. Principle of operation and applications of Amplidyne and Metaldyne generators.

UNIT-II Single Phase Transformers:
Construction, principle of operation, EMF equation, phasor diagram; Equivalent circuit, determination of equivalent circuit parameters, Losses, calculation of efficiency and regulation by direct and indirect methods; Predetermination of performance by Sumpner's test, Load sharing and operation of transformers in parallel, Separation of no load losses by experimental
method, principle of auto transformer, Saving of copper compared to two winding transformer and its application; Cooling methods of transformers.

UNIT-III Three Phase Transformer:
Type of connections, Relation between line and phase voltages and currents, use of tertiary winding, Scott connection of transformers for phase conversion:

UNIT-IV Tap Changing Transformers:
Concept of tap changing, on-load and off-load tap changers, single phase and three phase induction regulators and moving coil regulators.

Reading:

1. P. S Bimbhra-Electrical Machines-Khanna Publishers, 2016
2. A.E Fitzgerald, Charles Kingsley, Stephen D Umans Electrical Machines –TMH Publishers, 6th Edn,.
3. Nagarath & D.P.Khothari : Electrical Machines, TMH Publishers, 4th Edn, 2016

4. J.B. Gupta: Theory &Performance of Electrical Machines SK Kataria & Sons,.
5. A.E. Clayton & C.I. Hancock Performance and Design of DC Machines.

EC-231C	ANALOG ELECTRONICS	PCC	3– 1– 0	4 Credits

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

CO1	Understand operation of analog devices and circuits.
CO2	Examine the operation of oscillators and amplifiers.
CO3	Design multi-vibrators and wave shaping circuits

Detailed syllabus

UNIT-I Over view of Semi Conductor Physics
Introduction, static characteristics of PN-Junction diode, zener diode, BJT, FET and MOSFETs

UNIT-II Power Supplies
Single phase half wave, full wave and bridge rectifiers with filters (LC and π), Regulated power supply, series voltage regulator, principles of uninterrupted power supply

UNIT-III Transistor Amplifiers
Bias stability and thermal runway, analysis of amplifier circuits using h-parameters, emitter follower, simplified CE hybrid model, CE short circuit current gain, single stage CE amplifier response, low frequency response of an RC coupled amplifier, gain-band width product, high frequency response of two cascaded CE stages.

UNIT-IV Feedback Amplifiers and Oscillators
Analysis of voltage series, voltage shunt, current series, current shunt, feedback amplifiers, stability of negative feedback amplifiers, analysis of RC phase-shift, Wien bridge, LC-oscillators
(using BJT's only) and crystal oscillators.

UNIT-V Direct Coupled Amplifiers
Analysis of differential amplifier configurations, CMRR, stability and drift problems, compensation techniques

UNIT-VI Power Amplifiers
Classification of power amplifiers, analysis of class-A, class-B and class-AB operations, push-pull amplifiers and complementary symmetry, harmonic distortion, and cross-over distortion in power amplifiers

UNIT-VII Wave Shaping Circuits
RC-low pass, high pass circuits, response to step, pulse ramp and square wave inputs, differentiating and integrating circuits, clipping circuits using diodes-single level and two-level clipping, clamping circuits using diodes.

UNIT-VIII Multivibrators And Sweep Circuits
Introduction to voltage sweep circuits, boot strap and miller sweep circuits, Astable and Monostable Multi-vibrators and Triggering methods.

Reading:

1. Ramakanth A. Gayakwad: Operational Amplifiers and Linear integrated circuits,
2. Stanley: Operational Amplifiers with Linear Integrated Circuits, Edition 4, Pearson Education India,
3. U. A. Bakshi, A. P. Godse: Linear integrated, Technical Publications

YMCA UNIVERSITY OF SCIENCE AND TECHNOLOGY, FARIDABAD
SCHEME OF STUDIES & EXAMINATIONS
B.TECH 2nd YEAR (SEMESTER – IV)
ELECTRICAL ENGINEERING (2017-18)

Sl. No.	Course code.	Course Title	L	T	P	Credits	CAT code
1	EE-202C	Power System -I	3	1	0	4	PCC
2	EC-232C	Digital Electronics	3	0	0	3	PCC
3	EE-204C	Electric & Magnetic Fields	3	1	0	4	PCC
4	EE-206C	Power Electronics-I	4	0	0	4	PCC
5	EE-208C	Electrical Machines-II	3	1	0	4	PCC
6	EE-258C	Electrical Machines-II Lab	0	0	2	1	PCC
7	EC-252C	Digital Electronics Lab	0	0	2	1	PCC
8	EE- 256C	Power Electronics Lab-I	0	0	2	1	PCC
9	EE -268C	Workshop-IV	0	0	6	3	SEC
10	AC	Mandatory Audit Course-I	2	0	0	0	MAC
11		MOOC	4	0	0	4	MOOCs
		Total	**22**	**3**	**12**	**29**	

EE-206C	Power Electronics - I	PCC	4– 0–0	4 Credits

Detailed syllabus

UNIT-I Thyristors
Characteristics and switching behavior of different solid-state devices namely Power Diode, SCR, UJT, TRIAC, DIAC, MOSFET, IGBT, Two-transistor analogy of SCR, Firing circuits of SCR and TRIAC, static and dynamic characteristics of SCR, SCR ratings.

UNIT-II Phase Controlled Rectifiers
Protection of SCR against over current, over voltage, high dV/dt, high dI/dt, Series and Parallel operation of SCR, commutation techniques of SCR.

UNIT-III Classification of Rectifiers, Phase controlled rectifiers: Single phase half wave circuit with different types of load , Single phase Fully controlled and half controlled rectifiers and their performance parameters.
Three phase half wave and full wave rectifiers and their performance parameters.

UNIT-IV Effect of source impedance on the performance of single phase and three phase controlled rectifiers.
Single-phase and three phase Dual Converter.

Reading:

1. M. Ramamoorthy.Thyristor and their applications, East West Publication
2. PS Bhimbra.Power Electronics, Khanna Publishers.
3. M.D Singh and KB Khanchandani, Power Electronics ,TMH Edition.
4. AK Gupta and LP Singh, Power Electronics,Dhanpat Rai Publishing Co.
5. Rama Reddy, Fundamental of Power Electronics, Narosa Publishing.

EC-232C	Digital Electronics	PCC	3–0– 0	3 Credits

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

CO1	Design combinational and sequential digital circuits to meet a Given specification and be able to represent logic functions in multiple forms—understanding the advantages and disadvantages of each.
CO2	Understand how CMOS transistors can be used to realize digital logic circuits and understand basic characteristics of logic gates (such as power, noise margins, timing, tri-state circuitry, etc.).
CO3	Understand numerical and character representations in digital logic including ASCII, sign magnitude, 2's complement, and floating point and the corresponding design of arithmetic circuitry.
CO4	Understand the importance and need for verification and testing of digital logic circuits.
CO5	Understand the principle of operation and design of a wide range of electronic circuits such as computer RAM and ROM.
CO6	Understand how convert signals from analog to digital and digital to analog.

Detailed syllabus

UNIT-I Number system and codes: Analog versus digital, merits of digital system, number systems, base conversions, complements of numbers, weighted and unweighted codes, and error detecting and correcting codes.

UNIT-II Switching algebra and switching functions: Boolean algebra, postulates, theorems and switching algebra, completely and incompletely specified switching functions, minimization of Boolean functions using Karnaugh map and Quine McCluskey methods.

UNIT-III Logic Families: Characteristic parameters, Transistor-Transistor logic, TTL subfamilies, CMOS logic family, Implementation of Boolean function using CMOS logic, various logic gate ICs.

UNIT-IV Combinational Logic: Principles and practices, Logic design of combinational circuits code conversion, parity generation and checking, multiplexers, de-multiplexers, encoders, decoders, buffers, tri-state buffers, IC Versions of Combinational logic circuits.

UNIT-V Sequential Logic: Review of Flip-Flops, Finite State model of sequential Circuits, modulus counter, shift registers, IC Version of sequential logic circuits.

UNIT-VI Semiconductor Memories: RAM, ROM (Cell Structures and Organization on Chip)

UNIT-VII Data Conversion Circuits: D/A converter specifications, A/D converter specifications, D/A converters such as DAC 0808, DAC 1408/1508, Integrated circuit A/D Converters ADC 0808, ICL 7106/7107.

Reading:

1. Linear Integrated Circuits, S Salivahanan, TATA MC Graw Hill.
2. Jain R.P, "Modern Digital Electronics", Tata Mc Graw Hill,
3. Floyd T.L., "Digital Fundamentals ", Prentice Hall,
4. Anil K. Mani: Digital Electronics-Principles and Integrated Circuits, Wiley-India,
5. Herbert Taub, Schilling: Digital Integrated Electronics, TATA MC Graw Hill,

EE-208C	Electrical Machines-II	PCC	3–1–0	4 Credits

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

CO1	Understand the construction and principle of operation of induction machines and synchronous machines.
CO2	Evaluate performance characteristics of induction machine and synchronous machines
CO3	Analyze speed torque characteristics and control the speed of induction motors
CO4	Analyse the effects of excitation and mechanical input on the operation of synchronous machine

Detailed syllabus

UNIT-I 3-Phase Induction Motor:
Constructional details, types, production of magnetic field-principle of operation, Phasor diagram, equivalent circuit. Torque equation-starting and maximum torque-maximum output, slip for max. Output, Torque-slip characteristics, losses and efficiency. Testing-no load and blocked rotor tests-determination of equivalent circuit parameters ,Pre-determination of performance from equivalent circuits and circle diagram, Methods of starting-auto transformer, star delta and rotor resistance starters, Double cage induction motor –construction, theory, equivalent circuit, Characteristics and applications. Induction generator-principle of operation, equt. Circuit and application.

UNIT-II Synchronous Generator:
Construction, types, winding factors, production of emf, harmonics, armature reaction, Synchronous reactance, phasor diagram, load characteristics, open circuit and short circuit tests.

Methods of pre-determination of regulation by synchronous impedance, ampere turn, Potier triangle and ASA methods. Two reaction theory –analysis and its application for the pre-determination of regulation of salient pole alternator, phasor diagram. Slip test, power angle characteristics, synchronization and synchronizing power. Parallel operation and load sharing– operation on infinite bus-bar typical applications.

UNIT-III Synchronous Motor:
Theory of operation–phasor diagrams, variation of current and power factor with excitation. Hunting and its suppression, determination and pre-determination of V and inverted V curves. Excitation circles, power circles, method of starting.

Reading:

1. P.S. Bimbhra: Electrical Machinery –Khanna Publishers.
2. Charbs.I. Hubert: Electric Machines –Latest Edition –Pearson

3. Stephen.J.Chapman: Electric Machinery –Mc Graw Hill International Edition,
4. A.E. Fitzgerald, Charles Kingsley, Stephen D. Umans: Electric Machinery

EE-202C	Power Systems-I	PCC	3– 1–0	4 Credits

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

CO1	Understand the operation of conventional generating stations and renewable sources of electrical power.
CO2	Evaluate the power tariff methods.
CO3	Determine the electrical circuit parameters of transmission lines
CO4	Understand the layout of substation and underground cables and corona.

Detailed syllabus

UNIT-I Introduction: Typical Layout of an Electrical Power System–Present Power Scenario in India.

Generation of Electric Power: Conventional Sources (Qualitative):

Hydro station, Steam Power Plant, Nuclear Power Plant and Gas Turbine Plant

Non Conventional Sources (Qualitative):

Ocean Energy, Tidal Energy, Wave Energy, wind Energy, Fuel Cells, and Solar Energy, Cogeneration and energy conservation and storage.

