UNIVERSITY COLLEGE OF ENGINEERING KAKINADA (AUTONOMOUS) :: JNTUK,KAKINADA
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

R20 COURSE STRUCTURE

I B.Tech I Semester

S.No	Course No	Course Name	P.Os	Category	L	T	P	Credits
1		Mathematics – I (Calculus)		BSC	3	0	0	3
2		Mathematics – II (Linear Algebra and Numerical Methods)		BSC	3	0	0	3
3		Communicative English		HSMC	3	0	0	3
4		Programming for Problem Solving Using C		ESC	3	0	0	3
5		Thermal and Hydro Prime Movers		ESC	3	0	0	3
6		English Communications Skills Lab		HSMC	0	0	3	1.5
7		Electrical Engineering Workshop Lab		BSC	0	0	3	1.5
8		Programming for Problem Solving Using C Lab		ESC	0	0	3	1.5
9		Physical Fitness Activities		MC	0	0	2	0
				Total	15	0	11	19.5

I B.Tech II Semester

S.No	Course No	Course Name	P.Os	Category	L	T	P	Credits
1		Mathematics – III (Transforms, PDE and Vector Calculus)		BSC	3	0	0	3
2		Applied Physics		BSC	3	0	0	3
3		Data Structures Through C		ESC	3	0	0	3
4		Electrical Circuit Analysis –I		ESC	3	0	0	3
5		Engineering Drawing		ESC	3	0	0	3
6		Thermal and Hydro Prime Movers Lab		ESC	0	0	3	1.5
7		Applied Physics Laboratory		BSC	0	0	3	1.5
8		Data Structures through C Lab		ESC	0	0	3	1.5
9		Applied Physics Virtual Laboratory		BSC	0	0	2	0
10		Constitution of India		MC	2	0	0	0
11		Engineering Exploration Project- Design Thinking		MC	0	0	1	0
				Total	17	0	12	19.5

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R20 COURSE STRUCTURE

II B.Tech I Semester

S.No	Course No	Course Name	P.Os	Category	L	T	P	Credits
1		Mathematics – IV (Complex Variable and Statistical Methods)		BSC	3	0	0	3
2		Electronic Devices and Circuits		PCC	3	0	0	3
3		Electrical Circuit Analysis –II		PCC	3	0	0	3
4		DC Machines and Transformers		PCC	3	0	0	3
5		Electro Magnetic Fields		PCC	3	0	0	3
6		DC Machines and Transformers Lab		PCC	0	0	3	1.5
7		Electrical Circuits Lab		PCC	0	0	3	1.5
8		Electronic Devices and Circuits lab		PCC	0	0	3	1.5
9		Skill oriented course- Design of Electrical Circuits using Engineering Software Tools		SC	0	0	4	2
10		Essence of Indian Tradition Knowledge		MC	2	0	0	0
				Total	**17**	**0**	**13**	**21.5**

II B.Tech II Semester

S.No	Course No	Course Name	P.Os	Category	L	T	P	Credits
1		Python Programming		ESC	3	0	0	3
2		Digital Electronics		PCC	3	0	0	3
3		Power System-I		PCC	3	0	0	3
4		Induction and Synchronous Machines		PCC	3	0	0	3
5		Managerial Economics & Financial Analysis		HSMC	3	0	0	3
6		Python Programming Lab		ESC	0	0	3	1.5
7		Induction and Synchronous Machines Lab		PCC	0	0	3	1.5
8		Digital Electronics Lab		PCC	0	0	3	1.5
9		Soft skill course- Employability Skills		SC	2	0	0	2
				Total	**15**	**0**	**13**	**21.5**
		Minors Course*			4	0	0	4
		Honors Course*			4	0	0	4

R20 COURSE STRUCTURE
III B.Tech I Semester

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S.No	Course No	Course Name	P.Os	Category	L	T	P	Credits
1		Power Systems-II		PCC	3	0	0	3
2		Power Electronics		PCC	3	0	0	3
3		Control Systems		PCC	3	0	0	3
4		Open Elective- I/ Job Oriented Elective-I		OEC	3	0	0	3
5		Professional Elective - I		PEC	3	0	0	3
6		Control Systems Lab		PCC	0	0	3	1.5
7		Power Electronics Lab		PCC	0	0	3	1.5
8		Skill advanced course- Courses offered by Siemens Centre of excellence : AUTOMATION LAB- Basics of PLC, Basics of SCADA ELECTRICAL & ENERGY STUDIES LAB- Basics of Induction Motor PROCESS INSTRUMENTATION LAB- Basics of Process Instrumentation		SC	0	0	4	2
9		Environmental Science		MC	2	0	0	0
10		Summer Internship 2 Months (Mandatory) after second year (to be evaluated during V semester		PROJ	0	0	0	1.5
				Total	**17**	**0**	**10**	**21.5**
		Minors Course *			4	0	0	4
		Honors Course*			4	0	0	4

III B.Tech II Semester

S.No	Course No	Course Name	P.Os	Category	L	T	P	Credits
1		Microprocessors and Microcontrollers		PCC	3	0	0	3
2		Electrical Measurements and Instrumentation		PCC	3	0	0	3
3		Power System Analysis		PCC	3	0	0	3
4		Professional Elective - II		PEC	3	0	0	3
5		Open Elective –II/ Job Oriented Elective-II		OEC	3	0	0	3
6		Electrical Measurements and Instrumentation Lab		PCC	0	0	3	1.5
7		Microprocessors and Microcontrollers Lab		PCC	0	0	3	1.5
8		Power Systems and Simulation Lab		PCC	0	0	3	1.5
9		Skill advanced course- High Voltage Lab Courses offered by Siemens Centre of excellence : ELECTRICAL & ENERGY STUDIES LAB- Low Voltage Switchgear, AC & DC Drives		SC	0	0	4	2
10		Research Methodology		MC	2	0	0	0
				Total	**17**	**0**	**13**	**21.5**
		Minors Course*			4	0	0	4
		Honors Course*			4	0	0	4

R20 COURSE STRUCTURE
IV B.Tech I Semester

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S.No	Course No	Course Name	P.Os	Category	L	T	P	Credits
1		Professional Elective – III		PEC	3	0	0	3
2		Professional Elective – IV		PEC	3	0	0	3
3		Professional Elective – V		PEC	3	0	0	3
4		Open Elective- III /Job Oriented Elective-III		OEC	3	0	0	3
5		Open Elective-IV /Job Oriented Elective-IV		OEC	3	0	0	3
6		Universal Human Values-2: Understanding Harmony		HSMC	3	0	0	3
7		Skill advanced course- IoT Applications in Electrical Engineering		SC	0	0	4	2
8		Industrial / Research Internship 2 Months (Mandatory) after third year (to be evaluated during VII Semester)		PROJ	0	0	3	3
				Total	**18**	**0**	**7**	**23**
		Minors Course*			4	0	0	4
		Honors Course*			4	0	0	4

IV B.Tech II Semester

S.No	Course No	Course Name	P.Os	Category	L	T	P	Credits
1	Major Project	Project work, seminar and internship in industry (6 Months)		PROJ	--	--	--	12
				Total	**--**	**--**	**--**	**12**

HSMC : Humanities and Social Science Including Management Courses
BSC : Basic Science Courses
ESC : Engineering Science Courses
PCC : Professional Core Courses
PROJ : Internship, Seminar, Project Wok
MC : Mandatory Courses
SC : Skill Oriented Courses

PEC : Professional Elective Courses
OEC : Open Elective Courses

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*For Honor's/ Minor Course Fullfillments:

- The 20 additional Credits need to be acquired, 16/15 credits can be earned by undergoing specified courses listed as pools, with 4/5 courses, each carrying 4/3 credits. The remaining 4/5 credits must be acquired through two online MOOCs (Swayam)., which shall be domain specific, with 2/3 credits and with a minimum duration of 8/12weeks as recommended by the Board of Studies.
- Minor Engineering subjects are offered to other branches by EEE Department (except for EEE Students).
- Honors Engineering subjects are offered to EEE Students.
- Chairman in consultation with the local BoS members will float the list of allowed MOOC electives, each academic year, .based on the list floated by (MOOCs (Swayam).

Professional Elective Subjects offered to EEE Branch Students:

Professional Elective – I:

1.	Switchgear and Protection
2.	Utilization of Electrical Energy
3.	High Voltage Engineering
4.	Renewable and Distributed Energy Technologies

Professional Elective – II:

1.	AI Applications in Electrical Engineering
2.	Flexible Alternating Current Transmission Systems
3.	Electrical Distribution Systems
4.	Electric Drives

Professional Elective –III:

1.	Digital Signal Processing
2.	Linear IC Applications
3.	Programmable Logic Controllers and Applications
4.	Optimization Techniques

Professional Elective – IV:

1.	Object Oriented Programming through Java
2.	Data Base Management Systems
3.	Cloud Computing
4.	Operating Systems

Professional Elective – V:

1.	Power System Operation and Control
2.	Switch Mode Power Conversion
3.	Advanced Control Systems
4.	IoT Applications in Electrical Engineering

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Open Electives offered by EEE Department for Other Branches (Except EEE Branch)

Open Elective-I:

1.	Renewable Energy Sources
2.	Energy Auditing. Conservation and Management
3.	Optimization Techniques
4.	Basics of Control Systems

Open Elective-II:

1.	Neural Networks and Fuzzy Logic
2.	Basics of Power Systems and Power Quality
3.	Basics of Electrical Measurements
4.	Indian Electricity Act-2003

Open Elective-III:

1.	Basics of Microprocessors and Microcontrollers
2.	Fundamentals of utilization of Electrical Energy
3.	Electrical Estimation and Costing
4.	Introduction to Internet of Things

Open Elective-IV:

1.	Concepts of Power System Engineering
2.	Fundamentals of Electric Vehicles
3.	Introduction to Machine Learning
4.	Introduction to Smart Grid

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*Honors Engineering Courses offered EEE Branch students

II B.Tech II Semester:

1.	Communication Systems
2.	Special Electrical Machines
3.	Signal and Systems

III B.Tech I Semester:

1.	HVDC Transmission
2.	Power Quality
3.	Electrical Machine Design

III B.Tech II Semester:

1.	Digital Control Systems
2.	Analysis of Power Electronic Converters
3.	VLSI Design

IV B.Tech I Semester:

1.	Hybrid Electric Vehicles
2.	Smart Grid Technologies
3.	Power System Deregulation

*Minor Engineering Courses offered by EEE Department for Other Branches (Except EEE Branch)

II B.Tech II Semester:

1.	Basics of Control Systems
2.	Basics of Electrical Measurements
3.	Renewable Energy Sources

III B.Tech I Semester:

1.	Basics of Microprocessors and Microcontrollers
2.	Concepts of Power System Engineering
3.	Electrical Estimation and Costing

III B.Tech II Semester:

1.	Energy Auditing, Conservation and Management
2.	Fundamentals of utilization of Electrical Energy
3.	Fundamentals of Power Electronics

IV B.Tech I Semester:

1.	Basics of Power Systems and Power Quality
2.	Fundamentals of Electric Vehicles
3.	Basics of Electric Drives and Its Applications

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I B.Tech I Semester

COURSE CODE – R2011XXYY	MATHEMATICS-I (Calculus)	CATEGORY BSC	L-T-P 3-0-0	CREDITS 3

Pre-requisite:

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

		Knowledge Level (K)#
CO1	**utilize** mean value theorems to real life problems	L3
CO2	**solve** the differential equations related to various engineering fields	L3
CO3	**familiarize** with functions of several variables which is useful in optimization	L3
CO4	**apply** double integration techniques in evaluating areas bounded by region. Students will also learn important tools of calculus in higher dimensions. Students will become **familiar** with 2- dimensional and 3-dimensional coordinate systems	L3
CO5	**conclude** the use of special function in multiple integrals	L4

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	--	--	--	--	--	--	--	--	--	1	--	--	--
CO2	3	3	--	--	--	--	--	--	--	--	--	2	3	--	--
CO3	2	3	--	--	--	--	--	--	--	--	--	2	2	--	--
CO4	3	3	--	--	--	--	--	--	--	--	--	2	2	--	--
CO5	2	2	--	--	--	--	--	--	--	--	--	1	1	--	--

(Please fill the above with Levels of Correlation, viz., L, M, H)

UNIT	CONTENTS	Contact Hours
UNIT - 1	**Sequences, Series and Mean Value Theorems** Sequences and Series: Convergences and divergence – Ratio test – Comparison tests – Integral test – Cauchy's root test – Alternate series – Leibnitz's rule. Mean Value Theorems (without proofs): Rolle's Theorem – Lagrange's mean value theorem – Cauchy's mean value theorem – Taylor's and Maclaurin's theorems with remainders, Problems and applications on the above theorem.	**(10 hrs)**
UNIT - 2	**Differential Equations of First order and First Degree**	**(10 hrs)**

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	Linear differential equations – Bernoulli's equations – Exact equations and equations reducible to exact form – Homogeneous and Non-homogeneous differential equations of higher order with constant coefficients – with non-homogeneous term of the type e^{ax}, sin ax, cos ax, polynomials in x^n, e^{ax} V(x) and x^nV(x) – Method of Variation of parameters – Euler-Cauchy equation and Legender's equation. Applications: Orthogonal trajectories – Electrical circuits (RL, RC, RLC) – Simple Harmonic motion.	
UNIT - 3	**Partial Differentiation** Introduction – Homogeneous function – Euler's theorem – Total derivative – Chain rule – Jacobian – Functional dependence – Taylor's and MacLaurin's series expansion of functions of two variables. Applications: Maxima and Minima of functions of two variables without constraints and Lagrange's method (with constraints).	**(10 hrs)**
UNIT - 4	**Multiple Integrals** Double integrals – Change of order of integration – Double integrals in polar coordinates – Change of variables to polar coordinates – Areas enclosed by plane curves – Triple integrals – Volume of solids – Change of variables to spherical and cylindrical co-ordinates.	**(8 hrs)**
UNIT - 5	**Beta and Gamma Functions** Introduction to Improper Integrals –Beta and Gamma functions – Properties – Relation between Beta and Gamma functions – Evaluation of improper integrals.	**(5 hrs)**
	Total	

Text Books:

1. **B. S. Grewal,** Higher Engineering Mathematics, 44th Edition, Khanna Publishers.
2. **B. V. Ramana,** Higher Engineering Mathematics, 2007 Edition, Tata Mc. Graw Hill Education.

Reference Books:

1. **Erwin Kreyszig,** Advanced Engineering Mathematics, 10th Edition, Wiley-India.
2. **Joel Hass, Christopher Heil and Maurice D. Weir,** Thomas calculus, 14th Edition, Pearson.
3. **Lawrence Turyn,** Advanced Engineering Mathematics, CRC Press, 2013.
4. **Srimantha Pal, S C Bhunia,** Engineering Mathematics, Oxford University Press.

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I B.Tech I Semester

COURSE CODE – R2011XXYY	MATHEMATICS – II (Linear Algebra and Numerical Methods)	CATEGORY BSC	L-T-P 3-0-0	CREDITS 3

Pre-requisite:

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

		Knowledge Level (K)#
CO1	**develop** the use of matrix algebra techniques that is needed by engineers for practical applications	L6
CO2	**solve** system of linear algebraic equations using Gauss elimination, Gauss Jordan, Gauss Seidel	**L3**
CO3	**evaluate** the approximate roots of polynomial and transcendental equations by different algorithms	**L5**
CO4	**apply** Newton's forward & backward interpolation and Lagrange's formulae for equal and unequal intervals	**L3**
CO5	**apply** numerical integral techniques to different Engineering problems **apply** different algorithms for approximating the solutions of ordinary differential equations with initial conditions to its analytical computations	**L3**
CO6	**develop** the use of matrix algebra techniques that is needed by engineers for practical applications	L6

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	--	--	--	--	--	--	--	--	--	2	3	--	--
CO2	2	2	--	--	--	--	--	--	--	--	--	2	3	--	--
CO3	3	3	--	--	--	--	--	--	--	--	--	2	2	--	--
CO4	3	2	--	--	--	--	--	--	--	--	--	2	1	--	--
CO5	3	3	--	--	--	--	--	--	--	--	--	3	3	--	--

(Please fill the above with Levels of Correlation, viz., L, M, H)

UNIT	CONTENTS	Contact Hours
UNIT - 1	**Solving Systems Of Linear Equations, Eigen Values And Eigen Vectors** Rank of a matrix by echelon form and normal form – Solving system of homogeneous and non-homogeneous linear equations – Gauss Elimination method – Eigen values and Eigen vectors and properties (article-2.14 in text book-1). Applications: Fee vibration of two mass system.	**(10 hrs)**
UNIT - 2	**Cayley–Hamilton Theorem And Quadratic Forms** Cayley-Hamilton theorem (without proof) – Applications – Finding the inverse and power of a matrix by Cayley-Hamilton theorem – Reduction to	**(10 hrs)**

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	Diagonal form – Quadratic forms and nature of the quadratic forms – Reduction of quadratic form to canonical forms by orthogonal transformation. Singular values of a matrix, singular value decomposition (text book-3).	
UNIT - 3	**Iterative Methods** Introduction – Solutions of algebraic and transcendental equations: Bisection method – Secant method – Method of false position – Iteration method – Newton-Raphson method (One variable and simultaneous Equations) Solutions of system of equations – Jacobi and Gauss -Seidel methods Evaluation of largest eigen value – eigen vector using Power Method .	**(08 hrs)**
UNIT - 4	**Interpolation** Introduction – Errors in polynomial interpolation – Finite differences – Forward differences – Backward differences – Central differences – Relations between operators – Newton's forward and backward formulae for interpolation – Interpolation with unequal intervals – Lagrange's interpolation formula – Newton's divide difference formula.	**(10 hrs)**
UNIT - 5	**Numerical Differentiation And Integration, Solution Of Ordinary Differential Equations With Initial Conditions** Numerical differentiation using interpolating polynomial – Trapezoidal rule – Simpson's $1/3^{rd}$ and $3/8^{th}$ rule – Solution of initial value problems by Taylor's series – Picard's method of successive approximations – Euler's method – Runge-Kutta method (second and fourth order) – Milne's Predictor and Corrector Method.	**(10 hrs)**
	Total	

Text Books:

1. **B. S. Grewal,** Higher Engineering Mathematics, 44^{th} Edition, Khanna Publishers.
2. **B. V. Ramana,** Higher Engineering Mathematics, 2007 Edition, Tata Mc. Graw Hill Education.
3. **David Poole,** Linear Algebra- A modern introduction, 4^{th} Edition, Cengage.

Reference Books:

1. **Steven C. Chapra,** Applied Numerical Methods with MATLAB for Engineering and Science, Tata Mc. Graw Hill Education.
2. **M. K. Jain, S. R. K. Iyengar and R. K. Jain,** Numerical Methods for Scientific and Engineering Computation, New Age International Publications.
3. **Lawrence Turyn,** Advanced Engineering Mathematics, CRC Press.

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I B.Tech I Semester

COURSE CODE – R2011XXYY	COMMUNICATIVE ENGLISH	CATEGORY HSMC	L-T-P 3-0-0	CREDITS 3

Pre-requisite:

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

		Knowledge Level (K)#
CO1	understand social or transactional dialogues spoken by native speakers of English and identify the context, topic, and pieces of specific information	K2
CO2	ask and answer general questions on familiar topics and introduce oneself/others	**K3**
CO3	employ suitable strategies for skimming and scanning to get the general idea of a text and locate specific information	**K3**
CO4	recognize paragraph structure and be able to match beginnings/endings/headings with paragraphs	**K4**
CO5	form sentences using proper grammatical structures and correct word forms	**K6**
CO6	To promote learner autonomy in learning English language	**K5**

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	--	--	--	--	--	--	--	--	1	3	--	2	--	--	--
CO2	--	--	--	--	--	--	--	--	1	3	--	--	--	--	--
CO3	--	--	--	--	--	--	--	--	--	3	--	2	--	--	--
CO4	--	--	--	--	--	--	--	--	--	3	--	1	--	--	--
CO5	--	--	--	--	--	--	--	--	--	3	--	1	--	--	--

(Please fill the above with Levels of Correlation, viz., L, M, H)

UNIT	CONTENTS	Contact Hours
UNIT - 1	**Lesson-1: A Drawer full of happiness** from "**Infotech English**", Maruthi Publications **Lesson-2: Deliverance by Premchand** from "**The Individual Society",** Pearson Publications. (Non-detailed) **Listening:** Listening to short audio texts and identifying the topic. Listening to prose, prose and conversation. **Speaking:** Asking and answering general questions on familiar topics such as home, family, work, studies and interests. Self-introductions and introducing others.	

	Reading: Skimming text to get the main idea. Scanning to look for specific pieces of information. **Reading for Writing:** Paragraph writing (specific topics) using suitable cohesive devices; linkers, sign posts and transition signals; mechanics of writing - punctuation, capital letters. **Vocabulary:** Technical vocabulary from across technical branches (20) GRE Vocabulary (20) (Antonyms and Synonyms, Word applications) Verbal reasoning and sequencing of words. **Grammar:** Content words and function words; word forms: verbs, nouns, adjectives and adverbs; nouns: countables and uncountables; singular and plural basic sentence structures; simple question form - wh-questions; word order in sentences. **Pronunciation**: Vowels, Consonants, Plural markers and their realizations	
UNIT - 2	**Lesson-1: Nehru's letter to his daughter Indira on her birthday** from "**Infotech English**", Maruthi Publications **Lesson-2: Bosom Friend by Hira Bansode** from "**The Individual Society",** Pearson Publications. (Non-detailed) **Listening:** Answering a series of questions about main idea and supporting ideas after listening to audio texts, both in speaking and writing. **Speaking:** Discussion in pairs/ small groups on specific topics followed by short structured talks. Functional English: Greetings and leave takings. **Reading**: Identifying sequence of ideas; recognizing verbal techniques that help to link the ideas in a paragraph together. **Reading for Writing**: Summarizing - identifying main idea/s and rephrasing what is read; avoiding redundancies and repetitions. **Vocabulary**: Technical vocabulary from across technical branches (20 words). GRE Vocabulary Analogies (20 words) (Antonyms and Synonyms, Word applications) **Grammar**: Use of articles and zero article; prepositions. **Pronunciation**: Past tense markers, word stress-di-syllabic words	
UNIT - 3	**Lesson-1: Stephen Hawking-Positivity 'Benchmark'** from "**Infotech English**", Maruthi Publications **Lesson-2: Shakespeare's Sister by Virginia Woolf** from "**The Individual Society",** Pearson Publications. (Non-detailed**)** **Listening:** Listening for global comprehension and summarizing what is listened to, both in speaking and writing. **Speaking:** Discussing specific topics in pairs or small groups and reporting what is discussed. Functional English: Complaining and Apologizing. **Reading**: Reading a text in detail by making basic inferences - recognizing and interpreting specific context clues; strategies to use text clues for comprehension. Critical reading. **Reading for Writing**: Summarizing - identifying main idea/s and	

	rephrasing what is read; avoiding redundancies and repetitions. Letter writing-types, format and principles of letter writing. E-mail etiquette, Writing CV's. **Vocabulary**: Technical vocabulary from across technical branches (20 words). GRE Vocabulary (20 words) (Antonyms and Synonyms, Word applications) Association, sequencing of words **Grammar**: Verbs - tenses; subject-verb agreement; direct and indirect speech, reporting verbs for academic purposes. **Pronunciation**: word stress-poly-syllabic words.	
UNIT - 4	**Lesson-1: Liking a Tree, Unbowed: Wangari Maathai-biography** from "**Infotech English**", Maruthi Publications **Lesson-2: Telephone Conversation-Wole Soyinka** from "**The Individual Society",** Pearson Publications**.** (Non-detailed) **Listening:** Making predictions while listening to conversations/ transactional dialogues without video (only audio); listening to audio-visual texts. **Speaking:** Role plays for practice of conversational English in academic contexts (formal and informal) - asking for and giving information/directions. Functional English: Permissions, Requesting, Inviting. **Reading**: Studying the use of graphic elements in texts to convey information, reveal trends/patterns/relationships, communicative process or display complicated data. **Reading for Writing**: Information transfer; describe, compare, contrast, identify significance/trends based on information provided in figures/charts/graphs/tables. Writing SOP, writing for media. **Vocabulary**: Technical vocabulary from across technical branches (20 words) GRE Vocabulary (20 words) (Antonyms and Synonyms, Word applications) Cloze Encounters. **Grammar**: Quantifying expressions - adjectives and adverbs; comparing and contrasting; degrees of comparison; use of antonyms **Pronunciation**: Contrastive Stress	
UNIT - 5	**Lesson-1: Stay Hungry-Stay foolish** from "**Infotech English**", Maruthi Publications **Lesson-2: Still I Rise by Maya Angelou** from "**The Individual Society",** Pearson Publications. (Non-detailed) **Listening:** Identifying key terms, understanding concepts and interpreting the concepts both in speaking and writing. **Speaking:** Formal oral presentations on topics from academic contexts - without the use of PPT slides. Functional English: Suggesting/Opinion giving. **Reading**: Reading for comprehension. RAP Strategy Intensive reading and	

	Extensive reading techniques. **Reading for Writing**: Writing academic proposals- writing research articles: format and style. **Vocabulary**: Technical vocabulary from across technical branches (20 words) GRE Vocabulary (20 words) (Antonyms and Synonyms, Word applications) Coherence, matching emotions. **Grammar**: Editing short texts – identifying and correcting common errors in grammar and usage (articles, prepositions, tenses, subject verb agreement) **Pronunciation**: Stress in compound words	
	Total	

Prescribed text books for theory for Semester-I:

1. "**Infotech English**", Maruthi Publications. (Detailed)
2. "**The Individual Society",** Pearson Publications. (Non-detailed)

Prescribed text book for Laboratory for Semesters-I & II:

1. "**Infotech English**", Maruthi Publications. (with Compact Disc)

Reference Books

1. Bailey, Stephen. *Academic writing: A handbook for international students*. Routledge, 2014.
2. Chase, Becky Tarver. *Pathways: Listening, Speaking and Critical Thinking.* Heinley ELT; 2nd Edition, 2018.
3. Skillful Level 2 Reading & Writing Student's Book Pack (B1) Macmillan Educational.
4. Hewings, Martin. *Cambridge Academic English (B2)*. CUP, 2012.

UNIVERSITY COLLEGE OF ENGINEERING KAKINADA (AUTONOMOUS) :: JNTUK,KAKINADA
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

I B.Tech I Semester

COURSE CODE – R2011XXYY	PROGRAMMING FOR PROBLEM SOLVING USING C	CATEGORY ESC	L-T-P 3-0-0	CREDITS 3

Pre-requisite:

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

		Knowledge Level (K)#
CO1	To convert flowcharts/algorithms to C Programs, compile and debug programs	K3
CO2	To use different operators, data types and write programs that use two-way/ multi-way selection and select the best loop construct for a given problem.	K3
CO3	To implement operations on arrays, strings, structures and unions.	K4
CO4	To design and implement programs to analyze the different pointer applications	K4
CO5	To decompose a problem into functions and to develop modular reusable code and apply File I/O operations.	K5

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	3	2	3	-	-	-	1	1	1	1	2	1	1
CO2	1	2	3	2	3	-	-	-	1	1	1	1	2	1	1
CO3	1	2	3	1	3	-	-	-	1	1	1	1	2	1	1
CO4	1	2	3	1	3	-	-	-	1	1	1	1	2	1	1
CO5	1	2	3	2	3	-	-	-	1	1	1	1	2	1	1

(Please fill the above with Levels of Correlation, viz., L, M, H)

UNIT	CONTENTS	**Contact Hours**
UNIT - 1	**Introduction to Computers:** Creating and running Programs, Computer Numbering System, Storing Integers, Storing Real Numbers, **Introduction to the C Language:** Background, C Programs, Identifiers, Types, Variable, Constants, Input/output, Programming Examples, Scope, Storage Classes and Type Qualifiers. Pre-Processor Statements, Header Files **Structure of a C Program:** Expressions Precedence and Associativity, Side Effects, Evaluating Expressions, Type Conversion Statements, Simple Programs, Command Line Arguments.	
UNIT - 2	**Bitwise Operators:** Exact Size Integer Types, Logical Bitwise Operators, Shift Operators.	

	Selection & Making Decisions: Logical Data and Operators, Two Way Selection, Multiway Selection, More Standard Functions **Repetition:** Concept of Loop, Pretest and Post-test Loops, Initialization and Updating, Event and Counter Controlled Loops, Loops in C, Other Statements Related to Looping, Looping Applications, and Programming Examples.	
UNIT - 3	**Arrays:** Concepts, Using Array in C, Array Application, Two Dimensional Arrays, Multidimensional Arrays, Programming Example – Calculate Averages **Strings:** String Concepts, C String, String Input / Output Functions, Arrays of Strings, String Manipulation Functions String/ Data Conversion, A Programming Example – Morse Code **Enumerated, Structure, and Union:** The Type Definition (Type def), Enumerated Types, Structure, Unions, and Programming Application	
UNIT - 4	**Pointers:** Introduction, Pointers to pointers, Compatibility, L value and R value **Pointer Applications:** Arrays, and Pointers, Pointer Arithmetic and Arrays, Memory Allocation Function, Array of Pointers, Programming Application **Processor Commands**: Processor Commands	
UNIT - 5	**Functions:** Designing, Structured Programs, Function in C, User Defined Functions, Inter-Function Communication, Standard Functions, Passing Array to Functions, Passing Pointers to Functions, Recursion **Text Input / Output:** Files, Streams, Standard Library Input / Output Functions, Formatting Input / Output Functions, Character Input / Output Functions **Binary Input / Output:** Text versus Binary Streams, Standard Library, Functions for Files, Converting File Type.	
	Total	

Text Books:

1. Programming for Problem Solving, Behrouz A. Forouzan, Richard F.Gilberg, CENGAGE
2. The C Programming Language, Brian W.Kernighan, Dennis M. Ritchie, 2e, Pearson

Reference Books:

1. Computer Fundamentals and Programming, Sumithabha Das, Mc Graw Hill
2. Programming in C, Ashok N. Kamthane, Amit Kamthane, Pearson
3. Computer Fundamentals and Programming in C, Pradip Dey, Manas Ghosh, OXFORD

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I B.Tech I Semester

COURSE CODE – R2011XXYY	THERMAL AND HYDRO PRIME MOVERS	CATEGORY ESC	L-T-P 1-0-4	CREDITS 3

Pre-requisite:

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

		Knowledge Level (K)#
CO1	Air stand cycles, constructional and operational details of IC engines.	
CO2	Properties of steam, Rankine Cycle, Principle and working of steam turbines.	
CO3	Fundamentals, governing cycle, working and efficiency of gas turbines.	
CO4	Working principle of pumps and hydraulic turbines.	
CO5	Detail and working of hydroelectric power plants and various loads.	

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√			√			√	√		√	√	√
CO2	√	√	√	√			√	√		√	√	√
CO3	√	√	√	√			√	√		√	√	√
CO4	√	√	√	√			√	√		√	√	√
CO5	√	√	√	√		√	√	√	√	√	√	√

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UNIT	CONTENTS	**Contact Hours**
UNIT - 1	**I.C Engines:** Classification, working principles – valve and port timing diagrams – air standard cycles – Engine systems line fuel injection, carburetion, ignition, cooling and lubrication	
UNIT - 2	Properties of Steam and use of Steam Tables- T-S and H-S Diagrams. Analysis of various Thermodynamic and processes under gone by Steam. **Vapor Power Cycles:** Carnot Cycle-Rankine Cycle- Thermodynamic variables Effecting Efficiency and output of Rankine Cycle-. Analysis of simple Rankine Cycle and Re-heat cycle. **Steam Turbines:** Schematic layout of steam power plant – Classification of steam Turbines – Impulse Turbine and Reaction Turbine	
UNIT - 3	**Gas Turbines:** Simple gas turbine plant-ideal cycle, closed cycle - open cycle – Efficiency, Work ratio and optimum pressure ratio for simple gas turbine cycle.	
UNIT - 4	**Pumps:** Types of pumps, Centrifugal pumps: Main components, Working principle. **Hydraulic Turbines:** Classifications of turbines; Working principle, Efficiency calculation and Design principles for Pelton Wheel, Francis and for Kaplan turbines; Governing of turbines.	
UNIT - 5	**Hydro Power:** Components of Hydroelectric power plant; pumped storage systems, Estimation of water power potential ; Estimation of load on turbines: load curve, load factor, capacity factor, utilization factor, diversity factor, load - duration curve, firm power, secondary power, prediction of load.	
	Total	

Text Books:

1. Thermal Engineering by Rajput, Lakshmi publications.
2. Thermal engineering by M.L.Mathur and F.S.Mehta, Jain Brothers.
3. Hydraulics & Fluid Mechanics, P.N.Modi and S.M.Seth, Standard Book House, Delhi.

Reference Books:

1. “Fluid Mechanic & Hydraulic Machinery”,by A.K.Jain, Khanna Publishers, Delhi.
2. “Fluid Mechanics” by Victor.L.Streeter.
3. “Introduction to Fluid Mechanics” Edward.J.Shaughnessy Jr.
4. “Fluid Mechanics & Its Applications”, Vijay Gupta, Santosh.k.Gupta
5. “Fluid Mechanic & Fluid Power Engineering”, Dr.D.S.Kumar
6. “Water Power Engineering”, M.M.Desumukh

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I B.Tech I Semester

COURSE CODE – R2011XXYY	ENGLISH COMMUNICATIONS SKILLS LAB	CATEGORY HSMC	L-T-P 0-0-3	CREDITS 1.5

Pre-requisite:

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

		Knowledge Level (K)#
CO1	understand social or transactional dialogues spoken by native speakers of English and identify the context, topic, and pieces of specific information	K2
CO2	ask and answer general questions on familiar topics and introduce oneself/others	**K3**
CO3	employ suitable strategies for skimming and scanning to get the general idea of a text andlocate specific information	**K3**
CO4	recognize paragraph structure and be able to match beginnings/endings/headings with paragraphs	**K4**
CO5	form sentences using proper grammatical structures and correct word forms	**K6**
CO6	To promote learner autonomy in learning English language	**K5**

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	--	--	--	--	--	--	--	--	1	3	--	2	--	--	--
CO2	--	--	--	--	--	--	--	--	1	3	--	--	--	--	--
CO3	--	--	--	--	--	--	--	--	--	3	--	2	--	--	--
CO4	--	--	--	--	--	--	--	--	--	3	--	1	--	--	--
CO5	--	--	--	--	--	--	--	--	--	3	--	1	--	--	--
CO6	--	--	--	--	--	--	--	--	--	3	--	2	--	--	--

(Please fill the above with Levels of Correlation, viz., L, M, H)

UNIT	CONTENTS	**Contact Hours**
	Note: Collect the syllabus from HSS BOS	
	Total	

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I B.Tech I Semester

COURSE CODE – R2011XXYY	ELECTRICAL ENGINEERING WORKSHOP	CATEGORY BSC	L-T-P 0-0-3	CREDITS 1.5

Pre-requisite:

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

		Knowledge Level (K)#
CO1	Ensure the safety of electrical systems and wiring. Explain the limitations, tolerances, safety aspects of electrical systems and wiring.	
CO2	Specify wires/cables and other accessories used in different types of electrical installations.	
CO3	Design and implement different lighting and power circuits.	
CO4	Troubleshoot domestic electrical equipment.	

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3	1	2	--	--	--	--	2	2	2	1	1	2
CO2	2	1	2	--	1	--	--	--	--	1	--	2	1	1	2
CO3	3	2	1	1	1	--	--	--	--	--	--	--	1	1	2
CO4	3	--	1	--	--	--	--	--	--	--	2	2	1	1	2
CO5	1	1	2	1	2	--	--	--	--	--	--	2	1	1	2

(Please fill the above with Levels of Correlation, viz., L, M, H)

S. No.	List of Experiments	Contact Hours
1.	Study of various electrical tools and symbols.	
2.	Study various types of electrical cables/wires, switches, fuses, fuse carriers, MCB, ELCB, RCCB and MCCB with their specifications and usage.	
3.	Soldering and desoldering practice.	
4.	Identification of various types of resistors and capacitors and understand the usage digital multi-meter.	
5.	Identification of various semiconductor devices.	
6.	Study of Moving Iron, Moving Coil, Electro dynamic and Induction type meters.	
7.	Fluorescent lamp wiring.	
8.	Wiring of lighting circuit using two way control.(stair case wiring)	
9.	Godown wiring/ Tunnel wiring	

10.	Hospital wiring.	
11.	Measurement of voltage, current, power in DC circuit.	
12.	Wiring of power distribution arrangement using single phase MCB distribution board with ELCB, main switch and energy meter for calculating Power and Power Factor.	
13.	Understanding the concept of earth pit, importance of earth resistance and its measurement.	
14.	Wiring of backup power supply for domestic Installations including inverter, battery and load.	
15.	Troubleshooting of domestic electrical equipment's (tube light and fan).	
16.	Understand the usage of CRO, function generator. & Regulated power supply and Measurement of ac signal parameters using CRO.	
17.	Assembling electronic components on breadboard.	
18.	Obtain V-I characteristics of Light Emitting Diode.	
	Total	

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I B.Tech I Semester

COURSE CODE – R2011XXYY	PROGRAMMING FOR PROBLEM SOLVING USING C LAB	CATEGORY ESC	L-T-P 0-0-3	CREDITS 1.5

Pre-requisite:

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

		Knowledge Level (K)#
CO1	To develop effective C-programs for various problems.	K3
CO2	To develop effective C-programs on matrices arithmetic.	K3
CO3	To design and develop C-programs using arrays.	K4
CO4	To optimize the C-programming code by using pointers.	K4
CO5	To develop software for file management by using C-programming.	K5

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	1	3	2	--	--	--	1	1	1	3	3	3
CO2	2	3	3	1	3	2	--	--	--	1	1	1	2	3	3
CO3	2	2	3	1	3	1	--	--	--	1	1	1	2	2	3
CO4	2	2	2	1	2	1	--	--	--	1	1	1	2	2	2
CO5	2	2	2	1	2	1	--	--	--	1	1	1	2	2	2

(Please fill the above with Levels of Correlation, viz., L, M, H)

S.No.	List of Experiments	Contact Hours
1.	**Exercise 1:** 1. Write a C program to print a block F using hash (#), where the F has a height of six characters and width of five and four characters. 2. Write a C program to compute the perimeter and area of a rectangle with a height of 7 inches and width of 5 inches. 3. Write a C program to display multiple variables	
2.	**Exercise 2:** 4. Write a C program to calculate the distance between the two points. 5. Write a C program that accepts 4 integers p, q, r, s from the user where r and s are positive and p is even. If q is greater than r and	

	s is greater than p and if the sum of r and s is greater than the sum of p and q print "Correct values", otherwise print "Wrong values".	
3.	**Exercise 3:** 6. Write a C program to convert a string to a long integer. 7. Write a program in C which is a Menu-Driven Program to compute the area of the various geometrical shape. 8. Write a C program to calculate the factorial of a given number.	
4.	**Exercise 4:** 9. Write a program in C to display the n terms of even natural number and their sum. 10. Write a program in C to display the n terms of harmonic series and their sum. 1 + 1/2 + 1/3 + 1/4 + 1/5 ... 1/n terms. 11. Write a C program to check whether a given number is an Armstrong number or not.	
5.	**Exercise 5:** 12. Write a program in C to print all unique elements in an array. 13. Write a program in C to separate odd and even integers in separate arrays. 14. Write a program in C to sort elements of array in ascending order.	
6.	**Exercise 6:** 15. Write a program in C for multiplication of two square Matrices. 16. Write a program in C to find transpose of a given matrix. 17. Write a program in C to find inverse of a given matrix.	
7.	**Exercise 7:** 18. Write a program in C to search an element in a row wise and column wise sorted matrix. 19. Write a program in C to print individual characters of string in reverse order.	
8.	**Exercise 8:** 20. Write a program in C to compare two strings without using string library functions. 21. Write a program in C to copy one string to another string.	
9.	**Exercise 9:** 22. Write a C Program to Store Information Using Structures with Dynamically Memory Allocation 23. Write a program in C to demonstrate how to handle the pointers in the program.	

10.	**Exercise 10:** 24. Write a program in C to demonstrate the use of & (address of) and *(value at address) operator. 25. Write a program in C to add two numbers using pointers.	
11.	**Exercise 11:** 26. Write a program in C to add numbers using call by reference. 27. Write a program in C to find the largest element using Dynamic Memory Allocation.	
12.	**Exercise 12:** 28. Write a program in C to swap elements using call by reference. 29. Write a program in C to count the number of vowels and consonants in a string using a pointer.	
13.	**Exercise 13:** 30. Write a program in C to show how a function returning pointer. 31. Write a C program to find sum of n elements entered by user. To perform this program, allocate memory dynamically using malloc( ) function.	
14.	**Exercise 14:** 32. Write a C program to find sum of n elements entered by user. To perform this program, allocate memory dynamically using calloc( ) function. Understand the difference between the above two programs 33. Write a program in C to convert decimal number to binary number using the function.	
15.	**Exercise 15:** 34. Write a program in C to check whether a number is a prime number or not using the function. 35. Write a program in C to get the largest element of an array using the function.	
16.	**Exercise 16:** 36. Write a program in C to append multiple lines at the end of a text file. 37. Write a program in C to copy a file in another name. 38. Write a program in C to remove a file from the disk.	
17.	**Exercise 17:** 39. Write a program to create a data file. 40. Write a program to calculate the resonant frequency of an RLC series circuit.	

18.	**Exercise 18:** 41. Write a program to solve sin x, cos x, tan x expressed in exponential form where x is in radians – (i) $\frac{\pi}{4}$ (ii) $\pi/6$. 42. Write a program to draw a graph for y = mx + C where the constants 'm' and 'C' are defined and 'x' varies from 0 to 20 at intervals of 2 units. 43. Write a program to solve for 'x', if 2 log x = 4 log 3.	
	Total	

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I B.Tech I Semester

COURSE CODE – R2011XXYY	PHYSICAL FITNESS ACTIVITIES	CATEGORY MC	L-T-P 0-0-2	CREDITS 1.5

Pre-requisite:

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

		Knowledge Level (K)#
CO1		
CO2		
CO3		
CO4		
CO5		

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1															
CO2															
CO3															
CO4															
CO5															

(Please fill the above with Levels of Correlation, viz., L, M, H)

UNIT	CONTENTS	**Contact Hours**
	Note: Collect the syllabus from concerned BOS	
	Total	

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I B.Tech II Semester

COURSE CODE – R2011XXYY	MATHEMATICS – III (Transforms, PDE and Vector Calculus)	CATEGORY BSC	L-T-P 3-0-0	CREDITS 3

Pre-requisite:

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

		Knowledge Level (K)#
CO1	**apply** the Laplace transform for solving differential equations	L3
CO2	**find** or **compute** the Fourier series of periodic signals and be able to **apply** integral expressions for the forwards and inverse Fourier transform to a range of non-periodic waveforms	**L3**
CO3	**identify** solution methods for partial differential equations that model physical processes	**L3**
CO4	**interpret** the physical meaning of different operators such as gradient, curl and divergence	**L5**
CO5	**estimate** the work done against a field, circulation and flux using vector calculus	**L5**

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	--	--	--	--	--	--	--	--	--	2	2	--	--
CO2	3	3	--	--	--	--	--	--	--	--	--	2	3	--	--
CO3	2	2	--	--	--	--	--	--	--	--	--	1	2	--	--
CO4	2	3	--	--	--	--	--	--	--	--	--	2	2	--	--
CO5	3	3	--	--	--	--	--	--	--	--	--	2	3	--	--

(Please fill the above with Levels of Correlation, viz., L, M, H)

UNIT	CONTENTS	Contact Hours
UNIT - 1	**Laplace Transforms** Definition of Laplace transform - Laplace transforms of standard functions – Properties of Laplace Transforms: Shifting theorems – Transforms of derivatives and integrals – Unit step function – Dirac's delta function – Inverse Laplace transforms – Convolution theorem (with out proof). Applications: Solving ordinary differential equations (initial value problems) and integro differential equations using Laplace transforms.	**(10 hrs)**
UNIT - 2	**Fourier series and Fourier Transforms:** Fourier Series: Introduction – Periodic functions – Fourier series of	**(10 hrs)**

	periodic function – Dirichlet's conditions – Even and odd functions – Change of interval – Half-range sine and cosine series. Fourier Transforms: Fourier integral theorem (without proof) – Fourier sine and cosine integrals – Sine and cosine transforms – Properties (article-22.5 in text book-1) – inverse transforms – Convolution theorem (without proof) – Finite Fourier transforms.	
UNIT - 3	**Partial Differential Equations of first order** Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Solutions of first order linear (Lagrange) equation and nonlinear (standard types) equations.	**(08 hrs)**
UNIT - 4	**Second order PDE and Applications** Second order PDE: Solutions of linear partial differential equations with constant coefficients – Non-homogeneous term of the type $e^{ax+by}, \sin(ax+by), \cos(ax+by), x^m y^n$. Applications of PDE: Method of separation of Variables – Solution of One dimensional Wave, Heat and two-dimensional Laplace equation.	**(10 hrs)**
UNIT - 5	**Vector calculus** Differentiation of vectors – Scalar and vector point functions – Gradient – Directional derivative – Divergence – Curl – Scalar potential. Integration of vectors – Line integral – Circulation – Work done – Surface integral – Flux – Volume integral – Vector integral theorems: Greens, Stokes and Gauss Divergence theorems (without proof) and their applications.	**(10 hrs)**
	Total	

Text Books:

1. **B. S. Grewal,** Higher Engineering Mathematics, 44th Edition, Khanna Publishers.
2. **B. V. Ramana,** Higher Engineering Mathematics, 2007 Edition, Tata Mc. Graw Hill Education.

Reference Books:

1. **Erwin Kreyszig,** Advanced Engineering Mathematics, 10th Edition, Wiley-India.
2. **Dean. G. Duffy,** Advanced Engineering Mathematics with MATLAB, 3rd Edition, CRC Press.
3. **Peter O' Neil,** Advanced Engineering Mathematics, Cengage.
4. **Srimantha Pal, S C Bhunia,** Engineering Mathematics, Oxford University Press.

