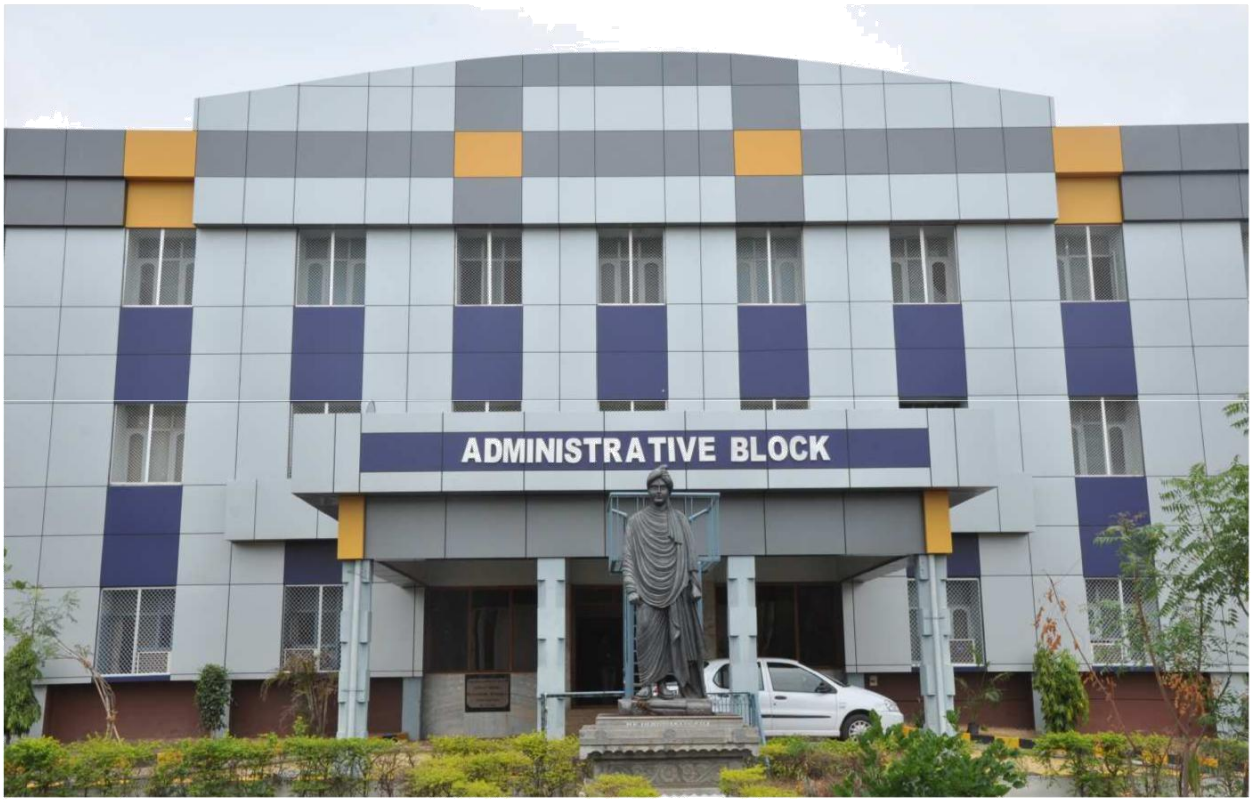
G. PULLA REDDY ENGINEERING COLLEGE (Autonomous): KURNOOL
Department of Electrical and Electronics Engineering Accredited by NBA of AICTE and NAAC of UGC Affiliated to JNTUA, Ananthapuramu.



Scheme – 2017

(Scheme and Syllabus of B.Tech. III to VIII Semesters)

Department of Electrical and Electronics Engineering
G.Pulla Reddy Engineering College (Autonomous): Kurnool
Accredited by NBA of AICTE and NAAC of UGC
Affiliated to JNTUA, Ananthapuramu

FOUR YEAR B.TECH DEGREE COURSE
Department of Electrical and Electronics Engineering
Scheme of instruction and Examination
(Effective from 2017-18)

I Semester **Scheme: 2017**

S.No.	Subject	Code	Credits	Scheme of Instruction periods/week	Scheme of Examination Max Marks		
				L:T:P	End Exam	Internal Assessment	Total
I	**Theory**						
1	Engineering Mathematics- I	BS101	3	3:0:0	60	40	100
2	Computer Programming	CS101	3	3:0:0	60	40	100
3	Professional Communication and English –I	HU101	3	3:0:0	60	40	100
4	Applied Physics	BS103	3	3:0:0	60	40	100
5	Engineering Chemistry	BS105	3	3:0:0	60	40	100
6	Engineering Drawing	ME101	3	1:0:4	60	40	100
II	**Practical**						
7	Computer Programming Lab	CS102	1	0:0:2	50	50	100
8	Applied Physics Lab	BS104	1	0:0:2	50	50	100
9	Engineering Chemistry Lab	BS106	1	0:0:2	50	50	100
	Total		**21**	**16:0:10**	**510**	**390**	**900**

FOUR YEAR B.TECH DEGREE COURSE
Department of Electrical and Electronics Engineering
Scheme of instruction and Examination
(Effective from 2017-18)

II Semester EEE **Scheme: 2017**

S.No.	Subject	Code	Credits	Scheme of Instruction periods/week	Scheme of Examination Max Marks		
				L:T:P	End Exam	Internal Assessment	Total
I	**Theory**						
1	Engineering Mathematics- II	BS102	3	3:0:0	60	40	100
2	Data Structures	CS103	3	2:1:0	60	40	100
3	Professional Communication and English –II	HU102	3	3:0:0	60	40	100
4	Elements of Electrical Engineering	EE101	3	3:0:0	60	40	100
5	Basic Electronics Engineering	EC101	3	3:0:0	60	40	100
6	Engineering Mechanics	CE101	3	3:0:0	60	40	100
II	**Practical**						
7	Data Structures Lab	CS104	1	0:0:2	50	50	100
8	Phonetics & Communication Skills Lab	HU103	1	0:0:2	50	50	100
9	Engineering Workshop	ME102	1	0:0:2	50	50	100
	Total		**21**	**17:1:6**	**510**	**390**	**900**

FOUR YEAR B.TECH DEGREE COURSE
Department of Electrical and Electronics Engineering
Scheme of instruction and Examination
(Effective from 2017-18)

III Semester EEE **Scheme: 2017**

S.No.	Subject	Code	Credits	Scheme of Instruction periods/week	Scheme of Examination Max Marks		
				L:T:P	End Exam	Internal Assessment	Total
I	**Theory**						
1	Probability and Statistical Analysis	BS202	3	3:0:0	60	40	100
2	Electronic Devices and circuits	EC201	3	3:0:0	60	40	100
3	Digital System Design	EC202	3	3:0:0	60	40	100
4	Electrical Circuits	EE201	4	3:1:0	60	40	100
5	Electrical Machines - 1	EE202	4	3:1:0	60	40	100
6	Electrical and Electronic Measuring Instruments	EE203	3	3:0:0	60	40	100
7	MLC - 1	ML01	0	1:0:0	-	-	-
II	**Practical**						
8	Electrical Measurements Lab	EE204	1	0:0:2	50	50	100
9	Electronics Engineering Lab - 1	EC212	1	0:0:2	50	50	100
10	Soft Skills Lab	HU201	1	0:0:2	-	100	100
			23	**19:2:6**	**460**	**440**	**900**

FOUR YEAR B.TECH DEGREE COURSE
Department of Electrical and Electronics Engineering
Scheme of instruction and Examination
(Effective from 2017-18)

IV Semester EEE **Scheme: 2017**

S.No	Subject	Code	Credits	Scheme of Instruction periods/week	Scheme of Examination Max Marks		
				L:T:P	End Exam	Internal Assessment	Total
I	**Theory**						
1	Analog Electronic Circuits	EC207	3	3:0:0	60	40	100
2	Complex Variables and Special Functions	BS203	3	3:0:0	60	40	100
3	Managerial Economics & Principles of Accountancy	HU202	3	3:0:0	60	40	100
4	Electrical Machines – 2	EE205	4	3:1:0	60	40	100
5	Power Systems-1	EE206	3	3:0:0	60	40	100
6	Electromagnetic Fields	EE207	3	3:0:0	60	40	100
II	**Practical**						
7	Electrical Machines – I Lab	EE208	1	0:0:2	50	50	100
8	Electrical Circuits lab	EE209	1	0:0:2	50	50	100
9	Electronics Engineering Lab-2	EC213	1	0:0:2	50	50	100
10	Advanced Communication Skills Lab	HU203	1	0:0:2	-	100	100
			23	**18:1:8**	**510**	**490**	**1000**

FOUR YEAR B.TECH DEGREE COURSE
Department of Electrical and Electronics Engineering
Scheme of instruction and Examination
(Effective from 2017-18)

V Semester EEE **Scheme: 2017**

S.No	Subject	Code	Credits	Scheme of Instruction periods/week	Scheme of Examination Max Marks		
				L:T:P	End Exam	Internal Assessment	Total
I	**Theory**						
1	Power Electronics-1	EE301	3	3:0:0	60	40	100
2	Microprocessors and Microcontrollers	EC302	3	3:0:0	60	40	100
3	Control Systems Engineering	EE302	3	3:0:0	60	40	100
4	Linear IC Applications	EC304	3	3:0:0	60	40	100
5	Power Systems-2	EE303	3	3:0:0	60	40	100
6	Open Elective - I		3	3:0:0	60	40	100
II	**Practical**						
7	Electrical Machines – II Lab	EE304	1	0:0:2	50	50	100
8	Control System and Automation Lab	EE305	1	0:0:2	50	50	100
9	IC and Microprocessors Lab	EC314	1	0:0:2	50	50	100
			21	**18:0:6**	**510**	**390**	**900**

FOUR YEAR B.TECH DEGREE COURSE
Department of Electrical and Electronics Engineering
Scheme of instruction and Examination
(Effective from 2017-18)

VI Semester EEE **Scheme: 2017**

S.No.	Subject	Code	Credits	Scheme of Instruction periods/week	Scheme of Examination Max Marks		
				L:T:P	End Exam	Internal Assessment	Total
I	**Theory**						
1	Power Electronics-2	EE306	3	3:0:0	60	40	100
2	Power Systems-3	EE307	3	3:0:0	60	40	100
3	Professional Elective - I		3	3:0:0	60	40	100
4	Professional Elective – II		3	3:0:0	60	40	100
5	Open Elective - II		3	3:0:0	60	40	100
II	**Practical**						
6	Power Systems Lab	EE308	1	0:0:2	50	50	100
7	Power Electronics Lab	EE309	1	0:0:2	50	50	100
8	Microcontrollers Lab	EE310	1	0:0:2	50	50	100
9	Mini Project - 1	EE311	2	0:0:4	-	100	100
			20	**15:0:10**	**450**	**450**	**900**

FOUR YEAR B.TECH DEGREE COURSE

Department of Electrical and Electronics Engineering

Scheme of instruction and Examination

(Effective from 2017-18)

VII Semester EEE **Scheme: 2017**

S.No.	Subject	Code	Credits	Scheme of Instruction periods/week	Scheme of Examination Max Marks		
				L:T:P	End Exam	Internal Assessment	Total
I	**Theory**						
1	Power Systems-4	EE401	3	3:0:0	60	40	100
2	Professional Elective – III		3	3:0:0	60	40	100
3	Professional Elective – IV		3	3:0:0	60	40	100
4	Open Elective – III		3	3:0:0	60	40	100
5	Open Elective – IV		3	3:0:0	60	40	100
6	MLC - 2	ML02	0	1:0:0	-	-	--
II	**Practical**						
7	Drives and Static Control Lab	EE402	1	0:0:2	50	50	100
8	Internet of Things Lab	EE403	1	0:0:2	50	50	100
9	Mini Project - 2	EE404	2	0:0:4	-	100	100
			19	**16:0:8**	**400**	**500**	**800**

FOUR YEAR B.TECH DEGREE COURSE

Department of Electrical and Electronics Engineering

Scheme of instruction and Examination

(Effective from 2017-18)

VIII Semester EEE **Scheme: 2017**

S.No.	Subject	Code	Credits	Scheme of Instruction periods/week	Scheme of Examination Max Marks		
				L:T:P	End Exam	Internal Assessment	Total
I	**Theory**						
1	Professional Elective –V		3	3:0:0	60	40	100
2	Professional Elective –VI		3	3:0:0	60	40	100
II	**Practical**						
	Project Work	EE405	6	0:0:12	50	50	100
			12	**6:0:12**	**170**	**130**	**300**
OR							
1	Internship	EE406	6		50	50	100
2	Project Work	EE405	6	0:0:12	50	50	100
			12	**0:0:12**	**100**	**100**	**200**

Professional Elective – I

EE312	Communication Systems
EE313	Introduction to Signals & Systems
EE314	Digital Control Systems

Professional Elective – II

EE315	High Voltage Engineering
EE316	Electrical Distribution Systems
EE317	Utilization of Electrical Power

Professional Elective – III

EE407	Advanced Power Electronics
EE408	Power Quality
EE409	HVDC and FACTS

Professional Elective – IV

EE410	Embedded Applications to Electrical Engineering
EE411	IoT Applications to Electrical Engineering
EE412	Industrial Automation and Control

Professional Elective – V

EE413	Elements of Digital Signal Processing
EE414	Bio-medical Instrumentation
EE415	Introduction to Hybrid & Electric Vehicles

Professional Elective – VI

EE416	Renewable and Distributed Energy Systems
EE417	Smart Grids
EE418	Electrical Estimation & Costing

Open Elective-I

OE301	Artificial Intelligence & Expert Systems
OE302	Introduction to information Systems
OE303	Web Development Programming
OE304	Introduction to cyber Security
OE305	Internet of Things
OE306	Nano Technology
OE307	Remote Sensing & GIS
OE308	Optimization techniques
OE309	Renewable Energy Systems
OE310	Introduction to JAVA

Open Elective-II

OE310	Object Oriented Programming through JAVA
OE311	Ethical Hacking
OE312	Principles of programming Languages
OE313	Advanced Information Systems
OE314	Scientific Programming with Python
OE315	Fuzzy Logic & Neural networks
OE316	Building Information Modeling
OE317	Product Life Cycle Management
OE318	Simulation of Engineering Systems

Open Elective-III

OE401	Image Processing
OE402	Machine Learning
OE403	Digital Design with FPGA

Open Elective-IV

OE404	Robotics
OE405	3D Printing
OE406	Virtual Reality

PROBABILITY AND STATISTICAL ANALYSIS (PSA)

III Semester : EEE					Scheme : 2017			
Course Code	Category	Hours/Week			Credits	Maximum Marks		
BS202	Basic Science	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	-	-	3	40	60	100
Sessional Exam Duration : 2 Hrs					End Exam Duration: 3 Hrs			

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

CO1: Understand basic concepts of Statistics and Probability

CO2: Find correlation coefficient and probability distributions for the random variables.

CO3: Evaluate mean and variance of various Probability distributions

CO4: Apply the test of hypothesis for large samples

CO5: Analyze the Test of significance for small samples

UNIT – I	
Basic Statistics	Introduction to statistics, Frequency distribution, Measures of Central Tendency, Measures of dispersion; Moments.
Probability	Basic concepts of probability, Addition and Multiplication law of probability, Baye's Theorem.
UNIT - II	
Statistical Methods	Skewness and Kurtosis, Co-efficient of Correlation, Lines of regression and Rank Correlation.
Random Variables	Random variable – Discrete and continuous probability distributions and Functions, Mathematical Expectation -Variance and Co-variance.
UNIT – III	
Probability Distributions	Binomial, Poisson, Normal, Exponential and Gamma distributions. Evaluation of statistical parameters mean and variance.
UNIT - IV	
Test of Hypothesis	Population and sample, Statistical hypothesis – Null and Alternative hypothesis, Level of Significance and Critical region, Large sample test for single proportion, difference of proportions, single mean , difference of means and difference of standard deviations
UNIT - V	
Test of Significance	Student t-test - sample mean, difference between sample means and paired t-test, F – test, Chi-square test –Goodness of fit and independence of attributes.

Text Books

1.Gupta and Kapur, "Fundamentals of Mathematical Statistics", S.Chand & Company, New Delhi, 2007.

2.T.K.V.iyengar et al., "Probability And Statistics" , S.Chand & Company, 5th Edition, 2015.

3.B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, New Delhi,2012.

Reference Books

1.K.Murugesan & P.Gurusamy , "Probability And Statistics ", Anuradha Publications, Chennai, 2011.

2.Murray R Spiegal et al. "Probability And Statistics" , Schaum's series, Tata Mcgraw Hill Education , New Delhi, 2012.

3.Leomard Kazmier , "Business Statistics" , Schaum's series, Tata Mcgraw Hill Education, New Delhi, 2004.

Question Paper Pattern:

Internal Assessment: The question paper for sessional examination is for 30 marks, covering half of the syllabus for first sessional and remaining half for second sessional exam. Question No 1 which carries 6 marks contains three short answer questions of two marks each. The remaining three questions shall be EITHER/OR type questions carrying 8 marks each

End Exam: Question Paper Contains Six Questions. Question 1 contains 5 short Answer questions each of 2 marks. (Total 10 marks) covering one question from each unit. The remaining five questions shall be

EITHER/OR type questions carrying 10 marks each. Each of these questions is from one unit and may contain sub-questions. i.e there will be two questions from each unit and the student should answer any one question

ELECTRONIC DEVICES AND CIRCUITS (EDC)

III Semester: Common to ECE & EEE					Scheme : 2017			
Course Code	Category	Hours/Week			Credits	Maximum Marks		
EC201	Professional Core	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	-	-	3	40	60	100
Sessional Exam Duration: 2 Hrs					End Exam Duration: 3Hrs			

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

CO1: Develop the ability to analyze and design analog electronic circuits using discrete components.

CO2: Design and analyze rectifier circuits with filters, Clippers & Clamper circuits,

CO3: Ability to know Stabilization, Biasing circuits for BJT

CO4: Understand the construction and principle of operation of special purpose electronic devices

CO5: Design and analyze Single stage amplifiers using BJT, FET and MOSFET.

CO6: Analyze the effect of cascading on amplifier Circuits

UNIT-I

Diode Applications	Rectifiers with filters: Half wave rectifier, Full wave rectifier, bridge rectifier and their analysis with L,C,LC and CLC filters.
Linear Wave Shaping	RC network as differentiator and integrator.
Non Linear Wave Shaping	Series & Shunt Diode clippers, Clampers- positive & negative clampers, Clamping circuit theorem.
Special Purpose Diodes	Schottky Diode, SCR, Tunnel Diode, UJT, Varactor diode, Solar cell.