UNIT-II Economics of Generation:

Introduction, definitions of connected load, maximum demand, demand factor, load factor, diversity factor, Load duration curve, number and size of generator units. Base load and peak load plants. Cost of electrical energy-fixed cost, running cost, Tariff on charge to customer.

UNIT-III A.C. Distribution:

Introduction, AC distribution, Single phase, 3-phase, 3 phase 4 wire system, bus bar arrangement, Selection of site for substation .

UNIT-IV Overhead Line Insulators:

Introduction, types of insulators, Potential distribution over a string of suspension insulators, Methods of equalizing the potential, testing of insulators.

UNIT-V Insulated Cables:

Introduction, insulation, insulating materials, Extra high voltage cables, grading of cables, insulation resistance of a cable, Capacitance of a single core and three core cables, Overhead lines versus underground cables, types of cables.

UNIT-VI Inductance and Capacitance Calculations of Transmission Lines:

Line conductors, inductance and capacitance of single phase and three phase lines with symmetrical and unsymmetrical spacing, Composite conductors-transposition, bundled conductors, and effect of earth on capacitance.

UNIT-VII Mechanical Design of Transmission Lines-

Different types of tower, sag-tension calculations, sag-template, string charts, vibrations & damaging Corona-corona losses, radio & audio noise, transmission line – communication line interference.

Reading:

1. W.D.Stevenson –Elements of Power System Analysis, Fourth Edition, McGraw Hill, .
2. C.L. Wadhwa –Generation, Distribution and Utilization of Electrical Energy, New Age International, 2016
3. C.L. Wadhwa –Electrical Power Systems, New Age International, 216
4. M.V. Deshpande –Elements of Electrical Power Station Design, Third Edition, Wheeler Pub. 1
5. H.Cotton & H. Barber-The Transmission and Distribution of Electrical Energy,ELBS, B.I.Pub.,

EE-204C	Electric and Magnetic Fields	PCC	3–1– 0	4 Credits

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

CO1	Compute electric and magnetic fields for symmetrical charge and current configurations
CO2	Determine voltage gradients for simple charge and current configurations and the force between charges and currents.
CO3	Calculate capacitance and inductance of common conductor configurations and the energy stored.
CO4	Examine time varying fields for torque developed, emf induced and energy stored

Detailed syllabus

UNIT-I- Static Electric Fields

Coulomb‘s Law, Introduction to Del operation, Study of Del operation on scalar and vector and its interpretation, Laplacian operator, Stoke‘s Theorem and Divergence Theorem, Gauss‘s Law, potential function, field due to a continuous distribution of charge, equi-potential surfaces, Poison ‘physical s equation, Laplace‘s equation, method of electrical images, capacitance, electro-static energy, boundary conditions, the electro-static uniqueness theorem for field of a charge distribution, Dirac-Delta representation for a point charge and an infinitesimal dipole.

UNIT-II- Steady Magnetic Fields

Faraday Induction law, Ampere‘s Work law in the differential vector form, Ampere's law for a current element, magnetic field due to volume distribution of current and the Dirac-delta function, Ampere‘s Force Law, boundary conditions for magneto static, magnetic vector potential, scalar vector potential (Alternative derivation).

UNIT-III- Time Varying Fields

Introduction to conduction current, convection current and displacement current; Equation of continuity for static and time varying fields, inconsistency of Ampere‘s law, Maxwell‘s field equations and their interpretation, solution for free space conditions, electromagnetic waves in a homogeneous medium, Discussion on : Group velocity, Phase velocity, Attenuation constant, Phase constant, Refractive index; propagation of uniform plane-wave, relation between E & H in a uniform plane-wave, wave equations for conducting medium, Maxwell‘s equations using phasor notation, wave propagation in a conducting medium, Loss Tangent, conductors, dielectrics, wave propagation in good conductor and good dielectric, depth of penetration, polarization, linear, circular and elliptical,

UNIT-IV- Reflection and Refraction Of E M Waves

Reflection and refraction of plane waves at the surface of a perfect conductor & perfect dielectric (both normal incidence as well as oblique incidence), Brewester's angle and total internal reflection, reflection at the surfaces of a conductive medium, surface impedance, transmission-line analogy, poynting theorem, interpretation of E x H, power loss in a plane conductor.

UNIT-V-Transmission Line Theory

Transmission line as a distributed circuit, Primary and Secondary constant, Transmission line equation, input impedance of terminated line, infinite transmission line, Distortion less and Loss less transmission line, Open circuit and short circuit transmission line, Reflection coefficient, Standing waves, VSWR, Smith's chart and its applications.

Reading:

1. William H.Hayt Jr. & John A.Buck: Engg. Electromagnetics,.
2. K. K. Shah: Introduction to electromagnetics-Dhanpat Rai 2016.
3. Matthew Sadiku: Elements of Electromagnetics, Oxford University Press,.
4. Ashutosh Pramanik: Electromagnetics, Theory & Applications,.
5. Nathan Ida: Engg. Electromagnetics, Springer

EE-258C	Electrical Machines Lab-II	PCC	0–0–2	1 Credits

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

CO1	Predetermine the performance of induction motor by conducting no-load and blocked rotor tests.
CO2	Determine the performance of induction motor by direct load test.
CO3	Predetermine the performance of cylindrical pole synchronous machine by oc and sc test.
CO4	Determine the direct and quadrature axis reactances by conducting slip test.
CO5	Synchronisation of synchronous machine to mains and determine V and inverted V curves

Detailed syllabus

1. Determination of Equivalent circuit parameters of three phase induction motor
2. Brake test on 3-phase induction motor
3. Circle diagram of 3-phase induction motor
4. Speed control of 3-phase induction motor
5. Single phase operation of 3-phase induction motor
6. Regulation of 3-phase alternator by Z.P.F. method
7. Parallel operation of alternators
8. Determination of V and inverted V curves of 3-phase synchronous machine
9. Characteristics of 3-phase Schrage motor
10. No load and load Characteristics of an Amplidyne
11. Determination of equivalent circuit parameters of single phase induction motor.

YMCA UNIVERSITY OF SCIENCE AND TECHNOLOGY, FARIDABAD
SCHEME OF STUDIES & EXAMINATIONS
B.TECH 3rd YEAR (SEMESTER – V)
ELECTRICAL ENGINEERING (2017-18)

Sl.No.	Course code.	Course Title	L	T	P	Credits	CAT code
1	EE-301C	Control Systems	3	1	0	4	PCC
	EE-303C	Power Electronics-II	3	1	0	4	PCC
2	EE-305C	Electrical Machines-III	3	0	0	3	PCC
3	EE-307C	Power Systems-II	3	1	0	4	PCC
4	MB-321C	Engineering Economics & Industrial Management	3	0	0	3	GEC
5	EE-355C	Electrical Machines Lab-III	0	0	2	1	PCC
6	EE-357C	Power System Lab	0	0	2	1	PCC
7	EE-353C	Power Electronics Lab-II	0	0	2	1	PCC
8	EE-351C	Control system lab	0	0	2	1	DEC
9	EE-369C	Workshop-V	0	0	6	3	SEC
		Total	15	3	14	25	

EE-301C	Control Systems	PCC	3–1–0	4 Credits

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

CO1	Analyse electromechanical systems by mathematical modelling.
CO2	Determine Transient and Steady State behavior of systems using standard test signals.
CO3	Analyze linear and non-linear systems for steady state errors, absolute stability and relative stability
CO4	Identify and design a control system satisfying requirements..

Detailed syllabus

UNIT-I Introduction: System, control system, types of control systems, open-loop and closed loop systems, types of feedback, feedback and its effects. Concept of linearization with incremental changes.

UNIT-II Mathematical Modelling of Physical Systems: Mathematical modelling of Electrical, Mechanical and Electro-mechanical elements, Synchros D.C. motors, two-phase a.c motors. Block diagram representation of them. Concept and use of Transfer function.

UNIT-III Transfer Function from Block Diagrams and Signal Flow Graphs: Introduction, impulse response and its relation with transfer function of linear systems. Block diagram reduction technique and signal flow graph, Mason's gain formula.

UNIT-IV State Variable Analysis of Linear Dynamic Systems: State variables, state variable representation of system, dynamic equations, merits for higher order differential equations and solution. Concept of controllability and observability and techniques to test them.

UNIT-V Time Domain Analysis of Control Systems: Introduction- typical Test signals, time domain indices, steady state error constants, error series, concept of BIBO stability, absolute stability, Routh-Hurwitz Criterion. Effect of P, PI & PID controllers.

UNIT-VI Root Locus Techniques: Introduction, Root loci theory, Application to system stability studies. Illustration of the effect of addition of a zero and a pole.

UNIT-VII Frequency Domain Analysis of Control Systems: Introduction, polar plots, Nyquist stability criterion, Frequency domain indices (gain margin, phase margin, bandwidth), Bode plots, application of Bode plots, M&N circles, Nichols charts, Application of Nichols charts.

UNIT-VIII Design Of Compensators: Need of compensators, design of lag and lead compensators using Bode plots.

Reading:

1. B.C. Kuo: Automatic Control Systems – Prentice Hall of India,
2. I.J. Nagarath, M.Gopal: Control Systems Engineering (2nd-Edition) —New Age Pub. Co.

EE-303C	Power Electronics-II	PCC	3–1–0	4 Credits

Detailed syllabus

UNIT-I D.C. to D.C. Converter:
Classification of choppers. Principle of operation of step up & step down chopper, Multi Quadrant operation of choppers, steady state analysis of class A chopper, step up chopper, Current commutated and voltage commutated chopper.

UNIT-II A.C. to A.C. Converter:
Classification, principle of operation of step up and step down cycloconverter. Single phase to single phase cycloconverter Three phase to single phase cycloconverter. Three phase to three phase cycloconverter. Output voltage equation of cycloconverter. Single phase half wave & full wave AC Voltage regulator with different types of load .

UNIT-III D.C. to A.C. Converter:
Classification, series and parallel inverter, single phase voltage source inverter, , Half bridge and full bridge inverter, voltage control in single phase inverters, PWM inverter, reduction of harmonics, current source inverter, three phase bridge inverter with 180^0 & 120^0 conduction mode.

UNIT-IVApplication of Power Electronics converters:
Introductoin to Switched mode power supplies, induction heating. Block diagram of D.C. and A.C. motor speed control.

Reading:
1. Jacob, Michael Power Electronics: Principles & Application, Vikas Publishing House Pvt. Ltd.
2. M.H. Rashid, Power Electronics : Circuits, devices and applications , PHI.
3. Ned Mohan, Tore M. Undeland, William P. Robbins, Power Electronics : Converters, Applications and Design , John Wiley & Sons.
4. P.S. Bimbhra, Power Electronics .
5. M. Ramamoorthy An Introduction to Thyristors and their applications East-West Press.
6. M.D. Singh and K.B. Khanchandani, Power Electronics, Tata McGraw-Hill.
7. A.K. Gupta & L.P. Singh, Power Electronics and Introduction to Drives Dhanpat Rai Publishing Co.

EE-305C	Electrical Machines-III	PCC	4–0– 0	4 Credits

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

CO1	Understand the working of single phase induction motors
CO2	Analyze and model single phase induction motor, reluctance motor, stepper motor, hysteresis motor and universal motors
CO3	Analyze the operation and performance of PMDC and BLDC motors
CO4	Design of electrical circuit, magnetic circuits and main dimensions of transformers, three phase induction machine and synchronous machines

Detailed syllabus:

UNIT-I Single Phase Induction Motors:
Principle of operation, Double revolving field theory, speed-torque characteristics, Equivalent circuit, Phasor diagrams, Determination of equivalent circuit parameters, Starting methods, Split phase starting, Resistance starting, Capacitance starting, Shade pole starting, Speed control methods, Applications, Principle of cross field theory, Problem on all the above motors.