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I B.Tech II Semester

COURSE CODE – R2011XXYY	APPLIED PHYSICS	CATEGORY BSC	L-T-P 3-0-0	CREDITS 3

Pre-requisite:

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

		Knowledge Level (K)#
CO1	➢ **Explain** the need of coherent sources and the conditions for sustained interference (L2) ➢ **Identify** engineering applications of interference (L3) ➢ **Analyze** the differences between interference and diffraction with applications (L4) ➢ **Illustrate** the concept of polarization of light and its applications (L2) ➢ **Classify** ordinary polarized light and extraordinary polarized light (L2)	
CO2	➢ **Understand** the basic concepts of LASER light Sources (L2) ➢ **Apply** the concepts to learn the types of lasers (L3) ➢ **Identifies** the Engineering applications of lasers (L2) ➢ **Explain** the working principle of optical fibers (L2) ➢ **Classify** optical fibers based on refractive index profile and mode of propagation (L2) ➢ **Identify** the applications of optical fibers in various fields (L2)	
CO3	➢ **Explain** the concept of dielectric constant and polarization in dielectric materials (L2) ➢ **Summarize** various types of polarization of dielectrics (L2) ➢ **Interpret** Lorentz field and Claussius- Mosotti relation in dielectrics(L2) ➢ **Classify** the magnetic materials based on susceptibility and their temperature dependence (L2) ➢ **Explain** the applications of dielectric and magnetic materials (L2) ➢ **Apply** the concept of magnetism to magnetic data storage devices (L3)	
CO4	➢ **Explain** the concept of dual nature of matter (L2) ➢ **Understand** the significance of wave function (L2) ➢ **Interpret** the concepts of classical and quantum free electron theories (L2) ➢ **Explain** the importance of K-P model ➢ **Classify** the materials based on band theory (L2) ➢ **Apply** the concept of effective mass of electron (L3)	
CO5	➢ **Explain** the concept of dual nature of matter (L2) ➢ **Understand** the significance of wave function (L2) ➢ **Interpret** the concepts of classical and quantum free electron theories (L2) ➢ **Explain** the importance of K-P model ➢ **Classify** the materials based on band theory (L2) ➢ **Apply** the concept of effective mass of electron (L3)	

#Based on suggested Revised BTL

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Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CO2	1	--	--	--	1	--	--	--	--	--	--	--	--	--	--
CO3	--	1	1	--	--	--	--	--	--	--	--	--	--	--	--
CO4	--	1	--	--	--	--	--	--	--	--	--	--	--	--	--
CO5	1	--	1	--	--	--	--	--	--	--	--	--	1	1	--

(Please fill the above with Levels of Correlation, viz., L, M, H)

UNIT	CONTENTS	**Contact Hours**
UNIT - 1	**Wave Optics** **Interference:** Introduction - Principle of superposition –Interference of light - Interference in thin films (Reflection Geometry) and its applications - Colors in thin films- Newton's Rings- Determination of wavelength and refractive index. **Diffraction:** Introduction - Fresnel and Fraunhofer diffraction - Fraunhofer diffraction due to single slit, double slit - N-slits (Qualitative) – Diffraction Grating - Dispersive power and resolving power of Grating (Qualitative). **Polarization:** Introduction-Types of polarization - Polarization by reflection, refraction and Double refraction - Nicol's Prism -Half wave and Quarter wave plates.	(10Hrs)
UNIT - 2	**Lasers and Fiber optics** **Lasers:** Introduction – Characteristics of laser – Spontaneous and Stimulated emissions of radiation – Einstein's coefficients – Population inversion – Lasing action - Pumping Schemes – Ruby laser – He-Ne laser - Applications of lasers. **Fiber optics:** Introduction –Principle of optical fiber- Acceptance Angle - Numerical Aperture -Classification of optical fibers based on refractive index profile and modes – Propagation of electromagnetic wave through optical fiber - Applications.	(08Hrs)
UNIT - 3	**Dielectric and Magnetic Materials** **Dielectric Materials:** Introduction - Dielectric polarization - Dielectric polarizability, Susceptibility and Dielectric constant - Types of polarizations - Electronic (Quantitative), Ionic (Quantitative) and Orientation polarizations (Qualitative) - Lorentz internal field - Clausius-Mossotti equation - Piezoelectricity. **Magnetic Materials:** Introduction - Magnetic dipole moment – Magnetization - Magnetic susceptibility and permeability - Origin of permanent magnetic moment - Classification of magnetic materials: Dia, para, Ferro, antiferro & Ferri magnetic materials - Domain concept for Ferromagnetism and Domain walls (Qualitative) - Hysteresis - soft and hard magnetic materials.	(08Hrs)
UNIT - 4	**Quantum Mechanics, Free Electron Theory and Band theory** **Quantum Mechanics:** Dual nature of matter – Heisenberg's Uncertainty	(10Hrs)

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	Principle – Significance and properties of wave function – Schrodinger's time independent and dependent wave equations– Particle in a one-dimensional infinite potential well. **Free Electron Theory:** Classical free electron theory (Qualitative with discussion of merits and demerits) – Quantum free electron theory– Equation for electrical conductivity based on quantum free electron theory- Fermi-Dirac distribution- Density of states (3D) - Fermi energy. **Band theory of Solids**: Bloch's Theorem (Qualitative) - Kronig - Penney model (Qualitative)- E vs K diagram - v vs K diagram - effective mass of electron – Classification of crystalline solids–concept of hole.	
UNIT - 5	**Semiconductors and Superconductors** Introduction- Intrinsic semiconductors – Density of charge carriers – Electrical conductivity – Fermi level – extrinsic semiconductors – density of charge carriers – dependence of Fermi energy on carrier concentration and temperature - Drift and diffusion currents – Einstein's equation - Hall effect – Hall coefficient –Applications of Hall effect. **Superconductors**: Introduction – Properties of superconductors – Meissner effect – Type I and Type II superconductors – BCS theory (Qualitative) – Josephson effects (AC and DC) – SQUIDs – High T_c superconductors – Applications of superconductors.	(12Hrs)
	Total	

Text books:

1. Engineering Physics by M. N. Avadhanulu, P.G.Kshirsagar & TVS Arun Murthy S.Chand Publications, 11th Edition 2019.
2. Engineering Physics" by D.K.Bhattacharya and Poonam Tandon, Oxford press (2018).
3. Applied Physics by P.K.Palanisamy ,SciTech publications (2018)

Reference Books:

1. Fundamentals of Physics – Halliday, Resnick and Walker, John Wiley &Sons, 11th Edition (2018)
2. Engineering Physics by M.R.Srinivasan, New Age international publishers (2014).
3. Engineering Physics by Shatendra Sharma, Jyotsna Sharma, "",Pearson Education(2018)
4. Engineering Physics by Sanjay D. Jain, D. Sahasrabudhe and Girish, University Press(2016)
5. Semiconductor physics and devices- Basic principle – Donald A, Neamen, Mc Graw Hill(2014)
6. Engineering Physics by B.K. Pandey and S. Chaturvedi, , Cengage Learning(2018)
7. University Physics by H.D.Young and R.A. Freedman,Pearson(2017)

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I B.Tech II Semester

COURSE CODE – R2011XXYY	DATA STRUCTURES THROUGH C	CATEGORY ESC	L-T-P 3-0-0	CREDITS 3

Pre-requisite:

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

		Knowledge Level (K)#
CO1	To develop C-programs on the implementation of Stacks, Queues and Circular Queues.	K3
CO2	To design and develop Data Structures using arrays and linked lists	K3
CO3	To implement C-programs for various operations on Binary Search Trees and Heaps.	K4
CO4	To develop effective software for sorting the given data.	K5
CO5	To demonstrate effective searching techniques to find the given value in database.	K5

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	-	-	1	-	-	-	-	-	-	1	1	2	1
CO2	2	2	-	-	1	-	-	-	-	-	-	1	1	2	1
CO3	2	2	2	2	2	-	-	-	-	-	-	1	1	2	1
CO4	2	2	3	2	3	-	-	-	-	-	-	2	1	2	1
CO5	2	2	3	2	3	-	-	-	-	-	-	2	1	2	1

(Please fill the above with Levels of Correlation, viz., L, M, H)

UNIT	CONTENTS	**Contact Hours**
UNIT - 1	**Linear Data Structures: Arrays, Stacks And Queues** Data Structures -Operations-Abstract Data Types-Complexity of Algorithms-Time and Space-Arrays-Representation of Arrays-Linear Arrays-Insertion–Deletion and Traversal of a Linear Array-Array as an Abstract Data Type-Multi-Dimensional arrays-Strings-String Operations-Storing Strings-String as an Abstract Data Type Stack -Array Representation of Stack-Stack Abstract Data Type-Applications of Stacks: Prefix-Infix and Postfix Arithmetic Expressions-Conversion-Evaluation of Postfix Expressions-Recursion-Towers of Hanoi-Queues-Definition-Array Representation of Queue-The Queue Abstract Data Type-Circular Queues-Dequeues-Priority Queues.	
UNIT - 2	**Linked Lists**	

	Pointers-Pointer Arrays-Linked Lists-Node Representation-Single Linked List-Traversing and Searching a Single Linked List-Insertion into and Deletion from a Single Linked List-Header Linked Lists-Circularly Linked Lists-Doubly Linked Lists-Linked Stacks and Queues-Polynomials-Polynomial Representation-Sparse Matrices.	
UNIT - 3	**Trees** Terminology-Representation of Trees-Binary Trees-Properties of Binary Trees-Binary Tree Representations-Binary Tree Traversal-Preorder-Inorder and Postorder Traversal-Threads-Thread Binary Trees-Balanced Binary Trees-Heaps-Max Heap-Insertion into and Deletion from a Max Heap-Binary Search Trees-Searching-Insertion and Deletion from a Binary Search Tree-Height of Binary Search Tree, m-way Search Trees, B-Trees.	
UNIT - 4	**Graphs** Graph Theory Terminology-Graph Representation-Graph Operations-Depth First Search-Breadth First Search-Connected Components-Spanning Trees-Biconnected Components-Minimum Cost Spanning Trees-Kruskal's Algorithm-Prism's Algorithm-Shortest Paths-Transitive Closure-All-Pairs Shortest Path-Warshall's Algorithm.	
UNIT - 5	**Searching And Sorting** Searching: Linear Search, Binary Search, Fibonacci Search, Hashing-Sorting: Definition. Bubble Sort, Insertion sort, Selection Sort, Quick Sort, Merging: Merge Sort, Iterative and Recursive Merge Sort, Shell Sort, Radix Sort, Heap Sort.	
	Total	

Text Books:

1. Fundamentals of Data Structures in C, 2nd Edition, E.Horowitz, S.Sahni and Susan Anderson Freed, Universities Press Pvt. Ltd.
2. Data Structures With C, Seymour Lipschutz, Schaum's Outlines, Tata McGraw Hill.

Reference Books:

1. Computer Fundamentals and Programming, Sumithabha Das, Mc Graw Hill
2. Programming in C, Ashok N. Kamthane, Amit Kamthane, Pearson

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I B.Tech II Semester

COURSE CODE – R2011XXYY	ELECTRICAL CIRCUIT ANALYSIS -I	CATEGORY ESC	L-T-P 3-0-0	CREDITS 3

Pre-requisite:

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

		Knowledge Level (K)#
CO1	Examine various electrical networks in presence of active and passive elements.	
CO2	Analyze electrical networks with network topology concepts.	
CO3	Analyze magnetic circuit with various dot conventions.	
CO4	Calculate the parameters of R, L, C network with sinusoidal excitation.	
CO5	Calculate the parameters of R, L, network with variation of any one of the parameters i.e R, L, C and f.	
CO6	Solve Electrical networks by using principles of network theorems.	

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	--	--	--	--	--	--	--	--	--	2	3	1
CO2	3	3	2	--	--	--	--	--	--	--	--	--	2	3	1
CO3	3	3	2	--	--	--	--	--	--	--	--	--	2	3	1
CO4	3	3	2	--	--	--	--	--	--	--	--	--	2	3	1
CO5	3	3	2	--	--	--	--	--	--	--	--	--	2	3	1
	3	3	2	--	--	--	--	--	--	--	--	--	2	3	1

(Please fill the above with Levels of Correlation, viz., L, M, H)

UNIT	CONTENTS	Contact Hours
UNIT - 1	**Introduction to Electrical Circuits** Basic Concepts of passive elements of R, L, C and their V-I relations, Sources (dependent and independent),Kirchoff's laws, Network reduction techniques(series, parallel, series - parallel, star-to-delta and delta-to-star transformation), source transformation technique, nodal analysis and mesh analysis to DC networks with dependent and independent voltage and current sources., node and mesh analysis.	
UNIT - 2	**Magnetic Circuits** Basic definition of MMF, flux and reluctance, analogy between electrical and magnetic circuits, Faraday's laws of electromagnetic induction –	

	concept of self and mutual inductance, Dot convention – coefficient of coupling and composite magnetic circuit, analysis of series and parallel magnetic circuits.	
UNIT - 3	**Single Phase A.C Systems** Periodic waveforms (determination of rms, average value and form factor), concept of phasor, phase angle and phase difference – waveforms and phasor diagrams for lagging, leading networks, complex and polar forms of representations. node and mesh analysis. Steady state analysis of R, L and C circuits, power factor and its significance, real, reactive and apparent power, waveform of instantaneous power and complex power .	
UNIT - 4	**Resonance - Locus Diagrams** series and parallel resonance, selectively band width and Quality factor, locus diagram- RL, RC, RLC with R, L and C variables.	
UNIT - 5	**Network theorems (DC & AC Excitations)** Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum Power Transfer theorem, Reciprocity theorem, Millman's theorem and compensation theorem.	
	Total	

Text Books:

1. Engineering Circuit Analysis by William Hayt and Jack E.Kemmerley,Mc Graw Hill Company,6th edition.
2. Network Analysis: Van Valkenburg; Prentice-Hall of India Private Ltd

Reference Books:

1. Fundamentals of Electrical Circuits by Charles K.Alexander and Mathew N.O.Sadiku, Mc Graw Hill Education (India)
2. Linear Circuit Analysis by De Carlo, Lin, Oxford publications
3. Electric Circuits – (Schaum's outlines) by Mahmood Nahvi & Joseph Edminister, Adapted by Kuma Rao, 5th Edition – Mc Graw Hill.
4. Electric Circuits by David A. Bell, Oxford publications
5. Introductory Circuit Analysis by Robert L Boylestad, Pearson Publications
6. Circuit Theory(Analysis and Synthesis) by A.Chakrabarthi,Dhanpat Rai&Co.

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I B.Tech II Semester

COURSE CODE – R2011XXYY	ENGINEERING DRAWING	CATEGORY ESC	L-T-P 3-0-0	CREDITS 3

Pre-requisite:

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

		Knowledge Level (K)#
CO1	Understand the basic principles of engineering drawing and construction of curves used in engineering field.	
CO2	Practice the representation of geometric physical quantities (Length, Area and Volume) in the form of scales.	
CO3	Apply the knowledge of interpretation of projection in different quadrants.	
CO4	Understand the projections of solids, when it is inclined to both planes simultaneously.	
CO5	Convert the pictorial views into orthographic views.	
CO6	Create intricate details of components through 3D-isometric Pictorial Projection.	

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	--	--	--	2	--	1	--	--	--	--	2	2	--	--
CO2	2	2	3	--	3	--	2	2	--	--	3	--	--	--	2
CO3	3	--	--	--	--	--	--	--	3	2		--	2	2	--
CO4	2	3	3	--	--	--	--	--	--	--	2	3	--	--	--
CO5	--	2	--	2	3	--	3	--	--	--	--	--	--	2	2
CO6	2	--	--	--	--	3	--	--	--	1	3	--	2	--	2

(Please fill the above with Levels of Correlation, viz., L, M, H)

UNIT	CONTENTS	**Contact Hours**

Course Objective: Engineering drawing being the principle method of communication for engineers, the objective is to introduce the students, the techniques of constructing the various types of polygons, curves and scales. The objective is also to visualize and represent the 3D objects in 2D planes with proper dimensioning, scaling etc.

Unit I

Objective: To introduce the students to use drawing instruments and to draw polygons, Engg. Curves.

Polygons: Constructing regular polygons by general methods, inscribing and describing polygons on

	circles. **Curves:** Parabola, Ellipse and Hyperbola by general and special methods, cycloids, involutes, tangents & normals for the curves. **Unit II** **Objective:** To introduce the students to use scales and orthographic projections, projections of points & simple lines. **Scales:** Plain scales, diagonal scales and vernier scales **Orthographic Projections:** Reference plane, importance of reference lines, projections of points in various quadrants, projections of lines, line parallel to both the planes, line parallel to one plane and inclined to other plane. **Unit III** **Objective:** The objective is to make the students draw the projections of the lines inclined to both the planes. Projections of straight lines inclined to both the planes, determination of true lengths, angle of inclination and traces. **Unit IV** **Objective:** The objective is to make the students draw the projections of the plane inclined to both the planes. Projections of planes: regular planes perpendicular/parallel to one reference plane and inclined to the other reference plane; inclined to both the reference planes. **Unit V** **Objective:** The objective is to make the students draw the projections of the various types of solids in different positions inclined to one of the planes. Projections of Solids – Prisms, Pyramids, Cones and Cylinders with the axis inclined to one of the planes. **Unit VI** **Objective:** The objective is to represent the object in 3D view through isometric views. The student will be able to represent and convert the isometric view to orthographic view and vice versa. Conversion of isometric views to orthographic views; Conversion of orthographic views to isometric views.	
	Total	

TEXT BOOKS:

1. Engineering Drawing by N.D. Butt, Chariot Publications
2. Engineering Drawing by Agarwal & Agarwal, Tata McGraw Hill Publishers

REFERENCE BOOKS:

1. Engineering Drawing by K.L.Narayana & P. Kannaiah, Scitech Publishers
2. Engineering Graphics for Degree by K.C. John, PHI Publishers
3. Engineering Graphics by PI Varghese, McGrawHill Publishers
4. Engineering Drawing + AutoCad – K Venugopal, V. Prabhu Raja, New Age

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I B.Tech II Semester

COURSE CODE – R2011XXYY	THERMAL AND HYDRO PRIME MOVERS LAB	CATEGORY ESC	L-T-P 0-0-3	CREDITS 1.5

Pre-requisite:

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

		Knowledge Level (K)#
CO1		
CO2		
CO3		
CO4		
CO5		

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1															
CO2															
CO3															
CO4															
CO5															

(Please fill the above with Levels of Correlation, viz., L, M, H)

S.No.	CONTENTS	**Contact Hours**
	NOTE: TO CONDUCT MINIMUM OF 12 EXPERIMENTS BY CONDUCTING MINIMUM OF SIX FROM EACH SECTION	
	SECTION A - THERMAL ENGINEERING LAB	
1.	I.C. Engines valve / port timing diagrams.	
2.	I.C. Engines performance test on 4 -stroke Diesel engine.	
3.	I.C. Engines performance test on 2-stroke petrol engine.	
4.	Evaluation of engine friction by conducting Morse test on 4-stroke multi cylinder petrol engine	
5.	Determination of FP by retardation and motoring test on IC engine	
6.	I.C. Engine heat balance on petrol / Diesel engines.	
7.	Economical speed test of an IC engine	
8.	Study of boilers	

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	SECTION B –HYDRAULIC MACHINES LAB	
1.	Impact of jets on Vanes.	
2.	Performance Test on Pelton Wheel.	
3.	Performance Test on Francis Turbine.	
4.	Performance Test on Kaplan Turbine.	
5.	Performance Test on Single Stage Centrifugal Pump.	
6.	Performance Test on Reciprocating Pump.	
7.	Calibration of Venturimeter.	
8.	Calibration of Orifice meter.	
9.	Determination of loss of head due to sudden contraction in a pipeline.	

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I B.Tech II Semester

COURSE CODE – R2011XXYY	APPLIED PHYSICS LABORATORY	CATEGORY BSC	L-T-P 0-0-3	CREDITS 1.5

Pre-requisite:

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

		Knowledge Level (K)#
CO1		
CO2		
CO3		
CO4		
CO5		

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CO2	1	--	1	--	1	--	--	--	--	--	--	--	--	--	--
CO3	1	--	1	--	--	--	--	--	--	--	--	--	--	--	--
CO4	1	--	1	--	1	--	--	--	--	--	--	--	--	--	--

(Please fill the above with Levels of Correlation, viz., L, M, H)

S.No.	CONTENTS	**Contact Hours**
	(Any 10 of the following listed experiments)	
1.	Determination of thickness of thin object by wedge method.	
2.	Determination of radius of curvature of a given plano convex lens by Newton's rings.	
3.	Determination of wavelengths of different spectral lines in mercury spectrum using diffraction grating in normal incidence configuration.	
4.	Determination of Resolving power of telescope.	
5.	Determination of dielectric constant using charging and discharging method.	
6.	Study the variation of B versus H by magnetizing the magnetic material (B-H curve).	
7.	Determination of numerical aperture and acceptance angle of an optical fiber.	
8.	Determination of wavelength of Laser light using diffraction grating.	
9.	Estimation of Planck's constant using photoelectric effect.	

10.	Determination of the Resistivity of semiconductor by four probe method.	
11.	Determination of the energy gap of a semiconductor using p-n junction diode.	
12.	Magnetic field along the axis of a current carrying circular coil by Stewart & Gee's Method	
13.	Determination of Hall voltage and Hall coefficient of a given semiconductor using Hall Effect.	
14.	Determination of the temperature coefficients of a given thermistor.	
15.	Determination of Acceleration due to gravity and Radius of gyration using Compound pendulum.	

References:

1. S. Balasubramanian, M.N. Srinivasan "A Text Book of Practical Physics"- S Chand Publishers, 2017.

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I B.Tech II Semester

COURSE CODE – R2011XXYY	DATA STRUCTURES THROUGH C LAB	CATEGORY ESC	L-T-P 0-0-3	CREDITS 1.5

Pre-requisite:

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

		Knowledge Level (K)#
CO1	To develop C-programs on the implementation of Stacks, Queues and Circular Queues.	K3
CO2	To design and develop Data Structures using arrays and linked lists	K3
CO3	To implement C-programs for various operations on Binary Search Trees and Heaps.	K4
CO4	To develop effective software for sorting the given data.	K5
CO5	To demonstrate effective searching techniques to find the given value in database.	K5

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	1	3	2	--	--	--	1	1	1	2	1	1
CO2	2	3	3	1	3	2	--	--	--	1	1	1	2	1	1
CO3	2	2	3	1	3	1	--	--	--	1	1	1	2	1	1
CO4	2	2	2	1	2	1	--	--	--	1	1	1	2	1	1
CO5	2	2	2	1	2	1	--	--	--	1	1	1	2	1	1

(Please fill the above with Levels of Correlation, viz., L, M, H)

UNIT	CONTENTS	**Contact Hours**
	To develop a program and implement	
1.	Operations on Strings.	
2.	Basic operations on Stacks.	
3.	Basic operations on Queue.	
4.	Basic operations on Circular Queue.	
5.	Multi stack in a single array.	
6.	List data structure using i) array ii) singly linked list.	
7.	Basic operations on doubly linked list.	
8.	Basic operations (insertion, deletion, search, find min and find max) on Binary Search trees.	
	To develop a program and implementation of	
1.	Heaps.	

2.	Breadth First Search Techniques.	
3.	Depth First Search Techniques.	
4.	Prim's algorithm.	
5.	Kruskal's Algorithm.	
6.	Linear search.	
7.	Fibanocci search.	
8.	Merge sort.	
9.	Quick sort**.**	
	Total	

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I B.Tech II Semester

COURSE CODE – R2011XXYY	APPLIED PHYSICS VIRTUAL LABORATORY	CATEGORY BSC	L-T-P 0-0-2	CREDITS 0

Pre-requisite:

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

		Knowledge Level (K)#
CO1		
CO2		
CO3		
CO4		
CO5		

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1														
CO2	1		1		1										
CO3	1		1												
CO4	1		1		1										

(Please fill the above with Levels of Correlation, viz., L, M, H)

S.No.	CONTENTS	**Contact Hours**
	(Any 5 of the following listed 10 experiments)	
1.	Hall Effect	
2.	Brewster's angle	
3.	Numerical Aperture of Optical fiber	
4.	Photoelectric Effect	
5.	Michelson's interferometer	
6.	Newton's rings –Refractive index of liquid	
7.	Dispersive power of a prism	
8.	Resolving power of the prism	

9.	Magnetic susceptibility by Quincke's method	
10.	AC Sonometer	
	Total	

URL: www.vlab.co.in

UNIVERSITY COLLEGE OF ENGINEERING KAKINADA (AUTONOMOUS) :: JNTUK,KAKINADA
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

I B.Tech II Semester

COURSE CODE – R2011XXYY	CONSTITUTION OF INDIA	CATEGORY MC	L-T-P 2-0-0	CREDITS 0

Pre-requisite:

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

		Knowledge Level (K)#
CO1	Understand historical background of the constitution making and its importance for building a democratic India.	
CO2	Understand the functioning of three wings of the government ie., executive, legislative and judiciary.	
CO3	Understand the value of the fundamental rights and duties for becoming good citizen of India.	
CO4	Analyze the decentralization of power between central, state and local self-government.	
CO5	Apply the knowledge in strengthening of the constitutional institutions like CAG, Election Commission and UPSC for sustaining democracy. ➢ Know the sources, features and principles of Indian Constitution. ➢ Learn about Union Government, State government and its administration. ➢ Get acquainted with Local administration and Pachayati Raj. ➢ Be aware of basic concepts and developments of Human Rights. ➢ Gain knowledge on roles and functioning of Election Commission	

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	--	--	2	--	--	2	2	--	2	--	--	2	--	--	1
CO2	--	--	3	--	--	3	3	--	3	--	--	2	--	--	1
CO3	--	--	3	--	--	3	3	--	3	--	--	2	--	--	1
CO4	--	--	2	--	--	2	2	--	2	--	--	1	--	--	1
CO5	--	--	3	--	--	3	3	--	3	--	--	3	--	--	2

(Please fill the above with Levels of Correlation, viz., L, M, H)

UNIT	CONTENTS	**Contact Hours**
UNIT – 1	Introduction to Indian Constitution: Constitution meaning of the term, Indian Constitution - Sources and constitutional history, Features - Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy.	
UNIT – 2	Union Government and its Administration Structure of the Indian	

	Union: Federalism, Centre- State relationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, LokSabha, RajyaSabha, The Supreme Court and High Court: Powers and Functions;	
UNIT – 3	State Government and its Administration Governor - Role and Position - CM and Council of ministers, State Secretariat: Organisation, Structure and Functions	
UNIT – 4	A.Local Administration - District's Administration Head - Role and Importance, Municipalities - Mayor and role of Elected Representative - CEO of Municipal Corporation PachayatiRaj: Functions PRI: ZilaPanchayat, Elected officials and their roles, CEO ZilaPanchayat: Block level Organizational Hierarchy - (Different departments), Village level - Role of Elected and Appointed officials - Importance of grass root democracy	
UNIT – 5	Election Commission: Election Commission- Role of Chief Election Commissioner and Election Commissionerate State Election Commission:, Functions of Commissions for the welfare of SC/ST/OBC and women	
	Total	

References:

1. Durga Das Basu, Introduction to the Constitution of India, Prentice – Hall of India Pvt. Ltd.. New Delhi
2. SubashKashyap, Indian Constitution, National Book Trust
3. J.A. Siwach, Dynamics of Indian Government & Politics
4. D.C. Gupta, Indian Government and Politics
5. H.M.Sreevai, Constitutional Law of India, 4th edition in 3 volumes (Universal Law Publication)
6. J.C. Johari, Indian Government andPolitics Hans
7. J. Raj IndianGovernment and Politics
8. M.V. Pylee, Indian Constitution Durga Das Basu, Human Rights in Constitutional Law, Prentice – Hall of India Pvt. Ltd.. New Delhi
9. Noorani, A.G., (South Asia Human Rights Documentation Centre), Challenges to Civil Right), Challenges to Civil Rights Guarantees in India, Oxford University Press 2012

E-resources:

1. nptel.ac.in/courses/109104074/8
2. nptel.ac.in/courses/109104045/
3. nptel.ac.in/courses/101104065/
4. www.hss.iitb.ac.in/en/lecture-details
5. www.iitb.ac.in/en/event/2nd-lecture-institute-lecture-series-indian-constitution

UNIVERSITY COLLEGE OF ENGINEERING KAKINADA (AUTONOMOUS) :: JNTUK,KAKINADA
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

I B.Tech II Semester

COURSE CODE – R2011XXYY	ENGINEERING EXPLORATION PROJECT- DESIGN THINKING	CATEGORY MC	L-T-P 0-0-1	CREDITS 0

Pre-requisite:

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

		Knowledge Level (K)#
CO1		
CO2		
CO3		
CO4		
CO5		

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1															
CO2															
CO3															
CO4															
CO5															

(Please fill the above with Levels of Correlation, viz., L, M, H)

UNIT	CONTENTS	**Contact Hours**
	Total	

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

II B.Tech I Semester

COURSE CODE – R2011XXYY	MATHEMATICS-IV (Complex Variable and Statistical Methods)	CATEGORY BSC	L-T-P 3-0-0	CREDITS 3

Pre-requisite:

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

		Knowledge Level (K)#
CO1	**apply** Cauchy-Riemann equations to complex functions in order to determine whether a given continuous function is analytic	L3
CO2	**find** the differentiation and integration of complex functions used in engineering problems	**L5**
CO3	**make use** of the Cauchy residue theorem to evaluate certain integrals	**L3**
CO4	**apply** discrete and continuous probability distributions	**L3**
CO5	**design** the components of a classical hypothesis test **infer** the statistical inferential methods based on small and large sampling tests	**L6**

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	--	--	--	--	--	--	--	--	--	1	3	--	--
CO2	2	2	--	--	--	--	--	--	--	--	--	1	2	--	--
CO3	3	3	--	--	--	--	--	--	--	--	--	2	3	--	--
CO4	3	3	--	--	--	--	--	--	--	--	--	2	1	--	--
CO5	3	3	--	--	--	--	--	--	--	--	--	3	2	--	--

(Please fill the above with Levels of Correlation, viz., L, M, H)

UNIT	CONTENTS	Contact Hours
UNIT - 1	**Functions of a complex variable and Complex integration:** Introduction – Continuity – Differentiability – Analyticity – Cauchy-Riemann equations in Cartesian and polar coordinates – Harmonic and conjugate harmonic functions – Milne – Thompson method. Complex integration: Line integral – Cauchy's integral theorem – Cauchy's integral formula – Generalized integral formula (all without proofs) and problems on above theorems.	**(10hrs)**
UNIT - 2	**Series expansions and Residue Theorem:**	**(10hrs)**

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	Radius of convergence – Expansion in Taylor's series, Maclaurin's series and Laurent series. Types of Singularities: Isolated – Essential – Pole of order m – Residues – Residue theorem (without proof) – Evaluation of real integral of the types $\int_{-\infty}^{\infty} f(x)dx$ and $\int_{c}^{c+2\pi} f(\cos\theta,\sin\theta)d\theta$.	
UNIT - 3	**Probability and Distributions:** Review of probability and Baye's theorem – Random variables – Discrete and Continuous random variables – Distribution functions – Probability mass function, Probability density function and Cumulative distribution functions – Mathematical Expectation and Variance – Binomial, Poisson, Uniform and Normal distributions.	**(10hrs)**
UNIT - 4	**Sampling Theory:** Introduction – Population and Samples – Sampling distribution of Means and Variance (definition only) – Central limit theorem (without proof) – Representation of the normal theory distributions – Introduction to t, χ^2 and F-distributions – Point and Interval estimations – Maximum error of estimate.	**(8hrs)**
UNIT - 5	**Tests of Hypothesis:** Introduction – Hypothesis – Null and Alternative Hypothesis – Type I and Type II errors – Level of significance – One tail and two-tail tests – Test of significance for large samples: Single and two means – Single and two proportions – Student's t- distribution: Significance test of a sample mean – Significance test of difference between sample means.	**(10hrs)**
	Total	

Text Books:

1. **B. S. Grewal,** Higher Engineering Mathematics, 44th Edition, Khanna Publishers.
2. **Miller and Freund's,** Probability and Statistics for Engineers, 7/e, Pearson, 2008.

Reference Books:

1. **J. W. Brown and R. V. Churchill**, Complex Variables and Applications, 9th edition, Mc-Graw Hill, 2013.
2. **S. C. Gupta and V. K. Kapoor**, Fundamentals of Mathematical Statistics, 11/e, Sultan Chand & Sons Publications, 2012.
3. **Jay l. Devore,** Probability and Statistics for Engineering and the Sciences, 8th Edition, Cengage.
4. **Shron L. Myers, Keying Ye, Ronald E Walpole,** Probability and Statistics Engineers and the Scientists, 8th Edition, Pearson 2007.
5. **Sheldon, M. Ross**, Introduction to probability and statistics Engineers and the Scientists, 4th Edition, Academic Foundation, 2011

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II B.Tech I Semester

COURSE CODE – R2011XXYY	ELECTRONIC DEVICES AND CIRCUITS	CATEGORY PCC	L-T-P 3-0-0	CREDITS 3

Pre-requisite:

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

		Knowledge Level (K)#
CO1	Apply the basic concepts of semiconductor physics.	K4
CO2	Understand the formation of p-n junction and how it can be used as a p-n junction as diode in different modes of operation.	K5
CO3	Know the construction, working principle of rectifiers with and without filters with relevant expressions and necessary comparisons.	K1
CO4	Understand the construction, principle of operation of transistors, BJT and FET with their V-I characteristics in different configurations.	K1
CO5	Know the need of transistor biasing, various biasing techniques for BJT and FET and stabilization concepts with necessary expressions & small signal low frequency transistor amplifier circuits using BJT and FET in different configurations.	K6

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	**3**	3	--	--	--	--	--	--	--	--	--	--	--	--
CO2	--	--	--	--	--	**3**	--	--	--	--	--	--	--	--	--
CO3	3	--	--	--	**2**	--	--	--	--	--	--	--	1	--	--
CO4	--	3	--	**1**	--	--	--	--	--	--	--	--	--	2	--
CO5	1	--	1	--	3	--	--	--	--	--	--	--	--	--	3

(Please fill the above with Levels of Correlation, viz., L, M, H)

UNIT	CONTENTS	Contact Hours
UNIT - 1	**Review of Semi-Conductor Physics:** Hall effect, continuity equation, law of junction, Fermi Dirac function, Fermi level in intrinsic and extrinsic Semiconductors. **Junction Diode Characteristics :** energy band diagram of PN junction Diode, Open circuited p-n junction, Biased p-n junction, p-n junction diode, current components in PN junction Diode, diode equation, V-I Characteristics, temperature dependence on V-I characteristics, Diode resistance, Diode capacitance.	12

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UNIT - 2	**Special Semiconductor Devices**: Zener Diode, Breakdown mechanisms, Zener diode applications, LED, Varactor Diode, Photodiode, Tunnel Diode, UJT, PNPN Diode, SCR. Construction, operation and V-I characteristics. **Rectifiers and Filters:** Basic Rectifier setup**,** half wave rectifier, full wave rectifier, bridge rectifier, derivations of characteristics of rectifiers, rectifier circuits-operation, input and output waveforms, Filters, Inductor filter(Series inductor), Capacitor filter(Stunt inductor), π-Filter, comparison of various filter circuits in terms of ripple factors.	12
UNIT - 3	**BJT:** Junction transistor, transistor current components, transistor equation, transistor configurations, transistor as an amplifier, and characteristics of transistor in Common Base, Common Emitter and Common Collector configurations, Ebers-Moll model of a transistor, punch through/ reach through, Photo transistor, typical transistor junction voltage values. **FET:** FET types, construction, operation, characteristicsμ, g_m, r_d parameters, MOSFET-types, construction, operation, characteristics, comparison between JFET and MOSFET.	12
UNIT - 4	**Transistor Biasing and Thermal Stabilization :** Need for biasing, operating point, load line analysis, BJT biasing- methods, basic stability, fixed bias, collector to base bias, self-bias, Stabilization against variations in V_{BE}, Ic, and β, Stability factors, (S,S',S''), Bias compensation, Thermal runaway, Thermal stability. FET Biasing- methods and stabilization.	12
UNIT - 5	**BJT:** Two port network, Transistor hybrid model, determination of h-parameters, conversion of h-parameters, generalized analysis of transistor amplifier model using h-parameters, Analysis of CB, CE and CC amplifiers using exact and approximate analysis, Comparison of transistor amplifiers. **FET:** Generalized analysis of small signal model, Analysis of CG, CS and CD amplifiers, comparison of FET amplifiers.	12
	Total	60

Text Books:

1. Electronic Devices and Circuits- J. Millman, C. Halkias, Tata Mc-Graw Hill, SecondEdition,2007
2. Electronic Devices and Circuits by David A. Bell, Oxford University Press
3. Electronics devices & circuit theory- Robert L.Boylestad and LouiNashelsky, Pearson/Prentice hall, tenth edition,2009

Reference Books:

1. Integrated Electronics-J. Millman, C. Halkias,Tata Mc-Graw Hill, Second Edition,2009
2. Electronic Devices and Circuits-K. Lal Kishore, BS Publications, Fourth Edition,2016.
3. Electronic Devices and Circuits-Salivahanan, Kumar, Vallavaraj, Tata Mc-Graw Hill, 4th Edition,2008.
4. Electronic Devices and Integrated Circuits – B.P. Singh,Rekha , Pearson publications, 2006.

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II B.Tech I Semester

COURSE CODE – R2011XXYY	ELECTRICAL CIRCUIT ANALYSIS - II	CATEGORY PCC	L-T-P 3-0-0	CREDITS 3

Pre-requisite:

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

		Knowledge Level (K)#
CO1	Solve three phase circuits under balanced and unbalanced conditions.	
CO2	Find the transient response of electrical networks for different types of excitations.	
CO3	Find the parameters of different types of networks.	
CO4	Realize electrical equivalent networks for a given network transfer function.	
CO5	Analyse electrical circuits using applications of Fourier series and Fourier transforms.	

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	--	--	--	--	--	--	--	--	2	3	1
CO2	3	3	2	2	--	--	--	--	--	--	--	--	2	3	1
CO3	3	3	2	2	--	--	--	--	--	--	--	--	2	3	1
CO4	3	3	2	2	--	--	--	--	--	--	--	--	2	3	1
CO5	3	3	2	2	--	--	--	--	--	--	--	--	2	3	1

(Please fill the above with Levels of Correlation, viz., L, M, H)

UNIT	CONTENTS	Contact Hours
UNIT - 1	**Balanced and Unbalanced Three phase circuits** **Analysis of three phase balanced circuits:** Phase sequence, star and delta connection of sources and loads, relation between line and phase voltages and currents, analysis of balanced three phase circuits, measurement of active and reactive power. **Analysis of three phase unbalanced circuits:** Loop method, Star-Delta transformation technique, two wattmeter method for measurement of three phase power.	
UNIT - 2	**Transient Analysis in DC Circuits** Transient response of First order (R-L, R-C) and second order (R-L-C) circuits using differential equations.	

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	Transient response of First order (R-L, R-C) and second order (R-L-C) circuits using Laplace transforms.	
UNIT - 3	**Transient Analysis in AC circuits** Transient response of First order (R-L, R-C) and second order (R-L-C) circuits using differential equations. Transient response of First order (R-L, R-C) and second order (R-L-C) circuits using Laplace transforms.	
UNIT - 4	**Two Port Networks** Two port network parameters – Z, Y, ABCD and Hybrid parameters and their relations, cascaded networks.	
UNIT - 5	**Filters** Need of Filters – Classification - Characteristic impedance - Low Pass Filter, High Pass Filter, Band Pass Filter, Band Stop or Band Elimination Filter, m-Derived Filter, Composite filters – Design of Filters.	
	Total	

Text Books:

1. Engineering Circuit Analysis by William Hayt and Jack E.Kemmerley, McGraw Hill Company, 9th edition, 2018.
2. Network analysis: Van Valkenburg: Prentice-Hall of India Private Ltd, 3rd edition, 2019.

Reference Books:

1. Fundamentals of Electrical Circuits by Charles K.Alexander and Mathew N.O.Sadiku, McGraw Hill Education (India), 6th edition, 2019.
2. Introduction to circuit analysis and design by Tildon H Glisson. Jr, Springer Publications, 1st edition, 2011.
3. Circuits by A. Bruce Carlson, Cengage Learning Publications, 1st edition, 2008.
4. Network Theory Analysis and Synthesis by Smarajit Ghosh, PHI publications, ninth print, 2015.
5. Networks and Systems by D. Roy Choudhury, New Age International publishers, 2nd edition, 2013.
6. Electric circuit by Joseph Edminister, schaum's outlines series, seventh edition, 2017.
7. Electric Circuits by David A. Bell, Oxford publications, 7th edition, 2009.
8. Circuit Theory (Analysis and Synthesis) by A.Chakrabarthi, DhanpatRai & Co, 7th - Revised edition, 2018).

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II B.Tech I Semester

COURSE CODE – R2011XXYY	DC MACHINES AND TRANSFORMERS	CATEGORY PCC	L-T-P 3-0-0	CREDITS 3

Pre-requisite:

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

		Knowledge Level (K)#
CO1	Understand the unifying principles of electromagnetic energy conversion, construction and principle of operation of DC machines	2
CO2	Understand Armature reaction and commutation principles of DC machines and illustrate the characteristics of DC motors	3
CO3	Illustrate speed control methods and testing methods of DC machines. Develop the equivalent circuit of a single-phase transformer	3
CO4	Apply testing methods for performance evaluation of single-phase transformer and describe the operation of autotransformer	4
CO5	Analyze the effect of harmonics in three-phase transformers and understand the functioning of off-load and on-load tap changers, Scott connection	4

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1	-	1	-	-	-	-	1	2	2	2	2
CO2	3	2	2	2	-	1	-	-	-	-	1	3	3	2	2
CO3	3	3	2	2	-	1	-	-	-	-	1	3	3	3	2
CO4	3	3	2	2	-	1	-	-	-	-	1	3	3	3	2
CO5	3	3	2	2	-	1	-	-	-	-	1	3	3	3	2

(Please fill the above with Levels of Correlation, viz., 3: Strong, 2: Moderate, 1: Week)

UNIT	CONTENTS	Contact Hours
UNIT - 1	**Electromechanical Energy Conversion and introduction to DC machines** Principles of electromechanical energy conversion - singly excited and multi excited systems- calculation of force and torque using the concept of co-energy**.** Construction and principle of operation of DC machines – EMF equation for generator –Excitation techniques– characteristics of DC shunt generator –applications of DC Generators.	
UNIT - 2	**Operation of DC motors** Back-emf and torque equations of dc motors – Armature reaction and	

	commutation – characteristics of separately-excited, shunt, series and compound motors – losses and efficiency – applications of dc motors. Necessity of a starter – starting by 3 point and 4 point starters.	
UNIT - 3	**Speed Control of motors and Testing of DC Machines** Speed control by armature voltage and field control – testing of DC machines – brake test, Swinburne's method – principle of regenerative or Hopkinson's method – retardation test –field's test- separation of losses. **Single-phase Transformers** Types and constructional details – principle of operation –emf equation – operation on no load and on load – lagging, leading and unity power factors loads –phasor diagrams of transformers – equivalent circuit.	
UNIT - 4	**Performance and testing of transformers and auto transformers:** Regulation – losses and efficiency – effect of variation of frequency and supply voltage on losses – all day efficiency. Tests on single phase transformers – open circuit and short circuit tests – Sumpner's test – separation of losses – parallel operation with equal voltage ratios – auto transformer – equivalent circuit – comparison with two winding transformers.	
UNIT - 5	**3-Phase Transformer:** Polyphase connections- Y/Y, Y/ Δ, Δ/Y, Δ/ Δ and open Δ- third harmonics in phase voltages – three winding transformers- transients in switching –off load and on load tap changers- Scott connection.	
	Total	

Text Books:

1. Electrical Machines by P.S. Bhimbra, Khanna Publishers, 7th edition, 2011.
2. Electric Machinery by A.E.Fitzgerald, Charles kingsley, Stephen D.Umans, TMH, 6th edition, 2003.

Reference Books:

1. Electrical Machines by D. P.Kothari, I .J .Nagarth, McGraw Hill Publications, 4th edition, 2010.
2. Electrical Machines by R.K.Rajput, Lakshmi publications, 5th edition.
3. Electrical Machinery by Abijith Chakrabarthi and SudhiptaDebnath, McGraw Hill, 1st edition.
4. Electrical Machinery Fundamentals by Stephen J Chapman McGraw Hill education, 4th edition, 2010.
5. Electric Machines by Mulukutla S.Sarma & Mukeshk. Pathak, CENGAGE Learning, 1st edition, 2008.
6. Theory & Performance of Electrical Machines by J.B.Guptha. S.K.Kataria & Sons, 1st edition, 2009.

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II B.Tech I Semester

COURSE CODE – R2011XXYY	ELECTRO MAGNETIC FIELDS	CATEGORY PCC	L-T-P 3-0-0	CREDITS 3

Pre-requisite:

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

		Knowledge Level (K)#
CO1	Compute electric fields and potentials using Guass law or solve Laplace's or Possion's equations for various electric charge distributions.	
CO2	Calculate the capacitance and energy stored in dielectrics.	
CO3	Calculate the magnetic field intensity due to current carrying conductor and understanding the application of Ampere's law, Maxwell's second and third law.	
CO4	Estimate self and mutual inductances and the energy stored in the magnetic field.	
CO5	Understand the concepts of displacement current and Poynting theorem and Poynting vector.	

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	2	2	1	2	1	1	2	2	2	3	2	2
CO2	2	2	1	1	1	1	1	1	1	2	1	2	2	2	2
CO3	3	2	2	2	2	1	1	1	1	1	2	2	2	2	2
CO4	2	2	1	1	1	1	2	1	1	1	2	2	2	2	2
CO5	2	2	1	1	1	1	1	1	1	1	1	2	2	2	2

(Please fill the above with Levels of Correlation, viz., L, M, H)

UNIT	CONTENTS	Contact Hours
UNIT - 1	**Electrostatics:** Coulomb's Law – Electric Field Intensity (EFI) – EFI due to a line and a surface charge, work done in moving a point charge in an electrostatic field, electric potential – potential gradient, Gauss's law – Maxwell's first law (div(D)=ρ_v), Laplace's and Poison's equations and solution of Laplace's equation in one variable.	
UNIT - 2	**Conductors – Dielectrics and Capacitance:** Electric dipole – dipole moment – potential and EFI due to an electric dipole, Torque on an Electric dipole in an electric field, conductors and Insulators – their behaviour in electric field. Polarization, boundary conditions between conductor to dielectric,	

	dielectric to dielectric and conductor to free space. Capacitance of parallel plates, spherical dielectrics, energy stored and energy density in a static electric field, current density, conduction and convection current densities, Ohm's law in point form – equation of continuity.	
UNIT - 3	**Magneto statics, Ampere's Law and Force in magnetic fields:** Biot-Savart's law and its applications viz. Straight current carrying filament, circular, square, rectangle and solenoid current carrying wire – Maxwell's second Equationb(div(B)=0), Ampere's circuital law and its applications viz. MFI due to an infinite sheet, long filament, solenoid, toroidal current carrying conductor, point form of Ampere's circuital law, Maxwell's third equation(Curl (H)=J) Magnetic force, moving charges in a magnetic field – Lorentz force equation, force on a current element in a magnetic field, force on a straight and a long current carrying conductor in a magnetic field, force between two straight long and parallel current carrying conductors.	
UNIT - 4	**Self and mutual inductance:** Self and mutual inductance – determination of self-inductance of a solenoid and toroid and mutual inductance between a straight long wire and a square loop wire in the same plane – energy stored and density in a magnetic field.	
UNIT - 5	**Time Varying Fields:** Faraday's laws of electromagnetic induction – integral and point forms, Maxwell's fourth equation(Curl(E)=-∂B/∂t), statically and dynamically induced EMF – modification of Maxwell's equations for time varying fields, displacement current, Poynting theorem and Poynting vector.	
	Total	

Text Books:

1. "Engineering Electromagnetics" by William H. Hayt & John. A. Buck Mc. Graw-Hill, 7th Editon.2006.
2. "Principles of Electro Magnetics" by Sadiku, Oxford Publications, 6th edition, 2015.

Reference Books:

1. Introduction to Electro Dynamics by D J Griffiths, Prentice-Hall of India Pvt. Ltd, 2nd edition
2. Electromagnetic Field Theory by Yaduvir Singh, Pearson India, 1st edition, 2011.
3. Fundamentals of Engineering Electromagnetics by Sunil Bhooshan, Oxford University Press, 2012.
4. Electromagnetics by Joseph A. Edminister, Schaum's Outline, 4th Edition,2014.

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II B.Tech I Semester

COURSE CODE – R2011XXYY	DC MACHINES AND TRANSFORMERS LAB	CATEGORY PCC	L-T-P 0-0-3	CREDITS 1.5

Pre-requisite:

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

		Knowledge Level (K)#
CO1	Analyze the performance of DC motor and generator by conducting different tests	4
CO2	Understand the characteristics of DC generator and demonstrate the speed control of motors	3
CO3	Determine the efficiency and regulation of transformers and assess their performance by conducting different tests	4
CO4	Produce 2-Ø supply from 3-Ø supply using Scott connection and understand parallel operation of transformers	3

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	-	-	-	-	2	1	1	2	3	3	2
CO2	3	2	2	2	-	-	-	-	2	1	1	2	3	2	2
CO3	3	3	2	2	-	-	-	-	2	1	1	2	3	3	2
CO4	3	2	2	1	-	-	-	-	2	1	1	1	2	2	2

(Please fill the above with Levels of Correlation, viz., 3: Strong, 2: Moderate, 1: Weak)

Exp. No	CONTENTS (Any 10 of the following experiments are to be conducted)	Contact Hours
1.	Determination of critical field resistance and critical speed of DC shunt generator by using Magnetization characteristics	
2.	Predetermination of efficiency of DC Machine by conducting Swinburne's test	
3.	Performance characteristics of a DC shunt motor by conducting Brake test.	
4.	Predetermination of efficiency of two DC shunt machines by conducting Hopkinson's test	
5.	Speed control of DC shunt motor by Field and armature Control methods	
6.	Determination of constant losses of DC shunt motor by conducting Retardation test	
7.	Separation of losses (Eddy current and Hysteresis) in a DC shunt motor.	
8.	Predetermination of efficiency, regulation and to obtain the parameters of the	

	equivalent circuit of a single-phase transformer by conducting OC & SC tests.	
9.	Predetermination of efficiency, regulation and to obtain the parameters of the equivalent circuit of a single-phase transformer by conducting Sumpner's test.	
10.	Conversion of three-phase to two-phase supply by using Scott connection of transformers	
11.	Parallel operation of Single-phase Transformers under no-load and load conditions	
12.	Separation of core losses of a single-phase transformer	
13.	Heat run test on a bank of three single-phase Delta connected transformers	

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II B.Tech I Semester

COURSE CODE – R2011XXYY	ELECTRICAL CIRCUITS LAB	CATEGORY PCC	L-T-P 0-0-3	CREDITS 1.5

Pre-requisite:

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

		Knowledge Level (K)#
CO1	Apply Thevenin's, Norton's, Thevenin's, superposition theorem, maximum power transfer, compensation, reciprocity and Millmann's Theorems to compare practical results obtained with theoretical calculations	3
CO2	Draw locus diagrams of RL, RC series circuits and examine series and parallel resonance	3
CO3	Determine self, mutual inductances and coefficient of coupling values, parameters of choke coil, Z, Y, Transmission and hybrid parameters	4
CO4	Calculate power consumed by balanced and unbalanced loads	3

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	1	-	-	-	2	1	1	2	3	2	2
CO2	3	3	2	2	1	-	-	-	2	1	1	2	3	2	2
CO3	3	2	2	2	1	-	-	-	2	1	1	2	3	2	2
CO4	3	2	2	1	1	-	-	-	2	1	1	1	2	2	1

(Please fill the above with Levels of Correlation, viz., 3: Strong, 2: Moderate, 1: Weak)

Exp. No.	CONTENTS (Any 10 of the following experiments are to be conducted)	Contact Hours
1.	Verification of Kirchhoff's circuit laws.	
2.	Verification of Superposition theorem	
3.	Verification of Thevenin's and Norton's Theorems	
4.	Verification of Maximum power transfer theorem	
5.	Verification of Compensation theorem	
6.	Verification of Reciprocity and Millmann's Theorems	
7.	Locus diagrams of R-L(L Variable) and R-C (C Variable) series circuits	
8.	Series and parallel resonance	
9.	Determination of self, mutual inductances and coefficient of coupling	
10.	Determination of Impedance (Z) and Admittance (Y) Parameters for a two port network	
11.	Determination of Transmission and Hybrid parameters	

12.	Determination of Parameters of a choke coil.	
13.	Determination of cold and hot resistance of an electric lamp.	
14.	Measurement of 3-phase power by two wattmeter method for unbalanced loads	

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II B.Tech I Semester

COURSE CODE – R2011XXYY	ELECTRONIC DEVICES AND CIRCUITS LAB	CATEGORY PCC	L-T-P 0-0-3	CREDITS 1.5

Pre-requisite:

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

		Knowledge Level (K)#
CO1	Study the characteristics of electronic components and measuring instruments.	
CO2	Understand the characteristics of PN, Zener diode, design rectifiers with and without filters	
CO3	Understand the characteristics of BJT, FET, MOSFET, SCR, UJT	
CO4	Understand the biasing of transistors	
CO5	Understand the frequency response of amplifiers, measure frequency, phase of signals.	