UNIT-II

Transistor Biasing	Need for biasing, Operating point, DC and AC load lines, Bias stabilization techniques: fixed bias, collector to base bias, self bias, Stabilization against variations in I_{CO}, VBE and β for the self bias circuit, Bias compensation techniques, Thermal runaway and thermal stability, Eber's moll model.
FET&MOSFET Biasing	DC load line and region of operation, Common-MOSFETs configurations, Design and analysis of various JFET & MOSFET biasing circuits, Introduction to CNTFET (elementary treatment)

UNIT-III

Single Stage Amplifiers	Two port device and hybrid Model, transistor hybrid Model, Analysis of a transistor amplifier circuit using h Parameters, Graphical determination of h parameters, Small signal model of bipolar junction transistor, Comparison of CB, CC and CE amplifier, Approximate CE, CB and CC models, Linear analysis of transistor amplifier circuits, Miller's Theorem and its Dual, CE amplifier with emitter resistor, Emitter Follower.

UNIT-IV

Multistage Transistor Amplifiers	Types of coupling-RC coupled, Direct coupled, Analysis of two stage RC coupled amplifier, Darlington, Bootstrap and Cascode amplifiers.

UNIT-V

FET and MOSFET Amplifiers	Small signal model of JFET, Analysis of CS, CD JFET amplifiers. Depletion and enhancement types of MOSFETs, Operation & Characteristics, Basic concepts of MOS amplifies, MOS small signal model. Common source amplifiers with resistive, diode and current source loads.

Text Books:

1. Milliman and Halkis, "Integrated Electronics", Tata Mc.Graw Hill, 2004.
2. R.E.Boylstead and L.Nashelsky, "Electronic Devices and Circuit Theory", 9/e, Pearson Education.
3. David Bell, "Electronic Devices and Circuits"- 5th Edition, Oxford
4. J.Milliman, C.Halkias & Satyabrata Jit, "Electronic Devices and Circuits", 2nd Edition, TMH, 2007

5. B.Razavi, “Design of Analog CMOS Integrated Circuits”. 1st edition, TMH.(For MOSFET amplifiers).

Reference Books:

1. Ben.G.Streetman ,” Solid state electronic devices”, PHI.
2. Nagrath , “Analog and Digital Circuits”, TMH.
3. G. K. Mithal , “Electronic Devices and Circuits”, 23rd Edition, Khanna pub. 2006
4. Bogart Theodore, “Electronic Devices and Circuits”, 6th Edition, PE, 2008.
5. Allen Mottershed, “Electronics devices and circuits”, PHI.

Web References:

1. https://www.electronics-tutorials.ws
2. www.informationvine.com

Question Paper Pattern:

Sessional Exam:

The question paper for sessional examination is for 30 marks, covering half of the syllabus for first sessional and remaining half for second sessional exam. Question No 1 which carries 6 marks contains three short answer questions of two marks each. The remaining three questions shall be EITHER/OR type questions carrying 8 marks each.

End Exam

Question paper contains Six questions; question 1 contains 5 short answer questions each of 2 marks. (Total 10 marks) covering one question from each unit. The remaining five questions shall be EITHER/OR type questions carrying 10 marks each. Each of these questions is from one unit and may contain sub-questions .i.e. there will be two questions from each unit and the student should answer any one question.

DIGITAL SYSTEM DESIGN (DSD)

III Semester : Common to ECE & EEE					Scheme : 2017			
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**Total**
EC202	**Professional Core**	**3**	**-**	**-**	**3**	**40**	**60**	**100**
Sessional Exam Duration : 2 Hrs					**End Exam Duration: 3 Hrs**			

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

CO1: Apply the basic knowledge of number systems, Boolean algebra to solve simple problems

CO2: Understand Boolean algebra, and apply it to minimize and realize Boolean functions

CO3: Design various common combinational logic circuits

CO4: Design simple sequential logic circuits

CO5: Distinguish types of FSMs and design them by following the standard procedure

UNIT – I	
Number System & Boolean Algebra	Binary numbers, Number-base Conversions, Octal and Hexadecimal numbers, Complements of numbers, Signed binary numbers, Binary codes, binary logic.
Boolean Algebra	Basic definitions, basic theorems and properties, Boolean functions, canonical and standard forms, all logic functions of two variables, digital logic gates.
UNIT – II	
Minimization & Realization Methods	2,3,4,5 - variable Karnaugh map (K-map) method, prime implicants, essential prime implicants, POS, SOP simplifications, simplifications with don't cares conditions, NAND/NOR implementations of digital gates, 2-level and multi-level NAND/NOR realizations, AND-OR-INVERT(AOI), OR-AND-INVERT(OAI), Quine-McCluskey (QM) Technique or Tabulation Method.
UNIT – III	
Combinational Logic Design	Combinational circuits, analysis & design procedures, half-adder, full-adder, binary adder, carry look ahead adder, half-subtractor, full-subtractor, binary adder with subtractor, BCD adder, binary multiplier, magnitude comparator, decoder and its applications for combinational logic implementation, encoder, priority encoder, multiplexer (MUX), combinational logic implementation using MUX, hazards in combinational logic.
UNIT – IV	
Sequential Logic Design	Sequential circuit, types of sequential circuits, latches, flip-flops, excitation tables, flip-flop conversions, registers, shift registers and its types, counters: ripple counter, BCD ripple counter, synchronous counter, Ring counter, Johnson counter.
UNIT – V	
Finite State Machines	Mealy and Moore state machines, Algorithmic State Machines, ASM chart, Design examples(ASMD chart), design of asynchronous sequential circuits, state reduction and flow tables, race-free state assignment, hazards, design examples.

Text Books:

1. Mano, Morris. M and Ciletti, Michael D, "Digital Design with an Introduction to Verilog HDL", 5th edition, Pearson, New Delhi,2013
2. Jain, R. P., "Modern Digital Electronics", 4th edition, Tata McGraw-Hill Education, New Delhi, 2010

Reference Books :

1. Kumar, Anand. A., "Fundamentals of Digital Circuit", 4th Edition, Prentice-Hall India, New Delhi, 2016
2. Fletcher, W.L., "An Engineering Approach to Digital Design", Pearson India, 2015
3. Kohavi, Zvi, "Switching and Finite Automata Theory", 3rd edition, Cambridge University Press, 2009
4. Roth,Charles H., "Fundamentals of Logic Design", 5thEdition, Cengage Learning, 2004
5. Taub, H and D.Schilling, "Digital Integrated Electronics", McGraw Hill, New York, 1977

Web References:

1. http://nptel.ac.in/courses/117106086/1
2. http://www.nptelvideos.in/2012/12/digital-systems-design.html
3. http://www.nptelvideos.in/2012/12/digital-circuits-and-systems.html
4. http://nptel.ac.in/courses/117105080/

Question Paper Pattern:

Sessional Exam:

The question paper for sessional examination is for 30 marks, covering half of the syllabus for first sessional and remaining half for second sessional exam. Question No 1 which carries 6 marks contains three short answer questions of two marks each. The remaining three questions shall be EITHER/OR type questions carrying 8 marks each

End Exam:

Question Paper Contains Six Questions. Question 1 contains 5 short Answer questions each of 2 marks. (Total 10 marks) covering one question from each unit. The remaining five questions shall be EITHER/OR type questions carrying 10 marks each. Each of these questions is from one unit and may contain sub-questions. i.e. there will be two questions from each unit and the student should answer any one question.

ELECTRICAL CIRCUITS (EC)

III Semester : EEE						Scheme : 2017		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
EE201	Professional Core	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	1	-	4	40	60	100
Sessional Exam Duration : 2 Hrs						End Exam Duration: 3 Hrs		

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

CO1: Understand circuit reduction techniques, mesh and nodal analysis, network topology concepts and coupled circuits for electrical circuits.

CO2: Understand the concept of locus diagrams, 3-phase balanced and unbalanced star and delta connected systems of electrical circuits.

CO3: Understand the concepts of series resonance, parallel resonance and applying network theorems to DC and AC circuits.

CO4: Determine the network parameters of electrical circuits

CO5: Determine the transient response of electrical circuits.

UNIT - I

Review of DC and AC Circuits:	Star-delta transformation, Super Mesh and Super Node Analysis, sinusoidal steady-state analysis of RLC parallel circuits, Complex Power, Power factor correction methods.
Network Topology:	Network graph, concept of tree, branch, links, incident matrix, tieset and cutset.
Coupled Circuits:	Concept of self and mutual inductance, co-efficient of coupling, dot convention methods.

UNIT - II

Locus Diagrams:	Current locus diagrams of series & parallel circuits.
Poly phase Circuits:	Generation of 3-phase voltages, currents and power, phase sequence, Relation between line & phase quantities in Star and Delta connection, Analysis of 3- phase balanced and unbalanced circuits with vector diagram, Measurement of 3-phase power using two wattmeter method, Measurement of reactive power.

UNIT - III

Resonance:	Series & Parallel resonance, Resonant frequency, Voltage magnification, Q-Factor, Band-Width, Half-Power frequencies, Maximum voltage drop across L and C.
Network Theorems:	Superposition theorem, Reciprocity, Thevinin's, Norton's, Maximum power transfer, Millmans, Tellegens and Compensation theorems. (DC & AC circuits)

UNIT - IV

Network Parameters:	Two port network parameters, Impedance parameters, Admittance parameters, ABCD (Transmission) parameters, Interconnection of two port networks.

UNIT - V

Transients:	Initial conditions, Transient response of RL, RC & RLC circuits for DC & AC excitations using Laplace transforms.

Text Books :

1. Hayt & Kimmerly, "Engineering Circuit Analysis", 8th Edition, TMH, 2004.
2. Joseph Edminister , "Electric Circuits", 2nd Edition, Schaum's Series , TMH, 1983.
3. Ajith Chakravarthy, "Circuit Theory", 5th Edition, Dhanpat Rai & Sons, 2006.
4. R.P.Punagin , "Electrical Circuit Analysis", 2nd Edition, Interline Publishers, Bangalore,1994.
5. Sivanaga Raju, G. Kishor and C. Srinivasa Rao, "Electrical Circuit Analysis", 1st Edition, Cengage Learning India Publishers, 2010.

Reference Books :

1. Vanvalken Berg,"Network Analysis", 3rd Edition, PHI, 2004.
2. Sudhakar & Shyam Mohan, "Circuits & Network", 5th Edition, TMH, 2007.
3. Roy Chowdary, "Networks & Systems" , 3rd Edition, New Age international publishers, 2007.

4. R.L.Boylstad, “Introductory Circuit Analysis”, 7th Edition, McMillan Publishers.1994.

Web References:

1. http://www.aast.edu/pheed/staffadminview/pdf_retreive.php?url=45_6575_EE231_2013_1__1_1_EE%20231%20_lect_01.pdf&stafftype=staffcourses
2. http://nptel.ac.in/downloads/108105053/
3. https://lecturenotes.in/subject/553/electrical-circuit-ec
4. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-002-circuits-and-electronics-spring-2007/lecture-notes/
5. https://www.smartzworld.com/notes/electric-circuits-ec/
6. https://www.docsity.com/en/subjects/electrical-circuit-analysis/

Question Paper Pattern:

Internal Assessment:

The question paper for sessional examination is for 30 marks, covering half of the syllabus for first sessional and remaining half for second sessional exam. Question No 1 which carries 6 marks contains three short answer questions of two marks each. The remaining three questions shall be EITHER/OR type questions carrying 8 marks each.

End Exam:

Question Paper Contains Six Questions. Question 1 contains 5 short Answer questions each of 2 marks. (Total 10 marks) covering one question from each unit. The remaining five questions shall be EITHER/OR type questions carrying 10 marks each. Each of these questions is from one unit and may contain sub-questions. i.e there will be two questions from each unit and the student should answer any one question

ELECTRICAL MACHINES-I (EMC-I)

III Semester :EEE						Scheme : 2017		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
EE202	Professional Core	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	1	-	4	40	60	100
Sessional Exam Duration : 2 Hrs						End Exam Duration: 3 Hrs		

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

CO1: Understand the constructional aspects, operation and working of separately excited and self-excited dc machines.

CO2: Understand the performance characteristics of dc machines.

CO3: Discuss about speed control methods of dc motors

CO4: Understand the constructional aspects and operation of 1-phase, auto transformer and poly phase transformers on various load conditions.

CO5: Analyze the performance characteristics of 1-phase, auto transformer and poly phase transformers through different testing methods.

UNIT - I	
DC Machines	Constructional details, Principle of Operation as a generator and motor, armature windings-simplex lap and wave windings, EMF equation. Armature reaction and its effects – cross magnetizing and Demagnetizing AT/pole, Methods of improving armature reaction and commutation, numerical problems.
UNIT - II	
Types of DC Generators and their characteristics	Methods of excitation – separately excited and self excited generators, build up of EMF and causes for failure, open circuit characteristics – critical field resistance and critical speed. Load characteristics of separately excited and self excited generators, parallel operation of dc generators – use of equalizer bar – load sharing, numerical problems.
UNIT - III	
DC Motor characteristics and Speed control	Back emf, starters, torque equation, characteristics of dc motors, various applications of dc motor. Losses–constant and variable losses, efficiency – condition for maximum efficiency, Speed control of dc motors-armature control, flux control and Ward-Leonard control, numerical problems
Testing of DC Machines	Direct (brake test), indirect (Swinburne's test) and regenerative testing (Hopkinsons' test), separation of stray losses test, Field's test, numerical problems.
UNIT - IV	
1-Phase Transformers	Operation on no-load and load, Equivalent circuit, phasor diagrams. Losses and efficiency, Per unit system, Regulation, All-day efficiency, Effect of variations of frequency & supply voltage on Iron losses.
Testing of transformers	Open circuit and short circuit tests, Sumpner's test, separation of losses test- parallel operation of transformers, numerical problems.
UNIT - V	
Autotransformer	Autotransformers-equivalent circuit- comparison with two-winding transformers numerical problems.
Poly-phase Transformers	Poly-phase transformer connections, third harmonics in phase voltages, three-winding transformers, tertiary windings, transients in switching, tap changing transformers, Scott connection, numerical problems.

Text Books :

1. P.S. Bimbhra, (2009) "Electrical machinery", 7th Edition, Khanna Publishers.
2. I.J. Nagrath& D.P. Kothari, (2004), "Electric Machines", 3rd Edition, Tata McGrawhill Publishers.
3. A.E. Fitzgerald, C. Kingsley and S. Umans ,"Electric Machinery", 6th Edition, Tata McGraw-Hill Companies, 2003.

4. P.S. Bimbhra, “Generalized Theory of Electrical machines”, 5th Edition, Khanna Publishers, 2002.

Reference Books :

1. H. Cotton, “Electrical Technology”, 7th Edition, CBS Publishers, 2003.
2. Mukherjee and Chakravarthy, “Electrical Machines”, 2nd Edition, Dhanpat Rai Publishers, 2001.
3. Ashfaq Hussain, “Electrical Machines” Second Edition, Dhanpat Rai Publishers.
4. Clayton and Hancock, “The Performance and Design of Direct Current machines”, 3rd Edition, CBS Publishers, 2004.

Web References:

1. www.nptel.ac.in
2. www.mit.edu
3. www.coursera.org

Question Paper Pattern:

Sessional Exam

The question paper for sessional examination is for 30 marks, covering half of the syllabus for first sessional and remaining half for second sessional exam. Question No 1 which carries 6 marks contains three short answer questions of two marks each. The remaining three questions shall be EITHER/OR type questions carrying 8 marks each.

End Exam

Question Paper Contains Six Questions. Question 1 contains 5 short Answer questions each of 2 marks. (Total 10 marks) covering one question from each unit. The remaining five questions shall be EITHER/OR type questions carrying 10 marks each. Each of these questions is from one unit and may contain sub-questions. i.e there will be two questions from each unit and the student should answer any one question

ELECTRICAL & ELECTRONIC MEASURING INSTRUMENTS (EEMI)

III Semester :EEE						Scheme : 2017		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
EE203	Professional Core	L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
		3	-	-	3	40	60	100
Sessional Exam Duration : 2 Hrs						End Exam Duration: 3 Hrs		

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

CO1: Identify suitable electrical measuring instruments for measuring electrical quantities.

CO2: Understand the operation of instrument transformer and analog instruments for the measurement of frequency, power and energy.

CO3: Understand the working of bridges and potentiometers.

CO4: Understand the operation of DVMs, multimeter and transducer.

CO5: Understand the operation of silicon based micro sensors.

UNIT - I	
Fundamentals	True Value, Errors (Gross, Systematic, Random); Static Characteristic of Instruments (Accuracy, Precision, Sensitivity, Resolution & threshold); Error Analysis-Simple problems; Statistical treatment of data-Simple problems.
Indicating Instruments	Three forces in Electromechanical indicating instrument (Deflecting, controlling & damping forces); Moving iron type (attraction and repulsion), PMMC, Electrodynamometer Type instruments: Torque equation (Expression only, no derivation), shape of scale – simple problems on torque equations; Measurement of voltage and current - Extension of Range of ammeter and voltmeter – problems on extension of range of ammeter and voltmeter.
UNIT - II	
Instrument transformers	Instrument transformers : Types, CT and PT – Ratio and phase angle errors; (Expression only, no derivation)
Measurement of power factor	Principle and operation of Single phase Electrodynamometer Power Factor Meter;
Measurement of Frequency	Principle and operation of single phase frequency meter- vibrating reed type, -ferrodynamic type meter;
Measurement of power	Principle and operation of Single phase dynamometer wattmeter, expression (Expression only no derivation) for deflecting and control torques, errors and compensations.
Measurement of energy	Principle and operation of Single phase induction type energy meter, driving and braking torques (expression only no derivation), errors and compensations, testing by phantom loading.
UNIT - III	
DC Potentiometers	Principle and operation of D.C. Crompton's potentiometer
Resistance Measurements	Principle of DC bridge balancing, Wheatstone's bridge - Kelvin's double bridge-Meggar- Applications.
Measurement of inductance	Principle of AC bridge balancing, Maxwell's inductance capacitance bridge-Anderson's bridge- Applications.
Measurement of Capacitance	Desauty's Bridge- Applications, Schering Bridge- Applications.
UNIT - IV	
Digital Voltmeters	Ramp type, Dual Slope integrating type, successive approximation, potentiometric type DVMs.
Electronic Multimeter	Electronic ohmmeter - Resistance measurement with electronic multimeter.
Transducers	Strain Gauge-gauge factor (Expression only, no derivations)-applications of strain gauge; Q-Meter.