UNIT-II Single Phase Synchronous Motors:
Construction, principle of operation and applications of Reluctance motors, Hysteresis motors, Sub-synchronous motors.

UNIT-III AC Series Motors:
Construction, Principle of operation, Phasor diagrams and Characteristics of Single phase and Three Phase AC Series motors, Simple and compensated motors, Universal motors and their Applications, Problems on all the above motors.

UNIT-IV Schrage Motor:
Construction, Principle of operation, Speed and power factor control, Applications.

UNIT-V Special Purpose Machines: Construction and principle of operation of Stepper motors, Permanent magnet DC motors, Brushless DC motors, Linear Induction motors and their Applications, Problems on all the above motors.

UNIT-VI Multi Winding Transformers: Construction, Equivalent circuits, Determination of equivalent circuit parameters, Voltage regulation, Efficiency calculations.

UNIT-VII Energy Efficient Machines (Qualitative treatment only):
Construction, Basic Concepts, losses minimization and efficiency calculations of Energy efficient AC machines.

UNIT-VIII Super Conducting Machines (Qualitative treatment only):

Construction, Principle of operation and basic concepts of super conducting AC machines.

Reading:

1. A.E.Fitzgerald, Charles Kingsley and Stepen D.Umans: Electric Machinery, Tata McGraw-Hill Pub,
2. P.S.Bimbhra: Generalized Theory of Electrical Machines, Khanna Pub. 2016.
3. D.P. Kothari and I.J.Nagarath: Electric Machines: Tata McGraw-Hill Pub., 2016
4. P.S. Kenjo and S.Nagamori: Permanent Magnet DC motors, Clarendon Press, Oxford, .
5. J.B.Gupta: Theory and Performance of Electrical Machines, S. K. Kataria & Sons,

EE-307C	Power Systems-II	PCC	3–1–0	4 Credits

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

CO1	Analyze transmission line performance.
CO2	Apply load compensation techniques to control reactive power
CO3	Understand the application of per unit quantities.
CO4	Design over voltage protection and insulation coordination
CO5	Determine the fault currents for symmetrical and unbalanced faults

Detailed syllabus

UNIT-I Performance of Lines

Representation of lines, short transmission lines, medium length lines, nominal T and PI-representations, long transmission lines. The equivalent circuit representation of a long Line, A, B, C, D constants, Ferranti Effect, Power flow through a transmission line, receiving end power circle diagram.

UNIT-II Voltage Control

Introduction – methods of voltage control, shunt and series capacitors / Inductors, tap changing transformers, synchronous phase modifiers.

UNIT-III Compensation in Power Systems

Introduction - Concepts of Load compensation – Loadability characteristics of overhead lines – Uncompensated transmission line – Symmetrical line – Radial line with asynchronous load – Compensation of lines.

UNIT-IV Per Unit Representation of Power Systems

The one line diagram, impedance and reactance diagrams, per unit quantities, changing the base of per unit quantities, advantages of per unit system.

UNIT-V Travelling Waves on Transmission Lines

Production of traveling waves, open circuited line, short circuited line, line terminated through a resistance, line connected to a cable, reflection and refraction at T-junction line terminated through a capacitance, capacitor connection at a T-junction, Attenuation of travelling waves.

UNIT-VI Overvoltage Protection and Insulation Coordination

Over voltage due to arcing ground and Peterson coil, lightning, horngaps, surge diverters, rod gaps, expulsion type lightning arrester, valve type lightning arrester, ground wires, ground rods, counter poise, surge absorbers, insulation coordination, volt-time curves.

UNIT-VII Symmetrical Components and Fault Calculations

Significance of positive, negative and zero sequence components, Average 3-phase power in terms of symmetrical components, sequence impedances and sequence networks, fault calculations, sequence network equations, single line to ground fault, line to line fault, double line to ground fault, three phase fault, faults on power systems, faults with fault impedance, reactors and their location, short circuit capacity of a bus.

Reading:

1. John J. Grainger & W.D. Stevenson: Power System Analysis – Mc Graw Hill International.
2. C.L. Wadhwa: Electrical Power Systems – New Age International Pub. Co., 2016.
3. Hadi Scadat: Power System Analysis – Tata Mc Graw Hill Pub. Co.
4. W.D. Stevenson : Elements of Power system Analysis – McGraw Hill International Student Edition.
5. D.P. Kothari and I.J. Nagrath, Modern Power System Analysis - Tata Mc Graw Hill Pub. Co., New Delhi, 2016

EE-357C	Power Systems Laboratory	PCC	0–0– 2	1 Credits

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

CO1	Determine the performance characteristics of a long transmission line and its reactive power requirement.
CO2	Compute fault currents for faults on power system elements.
CO3	Use modern software tools for power system simulation studies.
CO4	Use AI techniques for power system studies

Detailed syllabus

1. Voltage regulation and efficiency of long transmission line.
2. Reactive power control of long transmission line.
3. A, B, C, D constants of long transmission line.
4. Operating characteristics of Static differential Relay.
5. Operating characteristics of IDMT over current relay.
6. Symmetrical component analyzer.
7. Fault studies on DC Network Analyzer.
8. Sequence reactance of power system elements and fault studies.
9. Reactive power control using Tap changing transformer.
10. Simulation of long line and reactive power control in EMTP.
11. Measurement of High AC Voltages using Sphere gap.
12. Tracking and Treeing test on surface of solid insulation.
13. Determination of breakdown strength of oil.
14. Generation of different impulse waveforms.
15. Determination of breakdown characteristics of air gap.

EE-351C	Control Systems Laboratory	DEC	0– 0–2	1 Credits

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

CO1	Evaluate the characteristics of a given AC and DC servo motor.
CO2	Determine the performance of first and second order systems in time domain.
CO3	Analyze second order systems using frequency domain analysis.
CO4	Design of feedback control systems

Detailed syllabus

1. Speed-torque characteristics of AC servo-motor,
2. Study of effects of feedback,
3. Time-response of first and second order systems,
4. Frequency-response of second order system,
5. Study of PID controller,
6. Design of lag and lead compensator,
7. Study of synchro,
8. Determination of transfer function of a DC motor,
9. Design of PID controller,
10. Study of feed-forward control,
11. Design of two loop systems.

New Course

MB 321C	Engineering Economics & Industrial Management	GEC	3–0– 0	3 Credits

Pre-requisites: None

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

CO1	Understand the macro-economic environment of the business and its impact on enterprise
CO2	Understand the basic principles, approaches and functions of management
CO3	Understand marketing management process to discuss marketing mix in formulation of marketing strategies during the life cycle of product.
CO4	Outline various techniques for improving productivity using work study and understand concepts of quality management

Detailed syllabus.

Engineering Economics: Introduction to Engineering Economics – Fundamental concepts – Time value of money – Cash flow and Time Diagrams – Choosing between alternative investment proposals – Methods of Economic analysis. The effect of borrowing on investment- Various concepts of National Income – Significance of National Income estimation and its limitations, Inflation –Definition – Process and Theories of Inflation and measures to control, New Economic Policy 1991 – Impact on industry.
Accountancy Principles,Preparation of Profit & Loss account, Balance Sheet, Techniques of Costing and Breakeven analysis

Industrial Management:- Nature, significance and role of management organizations. Evolution of industry and professional management; Functions of management; Organization structures; Hawthorne Experiments and informal organizational structures; Motivational theories and leadership styles.

Marketing Management: Marketing management process; 4P's of marketing mix; Target marketing; Product life cycle and marketing strategies.

Work Study: Productivity and its role in the economy; Techniques for improving productivity; Method study; Principles of motion economy; Stop watch time study; Work sampling.

Quality Management: Dimensions of quality; Process control charts; Acceptance sampling; Taguchi's Quality Philosophy; Quality function deployment; Introduction to TQM.

Project Scheduling: PERT/CPM

Reading:

1. Henry Malcom Stenar, Engineering Economic Principles, McGraw Hill, 2005.

YMCA UNIVERSITY OF SCIENCE AND TECHNOLOGY, FARIDABAD
SCHEME OF STUDIES & EXAMINATIONS
B.TECH 3rd YEAR (SEMESTER – VI)
ELECTRICAL ENGINEERING (2017-18)

Sl.No.	Course Code	Course Title	L	T	P	INT.	Examination		Total Marks	Credits
							Theory	Practical		
1	EE-302C	Power System Operations & Control	3	0	0	25	75	-	100	3
2	EE-304C	Power System Protection	3	1	0	25	75	-	100	4
3		Elective-I	3	0	0	25	75	-	100	3
4		Elective-II	3	0	0	25	75	-	100	3
5	CS-306C	Data Structures	3	0	0	25	75	-	100	3
6	EC-355C/ EE- 352C	Digital Signal Processing Lab/ Design of Electrical Systems Lab	0	0	2	15	-	35	50	1
7	EC-358C	Micro Processor & Application Lab	0	0	2	15	-	35	50	1
8	CS-356C	Data Structures lab	0	0	2	15	-	35	50	1
9	EE-364C	Workshop-VI	0	0	6	30	-	70	100	3
10	AC-101C	Mandatory Audit Course- II	2	0	0	25	75	-	100	0
11	OE-390	General Elective – I	3	0	0	25	75	-	100	3
		TOTAL	**20**	**1**	**12**	**250**	**525**	**175**	**950**	**25**

List of Electives

3rd Year 6th Semester

EE -311C Computer Organization

EE- 312C Design of Electrical Systems

EC-335C Digital Signal Processing

EC-308C Microprocessors and applications

EE -317C Modelling and Analysis of Electrical machines

EE-302C	Power Systems Operation and Control	PCC	3–1–0	4 Credits

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

CO1	Understand operation and control of power systems.
CO2	Analyze various functions of Energy Management System (EMS) functions.
CO3	Analyze whether the machine is in stable or unstable position.
CO4	Understand power system deregulation and restructuring

Detailed syllabus

UNIT-I Load Flow Studies:
Introduction, Bus classification -Nodal admittance matrix - Load flow equations - Iterative methods - Gauss and Gauss Seidel Methods, Newton-Raphson Method-Fast Decoupled method-Merits and demerits of the above methods-System data for load flow study.

UNIT-II P –Q Control:
Effect of synchronous machine excitation-Power angle of a synchronous machine-Specification of bus voltagesCapacitor banks, control by transformers.

UNIT-III Economic Operation Of Power Systems:
Distribution of load between units within a plant-Transmission loss as a function of plant generation, Calculation of loss coefficients-Distribution of load between plants.

UNIT-IV Load Frequency Control:
Introduction, load frequency problem-Megawatt frequency (or P-f) control channel, MVAR-voltages (or Q-V) control channel-Dynamic interaction between P-f and Q-V loops. Mathematical model of speed-governing system-Turbine models, division of power system into control areas, P-f control of single control area (the uncontrolled and controlled cases)-P-f control of two area systems (the uncontrolled cases and controlled cases)

UNIT-V Power System Stability:
The stability problem-Steady state stability, transient stability and Dynamic stability-Swing equation. Equal area criterion of stability-Applications of Equal area criterion, Step by step solution of swing equation-Factors affecting transient stability, Methods to improve steady state and Transient stability, Introduction to voltage stability

UNIT-VI Power System Deregulation (Qualitative treatment only)
Introduction - Power system restructuring models- responsibilities and functions of independent system operator (ISO) – Ancillary Services

Reading:

1. C.L.Wadhwa, Electrical Power Systems, New Age International Publishing Co., 2016.
2. D.P.Kothari and I.J.Nagrath, Modern Power System Analysis, Tata McGraw Hill Education Private Limited 2016.