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	1	3	3	1	--	--	--	--	1	2	2	3	3
CO2	1	3	2	3	3	2	--	--	--	--	1	2	2	2	2
CO3	1	3	3	3	2	1	--	--	--	--	1	1	3	2	3
CO4	1	2	2	3	2	2	--	--	--	--	1	1	2	2	3
CO5	1	2	2	3	2	2	--	--	--	--	1	2	3	2	3

(Please fill the above with Levels of Correlation, viz., L, M, H)

Exp. No	CONTENTS	Contact Hours
	Electronic Workshop Practice:	
1.	Identification, Specifications, Testing of R, L, C Components (Colour Codes), Potentiometers, Coils, Gang Condensers, Relays, Bread Boards.	
2.	Identification, Specifications and Testing of active devices, Diodes, BJTs, JFETs, LEDs, LCDs, SCR, UJT.	
3.	Soldering Practice- Simple circuits using active and passive components.	
4.	Study and operation of Ammeters, Voltmeters, Transformers, Analog and Digital Multimeter, Function Generator, Regulated Power Supply and CRO.	

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	List of Experiments: **Any Ten of the following Experiments are to be conducted**	
1.	P-N Junction Diode Characteristics Part A: Germanium Diode (Forward bias& Reverse bias) Part B: Silicon Diode (Forward Bias only)	
2.	Zener Diode Characteristics Part A: V-I Characteristics Part B: Zener Diode as Voltage Regulator	
3.	Rectifiers (without and with c-filter) Part A: Half-wave Rectifier Part B: Full-wave Rectifier	
4.	BJT Characteristics(CE Configuration) Part A: Input Characteristics Part B: Output Characteristics	
5.	FET Characteristics(CS Configuration) Part A: Drain Characteristics Part B: Transfer Characteristics	
6.	SCR Characteristics	
7.	UJT Characteristics	
8.	Transistor Biasing	
9.	CRO Operation and its Measurements	
10.	BJT-CE Amplifier	
11.	Emitter Follower-CC Amplifier	
12.	FET-CS Amplifier	

Note: The students are required to perform the experiment to obtain the V-I characteristics and to determine the relevant parameters from the obtained graphs.

Equipment required:

1. Regulated Power supplies
2. Analog/Digital Storage Oscilloscopes
3. Analog/Digital Function Generators
4. Digital Multi-meters
5. Decade Résistance Boxes/Rheostats
6. Decade Capacitance Boxes
7. Ammeters (Analog or Digital)
8. Voltmeters (Analog or Digital)
9. Active & Passive Electronic Components

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II B.Tech I Semester

COURSE CODE – R2011XXYY	SKILL ORIENTED COURSE DESIGN OF ELECTRICAL CIRCUITS USING ENGINEERING SOFTWARE TOOLS	CATEGORY SC	L-T-P 0-0-4	CREDITS 2

Pre-requisite:

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

		Knowledge Level (K)#
CO1	write the MATLAB programs to simulate the electrical circuit problems	
CO2	simulate various circuits for electrical parameters	
CO3	simulate various wave form for determination of wave form parameters	
CO4	simulate RLC series and parallel resonance circuits for resonant parameters	
CO5	simulate magnetic circuits for determination of self and mutual inductances	

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1															
CO2															
CO3															
CO4															
CO5															

(Please fill the above with Levels of Correlation, viz., L, M, H)

S.No	CONTENTS	Contact Hours
	List of Experiments: **Any TEN of the following Experiments are to be conducted**	
1.	Generation of various signals and sequences (Periodic and Aperiodic), such as unit Impulse, Step, Square, Saw tooth, Triangular, Sinusoidal, Ramp.	
2.	Operations on signals and sequences such as Addition, Multiplication, Scaling, Shifting, Folding, Computation of Energy, and Average Power	
3.	Verification of Kirchhoff's current law and voltage law using simulation tools.	
4.	Verification of mesh analysis using simulation tools.	

5.	Verification of nodal analysis using simulation tools.	
6.	Determination of average value, rms value, form factor, peak factor of sinusoidal wave, square wave using simulation tools.	
7.	Verification of super position theorem using simulation tools.	
8.	Verification of reciprocity theorem using simulation tools.	
9.	Verification of maximum power transfer theorem using simulation tools.	
10.	Verification of Thevenin's theorem using simulation tools.	
11.	Verification of Norton's theorem using simulation tools.	
12.	Verification of compensation theorem using simulation tools.	
13.	Verification of Milliman's theorem using simulation tools.	
14.	Verification of series resonance using simulation tools.	
15.	Verification of parallel resonance using simulation tools.	
16.	Verification of self inductance and mutual inductance by using simulation tools	

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II B.Tech I Semester

COURSE CODE – R2011XXYY	ESSENCE OF INDIAN TRADITION KNOWLEDGE	CATEGORY MC	L-T-P 2-0-0	CREDITS 0

Pre-requisite:

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

		Knowledge Level (K)#
CO1		
CO2		
CO3		
CO4		
CO5		

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1															
CO2															
CO3															
CO4															
CO5															

(Please fill the above with Levels of Correlation, viz., L, M, H)

UNIT	CONTENTS	Contact Hours
	Note: Collect the syllabus from concerned BOS	
	Total	

Text Books:

1.

Reference Books:

1.

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II B.Tech II Semester

COURSE CODE – R2011XXYY	PYTHON PROGRAMMING	CATEGORY ESC	L-T-P 3-0-0	CREDITS 3

Pre-requisite:

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

		Knowledge Level (K)#
CO1	Develop essential programming skills in computer programming concepts like data types, containers	
CO2	Apply the basics of programming in the Python language Solve coding tasks related conditional execution, loops	
CO3	Know list and to design various functions and modules	
CO4	Solve coding tasks related to the file operations, fundamental notions and techniques used in object- oriented programming	
CO5	Identify errors and exceptions, develop GUI based programs	

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	--	2	2	2	--	--	--	--	--	--	--	2	1	1
CO2	--	--	2	3	3	--	--	--	--	--	--	--	2	1	1
CO3	--	--	1	3	3	--	--	--	--	--	--	--	2	1	1
CO4	1	2	2	2	2	--	--	--	--	--	--	--	2	1	1
CO5	--	1	2	2	3	--	--	--	--	--	--	--	2	1	1

(Please fill the above with Levels of Correlation, viz., L, M, H)

UNIT	CONTENTS	Contact Hours
UNIT - 1	**Introduction:** Introduction to Python, Program Development Cycle, Input, Processing, and Output, Displaying Output with the Print Function, Comments, Variables, Reading Input from the Keyboard, Performing Calculations, Operators. Type conversions, Expressions, More about Data Output. Data Types, and Expression: Strings Assignment, and Comment, Numeric Data Types and Character Sets, Using functions and Modules. Decision Structures and Boolean Logic: if, if-else, if-elif-else Statements, Nested Decision Structures, Comparing Strings, Logical Operators, Boolean Variables. Repetition Structures: Introduction, while loop, for loop, Calculating a Running Total, Input Validation Loops, Nested Loops.	

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UNIT - 2	**Control Statement:** Definite iteration for Loop Formatting Text for output, Selection if and if else Statement Conditional Iteration The While Loop Strings and Text Files: Accessing Character and Substring in Strings, Data Encryption, Strings and Number Systems, String Methods Text Files.	
UNIT - 3	**List and Dictionaries:** Lists, Defining Simple Functions, Dictionaries Design with Function**:** Functions as Abstraction Mechanisms, Problem Solving with Top Down Design, Design with Recursive Functions, Case Study Gathering Information from a File System, Managing a Program's Namespace, Higher Order Function. Modules: Modules, Standard Modules, Packages.	
UNIT - 4	**File Operations:** Reading config files in python, Writing log files in python, Understanding read functions, read(), readline() and readlines(), Understanding write functions, write() and writelines(), Manipulating file pointer using seek, Programming using file operations Object Oriented Programming**:** Concept of class, object and instances, Constructor, class attributes and destructors, Real time use of class in live projects, Inheritance , overlapping and overloading operators, Adding and retrieving dynamic attributes of classes, Programming using OOPs support Design with Classes: Objects and Classes, Data modeling Examples, Case Study An ATM, Structuring Classes with Inheritance and Polymorphism	
UNIT - 5	**Errors and Exceptions:** Syntax Errors, Exceptions, Handling Exceptions, Raising Exceptions, User-defined Exceptions, Defining Clean-up Actions, Redefined Clean-up Actions. Graphical User Interfaces: The Behavior of Terminal Based Programs and GUI -Based, Programs, Coding Simple GUI-Based Programs, Other Useful GUI Resources. Programming**:** Introduction to Programming Concepts with Scratch.	
	Total	

Text Books:

1. Fundamentals of Python First Programs, Kenneth. A. Lambert, Cengage, 2/e, 2011.

Reference Books:

1. Introduction to Python Programming, Gowrishankar S., VeenaA, CRC Press, 2nd Edition, 2019.
2. Introduction to Programming Using Python, Y. Daniel Liang, Pearson, 1st Edition, 2012.

e-Resources:

1. https://www.tutorialspoint.com/python3/python_tutorial.pdf

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II B.Tech II Semester

COURSE CODE – R2011XXYY	DIGITAL ELECTRONICS	CATEGORY PCC	L-T-P 3-0-0	CREDITS 3

Pre-requisite:

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

		Knowledge Level (K)#
CO1	Classify different number systems, generate various codes and use the concept of Boolean algebra in minimization of switching functions.	
CO2	Use the concept of K-map/tabulation method in minimization of switching functions and able to design the arithmetic combinational circuits.	
CO3	Design different types of data handling combinational circuits and PLDs	
CO4	Know the operation of various flip-flops and apply knowledge of flip-flops in designing of registers and counters	
CO5	Reduce state tables, analyze synchronous sequential circuits and apply different methods for the design of synchronous sequential circuits.	

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	2	1	2	-	-	-	-	-	-	2	3	1
CO2	3	2	3	2	1	3	-	-	-	-	-	-	2	3	1
CO3	3	2	3	2	1	3	-	-	-	-	-	2	2	3	1
CO4	3	2	3	2	1	3	-	-	-	-	-	3	2	3	1
CO5	3	2	3	2	1	3	-	-	-	-	-	2	2	3	1

(Please fill the above with Levels of Correlation, viz., L, M, H)

UNIT	CONTENTS	Contact Hours
UNIT - 1	**Review Of Number Systems & Codes** Representation of numbers of different radix, conversation from one radix to another radix, r-1's compliments and r's compliments of signed members.Gray code ,4 bit codes; BCD, Excess-3, 2421, 84-2-1 code etc., Error detection & correction codes: parity checking, even parity, odd parity, Hamming code. **Boolean theorems and logic operations** Boolean theorems, principle of complementation & duality, De-morgan theorems. Logic operations ; Basic logic operations -NOT, OR, AND, Universal Logic operations, EX-OR, EX-NOR operations. Standard SOP and POS Forms, NAND-NAND and NOR-NOR realizations.	

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UNIT - 2	**Minimization Techniques** Minimization and realization of switching functions using Boolean theorems, K-Map (up to 6 variables) and tabular method. **Combinational Logic Circuits Design** Design of Half adder, full adder, half subtractor, full subtractor, applications of full adders; 4-bit adder-subtractor circuit, BCD adder circuit, Excess 3 adder circuit and carry look-a-head adder circuit	
UNIT - 3	**Combinational Logic Circuits Design Using MSI &LSI** Design of encoder ,decoder, multiplexer and demultiplexers, Implementation of higher order circuits using lower order circuits . Realization of Boolean functions using decoders and multiplexers. Design of Priority encoder, 4-bit digital comparator and seven segment decoder.. **INTRODUCTION OF PLD's** PLDs:PROM, PAL, PLA -Basics structures, realization of Boolean functions.	
UNIT - 4	**Sequential Circuits I** Classification of sequential circuits (synchronous and asynchronous) , operation of NAND & NOR Latches and flip-flops; truth tables and excitation tables of RS flip-flop, JK flip-flop, T flip-flop, D flip-flop with reset and clear terminals. Conversion from one flip-flop to another flip-flop. Design of ripple counters, design of synchronous counters, Johnson counter, ring counter. Design of registers - Buffer register, control buffer register, shift register, bi-directional shift register, universal shift register.	
UNIT - 5	**Sequential Circuits II** Finite state machine; state diagrams, state tables, reduction of state tables. Analysis of clocked sequential circuits Mealy to Moore conversion and vice-versa. Realization of sequence generator and sequence detector circuits.	
	Total	

Text Books:

1. Switching and finite automata theory Zvi.KOHAVI 3RD EDITION
2. Fundamentals of Logic Design by Charles H. Roth Jr, Jaico Publishers
3. Digital Design by Mano PHI.

Reference Books:

1. Switching Theory and Logic Design by A. Anand Kumar
2. Switching Theory and Logic Design by Hill and Peterson Mc-Graw Hill TMH edition

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II B.Tech II Semester

COURSE CODE – R2011XXYY	POWER SYSTEMS - I	CATEGORY PCC	L-T-P 3-0-0	CREDITS 3

Pre-requisite:

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

		Knowledge Level (K)#
CO1	Identify the different components of thermal power plants.	
CO2	Identify the different components of nuclear Power plants.	
CO3	Identify the different components of air and gas insulated substations.	
CO4	Identify single core and three core cables with different insulating materials.	
CO5	Analyse the different economic factors of power generation and tariffs.	

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	3	--	--	--	--	--	1	--	1	2	3	3
CO2	2	1	1	3	--	--	--	--	--	1	--	1	2	3	3
CO3	2	3	2	2	--	--	--	--	--	1	--	1	2	3	3
CO4	2	2	2	3	--	--	2	--	--	1	--	1	2	3	3
CO5	2	2	2	2	--	--	2	--	--	1	--	1	2	3	3

(Please fill the above with Levels of Correlation, viz., L, M, H)

UNIT	CONTENTS	Contact Hours
UNIT - 1	**Hydroelectric Power Stations:** Selection of site, general layout of a hydroelectric power plant with brief description of major components and principle of operation **Thermal Power Stations** Selection of site, general layout of a thermal power plant. Brief description of components: boilers, super heaters, economizers and electrostatic precipitators, steam turbines: impulse and reaction turbines, condensers, feed water circuit, cooling towers and chimney.	
UNIT - 2	**Nuclear Power Stations** Location of nuclear power plant, working principle, nuclear fission, nuclear fuels, nuclear chain reaction, nuclear reactor components: moderators, control rods, reflectors and coolants, types of nuclear reactors	

	and brief description of PWR, BWR and FBR. Radiation: radiation hazards and shielding, nuclear waste disposal.	
UNIT - 3	**Classification of Air and Gas Insulated substation**s **Air Insulated Substations** – indoor & outdoor substations, substations layouts of 33/11 kV showing the location of all the substation equipment. Bus bar arrangements in the sub-stations: simple arrangements like single bus bar, sectionalized single bus bar, double bus bar with one and two circuit breakers, main and transfer bus bar system with relevant diagrams. **Gas Insulated Substations (GIS)** – advantages of gas insulated substations, constructional aspects of GIS, installation and maintenance of GIS, comparison of air insulated substations and gas insulated substations.	
UNIT- 4	**Underground Cables** Types of cables, construction, types of insulating materials, calculation of insulation resistance, stress in insulation and power factor of cable. Capacitance of single and 3-Core belted Cables. Grading of cables: capacitance grading and intersheath grading.	
UNIT - 5	**Economic Aspects of Power Generation & Tariff** **Economic Aspects** – load curve, load duration and integrated load duration curves, discussion on economic aspects: connected load, maximum demand, demand factor, load factor, diversity factor, plant capacity factor and plant use factor, base and peak load plants. **Tariff Methods**– costs of generation and their division into fixed, semi-fixed and running costs, desirable characteristics of a tariff method, tariff methods: simple rate, flat rate, block-rate, two-part, three–part, and power factor tariff methods.	
	Total	

Text Books:

1. A Text Book on Power System Engineering by M.L.Soni, P.V.Gupta, U.S.Bhatnagar and A. Chakrabarti, DhanpatRai& Co. Pvt. Ltd, 2016.
2. Generation, Distribution and Utilization of Electric Energy by C.L.Wadhawa, New age International (P) Limited, Publishers, 3rd edition.

Reference Books:

1. Elements of Electrical Power Station Design by M V Deshpande, PHI, New Delhi, 2009.

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II B.Tech II Semester

COURSE CODE – R2011XXYY	INDUCTION AND SYNCHRONOUS MACHINES	CATEGORY PCC	L-T-P 3-0-0	CREDITS 3

Pre-requisite:

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

		Knowledge Level (K)#
CO1	Explain the operation and performance of three-phase induction motor.	2
CO2	Analyze the torque-speed relation, performance of induction motor and induction generator.	4
CO3	Illustrate the starting methods of three-phase induction motors and understand the working of single-phase induction motors	3
CO4	Analyze the performance of Synchronous generators and motors	4
CO5	Explain the principle of working and methods of starting synchronous motor. Illustrate the usage of synchronous motor for power factor correction	3

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1	-	1	-	-	-	-	1	2	2	2	2
CO2	3	2	2	2	-	1	-	-	-	-	1	3	3	3	2
CO3	3	3	2	2	-	1	-	-	-	-	1	3	3	3	2
CO4	3	3	2	2	-	1	-	-	-	-	1	3	3	2	2
CO5	3	3	2	2	-	1	-	-	-	-	1	3	3	3	2

(Please fill the above with Levels of Correlation, viz., 3: Strong, 2: Moderate, 1: Weak)

UNIT	CONTENTS	Contact Hours
UNIT - 1	**3-phase induction motors** Construction details of squirrel cage and slip ring induction motors – production of rotating magnetic field – principle of operation – Equivalent circuit –phasor diagram- slip speed-rotor emf and rotor frequency – rotor current and pf at standstill and during running conditions – rotor power input, rotor copper loss and mechanical power developed and their interrelationship.	
UNIT - 2	**Characteristics and testing methods of induction motors** Torque equation – expressions for maximum torque and starting torque – torque slip characteristic – double cage and deep bar rotors – crawling and	

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	cogging – speed control of induction motor with V/f control method – no load and blocked rotor tests – circle diagram for predetermination of performance – induction generator operation (Qualitative treatment only)	
UNIT - 3	**Starting methods of 3-phase induction motors** Methods of starting of three phase Induction motors: DOL, Auto transformer, Star-Delta and rotor resistance methods. **Single phase induction motors**: Constructional features- equivalent circuit- problem of starting-double revolving field theory- Methods of starting. AC series motors.	
UNIT - 4	**Construction, operation, voltage regulation and parallel operation of synchronous generator:** Constructional features of non-salient and salient pole machines –types of armature windings – distribution, pitch and winding factors – E.M.F equation –improvements of waveform and armature reaction – phasor diagrams - voltage regulation by synchronous impedance method – MMF method and Potier triangle method– two reaction analysis of salient pole machines and phasor diagram. Parallel operation with infinite bus and other alternators – synchronizing power – load sharing – control of real and reactive power – numerical problems.	
UNIT - 5	**Synchronous motor – operation, starting and performance** Synchronous motor principle and theory of operation – phasor diagram – starting torque – variation of current and power factor with excitation – capability curves - synchronous condenser – mathematical analysis for power developed – hunting and its suppression – methods of starting – applications.	
	Total	

Text Books:

1. Electrical Machines by P.S. Bhimbra, Khanna Publishers
2. Electric Machinery by A.E.Fitzgerald, Charles Kingsley, Stephen D.Umans, TMH

Reference Books:

1. Performance and design of AC machines – M.G. Say
2. Alternating Current Machines by A.F.Puchstein, T.C. Lloyd, A.G. Conrad, ASIA Publishing House
3. Electrical Machinery Fundamentals by Stephen J Chapman McGraw Hill education, 2010.
4. Electrical Machines by R.K.Rajput, Lakshmi publications, 5th edition.

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II B.Tech II Semester

COURSE CODE – R2011XXYY	MANAGERIAL ECONOMICS & FINANCIAL ANALYSIS	CATEGORY HSMC	L-T-P 3-0-0	CREDITS 3

Pre-requisite:

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

		Knowledge Level (K)#
CO1	Learner equipped with the knowledge of demand, supply analysis and estimating Demand elasticity, demand forecasting and Law of Supply.	
CO2	Learner is able to knowledge of understanding the production, Production function, Input-Output-cost relationships and estimation of the lease cost combination of inputs.	
CO3	One is also ready to understand the nature of different markets and price-output determination under various Market conditions have a knowledge of Pricing Methods and to know the various Business Organizations and Business Cycles.	
CO4	Learner is able to prepare financial statements and the usage of various Accounting tools for analysis.	
CO5	Student equipped to evaluate the various investment project proposals with the help of Capital Budgeting techniques for decision making.	

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1			1			2	3						3		
CO2	2		3	3	2								2	1	
CO3		3	2	1	2								1		
CO4		2		2		3							3	1	
CO5		3	2	1	2								2	3	

(Please fill the above with Levels of Correlation, viz., L, M, H)

UNIT	CONTENTS	Contact Hours

Unit-I

Introduction to Managerial Economics and demand Analysis:

Definition of Managerial Economics –Scope of Managerial Economics and its relationship with other subjects –Concept of Demand, Types of Demand, Determinants of Demand- Demand schedule, Demand curve, Law of Demand and its limitations- Elasticity of Demand, Types of Elasticity of Demand and Measurement- Demand forecasting and Methods of forecasting, Concept of Supply and Law of Supply.

Unit – II:

Theories of Production and Cost Analyses:

Theories of Production function- Law of Variable proportions-Isoquants and Isocosts and choice of least cost factor combination-Concepts of Returns to scale and Economies of scale-Different cost concepts: opportunity costs, explicit and implicit costs-Fixed costs, Variable Costs and Total costs –Cost –Volume-Profit analysis-Determination of Breakeven point(problems)-Managerial significance and limitations of Breakeven point.

Unit – III:

Introduction to Markets, Theories of the Firm & Pricing Policies:

Market Structures: Perfect Competition, Monopoly, Monopolistic competition and Oligopoly – Features – Price and Output Determination – Managerial Theories of firm: Marris and Williamson's models – other Methods of Pricing: Average cost pricing, Limit Pricing, Market Skimming Pricing, Internet Pricing: (Flat Rate Pricing, Usage sensitive pricing) and Priority Pricing, Business Cycles : Meaning and Features – Phases of a Business Cycle. Features and Evaluation of Sole Trader, Partnership, Joint Stock Company – State/Public Enterprises and their forms.

Unit – IV:

Introduction to Accounting & Financing Analysis:

Introduction to Double Entry System, Journal, Ledger, Trail Balance and Preparation of Final Accounts with adjustments – Preparation of Financial Statements-Analysis and Interpretation of Financial Statements-Ratio Analysis – Preparation of Funds flow and cash flow analysis (Problems)

Unit – V:

Capital and Capital Budgeting: Capital Budgeting: Meaning of Capital-Capitalization-Meaning of Capital Budgeting-Time value of money- Methods of appraising Project profitability: Traditional Methods(pay back period, accounting rate of return) and modern methods(Discounted cash flow method, Net Present Value method, Internal Rate of Return Method and Profitability Index)

	Total	

Text Books:

1.

Reference Books:

1. 1. Varshney R.L, K.L Maheswari, Managerial Economics, S. Chand & Company Ltd,
2. JL Pappas and EF Brigham, Managerial Economics, Holt, R & W; New edition edition
3. N.P Srinivasn and M. Sakthivel Murugan, Accounting for Management, S. Chand & Company Ltd,
4. Maheswari S.N,AnIntroduction to Accountancy, Vikas Publishing House Pvt Ltd
5. I.M Pandey, Financial Management , Vikas Publishing House Pvt Ltd
6. V. Maheswari, Managerial Economics, S. Chand & Company Ltd,

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II B.Tech II Semester

COURSE CODE – R2011XXYY	PYTHON PROGRAMMING LAB	CATEGORY ESC	L-T-P 0-0-3	CREDITS 1.5

Pre-requisite:

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

		Knowledge Level (K)#
CO1	Write, Test and Debug Python Programs	
CO2	Use Conditionals and Loops for Python Programs	
CO3	Use functions and represent Compound data using Lists, Tuples and Dictionaries Use various applications using python	

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	2	2	2	--	--	--	--	--	--	--	2	2	2
CO2	2	2	2	3	3	--	--	--	--	--	--	--	2	2	2
CO3	2	2	2	3	3	--	--	--	--	--	--	--	2	2	1

(Please fill the above with Levels of Correlation, viz., L, M, H)

S.No	CONTENTS	Contact Hours
1.	Write a program that asks the user for a weight in kilograms and converts it to pounds. There are 2.2 pounds in a kilogram.	
2.	Write a program that asks the user to enter three numbers (use three separate input statements). Create variables called total and average that hold the sum and average of the three numbers and print out the values of total and average.	
3.	Write a program that uses a *for* loop to print the numbers 8, 11, 14, 17, 20, . . . , 83, 86,89.	
4.	Writeaprogramthatasks theuserfortheirnameandhowmanytimestoprintit.The program should print out the user's name the specified number of times.	
5.	Use a *for* loop to print a triangle like the one below. Allow the user to specify how high the triangle should be. * ** *** ****	
6.	Generate a random number between 1 and 10. Ask the user to guess the number and print a message based on whether they get it right or not.	

7.	Write a program that asks the user for two numbers and prints *Close* if the numbers are within .001 of each other and Not close otherwise.	
8.	Write a program that asks the user to enter a word and prints out whether that word contains any vowels.	
9.	Write a program that asks the user to enter two strings of the same length. The program should then check to see if the strings are of the same length. If they are not, the program should print an appropriate message and exit. If they are of the same length, the program should alternate the characters of the two strings. For example, if the user enters *abcde* and *ABCDE* the program should print out *AaBbCcDdEe*.	
10.	Write a program that asks the user for a large integer and inserts commas into it according to the standard American convention for commas in large numbers. For instance, if the user enters 1000000, the output should be1,000,000.	
11.	In algebraic expressions, the symbol for multiplication is often left out, as in 3x+4y or 3(x+5). Computers prefer those expressions to include the multiplication symbol, like 3*x+4*y or 3*(x+5). Write a program that asks the user for an algebraic expression and then inserts multiplication symbols where appropriate.	
12.	Write a program that generates a list of 20 random numbers between 1 and 100. (a) Print the list. (b) Print the average of the elements in the list. (c) Print the largest and smallest values in the list. (d) Print the second largest and second smallest entries in the list (e) Print how many even numbers are in the list.	
13.	Write a program that asks the user for an integer and creates a list that consists of the factors of that integer.	
14.	Write a program that generates 100 random integers that are either 0 or 1. Then find the longest run of zeros, the largest number of zeros in a row. For instance, the longest run of zeros in [1,0,1,1,0,0,0,0,1,0,0] is 4.	
15.	Write a program that removes any repeated items from a list so that each item appears at most once. For instance, the list [1,1,2,3,4,3,0,0] would become[1,2,3,4,0].	
16.	Write a program that asks the user to enter a length in feet. The program should then give the user the option to convert from feet into inches, yards, miles, millimeters, centimeters, meters, or kilometers. Say if the user enters a 1, then the program converts to inches, if they enter a 2, then the program converts to yards, etc. While this can be done with if statements, itis much shorter with lists and it is also easier to add new	

	conversions if you use lists.	
17.	Write a function called *sum_digits* that is given an integer num and returns the sum of the digits of num.	
18.	Write a function called *first_diff* that is given two strings and returns the first location in which the strings differ. If the strings are identical, it should return-1.	
19.	Write a function called *number_of_factors* that takes an integer and returns how many factors the number has.	
20.	Write a function called *is_sorted* that is given a list and returns True if the list is sorted and False otherwise.	
21.	Write a function called root that is given a number x and an integer n and returns $x^{1/n}$. In the function definition, set the default value of n to2.	
22.	Write a function called primes that is given a number n and returns a list of the first n primes. Let the default value of n be100.	
23.	Write a function called merge that takes two already sorted lists of possibly different lengths, and merges them into a single sorted list. (a)Do this using the sort method. (b) Do this without using the sort method	
24.	Write a program that asks the user for a word and finds all the smaller words that can be made from the letters of that word. The number of occurrences of a letter in a smaller word can't exceed the number of occurrences of the letter in the user's word.	
25.	Write a program that reads a file consisting of email addresses, each on its own line. Your program should print out a string consisting of those email addresses separated by semicolons.	
26.	Write a program that reads a list of temperatures from a file called *temps.txt*, converts those temperatures to Fahrenheit, and writes the results to a file called ftemps.txt.	
27.	Write a class called Product. The class should have fields called name, amount, and holding the product's name, the number of items of that product in stock, and the regular price of the product. There should be a method *get_price* that receives the number of items to be bought and returns a the cost of buying that many items, where the regular price is charged for orders of less than 10 items, a 10% discount is applied for orders of between 10 and 99 items, and a 20% discount is applied for orders of 100 or more items. There should also be a method called *make_purchase* that receives the number of items to be bought and decreases amount by that much.	
28.	Write a class called Time whose only field is a time in seconds. It should have a method called *convert_to_minutes* that returns a string of minutes and seconds formatted as in the following example: if seconds is 230, the method should return '5:50'. It should also have a method called	

	convert_to_hours that returns a string of hours, minutes, and seconds formatted analogously to the previous method.	
29.	Write a class called Converter. The user will pass a length and a unit when declaring an object from ~~th~~e class for example, c = Converter(9,'inches'). The possible units are inches, feet, yards, miles, kilometers, meters, centimeters, and millimeters. For each of these units there should be a method that returns the length converted into those units. For example, using the Converter object created above, the user could call c. feet() and should get 0.75 as the result.	
30.	Write a Python class to implement pow(x,n).	
31.	Write a Python class to reverse a string word byword.	
32.	Write a program that opens a file dialog that allows you to select a text file. The program then displays the contents of the file in a textbox.	
33.	Write a program to demonstrate Try/except/else.	
34.	Write a program to demonstrate try/finally and with/as.	

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II B.Tech II Semester

COURSE CODE – R2011XXYY	INDUCTION AND SYNCHRONOUS MACHINES LAB	CATEGORY PCC	L-T-P 0-0-3	CREDITS 1.5

Pre-requisite:

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

		Knowledge Level (K)#
CO1	Analyze the performance of three-phase Induction motor by conducting different tests	4
CO2	Determine the regulation of three–phase alternator by various methods, find X_d / X_q ratio of alternator and asses the performance of three–phase synchronous motor.	4
CO3	Demonstrate the power factor improvement methods of single-phase induction motor and asses its performance	3

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	2	-	1	-	-	2	1	1	2	3	3	2
CO2	3	3	2	2	-	1	-	-	2	1	1	2	3	3	2
CO3	3	2	2	2	-	1	-	-	2	1	1	2	3	2	2

(Please fill the above with Levels of Correlation, viz., 3: Strong, 2: Moderate, 1: Weak)

Any 10 of the following experiments are to be conducted:

Exp. No.	CONTENTS	Contact Hours
1	Performance characteristics of a three-phase Induction Motor by conducting Brake test	
2	Determination of equivalent circuit parameters, efficiency and regulation of a three phase Induction motor by conducting No–load & Blocked rotor tests	
3	Determination of Regulation of a three–phase alternator by using synchronous impedance & m.m.f. methods	
4	Determination of Regulation of a three–phase alternator by using Potier triangle method	
5	Determination of V and Inverted V curves of a three phase synchronous motor.	
6	Determination of X_d and X_q of a salient pole synchronous machine	
7	Speed control of three phase induction motor by V/f method.	
8	Determination of equivalent circuit parameters of single phase induction	

	motor	
9	Determination of efficiency of three-phase alternator by loading with three phase induction motor.	
10	Power factor improvement of single-phase induction motor by using capacitors.	
11	Parallel operation of three-phase alternator under no-load and load conditions	
12	Determination of efficiency of a single-phase AC series Motor by conducting Brake test.	
13	Starting of single-phase Induction motor by using capacitor start and capacitor start run methods.	
14	Determination of efficiency of a single-phase Induction Motor by conducting Brake test.	

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II B.Tech II Semester

COURSE CODE – R2011XXYY	DIGITAL ELECTRONICS LAB	CATEGORY PCC	L-T-P 0-0-3	CREDITS 1.5

Pre-requisite:

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

		Knowledge Level (K)#
CO1	Verify the basic operation of logic gates and design the combinational circuits.	
CO2	Design the arithmetic and data handling combinational circuits	
CO3	Analyse basic operation of filp-flops and verify the functional tables.	
CO4	Design the ripple and synchronous counters.	

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	3	3	2	-	-	3	2	1	-	2	3	2
CO2	3	2	2	3	3	2	-	-	3	2	1	-	2	3	2
CO3	3	2	2	3	3	2	-	-	3	2	1	-	2	3	2
CO4	3	2	2	3	3	2	-	-	3	2	1	-	2	3	2

(Please fill the above with Levels of Correlation, viz., 3: Strong, 2: Moderate, 1: Weak)

S.No	CONTENTS	Contact Hours
	List of Experiments: **Any TEN of the following Experiments are to be conducted**	
1.	Verification of truth tables of Logic gates: Two input (i) OR (ii) AND (iii) NOR (iv) NAND (v) Exclusive OR (vi) Exclusive NOR	
2.	Design a simple combinational circuit and obtain minimal SOP expression and verify the truth table using Digital Trainer Kit	
3.	Verification of functional table of 3 to 8 line Decoder / De-multiplexer	
4.	4 variable logic function verification using 8 to 1 multiplexer.	
5.	Design full adder circuit and verify its functional table.	
6.	Design full Subtractor circuit and verify its functional table.	
7.	Verification of functional tables of Flip-Flops	
8.	Design a four bit ring counter using D Flip – Flops / JK Flip Flop and verify output	
9.	Design a four bit Johnson's counter using D Flip-Flops / JK Flip Flops and	

	verify output	
10.	Draw the circuit diagram of MOD-8 ripple counter and construct a circuit using T-Flip-Flops and Test it with a low frequency clock and Sketch the output waveforms.	
11.	Design MOD – 10 ripple counter using T- Flip-Flop and verify the result and Sketch the output waveforms	
12.	Design MOD – 8 synchronous counter using D Flip-Flop and verify the result and Sketch the output waveforms.	

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II B.Tech II Semester

COURSE CODE – R2011XXYY	SOFT SKILL COURSE- EMPLOYABILITY SKILLS	CATEGORY SC	L-T-P 2-0-0	CREDITS 2

Pre-requisite:

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

		Knowledge Level (K)#
CO1	Follow strategies in minimizing time consumption in problem solving Apply shortcut methods to solve problems	K2
CO2	Confidently solve any mathematical problems and utilize these mathematical skills both in their professional as well as personal life.	K 2
CO3	Analyze, summarize and present information in quantitative forms including table, graphs and formulas	K4
CO4	Make presentations effectively with appropriate body language	K5
CO5	Understand the core competencies to succeed in professional and personal life	K6

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	1	-	-	-	-	-	-	1	-	-
CO2	2	3	2	2	2	1	-	-	-	-	-	-	1	-	-
CO3	2	3	2	2	2	1	-	-	-	-	-	-	1	-	-
CO4	1	1	1	2	2	1	1	2	3	3	2	2	1	-	1
CO5	1	1	1	2	2	1	1	2	3	3	2	2	1	-	1

(Please fill the above with Levels of Correlation, viz., L, M, H)

UNIT	CONTENTS	Contact Hours
UNIT - 1	Numerical ability l: Number system, HCF & LCM, Average, Simplification, Problems on numbers Numerical ability II: Ratio & Proportion, Partnership, Percentages, Profit & Loss	
UNIT - 2	Arithmetical ability l Problems on ages, Time & Distance, Problems on boats &Steams, Problems on Trains, Time & Work, Pipes & Cistern, Chain Rule. Arithmetical ability ll: Allegation, Simple interest and compound interest, Races & Games of skills, Calendar and Clock,	

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UNIT - 3	Logical ability: Permutations and Combination and Probability. Mensuration: Geometry, Areas, Volumes, Data interpretation: Tabulation, Bar graphs, Pie charts, line graphs	
UNIT - 4	Self-Management Skills Anger Management, Stress Management, Time Management, Six Thinking Hats, Team Building, Leadership Qualities Etiquette Social Etiquette, Business Etiquette, Telephone Etiquette, Dining Etiquette	
UNIT - 5	Job-Oriented Skills -I Group Discussion, Mock Group Discussions Job-Oriented Skills –II Resume Preparation, Interview Skills, Mock Interviews	
	Total	

Text Books:

1. R. S. Aggarwal "Quantitative Aptitude", Revised ed., S Chand publication, 2017 ISBN:8121924987
2. Barun K. Mitra, Personality Development and Soft Skills, Oxford University Press, 2011.
3. Raman, Meenakshi & Sharma, Sangeeta, Technical Communication Principles and Practice, Oxford University Press, 2011.

Reference Books:

1. S.P. Dhanavel, English and Soft Skills, Orient Blackswan, 2010.

E-resources and other digital material:

1. https://blog.feedspot.com/aptitude_youtube_channels/
2. https://www.tutorialspoint.com/quantitative_aptitude/
3. https://www.careerbless.com/aptitude/qa/home.php
4. https://www.Indiabix.com
5. https://www.freshersworld.com

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III B.Tech I Semester

COURSE CODE – R2011XXYY	POWER SYSTEMS-II	CATEGORY PC	L-T-P 3-0-0	CREDITS 3

Pre-requisite: Power Systems-I, Electromagnetic Fields.

Course Outcomes: After the completion of the course the student should be able to:

		Knowledge Level (K)#
CO1	Calculate parameters of transmission lines for different circuit configurations.	
CO2	Determine the performance of short, medium and long transmission lines.	
CO3	Analyse the effect of travelling waves on transmission lines.	
CO4	Analyse the various voltage control methods and effect of corona.	
CO5	Calculate sag/tension of transmission lines and performance of line insulators.	

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	2	1	2	-	-	-	-	-	-	1	3	1
CO2	3	2	3	2	1	3	-	-	-	-	-	2	1	3	1
CO3	3	2	3	2	1	2	-	-	-	-	-	3	1	3	2
CO4	3	2	3	2	1	3	-	-	-	-	-	4	1	3	2
CO5	3	2	3	2	1	3	-	-	-	-	-	-	1	3	2

(Please fill the above with Levels of Correlation, viz., 3: Strong, 2: Moderate, 1: Weak)

UNIT	CONTENTS	Contact Hours
UNIT - 1	**Transmission Line Parameters** Conductor materials – Types of conductors – Calculation of resistance for solid conductors – Skin and Proximity effects – Calculation of inductance for Single-phase and Three-phase– Single and double circuit lines– Concept of GMR and GMD–Symmetrical and asymmetrical conductor configuration with and without transposition–Bundled conductors – Calculation of capacitance for 2 wire and 3 wire systems – Effect of ground on capacitance – Capacitance calculations for symmetrical and asymmetrical single and Three-phase–Single and double circuit lines without and with Bundled conductors.	
UNIT - 2	**Performance Analysis of Transmission Lines** Classification of Transmission Lines – Short, medium, long lines and their model	

	representation –Nominal-T, Nominal-Pie and A, B, C, D Constants for symmetrical and Asymmetrical Networks. Rigorous Solution for long line equations – Surge Impedance and Surge Impedance Loading (SIL) of Long Lines – Representation of Long lines – Equivalent T and Equivalent Pie network models - Mathematical Solutions to estimate regulation and efficiency of lines – Ferranti effect – Charging Current – Power flow through transmission lines.	
UNIT - 3	**Power System Transients** Types of System Transients – Propagation of Surges – Attenuation–Distortion– Reflection and Refraction Coefficients. Termination of lines with different types of conditions – Open Circuited Line– Short Circuited Line – T-Junction – Lumped Reactive Junctions.	
UNIT - 4	**Voltage Control & Corona** Methods of Voltage Control – Sources & Sinks of reactive power – Shunt Capacitors/ Reactors and Series Capacitors – Tap Changing Transformers – Synchronous Phase Modifiers. Corona: Description of the phenomenon – Factors affecting corona – critical voltages and power loss.	
UNIT - 5	**Sag and Tension Calculations and Overhead Line Insulators:** Sag and Tension calculations with equal and unequal heights of towers–Effect of Wind and Ice on weight of Conductor – Stringing chart and sag template and its applications Types of Insulators – String efficiency and Methods for improvement - Voltage distribution–Calculation of string efficiency – Capacitance grading and Static Shielding.	
	Total	

Text Books:

1. Electrical Power Systems – by C.L.Wadhwa, New Age International (P) Limited, 1998.
2. Power System Engineering by I.J.Nagarath and D.P.Kothari, Tata McGraw Hill, 3rd Edition.

Reference Books:

1. Power system Analysis–by John J Grainger William D Stevenson, TMC Companies, 4thedition
2. Power System Analysis and Design by B.R.Gupta, Wheeler Publishing.
3. A Text Book on Power System Engineering by M.L.Soni, P.V.Gupta, U.S.Bhatnagar A.Chakrabarthy, DhanpatRai Co Pvt. Ltd.2016
4. Electrical Power Systems by P.S.R. Murthy, B.S. Publications, 2017.

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III B.Tech I Semester

COURSE CODE – R2011XXYY	POWER ELECTRONICS	CATEGORY PCC	L-T-P 3-0-0	CREDITS 3

Pre-requisite: Electrical Circuits, Power System-I, Basic concepts of Electronics

Course Outcomes: After the completion of the course the student should be able to:

		Knowledge Level (K)#
CO1	Illustrate the static and dynamic characteristics SCR, Power-MOSFET and Power-IGBT.	
CO2	Analyse the operation of phase controlled rectifiers.	
CO3	Analyse the operation of three-phase full–wave converters, AC Voltage Controllers and Cycloconverters.	
CO4	Examine the operation and design of different types of DC-DC converters.	
CO5	Analyse the operation of PWM inverters for voltage control and harmonic mitigation.	

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	1	1	-	-	-	-	-	-	-	1	2	2
CO2	3	3	2	2	1	2	2	-	-	-	-	-	1	3	1
CO3	3	3	2	1	1	2	2	-	-	-	-	-	1	3	1
CO4	3	3	2	2	1	2	2	-	-	-	-	-	1	3	1
CO5	3	3	2	2	1	2	2	-	-	-	-	-	1	3	1

(Please fill the above with Levels of Correlation, viz., 3: Strong, 2: Moderate, 1: Weak)

UNIT	CONTENTS	Contact Hours
UNIT - 1	**Power Semi-Conductor Devices** Silicon controlled rectifier (SCR) – Two transistor analogy - Static and Dynamic characteristics – Triggering methods (R, RC and UJT) – Snubber circuit design. Static and Dynamic Characteristics of Power MOSFET and Power IGBT– Gate Driver Circuits for Power MOSFET and IGBT - Numerical problems.	
UNIT - 2	**Single-phase AC-DC Converters** Single-phase half-wave controlled rectifiers - R load and RL load with and without freewheeling diode - Single-phase fully controlled mid-point and bridge converter with R load, RL load and RLE load - Continuous and Discontinuous conduction - Effect of source inductance in Single-phase fully controlled bridge rectifier – Expression for output voltages – Single-phase Semi-Converter with R	

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	load-RL load and RLE load – Continuous and Discontinuous conduction - Harmonic Analysis - Single-phase Dual Converters - Numerical Problems.	
UNIT - 3	**Three-phase AC-DC Converters & AC – AC Converters** Three-phase half-wave Rectifier with R and RL load - Three-phase fully controlled rectifier with R and RL load - Three-phase semi converter with R and RL load - Expression for Output Voltage - Harmonic Analysis - Three-phase Dual Converters - Numerical Problems. AC-AC power control by phase control with R and RL loads - Expression for rms output voltage – Single-phase step down and step up bridge Cycloconverter - Numerical Problems.	
UNIT - 4	**DC–DC Converters** Operation of Basic Chopper – Classification - Control Techniques – steady state time domain analysis of Basic Chopper - Analysis of Buck, Boost and Buck-Boost converters in Continuous Conduction Mode (CCM) and Discontinuous Conduction Modes (DCM) - Output voltage equations using volt-sec balance in CCM & DCM – Expressions for output voltage ripple and inductor current ripple- Numerical Problems.	
UNIT - 5	**DC–AC Converters** Introduction - Single-phase half-bridge and full-bridge inverters with R and RL loads – Phase Displacement Control – PWM with bipolar voltage switching, PWM with unipolar voltage switching - Three-phase square wave inverters - 120^0 conduction and 180^0 conduction modes of operation - Sinusoidal Pulse Width Modulation - Current Source Inverter (CSI) - Numerical Problems.	
	Total	

Text Books:

1. Power Electronics: Converters, Applications and Design by Ned Mohan, Tore M Undeland, William P Robbins, John Wiley & Sons.
2. Power Electronics: Circuits, Devices and Applications – by M. H. Rashid, Prentice Hall of India, 2nd edition, 1998
3. Power Electronics: Essentials & Applications by L.Umanand, Wiley, Pvt. Limited, India, 2009.

Reference Books:

1. Elements of Power Electronics–Philip T.Krein. Oxford University Press; Second edition
2. Power Electronics – by P.S.Bhimbra, Khanna Publishers.
3. Thyristorised Power Controllers – by G. K. Dubey, S. R. Doradla, A. Joshi and R. M. K.Sinha, New Age International (P) Limited Publishers, 1996.
4. Power Electronics: by Daniel W.Hart, Mc Graw Hill.

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III B.Tech I Semester

COURSE CODE – R2011XXYY	CONTROL SYSTEMS	CATEGORY PCC	L-T-P 3-0-0	CREDITS 3

Pre-requisite: Mathematics

Course Outcomes: After the completion of the course the student should be able to:

		Knowledge Level (K)#
CO1	Derive the transfer function of physical systems and determine overall transfer function using block diagram algebra and signal flow graphs.	2
CO2	Obtain the time response of first and specifications of second order systems and determine error constants. Analyze the absolute and relative stability of LTI systems using Routh's stability criterion and root locus method.	3
CO3	Analyze the stability of LTI systems using frequency response methods.	4
CO4	Design Lag, Lead, Lag-Lead compensators to improve system performance using Bode diagrams	5
CO5	Apply state space analysis concepts to represent physical systems as state models, derive transfer function and determine the response. Understand the concepts of controllability and observability	3

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	2	2	-	-	-	-	-	-	1	2	2	2	2
CO2	3	3	2	2	1	-	-	-	-	-	1	3	3	2	2
CO3	3	3	3	3	1	-	-	-	-	-	1	3	3	3	2
CO4	3	3	3	3	1	-	-	-	-	-	1	3	3	3	2
CO5	2	2	2	2	1	-	-	-	-	-	1	3	2	2	2

(Please fill the above with Levels of Correlation, viz., 3: Strong, 2: Moderate, 1: Weak)

UNIT	CONTENTS	Contact Hours
UNIT - 1	**Mathematical Modelling Of Control Systems** Classification of control systems - open loop and closed loop control systems and their differences - Feedback characteristics - transfer function of linear system, differential equations of electrical networks- translational and rotational mechanical systems - transfer function of Armature voltage controlled DC servo motor - block diagram algebra – representation by signal flow graph – reduction using Mason's gain formula.	
UNIT - 2	**Time Response Analysis**	

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	Standard test signals – time response of first and second order systems – time domain specifications - steady state errors and error constants - effects of proportional (P) - proportional integral (PI) - proportional derivative (PD) proportional integral derivative (PID) systems. **Stability And Root Locus Technique** The concept of stability – Routh's stability criterion – limitations of Routh's stability, root locus concept – construction of root loci (simple problems) - Effect of addition of Poles and Zeros to the transfer function.	
UNIT - 3	**Frequency Response Analysis** Introduction to frequency domain specifications – Bode diagrams – transfer function from the Bode diagram –Polar plots, Nyquist stability criterion- stability analysis using Bode plots (phase margin and gain margin).	
UNIT - 4	**Classical Control Design Techniques** Lag, lead, lag-lead compensators - physical realisation - design of compensators using Bode plots.	
UNIT - 5	**State Space Analysis Of LTI Systems** Concepts of state - state variables and state model - state space representation of transfer function: Controllable Canonical Form - Observable Canonical Form - Diagonal Canonical Form - diagonalization using linear transformation - solving the time invariant state equations State Transition Matrix and its properties- concepts of controllability and observability.	
	Total	

Text Books:

1. Modern Control Engineering by Kotsuhiko Ogata, Prentice Hall of India
2. Automatic control systems by Benjamin C.Kuo, Prentice Hall of India, 2nd Edition.