UNIT - V	
Silicon based micro sensors	Pressure sensor, Gyro sensor, Accelerometer, Flow sensor, Proximity sensor, Temperature sensor, Humidity sensor. (Elementary treatment only)

Text Books :

1. E.W.Golding and F.C.Widdis, "Electrical Measurements and measuring Instruments", Wheeler Publishers
2. A.K.Sawhney, "Electrical & Electronic Measurement & Instruments", Dhanpat Rai & Co. Publishers
3. J. B. Gupta: "A Course in Electrical and Electronic Measurements and Instrumentation", S.K. Kataria & Sons

Reference Books :

1. Buckingham and Price, "Electrical Measurements", Prentice – Hall
2. Reissland, M.U, "Electrical Measurements: Fundamentals, Concepts, Applications", New Age International (P) Limited Publishers
3. H.S.Kalsi, "Electronic Instrumentation", Tata MCGraw-Hill Edition
4. T. R. Padmanabhan, "Industrial Instrumentation – Principles and Design", Springer

Question Paper Pattern:

Sessional Exam

The question paper for Sessional examination is for 30 marks, covering half of the syllabus for first Sessional and remaining half for second Sessional exam. Question No 1 which carries 6 marks contains three short answer questions of two marks each. The remaining three questions shall be EITHER/OR type questions carrying 8 marks each. A continuous assessment for 10 marks for assignment/quiz/both. 2 assignments/1 quiz

End Exam

Question Paper Contains Six Questions. Question 1 contains 5 short Answer questions each of 2 marks. (Total 10 marks) covering one question from each unit. The remaining five questions shall be EITHER/OR type questions carrying 10 marks each. Each of these questions is from one unit and may contain sub-questions. i.e there will be two questions from each unit and the student should answer any one question

ENVIRONMENTAL STUDIES (ES)

III Semester: Common for CE, ME, and EEE					Scheme : 2017			
Course Code	Category	Hours/Week			Credits	Maximum Marks		
ML01	Mandatory Learning	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		1	-	-	-	-	-	-
Sessional Exam Duration : -					End Exam Duration:-			

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

CO1: Apply the knowledge of environmental issues in his area of work. Understands the need for the conservation of Natural resources for sustainable development.

CO2: Understands the importance of Ecosystem and conservation of biodiversity

CO3: Understands the problems due to environmental pollution with remedial measures and issues related to environment.

CO4: Understands the disaster management in prevention of loss of life and property

CO5: Understands the use of IT & related technology to conserve environment & human health.

UNIT - I	
Introduction to Environmental studies and Natural resources	Definition, scope, importance and multidisciplinary nature of Environmental studies. Need for public awareness. Energy resources-Growing energy needs nonrenewable and renewable energy resources: Hydroelectric, solar, wind and nuclear energy resources. Water resources-Use and over exploitation of surface and ground water. Dams and its effects on forest and tribal people. Forest resources- uses of forest, deforestation causes and effects. Food resources- changes caused by agriculture and over grazing. Modern agriculture and its effects. Role of individual in conservation of natural resources.
UNIT - II	
Concepts of ecosystem	Structure and function of an ecosystem. Energy flow in an ecosystem (single channel energy flow model). Ecological succession. Food chains, food webs and ecological pyramids. Introduction, types, characteristic features and functions of grasslands, desert, pond and ocean ecosystems.
UNIT - III	
Biodiversity and its conservation	Definition, levels of biodiversity. Values of biodiversity- consumptive, productive, social, ethical and ecological services. Hot spots of biodiversity. Biogeographical classification of India. Endangered and endemic species of India. Threats to biodiversity-Habitat loss, poaching of wild life and man-wild life conflict. Conservation strategies- In situ and ex situ conservation.
UNIT - IV	
Environmental pollution	Definition, causes, effects and control measures of air, soil,water and noise pollution. Disaster management- Floods. Earth quake, cyclone and landslides. Global warming, acid rains, ozone layer depletion. Waste management-Municipal solid waste. Role of an -individual in prevention of pollution.
UNIT - V	
Social issues and the environment	Consumerism and waste products. From unsustainable development to sustainable development. Salient features of Air Act, water Act and Forest conservation Act. Process involved in the enforcement of environmental legislation. Role of Information Technology in environment and human health.

Text books

1. C.P. Kaushik and Anubha Kaushik, " Environmental Studies" New Age International(p) Ltd., New Delhi
2. R.Rajagopalan " Environmental Studies", Oxford University press, Chennai
3. Y.Anjaneyulu " Introduction to Environmental sciences", BS Publications, Hyderabad

Reference books

1. Benny Joseph. "Environmental Studies" , Tata McGraw Hill, New Delhi.
2. Barucha Erach, "Environmental studies", Universities press.

EE204-ELECTRICAL MEASUREMENTS LAB (EM(P))

III Semester: EEE						Scheme : 2017	
Course Code	Hours/Week			Credits	Maximum Marks		
EE204	L	T	P	C	Continuous Internal Assessment	End Exam	Total
	-	-	2	1	50	50	100

End Exam Duration: 3 Hrs

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

CO1: Measure Resistance, Inductance and Capacitance using bridges.

CO2: Know the calibration of single phase energy meter.

CO3: Measure power, power factor in a single phase circuit and real, reactive power in a three phase circuit.

CO4: Apply the concept of extension of range of Ammeter and Voltmeter.

CO5: Use CRO, transducer and sensors to measure non-electrical quantities.

LIST OF EXPERIMENTS

NOTE: A minimum of **eight** experiments should be conducted.

1. Measurement of resistance using Wheat stone bridge and Kelvin's Double Bridge.
2. Measurement of inductance using Maxwell's Bridge, Anderson Bridge.
3. Measurement of capacitance using De-Sauty's bridge, Schering Bridge.
4. Calibration of single phase energy meter using direct loading method.
5. Calibration of energy meter using Phantom load kit.
6. Measurement of Power using three-Voltmeter and three-Ammeter methods in a single phase circuit.
7. Measurement of real and reactive power in a three phase circuit.
8. Extend the range of given Ammeter and Voltmeter.
9. Measurement of displacement using LVDT.
10. Study of CRO: Measurement of voltage, current, frequency using lissajous patterns.
11. Measurement of voltage of a given battery and current through divide circuit using Arduino.
12. Measurement of temperature using Arduino.
13. Measurement of humidity using Arduino.
14. Measurement of distance of the object using Arduino
15. Detect the soil moisture using Arduino.

ELECTRONICS ENGINEERING LAB 1 (EE1(P))

III Semester: EEE					Scheme : 2017		
Course Code	Hours/Week			Credits	Maximum Marks		
EC212	L	T	P	C	Continuous Internal Assessment	End Exam	Total
	-	-	2	1	50	50	100

End Exam Duration: 3 Hrs

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

CO1: Understand the V-I characteristics of PN diode, Zener diode

CO2: Analyse the rectifier circuits with and without filters.

CO3: Design differentiators and Integrators using R,C elements.

CO4: Design and analyse Clippers and Clampers circuits.

CO5: Understand the Characteristics of BJT and MOSFET.

CO6: Study the frequency response of BJT, FET and MOSFETS.

Introduction to Materials and Apparatus (2 lab sessions):1. Identification, specifications and testing of R, L, C components (colour codes), potentiometers, Bread boards, CDS, PCB.

2. Identification, specifications and testing of active devices: Diodes, BJT, FET, MOSFET, SCR, & UJT

3. Study and operation of Multi-meters, Function generators, Regulated power supplies CRO & DSO

LIST OF EXPERIMENTS

NOTE: A minimum of **eight** experiments should be conducted.

1. P-N Junction Diode & Zener Diode Characteristics

2. Rectifiers
a) To construct half wave, full wave & bridge rectifiers with and without filters - Calculation of ripple factors.
b) Simulation of rectifiers and trace their output waveforms with and without filters

3. RC Network as Integrator and differentiator

4. Clipper & Clamper circuits using diodes
(i) To design, construct and observe output of Positive, negative, biased and combinational clippers
(ii) To design, construct and observe output of i. Positive, negative and biased clampers

5. Common Base input-output Characteristics

6. Common Emitter input-output Characteristics

7. FET & MOSFET Characteristics

8. Biasing Circuits
a. To design, construct and test different biasing circuits using BJTs, FETs & MOSFETs.
b. To simulate the biasing circuits and obtain the Q point

9. Common Emitter Amplifier
a. To design, construct and obtain frequency response of the circuit
b. To measure signal handling capacity, input and output impedance
c. Compare performance practically and through simulation

10. Emitter follower
a. To design, construct and obtain frequency response of the circuit
b. To measure signal handling capacity, input and output impedance
c. Compare practical and simulated results

SOFT SKILLS LAB (SSP)

III Semester : Common for all Branches				Scheme : 2017		
Course Code	Hours/Week			Credits	Maximum Marks	
HU201	L	T	P	C	Continuous Internal Assessment	TOTAL
	-	-	2	1	100	100

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

CO1: Communicate effectively and enhance their interpersonal relationship building skills with renewed self confidence

CO2: Work together in teams and accomplish objectives in a cordial atmosphere

CO3: Face interviews, GDs and give presentations

CO4: Understand and develop the etiquette necessary to present themselves in a professional setting

CO5: Learn the Principles of Personal effectiveness

List of Experiments

1. Ice breaking Activities, Principles of Time and Stress Management
2. Art of speaking -1 (Prepared)
3. Art of speaking -2 (Extempore)
4. Art of writing - Essay / Picture / Story
5. Business etiquette - Telephone and email
6. Presentation Skills - Power point making
7. Group Discussion – Objectives and Skills tested in a GD, types of GD, Dos and don'ts
8. Group Discussion - Practice
9. Team work - Drama / Skit / Role play
10. Paper / Poster Presentation
11. Problem Solving by lateral thinking puzzles
12. Know your General Awareness / Knowledge - Quiz
13. Principles of Personal excellence

Reference Books :

1. Stephen R. Covey, “The Seven Habits of Highly Effective People”, Pocket Books Publishers, London
2. Priyadarshani Patnaik, “Group Discussion and Interview Skills with VCD”, Foundation Books.
3. Sangeeta Sharma & Binod Mishra, “Communication Skills for Engineers and Scientists”, PHI Learning Private Limited.
4. Shiv Khera, “You Can Win”, MacMillan India Publishers, New Delhi
5. Campus Connect Portals - TCS - https://campuscommune.tcs.com; Infosys - http://campusconnect.infosys.com/

ANALOG ELECTRONIC CIRCUITS (AEC)

IV Semester: Common to ECE& EEE						Scheme : 2017		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
EC 207	Professional Core	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	-	-	3	40	60	100
Sessional Exam Duration:2 Hrs						End Exam Duration: 3Hrs		

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

CO1: Understand the transistor at high frequencies.

CO2: Analyze Negative feedback amplifiers circuits

CO3: Design Oscillators circuits.

CO4: Analyze large signal amplifier circuits

CO5: Analyze Tuned amplifier circuits.

	UNIT-I
Transistor At High Frequencies	Hybrid-π model, Hybrid-π conductances and capacitances CE short circuit current gain Parameters and f_T, Current gain with resistive load, Single stage CE transistor amplifier frequency response, Gain-bandwidth product (GBW), Bandwidth of cascaded amplifier stages. Analysis of CS and CD JFET amplifiers at high frequencies.
	UNIT-II
Feedback Amplifiers	Classification of amplifiers, Concepts of feedback, Classification of feedback amplifiers- General characteristics of negative feedback amplifiers- Effect of Negative feedback on Amplifier characteristics. Analysis of Feedback amplifier using Voltage series, Voltage shunt, Current series and Current shunt feedback. Simple problems.
	UNIT-III
Oscillators	Condition for oscillations, Barkhausen criterion, RC Oscillators: RC Phase shift oscillator using FET & BJT, Wien bridge oscillator, LC Oscillators: General form of LC oscillator circuit, Hartley and Colpitts oscillators, and Crystal oscillator.
	UNIT-IV
Large Signal Amplifiers	Classes of operation, Class A amplifiers (Series fed, Transformer coupled, Push pull), Second Harmonic distortion, Class B amplifiers (Push pull, Complementary symmetry), Crossover distortion and Class AB operation, Class C amplifiers and efficiency. Transistor power dissipation, Heat sinks.
	UNIT-V
Tuned Amplifiers	Need of tuned amplifiers, Q-factor, Analysis of single stage capacitive coupled, Effect of cascading on bandwidth of single tuned amplifies, Double Tuned amplifiers, Effect of cascading on bandwidth of double tuned amplifies, Stability of Tuned amplifiers.

Text Books:

1. Millman and Halkias, " Integrated Electronics", 2nd Edition, TMH 2010.
2. llen Mottershed, "Electronic Devices and Circuits", 28th Edition, PHI 2006.
3. Donald A.Neamen, "Eletcronic Circuit Analysis and Design", 2nd Edition, Mc Graw Hill 2001.
4. G. K. Mithal , "Electronic Devices and Circuits", 23rd Edition, Khanna pub. 2006
5. David A.Bell, " Solid state Pulse Circuits", 4th Edition, PHI,2002.

Reference Books:

1. Bogart Theodore, "Electronic Devices and Circuits", 6th Edition, PE 2008.
2. Millman and Grabel, "Microelectronic", 2nd Edition, TMH 2003.
3. Henry Zanger, "Semiconductor Devices and Circuits", Johnwiley 1984.
4. Sedra and Smith, "Microelectronics Circuits", 4/e, Oxford University Press- 1998.
5. Milliman and Taub, "Pulse, Digital and Switching Waveforms", McGraw Hill.

Web References:

https://www.electronics-tutorials.ws

Question Paper Pattern:

Sessional Exam:

The question paper for sessional examination is for 30 marks, covering half of the syllabus for first sessional and remaining half for second sessional exam. Question No 1 which carries 6 marks contains three short answer questions of two marks each. The remaining three questions shall be EITHER/OR type questions carrying 8 marks each.

End Exam

Question paper contains Six questions; question 1 contains 5 short answer questions each of 2 marks. (Total 10 marks) covering one question from each unit. The remaining five questions shall be EITHER/OR type questions carrying 10 marks each. Each of these questions is from one unit and may contain sub-questions .i.e. there will be two questions from each unit and the student should answer any one question.

COMPLEX VARIABLES AND SPECIAL FUNCTIONS (CVSF)

IV Semester : Common to ECE & EEE						Scheme : 2017		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
BS203	Basic Science	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	-	-	3	40	60	100
Sessional Exam Duration : 2 Hrs						End Exam Duration: 3 Hrs		

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

CO1: Understand continuity and analyticity of various complex valued functions.

CO2: Find the Taylor's and Laurent's series expansion of complex functions and evaluate definite real integrals using residues theorem.

CO3: Explain the various properties of the Bessel's and Legendre functions.

CO4: Compute interpolating polynomial for the given data

CO5: Solve ordinary differential equations using numerical techniques

UNIT – I	
Complex Variables	Analytic functions, Cauchy-Riemann equations, sufficient condition for analyticity, Harmonic function, Method to find the Conjugate function, Milne – Thomson method. Conformal Mapping (e^z , z^2 , sinz, cosz) , Bilinear Transformation.
UNIT - II	
Complex Integration & Series	Simple and Multiple Connected regions, Cauchy's Integral theorem, Cauchy"s integral formula, Generalized Integral formula. Taylor's series, Maclaurin's series and Laurent"s series. Residue theorem, Method of finding residues. Evaluation of real integrals by contour integration, Integration round the unit circle and in the interval $(-\infty, \infty)$.
UNIT – III	
Bessel Functions	Solution of Bessel's equation, Recurrence relations for $J_n(x)$, Generating function, Jacobi series, Orthogonality of Bessel's function.
Legendre Functions	Solution of Legendre's equation, Rodrigue's formula, Legendre polynomials, Generating function, Recurrence relations for $P_n(x)$ and Orthogonality of Legendre polynomials.
UNIT - IV	
Interpolation	Operators, relation between the operators. Newton's forward and backward interpolation formulae. Lagrange's and Inverse Lagrange's interpolation formulae. Cubic Spline interpolation.
UNIT - V	
Numerical Methods	Solution of first order Differential equations. Taylor's method, Picard's method, Euler's and Modified Euler's method. Runge -Kutta methods of second and forth order. Predictor - Corrector methods- Milne's method and Adam's method.

Text Books

. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 2012.

. K.V Iyengar et all., "Engineering Mathematics", Vol-3, S.Chand & Co. New Delhi,2013.

Reference Books

1. S.S.Sastry, "Introductory Methods of Numerical Analysis", PHI, 2010.

2. Erwin Kreyszig "Advanced Engineering Mathematics", John Wiley and Sons 8th Edition,2008

Question Paper Pattern:

Internal Assessment: The question paper for sessional examination is for 30 marks, covering half of the syllabus for first sessional and remaining half for second sessional exam. Question No 1 which carries 6 marks contains three short answer questions of two marks each. The remaining three questions shall be EITHER/OR type questions carrying 8 marks each

End Exam: Question Paper Contains Six Questions. Question 1 contains 5 short Answer questions each

of 2 marks. (Total 10 marks) covering one question from each unit. The remaining five questions shall be EITHER/OR type questions carrying 10 marks each. Each of these questions is from one unit and may contain sub-questions. i.e there will be two questions from each unit and the student should answer any one question

.

MANAGERIAL ECONOMICS AND PRINCIPLES OF ACCOUNTACY (MEPA)

IV Semester: Common for CE and EEE						Scheme: 2017		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
HU202	Humanities	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	-	-	3	40	60	100
Sessional ExamDuration:2 Hrs						EndExamDuration:3 Hrs		

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

CO1: Understand the nature and scope of managerial economics and various concepts of demand analysis.

CO2: Understand the significance of demand elasticity and different concepts of demand

CO3: Understand the concepts of production and cost analysis and different market structures and their competitive situations

CO4: Understand the concept and significance of capital budgeting

CO5: Understand the principles and significance of accountancy and preparation of final accounts

UNIT– I	
Introduction to Managerial Economics & Demand	Definition, Nature and Scope; Demand -Meaning, Types of Demand, Demand Determinants, Law of Demand and its exceptions, Law of Diminishing Marginal Utility, Indifference curve.
UNIT-II	
Elasticity of Demand	Types, Measurement and Significance.
Demand forecasting	Importance, Factors, Purposes, Methods of Demand Forecasting
UNIT– III	
Production Analysis	Meaning, Isoquants & Isocosts, The law of diminishing Marginal Returns, Law of Returns to Scale, Internal and External Economies of scale.
Cost Analysis	Cost concepts, Cost output relationship for Short Run and Long Run, Break Even Analysis – Its Importance, Limitations and Managerial uses.
Market Structures:	Types and Features of different market structures–Perfect Competition – Monopoly – Monopolistic and Oligopolistic; Price output determination in case of perfect competition and Monopoly.
UNIT– IV	
Capital and Capital Budgeting	Significance of capital budgeting, steps in capital budgeting, optimum level of capital, decision to invest under certainty-payback period method, net discounted present value method, internal rate of return method, sources of capital, decision to invest under risk and uncertainty.
UNIT– V	
Introduction to Financial Accountancy	Introduction, Double Entry System of Book Keeping-, Journal, Ledger, Preparation of Trial balance.
Preparation of Final Accounts	Trading Account, Profit & Loss Account, and Balance Sheet with adjustments, Final Accounts problems.