EE-304C	Power System Protection	PCC	3–0–0	3 Credits

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

CO1	Compare and contrast electromagnetic, static and microprocessor based relays
CO2	Apply technology to protect power system components.
CO3	Select relay settings of overcurrent and distance relays.
CO4	Analyse quenching mechanisms used in air, oil and vacuum circuit breakers

Detailed syllabus

UNIT-I Protective Relays
Introduction, Need for power system protection, effects of faults, evolution of protective relays, zones of protection, primary and backup protection, essential qualities of protection, classification of protective relays and schemes, current transformers, potential transformers, basic relay terminology.

UNIT-II Operating Principles and Relay Construction
Electromagnetic relays, thermal relays, static relays, microprocessor based protective relays.

UNIT-III Overcurrent Protection
Time-current characteristics, current setting, over current protective schemes, directional relay, protection of parallel feeders, protection of ring mains, Phase fault and earth fault protection, Combined earth fault and phase fault protective scheme, Directional earth fault relay.

UNIT-IV Distance Protection
Impedance relay, reactance relay, MHO relay, input quantities for various types of distance relays, Effect of arc resistance, Effect of power swings, effect of line length and source impedance on the performance of distance relays, selection of distance relays, MHO relay with blinders, Reduction of measuring units, switched distance schemes, auto re-closing.

UNIT-V Pilot Relaying Schemes
Wire Pilot protection, Carrier current protection.

UNIT-VI Ac Machines and Bus Zone Protection
Protection of Generators, Protection of transformers, Bus-zone protection, frame leakage protection.

UNIT-VII Static Relays
Amplitude and Phase comparators, Duality between AC and PC, Static amplitude comparator, integrating and instantaneous comparators, static phase comparators, coincidence type of phase comparator, static over current relays, static directional relay, static differential relay, static distance relays, Multi input comparators, concept of Quadrilateral and Elliptical relay characteristics.

UNIT-VIII Microprocessor Based Relays

Advantages, over current relays, directional relays, distance relays.

UNIT-IX Circuit Breakers

Introduction, arcing in circuit breakers, arc interruption theories, re-striking and recovery voltage, resistance switching, current chopping, interruption of capacitive current, oil circuit breaker, air blast circuit breakers, SF6 circuit breaker, operating mechanism, selection of circuit breakers, high voltage d.c. breakers, ratings of circuit breakers, testing of circuit breakers.

UNIT-X Fuses

Introduction, fuse characteristics, types of fuses, application of HRC fuses, discrimination.

Reading:

1. Badriram and D.N. Vishwakarma, Power System Protection and Switchgear.
2. U.A.Bakshi, M.V.Bakshi: Switchgear and Protection, Technical Publications.
3. C.Russel Mason – "The art and science of protective relaying, Wiley Eastern,
4. L.P.Singh "Protective relaying from Electromechanical to Microprocessors", New Age International

CS-306C	DATA STRUCTURES	PCC	3–0–0	3 Credits

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

CO1	Understand the concept of ADT
CO2	Identify data structures suitable to solve problems
CO3	Develop and analyze algorithms for stacks, queues
CO4	Develop algorithms for binary trees and graphs
CO5	Implement sorting and searching algorithms
CO6	Implement symbol table using hashing techniques

Detailed syllabus

Introduction to Data Structures, Asymptotic Notations, Theorems and Examples based on Asymptotic Notations, Linear and Non linear Data Structures, Stack Data Structure and its Applications, Queue Data Structure and its Applications, Singly, Doubly and Circular Linked Lists, Trees and tree traversals, Dynamic Sets and Operations on Dynamic Sets, Binary Search Tree and its Operations, Heap Data Structure, Priority Queue, AVL Trees, Direct Addressing; Introduction to Hashing, Collision Resolution by Chaining, Collision Resolution by Open Addressing, Lower Bound for Comparison based Sorting Algorithms, Insertion Sort, Merge Sort, Quick Sort, Heap Sort and Counting Sort, Radix Sort, Introduction to Graphs and Representation of Graphs, Depth First Search (DFS), Breadth First Search (BFS), Applications:
BFS and DFS, Prim's Algorithm for finding Minimum Spanning Tree (MST), Kruskal's Algorithm for finding MST, Dijkstra's Algorithm for Single Source Shortest Paths, Floydd-Warshall Algorithm for All-Pairs Shortest Path Problem

Reading:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, Introduction to Algorithms,
2. Mark Allen Weiss, Data Structures and Algorithm Analysis in C++,
3. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, Fundamentals of Computer Algorithms,
4. Michael T.Goodrich and Roberto Tamassia, Algorithm Design: Foundations, Analysis and Internet Examples,

CS-356C	Data Structures Lab	PCC	0-0-2	1Credits

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

CO1	Develop ADT for stack and queue applications
CO2	Implement tree and graph algorithms
CO3	Implement and analyze internal and external sorting algorithms
CO4	Design and implement symbol table using hashing technique

Detailed syllabus

1. Write a program to implement stack using arrays.
2. Write a program to evaluate a given postfix expression using stacks.
3. Write a program to convert a given infix expression to postfix form using stacks.
4. Write a program to implement circular queue using arrays.
5. Write a program to implement double ended queue (de queue) using arrays.
6. Write a program to implement a stack using two queues such that the push operation runs in constant time and the pop operation runs in linear time .
7. Write a program to implement a stack using two queues such that the push operation runs in linear time and the pop operation runs in constant time .
8. Write a program to implement a queue using two stacks such that the enqueue operation runs in constant time and dequeue operation runs in linear time.
9. Write a program to implement a queue using two stacks such that the enqueue operation runs in linear time and dequeue operation runs in constant time.
10. Write programs to implement the following data structures: Single linked list, Double linked list
11. Write a program to implement a stack using a linked list such that the push and pop operations of stack still take O(1) time.
12. Write a program to implement a queue using a linked list such that the enqueue and dequeue operations of queue take O(1) time.
13. Write a program to create a binary search tree (BST) by considering the keys in given order and perform the following operations on it: Minimum key, Maximum key, Search for a given key, Find predecessor of a node, Find successor of a node, delete a node with given key
14. Write a program to construct an AVL tree for the given set of keys. Also write function for deleting a key from the given AVL tree.
15. Write a program to implement hashing with (a) Separate Chaining and (b) Open addressing methods.
16. Implement the following sorting algorithms: Insertion sort, Merge sort, Quick sort. Heap Sort
17. Write programs for implementation of graph traversals by applying: (a) BFS (b) DFS
18. Write programs to find out a minimum spanning tree of a simple connected undirected graph applying: (a) Prim's algorithm (b) Kruskal's algorithm

19. Write a program to implement Dijkstra's algorithm for solving single source shortest path problem using priority queue.
20. Write a program to implement Floydd-Warshall algorithm for solving all pairs shortest path problem.

EE-312C	Design of Electrical Systems	DSE	3– 0–0	3 Credits

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

CO1	Formulate equations for electric and magnetic circuits of electric machines.
CO2	Draw flow charts and write computer programs to solve the above equations
CO3	Understand optimum design procedure for electrical machines.
CO4	Select suitable layout and components for a sub-station

Detailed syllabus

UNIT-I Design of Electrical and Magnetic Circuits of Electrical Machines:
Formation of mathematical equations for electric and magnetic circuits, Flow charts and computer formation of design of electric and magnetic circuits for DC machines, Power transformers, Induction motors and Synchronous motor.

UNIT-II Design of Thermal Circuit of Electrical Machines
Formation of mathematical equations for thermal circuits, Flow charts and computer formation of design of thermal circuits for DC machines, Power transformers, Induction motors and Synchronous motor.

UNIT-III Design of Rotating Electrical Machines
Optimum Design procedures for Electrical Machines AC & DC machines-Criteria for optimization –flow Charts and Computer Programs.

UNIT-IV Design of Sub-Station
Indoor and outdoor substations, selection of site and layout, single feeder and double feeder substations, design of power capacitors, selection of circuit breakers and isolators.

Reading:

1. M.Ramamurthy, Computer aided Design of Electrical Equipment, East West Press Pvt. Ltd. Madras, 1988.
2. C.G. Veinott, Computer aided design of FHP motors, McGraw Hill Pub. Co.
3. M.G.Say, Performance and Design of AC Machines, Pitman Pub.
4. E Clayton & N.N. Hancock, Performance and Design of DC machines CBS Pub. 3rd Edn. 1998.
5. H.Partab, Arts and Science of Utilization of Electrical Energy.

EC-335C	Digital Signal Processing	DSE	3– 0–0	3 Credits

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

CO1	Determine the dynamics of a Linear, Time Invariant and Causal digital systems using convolution
CO2	Understand the sampling theorem and relationship between the time domain and frequency domain description of signals and systems
CO3	Determine the behavior of digital systems using Discrete Time Fourier Transformation and the Z-transformation
CO4	Synthesize IIR & FIR filters using direct, transposed, cascade, parallel and state-space structures

Detailed syllabus

UNIT-I Signals and Systems:
Sampling, Discrete-time signals, aliasing, impulse response, LTI systems, convolution, difference equations.

UNIT-II Fourier analysis and Z-Transform:
DTFT, properties, applications, Definition of z-transform, properties, inverse z-transform, one-sided z-transform

UNIT-III Transform Analysis of Systems:
System function, systems with linear phase, all pass filters, minimum phase systems.
Discrete Fourier and Fast Fourier Transforms: DFT, DFT properties, sampling the DTFT, Linear convolution using DFT, Radix-2 FFT algorithms, decimation in time, decimation in frequency.

UNIT-IV Implementation of Discrete Time Systems:
Direct, cascade and parallel structures for FIR systems & IIR systems

Reading:

1. Salivahanan, Vallavaraj, Gnanapriya-Digital signal processing –TMGH –2002
2. Proakis and Manolakis-Digital signal processing principles –algorithms and applications-PHI –2003
3. Oppenheim and Schaefer –Discrete time signal processing –PHI –1999

EC-308C	Microprocessors and Applications	DSE	3– 0–0	3 Credits

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

CO1	Understand the basic architecture of 8086 microprocessor.
CO2	Write assembly language programs to perform a given task.
CO3	Write interrupt service routines for all interrupt types
CO4	Interface memory and I/O devices to 8086 using peripheral devices
CO5	Write microcontroller programs and interface devices

Detailed syllabus

UNIT-I Introduction: Evolution of Microprocessors, Internal Architecture of 8086, BIU and EU, Registers in of 8086, Memory segmentation

UNIT-II Instruction sets and Addressing modes: Addressing modes-register related, Addressing modes-memory related, Instruction formats, Instruction set of 8086-functional groups, Assembler Directives, assembly language programming.

UNIT-III Pin and timing diagrams of 8086: Pin diagram of 8086 in minimum mode & Maximum mode configuration, Timing diagram of typical read write instructions.

UNIT-IV Interrupts- Steps in interrupt process, Interrupt structure in 8086, Internal and external interrupts-interrupt service routines.

UNIT-V Interfacing the microprocessor- Interfacing of I/O devices, Interfacing I/O-programmable peripheral interface-8255, Interfacing of multi digit seven segment display, Interfacing timer-Programmable interval timer-8254.

UNIT-VI Serial interface and data converters-USART 8251, Serial interface standards-RS 232 C and RS -485, Interfacing of ADCs and DACs,

UNIT-VII Microcontrollers- Introduction to Microcontroller, 8051 Microcontroller, memory and I/ O organization, Applications of Microcontroller.

Reading:

1. Douglas V. Hall : Microprocessors and Interfacing, TMH-Revised Second Edition, 2005
2. A.K. Ray & Burchandi: Advanced Microprocessors and Peripherals, TMH, 2003.
3. Ajay V. Deshmukh: Microcontrollers –Theory and Applications, TMH, 2009.