Reference Books:

1. Control Systems principles and design by M.Gopal, Tata Mc Graw Hill education Pvt Ltd., 4th Edition.
2. Control Systems Engineering by Norman S. Nise, Wiley Publications, 7th edition
3. Control Systems by Manik Dhanesh N, Cengage publications.
4. Control Systems Engineering by I.J.Nagarath and M.Gopal, Newage International Publications, 5th Edition.
5. Control Systems Engineering by S.Palani, Tata Mc Graw Hill Publications.

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III B.Tech I Semester

COURSE CODE – R2011XXYY	RENEWABLE ENERGY SOURCES (Open Elective –I)	CATEGORY OEC	L-T-P 3-0-0	CREDITS 3

Course Outcomes: After the completion of the course the student should be able to:

		Knowledge Level (K)#
CO1	Analyse solar radiation data, extra-terrestrial radiation, radiation on earth's surface and solar Energy Storage.	
CO2	Design the components of wind energy systems.	
CO3	Illustrate the working of biomass, digesters and Geothermal plants.	
CO4	Demonstrate the principle of Energy production from OTEC, Tidal and Waves.	
CO5	Evaluate the concept and working of Fuel cells & MHD power generation.	

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	1	1	--	1	--	--	--	--	1	1	1	1
CO2	2	2	3	2	1	--	1	--	--	--	--	1	1	1	1
CO3	2	2	3	2	1	--	1	--	--	--	--	1	1	1	1
CO4	1	2	2	--	--	--	1	--	--	--	--	1	1	1	1
CO5	1	2	2	--	--	--	1	--	--	--	--	1	1	1	1

(Please fill the above with Levels of Correlation, viz., L=1, M=2, H=3)

UNIT	CONTENTS	Contact Hours
UNIT - 1	**Solar Energy:** Introduction - Renewable Sources - prospects, Solar radiation at the Earth Surface - Equivalent circuit of a PV- I-V & P-V Characteristics of a PV - Solar Energy Collectors-Flat plate Collectors, concentrating collectors - Solar Energy storage systems – Solar Pond - Applications - Solar water heating - Solar Green house.	
UNIT - 2	**Wind Energy**: Introduction - basic Principles of Wind Energy Conversion, the nature of Wind - the power in the wind - Wind Energy Conversion - Site selection considerations - basic components of a WECS (Wind Energy Conversion Systems) - Classification of WEC Systems - Applications.	
UNIT - 3	**Biomass and Geothermal Energy:** **Biomass:** Introduction - Biomass conversion technologies - Photosynthesis, factors affecting Bio digestion - classification of biogas plants - Types of biogas plants - selection of site for a biogas plant	

	Geothermal Energy: Introduction, Geothermal Sources – Applications - operational and Environmental problems.	
UNIT - 4	**Energy From oceans, Waves & Tides:** **Oceans:** Introduction - Ocean Thermal Electric Conversion (OTEC) – methods - prospects of OTEC in India. **Waves:** Introduction - Energy and Power from the waves - Wave Energy conversion devices. **Tides:** Basic principle of Tide Energy -Components of Tidal Energy.	
UNIT - 5	**Chemical Energy Sources:** **Fuel Cells**: Introduction - Fuel Cell Equivalent Circuit - operation of Fuel cell - types of Fuel Cells - Applications. **Hydrogen Energy:** Introduction - Methods of Hydrogen production - Storage and Applications **Magneto Hydro Dynamic (MHD) Power generation:** Principle of Operation - Types.	
	Total	

Text Books:

1. G.D.Rai, Non-Conventional Energy Sources, Khanna Publications, 2011.
2. John Twidell & Tony Weir, Renewable Energy Sources, Taylor & Francis, 2013.

Reference Books:

1. S.P.Sukhatme & J.K.Nayak, Solar Energy-Principles of Thermal Collection and Storage, TMH, 2011.
2. John Andrews & Nick Jelly, Energy Science- principles, Technologies and Impacts, Oxford, 2nd edition, 2013.
3. Shoba Nath Singh, Non- Conventional Energy Resources, Pearson Publications, 2015.

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III B.Tech I Semester

COURSE CODE – R2011XXYY	ENERGY AUDITING, CONSERVATION AND MANAGEMENT (Open Elective –I)	CATEGORY OEC	L-T-P 3-0-0	CREDITS 3

Pre-requisite: Basics of Electrical Engineering-Motor, Illumination concepts.

Course Outcomes: After the completion of the course the student should be able to:

		Knowledge Level (K)#
CO1	Understand the principles of energy audit along with various Energy related terminologies.	
CO2	Asses the role of Energy Manager and Energy Management program.	
CO3	Design a energy efficient motors and good lighting system.	
CO4	Analyse the methods to improve the power factor and identify the energy instruments for various real time applications.	
CO5	Evaluate the computational techniques with regard to economic aspects.	

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	--	--	--	--	--	--	--	--	--	2	2	1
CO2	2	--	2	--	--	--	--	--	--	--	--	--	2	2	1
CO3	2	--	2	--	--	--	--	--	--	--	--	--	2	2	1
CO4	2	1	2	--	--	--	--	--	--	--	--	--	2	2	1
CO5	2	2	2	--	--	--	--	--	--	--	--	--	2	2	1

(Please fill the above with Levels of Correlation, viz., L=1, M=2, H=3)

UNIT	CONTENTS	Contact Hours
UNIT - 1	**Basic Principles of Energy Audit** Energy Audit - Definitions - Concept - Types Of Audit - Energy Index - Cost Index - Pie Charts - Sankey Diagrams And Load Profiles - Energy Conservation Schemes - Energy Audit Of Industries- Energy Saving Potential - Energy Audit Of Process Industry - Thermal Power Station - Building Energy Audit - Conservation Of Energy Building Codes (ECBC-2017).	
UNIT - 2	**Energy Management** Principles Of Energy Management - Organizing Energy Management Program - Initiating - Planning - Controlling - Promoting - Monitoring - Reporting. Energy Manager - Qualities And Functions - Language -	

	Questionnaire – Check List For Top Management.	
UNIT - 3	**Energy Efficient Motors and Lighting** Energy Efficient Motors - Factors Affecting Efficiency - Loss Distribution - Constructional Details And Characteristics – Variable Speed - RMS - Voltage Variation-Voltage Unbalance - Over Motoring-Motor Energy Audit - Lighting System Design And Practice - Lighting Control - Lighting Energy Audit.	
UNIT - 4	**Power Factor Improvement and energy instruments** Power Factor – Methods of Improvement - Location of Capacitors - Power Factor With Non-Linear Loads - Effect of Harmonics on P.F - P.F Motor Controllers – Energy Instruments - Watt Meter - Data Loggers – Thermocouples – Pyrometers - Lux Meters - Tongue Testers.	
UNIT - 5	**Economic Aspects and their computation:** Economics Analysis Depreciation Methods - Time Value of Money – Rate Of Return - Present Worth Method - Replacement Analysis - Lifecycle Costing Analysis – Energy Efficient Motors. Calculation of Simple Payback Method - Net Present Value Method- Power Factor Correction - Lighting – Applications Of Life Cycle Costing Analysis - Return on Investment.	
	Total	

Text Books:

1. Energy Management by W.R.Murphy&G.Mckay Butter worth - Heinemann publications - 1982.
2. Energy Management Hand Book by W.CTurner - John wiley and sons - 1982.

Reference Books:

1. Energy Efficient Electric Motors by John.C.Andreas - Marcel Dekker Inc Ltd-2nd Edition - 1995
2. Energy Management by Paul o' Callaghan - Mc-graw Hill Book company-1st edition - 1998
3. Energy Management And Good Lighting Practice : Fuel Efficiency- Booklet12-EEO

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III B.Tech I Semester

COURSE CODE – R2011XXYY	OPTIMIZATION TECHNIQUES (Open Elective –I)	CATEGORY OEC	L-T-P 3-0-0	CREDITS 3

Pre-requisite: Basics on Mathematical Methods

Course Outcomes: After the completion of the course the student should be able to:

		Knowledge Level (K)#
CO1	State and formulate the optimization problem without and with constraints, also apply classical optimization techniques to minimize or maximize a multi-variable objective function, without or with constraints and arrive at an optimal solution.	
CO2	Formulate a mathematical model and apply linear programming technique by using Simplex method. Also extend the concept of dual Simplex method for optimal solutions.	
CO3	Formulate a mathematical model and apply non-linear programming techniques for unconstrained and constrained case studies.	
CO4	Solve transportation and assignment problem by using Linear programming Simplex method.	
CO5	Formulate and apply Dynamic programming technique to inventory control, production planning, engineering design problems etc. to reach a final optimal solution from the current optimal solution.	

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	--	2	--	--	--	--	--	--	--	2	3	2
CO2	2	2	2	--	2	--	--	--	--	--	--	--	2	3	2
CO3	3	2	3	1	2	--	--	--	--	--	--	--	2	3	2
CO4	2	2	2	2	1	--	--	--	--	--	--	--	2	3	2
CO5	2	2	2	--	2	--	--	--	--	--	--	--	2	3	2

(Please fill the above with Levels of Correlation - viz. - L=1 - M=2 - H=3)

UNIT	CONTENTS	Contact Hours
UNIT - 1	**Introduction to Optimization Techniques** Statement of an Optimization problem – design vector – design constraints – constraint surface – objective function – objective function surfaces – classification of Optimization problems. **Classical Optimization Techniques** Single variable Optimization – multi variable Optimization without constraints – necessary and sufficient conditions for minimum/maximum – multivariable	

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	Optimization with equality constraints. Solution by method of Lagrange multipliers – multivariable Optimization with inequality constraints – Kuhn – Tucker conditions.	
UNIT - 2	**Linear Programming** Standard form of a linear programming problem – geometry of linear programming problems – definitions and theorems – solution of a system of linear simultaneous equations – pivotal reduction of a general system of equations – motivation to the simplex method – simplex algorithm - Duality in Linear Programming – Dual Simplex method.	
UNIT - 3	**Nonlinear Programming** **Unconstrained cases -** One – dimensional minimization methods: Classification - Fibonacci method and Quadratic interpolation method - Univariate method - Powell's method and steepest descent method. **Constrained cases -** Characteristics of a constrained problem - Classification - Basic approach of Penalty Function method; Basic approaches of Interior and Exterior penalty function methods.	
UNIT - 4	**Transportation Problem** Finding initial basic feasible solution by north – west corner rule - least cost method and Vogel's approximation method – testing for optimality of balanced transportation problems – Special cases in transportation problem.	
UNIT - 5	**Dynamic Programming** Dynamic programming multistage decision processes – types – concept of sub optimization and the principle of optimality – computational procedure in dynamic programming – examples illustrating the calculus method of solution - examples illustrating the tabular method of solution.	
	Total	

Text Books:

1. "Engineering optimization: Theory and practice"-by S. S.Rao - New Age International (P) Limited - 3rd edition - 1998.
2. "Introductory Operations Research" by H.S. Kasene & K.D. Kumar - Springer (India) 2013.

Reference Books:

1. "Optimization Methods in Operations Research and systems Analysis" – by K.V. Mital and C. Mohan - New Age International (P) Limited - Publishers - 3rd edition - 1996.
2. Operations Research – by Dr. S.D.Sharma - Kedarnath - Ramnath & Co - 2012.
3. "Operations Research: An Introduction" – by H.A.Taha - PHI pvt. Ltd. - 6th edition
4. Linear Programming–by G.Hadley.

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III B.Tech I Semester

COURSE CODE – R2011XXYY	BASICS OF CONTROL SYSTEMS (Open Elective –I)	CATEGORY OEC	L-T-P 3-0-0	CREDITS 3

Pre-requisite: Mathematics

Course Outcomes: After the completion of the course the student should be able to:

		Knowledge Level (K)#
CO1	Derive the transfer function of physical systems and determination of overall transfer function using block diagram algebra and signal flow graphs.	2
CO2	Obtain the time response of first and specifications of second order systems and determine error constants	3
CO3	Analyze absolute and relative stability of LTI systems using Routh's stability criterion and the root locus method.	4
CO4	Analyze the stability of LTI systems using frequency response methods.	4
CO5	Represent physical systems as state models and determine the response. Understanding the concepts of controllability and observability.	3

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1	2	-	-	1	1	1	1	1	2	1	1
CO2	3	3	1	2	1	-	-	1	1	1	2	1	2	1	1
CO3	3	2	1	2	1	-	-	1	1	1	2	2	2	2	1
CO4	3	2	1	2	1	-	-	1	1	1	1	2	2	2	1
CO5	3	3	2	1	2	-	-	1	1	1	1	2	2	1	1

(Please fill the above with Levels of Correlation, viz., 3: Strong, 2: Moderate, 1: Weak)

UNIT	CONTENTS	Contact Hours
UNIT - 1	**Mathematical Modelling of Control Systems** Classification of control systems - open loop and closed loop control systems and their differences - transfer function of linear system - differential equations of electrical networks - translational and rotational mechanical systems - transfer function of DC servo motor – AC servo motor – block diagram algebra – representation by signal flow graph – reduction using Mason's gain formula - Feedback characteristics.	
UNIT - 2	**Time Response Analysis** Standard test signals – time response of first and second order systems – time domain specifications - steady state errors and error constants - P - PI & PID Controllers.	

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UNIT - 3	**Stability and Root Locus Technique** The concept of stability – Routh-Hurwitz –limitations of Routh-Hurwitz criterion. Root locus concept – construction of root loci (simple problems).	
UNIT - 4	**Frequency Response Analysis** Introduction to frequency domain specifications – Polar Plot - Bode diagrams – Transfer function from the Bode diagram – phase margin and gain margin – stability analysis from Bode plots.	
UNIT - 5	**State Space Analysis of LTI Systems** Concepts of state - state variables and state model - state space representation of transfer function - diagonalization - solving the time invariant state equations - State Transition Matrix and it's properties - concepts of controllability and observability.	
	Total	

Text Books:

1. Modern Control Engineering by Kotsuhiko Ogata - Prentice Hall of India.
2. Automatic control systems by Benjamin C.Kuo - Prentice Hall of India - 2nd Edition.

Reference Books:

1. Control Systems principles and design by M.Gopal - Tata Mc Graw Hill education Pvt Ltd. - 4th Edition.
2. Control Systems by Manik Dhanesh N - Cengage publications.
3. Control Systems Engineering by I.J.Nagarath and M.Gopal - Newage International Publications - 5th Edition.
4. Control Systems Engineering by S.Palani - Tata Mc Graw Hill Publications.

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III B.Tech I Semester

COURSE CODE – R2011XXYY	SWITCHGEAR AND PROTECTION (Professional Elective – I)	CATEGORY PEC	L-T-P 3-0-0	CREDITS 3

Pre-requisite: Concepts of Power systems

Course Outcomes: After the completion of the course the student should be able to:

		Knowledge Level (K)#
CO1	Illustrate the principles of arc interruption for application to high voltage circuit breakers of air - oil - vacuum - SF_6 gas type.	
CO2	Analyse the working principle and operation of different types of electromagnetic protective relays.	
CO3	Acquire knowledge of protective schemes for generator and transformers for different fault conditions.	
CO4	Classify various types of protective schemes used for feeders and bus bar protection and Types of static relays.	
CO5	Analyse the operation of different types of over voltages protective schemes required for insulation co–ordination and types of neutral grounding.	

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	2	2	--	--	--	--	--	--	--	--	2	2	1
CO2	2	3	2	2	--	--	--	--	--	--	--	--	3	2	1
CO3	2	3	2	2	--	--	--	--	--	--	--	--	3	2	1
CO4	2	3	2	2	--	--	--	--	--	--	--	--	2	2	1
CO5	2	3	2	2	--	--	--	--	--	--	--	--	3	2	1

(Please fill the above with Levels of Correlation - viz. - L=1 - M=2 - H=3)

UNIT	CONTENTS	Contact Hours
UNIT - 1	**Circuit Breakers** Application oriented evolution of Switchgear - Miniature Circuit Breaker(MCB)– Elementary principles of arc interruption– Restriking Voltage and Recovery voltages– Restriking phenomenon - RRRV– Average and Max. RRRV– Current chopping and Resistance switching– Concept of oil circuit breakers– Description and operation of Air Blast– Vacuum and SF6 circuit breakers– CB ratings and specifications– Concept of Auto reclosing– Numerical examples	
UNIT - 2	**Electromagnetic Protection** Relay connection – Balanced beam type attracted armature relay - induction disc and induction cup relays–Torque equation - Relays classification–Instantaneous–	

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	DMT and IDMT types– Applications of relays**:** Over current and under voltage relays– Directional relays– Differential relays and percentage differential relays– Universal torque equation– Distance relays**:** Impedance– Reactance– Mho and offset mho relays– Characteristics of distance relays and comparison.	
UNIT - 3	**Generator Protection** Protection of generators against stator faults– Rotor faults and abnormal conditions– restricted earth fault and inter turn fault protection– Numerical examples. **Transformer Protection** Percentage differential protection– Design of CT's ratio– Buchholz relay protection–Numerical examples.	
UNIT - 4	**Feeder and Bus bar Protection & Static Relays:** Over current Protection schemes – PSM - TMS – Numerical examples – Carrier current and three zone distance relay using impedance relays. Protection of bus bars by using Differential protection. Static relays**:** Introduction – Classification of Static Relays – Basic Components of Static Relays.	
UNIT - 5	**Protection against over voltage and grounding** Generation of over voltages in power systems– Protection against lightning over voltages– Valve type and zinc oxide lighting arresters. Grounded and ungrounded neutral systems – Effects of ungrounded neutral on system performance – Methods of neutral grounding**:** Solid–resistance– Reactance–Arcing grounds and grounding Practices.	
	Total	

Text Books:

1. Power System Protection and Switchgear by Badri Ram and D.N Viswakarma - Tata McGraw Hill Publications - 2nd edition - 2011.
2. Power system protection- Static Relays with microprocessor applications by T.S.Madhava Rao - Tata McGraw Hill - 2nd edition.

Reference Books:

1. Fundamentals of Power System Protection by Paithankar and S.R.Bhide. - PHI - 2003.
2. Art & Science of Protective Relaying – by C R Mason - Wiley Eastern Ltd.
3. Protection and SwitchGear by BhaveshBhalja - R.P. Maheshwari - Nilesh G.Chothani - Oxford University Press - 2013.

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III B.Tech I Semester

COURSE CODE – R2011XXYY	UTILIZATION OF ELECTRICAL ENERGY (Professional Elective – I)	CATEGORY PEC	L-T-P 3-0-0	CREDITS 3

Pre-requisite: Concepts of Electrical Engineering

Course Outcomes: After the completion of the course the student should be able to:

		Knowledge Level (K)#
CO1	Identify various illumination methods produced by different illuminating sources.	
CO2	Identify a suitable motor for electric drives and industrial applications	
CO3	Identify most appropriate heating or welding techniques for suitable applications.	
CO4	Distinguish various traction system and determine the tractive effort and specific energy consumption.	
CO5	Validate the necessity and usage of different energy storage schemes for different applications and comparisons.	

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	--	1	--	--	--	--	--	--	--	1	3	3	1
CO2	3	3	--	1	--	--	--	--	--	--	--	1	3	3	1
CO3	3	3	--	1	--	--	--	--	--	--	--	1	3	3	1
CO4	3	3	--	2	--	--	--	--	--	--	--	1	3	3	1
CO5	3	3	--	1	--	--	1	--	--	--	--	1	3	3	1

(Please fill the above with Levels of Correlation - viz. - L=1 - M=2 - H=3)

UNIT	CONTENTS	Contact Hours
UNIT - 1	**Illumination fundamentals** Introduction - terms used in illumination–Laws of illumination–Polar curves–Integrating sphere–Lux meter–Sources of light. **Various Illumination Methods** Discharge lamps - MV and SV lamps – Comparison between tungsten filament lamps and fluorescent tubes–Basic principles of light control– Types and design of lighting and flood lighting–LED lighting - Energy conservation.	
UNIT - 2	**Selection of Motors** Choice of Motor - Type of Electric Drives - Starting And Running Characteristics – Speed Control–Temperature Rise – Applications of Electric Drives–Types of Industrial Loads–Continuous–Intermittent And Variable	

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	Loads–Load Equalization - Introduction To Energy Efficient Motors.	
UNIT - 3	**Electric Heating** Advantages and methods of electric heating–Resistance heating induction heating and dielectric heating. **Electric Welding** Electric welding–Resistance and arc welding–Electric welding equipment–Comparison between AC and DC Welding.	
UNIT - 4	**Electric Traction** System of electric traction and track electrification– Review of existing electric traction systems in India– Special features of traction motor–Mechanics of train movement–Speed–time curves for different services –Trapezoidal and quadrilateral speed time curves. Calculations of tractive effort– power –Specific energy consumption for given run–Effect of varying acceleration and braking retardation–Adhesive weight and braking retardation adhesive weight and coefficient of adhesion-Numerical problems.	
UNIT - 5	**Introduction to Energy Storage Systems** Need For Energy Storage - Types of Energy Storage-Thermal - Electrical - Magnetic And Chemical Storage Systems - Comparison of Energy Storage Technologies-Applications.	
	Total	

Text Books:

1. Utilization of Electric Energy – by E. Openshaw Taylor - Orient Longman.
2. Art & Science of Utilization of electrical Energy – by Partab - Dhanpat Rai& Sons.
3. "Thermal energy storage systems and applications"-by Ibrahim Dincer and Mark A.Rosen. John Wiley and Sons 2002.

Reference Books:

1. Utilization of Electrical Power including Electric drives and Electric traction – by N.V.Suryanarayana - New Age International (P) Limited - Publishers - 1996.
2. Generation - Distribution and Utilization of electrical Energy – by C.L. Wadhwa - New Age International (P) Limited - Publishers - 1997.

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III B.Tech I Semester

COURSE CODE – R2011XXYY	HIGH VOLTAGE ENGINEERING (Professional Elective – I)	CATEGORY PEC	L-T-P 3-0-0	CREDITS 3

Pre-requisite: Concepts on Electric Supply Systems

Course Outcomes: After the completion of the course the student should be able to:

		Knowledge Level (K)#
CO1	Recognise the dielectric properties of gaseous materials used in HV equipment.	
CO2	Differentiate the break down phenomenon in liquid and solid dielectric materials.	
CO3	Acquaint with the techniques of generation of high AC and DC voltages	
CO4	Acquaint with the techniques of generation of high Impulse voltages and currents.	
CO5	Getting the knowledge of measurement of high AC - DC - Impulse voltages and currents	

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3	3	--	--	--	--	--	--	2	1	2	3	2
CO2	2	2	2	2	--	--	--	--	--	--	2	1	2	3	2
CO3	2	2	2	3	--	--	--	--	--	--	2	2	2	3	2
CO4	2	2	2	2	--	--	--	--	--	--	1	1	3	2	2
CO5	2	2	2	2	3	--	--	--	--	--	1	1	2	2	2

(Please fill the above with Levels of Correlation - viz. - L=1 - M=2 - H=3)

UNIT	CONTENTS	Contact Hours
UNIT - 1	**Break down phenomenon in Gaseous:** Insulating Materials: Types - applications and properties. Gases as insulating media – Collision process – Ionization process – Townsend's criteria of breakdown in gases and its limitations – Streamers Theory of break down – Paschen's law- Paschens curve.	
UNIT - 2	**Break down phenomenon in Liquids:** Liquid as Insulator – Pure and commercial liquids – Breakdown in pure and commercial liquids. **Break down phenomenon in Solids:** Intrinsic breakdown – Electromechanical breakdown – Thermal breakdown – Breakdown of composite solid dielectrics.	

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UNIT - 3	**Generation of High DC voltages:** Voltage Doubler Circuit - Voltage Multiplier Circuit – Vande- Graaff Generator. **Generation of High AC voltages**: Cascaded Transformers – Resonant Transformers –Tesla Coil	
UNIT - 4	**Generation of Impulse voltages:** Specifications of impulse wave – Analysis of RLC circuit only- Marx Circuit. **Generation of Impulse currents:** Definitions – Circuits for producing Impulse current waves – Wave shape control - Tripping and control of impulse generators.	
UNIT - 5	**Measurement of High DC & AC Voltages:** Resistance potential divider - Generating Voltmeter - Capacitor Voltage Transformer (CVT) - Electrostatic Voltmeters – Sphere Gaps. **Measurement of Impulse Voltages & Currents:** Potential dividers with CRO - Hall Generator - Rogowski Coils.	
	Total	

Text Books:

1. High Voltage Engineering: Fundamentals by E.Kuffel - W.S.Zaengl - J.Kuffel by Elsevier - 2nd Edition.
2. High Voltage Engineering and Technology by Ryan - IET Publishers - 2nd edition.

Reference Books:

1. High Voltage Engineering by M.S.Naidu and V. Kamaraju – TMH Publications - 3rd Edition.
2. High Voltage Engineering by C.L.Wadhwa - New Age Internationals (P) Limited - 1997.
3. High Voltage Insulation Engineering by RavindraArora - Wolfgang Mosch - New Age International (P) Limited - 1995.

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III B.Tech I Semester

COURSE CODE – R2011XXYY	RENEWABLE AND DISTRIBUTED ENERGY TECHNOLOGIES (Professional Elective – I)	CATEGORY PEC	L-T-P 3-0-0	CREDITS 3

Pre-requisite: Concepts of Electrical Machines - Power Electronics

Course Outcomes: After the completion of the course the student should be able to:

		Knowledge Level (K)#
CO1	Illustrate basic concepts of renewable and distributed sources	
CO2	Demonstrate the components of wind energy conversion systems.	
CO3	Model PV systems and analyse MPPT Techniques.	
CO4	Illustrate the concept of Energy Production from Hydro - Tidal and Geothermal.	
CO5	Distinguish between standalone and grid connected DG systems and design hybrid renewable energy systems.	

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	1	--	--	--	--	--	1	2	2	2	2
CO2	2	2	2	2	1	--	--	--	--	--	--	2	2	2	2
CO3	3	2	2	2	--	--	--	--	--	--	--	2	2	2	2
CO4	2	2	2	2	--	--	--	--	--	--	--	2	2	1	2
CO5	2	2	2	2	1	--	--	--	--	--	--	2	2	1	1

(Please fill the above with Levels of Correlation - viz. - L=1 - M=2 - H=3)

UNIT	CONTENTS	Contact Hours
UNIT - 1	Brief idea on renewable and distributed sources - their usefulness and advantages; Wind Energy Systems: Estimates of wind energy potential - wind maps - Instrumentation for wind velocity measurements - Aerodynamic and mechanical aspects of wind machine design - Conversion to electrical energy - Aspects of location of wind farms.	
UNIT - 2	Wind speed and energy - Speed and power relations - Power extraction from wind - Tip speed ratio (TSR) - Functional structure of wind energy conversion systems - Pitch and speed control - Power-speed-TSR characteristics - Fixed speed and variable speed wind turbine control - Power optimization - Electrical generators - Self-Excited and Doubly-Fed Induction Generators operation and control.	

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UNIT - 3	Solar PV Systems: Present and new technological developments in photovoltaic - estimation of solar irradiance - components of solar energy systems - solar-thermal system applications to power generation - heating - Types of PV systems - Modelling of PV cell - current-voltage and power-voltage characteristics - Effects of temperature - Solar array simulator - Sun tracking - Peak power operations - PV system - MPPT techniques - Effects of partial shading on the characteristic curves and associated MPPT techniques - Solar park design outline.	
UNIT - 4	Hydel Power: Water power estimates - use of hydrographs - hydraulic turbine - characteristics and part load performance - design of wheels - draft tubes and penstocks - plant layouts; Brief idea of other sources viz. - tidal - geothermal - gas-based - etc.	
UNIT - 5	Requirements of hybrid/combined use of different renewable and distributed sources - Need of energy storage; Control of frequency and voltage of distributed generation in Stand-alone and Grid-connected mode - use of energy storage and power electronics interfaces for the connection to grid and loads - Design and optimization of size of renewable sources and storages.	
	Total	

Text Books & Reference Books:

1. Math J. Bollen - Fainan Hassan 'Integration of Distributed Generation in the Power System' - IEEE Press - 2011.
2. Loi Lei Lai and Tze Fun Chan 'Distributed Generation: Induction and Permanent Magnet Generators' - Wiley-IEEE Press - 2007.
3. Studies' Craig Anderson and Rudolf I. Howard 'Wind and Hydropower Integration: Concepts - Considerations and Case - Nova Publisher - 2012.
4. Amanda E. Niemi and Cory M. Fincher 'Hydropower from Small and Low-Head Hydro Technologies' - Nova Publisher - 2011.
5. D. Yogi Goswami - Frank Kreith and Jan F. Kreider 'Principles of Solar Engineering' - Taylor & Francis 2000.
6. G. N. Tiwari 'Solar Energy Technology' - Nova Science Publishers - 2005.
7. Math J. Bollen - Fainan Hassan 'Integration of Distributed Generation in the Power System' - IEEE Press - 2011.
8. S. Heier and R. Waddington 'Grid Intergration of Wind Energy Conversion Systems' – Wiley - 2006.

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III B.Tech I Semester

COURSE CODE – R2011XXYY	CONTROL SYSTEMS LABORATORY	CATEGORY PCC	L-T-P 0-0-3	CREDITS 1.5

Pre-requisite: Basics of Control Systems Theory.

Course Outcomes: After the completion of the course the student should be able to:

		Knowledge Level (K)#
CO1	Analyze the performance and working Magnetic amplifier - D.C and A.C. servo motors and synchros.	
CO2	Design P - PI - PD and PID controllers	
CO3	Design lag - lead and lag–lead compensators	
CO4	Evaluate temperature control of an oven using PID controller	
CO5	Determine the transfer function of D.C Motor and examine the truth table of logic gates using PLC.	
CO6	Judge the stability in time and frequency domain and Kalman's test for controllability and observability.	

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	2	2	--	--	--	--	--	--	1	1	1	1
CO2	3	3	3	2	2	--	--	--	--	--	--	2	2	1	1
CO3	3	2	3	2	2	--	--	--	--	--	--	1	2	1	2
CO4	3	2	2	2	2	--	--	--	--	--	--	2	2	1	2
CO5	3	2	2	2	3	--	--	--	--	--	--	2	3	2	1
CO6	3	2	1	2	2	--	--	--	--	--	--	1	1	1	1

(Please fill the above with Levels of Correlation - viz. - L=1 - M=2 - H=3)

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III B.Tech I Semester

COURSE CODE – R2011XXYY	CONTROL SYSTEMS LABORATORY	CATEGORY PCC	L-T-P 0-0-3	CREDITS 1.5

Exp. No.	CONTENTS (Any 10 of the following experiments are to be conducted)	Contact Hours
1	Analysis of second order system in time domain.	
2	Determination of performance characteristics of Synchro pair as error detector.	
3	Determination of performance of a second order systems with P - PD - PI - PID Controllers.	
4	Design of Lag and lead compensating network using frequency domain technique.	
5	Transfer function of DC motor	
6	Determination of stability of the transfer functions using Bode Plot - Root locus - Nyquist Plots by simulation tools.	
7	Kalman's test of Controllability and Observability.	
8	Temperature controller using PID	
9	Performance analysis of magnetic amplifiers	
10	Performance analysis of AC servo motor	
11	Performance analysis of DC servo motor	
12	To study and verify the truth table of logic gates and simple Boolean expressions using PLC	

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III B.Tech I Semester

COURSE CODE – R2011XXYY	POWER ELECTRONICS LABORATORY	CATEGORY PCC	L-T-P 0-0-3	CREDITS 1.5

Pre-requisite: Power Electronics

Course Outcomes: After the completion of the course the student should be able to:

		Knowledge Level (K)#
CO1	Analyze characteristics of various power electronic devices and design firing circuits for SCR.	
CO2	Analyze the performance of single–phase dual converter and three–phase full–wave bridge converters with both resistive and inductive loads.	
CO3	Examine the operation of Single-phase AC voltage regulator and Cycloconverter with resistive and inductive loads.	
CO4	Differentiate the working and control of Buck converter - Boost converter - single–phase square wave inverter and PWM inverter.	

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	2	2	1	-	-	3	2	1	-	2	3	3
CO2	3	2	3	2	2	1	-	-	3	2	1	-	2	3	3
CO3	3	2	3	2	2	1	-	-	3	2	1	-	2	3	3
CO4	3	2	3	2	2	1	-	-	3	2	1	-	2	3	3

(Please fill the above with Levels of Correlation, viz., 3: Strong, 2: Moderate, 1: Week)

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S.No	CONTENTS	Contact Hours
1.	Characteristics of SCR - Power MOSFET & Power IGBT.	
2.	R - RC & UJT firing circuits for SCR.	
3.	Single -Phase semi-converter with R & RL loads.	
4.	Single -Phase full-converter with R & RL loads.	
5.	Three- Phase full-converter with R & RL loads.	
6.	Single-phase dual converter in circulating current & non circulating current mode of operation.	
7.	Single-Phase AC Voltage Regulator with R & RL Loads.	
8.	Single-phase step down Cycloconverter with R & RL Loads.	
9.	Boost converter in Continuous Conduction Mode operation.	
10.	Buck converter in Continuous Conduction Mode operation.	
11.	Single -Phase square wave bridge inverter with R & RL Loads.	
12.	Single - Phase PWM inverter.	
13.	Three-phase bridge inverter with 120^0 and 180^0 conduction mode	
14.	SPWM control of Three-phase bridge inverter	

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III B.Tech I Semester

COURSE CODE – R2011XXYY	SKILL ADVANCED COURSE-COURSES OFFERED BY SIEMENS CENTRE OF EXCELLENCE : AUTOMATION LAB- Basics of PLC - Basics of SCADA/ - ELECTRICAL & ENERGY STUDIES LAB- Basics of Low Voltage Switchgear - Basics of Induction Motor/ PROCESS INSTRUMENTATION LAB- Basics of Process Instrumentation	CATEGORY SC	L-T-P 0-0-4	CREDITS 2

Pre-requisite:

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

		Knowledge Level (K)#
CO1		
CO2		
CO3		
CO4		
CO5		

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1															
CO2															
CO3															
CO4															
CO5															
CO6															

(Please fill the above with Levels of Correlation - viz. - L - M - H)

S.No	CONTENTS	Contact Hours
	List of Experiments: **Any TEN of the following Experiments are to be conducted**	
1.		
2.		
3.		
4.		

5.		
6.		
7.		
8.		
9.		
10.		

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III B.Tech I Semester

COURSE CODE – R2011XXYY	ENVIRONMENTAL SCIENCE	CATEGORY MC	L-T-P 2-0-0	CREDITS 0

Pre-requisite:

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

		Knowledge Level (K)#
CO1	Understand ecosystem and its function in the environment.	
CO2	Acquire knowledge on the natural resources and their importance.	
CO3	Recognize the biodiversity of India and the threats to biodiversity, and conservation practices to protect the biodiversity.	
CO4	Know various attributes of the pollution and their impacts and measures to reduce or control the pollution along with waste management practices.	
CO5	Beware of social issues both rural and urban environment and possible means to challenges like environmental impact assessment and the stages involved in EIA and the environmental audit.	

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	--	--	--	--	--	--	3	2	--	--	--	1	--	--	1
CO2	--	1	--	--	--	--	3	2	--	--	--	2	--	--	1
CO3	--	--	--	--	--	1	3	2	--	--	--	1	--	--	1
CO4	--	--	--	--	--	2	3	2	--	--	--	2	--	--	1
CO5	--	--	--	--	--	2	3	2	--	1	--	1	--	--	1

(Please fill the above with Levels of Correlation - viz. - L - M - H)

UNIT	CONTENTS	Contact Hours
UNIT - 1	**Multidisciplinary nature of Environmental Studies:** Definition, Scope and Importance – Sustainability: Stockholm and Rio Summit–Global Environmental Challenges: Global warming and climate change, acid rains, ozone layer depletion, population growth and explosion, effects;. Role of information technology in environment and human health. **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 Forest ecosystem, Grassland ecosystem, Desert	

	ecosystem, Aquatic ecosystems.	
UNIT - 2	**Natural Resources:** Natural resources and associated problems. Forest resources: Use and over – exploitation, deforestation – Timber extraction – Mining, dams and other effects on forest 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 using mineral resources. Food resources: World food problems, changes caused by non-agriculture activities-effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity. Energy resources: Growing energy needs, renewable and non-renewable energy sources use of alternate energy sources. Land resources: Land as a resource, land degradation, Wasteland reclamation, man induced landslides, soil erosion and desertification; Role of an individual in conservation of natural resources; Equitable use of resources for sustainable lifestyles.	
UNIT - 3	**Biodiversity and its conservation:** Definition: genetic, species and ecosystem diversity- classification - Value of biodiversity: consumptive use, productive use, social-Biodiversity at national and local levels. India as a mega-diversity nation - Hot-sports of biodiversity - Threats to biodiversity: habitat loss, man-wildlife conflicts. - Endangered and endemic species of India – Conservation of biodiversity: conservation of biodiversity.	
UNIT - 4	**Environmental Pollution:** Definition, Cause, effects and control measures of Air pollution, Water pollution, Soil pollution, Noise pollution, Nuclear hazards. Role of an individual in prevention of pollution. - Pollution case studies, Sustainable Life Studies. Impact of Fire Crackers on Men and his well being. **Solid Waste Management:** Sources, Classification, effects and control measures of urban and industrial solid wastes. Consumerism and waste products, Biomedical, Hazardous and e – waste management.	
UNIT - 5	**Social Issues and the Environment:** Urban problems related to energy - Water conservation, rain water harvesting - Resettlement and rehabilitation of people; its problems and concerns. Environmental ethics: Issues and possible solutions. Environmental 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.	

	Environmental Management: Impact Assessment and its significance various stages of EIA, preparation of EMP and EIS, Environmental audit. Ecotourism, Green Campus – Green business and Green politics. The student should Visit an Industry / Ecosystem and submit a report individually on any issues related to Environmental Studies course and make a power point presentation.	
	Total	

Text Books:

1. Environmental Studies, K. V. S. G. Murali Krishna, VGS Publishers, Vijayawada
2. Environmental Studies, R. Rajagopalan, 2nd Edition, 2011, Oxford University Press.
3. Environmental Studies, P. N. Palanisamy, P. Manikandan, A. Geetha, and K. Manjula Rani;Pearson Education, Chennai

Reference Books:

1. Text Book of Environmental Studies, Deeshita Dave & P. UdayaBhaskar, Cengage Learning.
2. A Textbook of Environmental Studies, Shaashi Chawla, TMH, New Delhi
3. Environmental Studies, Benny Joseph, Tata McGraw Hill Co, New Delhi
4. Perspectives in Environment Studies, Anubha Kaushik, C P Kaushik, New Age InternationalPublishers, 2014

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III B.Tech I Semester

COURSE CODE – R2011XXYY	SUMMER INTERNSHIP 2 MONTHS (MANDATORY) AFTER SECOND YEAR (TO BE EVALUATED DURING V SEMESTER	CATEGORY MC	L-T-P 2-0-0	CREDITS 0

Pre-requisite:

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

		Knowledge Level (K)#
CO1		
CO2		
CO3		
CO4		
CO5		

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1															
CO2															
CO3															
CO4															
CO5															
CO6															

(Please fill the above with Levels of Correlation - viz. - L - M - H)

UNIT	CONTENTS	Contact Hours
UNIT - 1		
UNIT - 2		
UNIT - 3		
UNIT - 4		
UNIT - 5		
	Total	

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III B.Tech II Semester

COURSE CODE – R2011XXYY	MICROPROCESSORS AND MICROCONTROLLERS	CATEGORY PCC	L-T-P 3-0-0	CREDITS 3

Pre-requisite: Basics of Processors

Course Outcomes: After the completion of the course the student should be able to:

		Knowledge Level (K)#
CO1	Know the concepts of the Microprocessor capability in general and explore the evaluation of microprocessors.	
CO2	Analyse the instruction sets - addressing modes - minimum and maximum modes operations of 8086 Microprocessors	
CO3	Analyse the Microcontroller and interfacing capability	
CO4	Describe the architecture and interfacing of 8051 controller	
CO5	Know the concepts of PIC micro controller and its programming.	

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	2	1	--	--	--	--	--	--	--	1	3	2	1
CO2	3	1	2	1	--	--	--	--	--	--	--	1	3	3	2
CO3	3	2	3	2	1	--	--	--	--	--	--	1	3	3	2
CO4	3	2	2	2	--	--	--	--	--	--	--	1	3	3	2
CO5	3	1	2	2	3	--	--	--	--	--	--	1	3	3	2

(Please fill the above with Levels of Correlation - viz. - L-1 - M-2 - H-3)

UNIT	CONTENTS	Contact Hours
UNIT - 1	**Introduction to Microprocessor Architecture** Introduction and evolution of Microprocessors – Architecture of 8086 – Memory Organization of 8086 – Register Organization of 8086– Introduction to 80286 - 80386 - 80486 and Pentium (brief description about architectural advancements only).	
UNIT - 2	**Minimum and Maximum Mode Operations** Instruction sets of 8086 - Addressing modes – Assembler directives - General bus operation of 8086 – Minimum and Maximum mode operations of 8086 – 8086 Control signal interfacing – Read and write cycle timing diagrams.	
UNIT - 3	**Microprocessors I/O interfacing** 8255 PPI– Architecture of 8255–Modes of operation– Interfacing I/O devices	

	to 8086 using 8255–Interfacing A to D converters– Interfacing D to A converters– Stepper motor interfacing– Static memory interfacing with 8086. Architecture and interfacing of 8251 USART – Architecture and interfacing of DMA controller (8257).	
UNIT - 4	**8051 Microcontroller** Overview of 8051 Microcontroller – Architecture– Memory Organization – Register set – I/O ports and Interrupts – Timers and Counters – Serial Communication – Interfacing of peripherals- Instruction set.	
UNIT - 5	**PIC Architecture** Block diagram of basic PIC 18 micro controller – registers I/O ports – Programming in C for PIC: Data types - I/O programming - logical operations - data conversion.	
	Total	

Text Books:

1. Ray and Burchandi - "Advanced Microprocessors and Interfacing" - Tata McGraw–Hill - 3rd edition - 2006.
2. Kenneth J Ayala - "The 8051 Microcontroller Architecture - Programming and Applications" - Thomson Publishers - 2nd Edition.
3. PIC Microcontroller and Embedded Systems using Assembly and C for PIC 18 - - Muhammad Ali Mazidi - RolindD.Mckinay - Danny causey -Pearson Publisher 21st Impression.

Reference Books:

1. Microprocessors and Interfacing - Douglas V Hall - Mc–Graw Hill - 2nd Edition.
2. R.S. Kaler - "A Text book of Microprocessors and Micro Controllers" - I.K. International Publishing House Pvt. Ltd.
3. Ajay V. Deshmukh - "Microcontrollers – Theory and Applications" - Tata McGraw–Hill Companies –2005.
   Ajit Pal - "Microcontrollers – Principles and Applications" - PHI Learning Pvt Ltd - 2011.

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

III B.Tech II Semester

COURSE CODE – R2011XXYY	ELECTRICAL MEASUREMENTS AND INSTRUMENTATION	CATEGORY PCC	L-T-P 3-0-0	CREDITS 3

Pre-requisite: Concepts of Electrical Engineering.

Course Outcomes: After the completion of the course the student should be able to:

		Knowledge Level (K)#
CO1	Know the construction and working of various types of analog instruments.	
CO2	Describe the construction and working of wattmeter and power factor meters	
CO3	Know the construction and working various bridges for the measurement resistance - inductance and capacitance	
CO4	Know the operational concepts of various transducers	
CO5	Know the construction and operation digital meters	

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	3	--	--	--	--	--	--	--	--	--	1	2	--
CO2	1	2	3	--	--	--	--	--	--	--	--	--	1	2	--
CO3	1	2	3	--	--	--	--	--	--	--	--	--	1	2	--
CO4	1	2	3	--	1	--	--	--	--	--	--	--	1	2	--
CO5	1	2	3	--	1	--	--	--	--	--	--	--	1	2	--

(Please fill the above with Levels of Correlation - viz. - L-1 - M-2 - H-3)

UNIT	CONTENTS	Contact Hours
UNIT - 1	**Analog Ammeter and Voltmeters** Classification – deflecting - control and damping torques - – PMMC - moving iron type and electrostatic instruments - Construction - Torque equation - Range extension - Errors and compensations - advantages and disadvantages. Instrument transformers: Current Transformer and Potential Transformer-construction - theory - errors-Numerical Problems.	
UNIT - 2	**Analog Wattmeter and Power Factor Meters** Electrodynamometer type wattmeter (LPF and UPF) - Power factor meters: Dynamometer and M.I type (Single phase and Three phase) - Construction - theory - torque equation - advantages and disadvantages. Potentiometers: Introduction to DC and AC Potentiometers – Construction-	

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	working – Applications - Numerical Problems.	
UNIT - 3	**Measurements of Electrical parameters** **DC Bridges:** Method of measuring low - medium and high resistance - sensitivity of Wheat stone's bridge - Kelvin's double bridge for measuring low resistance - Loss of charge method for measurement of high resistance - Megger – measurement of earth resistance - Numerical Problems. **AC Bridges:** Measurement of inductance and quality factor - - Maxwell's bridge - - Hay's bridge - - Anderson's bridge. Measurement of capacitance and loss angle - - Desauty's bridge - Schering Bridge - Wien's bridge - Wagner's earthing device - - Numerical Problems.	
UNIT - 4	**Transducers** Definition - Classification - Resistive - Inductive and Capacitive Transducer - LVDT - Strain Gauge - Thermistors - Thermocouples - Piezo electric and Photo Diode Transducers - Hall effect sensors- Numerical Problems.	
UNIT - 5	**Digital meters** Digital Voltmeters – Successive approximation DVM - Ramp type DVM and Integrating type DVM – Digital frequency meter - Digital multimeter - Digital tachometer - Digital Energy Meter - Q meter - Power Analyzer. CRO- measurement of phase difference & Frequency using lissajious patterns - Numerical Problems.	
	Total	

Text Books:

1. Electrical Measurements and measuring Instruments by E.W. Golding and F.C.Widdis - 5th Edition - Wheeler Publishing.
2. Modern Electronic Instrumentation and Measurement Techniques by A.D. Helfrick and W.D. Cooper - PHI - 5th Edition - 2002.
3. Electronic Instrumentation by H.S. Kalsi - McGraw Hill - 4th Edition - 2019.

Reference Books:

1. Electrical & Electronic Measurement & Instruments by A.K.Sawhney Dhanpat Rai & Co.Publications - 19th revised edition - 2011.
2. Electrical and Electronic Measurements and instrumentation by R.K.Rajput - S.Chand - 3rd edition.
3. Electrical Measurements by Buckingham and Price - Prentice – Hall
4. Electrical Measurements by Forest K. Harris. John Wiley and Sons
5. Electrical Measurements: Fundamentals - Concepts - Applications by Reissland - M.U - New Age International (P) Limited - Publishers.
6. Electrical and Electronic Measurements by G.K.Banerjee - PHI Learning Private Ltd - New Delhi–2012.

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III B.Tech II Semester

COURSE CODE – R2011XXYY	POWER SYSTEM ANALYSIS	CATEGORY PCC	L-T-P 3-0-0	CREDITS 3

Pre-requisite:

Course Outcomes: After the completion of the course the student should be able to:

		Knowledge Level (K)#
CO1	Draw impedance diagram for a power system network and calculate per unit quantities.	3
CO2	Apply the load flow solution to a power system using different methods.	4
CO3	Form Z_{bus} for a power system networks and analyse the effect of symmetrical faults.	4
CO4	Find the sequence components for power system Components and analyse its effects of unsymmetrical faults.	4
CO5	Analyse the stability concepts of a power system.	4

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	3	2	3	1	-	-	-	-	-	-	3	3	2
CO2	3	3	3	2	3	1	-	-	-	-	-	-	3	3	2
CO3	2	3	3	2	3	1	-	-	-	-	-	-	3	3	2
CO4	2	3	3	2	3	1	-	-	-	-	-	-	3	3	2
CO5	3	3	3	2	3	1	-	-	-	-	-	-	3	3	2

(Please fill the above with Levels of Correlation - viz. - L-1 - M-2 - H-3)

UNIT	CONTENTS	Contact Hours
UNIT - 1	**Circuit Topology & Per Unit Representation** Graph theory definition – Formation of element node incidence and bus incidence matrices – Primitive network representation – Formation of Y_{bus} matrix by singular transformation and direct inspection methods – Per Unit Quantities– Single line diagram – Impedance diagram of a power system – Numerical Problems.	
UNIT - 2	**Power Flow Studies** Necessity of power flow studies – Derivation of static power flow equations – Power flow solution using Gauss-Seidel Method – Newton Raphson Method (Rectangular and polar coordinates form) – Decoupled and Fast Decoupled methods – Algorithmic approach – Numerical Problems on 3–bus system only.	