Text Books :

1. A.R. Aryasri, "Managerial Economics and Financial Analysis", McGrawHill Education.

Reference Books :

1. Varshiney and Maheswari, "Managerial Economics", Sultan Chand & Co, New Delhi.

2. Vanita Agarwal," Managerial Economics", Pearson Education.
3. Domnick Salvatore, "Managerial Economics in a Global Economy", 4th Edition, Thomson.
4. S.P.Jain and K.L.Narang, "Financial Accounting", Kalyani Publishers.
Question Paper Pattern:
Internal Assessment: The question paper for sessional examination is for 30 marks, covering half of the syllabus for first sessional and remaining half for second sessional exam. Question No 1 which carries 6 marks contains three short answer questions of two marks each. The remaining three questions shall be EITHER/OR type questions carrying 8 marks each **End Exam:** Question Paper Contains Six Questions. Question 1 contains 5 short Answer questions each of 2 marks. (Total 10 marks) covering one question from each unit. The remaining five questions shall be EITHER/OR type questions carrying 10 marks each. Each of these questions is from one unit and may contain sub-questions. i.e there will be two questions from each unit and the student should answer any one question.

ELECTRICAL MACHINES-II (EMC-II)

IV Semester :EEE						Scheme : 2017		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
EE205	Professional Core	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	1	-	4	40	60	100
Sessional Exam Duration : 2 Hrs						End Exam Duration: 3 Hrs		

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

CO1: Understands the basic principles and constructional aspects of 3-phase rotating machines.

CO2: Analyze the operation, working and performance characteristics of 3-phase and 1-phase induction motors**.**

CO3: Discuss about synchronization, parallel operation and load sharing, effect of change of excitation and mechanical power input of alternators.

CO4: Analyze the performance characteristics of synchronous machines, methods of starting and its applications.

UNIT - I	
Basics of Three phase rotating machines	Constructional features, principle of working of 3-phase induction motor and synchronous machine, Armature windings, integral slot and fractional slot windings, Distributed, concentrated and chorded windings, distribution, pitch and windings factors,
3-phase induction motor	Phasor diagram, rotor input, losses and power flow diagram, torque equation-expressions for maximum torque and starting torque, torque - slip characteristics, crawling and cogging, double-cage and deep-bar rotors, equivalent circuit, circle diagram & predetermination of performance, numerical problems
UNIT - II	
Starting of three phase induction motor	Starting methods: direct online starting, stator reactor starting, autotransformer starting, star-delta starting, rotor resistance starter and starting current and starting torque calculations, numerical problems.
Speed control of Induction motors	Speed control – change of frequency, change of poles-methods of consequent poles–cascade connections, rotor resistance method, injection of an emf into rotor circuit (qualitative treatment only), induction generator (qualitative treatment only), numerical problems.
UNIT - III	
1-phase Induction motors	Principle of working, determination of equivalent circuit parameters – numerical problems. Starting methods and types - split-phase induction motors, capacitor motors, capacitor start motors, two value capacitor motors, permanent split capacitor (PSC) motor, shaded pole induction motor.
UNIT - IV	
Synchronous Machines	EMF equation, Harmonics in generated emf, slot harmonics and suppression of harmonics, Armature reaction, numerical problems
Regulation of Alternators	Regulation of Alternators: Regulation of alternator by synchronous impedance method, M.M.F. method and Z.P.F method, two reaction analysis, experimental determination of Xd and Xq, phasor diagrams, regulation of salient pole alternators, numerical problems
UNIT - V	
Parallel operation of Alternators	Synchronization of alternators with infinite bus bars , synchronizing power, parallel operation and load sharing, effect of change of excitation and mechanical power input, numerical problems.
Synchronous motors	Theory of operation, phasor diagram, synchronous condenser, numerical problems. Hunting and its suppression, methods of starting, numerical problems.

Text Books :

1. P.S. Bimbhra, “Electrical machinery”, 7th Edition, Khanna Publishers, 2009.
2. I.J. Nagrath& D.P. Kothari, “Electric Machines”, 3rd Edition, Tata McGrawhill Publishers,2004.

3. A.E. Fitzgerald, C. Kingsley and S. Umans , “Electric Machinery”, 6th Edition, Tata McGraw-Hill Companies, 2003.
4. P.S. Bimbhra, “Generalized Theory of Electrical machines”, 5th Edition, Khanna Publishers, 2002.

Reference Books :

1. H. Cotton, “Electrical Technology”, 7th Edition, CBS Publishers, 2003
2. Mukherjee and Chakravarthy, “Electrical Machines”, 2nd Edition, Dhanpat Rai Publishers,2001.
3. Ashfaq Hussain, “Electrical Machines” Second Edition, Dhanpat Rai Publishers.
4. M. G. Say, “ The Performance and Design of Alternating Current Machines”, CBS Publishers & Distributers PVT. Ltd.,New Delhi, 2005.

Web References:

1. www.nptel.ac.in
2. www.mit.edu
3. www.coursera.org

Question Paper Pattern:

Internal Assessment: The question paper for sessional examination is for 30 marks, covering half of the syllabus for first sessional and remaining half for second sessional exam. Question No 1 which carries 6 marks contains three short answer questions of two marks each. The remaining three questions shall be EITHER/OR type questions carrying 8 marks each

End Exam: Question Paper Contains Six Questions. Question 1 contains 5 short Answer questions each of 2 marks. (Total 10 marks) covering one question from each unit. The remaining five questions shall be EITHER/OR type questions carrying 10 marks each. Each of these questions is from one unit and may contain sub-questions. i.e there will be two questions from each unit and the student should answer any one question.

POWER SYSTEMS-I (PS-I)

IV Semester: EEE						Scheme : 2017		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
EE206	Professional Core	L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
		3	-	-	3	40	60	100
Sessional Exam Duration : 2 Hrs						End Exam Duration: 3 Hrs		

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

CO1: Understand the operation of conventional power plants.

CO2: Understand the electrical design of transmission lines.

CO3: Evaluate the performances of transmission lines.

CO4: Understand the mechanical design of transmission lines.

CO5: Understand the basic concepts of distribution system and underground cables.

UNIT - I	
Conventional Power Generation Plants	Line diagrams of Thermal Power Station, Hydro power station, Gas and nuclear Power stations. Advantages and disadvantages of the plants. Types of Nuclear reactors and brief description of PWR, BWR and FBR.
UNIT - II	
Transmission Line Parameters	Electrical design of Overhead Transmission Lines – Calculation of Line constants of 1- phase, 3-phase system of symmetrical, unsymmetrical and transposed configurations –Calculation of Line constants of stranded conductor, double circuit 3-phase system using GMD and GMR Concepts.
UNIT - III	
Performance Of Transmission Lines	Classification of Transmission Lines -Short, medium and long line and their model representations - Nominal-T, Nominal-π and A, B, C, D Constants for symmetrical networks, Numerical Problems and solutions for estimating regulation and efficiency of all types of lines. – Numerical Problems.
UNIT - IV	
Performance of Factors affecting the Transmission line	Skin and Proximity effects, Ferranti effect, Charging Current - Corona - factors affecting corona, critical voltages and power loss.
Overhead Line Insulators	Types of Insulators, String efficiency and Methods for improvement, voltage distribution, calculation of string efficiency, Numerical Problems.
Sag and Tension Calculations	Sag and Tension Calculations with equal and unequal heights of towers, Effect of Wind and Ice on weight of Conductor, Stringing chart, Numerical Problems.
UNIT - V	
Underground Cables	Types of Cables, Construction, Calculations of Insulation resistance and stress in insulation, Numerical Problems. Capacitance of Single and 3-Core belted cables, Numerical Problems. Grading of Cables, Capacitance grading, Inter-sheath grading, Numerical Problems.
DC And AC Distribution	Basic concepts of DC and AC distribution, Distributor fed at one end, Distributor fed at both end. Methods of AC distribution, Power factor referred to received end only, numerical problems.

Text Books :

1. M.L.Soni, P.V.Gupta, U.S.Bhatnagar, A.Chakrabarthy, "A Text Book on Power System Engineering", Dhanpat Rai & Co Pvt. Ltd. 1999.
2. C.L.Wadhwa, "Electrical Power Systems", New Age International (P) Limited, Publishers, 1998.
3. V.K Mehta and Rohit Mehta (2004), "Principles of Power Systems", S.Chand & Company, New Delhi.
4. Dr.B.R.Gupta , "Generation of Electric Energy", 6th edition, 2008**,** S.Chand Publisher.

Reference Books :

1. John J Grainger William D Stevenson, "Power system Analysis", TMC Companies, 4th edition, 2004
2. Hadi Saadat, "Power System Analysis", TMH Edition. 2002.

Web References:

1. https://en.wikipedia.org/wiki/Hydroelectricity
2. https://en.wikipedia.org/wiki/Thermal_power_station
3. https://www.electrical4u.com/power-plants-types-of-power-plant/
4. http://www.eng.uwi.tt/depts/elec/staff/alvin/ee35t/notes/Transmission-Line-Construction.html
5. http://engineering.electrical-equipment.org/others/underground-cables-advantages-disadvantages.html

Question Paper Pattern:

Internal Assessment: The question paper for sessional examination is for 30 marks, covering half of the syllabus for first sessional and remaining half for second sessional exam. Question No 1 which carries 6 marks contains three short answer questions of two marks each. The remaining three questions shall be EITHER/OR type questions carrying 8 marks each

End Exam: Question Paper Contains Six Questions. Question 1 contains 5 short Answer questions each of 2 marks. (Total 10 marks) covering one question from each unit. The remaining five questions shall be EITHER/OR type questions carrying 10 marks each. Each of these questions is from one unit and may contain sub-questions. i.e there will be two questions from each unit and the student should answer any one question.

ELECTROMAGNETIC FIELDS (EMF)

IV Semester : EEE						Scheme : 2017		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
EE207	Professional Core	L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
		3	-	-	3	40	60	100
Sessional Exam Duration : 2 Hrs						End Exam Duration: 3 Hrs		

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

CO1: Review the basics of three dimensional orthogonal coordinate systems (rectangular, cylindrical and spherical) and vector calculus applicable to electromagnetic field theory.

CO2: Understand laws of electrostatics and its application for different electrical engineering problems.

CO3: Understand the behavior of electric field in free space and materials and obtain expressions for energy, energy density, capacitance due to parallel plate and spherical capacitors.

CO4: Understand laws of magnetostatics and its application to determine parameters of magnetic circuits and configurations.

CO5: Understand Maxwell's equations for time varying fields and its applications in the electromechanical energy conversion and wave propagation fields.

UNIT – I	
Coordinate Systems and Transformation	Cartesian coordinates, Circular cylindrical coordinates, Spherical coordinates & their transformations.
Vector Calculus	Differential length, area and volume in different coordinate systems**;** Physical interpretation of gradient, divergence and curl - Numerical problems.
UNIT – II	
Electrostatic Fields	Coulomb's Law; Electric Field Intensity (EFI) – EFI due to a line and a surface charge; Electric Flux Density; Guass's law – Maxwell's first law Div(D) =ρ_v , Application of Guass's Law; Work done in moving a point charge in an electrostatic field, Maxwell's second equation Curl(E) = 0; Electric Potential – Potential due to point, line and spherical charge distributions; Potential gradient.
UNIT – III	
Electric fields in Material space	Classification of materials – Conductors, Insulators and semi conductors; Behaviour of conductors in an electric field; Electric field inside a dielectric material – polarization, Dielectric constant and strength; Boundary Conditions.
Capacitor and Capacitance	Capacitance – Capacitance of parallel plate and spherical capacitors; Energy stored and energy density in a static electric field.
UNIT – IV	
Magnetostatics	Biot-Savart's law, Magnetic field intensity (MFI) – MFI due to a straight current carrying filament, circular, solenoid current Carrying wire; Ampere's circuit law - Maxwell's third equation (Curl(H) = J), Ampere's circuit law applications; Magnetic flux density – Maxwell's fourth equation Div(B) = 0.
Magnetic Force and Inductance	Magnetic force on a moving charge in a Magnetic field, Lorentz force equation; Force on a current element in a magnetic field – Force on a straight, long current carrying conductor; Force between two differential current elements – Force between two straight long and parallel current carrying conductors. Inductors, Self and mutual inductance; Neuman's formulae; Determination of self inductance of solenoid and toroid; Magnetic circuits – Analogy between electric and magnetic circuits.
UNIT – V	
Time Varying Fields	Faraday's laws of electromagnetic induction – Maxwell's equation Curl(E) =$-\frac{\partial B}{\partial t}$, Static and dynamic induced EMF – Simple problems; Displacement current -

	Maxwell's equation Curl(H) = J + $\frac{\partial D}{\partial t}$; Maxwell's equations for time varying fields; Poynting Theorem and Poynting vector.

Text Books :

1. Matthew N O Sadiku, "Principles of Electromagnetics", Oxford University Press, 4th Edition.
2. William H. Hayt & John. A. Buck, "Engineering Electromagnetics", Mc. GrawHill Companies, 7th Edition, 2006.

Reference Books :

1. Joseph Edminister, "Electromagnetics", 2nd Edition, Schaum's outline series TMH, 2004.
2. S.Sivanagaraju , C.Srinivasa Rao, "Electromagnetic Fields", New Age publishers, India,2008.

Web References:

1. http://nptel.ac.in/courses/108106073/
2. https://www.youtube.com/watch?v=pGdr9WLto4A
3. https://tektro2011.files.wordpress.com/2013/03/schaums-outline-of-electromagnetics-2ed.pdf
4. http://freevideolectures.com/Course/3288/Electromagnetic-Theory

Question Paper Pattern:

Sessional Exam

The question paper for sessional examination is for 30 marks, covering half of the syllabus for first sessional and remaining half for second sessional exam. Question No 1 which carries 6 marks contains three short answer questions of two marks each. The remaining three questions shall be EITHER/OR type questions carrying 8 marks each.

End Exam

Question Paper Contains Six Questions. Question 1 contains 5 short Answer questions each of 2 marks. (Total 10 marks) covering one question from each unit. The remaining five questions shall be EITHER/OR type questions carrying 10 marks each. Each of these questions is from one unit and may contain sub-questions. i.e there will be two questions from each unit and the student should answer any one question

ELECTRICAL MACHINES-I LAB (EMC1(P))

IV Semester : EEE					Scheme : 2017		
Course Code	Hours/Week			Credits	Maximum Marks		
EE208	L	T	P	C	Continuous Internal Assessment	End Exam	Total
	-	-	2	1	50	50	100

End Exam Duration: 3Hrs

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

CO1: Obtain the performance characteristics of DC shunt machines under no load and for varying loads

CO2: Perform tests on self-excited DC Motor-Generator Sets.

CO3: Obtain the characteristics of dc compound machines

CO4: Conduct the speed control test and separate the losses test on dc shunt motor.

CO5: Obtain the performance characteristics of 1-phase Transformers under no load and for varying loads.

CO6: Perform tests on 1-phase transformers to verify 3-phase to 2-phase conversion and separate the losses.

LIST OF EXPERIMENTS

NOTE: A minimum of **eight** experiments should be conducted.

1. Open circuit characteristic (OCC) of DC shunt generator.
2. Load test on DC shunt generator.
3. Brake test on DC compound motor.
4. Swinburne's test on DC shunt Machine.
5. Brake test on DC shunt motor.
6. Hopkinson's test.
7. Field's test.
8. Speed control of DC shunt motor.
9. Separations of losses of DC shunt motor.
10. Load test on DC compound generator.
11. OC, SC Test on 1-phase transformer.
12. Sumpner's test on two identical single phase transformers.
13. Scott connection (3phase to 2phase conversion) of Transformer.
14. Separation of losses in a single phase transformer.
15. Load test on single phase transformer.

ELECTRICAL CIRCUITS LAB (EC(P))

IV Semester : EEE					Scheme : 2017		
Course Code	Hours/Week			Credits	Maximum Marks		
EE209	L	T	P	C	Continuous Internal Assessment	End Exam	Total
	-	-	2	1	50	50	100

End Exam Duration: 3Hrs

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

CO1: Understand the verifications of KCL, KCL, superposition, Maximum power, Thevenin's and Norton's theorems.

CO2: Understand the concept of RLC series and parallel resonance, Locus diagrams and coupled circuits

CO3: Determine the network parameters and transient response of the circuits

CO4: Simulate the circuits using PSpice

LIST OF EXPERIMENTS

NOTE: A minimum of **eight** experiments should be conducted.

1. Verification of KCL & KVL (i) Experiment (ii) Simulation
2. Verification of Maximum Power Transfer Theorem (i) Experiment (ii) Simulation
3. i. Verification of Reciprocity Theorem (i) Experiment (ii) Simulation

   ii. Verification of Superposition Theorem (i) Experiment (ii) Simulation
4. Verification of Thevenin's Theorem (i) Experiment (ii) Simulation
5. Verification of Norton's Theorem (i) Experiment (ii) Simulation
6. Determination of Self & Mutual Inductance
7. RLC Series & Parallel Resonance
8. Determination of Z & Y Parameters
9. Determination of ABCD Parameters
10. RL & RC Locus Diagrams
11. Digital simulation of an electric circuit (Including dependant sources) to find node voltages and branch currents using PSpice.
12. Digital simulation of an electric circuit to find transient response.
13. Digital simulation of series and parallel resonance using PSpice
14. Transient analysis of Series RL, RC circuits
15. Frequency response of single tuned coupled circuit

ELECTRONICS ENGINEERING LAB II (EE2(P))

IV Semester: EEE					Scheme : 2017		
Course Code	Hours/Week			Credits	Maximum Marks		
EC213	L	T	P	C	Continuous Internal Assessment	End Exam	Total
	-	-	2	1	50	50	100

End Exam Duration: 2 Hrs

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

CO1: Study the Combinational and Sequential Circuits

CO2: Study the MOSFET amplifier characteristics.

CO3: Analyse the effect of feedback on amplifier characteristics

CO4: Analyse the effect of Negative and Positive feedback on amplifiers

CO5: Determine the efficiency of Class A Power amplifier and Class B Complementary Symmetry Power amplifier

CO6: Design and analyse two stage RC coupled amplifier, Darlington, Bootstrap and amplifiers.

CO7: Design single Tuned amplifier and verify its frequency response.

Design and Simulation using simulation Software (tina-pro/multisim) and testing in Laboratory. (12 Experiments including simulation of 6experiments and testing of 6 experiments in Laboratory)

LIST OF EXPERIMENTS

NOTE: A minimum of **eight** experiments should be conducted.

1. Logic Gates:
Verify the logical operations of Basic gates and Universal gates of Logic gates

2. Arithmetic Operations:
Verify the operation of Half Adder and Full Adder, Half subtractor and Full Subtractor.

3. Combinational logic circuits:
Verify the operation of Multiplexer and decoder.

4. Sequential Logical Circuits:
Verify the operation of Shift Register and Ring Counter

5. MOSFET amplifier
a. To design, construct and obtain frequency response of the MOSFET amplifier circuits
b. To measure signal handling capacity, input and output impedance
c. Compare performance practically and through simulation

6. Negative feedback amplifier
a. To design, construct and test response of i. voltage shunt ii. voltage series feedback amplifiers with and without feedback for the given specifications
b. To compare their frequency response through simulation

7. RC oscillators
To design, construct and test the
a. RC Phase shift oscillator b. Wien bridge oscillator for the given specifications.