EE-311C	Computer Organization	DSE	3– 0–0	3 Credits

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

CO1	Understand the characteristics of functional components of a computer system
CO2	Determine the architectural features and functional inter-relationships between CPU, Memory, IO and operating system
CO3	Analyse the hierarchical structure of computer system components and determine how they influence performance.
CO4	Design a memory organization for a choice of memory chips
CO5	Analyse the internal architecture of ALU and control unit to improve performance
CO6	Identify the characteristics of IO device and design a IO configuration for CPU intensive and IO intensive applications

Detailed syllabus

UNIT-I Introduction: Historical review, evolution and design considerations, Computer evolution and performance organization and architecture, structure and function, Computer interconnection structures.

UNIT-II Interconnection structures: Bus Interconnection structures, Elements of bus design, Example bus systems, Signals, operations, commands and timing diagrams, Futurebus and other bus standards

UNIT-III Internal Memory: Characteristics of hierarchical memory systems, components and types Memory organization, Cache memory organization and elements of cache design, Mapping functions, replacement algorithms and hardware

UNIT-IV Operating system support: OS as a resource manager, Role of memory management and techniques, Virtual memory, address translation and implementation

UNIT-V External memory: Types of external memory devices and characteristics Input/output subsystem: Characteristics of I/O data transfer, External interfaces Front system bus (FSB) and its implication in I/O data transfer

UNIT-VI CPU – Arithmetic unit: Number systems and representations, Functions of ALU, Floating point number operations.
CPU – Processing Unit: Machine instruction formats, Instruction execution, CISC Vs RISC processors, superscalar processors.
CPU – Control Unit: Internal organization of CPU – micro-operations, Micro-programmed control unit, Advantages and disadvantages of Micro-programmed control unit, Hardwired control unit.
Recent trends in computer systems: Parallel processing, Vector processing, optimization of main memory across processors

Reading:

1. Computer Organization and Design-The HW/SW Interface: Peterson and Hennessey, Elsevier Pub.
2. Computer organization and Architecture-Designing for performance: William Stallings, PHI
3. Computer Organization: Hamacher, Vranesic and Zaky, McGraw Hill, ISE
4. Computer Organization: John P Hayes, McGraw Hill, ISE

EE-317C	Modelling and Analysis of Electrical Machine	DSE	3– 0–0	3 Credits

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

CO1	Understand the limitations of conventional models of electrical machines
CO2	Determine the torque produced in electrical machines using the concept of coenergy
CO3	Determine the performance of machines using reference frame theory
CO4	Select strategies to control the torque for a given application

Detailed syllabus

UNIT-I Principles for Electrical Machine Analysis

Magnetically coupled circuits:
Review of basic concepts, magnetizing inductance, Modelling linear and nonlinear magnetic circuits

UNIT-II Electromechanical energy conversion:
Principles of energy flow, concept of field energy and co-energy, Derivation of torque expression for various machines using the principles of energy flow and the principle of coenergy, Inductance matrices of induction and synchronous machines

UNIT-III Theory of DC machines:
Review of the DC machine, mathematical model of commutator, State-space model of a DC machine, reduced order model & transfer function of the DC machine, Reference Frame Theory-Concept of space vector, components of space vector, direct and quadrature axis variables

UNIT-IV Transformation:
Types of transformation, condition for power invariance, zero-sequence component, Expression for power with various types of transformation, Transformations between reference frames,
Clarke and Park's Transformations, Variables observed from various frames, Simulation studies

UNIT-V Theory of symmetrical Induction Machines:
Voltage and torque in machine variables, Derivation of dq0 model for a symmetrical induction machine, Voltage and torque equation in arbitrary reference frame variables, Analysis of steady-state operation, State-space model of induction machine in'd-q' variables, Simulation studies

UNIT-VI Theory of synchronous machines:
Equations in arbitrary reference frame, Park's transformation, Derivation of dq0 model for a salient pole synchronous machine with damper windings, Torque expression of a salient pole synchronous machine with damper windings and identification of various components

Reading:

1. Paul C. Krause, Oleg Wasynczuk, Scott D. Sudhoff: "Analysis of Electric Machinery & Drive systems"-IEEE Press, 2002.
2. Rama Krishnan: Electric motor drives: modeling, analysis, and control, Prentice Hall, 2001.
3. Rik De Doncker, Duco W. J. Pulle, André Veltman: Advanced Electrical Drives: Analysis, Modeling, Control Springer, 2011.
4. E. Fitzgerald, Charles Kingsley, Stephen D. Umans: Electric Machinery, TMH, 5th Ed.

YMCA UNIVERSITY OF SCIENCE AND TECHNOLOGY, FARIDABAD
SCHEME OF STUDIES & EXAMINATIONS
B.TECH 4TH YEAR (SEMESTER – VIII)
ELECTRICAL ENGINEERING (2017-18)

Sr. No.	Category	Course Code	Course Title	Hours Per Week			Internal Marks	Final Marks	Total	Credits
				L	T	P				
1	PCC	EE-402-C	Solid State Drives	3	0	0	25	75	100	3
2	PCC	EE-406-C	HVDC & FACTS	3	0	0	25	75	100	3
3	DSE		Elective-III	3	0	0	25	75	100	3
4	DSE		Elective –IV	3	0	0	25	75	100	3
5	DSE		Elective –V	3	0	0	25	75	100	3
6	AECC	EE-422-C	Seminar	0	0	2	50	-	50	1
7	PCC	EE-452-C	Electric Drives Lab	0	0	2	15	35	50	1
8	PCC	EE-456-C	Electrical Simulation Lab	0	0	2	15	35	50	1
9	SEC	EE-468-C	Project Workshop	0	0	6	30	70	100	3
10	SEC	EE-458-C	Major Project	0	0	8	30	70	100	4
11	GEC		General Elective-II	3	0	0	25	75	100	3
			Total	**18**	**0**	**20**	**290**	**660**	**950**	**28**

List of Electives 8th Semester

4th Year 8th Semester

EE- 410C AI Techniques in Electrical Engineering

EE -404C Computer Methods in Power Systems

EE- 414C Electric Traction

EE- 416C Switched Mode Power Conversion

EE- 418C Distribution System Planning and Automation

EE- 420C High Voltage Engineering

EE- 412C Recent Trends in Deregulated Power System

EE- 424C Real Time Control of Power System

EE- 426C Renewable Energy Systems

EE- 428C Smart Electric Grid

EE- 430C Utilization of Electrical Energy

EE-402C	Solid State Drives	PCC	3–0- 0	3 Credits

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

CO1	Understand the various drive mechanisms and methods for energy conservation.
CO2	Apply power electronic converters to control the speed of DC motors and induction motors.
CO3	Evaluate the motor and power converter for a specific application.
CO4	Develop closed loop control strategies of drives

Detailed syllabus

UNIT-I Introduction to electric drives:
Electrical Drives, Advantages of Electric drives, Parts of Electrical Drives, Electric Motors, Power Modulators, Sources, Control unit, Choice of Electric Drives and Losses

UNIT-II Dynamics of electrical drives:
Fundamental torque equation, components of load torque, load characteristics, modified torque equation, speed-torque convention & multi-quadrant operation. Equivalent values of drive parameters, load with rotational motion, loads with translational motion, measurement of moment of inertia, components of load torques, Nature and classification of load torque. Calculation of time and energy loss in transient operation, steady state stability, loads equalization.

UNIT-III Control of electrical drives: Modes of operation, speed control and drive classifications, closed loop control of drives.

UNIT-IV DC Motor Drives: Starting, Braking, Speed control of DC motors using single phase fully controlled and half controlled rectifiers. Three phases fully controlled and half controlled converter fed DC motor drives. Chopper controlled DC drives.

UNIT-V Induction Motor Drives: Speed control using pole changing, stator voltage control, AC voltage controllers. Variable frequency and variable voltage control from inverter. Different types of braking, dynamic, regenerative and plugging.

UNIT-VI Energy Conservation in Electric Drives: Losses in Electric drive systems, measurement of Energy conservation in Electric drives. Use of efficient converters, energy efficient operation of drives, Improvement of p.f., improvement of quality of supply, maintenance of motors

Reading:

1. G.K. Dubey: Fundamentals of Electric Drives –Narosa Publisher ,

2. Vedam Subramanyam: Electric Drives Concepts & Applications –Tata McGraw Hill Edn. Pvt.Ltd,.
3. Nisit K.De and Prashanta K.Sen: Electric Drives,
4. V. Subrahmanyam: Thyristor Control of Electric Drives, Tata McGraw Hill Edn. Pvt.Ltd,.
5. Werner Leonhard: Control of Electric Drives, Springer international edition
6. Nisit K.De and Swapan K.Dutta: Electric Machines and Electric Drives, PHI learning Pvt.Ltd .

EE-404C	Computer Methods in Power Systems	DSE	3–0– 0	3 Credits

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

CO1	Design mathematical models for power system components.
CO2	Analyze and pick the best algorithm for a selected power system problem.
CO3	Generate input data suitable for load flow, fault calculations and state estimation.
CO4	Understand application of Gauss-Seidel, Newton-Raphson and Fast Decoupled methods

Detailed syllabus

UNIT-I Incidence and network matrices:
Introduction, Graphs, Incidence matrices, Primitive matrices, Types of network matrices, formation of network matrix, PI-representation of off-nominal tap transformers, Ybus by singular transformation, examples of formation of incidence matrices, formation of Ybus by inspection.

UNIT-II Algorithms for formation of Z-bus matrix:
Step by Step algorithm for formation of Zbus. Modification of Zbus matrix for changes in the network, example of formation and modification of Zbus matrix.

UNIT-III Short Circuit calculations:
Introduction, Short circuit calculations using $Zbus^{012}$, zf^{abc} , yf^{abc}, zf^{012} , yf^{012} matrices for various faults, example of short circuit calculations using $Zbus^{012}$ for L-L-L and L-G faults.

UNIT-IV Sparsity Technique in Load Flow Studies:
Introduction, Sparsity technique for Ybus and Gauss-Seidel method

Review and Comparison of Gauss-Seidal, Newton-Raphson, Fast decoupled models.

AC-DC Load Flow study and concept of Contingency analysis

UNIT-V Introduction of Real time control of Power System:
Introduction, linear State Estimation WLS equations, Types of measurements, D.C power flow based WLS equations, examples of D.C based WLS State Estimation, SCADA.

UNIT-VI Transient Stability Analysis:
Representation of transmission networks, Generators and loads. Exciter and governor control system representations. Numerical Integration methods - Runge Kutta fourth order methods and modified Euler's method. Transient stability algorithm using modified Euler's method and fourth order Runge Kutta method.

Reading:

1. Stagg and El Abiad, Computer Methods in Power Systems Analysis, McGraw Hill ISE,.
2. M.A.Pai: Computer Techniques in Power System Analysis, Tata McGraw-Hill Education-.
3. K.U.Rao: Computer Methods and Models in Power Systems, I.K.International Pvt.Ltd.

EE-406C	HVDC AND FACTS	PCC	3–0– 0	3 Credits

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

CO1	Evaluate HVDC and EHVAC transmission
CO2	Analyze converter configurations used in HVDC and list the performance metrics.
CO3	Understand controllers for controlling the power flow through a dc link and compute filter parameters
CO4	Apply impedance, phase angle and voltage control for real and reactive power flow in ac transmission systems
CO5	Analyze and select a suitable FACTS controller for a given power flow condition

Detailed syllabus

UNIT-I HVDC Transmission:
DC Power Transmission: Need for power system interconnections, Evolution of AC and DC transmission systems, Comparison of HVDC and HVAC Transmission systems, Types of DC links, relative merits, Components of a HVDC system, Modern trends in DC Transmission systems

UNIT-II Terms and Definitions:
General Classes of Power quality Problems, Transients, Long-Duration Voltage Variations, Short-Duration Voltage Variations, Voltage Imbalance, Waveform Distortion, Voltage fluctuation, Power Quality Terms, CBEMA and ITI Curves.