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UNIT - 3	**Z-Bus Algorithm & Symmetrical Fault Analysis** Formation of Z_{bus}**:** Algorithm for the Modification of Z_{bus} Matrix (without mutual impedance) – Numerical Problems. **Symmetrical Fault Analysis:** Reactance's of Synchronous Machine – Three Phase Short Circuit Currents - Short circuit MVA calculations for Power Systems – Numerical Problems.	
UNIT - 4	**Symmetrical Components** Definition of symmetrical components – symmetrical components of unbalanced three phase systems – Power in symmetrical components – Sequence impedances: Synchronous generator – Transmission line and transformers – Sequence networks – Numerical Problems. **Unsymmetrical Fault analysis** Various types of faults: LG– LL– LLG and LLL on unloaded alternator- Numerical problems.	
UNIT - 5	**Power System Stability Analysis** Elementary concepts of Steady state – Dynamic and Transient Stabilities – Swing equation – Steady state stability – Equal area criterion of stability – Applications of Equal area criterion – Factors affecting transient stability – Methods to improve steady state and transient stability – Numerical problems.	
	Total	

Text Books:

1. Power System Analysis by Grainger and Stevenson - Tata McGraw Hill.2003
2. Modern Power system Analysis – by I.J.Nagrath & D .P.Kothari: Tata McGraw–Hill Publishing Company - 3rd edition - 2007.

Reference Books:

1. Power System Analysis – by A.R.Bergen - Prentice Hall - 2nd edition - 2009.
2. Power System Analysis by HadiSaadat – Tata McGraw–Hill 3rd edition - 2010.
3. Power System Analysis by B.R.Gupta - A H Wheeler Publishing Company Limited - 1998.
4. Power System Analysis and Design by J.Duncan Glover - M.S.Sarma - T.J.Overbye – Cengage Learning publications - 5th edition - 2011.

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III B.Tech II Semester

COURSE CODE – R2011XXYY	AI APPLICATIONS IN ELECTRICAL ENGINEERING (Professional Elective – II)	CATEGORY PEC	L-T-P 3-0-0	CREDITS 3

Pre-requisite: Concepts of Linear and Boolean Algebra - Optimization Techniques.

Course Outcomes: After the completion of the course the student should be able to:

		Knowledge Level (K)#
CO1	Analyse different models of artificial neuron & Use learning methods of ANN.	
CO2	Evaluate different paradigms of ANN.	
CO3	Classify between classical and fuzzy sets.	
CO4	Illustrate different modules of Fuzzy logic controller.	
CO5	Apply Neural Networks and fuzzy logic for real-time applications.	

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	2	--	--	--	--	--	--	--	2	2	2	1
CO2	2	2	2	1	--	--	--	--	--	--	--	2	2	1	1
CO3	3	2	2	1	--	--	--	--	--	--	--	2	2	1	1
CO4	3	2	2	1	--	--	--	--	--	--	--	2	2	1	1
CO5	3	2	2	2	--	--	--	--	--	--	--	2	2	2	2

(Please fill the above with Levels of Correlation - viz. - L-1 - M-2 - H-3)

UNIT	CONTENTS	Contact Hours
UNIT - 1	**Introduction** Artificial Neural Networks (ANN) – Humans and computers – Biological neural networks – ANN Terminology – Models of Artificial neuron – activation functions – typical architectures – biases and thresholds – learning strategy(supervised - unsupervised and reinforced) – Neural networks learning rules. Single layer feed forward neural networks: concept of pattern and its types - perceptron training and classification using Discrete and Continuous perceptron algorithms– linear separability- XOR function.	
UNIT - 2	**Multi-layer feed forward networks** Generalized delta rule– Back Propagation algorithm– Radial Basis Function (RBF) network - Kohonen's self-organizing feature maps (KSOFM) - Learning Vector Quantization (LVQ) – Bidirectional Associative Memory (BAM) – Hopfield Neural Network.	

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UNIT - 3	**Classical Sets and Fuzzy Sets** Introduction to classical sets- properties - Operations and relations - Fuzzy sets - Operations - Properties - Fuzzy relations - Cardinalities - Membership functions.	
UNIT - 4	**Fuzzy Logic Modules** Fuzzification - Membership value assignment - development of rule base and decision making system - Defuzzification to crisp sets - Defuzzification methods.	
UNIT - 5	**Applications** **Neural network applications:** Load flow studies - load forecasting - reactive power control. **Fuzzy logic applications:** Economic load dispatch - speed control of DC motors - single area and two area load frequency control.	
	Total	

Text Books:

1. Introduction to Artificial Neural Systems - Jacek M. Zuarda - Jaico Publishing House - 1997.
2. Neural Networks - Fuzzy logic - Genetic algorithms: synthesis and applications by RajasekharanandPai – PHI Publication.

Reference Books:

1. Artificial Neural Network – B.Yegnanarayana - PHI - 2012.
2. Fuzzy logic with Fuzzy Applications – T.J Ross – Mc Graw Hill Inc - 1997.
3. Introduction to Neural Networks using MATLAB 6.0 – S N Sivanandam - SSumathi - S N Deepa TMGH
4. Introduction to Fuzzy Logic using MATLAB – S N Sivanandam - SSumathi - S N Deepa Springer - 2007.

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III B.Tech II Semester

COURSE CODE – R2011XXYY	FLEXIBLE ALTERNATING CURRENT TRANSMISSION SYSTEMS (Professional Elective – II)	CATEGORY PEC	L-T-P 3-0-0	CREDITS 3

Pre-requisite: Concepts of Power Systems and Power Electronics

Course Outcomes: After the completion of the course the student should be able to:

		Knowledge Level (K)#
CO1	Know the concepts of facts controller and power flow control in transmission line.	
CO2	Demonstrate operation and control of voltage source converter and know the concepts current source converter.	
CO3	Analyse compensation by using different compensators to improve stability and reduce power oscillations in the transmission lines.	
CO4	Know the concepts methods of compensations using series compensators.	
CO5	Analyse operation of Unified Power Flow Controller (UPFC) and Interline power flow controller (IPFC).	

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	2	1	1	1	--	--	--	2	--	3	3	2
CO2	3	2	1	2	2	--	--	--	--	--	1	1	3	2	2
CO3	3	2	2	2	2	1	1	--	--	--	2	1	3	2	2
CO4	3	2	2	2	2	1	1	--	--	--	2	1	3	2	2
CO5	3	2	3	2	2	--	--	--	--	--	2	1	3	2	2

(Please fill the above with Levels of Correlation - viz. - L-1 - M-2 - H-3)

UNIT	CONTENTS	Contact Hours
UNIT - 1	**Introduction to FACTS** Power flow in an AC System – Loading capability limits – Dynamic stability considerations – Importance of controllable parameters – Basic types of FACTS controllers – Benefits from FACTS controllers – Requirements and characteristics of high power devices – Voltage and current rating – Losses and speed of switching – Parameter trade–off devices.	
UNIT - 2	**Voltage source and Current source converters** Voltage source converter (VSC) – Single phase full-wave bridge converter – Square wave voltage harmonics for a single–phase bridge converter – Three–phase full-wave bridge converter - Transformer connections for 12 pulse operation. Current Source Converter (CSC)-Three–phase current source converter – Comparison of current source converter with voltage source converter.	

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UNIT - 3	**Shunt Compensators** Objectives – Mid–point voltage regulation for line segmentation – End of line voltage support to prevent voltage instability – Improvement of transient stability – Power oscillation damping. **Variable Impedance Type VAR Generator**: Thyristor Switched/Controlled Reactor (TSR/TCR) – Thyristor Switched Capacitor (TSC) – Fixed Capacitor–Thyristor Controlled Reactor (FC-TCR) - Thyristor Switched Capacitor and Thyristor Controlled Reactor (TSC–TCR) - Switching Converter type VAR generator. Principle of operation and comparison of SVC and STATCOM.	
UNIT - 4	**Series Compensators** Concept of series capacitive compensation – Improvement of transient stability – Power oscillation damping – Functional requirements. Variable Impedance type series compensators – GTO Thyristor controlled Series Capacitor (GSC) – Thyristor Switched Series Capacitor (TSSC) and Thyristor Controlled Series Capacitor (TCSC) - Switching Converter type Series Compensation – Static Synchronous Series Compensator.	
UNIT - 5	**Combined Compensators** Schematic and basic operating principles of unified power flow controller (UPFC) and Interline power flow controller (IPFC) – Controller applications of transmission lines.	
	Total	

Text Books:

1. "Understanding FACTS" N.G.Hingorani and L.Guygi - IEEE Press.Indian Edition is available:—Standard Publications - 2001.

Reference Books:

1. "Flexible ac transmission system (FACTS)" Edited by Yong Hue Song and Allan T Johns - Institution of Electrical Engineers - London.

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III B.Tech II Semester

COURSE CODE – R2011XXYY	ELECTRICAL DISTRIBUTION SYSTEMS (Professional Elective – II)	CATEGORY PEC	L-T-P 3-0-0	CREDITS 3

Pre-requisite: Basic concepts of Electric circuits and power systems.

Course Outcomes: After the completion of the course the student should be able to:

		Knowledge Level (K)#
CO1	Discriminate various factors of distribution system - load modelling and characteristic of loads.	
CO2	Know the concept of design considerations of substation and distribution feeders.	
CO3	Determine the voltage drop and power loss for different types of distribution loads.	
CO4	Analyse the protection and its coordination for distribution systems.	
CO5	Analyse the effect of compensation for p.f improvement and voltage improvement.	

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	1	1	2	-	-	-	-	-	-	2	3	1
CO2	3	2	3	1	1	3	-	-	-	-	-	-	2	3	1
CO3	3	2	3	2	1	3	-	-	-	-	-	3	2	3	1
CO4	3	2	3	2	1	2	-	-	-	-	-	-	2	3	1
CO5	3	2	3	2	1	3	-	-	-	-	-	3	2	3	1

(Please fill the above with Levels of Correlation, viz., 3: Strong, 2: Moderate, 1: Weak)

UNIT	CONTENTS	Contact Hours
UNIT - 1	**General Concepts** Introduction to distribution systems - Distribution system losses – Coincidence factor – Contribution factor – loss factor – Relationship between the load factor and loss factor – Numerical Problems – Load Modeling and Characteristics – Classification and characteristics of loads (Residential - commercial - Agricultural and Industrial).	
UNIT - 2	**Substations** Selection for location of substations - Rating of distribution substation – Service area with 'n' primary feeders – K- Factors - Benefits and methods of optimal location of substations. **Distribution Feeders** Design Considerations of distribution feeders**:** Radial and loop types of	

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	primary feeders – Voltage levels – Feeder loading – Basic design practice of the secondary distribution system.	
UNIT - 3	**System Analysis** Voltage drop and power – loss calculations**:** Derivation for voltage drop and power loss in lines – Uniformly distributed loads and non-uniformly distributed loads – Three phase balanced primary lines – and Non three phase balanced primary lines.	
UNIT - 4	**Protection** Objectives of distribution system protection –Time current characteristics – Protective devices**:** Principle of operation of fuses – Circuit reclosures – Line sectionaliser and circuit breakers - Earth leakage circuit breakers – Protection schemes of parallel & Ring-main feeders. **Coordination of protective devices** General coordination procedure –Various types of co-ordinated operation of protective devices - Residual Current Circuit Breaker.	
UNIT - 5	**Compensation for Power Factor Improvement** Capacitive compensation for power factor control – Different types of power capacitors – shunt and series capacitors – Effect of shunt capacitors (Fixed and switched) – Power factor correction – Capacitor allocation – Economic justification – Procedure to determine the best capacitor location. **Voltage Control** Equipment for voltage control – Effect of series capacitors – Effect of AVB/AVR – Line drop compensation.	
	Total	

Text Book:

1. "Electric Power Distribution system - Engineering" – by Turan Gonen - McGraw–hill - 2nd edition - 2008.

Reference Books:

1. Electrical Distribution Systems by Dale R.Patrick and Stephen W.Fardo - CRC press - 2nd edition.
2. Electric Power Distribution – by A.S. Pabla - Tata McGraw–hill Publishing Company - 4th edition - 1997.
3. Electrical Power Distribution Systems by V.Kamaraju - Right Publishers.

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COURSE CODE – R2011XXYY	ELECTRIC DRIVES (Professional Elective – II)	CATEGORY PEC	L-T-P 3-0-0	CREDITS 3

Pre-requisite:

Course Outcomes: After the completion of the course the student should be able to:

		Knowledge Level (K)#
CO1	Understand the fundamentals of electric drive and different electric braking methods	2
CO2	Analyze the operation of three-phase converter-controlled DC motors and four quadrant operation of DC motors using dual converters	4
CO3	Illustrate the DC-DC converter fed control of dc motors in various quadrants of operation	3
CO4	Show the application of AC voltage controllers and voltage source inverters for speed control of induction motors. Apply static rotor resistance control and various slip power recovery schemes for speed control of Induction motor	4
CO5	Illustrate the concepts of speed control of synchronous motor with different methods.	3

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	-	1	-	-	-	-	1	2	2	2	2
CO2	3	3	3	3	-	1	-	-	-	-	1	3	3	3	2
CO3	3	3	2	2	-	1	-	-	-	-	1	2	3	3	2
CO4	3	3	3	3	-	1	-	-	-	-	1	3	3	3	2
CO5	2	2	2	2	-	1	-	-	-	-	1	2	3	2	2

(Please fill the above with Levels of Correlation, viz., 3: Strong, 2: Moderate, 1: Weak)

UNIT	CONTENTS	Contact Hours
UNIT - 1	**Fundamentals of Electric Drives** Electric drive and its components– Fundamental torque equation – Load torque components – Nature and classification of load torques – Steady state stability – Load equalization– Four quadrant operation of drive (hoist control) – Braking methods**:** Dynamic – Plugging – Regenerative methods.	
UNIT - 2	**Controlled Converter Fed DC Motor Drives** 3-phase half and fully-controlled converter fed separately and self-excited DC motor drive – Output voltage and current waveforms – Speed-torque expressions – Speed-torque characteristics – Dual converter fed DC motor drives -Numerical problems.	

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UNIT - 3	**DC–DC Converters Fed DC Motor Drives** Single quadrant – Two quadrant and four quadrant DC-DC converter fed separately excited and self-excited DC motors – Continuous current operation - Output voltage and current waveforms – Speed–torque expressions and characteristics – Closed loop operation (qualitative treatment only).	
UNIT - 4	**Stator and Rotor side control of 3-phase Induction motor Drive** Stator voltage control using 3-phase AC voltage regulators – Waveforms – Speed torque characteristics– Variable Voltage Variable Frequency control of induction motor by PWM voltage source inverter – Closed loop V/f control of induction motor drives (qualitative treatment only). Static rotor resistance control – Slip power recovery schemes – Static Scherbius drive – Static Kramer drive – Performance and speed torque characteristics.	
UNIT - 5	**Control of Synchronous Motor Drives** Separate control of synchronous motor – self-control of synchronous motor employing load commutated thyristor inverter - closed loop control of synchronous motor drive (qualitative treatment only)– PMSM (Basic operation only).	
	Total	

Text Books:

1. Fundamentals of Electric Drives – by G K Dubey - Narosa Publications - 2nd edition – 2002.
2. Power Semiconductor Drives - by S.B.Dewan - G.R.Slemon - A.Straughen - Wiley India - 1984.

Reference Books:

1. Electric Motors and Drives Fundamentals - Types and Apllications - by Austin Hughes and Bill Drury - Newnes.4th edition - 2013.
2. Thyristor Control of Electric drives – Vedam Subramanyam Tata McGraw Hill Publications - 1987.
3. Power Electronic Circuits - Devices and applications by M.H.Rashid - PHI - 3rd edition - 2009.
4. Power Electronics handbook by Muhammad H.Rashid - Elsevier - 2nd edition - 2010.

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III B.Tech II Semester

COURSE CODE – R2011XXYY	NEURAL NETWORKS AND FUZZY LOGIC (Open Elective – II)	CATEGORY OEC	L-T-P 3-0-0	CREDITS 3

Pre-requisite:

Course Outcomes: After the completion of the course the student should be able to:

		Knowledge Level (K)#
CO1	Analyse different models of artificial neuron.	
CO2	Illustrate training and classification using perceptron algorithms.	
CO3	Evaluate different paradigms of ANN.	
CO4	Classify between classical and fuzzy sets.	
CO5	Analyse various modules of Fuzzy logic controller.	

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	1	--	--	--	--	--	--	--	2	2	1	2
CO2	2	2	2	2	--	--	--	--	--	--	--	2	2	1	2
CO3	3	2	2	2	--	--	--	--	--	--	--	2	2	2	2
CO4	3	2	2	2	--	--	--	--	--	--	--	2	2	1	2
CO5	2	2	2	2	--	--	--	--	--	--	--	2	2	1	1

(Please fill the above with Levels of Correlation - viz. - L-1 - M-2 - H-3)

UNIT	CONTENTS	Contact Hours
UNIT - 1	**Introduction** Artificial Neural Networks (ANN) – Humans And Computers – Biological Neural Networks – ANN Terminology – Models of Artificial Neuron – activation functions – typical architectures – biases and thresholds – learning strategy(supervised - unsupervised and reinforced) – Neural networks learning rules.	
UNIT - 2	**Feed Forward Networks:** Single Layer Feed Forward Neural Networks: Concept Of Pattern And Its Types - Perceptron Training And Classification Using Discrete And Continuous Perceptron Algorithms– Linear Separability- XOR Function.	
UNIT - 3	**ANN Paradigms** Multi-layer feed forward networks –Generalized delta rule– Back Propagation algorithm – Radial Basis Function (RBF) network - Kohonen's self-organizing feature maps (KSOFM) – Bidirectional Associative Memory (BAM).	

UNIT - 4	**.Classical and Fuzzy Sets** Introduction to classical sets- properties - Operations and relations; Fuzzy sets - Operations - Properties - Fuzzy relations - Cardinalities - Membership functions.	
UNIT - 5	**Fuzzy Logic Modules** Fuzzification - Membership value assignment - development of rule base and decision making system - Defuzzification to crisp sets - Defuzzification methods.	
	Total	

Text Books:

1. Introduction to Artificial Neural Systems - Jacek M. Zuarda - Jaico Publishing House - 1997.
2. Neural Networks -Fuzzy logic - Genetic algorithms: synthesis and applications by RajasekharanandPai – PHI Publication.

Reference Books:

1. Artificial Neural Network – B.Yegnanarayana - PHI - 2012.
2. Fuzzy logic with Fuzzy Applications – T.J Ross – Mc Graw Hill Inc - 1997.
3. Introduction to Neural Networks using MATLAB 6.0 – S N Sivanandam - SSumathi - S N Deepa TMGH
4. Introduction to Fuzzy Logic using MATLAB – S N Sivanandam - SSumathi - S N Deepa Springer - 2007.

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

III B.Tech II Semester

COURSE CODE – R2011XXYY	BASICS OF POWER SYSTEMS AND POWER QUALITY (Open Elective – II)	CATEGORY OEC	L-T-P 3-0-0	CREDITS 3

Pre-requisite: Basic Electrical Engineering.

Course Outcomes: After the completion of the course the student should be able to:

		Knowledge Level (K)#
CO1	Know main conventional and renewable power generation schemes.	
CO2	Analyse the effect of harmonic distortion on electric equipment.	
CO3	Provide solutions for power factor improvement	
CO4	Learn the need of good quality power.	
CO5	Design custom power devices for power quality improvement.	

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	1	2	1	2	1	1	1	2	2	1	1	2
CO2	1	1	2	1	1	2	1	1	1	1	2	2	2	2	1
CO3	1	2	2	2	1	2	1	1	2	1	3	2	1	2	1
CO4	1	2	2	2	2	2	1	1	2	1	2	2	1	2	1
CO5	1	1	2	2	1	2	1	1	1	1	1	2	1	2	1

(Please fill the above with Levels of Correlation - viz. - L-1 - M-2 - H-3)

UNIT	CONTENTS	Contact Hours
UNIT - 1	**Basic Power Systems** Conventional Power generation-Hydel and thermal (block diagram only)-Renewable power generation-solar and wind (block diagrams only) - advantages and limitations of renewable power generation-Basic concepts of transmission and distribution.	
UNIT - 2	**Harmonics** Linear and nonlinear loads-examples - harmonics - total harmonic distortion (THD)-sources of harmonics-Effect of Harmonic distortion- impact on capacitors - Transformers - motors and meters.	
UNIT - 3	**Power Factor** AC apparent power - Active Power - Reactive Power - Power factor - power factor with non-linear loads - True Power factor - need for power factor improvement.	

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UNIT - 4	**Power Quality** Power Quality definition-need for quality power- power quality issues-voltage sag - voltage swell - low voltage - over voltage - short and long interruptions - voltage fluctuations - voltage unbalance – wave form distortion -Power quality issues due to renewable power generation.	
UNIT - 5	**Custom Power Devices** Reactive power and harmonic compensation devices - static var compensator - static shunt compensation; compensation devices for voltage sag and momentary interruptions - source transfer switch - Hybrid source transfer switch - high speed mechanical source transfer switch; back up energy supply devices -battery UPS - Super conducting magnetic energy storage (SMES) - flywheel.	
	Total	

Text Books:

1. Electrical Power Systems Quality - Dugan R C - McGranaghan M F - Santoso S - and Beaty H W - Second Edition - McGraw-Hill - 2002.
2. Understanding Power Quality Problems: Voltage Sags and Interruptions - Bollen M H J - First Edition - IEEE Press; 2000.
3. Guidebook on Custom Power Devices - Technical Report - Published by EPRI - Nov 2000
4. Power Quality Enhancement Using Custom Power Devices – Power Electronics and Power Systems - Gerard Ledwich - Arindam Ghosh - Kluwer Academic Publishers - 2002.

Reference Books:

1. Power Quality Primer - Kennedy B W - First Edition - McGraw-Hill - 2000.
2. Power System Harmonics - Arrillaga J and Watson N R - Second Edition - John Wiley & Sons - 2003.
3. Electric Power Quality control Techniques - W. E. Kazibwe and M. H. Sendaula - Van Nostrad Reinhold - New York.
4. Power Quality c.shankaran - CRC Press - 2001
5. Harmonics and Power Systems –Franciso C.DE LA Rosa-CRC Press (Taylor & Francis).
6. Power Quality in Power systems and Electrical Machines-EwaldF.fuchs - Mohammad A.S. Masoum-Elsevier
7. Power Quality - C. Shankaran - CRC Press - 2001
8. Instantaneous Power Theory and Application to Power Conditioning - H. Akagiet.al. - IEEE Press - 2007.
9. Custom Power Devices - An Introduction - Arindam Ghosh and Gerard Ledwich - Springer - 2002
10. A Review of Compensating Type Custom Power Devices for Power Quality Improvement - Yash Pal et.al. - Joint International Conference on Power System Technology and IEEE Power India Conference - 2008. POWERCON 2008.

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III B.Tech II Semester

COURSE CODE – R2011XXYY	BASICS OF ELECTRICAL MEASUREMENTS (Open Elective – II)	CATEGORY OEC	L-T-P 3-0-0	CREDITS 3

Pre-requisite: Basic concepts of Electrical Engineering

Course Outcomes: After the completion of the course the student should be able to:

		Knowledge Level (K)#
CO1	Choose right type of instrument for measurement of ac and dc voltage and current.	
CO2	Analyse the operation of wattmeter and energy meter.	
CO3	Differentiate the operation of AC and DC bridges.	
CO4	Describe the operation various Transducers.	
CO5	Know the importance of Digital Meters and their working principles.	

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	3	--	--	--	--	--	--	--	--	--	1	2	--
CO2	1	2	3	--	--	--	--	--	--	--	--	--	1	2	--
CO3	1	2	3	--	--	--	--	--	--	--	--	--	1	2	--
CO4	1	2	3	--	1	--	--	--	--	--	--	--	1	2	--
CO5	1	2	3	--	1	--	--	--	--	--	--	--	1	2	--

(Please fill the above with Levels of Correlation - viz. - L-1 - M-2 - H-3)

UNIT	CONTENTS	Contact Hours
UNIT - 1	**UNIT–I:** **Analog Ammeter and Voltmeters** Classification – deflecting - control and damping torques – Construction of PMMC - Moving Iron and Electro dynamo instruments - Torque equation - Errors and Compensation – Numerical Problems.	
UNIT - 2	**Analog Wattmeters and Energy Meters** Electrodynamometer type wattmeter (LPF and UPF) - Induction Type Energy meters-Construction and working - Errors and Compensation– Numerical Problems.	
UNIT - 3	**Measurements of Electrical parameters** **DC Bridges:** Measurement of Resistance – Kelvin's double bridge -	

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	Wheatstone bridge – Numerical Problems. **AC Bridges:** Measurement of inductance and quality factor - Maxwell's bridge - measurement of capacitance - Schering Bridge– Numerical Problems.	
UNIT - 4	**Transducers** Classification - Resistive (Strain Gauge) - Inductive (LVDT) and Capacitive (Piezo electric) Transducer – Numerical Problems.	
UNIT - 5	**Digital Meters** Successive approximation Digital Voltmeter — Digital frequency meter - Digital multimeter - Digital Energy Meter.	
	Total	

Text Books:

1. Electrical & Electronic Measurement & Instruments by A.K.Sawhney Dhanpat Rai & Co.Publications - 19th revised edition - 2011.
2. Electronic Instrumentation by H.S.Kalsi - THM.

Reference Books:

1. Electrical Measurements and measuring Instruments by E.W. Golding and F.C.Widdis - 5th Edition - Wheeler Publishing.
2. Modern Electronic Instrumentation and Measurement Techniques by A.D. Helfrick and W.D. Cooper - PHI - 5th Edition - 2002.
3. Electrical and Electronic Measurements and instrumentation by R.K.Rajput - S.Chand - 3rd edition.

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III B.Tech II Semester

COURSE CODE – R2011XXYY	INDIAN ELECTRICITY ACT-2003 (Open Elective – II)	CATEGORY OEC	L-T-P 3-0-0	CREDITS 3

Pre-requisite: Concepts of Generation - Transmission and Distribution.

Course Outcomes: After the completion of the course the student should be able to:

		Knowledge Level (K)#
CO1	Learn the national policy and plan and the joint responsibilities of state and central governments	
CO2	Analyse the licensing and the provisions related to transmission and distribution of electricity	
CO3	Remember the composition and powers of Regulatory commissions and CEA	
CO4	Learn the functions of Appellate Tribunal for electricity	
CO5	Know the constitution procedure and provisions in Special courts and dispute resolutions	

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	2	1	-	-	-	-	-	2	-	2	3	1
CO2	3	2	2	1	1	-	-	-	-	-	1	-	2	3	1
CO3	3	2	1	1	1	-	-	-	-	-	1	-	2	3	2
CO4	3	2	2	1	1	-	-	-	-	-	2	-	2	3	1
CO5	3	2	2	2	1	-	-	-	-	-	2	-	2	3	1

(Please fill the above with Levels of Correlation - viz. - L-1 - M-2 - H-3)

UNIT	CONTENTS	Contact Hours
UNIT - 1	**National Electricity Policy And Plan - Generation of Electricity** Electricity Act: commencement - definitions - comments; national policy on standalone systems - non-conventional energy systems - electrification and local distribution for rural areas; joint responsibilities of state and central governments in rural electrification - requirement for setting up of generating station - hydro-electric generation - captive generation; duties of generating companies.	
UNIT - 2	**Licensing - Transmission And Distribution Of Electricity** Licensing: powers - procedures - conditions - amendments - revocation - provisions - directions - suspension and sale; inter-state and intra-state transmission; other provisions relating to transmission; provisions with respect	

	to distribution licenses - electricity traders - supply generally; consumer protection: standard performance.	
UNIT - 3	**Tariff - CEA and Regulatory Commissions** Works of licenses - provisions relating to overhead lines; Constitution and functions of Central Electricity Authority (CEA) - directions and certain powers; Constitution - powers and functions of state and central commissions - other provisions - proceedings and powers of Appropriate commission - Grants - Fund - Accounts Audit and Report.	
UNIT - 4	**Appellate Tribunal - Reorganisation of Boards - Offences and Penalty** Appellate Tribunal for electricity; investigation and assessment; reorganisation of boards; Offences and penalties	
UNIT - 5	**Special Courts - Dispute Resolution - Other Provisions and Miscellaneous** Constitution of special courts - procedures - powers - appeal - revision; arbitration; protective clauses; miscellaneous and enactments.	
	Total	

Text Books:

1. The Electricity Act - 2003 {Act 36 of 2003 - dt.2-6-2003 - w.e.f. 10-6-2003 vide S.O. No. 669(E) - dt. 10-6-2003] published by Commercial Law Publishers (I) Pvt. Ltd.

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III B.Tech II Semester

COURSE CODE – R2011XXYY	ELECTRICAL MEASUREMENTS AND INSTRUMENTATION LABORATORY	CATEGORY PCC	L-T-P 0-0-3	CREDITS 1.5

Pre-requisite: Concepts of Electrical Instruments and its Measurements.

Course Outcomes: After the completion of the course the student should be able to:

		Knowledge Level (K)#
CO1	Know about the phantom loading.	
CO2	Learn the calibration process.	
CO3	Measure the electrical parameters voltage - current - power - energy and electrical characteristics of resistance - inductance and capacitance.	
CO4	Gain the skill knowledge of various brides and their applications.	
CO5	Learn the usage of CT's - PT's for measurement purpose.	
CO6	Know the characteristics of transducers.	
CO7	Measure the strains - frequency and phase difference.	

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	--	2	--	--	--	--	3	2	--	--	2	2	--
CO2	3	1	--	--	--	--	--	--	3	2	--	--	2	2	--
CO3	3	1	--	--	--	--	--	--	3	2	--	--	2	2	--
CO4	3	1	--	--	--	--	--	--	3	2	--	--	2	2	--
CO5	3	1	--	--	--	--	--	--	3	2	--	--	2	2	--
CO6	3	1	--	--	--	--	--	--	3	2	--	--	2	2	--
CO7	3	1	--	--	--	--	--	--	3	2	--	--	2	2	--

(Please fill the above with Levels of Correlation - viz. - L-1 - M-2 - H-3)

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III B.Tech II Semester

COURSE CODE – R2011XXYY	ELECTRICAL MEASUREMENTS AND INSTRUMENTATION LABORATORY	CATEGORY PCC	L-T-P 0-0-3	CREDITS 1.5

S.No	CONTENTS	Contact Hours
1.	Calibration of dynamometer wattmeter using phantom loading	
2.	Measurement of resistance using Kelvin's double Bridge and Determination of its tolerance.	
3.	Measurement of Capacitance using Schering Bridge.	
4.	Measurement of Inductance using Anderson Bridge.	
5.	Calibration of LPF Wattmeter by direct loading.	
6.	Measurement of 3 phase reactive power using single wattmeter method for a balanced load.	
7.	Testing of C.T. using mutual inductor – Measurement of % ratio error and phase angle of given C.T. by Null deflection method.	
8.	P.T. testing by comparison – V.G as Null detector – Measurement of % ratio error and phase angle of the given P.T.	
9.	Determination of the characteristics of a Thermocouple.	
10.	Determination of the characteristics of a LVDT.	
11.	Determination of the characteristics for a capacitive transducer.	
12.	Measurement of strain for a bridge strain gauge.	
13.	Measurement of Choke coil parameters and single phase power using three voltmeter and three ammeter methods.	
14.	Calibration of single phase Energy Meter.	
15.	Dielectric oil Test using HV Kit.	
16.	Calibration of DC ammeter and voltmeter using Crompton DC Potentiometer.	
17.	AC Potentiometer: Polar Form / Cartesian Form - Calibration of AC voltmeter - Parameters of choke.	

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III B.Tech II Semester

COURSE CODE – R2011XXYY	MICROPROCESSORS AND MICROCONTROLLERS LAB	CATEGORY PCC	L-T-P 0-0-3	CREDITS 1.5

Pre-requisite: Concepts of Microprocessors and Microcontrollers

Course Outcomes: After the completion of the course the student should be able to:

		Knowledge Level (K)#
CO1	Write assembly language program using 8086 microprocessor based on arithmetic - logical - number systems and shift operations.	
CO2	Write assembly language programs for numeric operations and array handling problems.	
CO3	Write a assembly program on string operations.	
CO4	Interface 8086 with I/O and other devices.	
CO5	Do parallel and serial communication using 8051 & PIC 18 micro controllers.	
CO6	Program microprocessors and microcontrollers for real world applications.	

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	--	--	--	--	--	--	1	2	3	2
CO2	3	3	3	3	--	--	--	--	--	--	--	1	2	3	2

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CO3	3	2	2	3	1	--	--	--	--	--	--	1	2	3	2
CO4	3	3	3	2	1	--	--	--	--	--	--	1	2	3	2
CO5	3	3	3	3	3	--	--	--	--	--	--	1	2	3	2
CO6	3	3	3	3	--	--	--	--	--	--	--	1	2	3	2

(Please fill the above with Levels of Correlation - viz. - L-1 - M-2 - H-3)

S.No	CONTENTS **Any 10 of the following experiments are to be conducted:**	Contact Hours
	8086 Microprocessor Programs:	
1.	Arithmetic operations – Two 16-bit numbers and multibyte addition - subtraction - multiplication and division – Signed and unsigned arithmetic operations - ASCII – Arithmetic operations.	
2.	Logic operations – Shift and rotate – Converting packed BCD to unpacked BCD - BCD to ASCII conversion.	
3.	Arrange the given array in ascending and descending order	
4.	Determine the factorial of a given number	
5.	By using string operation and Instruction prefix**:** Move block - Reverse string Sorting - Inserting - Deleting - Length of the string - String comparison.	
6.	Find the first and n^{th} number of 'n' natural numbers of a Fibonacci series.	
7.	Find the number and sum of even and odd numbers of a given array	
8.	Find the sum of 'n' natural numbers and squares of 'n' natural numbers	
9.	Arithmetic operations on 8051	
10.	Conversion of decimal number to hexa equivalent and hexa equivalent to decimal number	
11.	Find the Sum of elements in an array and also identify the largest & smallest number of a given array using 8051	
	Programs on Interfacing:	
12.	Interfacing 8255–PPI with 8086.	
13.	Stepper motor control using 8253/8255.	
14.	Reading and Writing on a parallel port using 8051	
15.	Timer in different modes using 8051	
16.	Serial communication implementation using 8051	
17.	Understanding three memory areas of 00 – FF Using 8051 external interrupts.	
18.	Traffic Light Controller using 8051.	

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III B.Tech II Semester

COURSE CODE – R2011XXYY	POWER SYSTEMS AND SIMULATION LAB	CATEGORY PCC	L-T-P 0-0-3	CREDITS 1.5

Pre-requisite:

Course Outcomes: After the completion of the course the student should be able to:

		Knowledge Level (K)#
CO1	Estimate the sequence impedances of 3-phase Transformer and Alternators	3
CO2	Evaluate the performance of transmission lines	3
CO3	Analyse and simulate power flow methods in power systems	4
CO4	Analyse and simulate the performance of PI controller for load frequency control.	4
CO5	Analyse and simulate stability studies of power systems	4

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	3	2	3	1	-	-	-	-	-	-	3	3	2
CO2	2	3	3	2	3	1	-	-	-	-	-	-	3	3	2
CO3	2	3	3	2	3	1	-	-	-	-	-	-	3	3	2
CO4	2	3	3	2	3	1	-	-	-	-	-	-	3	3	2
CO5	2	3	3	2	3	1	-	-	-	-	-	-	3	3	2

(Please fill the above with Levels of Correlation - viz. - L-1 - M-2 - H-3)

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S.No	CONTENTS **Any of 5 experiments are to be conducted from each section:**	Contact Hours
	Section I: Power Systems Lab:	
1.	Estimation of sequence impedances of 3-phase Transformer	
2.	Estimation of sequence impedances of 3-phase Alternator by Fault Analysis	
3.	Estimation of sequence impedances of 3-phase Alternator by Direct method	
4.	Estimation of ABCD parameters on transmission line model	
5.	Performance of long transmission line without compensation	
6.	Performance of long transmission line with shunt compensation	
7.	Analyze the Ferranti effect on long transmission line	
	Section II: Simulation Lab	
8.	Determination of Y_{bus} using direct inspection method	
9.	Load flow solution of a power system network using Gauss-Seidel method	
10.	Load flow solution of a power system network using Newton Raphson method (Polar)	
11.	Formation of Z_{bus} by building algorithm.	
12.	Economic load dispatch with & without losses	
13.	Load frequency control of a two area Power System without & with PI controller	
14.	Transient Stability analysis of single machine connected to an infinite bus (SMIB) using equal area criterion.	

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III B.Tech II Semester

COURSE CODE – R2011XXYY	SKILL ADVANCED COURSE – HIGH VOLTAGE LAB	CATEGORY SC	L-T-P 0-0-4	CREDITS 2

Pre-requisite: Concepts of High Voltage Engineering

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

		Knowledge Level (K)#
CO1	Analyse the breakdown characteristics of uniform and non uniform fields.	
CO2	Measure leakage current and insulation resistance of polypropylene scale and rope	
CO3	Measure leakage current and breakdown voltage of pin and suspension insulator.	
CO4	Analyse breakdown voltage of transformer oil and calibrate the Tong tester	
CO5	Analyse voltage distribution and impact of lightning impulse voltage on insulator string.	

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	3	2	--	2	2	1	--	--	2	1	1	2	3
CO2	2	2	3	2	--	2	2	1	--	--	2	2	1	2	3
CO3	2	3	3	2	--	2	2	1	--	--	1	2	1	2	3
CO4	2	2	2	2	--	2	2	1	--	--	2	1	1	2	3
CO5	3	3	2	2	--	2	2	1	--	--	1	2	2	2	2

(Please fill the above with Levels of Correlation - viz. - L-1 - M-2 - H-3)

S.No	CONTENTS	Contact

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		Hours
	List of Experiments: **Any TEN of the following Experiments are to be conducted**	
1.	Millivolt drop test and Tong tester calibration	
2.	Breakdown characteristics of sphere-sphere gap	
3.	Measurement of leakage current and breakdown voltage of pin insulator	
4.	Breakdown test of transformer oil	
5.	Breakdown characteristics of rod-rod gap	
6.	Measurement of leakage current and insulation resistance of polypropylene scale	
7.	Measurement of leakage current and insulation resistance of polypropylene rope	
8.	Breakdown characteristics of plane-rod-gap	
9.	Measurement of leakage current and breakdown voltage of suspension insulator	
10.	Breakdown characteristics of point-sphere gap	
11.	Measurement of voltage distribution for suspension insulator string	
12.	Lightning impulse testing on insulator string	

III B.Tech II Semester

COURSE CODE – R2011XXYY	**RESEARCH METHODOLOGY**	**CATEGORY MC**	**L-T-P 2-0-0**	**CREDITS 0**

Pre-requisite:

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

		Knowledge Level (K)#
CO1		
CO2		
CO3		
CO4		
CO5		

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1															
CO2															
CO3															
CO4															
CO5															

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CO6															

(Please fill the above with Levels of Correlation - viz. - L-1 - M-2 - H-3)

UNIT	CONTENTS	Contact Hours
	Note: Collect the syllabus from Concerned BOS	
	Total	

Text books and Reference Books:

IV B.Tech I Semester

COURSE CODE – R2011XXYY	DIGITAL SIGNAL PROCESSING (Professional Elective –III)	CATEGORY PEC	L-T-P 3-0-0	CREDITS 3

Pre-requisite: Mathematics and concepts of filters.

Course Outcomes: After the completion of the course the student should be able to:

		Knowledge Level (K)#
CO1	Know the concepts of Digital signal processing - frequency domain representation &z- transform.	
CO2	Compute discrete Fourier transform and fast fourier transforms for different sequences.	
CO3	Design IIR filters through analog filter approximation and basic structure of IIR filters.	
CO4	Design FIR filters with window techniques and basic structure of FIR filters.	
CO5	Learn the concepts of Multirate Signal Processing.	

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	--	--	--	--	--	--	--	--	1	2	--	--
CO2	3	2	2	1	--	--	--	--	--	--	--	3	2	--	--
CO3	3	3	3	3	--	--	--	--	--	--	--	2	3	--	--
CO4	3	3	3	2	--	--	--	--	--	--	--	2	3	--	--
CO5	2	1	1	1	--	--	--	--	--	--	--	2	1	--	--

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(Please fill the above with Levels of Correlation - viz. - L-1 - M-2 - H-3)

UNIT	CONTENTS	Contact Hours
UNIT – 1	**Introduction** Introduction to Digital Signal Processing: Discrete time signals & sequences - Classification of Discrete time systems - stability of LTI systems - Invertability - Response of LTI systems to arbitrary inputs. Solution of Linear constant coefficient difference equations. Frequency domain representation of discrete time signals and systems. Review of Z-transforms - solution of difference equations using Z-transforms - System function.	
UNIT - 2	**Discrete Fourier Transforms and FFT Algorithms** Discrete Fourier Series representation of periodic sequences -Properties of Discrete Fourier Series - Discrete Fourier transforms: Properties of DFT - linear filtering methods based on DFT - Fast Fourier transforms (FFT) - Radix-2 decimation in time and decimation in frequency FFT Algorithms - Inverse FFT.	
UNIT – 3	**Design and Realizations of IIR Digital Filters** Analog filter approximations – Butter worth and Chebyshev - Design of IIR Digital filters from analog filters - Design Examples. Analog and Digital frequency transformations. Basic structures of IIR systems – Direct-Form Structures - Transposed Structures - Cascade-Form Structures - Parallel-Form Structures Lattice and Lattice-Ladder Structures.	
UNIT – 4	**Design and Realizations of FIR Digital Filters** Characteristics of FIR Filters with Linear Phase - Frequency Response of Linear Phase FIR Filters - Design of FIR Digital Filters using Window Techniques and Frequency Sampling technique - Comparison of IIR & FIR filters. Basic structures of FIR systems – Direct-Form Structure - Cascade-Form Structures Linear Phase Realizations - Lattice structures.	
UNIT – 5	**Multirate Digital Signal Processing** Introduction-Decimation –Interpolation-Sampling Rate Conversion by a Rational Factor-Implementation of sampling rate converters-Applications of Multirate Signal Processing-Digital Filter Banks.	
	Total	

Text Books:

1. Digital Signal Processing - Principles - Algorithms - and Applications: John G. Proakis - Dimitris G.Manolakis - 4th Edition - Pearson Education / PHI - 2007.
2. Discrete Time Signal Processing – A.V.Oppenheim and R.W. Schaffer - PHI.
3. Digital Signal Processing: A Computer based approach. Sanjit K Mitra - 4th Edition - TMH - 2014.

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Reference Books:

1. Digital Signal Processing: Andreas Antoniou - TATA McGraw Hill - 2006
2. Digital Signal Processing: MH Hayes - Schaum's Outlines - TATA Mc-Graw Hill - 2007.
3. DSP Primer - C. Britton Rorabaugh - Tata McGraw Hill - 2005.
4. Fundamentals of Digital Signal Processing using Matlab – Robert J. Schilling - Sandra L. Harris - Thomson - 2007.
5. Digital Signal Processing – Alan V. Oppenheim - Ronald W. Schafer - PHI Ed. - 2006.
6. Digital Signal Processing – K Raja Rajeswari - 1st edition - I.K. International Publishing - House - 2014.

IV B.Tech I Semester

COURSE CODE – R2011XXYY	LINEAR IC APPLICATIONS (Professional Elective –III)	CATEGORY PEC	L-T-P 3-0-0	CREDITS 3

Pre-requisite: Network Theory, Electronic Devices and Circuits, Electronic Circuit Analysis

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

		Knowledge Level (K)#
CO1	Analyse the Differential Amplifier with Discrete components	L4
CO2	Describe the Op-Amp and internal Circuitry: 555 Timer, PLL	L2
CO3	Discuss the Applications of Operational amplifier: 555 Timer, PLL	L2
CO4	Design the Active filters using Operational Amplifier	L5
CO5	Use the Op-Amp in A to D & D to A Converters	L3

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	-	**2**	-	-	-	-	-	-	-	3	2	--
CO2	3	1	**2**	-	-	-	-	-	-	-	-	-	2	2	1
CO3	2	-	-	**2**	-	-	-	-	-	-	-	-	--	2	1
CO4	2	2	-	**3**	-	-	-	-	-	-	-	-	2	--	1
CO5	3	-	-	-	**1**	-	-	-	-	-	-	-	2	2	1

Unit	Contents	Hours
Unit – 1	**Integrated Circuits:** **Differential Amplifier**- DC and AC analysis of (i) Dual input Balanced output	9 hrs

	Configuration, (ii) Dual Input Unbalanced Output, (iii)Single Ended Input – Balanced Output (iv) Single Ended Input – un Balanced Output, Cascade Differential Amplifier Stages, Level translator. (Text Book: Op-Amps & Linear ICs - Ramakanth A. Gayakwad, PHI,1993) **Operational Amplifier:** Introduction, Basic information of Op-Amp, Ideal Operational Amplifier, Op-Amp internal Circuit, Examples of IC Op-Amps, FET Operational Amplifier (Linear Integrated Circuits – D. Roy Choudhury, New Age International (p) Ltd, 2nd Edition,2003) Block Diagram Representation of Typical Op-Amp, Analysis of Typical Op-Amp Equivalent Circuit(only MC1435) (Text Book: Op-Amps & Linear ICs - Ramakanth A. Gayakwad, PHI,1993) OP-Amps Characteristics: Introduction, DC and AC characteristics, 741 op-amp & its features.	
Unit – 2	**OP-AMPS Applications:** Introduction, Basic Op-Amp Applications, Instrumentation Amplifier, AC Amplifier, V to I and I to V Converter, Sample and Hold Circuit, Log and Antilog Amplifier, Multiplier and Divider, Differentiator, integrator. (Linear Integrated Circuits – D. Roy Choudhury, New Age International (p) Ltd, 2nd Edition,2003) **Comparators and Waveform Generators:** Introduction, Comparator, Square Wave Generator, Monostable Multivibrator, Triangular Wave Generator, Sine Wave Generators. (Linear Integrated Circuits – D. Roy Choudhury, New Age International (p) Ltd, 2nd Edition,2003)	9 hrs
Unit – 3	**Active Filters:** Design & Analysis of Butterworth active filters – 1st order, 2nd order LPF, HPF filters. Band pass, Band reject and all pass filters. (Linear Integrated Circuits – D. Roy Choudhury, New Age International (p) Ltd, 2nd Edition,2003)	9 hrs
Unit – 4	**Timer**s: Introduction to 555 timer, functional diagram, Monostable and Astable operations and applications, Schmitt Trigger. **Phase Locked Loops:** Introduction, block schematic, principles and description of individual blocks, 565 PLL, Applications of PLL – frequency multiplication, frequency translation, AM, FM & FSK demodulators. Applications of VCO (566) (Linear Integrated Circuits – D. Roy Choudhury, New Age International (p) Ltd, 2nd Edition,2003)	9 hrs
Unit – 5	**Digital To Analog And Analog To Digital Converters:** Introduction, basic DAC techniques, weighted resistor DAC, R-2R ladder DAC, inverted R-2R DAC, A-D Converters – parallel Comparator type ADC, counter type ADC, successive approximation ADC and dual slope ADC.DAC and ADC Specifications. (Linear Integrated Circuits – D. Roy Choudhury, New Age International (p) Ltd, 2nd Edition,2003)	9 hrs

	Total	45 hrs

Text Books:

1. Linear Integrated Circuits – D. Roy Choudhury, New Age International (p) Ltd, 2nd Edition 2003.
2. Op-Amps & Linear ICs - Ramakanth A. Gayakwad, PHI, 1993.

References Books:

1. Operational Amplifiers & Linear Integrated Circuits –Sanjay Sharma ;SK Kataria&Sons;2nd Edition,2010
2. Design with Operational Amplifiers & Analog Integrated Circuits – Sergio Franco, McGraw Hill, 1988.
3. OP AMPS and Linear Integrated Circuits concepts and Applications, James M Fiore, Cenage Learning India Ltd.
4. Operational Amplifiers & Linear Integrated Circuits–R.F.Coughlin& Fredrick Driscoll, PHI,6th Edition.
5. Operational Amplifiers & Linear ICs – David A Bell, Oxford Uni. Press, 3rd Edition.
6. Operational Amplifiers–C.G. Clayton, Butterworth & Company Publ. Ltd./Elsevier, 1971.

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IV B.Tech I Semester

COURSE CODE – R2011XXYY	PROGRAMMABLE LOGIC CONTROLLERS & ITS APPLICATIONS (Professional Elective – III)	CATEGORY PEC	L-T-P 3-0-0	CREDITS 3

Pre-requisite: Concepts of Digital Electronics - Microprocessors and PID controllers.

Course Outcomes: After the completion of the course the student should be able to:

		Knowledge Level (K)#
CO1	Illustrate I/O modules of PLC systems and ladder diagrams	
CO2	Demonstrate various types registers and programming instructions.	
CO3	Examine various types of PLC functions and its applications.	
CO4	Assess different data handling functions and its applications.	
CO5	Describe the analog operations and PID modules.	