8. Class B complementary symmetry amplifier .
To obtain the frequency Vs power and load Vs power characteristics.

9. Cascade Amplifier
a. To design, construct and obtain frequency response of a two stage RC coupled amplifier
b. To measure signal handling capacity, input and output impedance
c. Compare performance practically and through simulation

10. Darlington pair
To design, construct and obtain frequency response practically and through simulation

11. Bootstrap Amplifier
To design, construct and obtain frequency response practically and through simulation

12. Single Tuned Amplifier

To design, construct and obtain frequency response practically and through simulation

ADVANCED COMMUNICATION SKILLS LAB (ACSP)

IV Semester : Common for all Branches					Scheme : 2017	
Course Code	Hours/Week			Credits	Maximum Marks	
HU203	L	T	P	C	Continuous Internal Assessment	TOTAL
	-	-	2	1	100	100

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

CO1: Speak in English confidently, fluently and effectively.

CO2: Exhibit team playing and leadership skills.

CO3: Give Presentations effectively.

CO4: Comprehend the Verbal and Non-verbal texts.

CO5: Prepare Resume, Company profiles and Project presentations.

CO6: Enhance possibilities of Job prospects.

List of Experiments

Focus in the lab is more on fluency than on accuracy

1. Ice breaking Activities
2. JAM
3. Listening Comprehension – Practice tests
4. Oral Presentation
5. Presentation Strategies
6. Group Discussion – Team Playing, Leadership Skills
7. Debate
8. PPT's – Principles and Formats
9. Information Transfer – Verbal to Non-verbal and Vice-Versa
10. Resume Preparation
11. Company Profiling
12. Interview Skills – a) Telephonic Interview
    b) Personal Interview
13. Project Presentation

Reference Books :

1. Communication Skills, Sanjay Kumar and Pushp Lata, Oxford University Press.
2. English Language Laboratories A Comprehensive Manual, Nira Konar, PHI.
3. Technical Communication 3 E, Raman and Sharma, Oxford University Press.
4. Personality Development and Soft Skills, Barun k. Mitra, Oxford University Press.

POWER ELECTRONICS -I (PEL1)

V Semester : EEE					Scheme : 2017			
Course Code	Category	Hours/Week			Credits	Maximum Marks		
EE301	Professional Core	L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
		3	0	0	3	40	60	100
Sessional Exam Duration : 2 Hrs					End Exam Duration: 3 Hrs			

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

CO1: Understand the working and characteristics of power semi conductor devices like diode, SCR, TRIAC, MOSFET & IGBT.

CO2: Understand the principle of operation and performance parameters of 1-Φ half and fully controlled bridge converters with R, RL loads.

CO3: Understand power factor improvement schemes for converters.

CO4: Understand the principle, operation of 3-Φ half and fully controlled bridge converters with R, RL loads.

CO5: Understand the working of 1-Φ, 3-Φ dual converters in circulating and non-circulating modes of operation.

CO6: Understand the working of Class A, Class B, Class C, Class D and Class E choppers.

CO7: Understand the performance of converter fed DC separately excited motor.

UNIT - I	
Basics of Power Electronics	Concept of power electronics, scope and applications, power semiconductor switches (Diodes, SCR, TRIAC, Power BJT, Power MOSFET and Power IGBT), types of power converters, SCR triggering & commutation (Qualitative treatment only).
UNIT - II	
1-Φ Controlled Rectifiers	1-Φ half and fully controlled bridge converters with R and RL load. Performance analysis of 1-Φ fully and half-controlled bridge converters with continuous mode of operation, Simple Problems.
Power factor improvement schemes	Extinction angle control, symmetric angle control, pulse width modulation control.
UNIT - III	
3-Φ Controlled Rectifiers	Three-phase half and fully controlled bridge converters with R and RL load. Derivation of RMS and average values. Simple Problems.
Dual converters	1-Φ, 3-Φ Dual converters with circulating and non-circulating current operation, simple problems.
UNIT - IV	
Review of DC machines	Speed control and braking methods of separately excited DC machines.
Converter controlled DC motor	1-Φ and 3-Φ half and fully controlled bridge converter fed DC separately excited motor under continuous current operation – output voltage and current waveforms, speed-torque expressions and characteristics. Simple problems.
UNIT - V	
DC-DC Converters	Introduction to choppers- control strategies, principle and operation of step-down and step –up choppers, time domain analysis of step down chopper, classification of choppers. Simple problems.
Chopper controlled DC Motors:	Chopper fed dc separately excited motor under continuous current operation – output voltage and current waveforms, speed-torque expressions and characteristics. Closed loop operation of DC drive (block diagram only).

Text Books :

1. P.C. Sen, "Power Electronics", 35th Reprint, Tata McGraw Hill Publishers. 2010

2. M.H. Rasheed , "Power Electronics Circuits Devices and Applications", 3rd Edition, PHI publishers. 2004

3. P.S. Bimbhra , “Power Electronics”, 4th Edition, Khanna publishers. 2010

4. G.K. Dubey , “Fundamentals of Electrical drives” 2 nd Edition, Narosa Publishers. 2001.

Reference Books :

1. Ashfaq Ahmed, “Power Electronics for Technology” First Indian Reprint, Pearson Education Publishers. 2003

2. G.K. Dubey , “Power Semiconductor controlled drives”, Prentice-Hall, Englewood Cliffs, Publishers. 1989.

3. M.D. Singh and K.B. Khanchandani , “Power Electronics”, 2nd Edition, Tata McGraw Hill Publishers. 2002.

Web References:

1. https://nptel.ac.in/downloads/108105066/
2. https://nptel.ac.in/courses/108101126/
3. https://nptel.ac.in/syllabus/108108077/
4. https://www.youtube.com/watch?v=Coy-WRCfems

Question Paper Pattern:

Sessional Exam

The question paper for sessional examination is for 30 marks, covering half of the syllabus for first sessional and remaining half for second sessional exam. Question No 1 which carries 6 marks contains three short answer questions of two marks each. The remaining three questions shall be EITHER/OR type questions carrying 8 marks each.

End Exam

Question Paper Contains Six Questions. Question 1 contains 5 short Answer questions each of 2 marks. (Total 10 marks) covering one question from each unit. The remaining five questions shall be EITHER/OR type questions carrying 10 marks each. Each of these questions is from one unit and may contain sub-questions. i.e there will be two questions from each unit and the student should answer any one question

MICROPROCESSORS AND MICROCONTROLLERS (MPMC)

V Semester :Common for ECE&EEE						Scheme : 2017		
Course Code	Course Category	Hours/Week			Credits	Maximum Marks		
EC302	Professional Core	L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
		3	0	0	3	40	60	100
Sessional Exam Duration : 2 Hrs						End Exam Duration: 3 Hrs		

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

CO1: Understand the definition, architectures of 8086 microprocessor and 8051microcontroller.

CO2: Understand the programming model of 8086 microprocessor and 8051microcontroller.

CO3: Apply the programming model of 8086 microprocessor and the 8051 microcontroller forassembly language programs respectively.

CO4: Utilize the port interfacing concepts to program and control various peripherals.

UNIT – I

Introduction of Microprocessors

8-bit, 16-bit microprocessors. 8086: 8086 CPU architecture, segmented memory, Physical Memory Organization.

UNIT – II

8086 Programming model

Addressing modes, 8086 instruction set, Basic Assembler Directives, Simple programs on Arithmetic operations Sorting, Searching, Code conversions, and String manipulations.

UNIT –III

Peripheral Interfacing

8255 (Programmable Peripheral Interface), 8255 applications – Basic Mode Applications - Stepper Motor interfacing, DAC interfacing Waveform generation and ADC interfacing. Introduction to 8251(USART), 8259 (Programmable Interrupt Controller).

UNIT –IV

Introduction to MCS51 family

8051 Micro controller Architecture, Input / Output ports and circuits, External memory, counters and Timers, Serial data input/output, interrupts.

UNIT-V

Programming and Interfacing

Addressing Modes, Instruction set. Basic Programming with 8051 Micro controller. Interfacing LCD, LEDs, Stepper Motor.

Text Books :

1. A K Ray, K M Bhurchandi, Advanced Microprocessors and Peripherals, 2nd Edition, Tata McGraw Hill Education Private Ltd, 2010.
2. Mazidi Muhammad Ali, Mazidi Janice Gillespie & McKinlay Rolin D, The 8051 Microcontroller and Embedded Systems, 2nd Edition, Pearson Education, 2008.

Reference Books :

1. John Uffenbeck, The 8086/8088 Family: Design, Programming, and Interfacing, 3rd Edition, Pearson Ed, 2006.
2. Barry B. Brey, The Intel Microprocessors-Architecture, Programming and Interfacing, 8th Edition, Princeton Hall India, 2009.
3. Kenneth J. Ayala, The 8051 Microcontroller, Penram International Publication Ltd, 2006.
4. Gaonkar Ramesh, Microprocessors Architecture, Programming & Applications with 8085/8080A, 5th Edition, Penram International publication Ltd, 2010.
5. N. Senthil Kumar, M. Saravanan, S. Jeevananthan, Microprocessors and Interfacing, OUP India, 2012.

Web References:

1. www.nptel.onlinecourseac.in/.microprocessorsandmicrocontrollers
2. https://onlinecourses.nptel.ac.in/noc18_ec03/

Question Paper Pattern:

Sessional Exam:

The question paper for sessional examination is for 30 marks, covering half of the syllabus for first sessional and remaining half for second sessional exam. Question No 1 which carries 6 marks containsthree short answer questions of two marks each. The remaining three questions shall be EITHER/ORtype questions carrying 8 marks each

End Exam:

Question Paper Contains Six Questions. Question 1 contains 5 short Answer questions each of 2 marks. (Total 10 marks) covering one question from each unit. The remaining five questions shall be EITHER/OR type questions carrying 10 marks each. Each of these questions is from one unit and maycontain sub-questions. i.e. there will be two questions from each unit and the student should answer any one question.

CONTROL SYSTEMS ENGINEERING (CSE)

V Semester : EEE						Scheme : 2017		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
EE302	Professional Core	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	40	60	100
Sessional Exam Duration : 2 Hrs						End Exam Duration: 3 Hrs		

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

CO1: Understand the behavior of open loop and closed control system and mathematical model of electrical and mechanical systems.

CO2: Apply block diagram reduction techniques and Mason's gain formula for finding the transfer function of a given control system.

CO3: Understand standard test inputs, controllers, transient and steady state response for a 2^{nd} order control system for unit step input.

CO4: Apply analytical and graphical techniques to determine the stability of control system in both time and frequency domains.

CO5: Understand concept of compensation, state model, controllability & observability of a systems.

UNIT – I	
Equations and Models of Linear Systems:	Open-loop and closed-loop systems, control system components, servomotor, tachometer, synchro, Transfer functions, Determination of transfer function of electrical and mechanical systems, problems.
Block Diagram & Signal flow graph	Block diagram representation and manipulation, signal flow graphs-mason's gain formula to determine overall system gain of control system, problems.
UNIT - II	
Feedback Characteristics	Feedback and non-feedback systems, effects of feedback, regenerative feedback.
Time Response:	Types of input, transient response of second order control system for unit step input, time-domain specifications, steady state error and error constants, proportional, derivative and integral controls.
UNIT – III	
Concept of Stability:	Stability of systems - Routh Hurwitz criterion to determine stability of control systems, problems, Relative stability.
Root Locus:	Concept of root locus, Procedure to plot root locus, Stability analysis of control system by root locus technique, problems.
UNIT - IV	
Frequency Response:	Co-relation between time and frequency response, frequency domain specifications, resonant peak (Mp) and resonant frequency (Wp) for a second order system, gain margin (GM) and phase margin (PM).
Frequency Plots:	Bode plots, Polar plots, Nyquist stability criterion for control system, problems.
UNIT - V	
Compensation (Without Design):	The necessity of compensation, series and parallel compensation, Realization of basic lead, Lag and lead-Lag compensators.
State Variable Analysis:	Introduction, concepts of state, state variables, state vector, state space, state space representation, state model, state model of linear systems, state transition matrix, solution of state equations. Concept of Controllability and Observability.

Text Books

1. Nagrath and Gopal, "Control systems Engineering", New Age International Publications, 2003.
2. B.C.Kuo , "Automatic Control Systems", Oxford, 2003.
3. K. Ogata, "Modern control Engineering", Pearson, 2003.
4. Naresh - K.Sinha , "Control Systems", New Age International Publishers, 1998.
5. B.S.Manke , "Linear Control Systems", 1996.

Reference Books

1. Madan Gopal , “Control Systems”, TMH. 2003.
2. Dorf, Bishop , “Modern Conrtol systems”, Addison Wesley,1998.
3. Shaum‟s out line series , “Feedback control systems”, TMH,1986.
4. R.C.Shukla, “Control Systems”, Dhanpat Rai, 2004.
5. Ashok Kumar, “Control Systems“, TMH, 2006.

Web References:

1. https://nptel.ac.in/courses/108106098/
2. https://onlinecourses.nptel.ac.in/noc18_ee41/preview

Question Paper Pattern:

Internal Assessment: The question paper for sessional examination is for 30 marks, covering half of the syllabus for first sessional and remaining half for second sessional exam. Question No 1 which carries 6 marks contains three short answer questions of two marks each. The remaining three questions shall be EITHER/OR type questions carrying 8 marks each

End Exam: Question Paper Contains Six Questions. Question 1 contains 5 short Answer questions each of 2 marks. (Total 10 marks) covering one question from each unit. The remaining five questions shall be EITHER/OR type questions carrying 10 marks each. Each of these questions is from one unit and may contain sub-questions. i.e there will be two questions from each unit and the student should answer any one question

LINEAR IC APPLICATIONS (LICA)

V Semester : Common for ECE&EEE						Scheme : 2017		
Course Code	Course Category	Hours/Week			Credits	Maximum Marks		
EC304	Professional Core	L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
		3	0	0	3	40	60	100
Sessional Exam Duration : 2 Hrs						End Exam Duration: 3 Hrs		

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

CO1: Understand basic concepts and characteristics of differential amplifier and opamp using BJT and FET

CO2: Analyze basic application circuits of opamp with negative and positive feedback

CO3: Design various opamp application circuits using special ICs namely 555 timer, IC8038 & IC566, IC565 PLL

CO4: Understand the principle of operation and applications of IC regulators and data converters.

CO5: Understand the specifications and operation of logic families using BJT and MOSFETs.

UNIT – I

Op-Amp Fundamentals:

Differential amplifier: Basic operation, CMRR, DC and AC Analysis of dual input-balanced output and dual input-unbalanced output modes, characteristics.

Op-amp ideal characteristics, Study of typical IC op-amp and its different stages, Practical inverting and non-inverting op-amp

dc characteristics: i/p bias current, i/p offset current, Offset voltages, Offset balance, Thermal drift, ac characteristics: frequency response, stability of op-amp, Frequency compensation, Slew rate, op-amp parameters, Features of 741 op-amp. Brief analysis of opamp using JFET, Introduction to dual OP-AMP TL082 as a general purpose JFET –input operational amplifier: pin configuration and features.

UNIT – II

Op-amp Applications-I :

Summing amplifier, Difference amplifier, Current to voltage and voltage to current converters, Instrumentation amplifier, Clippers and clampers, Precision AC to DC converters, Integrator, Differentiator, Log & antilog amplifier, Sample and hold circuits.

Op-amp Applications-II

Comparators and active filters:

Comparators, window detector, Schmitt trigger, Pulse, Square and triangle wave generators, Wein Bridge oscillator, Active filters (Butterworth filters up to second order only).

UNIT – III

Timers & Waveform Generators:

555 Timer: Astable and Monostable modes, Applications, waveform generators: IC 566 and IC 8038.

Phase Locked Loops:

Principle of operation, Lock and capture ranges, detailed study of different blocks of PLL, IC 565 PLL, and Applications of PLL.

UNIT – IV

IC Regulators:

General form of series Regulators, Fixed voltage regulator (78XX, 79XX), IC 723 voltage regulator, switching regulators (SMPS).

D/A and A/D Converters : DACs :

Weighted resistor, R-2R ladder type and inverted R-2R ladder, ADCs: Parallel comparator type, Successive approximation and dual slope types, Sigma-Delta ADC, Specifications of converters.

UNIT – V

Logic Families:

Specifications of logic gates, DTL, HTL, TTL, ECL, MOS and CMOS circuits, CMOS bilateral switch, Comparison of logic families, TTL driving CMOS and CMOS driving TTL.

Text Books :

1. Roy Choudhury & Shail B.Jain, Linear Integrated Circuits, 4/e, New Age Int. Pub. 2010.

2. Ramakanth A. Gayakwad, Op-Amps & Linear ICs, 4/e, PHI, 2003.

3. Moris Mano, Digital Logic and Computer Design, Pearson Ed., 2011.

Reference Books :

1. S. Salivahanan, V.S.K. Bhaaskaran, Linear Integrated Circuits, TMH, 2008.
2. Anand Kumar, Pulse and digital Circuits, PHI, 2/e, 2010.
3. R.P. Jain, Modern Digital Electronics, TMH, 3/e, 2003.

Web References:

1. TL082: Data sheet: http://www.ti.com/lit/ds/symlink/tl082.pdf
2. Application note: http://www.ti.com/lit/an/sloa020a/sloa020a.pdf
3. https://www.youtube.com/watch?v=nb11AipMJd4
4. https://www.youtube.com/watch?v=9Rt7iuqSVJ8

Question Paper Pattern:

Sessional Exam:

The question paper for sessional examination is for 30 marks, covering half of the syllabus for first sessional and remaining half for second sessional exam. Question No 1 which carries 6 marks contains three short answer questions of two marks each. The remaining three questions shall be EITHER/OR type questions carrying 8 marks each

End Exam:

Question Paper Contains Six Questions. Question 1 contains 5 short Answer questions each of 2 marks. (Total 10 marks) covering one question from each unit. The remaining five questions shall be EITHER/OR type questions carrying 10 marks each. Each of these questions is from one unit and may contain sub-questions. i.e. there will be two questions from each unit and the student should answer any one question.

POWER SYSTEMS-2 (PS2)

V Semester : EEE						Scheme : 2017		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
EE303	Professional Core	L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
		3	0	0	3	40	60	100
Sessional Exam Duration : 2 Hrs						End Exam Duration: 3 Hrs		

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

CO1: Understand per unit quantities, symmetrical component theory, short circuit analysis and shunt fault calculations.

CO2: Understand steady state ,transient state,dynamic stability in power system.