UNIT-III Analysis of HVDC Converters:
Pulse number, choice of converter configurations, Analysis of Graetz circuit with and without overlap, voltage waveforms, Analysis of two and three valve conduction mode, Converter Bridge characteristics, Inverter mode of operation, voltage waveforms

UNIT-IV Converter and HVDC Control:
Principles of DC link control, Converter Control characteristics, Control hierarchy Constant current Control, CEA Control, firing angle control of valves, starting and stopping of a dc link, Power control

UNIT-V Harmonics and Filters:
Ill effects of Harmonics, sources of harmonic generation, Types of filters –Design examples

UNIT-VI Power Flow Analysis in AC/DC Systems:
Modelling of DC links, solutions of AC-DC Power flow

UNIT-VII Flexible AC Transmission Systems (FACTS):

FACTS concepts and general system conditions: Power flow in AC systems, Relative importance of controllable parameters, Basic types of FACTS controllers, shunt and series controllers, Current source and Voltage source converters

UNIT-VIII Static Shunt Compensators:
Objectives of shunt compensation, Methods of controllable VAR generation, Static Var Compensator, its characteristics, TCR, TSC, FC-TCR configurations, STATCOM, basic operating principle, control approaches and characteristics

UNIT-IX Static Series Compensators:
Objectives of series compensator, variable impedance type of series compensators, TCSC, TSSC-operating principles and control schemes, SSSC, Power Angle characteristics, Control range and VAR rating, Capability to provide reactive power compensation, external control

UNIT-X Combined Compensators:
Introduction to Unified Power Flow Controller, Basic operating principles, Conventional control capabilities, Independent control of real and reactive power

Reading:

1. HVDC Power Transmission Systems –Technology and System Interactions" K.R.Padiyar, New Age International Publishers
2. "Understanding FACTS –Concepts and Technology of Flexible AC Transmission Systems" Narain G.Honorani, Laszlo Gyugyi

EE-422C	**Seminar**	**PCC**	**0–0– 2**	**1 Credits**

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

CO1	Develop presentation skill.
CO2	Develop communication skill.
CO3	Understand others points of view
CO4	Be aware of latest developments

EE-456C	Electrical Simulations Laboratory	PCC	0– 0–2	1 Credits

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

CO1	Simulate and analyse electrical and electronic circuits.
CO2	Analyze and solve power flow problem in power systems
CO3	Model, simulate and analyze the performance of DC Machines
CO4	Analyze performance of feedback and load frequency control systems
CO5	Evaluate the performance of transmission lines

Detailed syllabus

Experiments:

1. Design and simulate the characteristics of first and second order circuits in time and frequency domain using Pspice
2. Simulation of three phase bridge rectifier using Pspice
3. Performance evaluation of medium and long transmission lines using Matlab
4. Symmetrical component analysis using Matlab
5. DC Motor Speed control using Matlab/Simulink
6. Design and analyse the performance of feedback control system
7. Simulate and tune parameters of a PID controller for a given system
8. Load frequency control of single area and two area power system with Matlab / Simulink
9. Performance of FC-TCR compensator using PSCAD/ EMTDC
10. Permanent Magnet DC motor simulation using Matlab/Simulink

Reading:

1. C.L. Wadhwa: Electrical Power Systems –Third Edition, New Age International Pub. Co., 2016.
2. Hadi Sadat: Power System Analysis –Tata Mc Graw Hill Pub. Co. 2015.
3. Control Systems Engineering-I.J. Nagrath & M.Gopal- New Age International Pub. Co
4. A.E. Clayton & C.I. Hancock Performance and Design of DC Machines.

EE-468C	Project Workshop	PCC	0–0–8	4 Credits

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

CO1	Identify a problem of current relevance to society.
CO2	Formulate the problem and identify suitable modelling paradigm.
CO3	Analyze the problem and identify the solution methodology

EE-410C	AI Techniques in Electrical Engineering	PCC	3–0– 0	3 Credits

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

CO1	Understand concepts of ANNs, Fuzzy Logic and Genetic Algorithm.
CO2	Remember difference between knowledge based systems and Algorithmic based systems.
CO3	Understand operation of Fuzzy Controller and Genetic Algorithm.
CO4	Apply soft computing techniques for real-world problems

Detailed syllabus

UNIT-I Artificial Neural Networks:
Introduction, Models of Neuron Network-Architectures –Knowledge representation, Artificial Intelligence and Neural networks–Learning process-Error correction learning, Hebbian learning –Competitive learning-Boltzman learning, supervised learning-Unsupervised learning– Reinforcement learning-Learning tasks.

UNIT-II ANN Paradigms:
Multi-layer perceptron using Back propagation Algorithm (BPA), Self –Organizing Map (SOM), Radial Basis Function Network-Functional Link Network (FLN), Hopfield Network.

UNIT-III Fuzzy Logic:
Introduction –Fuzzy versus crisp, Fuzzy sets-Membership function –Basic Fuzzy set operations, Properties of Fuzzy sets –Fuzzy cartesion Product, Operations on Fuzzy relations –Fuzzy logic –Fuzzy Quantifiers, Fuzzy Inference-Fuzzy Rule based system, Defuzzification methods

UNIT-IV Genetic Algorithms:
Introduction-Encoding –Fitness Function-Reproduction operators, Genetic Modeling –Genetic operators-Cross over-Single site cross over, Two point cross over –Multi point cross over-Uniform cross over, Matrix cross over-Cross over Rate-Inversion & Deletion, Mutation operator –Mutation –Mutation Rate-Bit-wise operators, Generational cycle-convergence of Genetic Algorithm.

UNIT-V Applications of AI Techniques:
Load forecasting, Load flow studies, Economic load dispatch, Load frequency control, Single area system and two area system, Small Signal Stability (Dynamic stability), Reactive power control , Speed control of DC and AC Motors.

Reading:

1. S.Rajasekaran and G.A.V.Pai Neural Networks, Fuzzy Logic & Genetic Algorithms, PHI, New Delhi,.

2. Rober J. Schalkoff, Artificial Neural Networks, Tata McGraw Hill Edition,
3. P.D.Wasserman; Neural Computing Theory & Practice, Van Nostrand Reinhold, New York,
4. Bart Kosko; Neural Network & Fuzzy System, Prentice Hall,
5. D.E.Goldberg, Genetic Algorithms, Addison-Wesley .

EE-404C	Computer Methods in Power Systems	DSE	3–0– 0	3 Credits

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

CO1	Design mathematical models for power system components.
CO2	Analyze and pick the best algorithm for a selected power system problem.
CO3	Generate input data suitable for load flow, fault calculations and state estimation.
CO4	Understand application of Gauss-Seidel, Newton-Raphson and Fast Decoupled methods

Detailed syllabus

UNIT-I Incidence and network matrices:
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AC-DC Load Flow study and concept of Contingency analysis

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UNIT-VI Transient Stability Analysis:
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Reading:

1. Stagg and El Abiad, Computer Methods in Power Systems Analysis, McGraw Hill ISE, .
2. M.A.Pai: Computer Techniques in Power System Analysis, Tata McGraw-Hill Education-.
3. K.U.Rao: Computer Methods and Models in Power Systems, I.K. International Pvt. Ltd..

EE-414C	**Electric Traction**	**DSE**	**3–0– 0**	**3 Credits**

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

CO1	Undestand track electrification systems
CO2	Determine speed time cuves, energy consumption and rating of motors
CO3	Understand motor requirement and power supply arrangement
CO4	Understand lighting requirement and radio interference

Detailed syllabus

UNIT-I Traction Systems:
Methods of traction Electrification, Single Phase high frequency AC system-Three phase low frequency system, Kando System, Single phase to DC system.

UNIT-II Traction Mechanics:
Speed-time curve, Calculation of Tractive effort requirements-Tractive effort, Speed characteristics, Power rating of traction motors, Specific energy consumption.

UNIT-III Traction Motors:
Desirable characteristics of traction motors, Suitability of series motor for traction, Single phase series motor, Repulsion motor, Variable frequency inverter employing SCR.

UNIT-IV Traction Motor Control:
Control of DC traction motors, Series-parallel control, Shunt and bridge transition.

UNIT-V Braking:
Types of braking –Plugging, Rheostatic braking, Regenerative braking of DC and three phase induction motors.

UNIT-VI Power Supply Arrangements:
Major equipment at sub-station, Transformer-Circuit breaker, Interrupter, Protective Systems for AC traction, Major equipment of DC sub-stations, Design considerations of sub-stations.

UNIT-VII Rectification Equipment and Semiconductor Devices:
Cyclo-converters, Choppers for variable frequency AC and Variable voltage converters for HVDC.

UNIT-VIII Train Lighting:
Special requirements of train lighting, Methods of obtaining unidirectional polarity, Methods of obtaining constant output, Single battery System, Double battery parallel block system.

UNIT-IX Radio Interference:

Principle of radio interference, origin of RI, Method of propagation, Factors to be considered in line design.

Reading:

1. J.B.Gupta: Utilization of Electric power 7 Electric Traction, 9th edition, S.K.kataria& Sons, 2016
2. Andreas Steimel: Electric Traction-Motion Power and Energy Supply, Oldenbourg Industrieverlag publishers,.
3. S. Rao: EHV AC & HVDC Transmission Engg. & Practice, Khanna Pub.

EE-416C	Switched Mode Power Conversion	DSE	3–0– 0	3 Credits

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

CO1	Understand isolated and non-isolated DC-DC converters and their operation in continuous conduction mode and discontinuous conduction mode.
CO2	Calculate minimum inductance, capacitance in single switch DC-DC converters. .
CO3	Apply current control and voltage control methods to regulate the output power.
CO4	Design DC-DC converters and evaluate the stability of the system

Detailed syllabus

UNIT-I DC/DC Converters:
Basic topologies of buck, boost converters, buck-boost converters,and cuk converter, isolated DC/DC converter topologies—forward, and fly-back converters, half and full bridge topologies, modeling of switching converters.

UNIT-II Current Mode and Current Fed Topologies:
Voltage mode and current mode control of converters, peak and average current mode control, its advantages and limitations, voltage and current fed converters.

UNIT-III Resonant Converters:
Need for resonant converters, types of resonant converters, methods of control, phase-modulation technique with ZVS in full-bridge topology, series resonant converter and resonant transition converter.

UNIT-IVConverter Transfer Functions:
Application of state-space averaging to switching converters, derivation of converter transfer functions for buck, boost, and fly-back topologies.

UNIT-V Power Converter Design:
Design of filter inductor & capacitor, and power transformer,
Ratings for switching devices, current transformer for current sensing, design of drive circuits for switching devices, considerations for PCB layout.

UNIT-VI Controller Design:
Introduction, mechanisms of loop stabilization, shaping E/A gain vs. frequency characteristic, conditional stability in feedback loops, stabilizing a continuous mode forward converter and discontinuous mode fly-back converter, feed-back loop stabilization with current mode control, the right-half plane zero.

Reading:

1. Ned Mohan Tore M. Undeland: Power Electronics: Converters, Applications, and Design, Edition3, John Wiley & Sons,.
2. Abraham I. Pressman, "Switching Power Supply Design", Mc Graw Hill International,
3. P.C. Sen: Modern Power Electronics, S. Chand-2015.
4. Andrzej M. Trzynadlowski Introduction to Modern Power Electronics, 2nd Edition, illustrated Publisher John Wiley & Sons,
5. Muhammad H. Rashid, Power electronics hand book, ISBN: 81 8147 367 1.