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1	2	3	-	-	-	-	-	3	2	3	1
CO2	3	2	2	1	2	3	-	-	-	-	-	2	2	3	1
CO3	3	2	2	1	2	2	-	-	-	-	-	-	2	3	1
CO4	3	2	2	1	2	2	-	-	-	-	-	-	2	3	1
CO5	3	2	2	1	2	3	-	-	-	-	-	3	2	3	1

(Please fill the above with Levels of Correlation, viz., 3: Strong, 2: Moderate, 1: Weak)

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UNIT	CONTENTS	Contact Hours
UNIT - 1	**Introduction to PLC systems:** I/O modules and interfacing - CPU processor - programming Equipment - programming formats - construction of PLC ladder diagrams - Devices connected to I/O Modules. Digital logic gates - programming in the Boolean algebra system - conversion examples Ladder Diagrams for process control: Ladder diagrams & sequence listings - ladder diagram construction and flowchart for spray process system.	
UNIT - 2	**PLC Programming:** Input instructions - outputs - operational procedures - programming examples using contacts and coils. Drill press operation. PLC Registers: Characteristics of Registers - module addressing - holding registers - Input Registers - Output Registers.	
UNIT - 3	**PLC Functions**: Timer functions & Industrial applications - counters - counter function industrial applications - Arithmetic functions - Number comparison functions - number conversion functions.	
UNIT - 4	**Data Handling functions:** SKIP - Master control Relay - Jump - Move - FIFO - FAL - ONS - CLR & Sweep functions and their applications. Bit Pattern and changing a bit shift register - sequence functions and applications - controlling of two-axis & three axis Robots with PLC - Matrix functions.	
UNIT - 5	**Analog PLC operation:** Analog modules & systems - Analog signal processing - Multi bit Data Processing - Analog output Application Examples - PID principles - position indicator with PID control - PID Modules - PID tuning - PID functions.	
	Total	

Textbooks:

1. Programmable Logic Controllers- Principles and Applications by John W. Webb & Ronald A. Reiss - Fifth Edition - PHI
2. Programmable Logic Controllers- Programming Method and Applications –JR.Hackworth &F.D Hackworth Jr. –Pearson - 2004

Reference Books:

1. Introduction to Programmable Logic Controllers- Gary A. Dunning - 3rd edition - Cengage Learning - 2005.
2. Programmable Logic Controllers –W.Bolton - 5th Edition - Elsevier publisher - 2009.

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IV B.Tech I Semester

COURSE CODE – R2011XXYY	OPTIMIZATION TECHNIQUES (Professional Elective –III)	CATEGORY PEC	L-T-P 3-0-0	CREDITS 3

Pre-requisite: Basics on Mathematical Methods

Course Outcomes: After the completion of the course the student should be able to:

		Knowledge Level (K)#
CO1	State and formulate the optimization problem without and with constraints, also apply classical optimization techniques to minimize or maximize a multi-variable objective function, without or with constraints and arrive at an optimal solution.	
CO2	Formulate a mathematical model and apply linear programming technique by using Simplex method. Also extend the concept of dual Simplex method for optimal solutions.	
CO3	Formulate a mathematical model and apply non-linear programming techniques for unconstrained and constrained case studies.	
CO4	Solve transportation and assignment problem by using Linear programming Simplex method.	
CO5	Formulate and apply Dynamic programming technique to inventory control, production planning, engineering design problems etc. to reach a final optimal solution from the current optimal solution.	

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	--	2	--	--	--	--	--	--	--	2	3	2
CO2	2	2	2	--	2	--	--	--	--	--	--	--	2	3	2

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CO3	3	2	3	1	2	--	--	--	--	--	--	--	2	3	2
CO4	2	2	2	2	1	--	--	--	--	--	--	--	2	3	2
CO5	2	2	2	--	2	--	--	--	--	--	--	--	2	3	2

(Please fill the above with Levels of Correlation - viz. - L=1 - M=2 - H=3)

UNIT	CONTENTS	Contact Hours
UNIT - 1	**Introduction to Optimization Techniques** Statement of an Optimization problem – design vector – design constraints – constraint surface – objective function – objective function surfaces – classification of Optimization problems. **Classical Optimization Techniques** Single variable Optimization – multi variable Optimization without constraints – necessary and sufficient conditions for minimum/maximum – multivariable Optimization with equality constraints. Solution by method of Lagrange multipliers – multivariable Optimization with inequality constraints – Kuhn – Tucker conditions.	
UNIT – 2	**Linear Programming** Standard form of a linear programming problem – geometry of linear programming problems – definitions and theorems – solution of a system of linear simultaneous equations – pivotal reduction of a general system of equations – motivation to the simplex method – simplex algorithm - Duality in Linear Programming – Dual Simplex method.	
UNIT – 3	**Nonlinear Programming** **Unconstrained cases -** One – dimensional minimization methods: Classification - Fibonacci method and Quadratic interpolation method - Univariate method - Powell's method and steepest descent method. **Constrained cases -** Characteristics of a constrained problem - Classification - Basic approach of Penalty Function method; Basic approaches of Interior and Exterior penalty function methods.	
UNIT – 4	**Transportation Problem** Finding initial basic feasible solution by north – west corner rule - least cost method and Vogel's approximation method – testing for optimality of balanced transportation problems – Special cases in transportation problem.	
UNIT – 5	**Dynamic Programming** Dynamic programming multistage decision processes – types – concept of sub optimization and the principle of optimality – computational procedure in dynamic programming – examples illustrating the calculus method of solution - examples illustrating the tabular method of solution.	
	Total	

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Text Books:

1. "Engineering optimization: Theory and practice"-by S. S.Rao - New Age International (P) Limited - 3rd edition - 1998.
2. "Introductory Operations Research" by H.S. Kasene & K.D. Kumar - Springer (India) 2013.

Reference Books:

1. "Optimization Methods in Operations Research and systems Analysis" – by K.V. Mital and C. Mohan - New Age International (P) Limited - Publishers - 3rd edition - 1996.
2. Operations Research – by Dr. S.D.Sharma - Kedarnath - Ramnath & Co - 2012.
3. "Operations Research: An Introduction" – by H.A.Taha - PHI pvt. Ltd. - 6th edition
4. Linear Programming–by G.Hadley.

IV B.Tech I Semester

COURSE CODE – R2011XXYY	OBJECT ORIENTED PROGRAMMING THROUGH JAVA (Professional Elective –IV)	CATEGORY PEC	L-T-P 3-0-0	CREDITS 3

Pre-requisite: Programming Skills

Course Outcomes: After the completion of the course the student should be able to:

		Knowledge Level (K)#
CO1	Illustrate basic concepts of JAVA.	
CO2	Write java programming using classes and objects.	
CO3	Implement inheritance and exception handling concepts in JAVA.	
CO4	Analyze multithreading application in JAVA.	
CO5	Create JAVA Applet program and analyze various AWT controls.	

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	--	3	-	-	-	-	-	1	1	2	3	2
CO2	3	2	2	--	2	-	-	-	-	-	1	1	2	3	2
CO3	3	2	2	--	2	-	-	-	-	-	1	1	2	3	2
CO4	3	3	2	--	3	-	-	-	-	-	1	1	2	3	2
CO5	3	3	2	--	3	-	-	-	-	-	1	1	2	3	2

(Please fill the above with Levels of Correlation - viz. - L-1 - M-2 - H-3)

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UNIT	CONTENTS	Contact Hours
UNIT – 1	**Introduction to JAVA:** Introduction to OOP - procedural programming language and object oriented language - principles of OOP - applications of OOP - history of java - java features - JVM - program structure. Variables - primitive data types - identifiers - literals - operators - expressions - precedence rules and associativity - primitive type conversion and casting - flow of control.	
UNIT – 2	**Objects and Classes:** Classes and objects - class declaration - creating objects - methods - constructors and constructor overloading - garbage collector - importance of static keyword and examples - this keyword - arrays - command line arguments - nested classes.	
UNIT – 3	**Inheritance:** Inheritance - types of inheritance - super keyword - final keyword - overriding and abstract class. Interfaces -creating the packages - using packages - importance of CLASSPATH and java.lang package. Exception handling - importance of try - catch - throw - throws and finally block - user-defined exceptions - Assertions.	
UNIT – 4	**Multithreading:** Introduction - thread life cycle - creation of threads - thread priorities - thread synchronization - communication between threads. Reading data from files and writing data to files - random access file.	
UNIT – 5	**Applets and AWT Classes:** Applet class - Applet structure - Applet life cycle - sample Applet programs. Event handling: event delegation model - sources of event - Event Listeners - adapter classes - inner classes. **AWT**: introduction - components and containers - Button - Label - Checkbox - Radio Buttons - List Boxes - Choice Boxes - Container class - Layouts - Menu and Scrollbar.	
	Total	

Text Books:

1. The complete Reference Java - 8th edition - Herbert Schildt - TMH.
2. Programming in JAVA - Sachin Malhotra - Saurabh Choudary - Oxford.2013
3. Introduction to java programming - 7th edition by Y Daniel Liang - Pearson.

Reference Books:

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1. "Object-Oriented Programming and Java" By Danny Poo - Derek Kiong - Swarnalatha Ashok - Springer London - 2008.
2. "Object Oriented Programming with Java" by M. T. Somashekara - D. S. Guru - K. S. Manjunatha - Prentice Hall India Pvt. - Limited - 2017.

IV B.Tech I Semester

COURSE CODE – R2011XXYY	DATA BASE MANAGEMENT SYSTEMS (Professional Elective –IV)	CATEGORY PEC	L-T-P 3-0-0	CREDITS 3

Pre-requisite: Programming skills - Linear Algebra - Data Structures.
Course Outcomes: After the completion of the course the student should be able to:

		Knowledge Level (K)#
CO1	Describe a relational database and object-oriented database.	
CO2	Create - maintain and manipulate a relational database using SQL	
CO3	Develop ER model and normalization for database design.	
CO4	Examine issues in data storage and query processing and can formulate appropriate solutions.	
CO5	Analyse the role and issues in management of data and Design database system for a given real world problem	

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	--	1	--	--	--	--	--	--	--	1	1	1
CO2	3	2	2	--	1	--	--	--	--	--	--	--	1	1	1
CO3	2	2	2	--	1	--	--	--	--	--	--	--	1	1	1
CO4	2	2	2	--	1	--	--	--	--	--	--	--	1	1	1
CO5	2	2	2	--	1	--	--	--	--	--	--	--	1	1	1

(Please fill the above with Levels of Correlation - viz. - L-1 - M-2 - H-3)

UNIT	CONTENTS	Contact

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		Hours
UNIT – 1	**An Overview of Database Management** Introduction- Definition of Database and Database System – Need of Database- Data Independence- Relation Systems and Others- Summary. Database system architecture - Introduction - Three Levels of Architecture - External Level - Conceptual Level- Internal Level – Mapping - Database Administrator - Database Management Systems Client/Server Architecture.	
UNIT - 2	**Entity-Relationship models & diagrams** The E/R Models - The Relational Model - Relational Calculus - Introduction to Database Design - Database Design and ER Diagrams-Entities Attributes - and Entity Sets-Relationship and Relationship Sets-Conceptual Design With the ER Models - The Relational Model Integrity Constraints Over Relations-Key Constraints –Foreign Key Constraints-General Constraints - Relational Algebra and Calculus - Relational Algebra- Selection and Projection- Set Operation - Renaming – Joins- Division- More Examples of Queries - Relational Calculus - Tuple Relational Calculus- Domain Relational Calculus.	
UNIT – 3	**Queries - Constraints - Triggers**: The Form of Basic SQL Query - Union - Intersect - and Except - Nested Queries - Aggregate Operators - Null Values - Complex Integrity Constraints in SQL - Triggers and Active Database. **Schema Refinement (Normalization):** Purpose of Normalization or schema refinement - concept of functional dependency - normal forms based on functional dependency(1NF - 2NF and 3 NF) - concept of surrogate key - Boyce-codd normal form(BCNF) - Lossless join and dependency preserving decomposition - Fourth normal form(4NF).	
UNIT – 4	**Transaction Management and Concurrency Control** Transaction - properties of transactions - transaction log - and transaction management with SQL using commit rollback and save point. Concurrency control for lost updates - uncommitted data - inconsistent retrievals and the Scheduler. Concurrency control with locking methods : lock granularity - lock types - two phase locking for ensuring serializability - deadlocks - Concurrency control with time stamp ordering : Wait/Die and Wound/Wait Schemes - Database Recovery management : Transaction recovery.	
UNIT – 5	**Overview of Storages and Indexing** Data on External Storage- File Organization and Indexing –Clustered Indexing – Primary and Secondary Indexes - Index Data Structures - Hash-Based Indexing – Tree-Based Indexing - Comparison of File Organization.	
	Total	

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Text Books:

1. Introduction to Database Systems - CJ Date - Pearson - 8th edition.
2. Data base Management Systems - Raghurama Krishnan - Johannes Gehrke - Tata McGraw Hill 3rd Edition.
3. Database Systems - The Complete Book - H G Molina - J D Ullman - J Widom - Pearson Education - 2008.

References Books:

1. Data base Systems design - Implementation - and Management - Peter Rob & Carlos Coronel - 7th Edition.
2. Fundamentals of Database Systems - Elmasri Navrate Pearson Education - 2008.

IV B.Tech I Semester

COURSE CODE – R2011XXYY	CLOUD COMPUTING (Professional Elective –IV)	CATEGORY PEC	L-T-P 3-0-0	CREDITS 3

Pre-requisite: Basics of Data Base Management Systems.

Course Outcomes: After the completion of the course the student should be able to:

		Knowledge Level (K)#
CO1	Illustrate the key dimensions of the challenge of Cloud Computing	
CO2	Assessment of the economics - financial - and technological implications for selecting cloud computing for own organization	
CO3	Assessing the financial - technological - and organizational capacity of employer's for actively initiating and installing cloud-based applications.	
CO4	Assessment of own organizations' needs for capacity building and training in cloud computing-related IT areas	
CO5	Analyse the necessity of cloud computing in various storage systems.	

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	--	2	2	2	--	--	--	--	--	--	--	2	1	1
CO2	--	--	2	3	3	--	--	--	--	--	--	--	2	1	1
CO3	--	--	1	3	3	--	--	--	--	--	--	--	2	1	1
CO4	1	2	2	2	2	--	--	--	--	--	--	--	2	1	1
CO5	--	1	2	2	3	--	--	--	--	--	--	--	2	1	1

(Please fill the above with Levels of Correlation - viz. - L-1 - M-2 - H-3)

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UNIT	CONTENTS	Contact Hours
UNIT – 1	**Systems Modelling - Clustering and virtualization** Scalable Computing over the Internet - Technologies for Network based systems - System models for Distributed and Cloud Computing - Software environments for distributed systems and clouds - Performance - Security And Energy Efficiency.	
UNIT – 2	**Virtual Machines and Virtualization of Clusters and Data Centers** Implementation Levels of Virtualization - Virtualization Structures/ Tools and mechanisms - Virtualization of CPU - Memory and I/O Devices - Virtual Clusters and Resource Management - Virtualization for Data Center Automation.	
UNIT – 3	**Cloud Platform Architecture** Cloud Computing and service Models - Architectural Design of Compute and Storage Clouds - Public Cloud Platforms - Inter Cloud Resource Management - Cloud Security and Trust Management. Service Oriented Architecture - Message Oriented Middleware. **Cloud Programming and Software Environments** Features of Cloud and Grid Platforms - Parallel & Distributed Programming Paradigms - Programming Support of Google App Engine - Programming on Amazon AWS and Microsoft Azure - Emerging Cloud Software Environments.	
UNIT – 4	**Cloud Resource Management and Scheduling** Policies and Mechanisms for Resource Management Applications of Control Theory to Task Scheduling on a Cloud - Stability of a Two Level Resource Allocation Architecture - Feedback Control Based on Dynamic Thresholds. Coordination of Specialized Autonomic Performance Managers - Resource Bundling - Scheduling Algorithms for Computing Clouds - Fair Queuing - Start Time Fair Queuing - Borrowed Virtual Time - Cloud Scheduling Subject to Deadlines - Scheduling MapReduce Applications Subject to Deadlines.	
UNIT – 5	**Storage Systems** Evolution of Storage Technology - Storage Models - File Systems And Database - Distributed File Systems - General Parallel File Systems. Google File System. Apache Hadoop - Big Table - Megastore - Amazon Simple Storage Service (S3)	
	Total	

Text Books:

1. Distributed and Cloud Computing - Kai Hwang - Geoffry C. Fox - Jack J. Dongarra MK Elsevier - 2011.
2. Cloud Computing - Theory and Practice - Dan C Marinescu - MK Elsevier - 2013.
3. Cloud Computing - A Hands on approach - Arshadeep Bahga - Vijay Madisetti - University Press - 2014.

Reference Books:

1. Cloud Computing - A Practical Approach - Anthony T Velte - Toby J Velte - Robert Elsenpeter - Tata McGraw Hill - 2009.
2. Mastering Cloud Computing - Foundations and Application Programming - Raj Kumar Buyya - Christen vecctiola - S Tammaraiselvi - MK Elsevier - 2013.

IV B.Tech I Semester

COURSE CODE – R2011XXYY	OPERATING SYSTEMS (Professional Elective –IV)	CATEGORY PEC	L-T-P 3-0-0	CREDITS 3

Pre-requisite: Concepts of Computer programming - Data Structures - Computer Organization.

Course Outcomes: After the completion of the course the student should be able to:

		Knowledge Level (K)#
CO1	Design various Scheduling algorithms.	
CO2	Apply the principles of concurrency and design deadlock - prevention and avoidance algorithms.	
CO3	Compare and contrast various memory management schemes.	
CO4	Design and Implement a prototype file systems.	
CO5	Analyse administrative tasks on Linux Servers and introduction to Android Operating System	

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	--	--	--	--	--	--	--	--	--	--	1	1	1	1
CO2	--	--	--	--	--	--	--	--	--	--	--	1	1	1	1
CO3	2	1	3	1	--	--	--	--	--	--	--	1	1	1	1
CO4	2	--	2	--	--	--	--	--	--	--	--	1	1	1	1
CO5	--	--	--	--	3	--	--	--	--	--	--	1	1	1	1

(Please fill the above with Levels of Correlation - viz. - L-1 - M-2 - H-3)

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UNIT	CONTENTS	Contact Hours
UNIT – 1	**Introduction to Operating System and Concept Process Management** Types of operating systems - operating systems concepts - operating systems services - Introduction to System call - System call types. Process concept - The process - Process State Diagram - Process control block - Process Scheduling- Scheduling Queues - Schedulers - Operations on Processes - Interprocess Communication - Threading Issues - Scheduling-Basic Concepts - Scheduling Criteria - Scheduling Algorithms.	
UNIT - 2	**Memory Management** Swapping - Contiguous Memory Allocation - Paging - structure of the Page Table - Segmentation. **Virtual Memory Management** Virtual Memory - Demand Paging - Page-Replacement Algorithms - Thrashing.	
UNIT – 3	**Concurrency** ProcessSynchronization - The Critical- Section Problem - Synchronization Hardware - Semaphores - Classic Problems of Synchronization - Monitors - Synchronization examples. **Principles of deadlock** System Model - Deadlock Characterization - Deadlock Prevention - Detection and Avoidance - Recovery form Deadlock.	
UNIT – 4	**File system Interface** The concept of a file - Access Methods - Directory structure - File system mounting - file sharing - protection. **File System implementation-** File system structure - allocation methods - free-space management. **Mass-storage structure-** overview of Mass-storage structure - Disk scheduling - Device drivers.	
UNIT – 5	**Linux System** Components of LINUX - Interprocess Communication - Synchronisation - Interrupt - Exception and System Call. **Android Software Platform** Android Architecture - Operating System Services - Android Runtime Application Development - Application Structure - Application Process management	
	Total	

Text Books:

1. Operating System Concepts - Abraham Silberschatz - Peter Baer Galvin and Greg Gagne 9th Edition - John Wiley and Sons Inc. - 2012.
2. Operating Systems – Internals and Design Principles - William Stallings - 7th Edition -

Prentice Hall - 2011.
3. Operating Systems-S Halder - Alex A Aravind Pearson Education Second Edition 2016

References Books:

1. Modern Operating Systems - Andrew S. Tanenbaum - Second Edition - Addison Wesley - 2001.
2. Operating Systems: A Design-Oriented Approach - Charles Crowley - Tata Mc Graw Hill Education" - 1996.
3. Operating Systems: A Concept-Based Approach - D M Dhamdhere - Second Edition - Tata Mc Graw-Hill Education - 2007.

IV B.Tech I Semester

COURSE CODE – R2011XXYY	POWER SYSTEM OPERATION AND CONTROL (Professional Elective – V)	CATEGORY PEC	L-T-P 3-0-0	CREDITS 3

Pre-requisite:

Course Outcomes: After the completion of the course the student should be able to:

		Knowledge Level (K)#
CO1	Compute optimal load scheduling of Generators.	3
CO2	Formulate hydrothermal scheduling and unit commitment problem..	3
CO3	Analyse effect of Load Frequency Control for single area systems	4
CO4	Analyse effect of Load Frequency Control for two area systems	4
CO5	Describe the effect of reactive power control for transmission lines.	3

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	3	1	3	1	-	-	-	-	-	-	3	3	3
CO2	1	3	3	1	2	1	-	-	-	-	-	-	3	3	3
CO3	1	2	3	1	2	1	-	-	-	-	-	-	3	3	3
CO4	1	2	3	1	2	1	-	-	-	-	-	-	3	3	3
CO5	1	1	2	1	2	1	-	-	-	-	-	-	3	2	3

(Please fill the above with Levels of Correlation - viz. - L-1 - M-2 - H-3)

UNIT	CONTENTS	Contact

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		Hours
UNIT – 1	**Economic Operation of Power Systems** Optimal operation of Generators in Thermal power stations - – Heat rate curve – Cost Curve – Incremental fuel and Production costs – Input–output characteristics – Optimum generation allocation with line losses neglected – Optimum generation allocation including the effect of transmission line losses – Loss Coefficients – General transmission line loss formula.	
UNIT - 2	**Hydrothermal Scheduling** Mathematical Formulation – Solution Technique. **Unit Commitment** Need for unit commitment – Constraints in unit commitment – Cost function formulation – Solution methods – Priority ordering – Dynamic programming.	
UNIT – 3	**Load Frequency Control-I** Modelling of steam turbine – Generator – Mathematical modelling of speed governing system – Transfer function – Necessity of keeping frequency constant. Definitions of Control area – Single area control system – Block diagram representation of an isolated power system – Steady state analysis – Dynamic response – Uncontrolled case. Proportional plus Integral control of single area and its block diagram representation – Steady state response.	
UNIT – 4	**Load Frequency Control-II** Block diagram development of Load Frequency Control of two area system uncontrolled case and controlled case – Tie-line bias control – Load Frequency Control and Economic dispatch control – State space model – optimal parameter adjustment.	
UNIT – 5	**Compensation in Power Systems** Overview of Reactive Power control – Reactive Power compensation in transmission systems – Advantages and disadvantages of different types of compensating equipment for transmission systems – Load compensation – Specifications of load compensator – compensated transmission lines. Introduction of FACTS devices – Need of FACTS controllers – Types of FACTS devices.	
	Total	

Text Books:

1. Power Generation - Operation and Control by Allen J Wood - Bruce F WollenBerg 3rd Edition - Wiley Publication 2014.
2. Electric Energy systems Theory – by O.I.Elgerd - Tata McGraw–hill Publishing Company Ltd. - Second edition.
2. Modern Power System Analysis – by I.J.Nagrath&D.P.Kothari Tata McGraw Hill Publishing Company Ltd - 2nd edition.

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Reference Books:

1. Power System Analysis and Stability by S.S.Vadhera - Khanna Publications - 4th edition - 2005.
2. Power System Analysis by Grainger and Stevenson - Tata McGraw Hill.
3. Power System Analysis by HadiSaadat – – Tata McGraw–Hill 3rd edition - 2010.
4. Power System stability & control - Prabha Kundur - TMH - 1994.

IV B.Tech I Semester

COURSE CODE – R2011XXYY	SWITCH MODE POWER CONVERSION (Professional Elective – V)	CATEGORY PEC	L-T-P 3-0-0	CREDITS 3

Pre-requisite: Power electronics - Control Systems.

Course Outcomes: After the completion of the course the student should be able to:

		Knowledge Level (K)#
CO1	Design and analyse the operation of non-isolated switch mode converters.	4
CO2	Analyze the operation of isolated switch mode converters.	4
CO3	Illustrate the operation and control of resonant converters.	3
CO4	Analyse the control schemes of converters and design transformer - inductor.	4
CO5	Model the converters and design controller for closed loop operation.	4

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1	1	-	-	-	-	-	2	2	3	2	2
CO2	3	2	2	1	1	-	-	-	-	-	2	3	3	3	2
CO3	3	2	2	2	1	-	-	-	-	-	2	2	2	2	2
CO4	3	2	2	1	1	-	-	-	-	-	2	3	3	3	2
CO5	3	2	3	2	1	-	-	-	-	-	2	3	3	3	2

(Please fill the above with Levels of Correlation, viz., 3: Strong, 2: Moderate, 1: Weak)

UNIT	CONTENTS	Contact Hours
UNIT – 1	**Non-Isolated Switch Mode Converters**	

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	Control of DC-DC converters: Buck converters - Boost converters - Buck-Boost converter - CUK Converter - continuous and discontinuous operation - Converter realization with non-ideal components.	
UNIT – 2	**Isolated Switched Mode Converters** Forwarded converter - flyback converter - push-pull converter - half-bridge converter - full bridge converter.	
UNIT – 3	**Resonant Converters** Basic resonant circuit concepts - series resonant circuits - parallel resonant circuits - zero current switching quasi-resonant buck converter - zero current switching quasi-resonant boost converter - zero voltage switching quasi-resonant buck converter - zero voltage switching quasi-resonant boost converter.	
UNIT – 4	**Control Schemes of Resonant Converters** Voltage control - Current mode control - Current control mode instability. **Magnetic Design:** Transformer design - inductor and capacitor design.	
UNIT – 5	**Modelling of Converters and Controller Design Based On Linearization:** Formulation of large signal models for buck and boost converters using state space analysis-derivation of average large signal model using circuit averaging method-small signal model derivation- average switch modelling technique to obtain small signal models of buck and boost converters- Transfer function of converters-Controller design based on linearization.	
	Total	

Text Books:

1. Fundamentals of Power Electronics- Erickson - Robert W. - Maksimovic - Dragan - Springer - 2011.
2. Power switching converters- Simon Ang - Alejandro Oliva - CRC Press - 2010.
3. Elements of Power Electronics – Philip T. Krein - Oxford University press - 2014.
4. Design of Magnetic Components for Switched Mode Power Converters- Z Umanand - S.P. Bhat - John Wiley & Sons Australia - 1992.

Reference Books:

1. Switching Power Supply Design- Abraham I. Pressman - McGraw-Hill Ryerson - Limited - 1991.
2. Power Electronics – Issa Batareseh - Jhon Wiley publications - 2004.
3. Power Electronics: converters Applications & Design – Mohan - Undeland - Robbins-Wiley publications.

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IV B.Tech I Semester

COURSE CODE – R2011XXYY	ADVANCED CONTROL SYSTEMS (Professional Elective – V)	CATEGORY PEC	L-T-P 3-0-0	CREDITS 3

Pre-requisite: Concepts of Control Systems

Course Outcomes: After the completion of the course the student should be able to:

		Knowledge Level (K)#
CO1	Analyse different canonical forms - solution of State equation.	
CO2	Design of control system using the pole placement technique is given after introducing the concept of controllability and observability.	
CO3	Analyze nonlinear system using describing function technique and phase plane analysis.	
CO4	Examine the stability analysis using Lyapunov method.	
CO5	Illustrate the Minimization of functional using calculus of variation - state and quadratic regulator problems.	

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	2	--	--	--	--	--	--	1	2	2	--	2
CO2	3	2	2	2	--	--	--	--	--	--	1	2	2	2	1
CO3	2	2	2	2	--	--	--	--	--	--	--	2	2	1	2
CO4	2	2	2	2	--	--	--	--	--	--	--	2	2	1	1
CO5	3	2	1	2	--	--	--	--	--	--	--	2	2	2	2

(Please fill the above with Levels of Correlation - viz. - L-1 - M-2 - H-3)

UNIT	CONTENTS	Contact Hours
UNIT - 1	**State Space Analysis** State Space Representation – Canonical forms – Controllable canonical form – Observable canonical form - Jordan Canonical Form - Solution of state equation – State transition matrix.	
UNIT - 2	**Controllability - Observability and Design of Pole Placement** Tests for controllability and observability for continuous time systems – Time varying case – Minimum energy control – Time invariant case – Principle of duality – Controllability and observability form Jordan canonical form and other canonical forms – Effect of state feedback on controllability and observability – Design of state feedback control through pole placement.	

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UNIT - 3	**Nonlinear Systems** Introduction to nonlinear systems - Types of nonlinearities. Introduction to phase–plane analysis - Singular points; Describing function - basic concepts - Describing functions of non- linearities.	
UNIT - 4	**Stability analysis by Lyapunov Method** Stability in the sense of Lyapunov – Lyapunov's stability and Lyapunov's instability theorems – Direct method of Lyapunov for the linear and nonlinear continuous time autonomous systems.	
UNIT - 5	**Introduction to optimal control:** Minimization of functional of single function – Constrained minimization – Minimum principle – Control variable inequality constraints – Control and state variable inequality constraints –Euler lagrangine equation-Typical optimal control performance measures-Optimal control based on quadratic performance measures- Quadratic optimal regulator systems-State regulator problems-output regulator problems - tracking problems.	
	Total	

Text Books:

1. Modern Control Engineering – by K. Ogata - Prentice Hall of India - 3rd edition - 1998.
2. Automatic Control Systems by B.C. Kuo - Prentice Hall Publication.

Reference Books:

1. Modern Control System Theory – by M. Gopal - New Age International Publishers - 2nd edition - 1996
2. Control Systems Engineering by I.J. Nagarath and M.Gopal - New Age International (P) Ltd.
3. Digital Control and State Variable Methods – by M. Gopal - Tata Mc Graw–Hill Companies - 1997.
4. Systems and Control by Stainslaw H. Zak - Oxford Press - 2003.
5. Optimal control theory: an Introduction by Donald E.Kirk by Dover publications.

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IV B.Tech I Semester

COURSE CODE – R2011XXYY	IOT APPLICATIONS IN ELECTRICAL ENGINEERING (Professional Elective – V)	CATEGORY PEC	L-T-P 3-0-0	CREDITS 3

Pre-requisite: Concepts of Computer Organisation - Computer Networking

Course Outcomes: After the completion of the course the student should be able to:

		Knowledge Level (K)#
CO1	Adopt the various fundamentals - architectures and technologies of Internet of Things.	
CO2	Develop various communication technologies used in the Internet of Things.	
CO3	Analyse the various device connectivity methods using web and internet in the IoT environment.	
CO4	Compute various data acquisition methods - data handling using cloud for IoT applications.	
CO5	Design the implementation of IoT from the case studies like Smart Home - Smart city - etc.	

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	2	2	2	--	--	--	--	--	--	--	1	3	1
CO2	1	--	2	2	3	--	--	--	--	--	--	--	1	3	1
CO3	1	--	--	2	3	--	--	--	--	--	--	2	1	3	1
CO4	1	--	--	2	3	--	--	--	--	--	--	2	1	3	1
CO5	1	--	1	2	3	--	--	--	--	--	--	2	1	3	1

(Please fill the above with Levels of Correlation - viz. - L-1 - M-2 - H-3)

UNIT	CONTENTS	Contact Hours
UNIT - 1	**The Internet of Things**: An Overview of Internet of Things (IoT) – IoT framework –Architecture – Technology behind IoT – Sources of the IoT – M2M Communication – Examples of IoT.	
UNIT - 2	**Design Principles For Connected Devices**: Introduction –IoT/M2M systems - Layers and Designs Standardization – Communication Technologies – Data Enrichment - Consolidation and Device Management at Gateway – Ease of designing and affordability.	
UNIT - 3	**Design Principles for the Web Connectivity**: Introduction – Web Communication protocols for Connected Devices - Message Communication protocols for Connected Devices – Web	

	Connectivity for connected devices network. Introduction to Internet Connectivity Principles - Internet connectivity - Internet based communication – IP addressing in the IoT – Application Layer Protocols: HTTP - HTTPS - FTP - Telnet - WAP (Wireless Application Protocol).	
UNIT - 4	**Data Acquiring - Organizing - Processing and Analytics** Introduction – Data Acquiring and Storage – Organizing the Data – Analytics. **Data Collection - Storage and Computing Using a Cloud Platform** Introduction – Cloud computing paradigm for data collection - storage and computing – IoTas a service and Cloud Service Models - IoT cloudbased services using the Xively (Pachube/COSM) - Nimbits and other platforms.	
UNIT - 5	**Sensor Technology** Actuator - Sensor data communication protocols - Radio Frequency Identification technology - Wireless Sensor Network Technology. IoT application case studies: Smart Home - Smart Cities - Environment monitoring and Agriculture practices.	
	Total	

Text Books:

1. Internet of Things: Architecture - Design Principles - Raj Kamal - McGraw Hill Education (India) Pvt. Limited - 2017.

Reference Books:

1. Designing the Internet of Things - Adrian McEwen and Hakim Cassimally - Wiley - First Edition - 2013.
2. Getting Started with the Internet of Things - Cuno Pfister - O'Reilly - 2011.
3. Internet of Things: A Hands-on Approach - Arshdeep Bahga - and Vijay Madisetti - 2014.

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IV B.Tech I Semester

COURSE CODE – R2011XXYY	BASICS OF MICROPROCESSORS AND MICROCONTROLLERS (Open Elective-III)	CATEGORY OEC	L-T-P 3-0-0	CREDITS 3

Pre-requisite: Basics of Processors

Course Outcomes: After the completion of the course the student should be able to:

		Knowledge Level (K)#
CO1	Know the concepts of the Microprocessor capability in general and explore the evaluation of microprocessors.	
CO2	Analyse the instruction sets - addressing modes - minimum and maximum modes operations of 8086 Microprocessors	
CO3	Analyse the Microcontroller and interfacing capability	
CO4	Describe the architecture and interfacing of 8051 controller	
CO5	Know the concepts of PIC micro controller and its programming.	

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	2	1	--	--	--	--	--	--	1	1	3	2	1
CO2	3	1	2	1	--	--	--	--	--	--	--	1	3	3	2
CO3	3	2	3	2	1	--	--	--	--	--	--	1	3	3	2
CO4	3	2	2	2	1	--	--	--	--	--	--	1	3	3	2
CO5	3	1	2	2	3	--	--	--	--	--	1	1	3	3	2

(Please fill the above with Levels of Correlation - viz. - L-1 - M-2 - H-3)

UNIT	CONTENTS	Contact Hours
UNIT - 1	**Introduction to Microprocessor Architecture** Introduction and evolution of Microprocessors – Architecture of 8086 – Memory Organization of 8086 – Register Organization of 8086– Introduction to 80286 - 80386 - 80486 and Pentium (brief description about architectural advancements only).	
UNIT - 2	**Minimum and Maximum Mode Operations** Instruction sets of 8086 - Addressing modes – Assembler directives - General bus operation of 8086 – Minimum and Maximum mode operations of 8086 – 8086 Control signal interfacing – Read and write cycle timing diagrams.	
UNIT - 3	**Microprocessors I/O Interfacing** 8255 PPI– Architecture of 8255–Modes of operation – Interfacing I/O devices	

	to 8086 using 8255 – Interfacing A to D converters – Interfacing D to A converters – Stepper motor interfacing– Static memory interfacing with 8086.	
UNIT - 4	**8051 Microcontroller** Overview of 8051 Microcontroller – Architecture – Memory Organization – Register set.	
UNIT - 5	**8051 Interfacing and Applications** Instruction set – I/O ports and Interrupts – Timers and Counters – Serial Communication – Interfacing of peripherals – Applications of microcontrollers.	
	Total	

Text Books:

1. Ray and Burchandi - "Advanced Microprocessors and Interfacing" - Tata McGraw–Hill - 3rd edition - 2006.
2. Kenneth J Ayala - "The 8051 Microcontroller Architecture - Programming and Applications" - Thomson Publishers - 2nd Edition.
3. PIC Microcontroller and Embedded Systems using Assembly and C for PIC 18 - - Muhammad Ali Mazidi - RolindD.Mckinay - Danny causey -Pearson Publisher 21st Impression.

Reference Books:

1. Microprocessors and Interfacing - Douglas V Hall - Mc–Graw Hill - 2nd Edition.
2. R.S. Kaler - "A Text book of Microprocessors and Micro Controllers" - I.K. International Publishing House Pvt. Ltd.
3. Ajay V. Deshmukh - "Microcontrollers – Theory and Applications" - Tata McGraw–Hill Companies –2005.
4. Ajit Pal - "Microcontrollers – Principles and Applications" - PHI Learning Pvt Ltd - 2011.

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IV B.Tech I Semester

COURSE CODE – R2011XXYY	FUNDAMENTALS OF UTILIZATION OF ELECTRICAL ENERGY (Open Elective –III)	CATEGORY OEC	L-T-P 3-0-0	CREDITS 3

Pre-requisite: Basics of Electrical Engineering

Course Outcomes: After the completion of the course the student should be able to understand:

		Knowledge Level (K)#
CO1	Know the concepts of illumination and various illumination methods.	
CO2	Know about the resistance - induction and dielectric heating.	
CO3	Learn about the resistance and arc welding and welding equipment	
CO4	Know about the mechanisms - equipment and technology used in the electric traction.	
CO5	Differentiate the importance of various energy storage systems	

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	--	1	--	--	--	--	--	--	--	1	3	3	1
CO2	3	3	--	1	--	--	--	--	--	--	--	1	3	3	1
CO3	3	3	--	1	--	--	--	--	--	--	--	1	3	3	1
CO4	3	3	--	2	--	--	--	--	--	--	--	1	3	3	1
CO5	3	3	--	1	--	--	1	--	--	--	--	1	3	3	1

(Please fill the above with Levels of Correlation - viz. - L-1 - M-2 - H-3)

UNIT	CONTENTS	Contact Hours
UNIT - 1	**Illumination fundamentals** Introduction - terms used in illumination–Laws of illumination–Lux meter–Sources of light. **Various Illumination Methods** Tungsten filament lamps and fluorescent lamps - Comparison –Basic principles of light control– Types and design of lighting and flood lighting–LED lighting - Energy conservation.	
UNIT - 2	**Electric Heating** Advantages and methods of electric heating–Resistance heating induction heating and dielectric heating.	

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UNIT - 3	**Electric Welding** Electric welding–Resistance and arc welding–Electric welding equipment–Comparison between AC and DC Welding	
UNIT - 4	**Electric Traction** System of electric traction and track electrification– Review of existing electric traction systems in India– Special features of traction motor–Mechanics of train movement–Speed–time curves for different services –Trapezoidal and quadrilateral speed time curves. Calculations of tractive effort– power –Specific energy consumption for given run–Effect of varying acceleration and braking retardation–Adhesive weight and braking retardation adhesive weight and coefficient of adhesion.	
UNIT - 5	**Introduction to Energy Storage Systems** Need for energy storage - Types of energy storage-Thermal - electrical - magnetic and chemical storage systems - Comparison of energy storage technologies-Applications.	
	Total	

Text Books:

1. Electrical Power Systems (Generation - Transmission - Distribution - Protecection and Utilization of Electrical Energy) – Dr. S.L.Uppal and Prof. Sunil S.Rao – Khanna Publisher - 15th edition - 1987.
2. Electric Power Distribution – A. S. Pabla – McGrawHill - 5th edition - 2004.

Reference Books:

1. Generation Distribution and Utilization of Electrical Energy – C.L.Wadhwa- New Age International Publishers- revised 3rd edition.

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IV B.Tech I Semester

COURSE CODE – R2011XXYY	ELECTRICAL ESTIMATION AND COSTING (Open Elective – III)	CATEGORY OEC	L-T-P 3-0-0	CREDITS 3

Pre-requisite: Basics of Power Systems

Course Outcomes: After the completion of the course the student should be able to:

		Knowledge Level (K)#
CO1	Demonstrate the various electrical apparatus and their interconnections.	
CO2	Examine various components of electrical installations.	
CO3	Estimate the cost for installation of wiring for different types of building and small industries.	
CO4	Illustrate the components of electrical substations.	
CO5	Design suitable control circuit for starting of three phase induction motor and synchronous motor.	

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	2	1	1	-	-	-	-	-	1	2	2	1	2
CO2	3	1	2	1	2	-	-	-	-	-	1	2	2	1	1
CO3	2	2	1	2	2	-	-	-	-	-	2	1	2	2	2
CO4	3	1	1	2	2	-	-	-	-	-	1	2	2	1	1
CO5	2	2	2	2	2	-	-	-	-	-	1	2	2	1	2

(Please fill the above with Levels of Correlation - viz. - L-1 - M-2 - H-3)

UNIT	CONTENTS	Contact Hours
UNIT - 1	**Electrical Symbols and Simple Electrical Circuits** Identification of electrical symbols - Electrical Diagrams - Methods of representation of wiring diagrams - introduction to simple light and fan circuits - system of connection of appliances and accessories.	
UNIT - 2	**Design Considerations of Electrical Installations** Electric supply system - Three-phase four wire distribution system - protection of electric installation against overload - short circuit and earth fault - earthing - neutral and earth wire - types of loads - systems of wiring - permissible of voltage drops and sizes of wires - estimating and costing of electrical installations.	

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UNIT - 3	**Electrical Installation for Different Types of Buildings and Small Industries** Electrical installations for electrical buildings - estimating and costing of material - simple examples on electrical installation for residential buildings - electrical installations for commercial buildings - electrical installation for small industries-case study.	
UNIT - 4	**Substations** Introduction - types of substations - outdoor substations-pole mounted type - indoor substations-floor mounted type - simple examples on quantity estimation-case study.	
UNIT - 5	**Motor control circuits** Introduction to AC motors - starting of three phase squirrel cage induction motors - starting of wound rotor motors - starting of synchronous motors - contractor control circuit components - basic control circuits - motor protection	
	Total	

Text Books:

1. Electrical Design and Estimation Costing - K. B. Raina and S.K.Bhattacharya – New Age International Publishers - 2007.

References Books:

1. Electrical wiring estimating and costing – S.L.Uppal and G.C.Garg – Khanna publishers - 6th edition - 1987.
2. A course in electrical installation estimating and costing – J.B.Gupta –Kataria SK & Sons - 2013.

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IV B.Tech I Semester

COURSE CODE – R2011XXYY	INTRODUCTION TO INTERNET OF THINGS (Open Elective – III)	CATEGORY OEC	L-T-P 3-0-0	CREDITS 3

Pre-requisite: Basics of Computer Organisation - Computer Networking

Course Outcomes: After the completion of the course the student should be able to:

		Knowledge Level (K)#
CO1	Adopt the various fundamentals architectures and technologies of Internet of Things.	
CO2	Develop various communication technologies used in the Internet of Things.	
CO3	Analyse the various device connectivity methods using web and internet in the IoT environment.	
CO4	Compute various data acquisition methods, data handling using cloud for IoT applications.	
CO5	Analyse the implementation of IoT from the case studies like Smart Home, Smart city, etc.	

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	2	2	2	--	--	--	--	--	--	--	1	3	1
CO2	1	--	2	2	3	--	--	--	--	--	--	--	1	3	1
CO3	1	--	--	2	3	--	--	--	--	--	--	2	1	3	1
CO4	1	--	--	2	3	--	--	--	--	--	--	2	1	3	1
CO5	1	--	1	2	3	--	--	--	--	--	--	2	1	3	1

(Please fill the above with Levels of Correlation - viz. - L-1 - M-2 - H-3)

UNIT	CONTENTS	Contact Hours
UNIT - 1	**The Internet of Things**: An Overview of Internet of Things (IoT) – IoT framework –Architecture – Technology behind IoT – Sources of the IoT – M2M Communication – Examples of IoT.	
UNIT - 2	**Design Principles For Connected Devices**: Introduction –IoT/M2M systems - Layers and Designs Standardization – Communication Technologies – Data Enrichment - Consolidation and Device Management at Gateway – Ease of designing and affordability.	
UNIT - 3	**Design Principles for the Web Connectivity**: Introduction – Web Communication protocols for Connected Devices - Message Communication protocols for Connected Devices – Web	

	Connectivity for connected devices network. Introduction to Internet Connectivity Principles - Internet connectivity - Internet based communication – IP addressing in the IoT – Application Layer Protocols: HTTP - HTTPS - FTP - Telnet - WAP (Wireless Application Protocol).	
UNIT - 4	**Data Acquiring - Organizing - Processing and Analytics:** Introduction – Data Acquiring and Storage – Organizing the Data – Analytics. **Data Collection - Storage and Computing Using a Cloud Platform:** Introduction – Cloud computing paradigm for data collection - storage and computing – IoTas a service and Cloud Service Models - IoT cloudbased services using the Xively (Pachube/COSM) - Nimbits and other platforms.	
UNIT - 5	**Sensor technology**: Actuator - Sensor data communication protocols - Radio Frequency Identification technology - Wireless Sensor Network Technology. IoT application case studies: Smart Home - Smart Cities - Environment monitoring and Agriculture practices.	
	Total	

Text Books:

1. Internet of Things: Architecture - Design Principles - Raj Kamal - McGraw Hill Education (India) Pvt. Limited - 2017.

Reference Books:

2. Designing the Internet of Things - Adrian McEwen and Hakim Cassimally - Wiley - First Edition - 2013.
3. Getting Started with the Internet of Things - Cuno Pfister - O'Reilly - 2011.
4. Internet of Things: A Hands-on Approach - Arshdeep Bahga - and Vijay Madisetti - 2014.

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IV B.Tech I Semester

COURSE CODE – R2011XXYY	CONCEPTS OF POWER SYSTEM ENGINEERING (Open Elective – IV)	CATEGORY OEC	L-T-P 3-0-0	CREDITS 3

Pre-requisite: Basics of Power Systems

Course Outcomes: After the completion of the course the student should be able to:

		Knowledge Level (K)#
CO1	Know the concepts of power generation by various types of power plants.	2
CO2	Learn about transmission line concepts and distribution systems schemes.	2
CO3	Learn about protection equipments and grounding methods of power system.	2
CO4	Know the economic aspects of electrical energy and their importance.	2
CO5	Know the importance of power factor improvement and voltage control in power systems.	3

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	1	2	1	-	-	-	-	-	-	2	3	2
CO2	1	2	2	1	2	1	-	-	-	-	-	-	2	3	2
CO3	1	2	2	1	2	1	-	-	-	-	-	-	2	3	2
CO4	1	2	2	1	2	1	-	-	-	-	-	-	2	3	2
CO5	2	2	2	1	2	1	-	-	-	-	-	-	2	3	2

(Please fill the above with Levels of Correlation - viz. - L-1 - M-2 - H-3)

UNIT	CONTENTS	Contact Hours
UNIT - 1	**Power Generation Concepts & Types** Generation and sources of Energy – working principle and Schematic diagram approach of Thermal Power Plant – Hydro Power Plant - Nuclear Power Plant – Gas Power Plants – Comparison between Power Plants.	
UNIT - 2	**Transmission and Distribution Concepts** Types of Conductors Materials – Constants of Transmission Line – Classification of Overhead Transmission Lines – Performance of Short Transmission Lines – Simple Problems. Basic concept of Sub Station – Distribution Systems – Connection Schemes of Distribution Systems – Structure of Cables – Differences between Overhead & Underground systems.	
UNIT - 3	**Protection and Grounding**	

	List of Faults – Basic concepts of fuse – Circuit Breakers – Relays – SF_6 Circuit Breakers – Vacuum Circuit Breakers – Operation of Lightning Arrester – Grounding and its advantages - Methods of Neutral Grounding: Resistance - Reactance and Resonant Grounding – Numerical Problems.	
UNIT - 4	**Economic Aspects** Definitions of Load - Load & Load Duration Curves - Load Factor - Demand Factor – Utilization Factor - Loss Factor – Types of Tariff - Cost of Electrical Energy – Expression for Cost of Electrical Energy – Numerical Problems	
UNIT - 5	**Power Factor Improvement and Voltage Control** Power Factor – Effects and Causes of low Power Factor- Shunt & Series Capacitor Compensation - Numerical Problems – Need of Voltage Control – Types of Voltage regulating Devices.	
	Total	

Text Books:

1. Principles of Power System by V.K.Mehata - Rohit Mehata - S.Chand Publishers.

Reference Books:

1. Electrical Power Systems by C.L.Wadwa - New Age International Publishers.

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IV B.Tech I Semester

COURSE CODE – R2011XXYY	FUNDAMENTALS OF ELECTRIC VEHICLES (Open Elective – IV)	CATEGORY OEC	L-T-P 3-0-0	CREDITS 3

Pre-requisite: Basics of Machines and Electronics.

Course Outcomes: After the completion of the course the student should be able to:

		Knowledge Level (K)#
CO1	Illustrate different types of electric vehicles.	
CO2	Select suitable power converters for EV applications.	
CO3	Design HEV configuration for a specific application.	
CO4	Choose an effective method for EV and HEV applications.	
CO5	Analyse a battery management system for EV and HEV.	