CO3: Understand swing equation, equal area criterion and methods to improve transient state stability.

CO4: Understand the need of power flow studies and obtain load flow solution using GS method.

CO5: Understand NR and FDC methods for load flow studies.

UNIT - I	
Short Circuit Analysis-I	Per-Unit System, Per-Unit equivalent reactance network of a three phase Power System, Numerical Problems. Short Circuit Current and MVA Calculations, Fault levels, Application of Series Reactors, Numerical Problems.
Short Circuit Analysis-II	Symmetrical Component Theory, Symmetrical Component Transformation, Positive, Negative and Zero sequence components of Voltages, Currents and Impedances.
Unsymmetrical Fault Analysis	Positive, Negative and Zero sequence Networks, Numerical Problems. LG, LL,LLG faults with and without fault impedance, LLL fault, Numerical Problems.
UNIT - II	
Power System Steady State Stability Analysis	Elementary concepts of Steady State, Dynamic and Transient Stabilities. Steady State Stability Power Limit, Transfer Reactance, Synchronizing Power Coefficient, Power Angle Curve and Determination of Steady State Stability and Methods to improve Steady State Stability.
UNIT – III	
Power System Transient State Stability Analysis	Derivation of Swing Equation. Determination of Transient Stability by Equal Area Criterion, Application of Equal Area Criterion, Critical Clearing Angle Calculation-Solution of Swing Equation using Point-by-Point Method, Methods to improve transient Stability.
UNIT – IV	
Power flow Studies-1	Necessity of Power Flow Studies, types of buses, Load flow solution using Gauss Seidel Method, Load flow solution with and without P-V buses, Numerical load flow Solution for Simple Power Systems (Max. 3-Buses)
UNIT - V	
Power flow Studies-2	Newton Raphson Method in Rectangular and Polar Co-Ordinates: Load Flow Solution with and without PV Busses- Derivation of Jacobian Elements, Algorithm and Flowchart. Decoupled and Fast Decoupled Methods, Comparison of Different Methods.

Text Books :

5. M.L.Soni, P.V.Gupta, U.S.Bhatnagar, A.Chakrabarthy, "A Text Book on Power System Engineering", Dhanpat Rai & Co Pvt. Ltd. 1999.
6. C.L.Wadhwa, "Electrical power systems", New Age International (P) Limited, Publishers, 1998.
7. W.D.Stewenson, "Elements of power system analysis" McGraw-Hill, 1982.
8. B.R.Gupta, "Power System Analysis and Design", S.chand Publishing. 1998.
9. .J.Nagarath and D.P.Kothari, "Modern Power System Analysis", Tata McGraw Hill, 2nd Edition. 2004

Reference Books :

3. John J Grainger William D Stevenson, "Power system Analysis", TMC Companies, 4th edition, 2004
4. Hadi Saadat, "Power System Analysis", TMH Edition. 2002

Web References:

1. https://www.chegg.com/homework-help/definitions/unsymmetrical-faults-and-symmetrical-components-4
2. http://nptel.ac.in/courses/Webcourse-contents/IIT-KANPUR/power-system/chapter_7/7_2.html
3. https://www.chegg.com/homework-help/definitions/sequence-impedances-and-sequence-networks-4
4. https://gradeup.co/load-flow-methods-i-e3525295-bdc8-11e5-a334-83f7a2af1075
5. https://www.electrical4u.com/load-flow-or-power-flow-analysis

Question Paper Pattern:

Sessional Exam

The question paper for sessional examination is for 30 marks, covering half of the syllabus for first sessional and remaining half for second sessional exam. Question No 1 which carries 6 marks contains three short answer questions of two marks each. The remaining three questions shall be EITHER/OR type questions carrying 8 marks each.

End Exam

Question Paper Contains Six Questions. Question 1 contains 5 short Answer questions each of 2 marks. (Total 10 marks) covering one question from each unit. The remaining five questions shall be EITHER/OR type questions carrying 10 marks each. Each of these questions is from one unit and may contain sub-questions. i.e there will be two questions from each unit and the student should answer any one question

ELECTRICAL MACHINES – II LAB (EMC-2 (P))

V Semester : EEE				Scheme : 2017			
Course code	Hours/Week			Credits	Maximum Marks		
EE304	L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
	0	0	2	1	50	50	100

End Exam Duration: 2 Hrs

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

CO1: Apply EMF, MMF and ZPF methods to find the regulation of non salient pole alternator.

CO2: Analyze the characteristics of synchronous machines through experimentation.

CO3: Apply brake, no – load and rotor blocked tests to determine the performance characteristics of 3-phase Induction machines through simulation and experimentation.

CO4: Apply slip test on salient pole synchronous machines to determine the reactances and regulation. .

CO5: Analyze the performance characteristics of 1-phase motors through simulation and experimentation.

List of Experiments

Note : At least **8** of the following experiments shall be conducted

1. Regulation of an alternator using EMF Method and MMF method.
2. Regulation of an alternator using ZPF Method.
3. Brake test on three phase squirrel-cage induction motor.
4. No – load test and Rotor blocked tests on three phase squirrel-cage induction motor.
5. No – load test and Rotor blocked tests on single phase induction motor.
6. Slip test on alternator to determine the X_d and X_q reactances.
7. Synchronization of alternators and V & ∧ curves of synchronous machine.
8. Performance characteristics of Induction Generator.
9. Performance characteristics of Universal Motor.
10. Load test on Alternator.
11. Regulation of salient pole Alternator.
12. Load test on single phase squirrel-cage induction motor.
13. Simulation of 3-phase induction motor.
14. Simulation of 1-phase induction motor.
15. Simulation of Torque Vs Speed characteristics of 3-phase induction motor.

CONTROL SYSTEMS AND AUTOMATION LAB (CSA (P))

V Semester : EEE				Scheme : 2017			
Course Code	Hours/Week			Credits	Maximum Marks		
EE305	L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
	0	0	2	1	50	50	100

End Exam Duration: 3 Hrs

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

CO1: Understand the behaviour of second order control systems and Servo motors.

CO2: Analyze the stability of a control system in time and frequency domain using MATLAB programming.

CO3: Understand the steady state errors and maximum peak over shoot of Second order control system using PID controller.

CO4: Understand the characteristics of various compensators for control systems.

CO5: Understand about automation systems and PLC ladder programming.

List of Experiments

Note : At least 8 of the following experiments shall be conducted

1. Characteristics of A.C.Servo & D.C.Servo Motor
2. Linear System Simulator & Stepper Motor Control
3. PID controller & Synchros
4. DC Position Control Systems & Compensation Design
5. Root Locus plot, Bode plot, Polar plot, Nyquist plot using MATLAB
6. Programmable logic controller-Study and verification of truth tables of logic gates, Timer and Counter
7. Traffic light control Systems.
8. Automatic water level control systems of a tank.
9. Automatic water filling system using coin sensor.
10. Automatic temperature monitoring and control system.
11. Automatic water bottle filling control systems using conveyer belt.
12. Automatic fault detection and protection of induction motor using PLC.
13. Colour mixture and colour creation control systems using HMI.

IC AND MICROPROCESSORS LAB (ICMP (P))

V Semester : EEE					Scheme : 2017		
Course Code	Hours/Week			Credits	Maximum Marks		
EC314	L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
	0	0	2	1	50	50	100
				End Exam Duration: 3 Hrs			

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

CO1: Design inverting and non-inverting amplifiers, precision rectifiers using opamp 741 and its application circuits and verify their operation.

CO2: Design second order active filters (LPF and HPF) and verify their frequency response

CO3: Verify the operation of digital to analog converter constructed using opamp 741 and

CO4: Design and test waveform generator circuits using IC 555 Timer

CO5: Execute 8086 programs using Addressing modes and instruction set on trainer kit

CO6: Compile programs of 8051 using Keil software and Interface 8086 with peripherals.

LIST OF EXPERIMENTS

1. Inverting and non-inverting amplifiers (CO1)
   a. To design and verify the operation of amplifiers using opamp IC741, in inverting and non-inverting mode
   b. To obtain frequency response and bandwidth of amplifiers.
2. Integrator and Differentiator (CO1)
   a. To design circuits using IC 741 to perform mathematical operations of Integration and differentiation
   b. To study the performance of circuits by applying different input waveforms.
3. Precision Rectifiers (CO1)
   a. To study the operation of Half-wave and Full-wave rectifier circuits constructed using IC741.
4. Active filters: Low Pass Filter and High Pass Filter (CO2)
   a. To design a Second order Butterworth LPF for given higher cutoff frequency.
   b. To obtain frequency response and practical value of upper cut of frequency.
5. Digital to Analog Converter (CO3)
   a. To study the performance of R-2R ladder type digital to analog converter.
   b. To calculate values of LSB, MSB and full scale o/p voltage theoretically and practically.
6. Multivibrators using IC 555 Timer (CO4)
   a. To design multivibrator circuits using IC 555 Timer in monostable and astable modes for given specifications.
   b. To study the performance of the circuits and obtain width of o/p pulse from monostable and frequency of o/p square wave from astable circuit.

Introduction to Assembly Language Programs Using 8086 Kits

(8086 RELATED PROGRAMS)

7.Execute the 8086 assembly language programs on arithmetic operations. (CO 5)

8.Execute the 8086 assembly language programs on series of data operations. (CO 5)

9.i) Execute the 8086 assembly language programs on factorial of a number (CO 5)

ii) Execute the 8086 assembly language programs on Fibonacci series generation

Introduction to Microcontroller Programming and Usage of Software and Boards

(Interfacing Programs)

10. Interface and execute LCD functioning using 8086 Microprocessor (CO 6)

11.Interface and execute Dancing LEDs pattern using AT89S52 Microcontroller (CO 6)

12. Interface and execute the 7 segment Display using AT89S52 Microcontroller (CO 6)

ADDITIONAL EXPERIMENTS

1.Schmitt trigger and square wave generator (CO1)

a. To design Schmitt trigger and square wave generator circuits for given specifications.

b. To conduct comparative study of the circuit performance for the parameters such as UTP,LTP and output frequency.

2.Using 8086 boards display the department and college name in two rows. (CO 5)

3. Interface and execute LCD operation using AT89S52 Microcontroller (CO 6)

POWER ELECTRONICS-2 (PEL2)

VI Semester : EEE					Scheme : 2017			
Course Code	Category	Hours/Week			Credits	Maximum Marks		
EE306	Professional Core	L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
		3	0	0	3	40	60	100
Sessional Exam Duration : 2 Hrs					End Exam Duration: 3 Hrs			

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

CO1: Understand the working of cycloconverters and AC voltage controllers with R, RL load.

CO2: Understand the working of 1-Φ half and full bridge, 3-Φ full bridge voltage source inverters.

CO3: Understand voltage control and harmonic reduction methods for VSI and operation of CSI.

CO4: Understand speed control methods for induction motor using converters.

CO5: Understand speed control methods for synchronous motor using converters.

UNIT - I	
Cycloconverters	Basic principle and working of 1-Φ to 1-Φ (step up and step down) cycloconverters with R and RL loads, output voltage equation. 3-Φ to 1-Φ, 3-Φ to 3-Φ cycloconverters circuits (principle of operation only).
AC voltage Controllers	1-Φ AC voltage controller with R and RL loads, wave forms, derivation of RMS load voltage, current and power factor, simple problems. 3-Φ AC voltage controllers with R load.
UNIT - II	
1-Φ Voltage Source Inverters	1-Φ half and full-bridge inverters with R and RL loads. Fourier analysis of output voltage, expression for rms output voltage and rms fundamental output voltage. Simple problems.
3-Φ Voltage Source Inverters	3-Φ bridge VSI with 180^o and 120^o modes of operations. Fourier analysis of output voltage, expression for rms output voltage and rms fundamental output voltage. Simple problems.
UNIT - III	
PWM Techniques	Voltage control, harmonic reduction methods, pulse width modulated 1-Φ inverters (single, multiple and sinusoidal PWM methods).
Current Source Inverters	Principle of operation of CSI, 1-Φ capacitor commutated and auto sequential commutated inverters. Comparison of CSI with VSI. Simple problems.
UNIT - IV	
Introduction	Review of speed torque characteristics of induction motors, conventional speed control methods.
Stator side control of IM	Variable voltage constant frequency, variable frequency constant voltage and /f control of induction motor-speed torque characteristics. Simple problems. Closed loop operation of V/f controlled induction motor drives (Block Diagram Only).
Rotor side control of IM	Static rotor resistance control, slip power recovery schemes–Static Scherbius drive, Static Kramer drive -speed torque characteristics, simple problems.
UNIT - V	
Synchronous motor control	Review of speed torque characteristics of synchronous motors, variable frequency control methods-self controlled synchronous motor drive employing load commutated thyristor inverter, closed loop speed control of load commutated inverter synchronous motor drive.

Text Books :

1. M.H. Rasheed , “Power Electronics Circuits Devices and Applications”, 3rd Edition, PHI publishers. 2004
2. P.S. Bimbhra , “Power Electronics”, 4th Edition, Khanna publishers. 2010
3. G.K. Dubey , “Fundamentals of Electrical drives” 2 nd Edition, Narosa Publishers. 2001
4. B.K.Bose , “Modern Power electronics and ac drives”, Pearson Education Publishers. 2003

Reference Books :

1. M.D. Singh and K.B. Khanchandani , “Power Electronics”, 2nd Edition, Tata McGraw Hill Publishers. 2002.
2. Vedam Subrahmanayam, “Electrical drives concepts and applications”, Tata McGraw Hill publishers. 2008.
3. G.K. Dubey , “Power Semiconductor controlled drives”, Prentice-Hall, Englewood Cliffs, Publishers. 1989.

Web References:

1. https://nptel.ac.in/downloads/108105066/
2. https://nptel.ac.in/courses/108101126/
3. https://nptel.ac.in/syllabus/108108077/
4. https://www.youtube.com/watch?v=Coy-WRCfems

Question Paper Pattern:

Sessional Exam

The question paper for sessional examination is for 30 marks, covering half of the syllabus for first sessional and remaining half for second sessional exam. Question No 1 which carries 6 marks contains three short answer questions of two marks each. The remaining three questions shall be EITHER/OR type questions carrying 8 marks each.

End Exam

Question Paper Contains Six Questions. Question 1 contains 5 short Answer questions each of 2 marks. (Total 10 marks) covering one question from each unit. The remaining five questions shall be EITHER/OR type questions carrying 10 marks each. Each of these questions is from one unit and may contain sub-questions. i.e there will be two questions from each unit and the student should answer any one question.

POWER SYSTEMS – 3 (PS3)

VI Semester : EEE					Scheme : 2017			
Course Code	Category	Hours/Week			Credits	Maximum Marks		
EE307	Professional Core	L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
		3	0	0	3	40	60	100
Sessional Exam Duration : 2 Hrs					End Exam Duration: 3 Hrs			

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

CO1: Understand the principle and working of protective relays against over currents and over voltages.

CO2: Understand the principle of operation of microprocessor based protective relays.

CO3: Understand the power system transient phenomena and advantages of neutral grounding.

CO4: Understand the principle and working of circuit breakers.

CO5: Understand the protection schemes employed for alternators, transformers, feeder and bus-bar

UNIT - I	
Relays	Definitions-Relay Setting, PSM, TMS Principle of operation of Over current relays, Directional relays, Differential Relays and Percentage Differential Relays. Distance Relays-Universal torque equation, Impedance, Reactance, Mho and Off-Set Mho relays, Characteristics of Distance Relays and Comparison. Static Relays-Basic concept of Static Relay, advantages and disadvantages.
UNIT – II	
Microprocessor based protective Relays	Introduction to Numerical Relays, Advantages of Numerical Relays, Microprocessor based Over current relays, Directional relays, Impedance relay, Reactance relay and Mho relay (Block diagram and flow chart approach only)
UNIT - III	
Power System Transients	Types of System Transients, travelling wave Phenomena, Attenuation, Distortion, Reflection and Refraction Coefficients, Termination of lines with different types of conditions - Open Circuited Line, Short Circuited Line, T-Junction , Numerical Problems.
Neutral Grounding	Effects of ungrounded neutral on system performance, Arcing Grounds, Methods of Neutral Grounding: Solid, Resistance and Reactance grounding.
UNIT - IV	
Circuit Breakers	Elementary principles of arc interruption, Restriking and Recovery voltages, Restriking Phenomenon, Average and Max. RRRV, Numerical Problems. Current Chopping and Resistance Switching, CB ratings and Specifications, Numerical Problems. Auto reclosures. Description and Operation of the following types of circuit breakers: Oil Circuit breakers, Air Circuit Breakers, Vacuum and SF_6 circuit breakers, advantages and disadvantages
UNIT - V	
Generator Protection	Protection of generators against Stator faults, Rotor faults, and Abnormal Conditions, Numerical Problems
Transformer Protection	Protection of transformers: Percentage Differential Protection, Protection against magnetizing inrush currents, Buchholz relay Protection. Numerical Problems
Feeder and Bus-Bar Protection	Protection of Lines: Over Current, Three-zone distance relay protection using Impedance relays. Protection of Bus bars, Differential protection.

Text Books :

1.Paithankar and S.R.Bhide , “Fundamentals of Power System Protection”, PHI 2003
2.Badari Ram , D.N Viswakarma, “Power System Protection and Switchgear”, TMH Publications 2005
3.C.L.Wadhwa , “Electrical Power Systems”, 3rd edition New Age international (P) Limited, Publishers, 2010

Reference Books :

1. Sunil S Rao , “Switchgear and Protection”, Khanna Publlishers,1995
2.B.L.Soni, Gupta, Bhatnagar, Chakrabarthy , “A Text book on Power System Engineering”, Dhanpat Rai & Co., 2006

Web References:

1. https://circuitglobe.com/electromagnetic-relay.html
2. http://electrical-engineering-portal.com/distance-relays
3.http://www.academia.edu/9285881/REVIEW_OF_MICROPROCESSOR_BASED_PROTECTIVE_RELAYS
4. https://www.crcpress.com/Power-System-Transients-Theory-and-Applications/Ametani-Nagaoka-Baba-Ohno/p/book/9781466577848#googlePreviewContainer
5. https://www.electrical4u.com/electrical-circuit-breaker-operation-and-types-of-circuit-breaker/
6. https://www.eng.uwo.ca/people/tsidhu/Documents/Microsoft%20Word%20-%20STATOR%20PROTECTION.%20final%20report.doc.pdf

Question Paper Pattern:

Sessional Exam

The question paper for sessional examination is for 30 marks, covering half of the syllabus for first sessional and remaining half for second sessional exam. Question No 1 which carries 6 marks contains three short answer questions of two marks each. The remaining three questions shall be EITHER/OR type questions carrying 8 marks each.