EE-418C	**Distribution System Planning and Automation**	**DSE**	**3–0–0**	**3 Credits**

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

CO1	Understand the characteristics and components of electric power distribution systems.
CO2	Analyze and evaluate the impact of geographical, demographical and economic factors on distribution systems
CO3	Understand the components of distribution automation systems.
CO4	Design, analyze and evaluate distribution system design based on forecasted data

Detailed syllabus

UNIT-I Power sector in India:

An overview of distribution systems, Distribution system planning-issues and aspects, Introduction to Distribution system forecasting techniques, Stochastic and time series techniques for forecasting, intelligent techniques based load forecasting techniques, Definitions and importance of various terms that characterize loads, Load management and types of tariffs

UNIT-II Distribution transformers (DTRs):

Basic design considerations, 3-ph and 1-ph DTRs-types of connections and its relevance in operation, Need for special types of distribution transformers, Cast resin, CSP, Amorphous core DTRs, Regulation and efficiency of transformers-use of predetermined curves

UNIT-III Sub-transmission system:

Sub-stations site selection procedure, Sub-station capacity expansion, Location of new sub-stations and their rating, Sub-station bus schemes, VD and PL calculations for a service area with four and six feeders, VD and PL calculations for a service area with n-feeders, Characteristics of primary systems, Voltage drop (VD) and power loss (PL) calculations, Importance of power factor in distribution systems, Capacitors and their role in improving power factor

UNIT-IV Distribution system protection:

Distribution system protection devices, Problems in distribution systems and the need for automation,

UNIT-V Distribution system automation (DSA):

General schematic, DSA-Hardware modules and their functions, DSA-Software modules and their functions, DSA-Alternatives in Communication media, Communication protocols for DSA schemes and need for OSA, Examples of DSA schemes, Distribution system grounding

Reading:

1. Turan Gonen: Electric power Distribution System Engineering, CRC Press, II Edition
2. A S Pabla: Electric Power Distribution, TMH, Fifth Edition
3. James A Momoh: Electric Power Distribution, Automation, Protection and Control, CRC Press

EE-412C	**RECENT TRENDS IN DEREGULATED POWER SYSTEMS**	**DSE**	**3– 0–0**	**3 Credits**

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

CO1	Understand the deregulation of Electricity Supply Industry.
CO2	Identify the roles and responsibilities of service entities in the power market.
CO3	Analyze congestion management, transmission pricing, and ancillary services management

Detailed syllabus

UNIT-I
Deregulation of the Electricity Supply Industry: Background of deregulation and the current situation, Benefits from a competitive Electricity Market, After effects of Deregulation.

UNIT-II
Power System Operation in Competitive Environment: Role of Independent System operator, Operational Planning activities of ISO, operational planning activities of Genco.

UNIT-III
Transmission open Access and Pricing Issues: Power Wheeling, Transmission Open Access, Cost component in Transmission, Pricing of Power Transmissions, Security Management in Deregulated environment, Congestion management in Deregulation.

UNIT-IV
Reliability and Deregulation: Reliability Analysis, Optimal Power Flow as a Basic Tool, Unit Commitment, Formation of Power Pools.

Reading:

1. Kankar Bhattacharya, Math H.J. Boller, Jaap E. Daalder, "Operation of Restructured Power System" Klum, er Academic Publisher –2016.
2. Ashikur Bhuiya: Power System Deregulation: Loss Sharing in Bilateral Contracts and Generator Profit Maximization, Publisher VDM Verlag, 2014.
3. Mohammad Shahidehpour, and Muwaffaqalomoush,-"Restructured Electrical Power systems" Marcel Dekker, Inc. 2016.
4. Loi Lei Lai; "Power system Restructuring and Deregulation", Jhon Wiley & Sons Ltd., England.

EE-424C	Real Time Control of Power Systems	DSE	3– 0–0	3 Credits

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

CO1	Remember the definition of power quality and different terms in power quality.
CO2	Evaluate the severity of power quality problem in a particular case.
CO3	Understand the behavior of power electronic loads
CO4	Design ways to mitigate power quality issues

Detailed syllabus

UNIT-I Substation/ Generating Station:
Lay out of substation / Generating Station, Main Equipment in Sub Station/ Generating Station, Instrument Transformers and their importance in measurements and protection, important parameters necessary for Grid operation: Analog Points (MW, MVar, Tap Position, Voltage, Frequency), Status Points (CB Status, Isolator Status, SOE Points), Alarms. Hardware required getting these parameters to RTU: Transducers & their connectivity.

UNIT-II SCADA Functions:
Introduction to SCADA: Grid Operation & Control, Difficulties in operating the large power systems manually, need for going to SCADA operation, advantages of SCADA operation. Data Acquisition, Monitoring and Event Processing, Control Functions, Time tagged data, Disturbance data collection and analysis, Reports and Calculations. Man –Machine
Communication: Operator's Console, VDU Display and its use, Operator Dialogs, Mimic Diagram Functions, and Printing Facilities.

UNIT-III Remote Terminal Unit (RTU) & Communication Practices:
Major Components: RTU Panel, Interface Panel. D20M Main Processor, Analog Card, Status Card, Control Card, Modems. Types Of Communications: Power Line Carrier Communications, Microwave, Optical fibre, VSAT Communications. Types of Network Elements in LAN & WAN. Process of Data Communication.

UNIT-IV Sub-Load Dispatch Center (SUB-LDC):
Various Equipment in Sub LDC: (a) Work Stations: details (b) FEPS: Function of FEPS (Front End Processors). (c) Routers: function of routers, interconnectivity of the equipment by LAN, Functionality and responsibilities of Sub LDC

UNIT-V Introduction to SCADA Protocols and Communication Standards for Electrical Power Systems:
Power System Control requirements and evolution of Protocol for Communication, Protocols - Modbus, Distributed Network Protocol (DNP), IEC 870-5 and 60870 series, Benefits from the IEC

(International Electro technical Commission) communication Standards. **(Ref: www.dnp.org,www.modbus.org, www.kema.nl)**

UNIT-VI Real Time Software:
Classification of Programs, Structure of Real time Programs, Construction Techniques & Tools, Programming Language Requirements for Process Control.

UNIT-VII Computer Control of Electrical Power Systems:
Evolution of System Control, time scale of system control, online computer control, and Software Elements: State Estimation, Monitoring & Prediction, Generation & Load Control, Security Analysis; Software Coordination & Systems Simulation. State Load Dispatch Center (SLDC): Inter Connectivity of Sub-LDCs & SLDCs, Hierarchy of Data Transfer, Functions & Responsibilities of SLDC, Real Time Operation carried at SLDC.

UNIT-VIII Southern Regional Load Dispatch Center (SRLDC):
Functions & Responsibilities of SRLDC, Operations carried at SRLDC, Overview of SCADA, and Real Time Operation in detail.

Reading:

1. Hassan Bevrani: Robust Power System Frequency Control, Power Electronics and Power Systems, Edition illustrated Publisher Springer, 2009.
2. Michael John Howard Sterling: Power system control, Volume 6 of IEE control engineering series, Edition illustrated Publisher Peregrinus [for] the Institution of Electrical Engineers, 1978.
3. TorstenCegrell, "Power System control –Technology", Prentice –Hall International series in Systems and control Engineering, Prentice Hall International Ltd., 1986.
4. S. Bennett and D.A. Linkens (Editors): Real –Time Computer Control, IEE Control Engineering series (24), peter Peregrinus Ltd., 1984.
5. Real –Time Systems –by C.M. Krishna and Kangg. Shin, McGraw-Hill international companies, 1997.

EE-426C	Renewable Energy Systems	DSE	3– 0–0	3 Credits

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

CO1	Understand the principles of wind power and solar photovoltaic power generation, fuel cells.
CO2	Assess the cost of generation for conventional and renewable energy plants
CO3	Design suitable power controller for wind and solar applications
CO4	Analyze the issues involved in the integration of renewable energy sources to the grid

Detailed syllabus

UNIT-I Introduction:
Renewable Sources of Energy-Grid-Supplied Electricity-Distributed Generation-Renewable Energy Economics-Calculation of Electricity Generation Costs –Demand side Management Options –Supply side Management Options-Modern Electronic Controls of Power Systems.

UNIT-II Wind Power Plants:
Appropriate Location -Evaluation of Wind Intensity -Topography -Purpose of the Energy Generated -General Classification of Wind Turbines-Rotor Turbines-Multiple-Blade Turbines -Drag Turbines -Lifting Turbines-Generators and Speed Control used in Wind Power Energy -Analysis of Small Generating Systems.

UNIT-III Photovoltaic Power Plants:
Solar Energy-Generation of Electricity by Photovoltaic Effect -Dependence of a PV Cell Characteristic on Temperature-Solar cell Output Characteristics-Equivalent Models and Parameters for Photovoltaic Panels-Photovoltaic Systems-Applications of Photovoltaic Solar Energy-Economical Analysis of Solar Energy.

UNIT-IV Fuel Cells:
The Fuel Cell-Low and High Temperature Fuel Cells-Commercial and Manufacturing Issues-Constructional Features of Proton Exchange-Membrane Fuel Cells –Reformers-Electrolyzer Systems and Related Precautions-Advantages and Disadvantages of Fuel Cells-Fuel Cell Equivalent Circuit-Practical Determination of the Equivalent Model Parameters -Aspects of Hydrogen as Fuel.

UNIT-V Induction Generators:
Principles of Operation-Representation of Steady-State Operation-Power and Losses Generated-Self-Excited Induction Generator-Magnetizing Curves and Self-Excitation-Mathematical Description of the Self-Excitation Process-Interconnected and Stand-alone operation -Speed and Voltage Control -Economical Aspects.

UNIT-VI Storage Systems:
Energy Storage Parameters-Lead–Acid Batteries-Ultra Capacitors-Flywheels -Superconducting Magnetic Storage System-Pumped Hydroelectric Energy Storage -
Compressed Air Energy Storage -Storage Heat -Energy Storage as an Economic Resource.

UNIT-VII Integration of Alternative Sources of Energy:
Principles of Power Injection-Instantaneous Active and Reactive Power Control Approach-Integration of Multiple Renewable Energy Sources-Islanding and Interconnection Control-DG Control and Power Injection.

UNIT-VIII Interconnection of Alternative Energy Sources with the Grid:
Interconnection Technologies -Standards and Codes for Interconnection-Interconnection Considerations -Interconnection Examples for Alternative Energy Sources.

Reading:

1. Felix A. Farret, M. Godoy Simoes, "Integration of Alternative Sources of Energy", John Wiley & Sons, 2006.
2. Solanki: Renewable Energy Technologies: Practical Guide For Beginneers, PHI Learning Pvt. Ltd., 2008.
3. D.Mukherjee: Fundamentals Of Renewable Energy Systems, New Age International publishers, 2007.
4. Remus Teodorescu, Marco Liserre, Pedro Rodríguez: Grid Converters for Photovoltaic and Wind Power Systems, John Wiley & Sons, 2011.
5. Gilbert M. Masters: Renewable and Efficient Electric Power Systems, John Wiley & Sons, 2004.

EE-428C	Smart Electric Grid	DSE	3– 0–0	3 Credits

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

CO1	Understand the features of small grid in the context of Indian grid.
CO2	Understand the role of automation in transmission and distribution.
CO3	Apply evolutionary algorithms for smart grid.
CO4	Understand operation and maintenance of PMUs, PDCs, WAMs, and voltage and frequency control in micro grid

Detailed syllabus

UNIT-I Smart Grid Architecture:
Working definitions of Smart Grid and Associated Concepts –Smart Grid Functions-Traditional Power Grid and Smart Grid –New Technologies for Smart Grid – Advantages –Indian Smart Grid –Key Challenges for Smart Grid.