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	--	--	--	--	3	3	2	--	--	--	3	--	--	--
CO2	2	3	2	1	--	1	1	2	1	--	--	--	2	3	--
CO3	--	3	3	3	2	1	--	--	2	2	3	--	--	2	--
CO4	3	2	2	3	1	2	1	--	--	2	2	--	--	3	3
CO5	2	--	2	--	2	2	--	--	--	--	--	3	2	2	2

(Please fill the above with Levels of Correlation - viz. - L-1 - M-2 - H-3)

UNIT	CONTENTS	Contact Hours
UNIT - 1	**Introduction** Fundamentals of vehicles - Components of conventional vehicles - drawbacks of conventional vehicles – Need for electric vehicles - History of Electric Vehicles – Types of Electric Vehicles – Advantages and applications of Electric Vehicles.	
UNIT - 2	**Components of Electric Vehicles** Main components of Electric Vehicles – Power Converters - Controller and Electric Traction Motor – Rectifiers used in EVs – Bidirectional DC–DC Converters – Voltage Source Inverters – PWM inverters used in EVs.	
UNIT - 3	**Hybrid Electric Vehicles** Evolution of Hybrid Electric Vehicles – Advantages and Applications of Hybrid Electric Vehicles – Architecture of HEVs - Series and Parallel HEVs –	

	Complex HEVs – Range extended HEVs – Examples - Merits and Demerits.	
UNIT - 4	**Motors for Electric Vehicles** Characteristics of traction drive - requirements of electric machines for EVs – Different motors suitable for Electric and Hybrid Vehicles – Induction Motors – Synchronous Motors – Permanent Magnetic Synchronous Motors – Brushless DC Motors – Switched Reluctance Motors (Construction details and working only)	
UNIT - 5	**Energy Sources for Electric Vehicles** Batteries - Types of Batteries – Lithium-ion - Nickel-metal hydride - Lead-acid – Comparison of Batteries - Battery Management System – Ultra capacitors – Flywheels – Fuel Cell – it's working.	
	Total	

Text Books

1. Iqbal Hussein - Electric and Hybrid Vehicles: Design Fundamentals - CRC Press - 2021.
2. Denton - Tom. Electric and hybrid vehicles. Routledge - 2020.

Reference Books:

1. Kumar - L. Ashok - and S. Albert Alexander. Power Converters for Electric Vehicles. CRC Press - 2020.
2. Chau - Kwok Tong. Electric vehicle machines and drives: design - analysis and application. John Wiley & Sons - 2015.
3. Berg - Helena. Batteries for electric vehicles: materials and electrochemistry. Cambridge university press - 2015.

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IV B.Tech I Semester

COURSE CODE – R2011XXYY	INTRODUCTION TO MACHINE LEARNING (Open Elective – IV)	CATEGORY OEC	L-T-P 3-0-0	CREDITS 3

Pre-requisite: Basics of Computer Networks - Linear Algebra - Probability - statistics

Course Outcomes: After the completion of the course the student should be able to:

		Knowledge Level (K)#
CO1	Develop the concepts of computational intelligence like machine learning.	
CO2	Adapt the skill to apply machine learning techniques to address the real time problems in different areas	
CO3	Analyse the various learning forms in ANN and its usage in machine learning application.	
CO4	Illustrate the essence of Bayesian learning	
CO5	Analyse the importance of Genetic Algorithm	

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	1	1	-	-	-	-	-	-	-	3	1	2
CO2	3	3	3	2	1	-	-	-	-	-	-	-	3	1	2
CO3	3	3	2	2	1	-	-	-	-	-	-	-	3	1	2
CO4	3	2	2	1	2	-	-	-	-	-	-	-	3	1	2
CO5	3	3	2	2	2	-	-	-	-	-	-	-	3	1	2

(Please fill the above with Levels of Correlation - viz. - L-1 - M-2 - H-3)

UNIT	CONTENTS	Contact Hours
UNIT - 1	**Introduction:** Towards Intelligent Machines - Well-posed learning problems - designing a learning system - Perspectives and issues in machine learning. Concept learning and the general to specific ordering – introduction - a concept learning task - concept learning as search - find-S: finding a maximally specific hypothesis - version spaces and the candidate elimination algorithm - remarks on version spaces and candidate elimination - inductive bias**.**	
UNIT - 2	**Decision Tree Learning**: Introduction - decision tree representation - appropriate problems for decision tree learning - the basic decision tree learning algorithm - hypothesis space search in decision tree learning - inductive bias in decision tree learning -	

	issues in decision tree learning.	
UNIT - 3	**Artificial Neural Networks:** Introduction - neural network representation - appropriate problems for neural network learning - perceptions - multilayer networks and the back-propagation algorithm. **Reinforcement Learning** – Introduction - the learning task - Q–learning - non-deterministic - rewards and actions - temporal difference learning - generalizing from examples - relationship to dynamic programming.	
UNIT - 4	**Bayesian learning:** Introduction - Bayes theorem - Bayes theorem and concept learning - Maximum Likelihood and least squared error hypotheses - maximum likelihood hypotheses for predicting probabilities - minimum description length principle - Bayes optimal classifier - Gibs algorithm - Naïve Bayes classifier - an example: learning to classify text - Bayesian belief networks - the EM algorithm.	
UNIT - 5	**Genetic Algorithms:** Motivation - Genetic algorithms - an illustrative example - hypothesis space search - genetic programming - models of evolution and learning - parallelizing genetic algorithms.	
	Total	

Text Book:

1. Machine Learning – Tom M. Mitchell - - MGH

Reference Book:

1. Machine Learning: An Algorithmic Perspective - Stephen Marshland - Taylor & Francis

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IV B.Tech I Semester

COURSE CODE – R2011XXYY	INTRODUCTION TO SMART GRID (Open Elective – IV)	CATEGORY OEC	L-T-P 3-0-0	CREDITS 3

Pre-requisite: Basics of Renewable Energy

Course Outcomes: After the completion of the course the student should be able to:

		Knowledge Level (K)#
CO1	Describe the concepts of smart grids and analyse the smart grid policies and developments in smart grids.	
CO2	Develop concepts of smart grid technologies in hybrid electrical vehicles etc.	
CO3	Illustrate the concepts of smart substations - feeder automation - Battery Energy storage systems etc.	
CO4	Analyse micro grids and distributed generation systems.	
CO5	Analyse the effect of power quality in smart grid and to understand latest developments in ICT for smart grid.	

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	2	--	--	--	--	--	--	--	--	--	1	1	2
CO2	1	2	2	--	--	--	--	--	--	--	--	--	1	1	3
CO3	2	2	--	2	1	--	--	--	--	--	--	--	1	2	2
CO4	2	2	--	2	--	--	--	--	--	--	--	--	1	1	3
CO5	2	2	--	2	1	--	--	--	--	--	--	--	1	2	2

(Please fill the above with Levels of Correlation - viz. - L-1 - M-2 - H-3)

UNIT	CONTENTS	Contact Hours
UNIT - 1	**Introduction to Smart Grid** Evolution of Electric Grid - Concept of Smart Grid - Definitions - Need of Smart Grid - Functions of Smart Grid - Opportunities & Barriers of Smart Grid - Difference between conventional & smart grid - Concept of Resilient & Self-Healing Grid - Present development & International policies on Smart Grid. Case study of Smart Grid.	
UNIT - 2	**Smart Grid Technologies: Part 1** Introduction to Smart Meters - Real Time Pricing - Smart Appliances - Automatic Meter Reading(AMR) - Outage Management System(OMS) - Plug in Hybrid Electric Vehicles(PHEV) - Vehicle to Grid - Smart Sensors - Home & Building Automation - Phase Shifting Transformers - Net Metering.	

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UNIT - 3	**Smart Grid Technologies: Part 2** Smart Substations - Substation Automation - Feeder Automation. Geographic Information System(GIS) - Intelligent Electronic Devices (IED) & their application for monitoring & protection. Smart storage like Battery Energy Storage Systems (BESS) - Super Conducting Magnetic Energy Storage Systems (SMES) - Pumped Hydro - Compressed Air Energy Storage (CAES) - Wide Area Measurement System (WAMS) - Phase Measurement Unit (PMU).	
UNIT - 4	**Micro grids and Distributed Energy Resources** Concept of micro grid - need & applications of microgrid - formation of microgrid - Issues of interconnection - protection & control of microgrid - Integration of renewable energy sources - Demand Response.	
UNIT - 5	**Power Quality Management in Smart Grid** Power Quality & EMC in Smart Grid - Power Quality issues of Grid connected Renewable Energy Sources - Power Quality Conditioners for Smart Grid - Web based Power Quality monitoring - Power Quality Audit. **Information and Communication Technology for Smart Grid** Advanced Metering Infrastructure (AMI) - Home Area Network (HAN) - Neighborhood Area Network (NAN) - Wide Area Network (WAN).	
	Total	

Text Books:

1. Integration of Green and Renewable Energy in Electric Power Systems - by Ali Keyhani - Mohammad N. Marwali - Min Dai Wiley - 2009.
2. The Smart Grid: Enabling Energy Efficiency and Demand Response - by Clark W. Gellings - Fairmont Press - 2009.
3. Smart Grid: Technology and Applications - by Janaka B. Ekanayake - Nick Jenkins - Kithsiri Liyanage - Jianzhong Wu - Akihiko Yokoyama - Wiley publishers - 2012.
4. Smart Grids by Jean-Claude Sabonnadière - NouredineHadjsaïd - Wiley publishers - 2013.
5. Smart Power: Climate Changes - the Smart Grid - and the Future of Electric Utilities - by Peter S. Fox Penner - Island Press; 1st edition - 8 Jun 2010.
6. Microgrids and Active Distribution Networks by S. Chowdhury - S. P. Chowdhury - P. Crossley - Institution of Engineering and Technology - 30 Jun 2009

Reference Books:

1. The Advanced Smart Grid: Edge Power Driving Sustainability:1 by Andres Carvallo - John Cooper - Artech House Publishers July 2011
2. Control and Automation of Electric Power Distribution Systems (Power Engineering) by James Northcote - Green - Robert G. Wilson - CRC Press - 2017.
3. Substation Automation (Power Electronics and Power Systems) by MladenKezunovic - Mark G. Adamiak - Alexander P. Apostolov - Jeffrey George Gilbert - Springer - 2010.
4. Electrical Power System Quality by R. C. Dugan - Mark F. McGranghan - Surya Santoso - H. Wayne Beaty - McGraw Hill Publication - 2nd Edition.

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IV B.Tech I Semester

COURSE CODE – R2011XXYY	UNIVERSAL HUMAN VALUES 2: UNDERSTANDING HARMONY	CATEGORY HSMC	L-T-P 3-0-0	CREDITS 0

Pre-requisite:

Course Outcomes: After the completion of the course the student should be able to:

		Knowledge Level (K)#
CO1		
CO2		
CO3		
CO4		
CO5		

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	--	--	--	--	--	2	3	3	--	--	--	--	--	--	--
CO2	--	--	--	--	--	2	3	3	--	--	--	--	--	--	--
CO3	--	--	--	--	--	2	3	3	--	--	--	--	--	--	--
CO4	--	--	--	--	--	2	3	3	--	--	--	--	--	--	--
CO5	--	--	--	--	--	2	3	3	--	--	--	--	--	--	--
CO6	--	--	--	--	--	2	3	3	--	--	--	--	--	--	--

(Please fill the above with Levels of Correlation - viz. - L - M - H)

UNIT	CONTENTS	Contact Hours
	Module 1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education 1. Purpose and motivation for the course, recapitulation from Universal Human Values-I 2. Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration 3. Continuous Happiness and Prosperity- A look at basic Human Aspirations 4. Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority 5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario 6. Method to fulfil the above human aspirations: understanding and living in harmony	

at various levels.

Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking

Module 2: Understanding Harmony in the Human Being - Harmony in Myself!

7. Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
8. Understanding the needs of Self ('I') and 'Body' - happiness and physical facility
9. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
10. Understanding the characteristics and activities of 'I' and harmony in 'I'
11. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail
12. Programs to ensure Sanyam and Health.

Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease

Module 3: Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship

13. Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship
14. Understanding the meaning of Trust; Difference between intention and competence
15. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship
16. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals
17. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.

Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives

Module 4: Understanding Harmony in the Nature and Existence - Whole existence

as Coexistence

18. Understanding the harmony in the Nature
19. Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self- regulation in nature
20. Understanding Existence as Co-existence of mutually interacting units in all-pervasive space
21. Holistic perception of harmony at all levels of existence.

Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

Module 5: Implications of the above Holistic Understanding of Harmony on Professional ethics

22. Natural acceptance of human values
23. Definitiveness of Ethical Human Conduct
24. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
25. Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people- friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.
26. Case studies of typical holistic technologies, management models and production systems
27. Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations
28. Sum up.

Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions eg. to discuss the conduct as an engineer or scientist etc.

Text Book:

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010

Reference Books:

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.

3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj - PanditSunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

4. MODE OF CONDUCT (L-T-P-C 2-1-0-3 or 2L: 1T:0P 3 credits)

Lectures hours are to be used for interactive discussion, placing the proposals about the topics at hand and motivating students to reflect, explore and verify them.

Tutorial hours are to be used for practice sessions.

While analysing and discussing the topic, the faculty mentor's role is in pointing to essential elements to help in sorting them out from the surface elements. In other words, help the students explore the important or critical elements.

In the discussions, particularly during practice sessions (tutorials), the mentor encourages the student to connect with one's own self and do self-observation, self-reflection and self-exploration. Scenarios may be used to initiate discussion. The student is encouraged to take up" ordinary" situations rather than" extra-ordinary" situations. Such observations and their analyses are shared and discussed with other students and faculty mentor, in a group sitting.

Tutorials (experiments or practical) are important for the course. The difference is that the laboratory is everyday life, and practical are how you behave and work in real life. Depending on the nature of topics, worksheets, home assignment and/or activity are included. The practice sessions (tutorials) would also provide support to a student in performing actions commensurate to his/her beliefs. It is intended that this would lead to development of commitment, namely behaving and working based on basic human values.

It is recommended that this content be placed before the student as it is, in the form of a basic foundation course, without including anything else or excluding any part of this content. Additional content may be offered in separate, higher courses.

This course is to be taught by faculty from every teaching department, including HSS faculty. Teacher preparation with a minimum exposure to at least one 8-day FDP on Universal Human Values is deemed essential.

5. ASSESSMENT:

This is a compulsory credit course. The assessment is to provide a fair state of development of the student, so participation in classroom discussions, self-assessment, peer assessment etc. will be used in evaluation.

Example:

Assessment by faculty mentor: 10 marks Self-assessment: 10 marks
Assessment by peers: 10 marks
Socially relevant project/Group Activities/Assignments: 20 marks Semester End Examination: 50 marks

The overall pass percentage is 40%. In case the student fails, he/she must repeat the course.

6. OUTCOME OF THE COURSE:

By the end of the course, students are expected to become more aware of themselves, and their surroundings (family, society, nature); they would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind. They would have better critical ability. They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society). It is hoped that they would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.

This is only an introductory foundationalinput. It would be desirable to follow it up by

a) faculty-student or mentor-mentee programs throughout their time with the institution
b) Higher level courses on human values in every aspect of living. E.g. as a professional

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	Total	

Text Books:

1.

Reference Books:

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IV B.Tech I Semester

COURSE CODE – R2011XXYY	SKILLED ADVANCED COURSE – IOT APPLICATIONS IN ELECTRICAL ENGINEERING LAB	CATEGORY SC	L-T-P 0-0-4	CREDITS 2

Pre-requisite: Concepts of Computer Organisation - Computer Networks.

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

		Knowledge Level (K)#
CO1	Apply various technologies of Internet of Things to real time applications.	
CO2	Apply various communication technologies used in the Internet of Things.	
CO3	Demonstrate the devices using web and internet in the IoT environment.	
CO4	Develop IoT to study Smart Home - Smart city - etc.	
CO5	Apply various technologies of Internet of Things to real time applications.	

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	2	--	--	--	--	--	--	--	1	3	1
CO2	2	2	2	2	3	--	--	--	--	--	--	--	1	3	1
CO3	2	2	2	2	3	--	--	--	--	--	--	2	1	3	1

(Please fill the above with Levels of Correlation - viz. - L-1 - M-2 - H-3)

S.No	CONTENTS	Contact Hours
	List of Experiments: **Any TEN of the following Experiments are to be conducted**	
1.	Familiarization with Arduino/Raspberry Pi and perform necessary software installation.	
2.	To interface LED/Buzzer with Arduino/Raspberry Pi and write a program to turn ON LED for 1 sec after every 2 seconds.	
3.	To interface Push button/Digital sensor (IR/LDR) with Arduino/Raspberry Pi and write a program to turn ON LED when push button is pressed or at sensor detection.	
4.	To interface temperature sensor with Arduino/Raspberry Pi and write a program to print temperature and humidity readings.	
5.	To interface Organic Light Emitting Diode (OLED) with Arduino/Raspberry Pi	

6.	To interface Bluetooth with Arduino/Raspberry Pi and write a program to send sensor data to smartphone using Bluetooth.	
7.	To interface Bluetooth with Arduino/Raspberry Pi and write a program to turn LED ON/OFF when '1'/'0' is received from smartphone using Bluetooth.	
8.	Write a program on Arduino/Raspberry Pi to upload and retrieve temperature and humidity data to thingspeak cloud.	
9.	7 Segment Display	
10.	Analog Input & Digital Output	
11.	Night Light Controlled & Monitoring System	
12.	Fire Alarm Using Arduino	
13.	IR Remote Control for Home Appliances	
14.	A Heart Rate Monitoring System	
15.	Alexa based Home Automation System	

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IV B.Tech I Semester

COURSE CODE – R2011XXYY	INDUSTRIAL / RESEARCH INTERNSHIP 2 MONTHS (MANDATORY) AFTER THIRD YEAR (TO BE EVALUATED DURING VII SEMESTER)	CATEGORY PROJ	L-T-P 0-0-3	CREDITS 3

Pre-requisite:

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

		Knowledge Level (K)#
CO1		
CO2		
CO3		
CO4		
CO5		

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1															
CO2															
CO3															
CO4															
CO5															
CO6															

(Please fill the above with Levels of Correlation - viz. - L - M - H)

UNIT	CONTENTS	Contact Hours
UNIT - 1		
UNIT - 2		
UNIT - 3		
UNIT - 4		
UNIT - 5		
	Total	

Text books and Reference Books:

1.

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IV B.Tech II Semester

COURSE CODE – R2011XXYY	PROJECT WORK - SEMINAR AND INTERNSHIP IN INDUSTRY (6 MONTHS)	CATEGORY PROJ	L-T-P 0-0-0	CREDITS 12

Pre-requisite:

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

		Knowledge Level (K)#
CO1		
CO2		
CO3		
CO4		
CO5		

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1															
CO2															
CO3															
CO4															
CO5															
CO6															

(Please fill the above with Levels of Correlation - viz. - L - M - H)

S.No	CONTENTS	Contact Hours
	List of Experiments: **Any TEN of the following Experiments are to be conducted**	
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		

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II B.Tech II Semester

COURSE CODE – R2011XXYY	COMMUNICATION SYSTEMS (Honors Course)	CATEGORY	L-T-P 4-0-0	CREDITS 4

Pre-requisite:

Course Outcomes: After the completion of the course the student should be able to:

		Knowledge Level (K)#
CO1	Understand the basics of communication system, analog and digital modulation techniques.	
CO2	Apply the knowledge of digital electronics and understand the error control coding techniques.	
CO3	Adapting various PWM Techniques.	
CO4	Apply the knowledge of digital electronics and understand the error control coding techniques	
CO5	Summarize different types of communication systems and its requirements	

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	--	1	--	--	--	--	--	--	--	--	2	--	1
CO2	2	--	--	--	2	--	--	--	--	--	--	--	--	2	--
CO3	--	--	2	--	--	--	--	--	--	--	--	--	2	--	1
CO4	1	2	--	2	--	--	--	--	--	--	--	--	--	2	--
CO5	2	--	1	--	2	--	--	--	--	--	--	--	2	--	1

(Please fill the above with Levels of Correlation, viz., L-1, M-2, H-3)

UNIT	CONTENTS	**Contact Hours**

Unit – I:
Basic blocks of Communication System. Analog Modulation - Principles of Amplitude Modulation, DSBSC, SSB-SC and VSB-SC, AM transmitters and receivers.

Unit- II:
Angle Modulation - Frequency and Phase Modulation. Transmission Bandwidth of FM signals, Methods of generation and detection, FM Transmitters and Receivers.

Unit–III:
Sampling theorem - Pulse Modulation Techniques - PAM, PWM and PPM concepts - PCM system – Data transmission using analog carriers (BASK, BFSK, BPSK, QPSK).

	UNIT -IV: **Error control coding techniques** – Linear block codes- Encoder and decoder, Cyclic codes – Encoder, Syndrome Calculator, Convolution codes. **UNIT -V:** **Modern Communication Systems** – Microwave communication systems - Optical communication system - Satellite communication system - Mobile communication system.	
	Total	

Text Books:

1. Simon Haykins, 'Communication Systems', John Wiley, 3rd Edition, 1995.
2. D.Roddy & J.Coolen, 'Electronic Communications', Prentice Hall of India, 4th Edition, 1999.
3. Kennedy G, 'Electronic Communication System', McGraw Hill, 1987.

Reference Books:

1. Shulin Daniel, 'Error Control Coding', Pearson, 2nd Edition, 2011.
2. B.P. Lathi and Zhi Ding, 'Modern Digital and Analog Communication Systems', OUP USA Publications, 4th Edition, 2009.

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II B.Tech II Semester

COURSE CODE – R2011XXYY	SPECIAL ELECTRIC MACHINES (Honors Course)	CATEGORY	L-T-P 4-0-0	CREDITS 4

Pre-requisite: Concepts of Electrical Machines

Course Outcomes: After the completion of the course the student should be able to:

		Knowledge Level (K)#
CO1	Learn merits of PMDC motor	
CO2	Choose best control scheme for stepper motor	
CO3	Construct the various converter circuits for Switched Reluctance Motors.	
CO4	Analyse the characteristics of Brushless dc Motor.	
CO5	Understand the operation of Linear Induction Motors.	

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	--	1	--	--	--	--	--	--	--	--	1	1	--	--
CO2	2	1	2	2	--	--	--	--	--	--	--	--	2	2	2
CO3	1	2	2	-	--	--	--	--	--	--	1	1	1	2	2
CO4	1	2	--	1	2	--	--	--	--	1	--	--	1	1	1
CO5	2	--	2	1	1	2	1	--	--	2	2	2	2	2	3

(Please fill the above with Levels of Correlation, viz., L=1, M=2, H=3)

UNIT	CONTENTS	Contact Hours
UNIT - 1	**Permanent Magnet Materials and PMDC motors** Introduction - classification of permanent magnet materials used in electrical machines - minor hysteresis loop and recoil line - Stator frames of conventional dc machines - Development of electronically commutated dc motor from conventional dc motor – Permanent magnet materials and characteristics - B-H loop and demagnetization characteristics-high temperature effects-reversible losses - Irreversible losses - Mechanical properties - handling and magnetization - Application of permanent magnets in motors - power density - operating temperature range - severity of operation duty.	

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UNIT - 2	**Stepper Motors** Principle of operation of Stepper Motor – Constructional details - Classification of stepper motors – Different configuration for switching the phase windings - Control circuits for stepper motors – Open loop and closed loop control of two phase hybrid stepping motor.	
UNIT - 3	**Switched Reluctance Motors** Construction and Principle of operation of Switched Reluctance Motor – Comparison of conventional and switched reluctance motors – Design of stator and rotor pole arcs. Torque producing principle and torque expression – Different converter configurations for SRM – Drive and power circuits for SRM – Position sensing of rotor – Applications of SRM.	
UNIT - 4	**Permanent Magnet Brushless DC Motor** Principle of operation of BLDC motor - Types of constructions - Surface mounted and interior type permanent magnet DC Motors - Torque and EMF equations for Square wave & Sine wave for PMBLDC Motor – Torque - Speed characteristics of Square wave & Sine wave for PMBLDC Motor - Merits & demerits of Square wave & Sine wave for PMBLDC Motor - Performance and efficiency – Applications.	
UNIT - 5	**Linear Induction Motors (LIM)** Construction– principle of operation – Double sided LIM from rotating type Induction Motor – Schematic of LIM drive for traction – Development of one sided LIM with back iron - equivalent circuit of LIM.	
	Total	

Text Books:

1. Brushless Permanent magnet and reluctance motor drives, Clarenden press, T.J.E. Miller, 1989, Oxford.
2. Special electrical Machines, K.Venkata Ratnam, University press, 2009, New Delhi.

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II B.Tech II Semester

COURSE CODE – R2011XXYY	SIGNALS AND SYSTEMS (Honors Course)	CATEGORY	L-T-P 4-0-0	CREDITS 4

Pre-requisite: Basics of Mathematics

Course Outcomes: After the completion of the course the student should be able to:

		Knowledge Level (K)#
CO1	Apply the knowledge of various signals and operations.	
CO2	Analyze the spectral characteristics of periodic signals using Fourier Analysis.	
CO3	Classify the systems based on their properties and determine the response of LSI system using convolution.	
CO4	Understand the process of sampling and the effects of under sampling.	
CO5	Apply Laplace and z-transforms to analyze signals and Systems (continuous & discrete).	

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	--	--	--	--	--	--	--	--	--	2	2	2
CO2	1	2	2	--	--	--	--	--	--	--	--	--	2	2	2
CO3	2	2	2	2	1	--	--	--	--	--	--	--	2	2	2
CO4	--	2	2	1	--	--	--	--	--	--	--	--	2	2	2
CO5	3	3	3	--	--	--	--	--	--	--	--	--	2	2	2

(Please fill the above with Levels of Correlation, viz., L=1, M=2, H=3)

UNIT	CONTENTS	Contact Hours
UNIT - 1	**Introduction** Definition of Signals and Systems - Classification of Signals - Classification of Systems - Operations on signals: time-shifting - time-scaling - amplitude-shifting - amplitude-scaling. Problems on classification and characteristics of Signals and Systems. Complex exponential and sinusoidal signals - Singularity functions and related functions: impulse function - step function signum function and ramp function. Analogy between vectors and signals - orthogonal signal space - Signal approximation using orthogonal functions - Mean square error - closed or complete set of orthogonal functions - Orthogonally in complex functions. Related Problems.	

UNIT - 2	**Fourier Series And Fourier Transform** Fourier series representation of continuous time periodic signals - properties of Fourier series - Dirichlet's conditions - Trigonometric Fourier series and Exponential Fourier series - Relation between Trigonometric and Exponential Fourier series - Complex Fourier spectrum. Deriving Fourier transform from Fourier series - Fourier transform of arbitrary signal - Fourier transform of standard signals - Fourier transform of periodic signals - properties of Fourier transforms - Fourier transforms involving impulse function and Signum function. Introduction to Hilbert Transform. Related Problems.	
UNIT - 3	**Analysis Of Linear Systems** Introduction - Linear system - impulse response - Response of a linear system - Linear time invariant (LTI) system - Linear time variant (LTV) system - Concept of convolution in time domain and frequency domain - Graphical representation of convolution - Transfer function of a LTI system - Related problems. Filter characteristics of linear systems. Distortion less transmission through a system - Signal bandwidth - system bandwidth - Ideal LPF - HPF and BPF characteristics - Causality and Poly-Wiener criterion for physical realization - relationship between bandwidth and rise time.	
UNIT - 4	**Correlation** Auto-correlation and cross-correlation of functions - properties of correlation function - Energy density spectrum - Parseval's theorem - Power density spectrum - Relation between Convolution and correlation - Detection of periodic signals in the presence of noise by correlation - Extraction of signal from noise by filtering. **Sampling Theorem** Graphical and analytical proof for Band Limited Signals - impulse sampling - Natural and Flat top Sampling - Reconstruction of signal from its samples - effect of under sampling – Aliasing - Introduction to Band Pass sampling - Related problems.	
UNIT - 5	**Laplace Transforms** Introduction - Concept of region of convergence (ROC) for Laplace transforms - constraints on ROC for various classes of signals - Properties of L.T's - Inverse Laplace transform - Relation between L.T's - and F.T. of a signal. Laplace transform of certain signals using waveform synthesis. **Z–Transforms** Concept of Z- Transform of a discrete sequence. Region of convergence in Z-Transform - constraints on ROC for various classes of signals - Inverse Z-transform - properties of Z-transforms. Distinction between Laplace - Fourier and Z transforms.	
	Total	

Text Books:

1. Signals - Systems & Communications - B.P. Lathi - BS Publications - 2003.
2. Signals and Systems - A.V. Oppenheim - A.S. Willsky and S.H. Nawab - PHI - 2nd Edn - 1997
3. Signals & Systems - Simon Haykin and Van Veen - Wiley - 2nd Edition - 2007

Reference Books:

1. Principles of Linear Systems and Signals – BP Lathi - Oxford University Press - 2015
2. Signals and Systems – T K Rawat - Oxford University press - 2011

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III B.Tech I Semester

COURSE CODE – R2011XXYY	HVDC TRANSMISSION (Honors Course)	CATEGORY	L-T-P 4-0-0	CREDITS 4

Pre-requisite: Concepts of Power Systems and Power Electronics.

Course Outcomes: After the completion of the course the student should be able to:

		Knowledge Level (K)#
CO1	Learn the basic concepts of HVDC Transmission & their converters	
CO2	Identify the electrical requirements of HVDC lines.	
CO3	Understand the HVDC System Control Strategies with respect to protection.	
CO4	Understand the various sources of reactive power	
CO5	Understand the Multi Terminal HVDC Systems.	

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	1	2	3	-	-	-	-	-	3	2	3	1
CO2	3	2	3	1	2	3	-	-	-	-	-	2	2	3	1
CO3	3	2	3	1	2	3	-	-	-	-	-	2	2	3	1
CO4	3	2	3	1	2	2	-	-	-	-	-	3	2	3	1
CO5	3	2	3	1	2	2	-	-	-	-	-	2	2	3	1

(Please fill the above with Levels of Correlation, viz., 3: Strong, 2: Moderate, 1: Weak)

UNIT	CONTENTS	Contact Hours
UNIT - 1	**DC Power Transmission Technology** Introduction - Historical Development - Comparison of AC and DC transmission - types of DC links - Existing HVDC Projects in INDIA. Modern Trends in HVDC Technology. **Analysis of HVDC Converters** Three Phase 6-Pulse bridge converter - simplified analysis - waveform with and without overlap - Current and voltage relationship - Equivalent circuits of converters - Analysis of a 12 pulse converters.	
UNIT - 2	**HVDC System Control** Principles of DC link control - converter control characteristics - constant	

	current and constant extinction angle control - constant ignition angle control - starting and stopping of HVDC link - power control & power reversal in HVDC link.	
UNIT - 3	**Converter Faults and Protection** Converter faults - over voltages in converter station - Surge arrestors - Protection against over voltages and over currents. Protection against faults in voltage source converter. Smoothing Rector - Transient over voltages for DC line – Protection of DC lines.	
UNIT - 4	**Reactive Power Control:** Sources of reactive power - Static VAR system – SVC and STATCOM - Reactive power control during transients. **Harmonics & Filters:** Generation of harmonics – Types and design of various AC filters - DC filters – Active Filters.	
UNIT - 5	**Multi Terminal HVDC Systems & DC Circuit Breakers:** Types of MTDC systems - Control and Protection of MTDC system – HVDC insulation – DC line insulators – DC breakers – Characteristics and types of DC breakers.	
	Total	

Text Book

1. K. R. Padiyar - "HVDC Power Transmission Systems Technology and System Interactions" - New Age International (p) Limited - New Delhi - 2003.
2. Edward Wilson Kimbark - "Direct current Transmission" - Wiley Interscience - Vol. I - New York - 1971.

Reference Books

1. Vijay K. Sood - "HVDC and FACTS Controller: Application of Static Converters in power systems" - IEEE Power Electronics and Power Systems series - Kluwer Academic publishers - Boston - First edition January 2004.
2. C. Adamson and N.G. Hingorani - "High voltage DC power Transmission" - Garraway Limited - England - 1960.
3. Mohan - Undeland and Robbins - "Power Electronics Converters - Applications and Design - John Wiley & Son - Inc. - 2003.
4. J. Arrialga - "HVDC Transmission" - Peter Peregrinus Ltd. - London - 1983.

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III B.Tech I Semester

COURSE CODE – R2011XXYY	POWER QUALITY (Honors Course)	CATEGORY	L-T-P 4-0-0	CREDITS 4

Pre-requisite: Concepts of Power Systems

Course Outcomes: After the completion of the course the student should be able to:

		Knowledge Level (K)#
CO1	Differentiate between different types of power quality problems.	
CO2	Explain the sources of voltage sag - voltage swell - interruptions - transients - long duration over voltages and harmonics in a power system.	
CO3	Explain the principle of voltage regulation and improvement methods.	
CO4	Analyse voltage distortion and current distortion and their indices.	
CO5	Know the concepts of distributed generation technologies and power quality monitoring.	

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	2	2	1	1	1	1	1	2	2	2	1	1
CO2	1	2	2	1	1	2	1	1	1	1	2	2	2	2	2
CO3	2	2	2	1	1	1	1	1	1	1	1	2	3	2	1
CO4	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2
CO5	2	2	2	1	1	1	1	1	1	1	1	2	2	1	1

(Please fill the above with Levels of Correlation - viz. - L-1 - M-2 - H-3)

UNIT	CONTENTS	Contact Hours
UNIT - 1	**Introduction - Terms & Definitions** Overview of power quality – Concern about the power quality – General classes of power quality and voltage quality problems – Transients – Long–duration voltage variations – Short–duration voltage variations – Voltage unbalance – Waveform distortion – Voltage fluctuation – Power frequency variations – Voltage Sags – Voltage Swell.	
UNIT - 2	**Transient Over Voltages** Sources of Transient Over voltages - Principles of Over voltage protection- Devices for Over voltage protection – Utility Capacitor Switching Transients -	

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	Utility System Lightning Protection – Managing Ferro resonance – Switching Transient Problems with Loads.	
UNIT - 3	**Long – Duration Voltage Variations** Principles of regulating the voltage – Device for voltage regulation – Utility voltage regulator application – Capacitor for voltage regulation – End–user capacitor application – Regulating utility voltage with distributed resources – Flicker	
UNIT - 4	**Harmonic distortion and solutions** Voltage distortion vs. Current distortion –Harmonic indices: THD - TDD and True Power Factor– Sources of harmonics – Effect of harmonic distortion – Impact on capacitors - transformers - motors and meters – Concept of Point of common coupling – Passive and active filtering – Numerical problems.	
UNIT - 5	**Distributed Generation and Monitoring** Resurgence of distributed generation – DG technologies – Interface to the utility system – Power quality issues and operating conflicts – DG on low voltage distribution networks. **Monitoring** Power quality monitoring and considerations – Historical perspective of PQ measuring instruments – PQ measurement equipment – Assessment of PQ measuring data.	
	Total	

Textbooks:

1. Electrical Power Systems Quality - Dugan R C - McGranaghan M F - Santoso S - andBeaty H W - Second Edition - McGraw–Hill - 2012 - 3rd edition.
2. Electric power quality problems –M.H.J.Bollen IEEE series-Wiley india publications - 2011.
3. Power Quality Primer - Kennedy B W - First Edition - McGraw–Hill - 2000.

Reference Books:

1. Understanding Power Quality Problems: Voltage Sags and Interruptions - Bollen M HJ - First Edition - IEEE Press; 2000.
2. Power System Harmonics - Arrillaga J and Watson N R - Second Edition - John Wiley & Sons - 2003.
3. Electric Power Quality control Techniques - W. E. Kazibwe and M. H. Sendaula - Van Nostrad Reinhold - New York.
4. Power Quality c.shankaran - CRC Press - 2001
5. Harmonics and Power Systems –Franciso C.DE LA Rosa–CRC Press (Taylor & Francis)
6. Power Quality in Power systems and Electrical Machines–EwaldF.fuchs - Mohammad A.S.Masoum–Elsevier.

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III B.Tech I Semester

COURSE CODE – R2011XXYY	ELECTRICAL MACHINE DESIGN (Honors Course)	CATEGORY	L-T-P 4-0-0	CREDITS 4

Pre-requisite: Electrical Machines

Course Outcomes: After the completion of the course the student should be able to:

		Knowledge Level (K)#
CO1	Select a proper material for the design of electrical machine.	
CO2	Design the output equations of a dc machine with overall dimensions.	
CO3	Design a overall transformer further requirements.	
CO4	Design of stator core and other characteristics of Induction Motor.	
CO5	Design overall dimensions of Synchronous Machine.	

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1	1	1	1	--	--	--	1	1	3	2	2
CO2	3	2	2	2	1	1	--	--	--	--	1	--	3	2	2
CO3	3	2	2	2	2	1	--	--	--	--	1	--	3	2	2
CO4	3	2	2	2	2	1	--	--	--	--	1	--	3	2	2
CO5	3	2	2	2	2	1	--	--	--	--	1	--	3	2	2

(Please fill the above with Levels of Correlation - viz. - L=1 - M=2 - H=3)

UNIT	CONTENTS	Contact Hours
UNIT - 1	**Fundamental Aspects of Electrical Machine Design** Design of machines - design factors - limitation in design - modern trends in electrical machine design – types of magnetic and insulating materials – modes of heat dissipation – cooling of rotating machines – methods of cooling.	
UNIT - 2	**Design of DC Machines** Construction details – design of different windings – output equation – selection of specific magnetic and electric loadings - separation of D and L – estimation of number of conductors - armature slots and conduct dimensions – choice of number of poles and calculation of length of airgap – design of field systems - interpoles and brushes.	
UNIT - 3	**Design of Transformers**	

	Transformer windings – output equation – determination of number of turns and length of mean term – design of core - choice of flux density – resistance and leakage reactance – no load current calculation – losses and efficiency – design of efficiency - cooling of transformers- calculation of number of tubes	
UNIT - 4	**Design of Induction Motors** Comparison between squirrel cage and wound rotors – choice of average flux density and ampere conduction for meter – output equation – design of stator slots and rotor slots – design of no load current – dispersion coefficient and its effects on performance of induction motor.	
UNIT - 5	**Design of Synchronous Machines** Types of construction – output equation - main dimensions – short circuit ration and its effects on the performance – design of rotor – temperature rise and its effects.	
	Total	

Text Books:

1. "Electrical Machine Design" - A.K.Sawhney - Dhanpath Rai & Co. - 2016

Reference Books:

1. "Performance and Design of DC Machines" - Clayton & Hancock - ELBS.
2. "Performance and Design of AC Machines" - M.G.Say; Pitman - ELBS.

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III B.Tech II Semester

COURSE CODE – R2011XXYY	DIGITAL CONTROL SYSTEMS (Honors Course)	CATEGORY PCC	L-T-P 4-0-0	CREDITS 4

Pre-requisite: Concepts of Advanced Control Systems - basics of Engineering Mathematics.

Course Outcomes: After the completion of the course the student should be able to:

		Knowledge Level (K)#
CO1	Illustarte advantages of digital systems - sampling and data reconstruction.	
CO2	Calculate Z Transform and Inverse Z Transfer function - pulse transfer functions of open and closed loop response.	
CO3	Construct various canonical forms and concepts of controllability and observability.	
CO4	Compute the absolute and relative stability of discrete time systems using Routh Stability criterion - and Root Locus - Design lag and lead compensators to improve system performance using bode diagrams.	
CO5	Design of state feedback controllers and state observers.	

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	--	--	--	--	--	--	1	2	2	1	2
CO2	3	2	2	1	--	--	--	--	--	--	--	2	2	1	1
CO3	2	2	2	2	--	--	--	--	--	--	--	2	2	2	1
CO4	2	2	1	2	--	--	--	--	--	--	--	2	2	2	2
CO5	2	2	2	2	1	--	--	--	--	--	1	2	2	1	2

(Please fill the above with Levels of Correlation - viz. - L=1 - M=2 - H=3)

UNIT	CONTENTS	Contact Hours
UNIT - 1	**Introduction And Signal Processing** Introduction to analog and digital control systems – Advantages of digital systems – Typical examples – Continuous and Discrete Time Signals – Sample and hold devices – Sampling theorem and data reconstruction – Frequency domain characteristics of zero order hold.	
UNIT - 2	**Z–Transformations** z–Transforms – Theorems – Finding inverse z–transforms – Formulation of difference equations and solving – Block diagram representation – Pulse transfer functions and finding open loop and closed loop responses.	

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UNIT - 3	**State Space Analysis And The Concepts of Controllability And Observability** State space representation of discrete time systems – Solving Discrete Time state space equations – State transition matrix and its properties – Discretization of continuous time state equations – Concepts of controllability and observability – Tests(without proof).	
UNIT - 4	**Stability Analysis** Mapping between the s–Plane and the z–Plane – Primary strips and Complementary strips – Stability criterion – Modified Routh's stability criterion and Jury's stability test. **Design of Discrete–Time Control Systems By Conventional Methods** Transient and steady state specifications – Design using frequency response in the w–plane for lag and lead compensators – Root locus technique in the z–plane.	
UNIT - 5	**State Feedback Controllers and State Observers** Design of state feedback controller through pole placement – Necessary and sufficient conditions – Ackerman's formula – Design of state observers (Full Order and Reduced Order).	
	Total	

Text Book:

1. Discrete–Time Control systems – K. Ogata - Pearson Education/PHI - 2nd Edition.
2. Digital Control and State Variable Methods by M.Gopal - TMH - 4th Edition.

Reference Books:

1. Digital Control Systems - Kuo - Oxford University Press - 2nd Edition - 2003.

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III B.Tech II Semester

COURSE CODE – R2011XXYY	ANALYSIS OF POWER ELECTRONIC CONVERTERS (Honors Course)	CATEGORY PCC	L-T-P 4-0-0	CREDITS 4

Pre-requisite: Power Electronics and Electric Drives.

Course Outcomes: After the completion of the course the student should be able to:

		Knowledge Level (K)#
CO1	Describe and analyze the characteristics of Switching devices	
CO2	Demonstrate the operation and perform harmonic analysis of AC-DC power converters.	
CO3	Analyze the operation of single-phase and three-phase inverters with PWM control.	
CO4	Illustrate the principles of operation of multilevel inverters	
CO5	PWM Control of CHB and diode clamped multilevel inverters	

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1	1	2	-	-	-	-	-	-	2	3	1
CO2	3	3	2	2	3	2	-	-	-	-	-	2	2	3	2
CO3	3	3	2	2	3	3	-	-	-	-	-	3	2	3	2
CO4	3	3	2	2	3	2	-	-	-	-	-	2	2	3	3
CO5	3	3	3	3	3	3	-	-	-	-	-	3	2	3	3

(Please fill the above with Levels of Correlation, viz., 3: Strong, 2: Moderate, 1: Weak)

UNIT	CONTENTS	Contact Hours
UNIT - 1	**Overview of Switching Devices** Power MOSFET, IGBT, GTO -static and dynamic characteristics, gate drive circuits for switching devices.	
UNIT - 2	**AC-DC Converters** Single-phase fully-controlled converters with RL load– Evaluation of input power factor and harmonic factor-Continuous and Discontinuous load current, Power factor improvements, Extinction angle control, symmetrical angle control, PWM control. Three-Phase AC-DC Converters, fully-controlled Converters with RL load, Evaluation of input power factor and harmonic factor, Continuous and Discontinuous load current-three-phase dual converters.	
UNIT - 3	**PWM Inverters** Principle of operation-Voltage control of single-phase inverters - phase displacement	

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	Control –Bipolar PWM– Unipolar PWM- staircase PWM. Voltage Control of Three-Phase Inverters- Sinusoidal PWM- Third Harmonic PWM- Space Vector Modulation-Comparison of PWM Techniques- Three phase current source inverters-Variable dc link inverter.	
UNIT - 4	**Multilevel Inverters** Introduction, Multilevel Concept, Types of Multilevel Inverters- Diode-Clamped Multilevel Inverter, Principle of Operation, Features of Diode-Clamped Inverter-Flying-Capacitors Multilevel Inverter- Principle of Operation, Features of Flying-Capacitors Inverter- Cascaded H-bridge Multilevel Inverter, Principle of Operation, Features of Cascaded H-bridge Inverter- Comparisons of Multilevel inverters.	
UNIT - 5	**PWM Multilevel Inverters** CHB Multilevel Inverter: SHE PWM- Phase shifted PWM-Level shifted PWM-Diode clamped Multilevel inverter: SHE PWM-Sinusoidal PWM- Space vector PWM-Capacitor voltage balancing.	
	Total	**48 Hrs**

Text Books

1. Power Electronics: Converters, Applications, and Design- Ned Mohan, Tore M. Undeland, William P. Robbins, John Wiley& Sons, 2nd Edition, 2003.
2. Power Electronics-Md.H.Rashid –Pearson Education Third Edition- First IndianReprint-2008.
3. HIGH-POWER CONVERTERS AND AC DRIVES – Bin Wu, Wiley-IEEE Press, 2006.

Reference Books:

1. Elements of Power Electronics – Philip T. Krein, Oxford University press, 2014.
2. Power Converter Circuits – William Shepherd & Li Zhang-Yes Dee CRC Press, 2004.
3. Power Electronics Daniel W. Hart - McGraw-Hill,2011.

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III B.Tech II Semester

COURSE CODE – R2011XXYY	VLSI DESIGN (Honors Course)	CATEGORY	L-T-P 4-0-0	CREDITS 4

Pre-requisite:

Course Outcomes: After the completion of the course the student should be able to:

		Knowledge Level (K)#
CO1	Understand the insights of the MOS devices and its characteristics.	
CO2	Appreciate the different VLSI process technologies.	
CO3	Design the CMOS combinational logic circuits and its layout.	
CO4	Develop the sequential circuits and clocking schemes.	
CO5	Realize the Design flow of application-specific Integrated circuit.	

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	--	--	2	2	--	--	--	--	--	--	--	1	--	1
CO2	--	--	--	--	--	--	--	--	--	--	--	--	--	2	--
CO3	--	1	2	--	1	--	--	--	--	--	--	--	--	--	3
CO4	1	--	--	--	--	--	--	--	--	--	--	--	2	1	--
CO5	--	--	2	--	2	--	--	--	--	--	--	--	1	--	2

(Please fill the above with Levels of Correlation - viz. - L-1 - M-2 - H-3)

UNIT	CONTENTS	**Contact Hours**

UNIT – I:
Introduction to MOS Devices
MOS characteristics: NMOS characteristics, inverter action – CMOS characteristics, inverter action - models and second order effects of MOS transistors – Current equation – MOSFET Capacitances - MOS as Switch, Diode/ resistor – current source and sink – Current mirror.

UNIT – II:
MOS Fabrication
CMOS Fabrication – n-well, p-well, twin-tub processes – fabrication steps – crystal growth –

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Photolithography – oxidation – diffusion – Ion implantation – etching – metallization.

UNIT – III:
CMOS Logic Circuits
CMOS Logic Circuits: Implementation of logic circuits using nMOS and CMOS, Pass transistor and transmission gates – Implementation of combinational circuits – parity generator – magnitude comparator – stick diagram – Design rules and layout design.

UNIT – IV:
Higher order digital Logic Circuits
Memory design – SRAM cell – 6T SRAM – DRAM – 1T, 3T, 4T cells, CMOS Sequential circuits: Static and Dynamic circuits – True Single-phase clocked registers – Clocking schemes.

UNIT – V:
Application Specific Integrated Circuits
ASIC - Types of ASICs - Design flow – Design Entry – Simulation – Synthesis – Floor planning – Placement – Routing - Circuit extraction – Programmable ASICs.

	Total	

Text Books:

1. Neil Weste, David Harris, ‘CMOS VLSI Design: A Circuits and Systems Perspective’, Addison Wesley, 4th Edition, 2020.
2. Debaprasad Das, ‘VLSI Design’, Oxford University Press, 2010.
3. Ken Martin, ‘Digital Integrated Circuits’, Oxford University Press, 1999.
4. Peter Van, ‘Microchip Fabrication’, Mc-Graw Hill Professional, 6th Edition, 2014.

Reference Books:

1. M. J. S. Smith, ‘Application Specific Integrated Circuits’, Addison Wesley, 1997.
2. Uyemura, ‘Introduction to VLSI Circuits and Systems’, Wiley, 1st Edition, 2012.

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IV B.Tech I Semester

COURSE CODE – R2011XXYY	HYBRID ELECTRICAL VEHICLES (Honors Course)	CATEGORY	L-T-P 4-0-0	CREDITS 4

Pre-requisite: Concepts of Electrical Machines - Power Electronics.

Course Outcomes: After the completion of the course the student should be able to:

		Knowledge Level (K)#
CO1	Know the concept of electric vehicles and hybrid electric vehicles.	
CO2	Familiar with different configuration of hybrid electric vehicles.	
CO3	Choose an effective motor for EV and HEV application	
CO4	Design the power converters used in hybrid electric vehicles	
CO5	Choose different batteries and other energy storage systems.	

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	--	--	--	2	3	1	1	--	--	--	3	1	1	--
CO2	2	1	1	--	2	1	1	--	--	--	--	2	1	2	2
CO3	3	2	2	2	1	--	1	--	--	--	1	1	3	2	2
CO4	3	3	3	2	2	--	1	--	--	--	--	--	3	3	2
CO5	2	1	1	--	--	--	2	--	--	--	2	3	1	1	2

(Please fill the above with Levels of Correlation - viz. - L-1 - M-2 - H-3)

UNIT	CONTENTS	Contact Hours
UNIT - 1	**Introduction** Fundamentals of vehicle - components of conventional vehicle and propulsion load; Drive cycles and drive terrain; Concept of electric vehicle and hybrid electric vehicle; History of hybrid vehicles - advantages and applications of Electric and Hybrid Electric Vehicles.	
UNIT - 2	**Hybridization of Automobile** Architectures of HEVs - series and parallel HEVs - complex HEVs. Plug-in hybrid vehicle(PHEV) - constituents of PHEV - comparison of HEV and PHEV; Extended range hybrid electric vehicles(EREVs) - blended PHEVs - Fuel Cell vehicles and its constituents.	
UNIT - 3	**Special Machines for EV and HEVs** Characteristics of traction drive - requirement of electric motors for EV/HEVs.	