End Exam

Question Paper Contains Six Questions. Question 1 contains 5 short Answer questions each of 2 marks. (Total 10 marks) covering one question from each unit. The remaining five questions shall be EITHER/OR type questions carrying 10 marks each. Each of these questions is from one unit and may contain sub-questions. i.e there will be two questions from each unit and the student should answer any one question

POWER SYSTEMS LAB (PSP (P))

VI Semester : EEE				Scheme : 2017			
Course Code	Hours/Week			Credits	Maximum Marks		
EE308	L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
	0	0	2	1	50	50	100

End Exam Duration: 3 Hrs

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

CO1: Analyze the characteristics of different types of electromagnetic and numeric relays.

CO2: Analyze the power system network for different conditions

CO3: Analyze the sequence impedances of synchronous machines and transformers.

CO4: Apply solutions for the numerical problems related to synchronous machine dynamics.

CO5: Apply modern Engineering tools like ETAP for solving Power System problems.

List of Experiments

Note : At least 8 of the following experiments shall be conducted

1. IDMT Over Current Relay
2. Micro processor based IDMT Over current relay
3. Directional IDMT Over Current relay
4. Micro Processor Based Directional Over current Relay
5. Inverse Time Over Current Relay
6. 220 KV-180KM EHV-AC Long Transmission Line Simulator (Voltage regulation and determination of surge Impedance)
7. Simulation of faults on a 3phase unloaded alternator
8. Determination of +ve, -ve and zero sequence impedances of 3-phase alternator
9. Determination of +ve, -ve and zero sequence impedances of 3-phase Transformer
10. Study of oil testing kit and determination of dielectric strength
11. Simulation of String Insulators for the determination of Voltage distribution and string efficiency.
12. Measurement of earth resistance.
13. Load flow analysis using e-tap.
14. Short circuit analysis using e-tap
15. Harmonic Analysis using etap.
16. Determination of Transient Stability (Equal Area Criterion and Swing Equation) using etap.
17. Optimal Power flow using etap.

POWER EECTRONIC LAB (PEL(P))

VI Semester : EEE				Scheme : 2017			
Course Code	Hours/Week			Credits	Maximum Marks		
EE309	L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
	0	0	2	1	50	50	100

End Exam Duration: 3 Hrs

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

CO1: Understand I-V characteristics of SCR, MOSFET, IGBT and their gate driver circuits

CO2: Apply phase angle control for 1-Φ half and fully controlled bridge converters, 1-ϕ dual converter, 1-ϕ cycloconverter and 1-ϕ, 3-ϕ AC voltage controller to control output voltage.

CO3: Apply duty ratio control for choppers and inverters to control output voltage

CO4: Understand control signals generation using analog and digital controllers.

List of Experiments

Note : At least 8 of the following experiments shall be conducted

1. Steady state characteristics of SCR, IGBT and MOSFET
2. Single phase fully controlled bridge converter
3. Single phase semi controlled bridge converter
4. Single phase Dual converter
5. Single-phase mid-point cycloconverter
6. Single-phase AC voltage controller
7. Three-phase AC voltage controller
8. Single phase full bridge PWM inverter
9. Forced commutated step down chopper
10. Step up chopper
11. R, RC and digital triggering methods for SCR
12. Design of triggering (or) driver circuit for SCR
13. Design of triggering (or) driver circuit for IGBT and MOSFET
14. Generation of control signals using controllers

MICROCONTROLLERS LAB (MC (P))

VI Semester :EEE				Scheme : 2017			
Course Code	Hours/Week			Credits	Maximum Marks		
EE310	L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
	0	0	2	1	50	50	100

End Exam Duration: 3 Hrs

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

CO1: Apply embedded C programming method for MSP 430 microcontroller using Code Composer Studio.

CO2: Understand configuration of GPIO, serial ports, ADC and DAC for MSP430 microcontroller.

CO3: Understand interfacing of sensors, actuators with Arduino.

List of Experiments

Note : At least 8 of the following experiments shall be conducted

1. Write a program for configuration of GPIO ports for MSP430 (blinking LEDs).
   i) Modify the delay with which the Red LED blinks.
   ii) Modify the code to make the Green LED blinks.
   iii) Modify the code to make the green and red LEDs blink: a) Together b) Alternately

2. Write a program for configuration of GPIO ports of MSP430 for pushbuttons interface.
   a) Turn the LED ON when the button is pressed and OFF when it is released.
   b) Turn the red LED ON when the button is pressed and the green LED ON when the button is released.

3. Write a program for configuration of GPIO ports of MSP430 for driving a DC Motor.

4 .Write a program for configuration of GPIO ports of MSP430 for driving a stepper Motor.

5.Write a program to interface Array of LEDs to Arduino to display hexadecimal number equivalent values.

6.Write a program to interface IR sensor to Arduino and display the sensor values on serial monitor

7.Write a program to interface Ultrasonic sensor to Arduino and display the sensor values on serial monitor

8.Write a program to interface temperature and humidity sensor to Arduino and display the sensor values on serial monitor

9. Write a program to interface PIR sensor to Arduino and display the sensor values on serial monitor

10.Write a program for configuration of GPIO ports of MSP430 for blinking Array of LEDs.
   a) Turn on the LEDs to display a hexadecimal number equivalent values from 00 to FF.
   b) Turn on the ALL LEDs ones and then one by one with delay.

11.Write a program for configuration of GPIO ports of MSP430 for variable duty cycle PWM. (Without and with timer)

12.Write a program to interface 16X2 LCD to Arduino and display the given inputs on the screen.

13.Write a program to interface moisture sensor to Arduino to control the brightness of LED.

14. Write a program to interface XBee to Arduino and display the sensor values on serial monitor.

15. Write a program to interface bluetooth to Arduino using mobile app.

POWER SYSTEMS-IV (PS-4)

VII Semester : EEE						Scheme : 2017		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
EE401	Professional Core	L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
		3	0	0	3	40	60	100
Sessional Exam Duration : 2 Hrs						End Exam Duration: 3 Hrs		

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

CO1: Understand the economic aspects of power system.

CO2: Develop mathematical models for turbine, generator and governing mechanisms

CO3: Analyze load frequency control of single area and two-area systems

CO4: Understand the basic principles of power system economics

CO5: Understand the concepts of Smart Grids

	UNIT - I
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 considering transmission line losses, Loss Coefficients, General transmission line loss formula.
	UNIT – II
Load Frequency Control	Necessity of keeping frequency constant, Automatic Voltage and frequency control. Basic concepts of governing mechanism: speed governing system model, turbine model, generator and load model, Numerical problems.
	UNIT – III
Single Area Load Frequency Control	Analysis of Load Frequency Control of an Isolated Power System, Steady state analysis, Dynamic response, Controlled and Uncontrolled case, Integral Control of Single area system
Two-Area Load Frequency Control	Load frequency control of two-area system, uncontrolled case and controlled case, tie-line bias control
	UNIT – IV
Power System Economics and Management	Basic pricing principles : Generator cost curves, Utility functions, Power exchanges, spot pricing. Electricity market model (vertically integrated, purchasing agency, Whole sale competition, Retail competition), Demand side management, Transmission and distribution charges, Ancillary Services, Regulatory framework.
	UNIT – V
Introduction to Smart Grid Solutions	Advanced Metering Infrastructure, Demand Response, Distributed generation. Home Area Network, Communication, Cyber Security, Electric Vehicles, Electric Energy Storages (EES).

Text Books :

1. C.L. Wadhwa , "Electrical Power Systems", New Age International (P) Ltd. 2006
2. L.P. Singh , " Advanced Power System Analysis and Dynamics", New Age International (P) Ltd. 2006.
3. I.J.Nagrath & D.P.Kothari, "Modern Power system Analysis", Tata McGraw-Hill Publishing company, 3rd edition,2003.
4. A.S. Pabla , "Electric Power Distribution", Tata Mc Graw-hill Publishing company, 4th edition. 1997.

Reference Books :

1. Hadi Saadat , “Power System Analysis”, TMH Edition. 2009
2. Grainger and Stevenson , “Power System Analysis”, Tata McGraw Hill. 2008
3 .A.R.Bergen , “Power System Analysis”, 2nd edition, Prentice Hall, Inc. 2001
4. Turan Gonen, “Electric Power Distribution system, Engineering”, Mc Graw-hill Book Company.
5. S. Sivanagaraju, V.Sankar, “Electrical Power Distribution and Automation”, Dhanpat

Web References:

1. https://www.slideshare.net/BalaramDas3/economic-operation-of-power-system
2. https://nptel.ac.in/courses/Webcourse-contents/IIT-KANPUR/power-system/chapter_5/5_7.html
3. https://www.slideshare.net/manash234/load-frequency-control-of-two-area-system
4. https://nptel.ac.in/courses/108101005/6
5. https://www.smartgrid.gov/files/sg_introduction.pdf

Question Paper Pattern:

Sessional Exam

The question paper for sessional examination is for 30 marks, covering half of the syllabus for first sessional and remaining half for second sessional exam. Question No 1 which carries 6 marks contains three short answer questions of two marks each. The remaining three questions shall be EITHER/OR type questions carrying 8 marks each.

End Exam

Question Paper Contains Six Questions. Question 1 contains 5 short Answer questions each of 2 marks. (Total 10 marks) covering one question from each unit. The remaining five questions shall be EITHER/OR type questions carrying 10 marks each. Each of these questions is from one unit and may contain sub-questions. i.e there will be two questions from each unit and the student should answer any one question

CONSTITUTION OF INDIA (CI)

VII Semester: Common for CE, ME, and EEE						Scheme : 2017		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	Total
ML02	Mandatory Learning	1	-	-	-	-	-	-
Sessional Exam Duration : -						End Exam Duration:-		

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

CO1: Understand the formation and principles of Indian Constitution.

CO2: Understand structure and functions of Union government and State executive. Duties of President, Vice president, Prime Minister, Governor, Chief Minister cabinet and State legislature.

CO3: Understand constitutional amendments of 42, 44,74,76,86 and 91. Central-State relations, President rule.

CO4: Understand Indian social structure and languages in India. Rights of women, SC, ST and then weaker section.

CO5: Understand the structure of Judiciary, Role and functions of Supreme Court, High court and Subordinate courts, Judicial review.

UNIT - I	
History of Indian Constitution	Historical back ground, Significance of Constitution, Making of the constitution, Role of the constituent Assembly, Salient features, the Preamble, Citizenship, procedure for amendment of Constitution Fundamental rights-Derivative principles of state policy-Elections in India.
UNIT - II	
Union and State Executives	Structures of Union Government & Functions, President, Vice President, Prime Minister, Cabinet, Parliament- State Executive: Structures and Functions, Governor, Chief Minister, Cabinet, State Legislature
UNIT - III	
Constitutional Amendments	Central, State Relations, President's Rule, Constitutional Amendments [42, 44, 74, 76, 86 & 91]-Constitutional functionaries, Working of Parliamentary system in India
UNIT - IV	
Indian Social Structure	Indian Social Structure, Languages in India-Political Parties & Pressure groups, Rights of Women-S.C"s, S.T"s & other weaker sections.
UNIT - V	
Judiciary	Structure, Organisation of Judiciary, independence of the Judiciary, role and functions of Supreme Court, High Courts & Sub ordinate courts Judicial Review.

Text books

1. Durga Das Basu, *"Introduction to the Constitution of India"*, Wedwe& Company
2. Macivel, Page, "An Introduction Analysis", Society
3. M.V. Pylee, *"Indian Constitution"*, S. Chand Publications
4. Subhash C Kashyao :*"Our Constitution"*,NationalBank,Trust, India.
5. Constitutional Law of india by Dr.S.M.Rajan

Reference books

1. The Constitution of India.By the Ministry of Law and Justice, The Govt. of India.
2. Constitutional Law of India by kashyapsubhasah ,c
3. Indian constitution Law by M.P.Jain
4. Constitutional Law of India by H.M Seervai

Web References:

1. https://www.india.gov.in/my-government/constitution-india

DRIVES AND STATIC CONTROL LAB (DSC(P))

VII Semester: EEE					Scheme : 2017		
Course Code	Hours/Week			Credits	Maximum Marks		
EE402	L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
	0	0	2	1	50	50	100

End Exam Duration: 3 Hrs

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

CO1: Apply stator side control methods for the speed control of induction motor and verify the results through simulation and experimentation

CO2: Apply slip power control schemes for the speed control of induction motor through experimentation using power converters.

CO3: Apply speed control method for the speed control of DC separately excited motor and verify the results through simulation and experimentation

CO4: Evaluate the performance characteristics of inverter fed induction motor drive

List of Experiments

Note : At least 8 of the following experiments shall be conducted

1. Speed control of induction motor using rotor resistance control
2. Speed control of induction using emf injection method (static Kramer"s drive)
3. Speed control of induction motor using three phase AC voltage controller
4. dSPACE based scalar control of induction motor using DC link converter
5. Speed control of DC motor using 4-quadrant Chopper
6. Simulation of v/f control of induction motor drive using DC link converter
7. Simulation of three phase rectifier fed separately excited DC motor drive
8. Simulation of step down chopper fed separately excited DC motor drive
9. Simulation of induction motor and DC motor from direct power supply with using any power electronic converter.
10. Simulation of cycloconverter fed induction motor drive.
11. Speed control of separately excited DC motor drive using three phase rectifier
12. Speed control of separately excited DC motor drive using Dc link converter
13. Speed control of separately excited DC motor using Step up chopper
14. Harmonic analysis of output voltage and current of inverter fed induction motor drive
15. Simulation of PWM controlled multilevel inverter fed induction motor drive

INTERNET OF THINGS LAB (IoT (P))

VII Semester : EEE				Scheme : 2017			
Course Code	Hours/Week			Credits	Maximum Marks		
EE403	L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
	0	0	2	1	50	50	100

End Exam Duration: 2 Hrs

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

CO1: Understand and write programs using arithmetic, loop and conditional statements in python.

CO2: Understand LED, IR, PIR, ultrasonic sensors interfacing to Rasberry pi

CO3: Understand zigbee protocol for Rasberry pi

CO4: Understand LED, temperature, moisture, humidifty, ultrasonic sensor and motors interfacing to NodeMCU

CO5: Understand LED, temperature, moisture, humidifty, interfacing to ESP32

List of Experiments

Note : At least **8** of the following experiments shall be conducted

1. Write a program for arithmetic operation in Python.
2. Write a program for looping statement in Python.
3. Write a program for LED blink using Raspberry Pi.
4. Study and Implement Interfacing of IR sensor to Rasberry pi.
5. Study and Implement Interfacing of PIR sensor to Rasberry pi.
6. Study and Implement Interfacing of ultrasonic sensor to Rasberry pi.
7. Study and Implement Zigbee Protocol using Raspberry Pi.
8. Study and Implement Interfacing an LED to NodeMCU.
9. Study and Implement LED brightness controller with NodeMCU.
10. Study and Implement Interfacing the temperature and humidity sensor to NodeMCU.
11. Study and Implement Interfacing the moisture sensor to NodeMCU.
12. Study and Implement to control the speed of a DC motor using NodeMCU
13. Study and Implement Interfacing Ultrasonic Sensor with Blynk and NodeMCU
14. Study and Implement Interfacing an LED to ESP32.
15. Study and Implement Interfacing the temperature and humidity sensor to ESP32.

Professional Elective – I

EE312	Communication Systems
EE313	Introduction to Signals & Systems
EE314	Digital Control Systems

Professional Elective – II

EE315	High Voltage Engineering
EE316	Electrical Distribution Systems
EE317	Utilization of Electrical Power

Professional Elective – III

EE407	Advanced Power Electronics
EE408	Power Quality
EE409	HVDC and FACTS

Professional Elective – IV

EE410	Embedded Applications to Electrical Engineering
EE411	IoT Applications to Electrical Engineering
EE412	Industrial Automation and Control

Professional Elective – V

EE413	Elements of Digital Signal Processing
EE414	Bio-medical Instrumentation
EE415	Introduction to Hybrid & Electric Vehicles

Professional Elective – VI

EE416	Renewable and Distributed Energy Systems
EE417	Smart Grids
EE418	Electrical Estimation & Costing

COMMUNICATION SYSTEMS (CS)

VI Semester : EEE						Scheme : 2017		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
EE312	Professional Elective - I	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	40	60	100
Sessional Exam Duration : 2 Hrs						End Exam Duration: 3 Hrs		

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

CO1: Understand amplitude modulation and demodulation schemes.

CO2: Understand modulation and demodulation design for angle modulation techniques.

CO3: Understand the principles of various pulse modulation and demodulation schemes.

CO4: Understand various digital modulation techniques.

CO5: Understand spread spectrum modulation and various multiple access techniques.

UNIT – I	
Amplitude Modulation	Block diagram of general communication system, Need for Modulation, Generation and demodulation of AM, Band width, Power relations, Generation and demodulation of DSB-SC. Single Side Band Modulation (theory only),Vestigial side band modulation(theory only),Comparison of various AM systems, Problems. Frequency division multiplexing (FDM).
UNIT - II	
Angle Modulation	Frequency Modulation and Phase Modulation, FM narrow band and wide band techniques, Band width, Generation of FM, Direct and indirect FM, Demodulation of FM using phase discrimination method.
UNIT – III	
Pulse Modulation Techniques	Sampling theorem, Introduction of PAM, PWM, and PPM, Time division multiplexing (TDM), Elements of PCM: Sampling, Quantization & Coding, Quantization error, Companding in PCM systems. Differential PCM systems (DPCM). Delta modulation, its draw backs, adaptive delta modulation (Theory only).
UNIT - IV	
Digital Modulation Techniques	Elements of digital communication systems, advantages of digital communication systems, brief discussion on ASK, FSK, PSK, DPSK, QPSK, M-ary PSK.
UNIT - V	
Spread Spectrum Modulation	Introduction, Pseudo-noise sequence, DS spread spectrum with coherent binary PSK, Processing gain, FH spread spectrum.
Multiple Access Techniques	TDMA, FDMA & CDMA.

Text Books

1. Simon Haykin, "Communication Systems", 2nd Edition, Wiley Eastern, 2008
2. K. Sam Shanmugam, "Digital and Analog Communication Systems", 2nd Edition, Wiley-India, 2008
3. T. S. Rappaport, "Wireless Communications", 2nd Edition, Prentice Hall of India, 2012.

Reference Books

1. Kennedy.G., "Electronic Communication Systems", 5th edition. Mc-Graw Hill, 2014.
2. Taub, H and D.Schilling, "Principles of communication systems", 3rd edition, Tata McGraw Hill, 2013.
3. A.Bruce Carlson, "Communication systems", 5th edition, McGraw Hill International, 2012.
4. Simon Haykin, "Digital Communication", 2nd Edition, Wiley Eastern, 2006.
5. H.Taub and D.Schilling, "Principles of communication systems", 3rd edition, Tata McGraw Hill, 2013.