Components and Architecture of Smart Grid Design –Review of the proposed architectures for Smart Grid. The fundamental components of Smart Grid designs –Transmission Automation –Distribution Automation –Renewable Integration

UNIT-II Tools and Distribution Generation Technologies:
Computational Techniques –Static and Dynamic Optimization Techniques –Computational Intelligence Techniques –Evolutionary Algorithms –Artificial Intelligence techniques
Introduction to Renewable Energy Technologies –Micro grids –Storage Technologies –Electric Vehicles and plug –in hybrids –Environmental impact and Climate Change –Economic Issues.

UNIT-III Communication Technologies and Smart Grid:
Introduction to Communication Technology –SynchroPhasor Measurement Units (PMUs) –Wide Area Measurement Systems (WAMS).
Load Frequency Control (LFC) in Micro Grid System –Voltage Control in Micro Grid System –Reactive Power Control in Smart Grid.Case Studies and Test beds for the Smart Grids.

UNIT-IV SCADA
Introduction to SCADA: Grid Operation & Control, Difficulties in operating the large power systems manually, need for going to SCADA operation, advantages of SCADA operation. Data Acquisition, Monitoring and Event Processing, Control Functions, Time tagged data, Disturbance data collection and analysis, Reports and Calculations. Man –Machine

Reading:

1. Stuart Borlase, Smart Grids, Infrastructure, Technology and Solutions, CRC Press, 2013
2. Gil Masters, Renewable and Efficient Electric Power System, Wiley-IEEE Press, 2004.

3. A.G. Phadke and J.S. Thorp, “Synchronized Phasor Measurements and their Applications”, Springer Edition, 2010.
4. T. Ackermann, Wind Power in Power Systems, Hoboken, NJ, USA, John Wiley, 2005

EE-430C	Utilization of Electrical Energy	DSE	3– 0–0	3 Credits

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

CO1	Understand basic principles of electric heating and welding.
CO2	Determine the lighting requirements for flood lighting, household and industrial needs.
CO3	Calculate heat developed in induction furnace.
CO4	Evaluate speed time curves for traction

Detailed syllabus

UNIT-I Electrical Heating and Welding

Advantages and methods of electric heating, resistance heating, induction heating and dielectric heating. Electric welding: Electric welding equipment, resistance welding and arc welding, comparison between AC and DC welding. Electrolysis process:principle of electrolysis, electroplating, metal extraction and metal processing, electromagnetic stirs.

UNIT-II Illumination

Terminology, Laws of illumination, coefficient of Utilisation and depreciation, Polar curves, photometry, integrating sphere, sources of light, fluorescent lamps, compact fluorescent lamps, LED lamps discharge lamps, mercury vapour lamps, sodium vapour lamps and neon lamps,comparison between tungsten filament lamps and fluorescent tubes. Basic principles of light control, Types and design of lighting scheme, lighting calculations, factory lighting, street lighting and flood lighting.

UNIT-III Electric Traction

Systems of electric traction and track electrification- DC system, single phase and 3-phase low frequency and high frequency system, composite system, kando system, comparison between AC and DC systems, problems of single phase traction with current unbalance and voltage unbalance. Mechanics of traction movement, speed – time curves for different services,
trapezoidal and quadrilateral speed – time curves, tractive effort, power, specific energy consumption, effect of varying acceleration and braking, retardation, adhesive weight and braking retardation, coefficient of adhesion.Systems of train lighting, special requirements of train lighting, methods of obtaining unidirectional polarity constant output- single battery system, Double battery parallel block system, coach wiring, lighting by making use of 25KV AC supply.

Reading:

1. H. Partab: Modern Electric Traction, Dhanpat Rai & Co, 2007.
2. E. Openshaw Taylor: Utilisation of Electric Energy, Orient Longman, 2010.

3. H. Partab: Art & Science of Utilisation of Electric Energy, Dhanpat Rai & Sons, 1998.
4. N.V. Suryanarayana: Utilisation of Electrical power including Electric drives and Electric Traction, New Age Publishers, 1997.

EE-420C	High Voltage Engineering	DSE	3– 0–0	3 Credits

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

CO1	Understand the various aspects of transmission system
CO2	Distinguish between the conduction and breakdown methods in various insulators.
CO3	Evaluate the voltage gradients on different types of conductors.
CO4	Know about the generation of corona pulses and its effects in system
CO5	Examine the phenomena of lightning and lightning arrestors
CO6	Analyze the generation and testing of high voltages

UNIT-I- INTRODUCTION
Recent trends in high voltage transmission, Tasks of transmission system, Choice of transmission system, Comparison of High Voltage DC and AC transmission system

UNIT-II- CONDUCTION AND BREAKDOWN
Conduction and breakdown in gases, liquids and solid dielectrics

UNIT-III- VOLTAGE GRADIENTS OF CONDUCTORS
Field of a point charge and its properties,Electrostatic fields of sphere gaps,Calculation of voltage gradient for sphere gap, fields of line charges and their properties, charge-potential relations for multi conductor lines, surface voltage gradients on conductors.

UNIT-IV- CORONA
Concept of corona, measures for corona reduction, corona loss, corona loss formula, audible noise generation and characteristics, limits for audible noise,generation of corona pulses, positive and negative pulses, properties of coronapulses

UNIT-V- LIGHTNING
Lightning, Isokeraunic level, lightning stroke mechanism, principles of lightning protection, tower footing resistance, lightning arrestors and their characteristics.

UNIT-VI- H.V. TESTING AND LAB EQUIPMENTS
Standard wave shapes for testing, , generation ofA.C high voltage for testing,impulse generator, generation of direct voltage, Cockroft -Walton arrangement, measurement of high voltage: Resistive voltage divider, capacitive voltage divider, resistive capacitive voltage divider, sphere gap

TEXTBOOKS:
1. E.H.V. AC Transmission: R.D. Begamudre, Wiley EasternLtd.
2. H.V. Engineering: V. Kamaraju and M.S. Naidu. TMH

Department of Electrical Engineering

Mapping of courses with Employability/ Entrepreneurship/ Skill development category

Scheme 2017

Course Code	Name of the Course	Employability/ Entrepreneurship/ Skill development
HAS- 101C	Physics-I	Employability
HAS-103C	Mathematics-I	Employability
HAS- 105C	Chemistry	Employability
HAS-109C	Interactive English	Employability
EE-101C	Basic Electrical Engineering	Employability
HAS-107C	Environmental Science	Employability
CE- 101C	Fundamentals of Computer & Programming with C	Employability
EC-101C	Elements of Electronics Engg.	Employability
ME-101C	Basics of Mechanical Engg.	Employability
ME-152C	Engineering Drawing	Skill Development
HAS-151C	Physics Lab-I	Skill Development
CE- 151C	Fundamentals of Computer & Programming with C Lab	Skill Development
HAS- 155C	Chemistry Lab	Skill Development
EE- 151C	Basic Electrical Engineering Lab	Skill Development
ME- 151C	Basics of Mechanical Engg Lab	Skill Development
HAS- 159C	Language lab	Skill Development
WS- 161C	Workshop-I	Skill Development
HAS- 102C	Physics-II	Employability
HAS- 104C	Mathematics-II	Employability
HAS- 152C	Physics Lab-II	Skill Development
WS- 162C	Workshop- II	Skill Development
MA-201C	Mathematics – III	Employability
EC-231C	Analog Electronics	Employability
EE-201C	Electrical Engineering Materials & Semiconductor Devices	Employability
EE-203C	Electrical Measurements & Instrumentation	Employability
EE-205C	Network Analysis & Synthesis	Employability
EE-207C	Electrical Machines-I	Employability
EC-251C	Analog Electronics Lab	Skill Development
EE-257C	Electrical Machines Lab-I	Skill Development
EE-255C	Network Analysis & Synthesis lab	Skill Development
EE-253C	EMMI Lab	Skill Development
EE-261C	Workshop-III	Skill Development
EE-202C	Power System -I	Employability
EC-232C	Digital Electronics	Employability

EE-204C	Electric & Magnetic Fields	Employability
EE-206C	Power Electronics-I	Employability
EE-208C	Electrical Machines-II	Employability
EE-258C	Electrical Machines-II Lab	Skill Development
EC-252C	Digital Electronics Lab	Skill Development
EE- 256C	Power Electronics Lab-I	Skill Development
EE -268C	Workshop-IV	Skill Development
EE-301C	Control Systems	Employability
EE-303C	Power Electronics-II	Employability
EE-305C	Electrical Machines-III	Employability
EE-307C	Power Systems-II	Employability
MB-321C	Engineering Economics & Industrial Management	Entrepreneurship
EE-355C	Electrical Machines Lab-III	Skill Development
EE-357C	Power System Lab	Skill Development
EE-353C	Power Electronics Lab-II	Skill Development
EE-351C	Control system lab	Skill Development
EE-369C	Workshop-V	Skill Development
EE-302C	Power System Operations & Control	Employability
EE-304C	Power System Protection	Employability
CS-306C	Data Structures	Employability
EC-355C	Digital Signal Processing Lab	Skill Development
EE- 352C	Design of Electrical Systems Lab	Skill Development
EC-358C	Micro Processor & Application Lab	Skill Development
CS-356C	Data Structures lab	Skill Development
EE-364C	Workshop-VI	Skill Development
EE-401C	Industrial Training	Skill Development
EE-402-C	Solid State Drives	Employability
EE-406-C	HVDC & FACTS	Employability
EE-422-C	Seminar	Skill Development
EE-452-C	Electric Drives Lab	Skill Development
EE-456-C	Electrical Simulation Lab	Skill Development
EE-468-C	Project Workshop	Skill Development
EE-458-C	Major Project	Skill Development
EE-410-C	AI Techniques in Electrical	Employability
EE -404C	Computer Methods in Power Systems	Employability
EE- 414C	Electric Traction	Employability
EE- 416C	Switched Mode Power Conversion	Employability
EE- 418C	Distribution System Planning and Automation	Employability

EE- 420C	High Voltage Engineering	Employability
EE- 422C	Recent Trends in Deregulated Power System	Employability
EE- 424C	Real Time Control of Power System	Employability
EE- 426C	Renewable Energy Systems	Employability
EE- 428C	Smart Electric Grid	Employability
EE- 430C	Utilization of Electrical Energy	Employability
EE -311 C	Computer Organization	Employability
EE- 312C	Design of Electrical Systems	Employability
EC-335C	Digital Signal Processing	Employability
EC-308C	Microprocessors and applications	Employability
EE -317C	Modelling and Analysis of Electrical Machines	Employability

List of New Courses Introduced in Scheme 2017-18

B. Tech Electrical Engineering

MB-321C	Engineering Economics & Industrial Management
CS306C	Data Structures
CS356C	Data Stracture Lab
EE- 312C	Design of Electrical Systems
EC335C	Digital Signal Processing
EE -317C	Modelling and Analysis of Electrical machines
EE311C	Computer Organization
EE-406C	HVDC & FACTS
EE-456C	Electrical Simulation Lab
EE- 410C	AI Techniques in Electrical Engineering
EE- 414C	Electric Traction
EE-416C	Switched Mode Power Conversion
EE- 418C	Distribution System Planning and Automation
EE- 422C	Recent Trends in Deregulated Power System
EE- 424C	Real Time Control of Power System
EE- 426C	Renewable Energy Systems
EE- 428C	Smart Electric Grid