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	Induction Motor drives - their control and applications in EV/HEVs. Permanent magnet Synchronous motor: configuration - control and applications in EV/HEVs. Brushless DC Motors: Advantages - control of application in EV/HEVs. Switch reluctance motors: Merits limitations - converter configuration - control of SRM for EV/HEVs.	
UNIT - 4	**Power Electronics in HEVs** Boost and Buck-Boost converters - Multi Quadrant DC-DC converters - DC-AC Inverter for EV and HEV applications - Three Phase DC-AC inverters - Voltage control of DC-AC inverters using PWM - EV and PHEV battery chargers.	
UNIT - 5	**Energy Sources for HEVs** Energy Storage - Battery based energy storage and simplified models of battery - fuel cells - their characteristics and simplified models - super capacitor based energy storage - its analysis and simplified models - flywheels and their modeling for energy storage in EV/HEV - Hybridization of various energy storage devices.	
	Total	

Text Books

1. Ali Emadi - Advanced Electric Drive Vehicles - CRC Press - 2014.
2. Iqbal Hussein - Electric and Hybrid Vehicles: Design Fundamentals - CRC Press - 2003.

Reference Books:

1. MehrdadEhsani - YimiGao - Sebastian E. Gay - Ali Emadi - Modern Electric - Hybrid Electric and Fuel Cell Vehicles: Fundamentals - Theory and Design - CRC Press - 2004.
2. James Larminie - John Lowry - Electric Vehicle Technology Explained - Wiley - 2003.
3. H. Partab: Modern Electric Traction - DhanpatRai& Co - 2007.

ResearchBooks:

1. Pistooa G. - "Power Sources - Models - Sustanability - Infrstructure and the market" - Elsevier 2008
2. Mi Chris - Masrur A. - and Gao D.W. - " Hybrid Electric Vehicle: Principles and Applications with Practical Perspectives" 1995.

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IV B.Tech I Semester

COURSE CODE – R2011XXYY	SMART GRID TECHNOLOGIES (Honors Course)	CATEGORY	L-T-P 4-0-0	CREDITS 4

Pre-requisite: Concepts of Electric Grid - Renewable Energy Sources

Course Outcomes: After the completion of the course the student should be able to:

		Knowledge Level (K)#
CO1	Know the concept of smart grid and analyse the smart grid policies and developments in smart grids.	
CO2	Develop concepts of smart grid technologies in hybrid electrical vehicles etc.	
CO3	Adapt the concepts of smart substations - feeder automation - Battery Energy storage systems etc.	
CO4	Analyse micro grids and distributed generation systems.	
CO5	Analyse the effect of power quality in smart grid and to understand latest developments in ICT for smart grid.	

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	2	--	--	--	--	--	--	--	--	--	1	1	2
CO2	1	2	2	--	--	--	--	--	--	--	--	--	1	1	3
CO3	2	2	--	2	1	--	--	--	--	--	--	--	1	2	2
CO4	2	2	--	2	--	--	--	--	--	--	--	--	1	1	3
CO5	2	2	--	2	1	--	--	--	--	--	--	--	1	2	2

(Please fill the above with Levels of Correlation - viz. - L=1 - M=2 - H=3)

UNIT	CONTENTS	Contact Hours
UNIT - 1	**Introduction to Smart Grid** Evolution of Electric Grid - Concept of Smart Grid - Definitions - Need of Smart Grid - Functions of Smart Grid - Opportunities & Barriers of Smart Grid - Difference between conventional & smart grid - Concept of Resilient & Self-Healing Grid - Present development & International policies on Smart Grid. Case study of Smart Grid.	
UNIT - 2	**Smart Grid Technologies: Part 1** Introduction to Smart Meters - Real Time Pricing - Smart Appliances - Automatic Meter Reading(AMR) - Outage Management System(OMS) -	

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	Plug in Hybrid Electric Vehicles(PHEV) - Vehicle to Grid - Smart Sensors - Home & Building Automation - Phase Shifting Transformers - Net Metering.	
UNIT - 3	**Smart Grid Technologies: Part 2** Smart Substations - Substation Automation - Feeder Automation. Geographic Information System (GIS) - Intelligent Electronic Devices (IED) & their application for monitoring & protection. Smart storage like Battery Energy Storage Systems (BESS) - Super Conducting Magnetic Energy Storage Systems (SMES) - Pumped Hydro - Compressed Air Energy Storage (CAES) - Wide Area Measurement System (WAMS) - Phase Measurement Unit (PMU).	
UNIT - 4	**Micro grids and Distributed Energy Resources** Concept of micro grid - need & applications of microgrid - formation of microgrid - Issues of interconnection - protection & control of microgrid - Integration of renewable energy sources - Demand Response.	
UNIT - 5	**Power Quality Management in Smart Grid** Power Quality & EMC in Smart Grid - Power Quality issues of Grid connected Renewable Energy Sources - Power Quality Conditioners for Smart Grid - Web based Power Quality monitoring - Introduction to Power Quality Audit. **Information and Communication Technology for Smart Grid** Advanced Metering Infrastructure (AMI) - Home Area Network (HAN) - Neighborhood Area Network (NAN) - Wide Area Network (WAN).	
	Total	

Text Books:

1. Integration of Green and Renewable Energy in Electric Power Systems - by Ali Keyhani - Mohammad N. Marwali - Min Dai Wiley - 2009.
2. The Smart Grid: Enabling Energy Efficiency and Demand Response - by Clark W. Gellings - Fairmont Press - 2009.
3. Smart Grid: Technology and Applications - by Janaka B. Ekanayake - Nick Jenkins - Kithsiri Liyanage - Jianzhong Wu - Akihiko Yokoyama - Wiley publishers - 2012.
4. Smart Grids by Jean-Claude Sabonnadière - NouredineHadjsaïd - Wiley publishers - 2013.
5. Smart Power: Climate Changes - the Smart Grid - and the Future of Electric Utilities - by Peter S. Fox Penner - Island Press; 1st edition - 8 Jun 2010
6. Microgrids and Active Distribution Networks by S. Chowdhury - S. P. Chowdhury - P. Crossley - Institution of Engineering and Technology - 30 Jun 2009
7. Smart Grids (Power Engineering)by Stuart Borlase CRC Press.

Reference Books:

1. The Advanced Smart Grid: Edge Power Driving Sustainability:1 by Andres Carvallo - John Cooper - Artech House Publishers July 2011

2. Control and Automation of Electric Power Distribution Systems (Power Engineering) by James Northcote - Green - Robert G. Wilson - CRC Press - 2017.
3. Substation Automation (Power Electronics and Power Systems) by MladenKezunovic - Mark G. Adamiak - Alexander P. Apostolov - Jeffrey George Gilbert - Springer - 2010.
4. Electrical Power System Quality by R. C. Dugan - Mark F. McGranghan - Surya Santoso - H. Wayne Beaty - McGraw Hill Publication - 2nd Edition.
5. Communication and Networking in Smart Grids by Yang Xiao - CRC Press - 2012.

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IV B.Tech I Semester

COURSE CODE – R2011XXYY	POWER SYSTEM DEREGULATION (Honors Course)	CATEGORY	L-T-P 4-0-0	CREDITS 4

Pre-requisite: Concepts of Power System Operation and Control

Course Outcomes: After the completion of the course the student should be able to:

		Knowledge Level (K)#
CO1	Know the essential and operation of deregulated electricity market systems	
CO2	Learn about the different structure model.	
CO3	Analyze various types of electricity market operational and control issues using new mathematical models.	
CO4	Analyse LMP's wheeling transactions and congestion management.	
CO5	Analyze impact of ancillary services	

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	1	1	1	1	1	1	1	1	2	2	1	1	1
CO2	1	2	1	1	1	1	1	1	1	1	2	2	1	2	1
CO3	1	2	1	1	1	2	1	1	1	1	2	2	1	1	1
CO4	1	2	2	1	1	2	1	1	1	1	2	2	2	2	2
CO5	2	2	1	1	2	1	1	1	1	1	2	2	2	2	2

(Please fill the above with Levels of Correlation - viz. - L-1 - M-2 - H-3)

UNIT	CONTENTS	Contact Hours
UNIT - 1	Need and conditions for deregulation. Introduction of Market structure - Market Architecture - Spot market - forward markets and settlements. Review of Concepts marginal cost of generation - least-cost operation - incremental cost of generation. Power System Operation - Power Exchange.	
UNIT - 2	Electricity sector structures and Ownership /management - the forms of Ownership and management. Different structure model like Monopoly model - Purchasing agency model - wholesale competition model - Retail competition model - Definition of Available Transfer Capability (ATC) - computation of ATC.	

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UNIT - 3	Framework and methods for the analysis of Bilateral and pool markets - LMP based markets. Auction models and price formation - price based unit commitment - country practices.	
UNIT - 4	Transmission network and market power. Power wheeling transactions and marginal costing - transmission costing. Congestion management methods- market splitting - counter-trading; Effect of congestion on LMPs- country practices.	
UNIT - 5	Ancillary Services and System Security in Deregulation. Classifications and definitions - AS management in various markets- country practices. Technical - economic - & regulatory issues involved in the deregulation of the power industry.	
	Total	

Text Books:

1. Power System Economics: Designing markets for electricity - Steven Stoft - wiley publishers - 2002.
2. Operation of restructured power systems - K. Bhattacharya - M.H.J. Bollen and J.E. Daalder – Springer - 2012.

Reference Books:

1. Power generation - operation and control - -J. Wood and B. F. Wollenberg - Wiley – 1998.
2. Market operations in electric power systems - M. Shahidehpour - H. Yaminand Z. Li – Wiley -2003.
3. Fundamentals of power system economics - S. Kirschen and G. Strbac - Wiley - 2nd edition - 2018.
4. Optimization principles: Practical Applications to the Operation and Markets of the Electric Power Industry - N. S. Rau - IEEE Press series on Power Engineering.
5. “Competition and Choice in Electricity” by Sally Hunt and Graham Shuttleworth - Wiley publishers - 1997.

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II B.Tech II Semester

COURSE CODE – R2011XXYY	BASICS OF CONTROL SYSTEMS (Minor Course)	CATEGORY	L-T-P 4-0-0	CREDITS 4

Pre-requisite: Concepts of Mathematics

Course Outcomes: After the completion of the course the student should be able to:

		Knowledge Level (K)#
CO1	Derive the transfer function of physical systems and determination of overall transfer function using block diagram algebra and signal flow graphs.	3
CO2	Evaluate the time response of first and specifications of second order systems and determine error constants	3
CO3	Analyze absolute and relative stability of LTI systems using Routh's stability criterion and root locus method.	4
CO4	Analyze the stability of LTI systems using frequency response methods.	4
CO5	Apply state space analysis concepts to represent physical systems as state models, derive transfer function and determine the response. Understand the concepts of controllability and observability	3

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	-	-	-	-	-	-	1	2	2	2	2
CO2	2	2	2	2	-	-	-	-	-	-	1	2	2	2	2
CO3	3	3	2	2	-	-	-	-	-	-	1	3	3	2	2
CO4	3	3	3	3	-	-	-	-	-	-	1	3	3	3	2
CO5	2	2	2	2	-	-	-	-	-	-	1	3	2	2	2

(Please fill the above with Levels of Correlation, viz., 3: Strong, 2: Moderate, 1: Weak)

UNIT	CONTENTS	Contact Hours
UNIT - 1	**Mathematical Modeling of Control Systems** Classification of control systems - open loop and closed loop control systems and their differences - transfer function of linear system - differential equations of electrical networks - translational and rotational mechanical systems - transfer function of DC servo motor – AC servo motor – block diagram algebra – representation by signal flow graph – reduction using Mason's gain formula - Feedback characteristics.	
UNIT - 2	**Time Response Analysis**	

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	Standard test signals – time response of first and second order systems – time domain specifications - steady state errors and error constants - P - PI - PID Controllers.	
UNIT - 3	**Stability and Root Locus Technique** The concept of stability – Routh-Hurwitz –limitations of Routh-Hurwitz criterion - Root locus concept – construction of root loci (simple problems).	
UNIT - 4	**Frequency Response Analysis** Introduction to frequency domain specifications – Polar Plot - Bode diagrams – transfer function from the Bode diagram – phase margin and gain margin – stability analysis from Bode plots.	
UNIT - 5	**State Space Analysis of LTI Systems** Concepts of state - state variables and state model - state space representation of transfer function - diagonalization - solving the time invariant state equations - State Transition Matrix and it's properties - concepts of controllability and observability.	
	Total	

Text Books:

1. Modern Control Engineering by Kotsuhiko Ogata - Prentice Hall of India.
2. Automatic control systems by Benjamin C.Kuo - Prentice Hall of India - 2nd Edition.

Reference Books:

1. Control Systems principles and design by M.Gopal - Tata Mc Graw Hill education Pvt Ltd. - 4th Edition.
2. Control Systems by Manik Dhanesh N - Cengage publications.
3. Control Systems Engineering by I.J.Nagarath and M.Gopal - Newage International Publications - 5th Edition.
4. Control Systems Engineering by S.Palani - Tata Mc Graw Hill Publications.

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II B.Tech II Semester

COURSE CODE – R2011XXYY	BASICS OF ELECTRICAL MEASUREMENTS (Minor Course)	CATEGORY	L-T-P 4-0-0	CREDITS 4

Pre-requisite: Basic concepts of Electrical Engineering

Course Outcomes: After the completion of the course the student should be able to:

		Knowledge Level (K)#
CO1	Choose right type of instrument for measurement of ac and dc voltage and current.	
CO2	Analyse the operation of wattmeter and energy meter.	
CO3	Differentiate the operation of AC and DC bridges.	
CO4	Describe the operation various Transducers.	
CO5	Know the importance of Digital Meters and their working principles.	

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	3	--	--	--	--	--	--	--	--	--	1	2	--
CO2	1	2	3	--	--	--	--	--	--	--	--	--	1	2	--
CO3	1	2	3	--	--	--	--	--	--	--	--	--	1	2	--
CO4	1	2	3	--	1	--	--	--	--	--	--	--	1	2	--
CO5	1	2	3	--	1	--	--	--	--	--	--	--	1	2	--

(Please fill the above with Levels of Correlation - viz. - L-1 - M-2 - H-3)

UNIT	CONTENTS	Contact Hours
UNIT - 1	**UNIT–I:** **Analog Ammeter and Voltmeters** Classification – deflecting - control and damping torques – Construction of PMMC - Moving Iron and Electrodynamo instruments - Torque equation - Errors and Compensation – Numerical Problems.	
UNIT - 2	**Analog Wattmeters and Energy Meters** Electrodynamometer type wattmeter (LPF and UPF) - Induction Type Energy meters-Construction and working - Errors and Compensation– Numerical Problems.	
UNIT - 3	**Measurements of Electrical parameters**	

	DC Bridges: Measurement of Resistance – Kelvin's double bridge - Wheatstone bridge – Numerical Problems. **AC Bridges:** Measurement of inductance and quality factor - Maxwell's bridge - measurement of capacitance - Schering Bridge– Numerical Problems.	
UNIT - 4	**Transducers** Classification - Resistive (Strain Gauge) - Inductive (LVDT) and Capacitive (Piezo electric) Transducer – Numerical Problems.	
UNIT - 5	**Digital Meters** Successive approximation Digital Voltmeter — Digital frequency meter - Digital multimeter - Digital Energy Meter.	
	Total	

Text Books:

1. Electrical & Electronic Measurement & Instruments by A.K.Sawhney Dhanpat Rai & Co.Publications - 19th revised edition - 2011.
2. Electronic Instrumentation by H.S.Kalsi - THM.

Reference Books:

2. Electrical Measurements and measuring Instruments by E.W. Golding and F.C.Widdis - 5th Edition - Wheeler Publishing.
3. Modern Electronic Instrumentation and Measurement Techniques by A.D. Helfrick and W.D. Cooper - PHI - 5th Edition - 2002.
4. Electrical and Electronic Measurements and instrumentation by R.K.Rajput - S.Chand - 3rd edition.

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II B.Tech II Semester

COURSE CODE – R2011XXYY	RENEWABLE ENERGY SOURCES (Minor Course)	CATEGORY	L-T-P 4-0-0	CREDITS 4

Pre-requisite: Basic concepts on different sources of Energy.

Course Outcomes: After the completion of the course the student should be able to:

		Knowledge Level (K)#
CO1	Analyze solar radiation data - extra-terrestrial radiation - radiation on earth's surface and solar Energy Storage.	
CO2	Illustrate the components of wind energy systems.	
CO3	Illustrate the working of biomass - digesters and Geothermal plants.	
CO4	Demonstrate the principle of Energy production from OTEC - Tidal and Waves.	
CO5	Evaluate the concept and working of Fuel cells & MHD power generation.	

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	1	1	--	1	--	--	--	--	--	1	1	1
CO2	2	2	3	2	1	--	--	--	--	--	--	--	1	1	1
CO3	2	2	3	2	1	--	--	--	--	--	--	--	1	1	1
CO4	1	2	2	--	--	--	--	--	--	--	--	--	1	1	1
CO5	1	2	2	--	--	--	--	--	--	--	--	--	1	1	1

(Please fill the above with Levels of Correlation - viz. - L=1 - M=2 - H=3)

UNIT	CONTENTS	Contact Hours
UNIT - 1	**Solar Energy** Introduction - Renewable Sources - prospects - Solar radiation at the Earth Surface - Equivalent circuit of a PV - I-V & P-V Characteristics of a PV- Solar Energy Collectors-Flat plate Collectors - concentrating collectors - Solar Energy storage systems – Solar Pond - Applications - Solar water heating - Solar Green house.	
UNIT - 2	**Wind Energy** Introduction - basic Principles of Wind Energy Conversion - the nature of Wind - the power in the wind - Wind Energy Conversion - Site selection considerations - basic components of a WECS (Wind Energy Conversion Systems) - Classification of WEC Systems - Applications.	

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UNIT - 3	**Biomass and Geothermal Energy** **Biomass:** Introduction - Biomass conversion technologies - Photosynthesis - factors affecting Bio digestion - classification of biogas plants - Types of biogas plants - selection of site for a biogas plant **Geothermal Energy**: Introduction - Geothermal Sources - Applications - operational and Environmental problems.	
UNIT - 4	**Energy From oceans - Waves & Tides:** **Oceans:** Introduction - Ocean Thermal Electric Conversion (OTEC) - methods - prospects of OTEC in India. **Waves:** Introduction - Energy and Power from the waves - Wave Energy conversion devices - **Tides:** Basic principle of Tide Energy - Components of Tidal Energy -	
UNIT - 5	**Chemical Energy Sources:** **Fuel Cells**: Introduction - Fuel Cell Equivalent Circuit - operation of Fuel cell - types of Fuel Cells - Applications. **Hydrogen Energy:** Introduction - Methods of Hydrogen production - Storage and Applications **Magneto Hydro Dynamic (MHD) Power generation:** Principle of Operation - Types.	
	Total	

Text Books:

1. G.D.Rai - Non-Conventional Energy Sources - khanna Publications - 2011.
2. John Twidell & Tony Weir - Renewable Energy Sources - Taylor & francis - 2013.

Reference Books:

1. S.P.Sukhatme & J.K.Nayak - Solar Energy-Principles of Thermal Collection and Storage - TMH - 2011.
2. John Andrews & Nick Jelly - Energy Science- principles - technologies and Impacts - Oxford - 2nd edition - 2013.
3. Shoba Nath Singh - Non- Conventional Energy Resources - Pearson Publications - 2015.

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III B.Tech I Semester

COURSE CODE – R2011XXYY	BASICS OF MICROPROCESSORS AND MICROCONTROLLERS (Minor Course)	CATEGORY	L-T-P 4-0-0	CREDITS 4

Pre-requisite: Basics of Processors

Course Outcomes: After the completion of the course the student should be able to:

		Knowledge Level (K)#
CO1	Know the concepts of the Microprocessor capability in general and explore the evaluation of microprocessors.	
CO2	Analyse the instruction sets - addressing modes - minimum and maximum modes operations of 8086 Microprocessors	
CO3	Analyse the Microcontroller and interfacing capability	
CO4	Describe the architecture and interfacing of 8051 controller	
CO5	Know the concepts of PIC micro controller and its programming.	

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	2	1	--	--	--	--	--	--	--	1	3	2	1
CO2	3	1	2	1	--	--	--	--	--	--	--	1	3	3	2
CO3	3	2	3	2	1	--	--	--	--	--	--	1	3	3	2
CO4	3	2	2	2	1	--	--	--	--	--	--	1	3	3	2
CO5	3	1	2	2	3	--	--	--	--	--	--	1	3	3	2

(Please fill the above with Levels of Correlation - viz. - L-1 - M-2 - H-3)

UNIT	CONTENTS	Contact Hours
UNIT - 1	**Introduction to Microprocessor Architecture** Introduction and evolution of Microprocessors – Architecture of 8086 – Memory Organization of 8086 – Register Organization of 8086– Introduction to 80286 - 80386 - 80486 and Pentium (brief description about architectural advancements only).	
UNIT - 2	**Minimum and Maximum Mode Operations** Instruction sets of 8086 - Addressing modes – Assembler directives - General bus operation of 8086 – Minimum and Maximum mode operations of 8086 – 8086 Control signal interfacing – Read and write cycle timing diagrams.	
UNIT - 3	**Microprocessors I/O interfacing** 8255 PPI– Architecture of 8255–Modes of operation – Interfacing I/O devices	

	to 8086 using 8255 – Interfacing A to D converters – Interfacing D to A converters – Stepper motor interfacing– Static memory interfacing with 8086.	
UNIT - 4	**8051 Microcontroller** Overview of 8051 Microcontroller – Architecture – Memory Organization – Register set.	
UNIT - 5	**8051 Interfacing and Applications** Instruction set – I/O ports and Interrupts – Timers and Counters – Serial Communication – Interfacing of peripherals – Applications of microcontrollers.	
	Total	

Text Books:

1. Ray and Burchandi - "Advanced Microprocessors and Interfacing" - Tata McGraw–Hill - 3rd edition - 2006.
2. Kenneth J Ayala - "The 8051 Microcontroller Architecture - Programming and Applications" - Thomson Publishers - 2nd Edition.
3. PIC Microcontroller and Embedded Systems using Assembly and C for PIC 18 - - Muhammad Ali Mazidi - RolindD.Mckinay - Danny causey -Pearson Publisher 21st Impression.

Reference Books:

1. Microprocessors and Interfacing - Douglas V Hall - Mc–Graw Hill - 2nd Edition.
2. R.S. Kaler - "A Text book of Microprocessors and Micro Controllers" - I.K. International Publishing House Pvt. Ltd.
3. Ajay V. Deshmukh - "Microcontrollers – Theory and Applications" - Tata McGraw–Hill Companies –2005.
4. Ajit Pal - "Microcontrollers – Principles and Applications" - PHI Learning Pvt Ltd - 2011.

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III B.Tech I Semester

COURSE CODE – R2011XXYY	CONCEPTS OF POWER SYSTEM ENGINEERING (Minor Course)	CATEGORY	L-T-P 4-0-0	CREDITS 4

Pre-requisite: Basics of Power Systems

Course Outcomes: After the completion of the course the student should be able to:

		Knowledge Level (K)#
CO1	Know the concepts of power generation by various types of power plants.	2
CO2	Learn about transmission line concepts and distribution systems schemes.	2
CO3	Learn about protection equipments and grounding methods of power system.	2
CO4	Know the economic aspects of electrical energy and their importance.	2
CO5	Know the importance of power factor improvement and voltage control in power systems.	3

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	2	1	1	--	--	--	--	--	2	--	2	3	1
CO2	3	2	2	1	2	--	--	--	--	--	1	--	2	3	1
CO3	3	2	2	1	1	--	--	--	--	--	2	--	2	3	1
CO4	3	2	2	1	2	--	--	--	--	--	2	--	2	3	2
CO5	3	2	2	2	2	--	--	--	--	--	2	--	2	3	2

(Please fill the above with Levels of Correlation - viz. - L-1 - M-2 - H-3)

UNIT	CONTENTS	Contact Hours
UNIT - 1	**Power Generation Concepts & Types** Generation and sources of Energy – working principle and Schematic diagram approach of Thermal Power Plant – Hydro Power Plant - Nuclear Power Plant – Gas Power Plants – Comparison between Power Plants.	
UNIT - 2	**Transmission and Distribution Concepts** Types of Conductors Materials – Constants of Transmission Line – Classification of Overhead Transmission Lines – Performance of Short Transmission Lines – Simple Problems. Basic concept of Sub Station – Distribution Systems – Connection Schemes of Distribution Systems – Structure of Cables – Differences between Overhead &	

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	Underground systems.	
UNIT - 3	**Protection and Grounding** List of Faults – Basic concepts of fuse – Circuit Breakers – Relays – SF_6 Circuit Breakers – Vacuum Circuit Breakers – Operation of Lightning Arrester – Grounding and its advantages - Methods of Neutral Grounding: Resistance - Reactance and Resonant Grounding – Numerical Problems.	
UNIT - 4	**Economic Aspects** Definitions of Load - Load & Load Duration Curves - Load Factor - Demand Factor – Utilization Factor - Loss Factor – Types of Tariff - Cost of Electrical Energy – Expression for Cost of Electrical Energy – Numerical Problems	
UNIT - 5	**Power Factor Improvement and Voltage Control** Power Factor – Effects and Causes of low Power Factor- Shunt & Series Capacitor Compensation - Numerical Problems – Need of Voltage Control – Types of Voltage regulating Devices.	
	Total	

Text Books:

1. Principles of Power System by V.K.Mehata - Rohit Mehata - S.Chand Publishers.

Reference Books:

1. Electrical Power Systems by C.L.Wadwa - New Age International Publishers.

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III B.Tech I Semester

COURSE CODE – R2011XXYY	ELECTRICAL ESTIMATION AND COSTING (Minor Course)	CATEGORY	L-T-P 4-0-0	CREDITS 4

Pre-requisite: Basics of Power Systems

Course Outcomes: After the completion of the course the student should be able to:

		Knowledge Level (K)#
CO1	Demonstrate the various electrical apparatus and their interconnections.	
CO2	Examine various components of electrical installations.	
CO3	Estimate the cost for installation of wiring for different types of building and small industries.	
CO4	Illustrate the components of electrical substations.	
CO5	Design suitable control circuit for starting of three phase induction motor and synchronous motor.	

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	2	--	1	--	--	--	--	--	1	2	2	1	2
CO2	--	--	2	--	2	--	--	--	--	--	1	2	2	1	1
CO3	2	2	1	--	--	--	--	--	--	--	2	1	2	2	2
CO4	3	1	1	2	--	--	--	--	--	--	1	2	2	1	1
CO5	2	2	2	2	--	--	--	--	--	--	1	2	2	1	2

(Please fill the above with Levels of Correlation - viz. - L-1 - M-2 - H-3)

UNIT	CONTENTS	Contact Hours
UNIT - 1	**Electrical Symbols and Simple Electrical Circuits** Identification of electrical symbols - Electrical Diagrams - Methods of representation of wiring diagrams - introduction to simple light and fan circuits - system of connection of appliances and accessories.	
UNIT - 2	**Design Considerations of Electrical Installations** Electric supply system - Three-phase four wire distribution system - protection of electric installation against overload - short circuit and earth fault - earthing - neutral and earth wire - types of loads - systems of wiring	

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	- permissible of voltage drops and sizes of wires - estimating and costing of electrical installations.	
UNIT - 3	**Electrical Installation for Different Types of Buildings and Small Industries** Electrical installations for electrical buildings - estimating and costing of material - simple examples on electrical installation for residential buildings - electrical installations for commercial buildings - electrical installation for small industries-case study.	
UNIT - 4	**Substations** Introduction - types of substations - outdoor substations-pole mounted type - indoor substations-floor mounted type - simple examples on quantity estimation-case study.	
UNIT - 5	**Motor control circuits** Introduction to AC motors - starting of three phase squirrel cage induction motors - starting of wound rotor motors - starting of synchronous motors - contractor control circuit components - basic control circuits - motor protection	
	Total	

Text Books:

1. Electrical Design and Estimation Costing - K. B. Raina and S.K.Bhattacharya – New Age International Publishers - 2007.

References Books:

1. Electrical wiring estimating and costing – S.L.Uppal and G.C.Garg – Khannapublishers - 6th edition - 1987.
2. A course in electrical installation estimating and costing – J.B.Gupta –Kataria SK & Sons - 2013.

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III B.Tech II Semester

COURSE CODE – R2011XXYY	ENERGY AUDITING - CONSERVATION AND MANAGEMENT (Minor Course)	CATEGORY	L-T-P 4-0-0	CREDITS 4

Pre-requisite: Basics of Electrical Engineering-Motor - Illumination concepts.

Course Outcomes: After the completion of the course the student should be able to:

		Knowledge Level (K)#
CO1	Understand the principles of energy audit along with various Energy related terminologies.	
CO2	Asses the role of Energy Manager and Energy Management program.	
CO3	Design a energy efficient motors and good lighting system.	
CO4	Analyse the methods to improve the power factor and identify the energy instruments for various real time applications.	
CO5	Evaluate the computational techniques with regard to economic aspects.	

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	--	--	--	--	--	--	--	--	--	2	2	1
CO2	2	--	2	--	--	--	--	--	--	--	--	--	2	2	1
CO3	2	--	2	--	--	--	--	--	--	--	--	--	2	2	1
CO4	2	1	2	--	--	--	--	--	--	--	--	--	2	2	1
CO5	2	2	2	--	--	--	--	--	--	--	--	--	2	2	1

(Please fill the above with Levels of Correlation - viz. - L=1 - M=2 - H=3)

UNIT	CONTENTS	Contact Hours
UNIT - 1	**Basic Principles of Energy Audit** Energy audit- definitions - concept - types of audit - energy index - cost index - pie charts - Sankey diagrams and load profiles - Energy conservation schemes- Energy audit of industries- energy saving potential - energy audit of process industry - thermal power station - building energy audit - Conservation of Energy Building Codes (ECBC-2017) -	
UNIT - 2	**Energy Management** Principles of energy management - organizing energy management program - initiating - planning - controlling - promoting - monitoring - reporting. Energy manager - qualities and functions - language - Questionnaire –	

	check list for top management.	
UNIT - 3	**Energy Efficient Motors and Lighting** Energy efficient motors - factors affecting efficiency - loss distribution - constructional details - characteristics – variable speed - RMS - voltage variation-voltage unbalance-over motoring-motor energy audit. lighting system design and practice - lighting control - lighting energy audit.	
UNIT - 4	**Power Factor Improvement And Energy Instruments** Power factor – methods of improvement - location of capacitors - Power factor with non-linear loads - effect of harmonics on p.f - p.f motor controllers – Energy Instruments- watt meter - data loggers - thermocouples - pyrometers - lux meters - tongue testers.	
UNIT - 5	**Economic Aspects And Their Computation** Economics Analysis depreciation Methods - time value of money - rate of return - present worth method - replacement analysis - lifecycle costing analysis – Energy efficient motors. Calculation of simple payback method - net present value method- Power factor correction - lighting – Applications of life cycle costing analysis - return on investment.	
	Total	

Text Books:

1. Energy management by W.R.Murphy&G.Mckay Butter worth - Heinemann publications - 1982.
2. Energy management hand book by W.CTurner - John wiley and sons - 1982.

Reference Books:

1. Energy efficient electric motors by John.C.Andreas - Marcel Dekker Inc Ltd-2nd edition - 1995
2. Energy management by Paul o' Callaghan - Mc-graw Hill Book company-1st edition - 1998
3. Energy management and good lighting practice : fuel efficiency- booklet12-EEO

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III B.Tech II Semester

COURSE CODE – R2011XXYY	FUNDAMENTALS OF UTILIZATION OF ELECTRICAL ENERGY (Minor Course)	CATEGORY	L-T-P 4-0-0	CREDITS 4

Pre-requisite: Basics of Electrical Engineering

Course Outcomes: After the completion of the course the student should be able to understand:

		Knowledge Level (K)#
CO1	Know the concepts of illumination and various illumination methods.	
CO2	Know about the resistance - induction and dielectric heating.	
CO3	Learn about the resistance and arc welding and welding equipment	
CO4	Know about the mechanisms - equipment and technology used in the electric traction.	
CO5	Differentiate the importance of various energy storage systems	

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	--	1	--	--	--	--	--	--	--	1	3	3	1
CO2	3	3	--	1	--	--	--	--	--	--	--	1	3	3	1
CO3	3	3	--	1	--	--	--	--	--	--	--	1	3	3	1
CO4	3	3	--	2	--	--	--	--	--	--	--	1	3	3	1
CO5	3	3	--	1	--	--	1	--	--	--	--	1	3	3	1

(Please fill the above with Levels of Correlation - viz. - L-1 - M-2 - H-3)

UNIT	CONTENTS	Contact Hours
UNIT - 1	**Illumination Fundamentals** Introduction - terms used in illumination–Laws of illumination–Lux meter–Sources of light. **Various Illumination Methods** Tungsten filament lamps and fluorescent lamps - Comparison –Basic principles of light control – Types and design of lighting and flood lighting–LED lighting - Energy conservation.	
UNIT - 2	**Electric Heating** Advantages and methods of electric heating–Resistance heating induction heating and dielectric heating.	
UNIT - 3	**Electric Welding**	

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	Electric welding–Resistance and arc welding–Electric welding equipment–Comparison between AC and DC Welding	
UNIT - 4	**Electric Traction** System of electric traction and track electrification– Review of existing electric traction systems in India– Special features of traction motor–Mechanics of train movement–Speed–time curves for different services –Trapezoidal and quadrilateral speed time curves. Calculations of tractive effort– power –Specific energy consumption for given run–Effect of varying acceleration and braking retardation–Adhesive weight and braking retardation adhesive weight and coefficient of adhesion.	
UNIT - 5	**Introduction to Energy Storage Systems** Need for energy storage - Types of energy storage-Thermal - electrical - magnetic and chemical storage systems - Comparison of energy storage technologies-Applications.	
	Total	

Text Books:

1. Electrical Power Systems (Generation - Transmission - Distribution - Protecection and Utilization of Electrical Energy) – Dr. S.L.Uppal and Prof. Sunil S.Rao – Khanna Publisher - 15th edition - 1987.
2. Electric Power Distribution – A. S. Pabla – McGrawHill - 5th edition - 2004.

Reference Books:

1. Generation Distribution and Utilization of Electrical Energy – C.L.Wadhwa- New Age International Publishers- revised 3rd edition.

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III B.Tech II Semester

COURSE CODE – R2011XXYY	FUNDAMANTALS OF POWER ELECTRONICS (Minor Course)	CATEGORY	L-T-P 4-0-0	CREDITS 4

Pre-requisite: Electrical Circuits - Power Systems-I - Basic concepts of

Course Outcomes: After the completion of the course the student should be able to:

		Knowledge Level (K)#
CO1	Illustrate the static and dynamic characteristics SCR - Power MOSFET and Power IGBT.	
CO2	Analyse the operation of phase controlled rectifiers.	
CO3	Analyse the operation of Three-phase full–wave converters - AC Voltage Controllers and Cyclo-converters.	
CO4	Examine the operation and design of different types of DC-DC converters.	
CO5	Analyse the operation of PWM inverters for voltage control and harmonic mitigation.	

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1	1	-	-	-	-	-	-	-	1	2	2
CO2	3	2	2	2	1	2	-	-	-	-	-	-	1	3	1
CO3	3	2	2	1	1	2	-	-	-	-	-	-	1	3	1
CO4	3	2	2	2	1	2	-	-	-	-	-	-	1	3	1
CO5	3	2	2	2	1	2	-	-	-	-	-	-	1	3	1

(Please fill the above with Levels of Correlation, viz., 3: Strong, 2: Moderate, 1: Weak)

UNIT	CONTENTS	Contact Hours
UNIT - 1	**Power Semi-Conductor Devices** Silicon controlled rectifier (SCR) – Two transistor analogy - Static and Dynamic characteristics Static and Dynamic Characteristics of Power MOSFET and Power IGBT– Gate Driver Circuits for Power MOSFET and IGBT - Numerical problems.	
UNIT - 2	**Single-phase AC-DC Converters** Single-phase half wave controlled rectifiers - R load and RL load with and without freewheeling diode - Single-phase fully controlled bridge converter with R load - RL load and RLE load - Continuous and Discontinuous conduction - Expression for output voltages – Single-phase Semi-Converter with R load - RL	

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	load and RLE load – Continuous and Discontinuous conduction - Harmonic Analysis - Numerical Problems.	
UNIT - 3	**Three-phase AC-DC Converters & AC – AC Converters** Three-phase half wave Rectifier with R and RL load - Three-phase fully controlled rectifier with R and RL load - Three-phase semi converter with R and RL load - Expression for Output Voltage - Harmonic Analysis - Numerical Problems. AC-AC power control by phase control with R and RL loads - Expression for rms output voltage-Numerical problems.	
UNIT - 4	**DC–DC Converters** Analysis of Buck - Boost and Buck-Boost converters in Continuous Conduction Mode (CCM) and Discontinuous Conduction Modes (DCM) - Output voltage equations using volt-sec balance in CCM & DCM – Expressions for output voltage ripple and inductor current ripple- Numerical Problems.	
UNIT - 5	**DC–AC Converters** Introduction - Single-phase half bridge and full bridge inverters with R and RL loads – Three-phase square wave inverters - 120^0 conduction and 180^0 conduction modes of operation - PWM inverters - Sinusoidal Pulse Width Modulation - Numerical Problems.	
	Total	

Text Books:

1. Power Electronics: Converters - Applications and Design by Ned Mohan - Tore M Undeland - William P Robbins - John Wiley & Sons.
2. Power Electronics: Circuits - Devices and Applications – by M. H. Rashid - Prentice Hall of India - 2nd edition - 1998
3. Power Electronics: Essentials & Applications by L.Umanand - Wiley - Pvt. Limited - India - 2009.

Reference Books:

1. Elements of Power Electronics–Philip T.Krein. Oxford University Press; Second edition
2. Power Electronics – by P.S.Bhimbra - Khanna Publishers.
3. Thyristorised Power Controllers – by G. K. Dubey - S. R. Doradla - A. Joshi and R. M. K.Sinha - New Age International (P) Limited Publishers - 1996.
4. Power Electronics: by Daniel W.Hart - Mc Graw Hill.

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IV B.Tech I Semester

COURSE CODE – R2011XXYY	BASICS OF POWER SYSTEMS AND POWER QUALITY (Minor Course)	CATEGORY	L-T-P 4-0-0	CREDITS 4

Pre-requisite: Basic Electrical Engineering.

Course Outcomes: After the completion of the course the student should be able to:

		Knowledge Level (K)#
CO1	Know main conventional and renewable power generation schemes.	
CO2	Analyse the effect of harmonic distortion on electric equipment.	
CO3	Provide solutions for power factor improvement	
CO4	Learn the need of good quality power.	
CO5	Design custom power devices for power quality improvement.	

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	1	2	1	2	1	1	1	2	2	1	2	2
CO2	1	1	2	1	1	2	1	1	1	1	2	2	2	2	1
CO3	1	2	2	2	1	2	1	1	2	1	3	2	1	2	1
CO4	1	2	2	2	2	2	1	1	2	1	2	2	1	2	1
CO5	1	1	2	2	1	2	1	1	1	1	1	1	1	2	1

(Please fill the above with Levels of Correlation - viz. - L-1 - M-2 - H-3)

UNIT	CONTENTS	Contact Hours
UNIT - 1	**Basic Power Systems** Conventional Power generation-Hydel and thermal (block diagram only)-Renewable power generation-solar and wind (block diagrams only) - advantages and limitations of renewable power generation-Basic concepts of transmission and distribution.	
UNIT - 2	**Harmonics** Linear and nonlinear loads-examples - harmonics - total harmonic distortion (THD)-sources of harmonics-Effect of Harmonic distortion- impact on capacitors - Transformers - motors and meters.	
UNIT - 3	**Power Factor** AC apparent power - Active Power - Reactive Power - Power factor - power factor with non-linear loads - True Power factor - need for power factor	

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	improvement.	
UNIT - 4	**Power Quality** Power Quality definition-need for quality power- power quality issues-voltage sag - voltage swell - low voltage - over voltage - short and long interruptions - voltage fluctuations - voltage unbalance – wave form distortion -Power quality issues due to renewable power generation.	
UNIT - 5	**Custom Power Devices** Reactive power and harmonic compensation devices-static var compensator - static shunt compensation; compensation devices for voltage sag and momentary interruptions-source transfer switch - Hybrid source transfer switch - high speed mechanical source transfer switch; back up energy supply devices-battery UPS - Super conducting magnetic energy storage (SMES) - flywheel.	
	Total	

Text Books:

1. Electrical Power Systems Quality - Dugan R C - McGranaghan M F - Santoso S - and Beaty H W - Second Edition - McGraw-Hill - 2002.
2. Understanding Power Quality Problems: Voltage Sags and Interruptions - Bollen M H J - First Edition - IEEE Press; 2000.
3. Guidebook on Custom Power Devices - Technical Report - Published by EPRI - Nov 2000
4. Power Quality Enhancement Using Custom Power Devices – Power Electronics and Power Systems - Gerard Ledwich - Arindam Ghosh - Kluwer Academic Publishers - 2002.

Reference Books:

1. Power Quality Primer - Kennedy B W - First Edition - McGraw-Hill - 2000.
2. Power System Harmonics - Arrillaga J and Watson N R - Second Edition - John Wiley & Sons - 2003.
3. Electric Power Quality control Techniques - W. E. Kazibwe and M. H. Sendaula - Van Nostrad Reinhold - New York.
4. Power Quality c.shankaran - CRC Press - 2001
5. Harmonics and Power Systems –Franciso C.DE LA Rosa-CRC Press (Taylor & Francis).
6. Power Quality in Power systems and Electrical Machines-EwaldF.fuchs - Mohammad A.S. Masoum-Elsevier
7. Power Quality - C. Shankaran - CRC Press - 2001
8. Instantaneous Power Theory and Application to Power Conditioning - H. Akagiet.al. - IEEE Press - 2007.
9. Custom Power Devices - An Introduction - Arindam Ghosh and Gerard Ledwich - Springer - 2002
10. A Review of Compensating Type Custom Power Devices for Power Quality Improvement - Yash Pal et.al. - Joint International Conference on Power System Technology and IEEE Power India Conference - 2008. POWERCON 2008.

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IV B.Tech I Semester

COURSE CODE – R2011XXYY	FUNDAMENTALS OF ELECTRIC VEHICLES (Minor Course)	CATEGORY	L-T-P 4-0-0	CREDITS 4

Pre-requisite: Basics of Machines and Electronics.

Course Outcomes: After the completion of the course the student should be able to:

		Knowledge Level (K)#
CO1	Illustrate different types of electric vehicles.	
CO2	Select suitable power converters for EV applications.	
CO3	Design HEV configuration for a specific application.	
CO4	Choose an effective method for EV and HEV applications.	
CO5	Analyse a battery management system for EV and HEV.	

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	-	-	-	-	3	3	2	-	-	-	3	-	-	-
CO2	2	3	2	1	-	1	1	2	1	-	-	-	2	3	-
CO3	-	3	3	3	2	1	-	-	2	2	3	-	-	2	-
CO4	3	2	2	3	1	2	1	-	-	2	2	-	-	3	3
CO5	2	-	2	-	2	2	-	-	-	-	-	3	2	2	2

(Please fill the above with Levels of Correlation - viz. - L-1 - M-2 - H-3)

UNIT	CONTENTS	Contact Hours
UNIT - 1	**Introduction** Fundamentals of vehicles - Components of conventional vehicles - drawbacks of conventional vehicles – Need for electric vehicles - History of Electric Vehicles – Types of Electric Vehicles – Advantages and applications of Electric Vehicles.	
UNIT - 2	**Components of Electric Vehicles** Main components of Electric Vehicles – Power Converters - Controller and Electric Traction Motor – Rectifiers used in EVs – Bidirectional DC–DC Converters – Voltage Source Inverters – PWM inverters used in EVs.	
UNIT - 3	**Hybrid Electric Vehicles** Evolution of Hybrid Electric Vehicles – Advantages and Applications of	

	Hybrid Electric Vehicles – Architecture of HEVs - Series and Parallel HEVs – Complex HEVs – Range extended HEVs – Examples - Merits and Demerits.	
UNIT - 4	**Motors for Electric Vehicles** Characteristics of traction drive - requirements of electric machines for EVs – Different motors suitable for Electric and Hybrid Vehicles – Induction Motors – Synchronous Motors – Permanent Magnetic Synchronous Motors – Brushless DC Motors – Switched Reluctance Motors (Construction details and working only)	
UNIT - 5	**Energy Sources for Electric Vehicles** Batteries - Types of Batteries – Lithium-ion - Nickel-metal hydride - Lead-acid – Comparison of Batteries - Battery Management System – Ultra capacitors – Flywheels – Fuel Cell – its working.	
	Total	

Text Books

1. Iqbal Hussein - Electric and Hybrid Vehicles: Design Fundamentals - CRC Press - 2021.
2. Denton - Tom. Electric and hybrid vehicles. Routledge - 2020.

Reference Books:

1. Kumar - L. Ashok - and S. Albert Alexander. Power Converters for Electric Vehicles. CRC Press - 2020.
2. Chau - Kwok Tong. Electric vehicle machines and drives: design - analysis and application. John Wiley & Sons - 2015.
3. Berg - Helena. Batteries for electric vehicles: materials and electrochemistry. Cambridge university press - 2015.

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IV B.Tech I Semester

COURSE CODE – R2011XXYY	BASICS OF ELECTRIC DRIVES AND IT'S APPLICATIONS (Minor Course)	CATEGORY	L-T-P 4-0-0	CREDITS 4

Pre-requisite: Electrical Machines - Fundamentals of Power Electronics

Course Outcomes: After the completion of the course the student should be able to:

		Knowledge Level (K)#
CO1	Explain the fundamentals of electric drive and different electric braking methods.	
CO2	Analyze the operation of Three-phase converter fed dc motors and four quadrant operations of dc motors using dual converters.	
CO3	Describe the converter control of dc motors in various quadrants of operation	
CO4	Know the concept of speed control of induction motor by using AC voltage controllers and voltage source inverters.	
CO5	Differentiate the stator side control and rotor side control of Three-phase induction motor - explain the speed control mechanism of synchronous motors.	

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	1	1	--	--	--	--	--	--	--	3	2	1
CO2	3	2	3	2	1	--	--	--	--	--	--	--	3	2	1
CO3	3	2	2	2	2	--	--	--	--	--	--	--	3	2	2
CO4	3	2	2	2	1	--	--	--	--	--	--	--	3	2	2
CO5	3	2	2	1	1	--	--	--	--	--	--	--	3	2	1

(Please fill the above with Levels of Correlation - viz. - L=1 - M=2 - H=3)

UNIT	CONTENTS	Contact Hours
UNIT - 1	**Fundamentals of Electric Drives** Electric drive and its components– Fundamental torque equation – Load torque components – Nature and classification of load torques – Steady state stability – Load equalization– Four quadrant operation of drive (hoist control) – Braking methods**:** Dynamic – Plugging – Regenerative methods.	**(10hrs)**
UNIT - 2	**Controlled Converter Fed DC Motor Drives** 3-phase half and fully-controlled converter fed separately and self-excited DC motor drive – Output voltage and current waveforms – Speed-torque expressions – Speed-torque characteristics -Numerical problems.	**(10hrs)**

UNIT - 3	**DC–DC Converters Fed DC Motor Drives** Single quadrant – Two quadrant and four quadrant DC-DC converter fed separately excited and self-excited DC motors – Continuous current operation - Output voltage and current waveforms – Speed–torque expressions and characteristics.	**(10hrs)**
UNIT - 4	**Stator and Rotor side control of 3-phase Induction motor Drive** Stator voltage control using 3-phase AC voltage regulators – Waveforms – Speed torque characteristics– Variable Voltage Variable Frequency control of induction motor by PWM voltage source inverter. Static rotor resistance control– Static Scherbius drive – Static Kramer drive – Performance and speed torque characteristics.	**(10hrs)**
UNIT - 5	**Control of Synchronous Motor Drives** Separate control of synchronous motor – self-control of synchronous motor employing load commutated thyristor inverter - closed loop control of synchronous motor drive (qualitative treatment only).	**(8hrs)**
	Total	

Text Books:

1. Fundamentals of Electric Drives – by G K Dubey - Narosa Publications - 2nd edition 2002.
2. Power Semiconductor Drives - by S.B.Dewan - G.R.Slemon - A.Straughen - Wiley-India - 1984.

Reference Books:

1. Electric Motors and Drives Fundamentals - Types and Apllications - by Austin Hughes and Bill Drury - Newnes.4th edition - 2013.
2. Thyristor Control of Electric drives – Vedam Subramanyam Tata McGraw Hill Publications - 1987.
3. Power Electronic Circuits - Devices and applications by M.H.Rashid - PHI - 3rd edition - 2009.
4. Power Electronics handbook by Muhammad H.Rashid - Elsevier - 2nd edition - 2010.