Question Paper Pattern:

Internal Assessment: The question paper for sessional examination is for 30 marks, covering half of the syllabus for first sessional and remaining half for second sessional exam. Question No 1 which carries 6 marks contains three short answer questions of two marks each. The remaining three questions shall be EITHER/OR type questions carrying 8 marks each

End Exam: Question Paper Contains Six Questions. Question 1 contains 5 short Answer questions each of 2 marks. (Total 10 marks) covering one question from each unit. The remaining five questions shall be EITHER/OR type questions carrying 10 marks each. Each of these questions is from one unit and may contain sub-questions. i.e there will be two questions from each unit and the student should answer any one question

INTRODUCTION TO SIGNALS AND SYSTEMS (ISS)

VI Semester :EEE					Scheme : 2017			
Course Code	Category	Hours/Week			Credits	Maximum Marks		
EE313	Professional Elective - I	L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
		3	0	0	3	40	60	100
Sessional Exam Duration : 2 Hrs					End Exam Duration: 3 Hrs			

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

CO1: Understand the concepts of signals, systems their properties and Fourier series of periodic signals.

CO2: Understand the concepts of continuous, discrete LTI systems and convolution methods.

CO3: Apply Fourier transform to continuous time signals and systems.

CO4: Apply Laplace transform to continuous time signals and systems.

CO5: Apply Z-Transform to Discrete time signals and systems.

UNIT - I	
Introduction to Signals and Systems	Basic continuous and discrete time signals, systems and their properties, classification of signals, analogy between vector and signal, principles of least squares, Orthogonality and completeness, trigonometric and exponential Fourier series of periodic signals.
UNIT - II	
Behavior of continuous and discrete-time LTI systems	Introduction-Properties of LTI systems, Impulse response, convolution as summation, graphical method of convolution, transfer function of an LTI system.
UNIT - III	
Fourier Transforms	Fourier Transforms and properties, Fourier Transform of periodic signals, Parsevals theorem, Fourier transform of some common signals, System analysis with Fourier transform- Sampling theorem
UNIT - IV	
Laplace Transforms and Applications	Introduction , Properties, Laplace transform of some common signals, Laplace transform of periodic signals, Inverse Laplace transform, circuit analysis using laplace transforms, Response of RL, RC, RLC Networks to Step, Ramp, and impulse functions.
UNIT - V	
Z- Transforms	Introduction, Distinction between Laplace, Fourier and Z-Transforms, Region of convergence in Z-Transforms, properties of ROC, properties of Z-Transforms, Z-transform of some common signals, Inverse Z-Transform.

Text Books :

6. A. V. Oppenheim, A. S. Willsky and S. H. Nawab, “Signals and systems”, Prentice Hall India, 1997
7. J. G. Proakis and D. G. Manolakis, “Digital Signal Processing: Principles, Algorithms, and Applications”, Pearson, 2006
8. H. P. Hsu, “Signals and systems”, Schaum’s series, McGraw Hill Education, 2010.
9. S. Haykin and B. V. Veen, “Signals and Systems”, John Wiley and Sons, 2007.

Reference Books :

5. A. V. Oppenheim and R. W. Schafer, “Discrete-Time Signal Processing”, Prentice Hall, 2009
6. M. J. Robert “Fundamentals of Signals and Systems”, McGraw Hill Education, 2007
7. B. P. Lathi, “Linear Systems and Signals”, Oxford University Press, 2009.

Web References:

1. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-011-introduction-to-communication-control-and-signal-processing-spring-2010/readings/MIT6_011S10_notes.pdf
2. https://ocw.mit.edu/resources/res-6-007-signals-and-systems-spring-2011/lecture-notes/

3. http://nptel.ac.in/downloads/117101055/
4. http://www.bput.ac.in/lecture-notes-download.php?file=lecture_note_222311150215010.pdf.
5. https://lecturenotes.in/subject/36/signals-and-systems-ss.

Question Paper Pattern:

Internal Assessment:

The question paper for sessional examination is for 30 marks, covering half of the syllabus for first sessional and remaining half for second sessional exam. Question No 1 which carries 6 marks contains three short answer questions of two marks each. The remaining three questions shall be EITHER/OR type questions carrying 8 marks each.

End Exam:

Question Paper Contains Six Questions. Question 1 contains 5 short Answer questions each of 2 marks. (Total 10 marks) covering one question from each unit. The remaining five questions shall be EITHER/OR type questions carrying 10 marks each. Each of these questions is from one unit and may contain sub-questions. i.e there will be two questions from each unit and the student should answer any one question

DIGITAL CONTROL SYSTEMS (DCS)

VI Semester : EEE						Scheme : 2017		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
EE314	Professional Elective - I	L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
		3	0	0	3	40	60	100
Sessional Exam Duration : 2 Hrs						End Exam Duration: 3 Hrs		

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

CO1: Understand the basic A/D and D/A conversion

CO2: Understand the Z- Transform

CO3: Analyze the state space analysis methods

CO4: Analyze the stability analysis and time domain analysis

CO5: Apply digital process control and design

UNIT - I	
Z-Transforms and SFG Methods applied to digital control systems	**Introduction:** Bolck diagram of typical digital control systems,Advantages of sampling in control systems,Examples of discrete data and digital control systems,Reconstruction of sampled signals, ZOH **Z-Transform;** Definition and evaluation of Z-transforms, mapping between s-plane and z-plane – inverse Z-transform, theorems of Z-transforms - limitation of Z-transform –pulse transfer function - pulse transfer function of ZOH - relation between G(s) and G(z) - signal flow graph method applied to digital systems.
UNIT - II	
State Space Analysis	**State Space Analysis:** State space modeling of digital systems with sample and hold - state transition equation of digital time in variant systems - solution of time in variant discrete state equation by the Z-transformation - transfer function from the state model, Eigen values, Eigen vectors and diagonalisation of the A-matrix, Jordan canonical form, computation of state transition matrix.
UNIT - III	
Stability:	**Stability:** Definition of stability, stability tests, the second method of Lyapunov.
UNIT - IV	
Time Domain analysis. And Root Locus Method	**Time Domain Analysis:**Comparison of time responses of continuous data and digital control systems - correlation between time response and root locus in the s-plane and z-plane – root loci for digital control systems - steady state error analysis of digital control systems.
UNIT - V	
Controllability,Observability and Design of controllers	**Controllability and Observability** Theorems on controllability - theorems on observability (time invariant systems) - relationships between controllability, observability and transfer functions, controllability and observability vs. sampling perios. **Design :** Digital PID controller - pole placement through state feedback.

Text Books :

1.B. C. Kuo, “Digital Control Systems”, Oxford University Press, USA, 2nd edition, 1995

2. M.Gopal, “Digital Control Systems”, Wiley; 1st edition, 1988

3.K. Ogata, “Modern Control Engineering”, Prentice Hall, 5th edition, 2010

Reference Books :

1.Ioan Doré Landau, Gianluca Zito, "Digital Control Systems: Design, Identification and Implementation", Springer Science & Business Media

Web References:

1.https://link.springer.com/book/10.1007%2F978-1-84628-056-6
2. http://www.sciencedirect.com/science/book/9780123943910
3. http://faculty.ksu.edu.sa/hedjar/Documents/CEN455/Digital%20Control%20Systems.pdf
4. http://www.springer.com/in/book/9781846280559
5. http://www.springer.com/in/book/9783642864193
6. http://nptel.ac.in/courses/108103008/
7. https://www.coursehero.com/file/13785953/DIGITAL-CONTROL-SYSTEMSpdf/
8.http://een.iust.ac.ir/profs/Esmaeilzadeh/MSc.%20Digital%20Control%20Systems/Digital%20Control%20System_PhilipsNagle.pdf

Question Paper Pattern:

Sessional Exam

The question paper for sessional examination is for 30 marks, covering half of the syllabus for first sessional and remaining half for second sessional exam. Question No 1 which carries 6 marks contains three short answer questions of two marks each. The remaining three questions shall be EITHER/OR type questions carrying 8 marks each.

End Exam

Question Paper Contains Six Questions. Question 1 contains 5 short Answer questions each of 2 marks. (Total 10 marks) covering one question from each unit. The remaining five questions shall be EITHER/OR type questions carrying 10 marks each. Each of these questions is from one unit and may contain sub-questions. i.e there will be two questions from each unit and the student should answer any one question

HIGH VOLTAGE ENGINEERING (HVE)

VI Semester : EEE						Scheme : 2017		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
EE315	Professional Elective - II	L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
		3	0	0	3	40	60	100
Sessional Exam Duration : 2 Hrs					End Exam Duration: 3 Hrs			

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

CO1: Understand the dielectric properties, its applications and methods to compute electric field stress.

CO2: Understand the various breakdown methods in solids, fluid dielectrics.

CO3: Understand the various high voltage and current generation methods.

CO4: Understand the various high voltage and current measuring methods.

CO5: Understand the over voltage phenomena due to various conditions and insulation coordination in power systems.

UNIT - I	
Introduction To High Voltage Technology And Applications	Electric Field Stresses, Gas / Vacuum as Insulator, Liquid Dielectrics, Solids and Composites, Estimation and Control of Electric Stress, Numerical methods for electric field computation, Surge voltages, their distribution and control, Applications of insulating materials in transformers, rotating machines, circuit breakers, cable power capacitors and bushings.
UNIT - II	
Break Down In Fluid Dielectrics	Gases as insulating media, collision process, Ionization process, Townsend's criteria of breakdown in gases, Paschen's law. Liquid as Insulator, pure and commercial liquids, breakdown in pure and commercial liquids
UNIT - III	
Break Down In Solid Dielectrics	Intrinsic breakdown, electromechanical breakdown, thermal breakdown, breakdown of solid dielectrics in practice, Breakdown in composite dielectrics, solid dielectrics used in practice.
Generation Of High Voltages And Currents	Generation of High DC Voltages, Generation of High AC voltages, Generation of Impulse Voltages, Generation of Impulse currents, Tripping and control of impulse generators
UNIT - IV	
Measurement Of High Voltages And Currents:	Measurement of High Direct Current voltages, Measurement of High Voltages alternating and impulse, Measurement of High Currents-direct, alternating and Impulse, Oscilloscope for impulse voltage and current measurements
Over Voltage Phenomenon And Insulation Co-Ordination	Natural causes for over voltages, Lightning phenomenon, Over voltages due to switching surges, system faults and other abnormal conditions, Principles of Insulation Coordination on High voltage and Extra High Voltage power systems.
UNIT - V	
Non-Destructive Testing Of Material And Electrical Apparatus	Measurement of D.C Resistivity, Measurement of Dielectric Constant and loss factor, Partial discharge measurements

High Voltage Testing Of Electrical Apparatus	Testing of Insulators and bushings, Testing of Isolators and circuit breakers, Testing of cables, Testing of Transformers, Testing of Surge Arresters, Radio Interference measurements

Text Books:

1."High Voltage Engineering" by M.S. Naidu and V. Kamaraju – TMH Publications, 3rd Edition

2."High Voltage Engineering: Fundamentals" by E .Kuffel, W.S. Zaengl, J. Kuffel by Elsevier, 2nd Edition

Reference Books:

1.C.L. Wadhwa , "High Voltage Engineering", New Age Internationals (P) Limited. 1997

2.Ravindra Arora, Wolfgang Mosch , "High Voltage Insulation Engineering", New Age International (P) Limited. 1995

Web References:

1. http://www.dbc.wroc.pl/Content/3458/high_voltage_engineering.pdf
2. http://nptel.ac.in/courses/108104048/
3. https://en.wikipedia.org/wiki/Electrical_breakdown
4. http://www.uomisan.edu.iq/eng/ar/admin/pdf/74047849932.pdf
5. http://www.wbuthelp.com/chapter_file/721.pdf

Question Paper Pattern:

Sessional Exam

The question paper for sessional examination is for 30 marks, covering half of the syllabus for first sessional and remaining half for second sessional exam. Question No 1 which carries 6 marks contains three short answer questions of two marks each. The remaining three questions shall be EITHER/OR type questions carrying 8 marks each.

End Exam

Question Paper Contains Six Questions. Question 1 contains 5 short Answer questions each of 2 marks. (Total 10 marks) covering one question from each unit. The remaining five questions shall be EITHER/OR type questions carrying 10 marks each. Each of these questions is from one unit and may contain sub-questions. i.e there will be two questions from each unit and the student should answer any one question

ELECTRICAL DISTRIBUTION SYSTEMS (EDS)

VI Semester : EEE						Scheme : 2017		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
EE316	Professional Elective - II	L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
		3	0	0	3	40	60	100
Sessional Exam Duration : 2 Hrs						End Exam Duration: 3 Hrs		

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

CO1: Understand the basic concepts radial and loop feeders for distribution lines

CO2: Understand the importance of power factor and voltage regulation in distribution systems

CO3: Analyze the power loss and voltage loss for uniform and non uniform loads..

CO4: Understand the concepts of substation and its protection.

CO5: Apply the concepts of power factor improvement and voltage control in distribution systems

UNIT - I	
General Concepts	Introduction to distribution systems, Load modeling and characteristics. Coincidence factor, contribution factor loss factor, Relationship between the load factor and loss factor. Classification of loads (Residential, commercial, Agricultural and Industrial) and their characteristics.
UNIT - II	
Distribution Feeders	Design Considerations of Distribution Feeders: Radial and loop types of Primary feeders, voltage levels, feeder loading.
Substations	Location of Substations: Rating of distribution substation, service area within Primary feeders. Benefits derived through optimal location of substations.
UNIT - III	
System Analysis	Voltage drop and power-loss calculations: Derivation for voltage drop and power loss in lines, manual methods of solution for radial networks, three phase balanced primary lines.
UNIT - IV	
Protection	Objectives of distribution system protection, types of common faults and procedure for fault calculations. Protective Devices: Principle of operation of Fuses, Circuit Reclosures, line sectionalizes, and circuit breakers.
Coordination	Coordination of Protective Devices: General coordination procedure.
UNIT - V	
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	Voltage Control: Equipment for voltage control, effect of series capacitors, effect of AVB/AVR, line drop compensation.

Text Books :

1. Turan Gonen, “Electric Power Distribution system, Engineering”, Mc Graw-hill Book Company.
2. A.S. Pabla , “Electric Power Distribution”, Tata Mc Graw-hill Publishing company, 4th

edition. 1997

Reference Books :

1. S. Sivanagaraju, V.Sankar, “Electrical Power Distribution and Automation”, Dhanpat Rai & Co. 2006.
2. V. Kamaraju, “Electrical Power Distribution Systems”, Right Publishers.

Web References:

1. http://gvpcew.ac.in/Material/EEE/4%20EEE%20-%20eds%20unit%201.pdf
2. http://pages.mtu.edu/~avsergue/EET3390/Lectures/CHAPTER6.pdf
3. https://www.slideshare.net/srtu99ler/chapter-iv-426students
4. https://www.eng.uwo.ca/people/tsidhu/Documents/ES586B-Hesam%20Hosseinzadeh-250441131.pdf
5. https://www.slideshare.net/tbmeng/power-factor-improvement-45696305

Question Paper Pattern:

Sessional Exam

The question paper for sessional examination is for 30 marks, covering half of the syllabus for first sessional and remaining half for second sessional exam. Question No 1 which carries 6 marks contains three short answer questions of two marks each. The remaining three questions shall be EITHER/OR type questions carrying 8 marks each.

End Exam

Question Paper Contains Six Questions. Question 1 contains 5 short Answer questions each of 2 marks. (Total 10 marks) covering one question from each unit. The remaining five questions shall be EITHER/OR type questions carrying 10 marks each. Each of these questions is from one unit and may contain sub-questions. i.e there will be two questions from each unit and the student should answer any one question

UTILIZATION OF ELECRICAL POWER (UEP)

VI Semester : EEE					Scheme : 2017			
Course Code	Category	Hours/Week			Credits	Maximum Marks		
EE317	Professional Elective - II	L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
		3	0	0	3	40	60	100
Sessional Exam Duration : 2 Hrs					End Exam Duration: 3 Hrs			

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

CO1: Understand the estimation of electric power and able to plot the power demand in the form of load curve

CO2: Understand the importance of power factor improvement.

CO3: Understand the concept, types and usage of electrical heating and welding.

CO4: Understand different types of lighting schemes. Design street lighting and flood lighting

CO5: Design street lighting and flood lighting for airports, stadiums and malls

CO6: Understand the principles of electric traction.

	UNIT - I
Economic aspects of power generation	Load curve, load duration and integrated load duration curves-load, demand, diversity, capacity, utilization and plant use factors- Numerical Problems. Tariff Methods: Costs of generation and their division into Fixed, Semi-fixed and Running Costs. Desirable Characteristics of a Tariff Method.-Tariff Methods: Flat Rate, Block-Rate, two-part, three –part, and power factor tariff methods, Types of Depreciation and Numerical Problems.
	UNIT - II
Power factor improvement	Causes of low p.f -Methods of Improving p.f -Phase advancing and generation of reactive KVAR using static Capacitors-Most economical p.f. for constant KW load and constant KVA type loads, Numerical Problems.
	UNIT – III
Electric Heating	Advantages and methods of electric heating, resistance heating, induction heating and dielectric heating.
Electric Welding	Electric welding, resistance welding and arc welding, electric welding equipment, comparison between A.C. and D.C. Welding.
	UNIT - IV
Illumination fundamentals	Basic principles of light control, Types of lighting schemes. Street Lighting: Objectives, Principles and types Flood Lighting: Purpose, Design of flood lighting scheme for Airports, Stadiums and Malls
	UNIT - V
Electric Traction	System of electric traction and track electrification. 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.

Text Books :

1. M.L.Soni, P.V.Gupta, U.S.Bhatnagar, A.Chakrabarthy, “A Text Book on Power System Engineering”, Dhanpat Rai & Co Pvt. Ltd. 1999.
2. C.L. Wadhwa , “Generation, Distribution and Utilization of electrical Energy”, New Age
   a. International (P) Limited, Publishers. 1997
3. J.B.Gupta , “Utilisation of Electric Power & Electric Traction”, S.K. Kataria & Sons Publishers.

1997

4. Partab , “Art & Science of Utilization of electrical Energy”, 3 rd edition Dhanpat Rai & Sons. 2004
5. J.B.Gupta , “Utilisation of Electric Power & Electric Traction”, S.K. Kataria & Sons Publishers. 1997

Reference Books :

1. V.K Mehta and Rohit Mehta (2004), “Principles of Power Systems”, S.Chand & Company, New Delhi.
2. G.C. Garg, Utilization of Electric Power”, Khanna Publishers. 2008

Web References:

1. http://www.fayoum.edu.eg/stfsys/stfFiles//243//2512//Ch%204%20-%20Principles%20of%20Power%20system.pdf
2. https://www.electrical4u.com/electrical-power-factor/
3. https://www.scribd.com/doc/51540789/ELECTRIC-HEATING-AND-WELDING
4. https://en.wikipedia.org/wiki/Illumination
5. https://en.wikipedia.org/wiki/Railway_electric_traction

Question Paper Pattern:

Sessional Exam

The question paper for sessional examination is for 30 marks, covering half of the syllabus for first sessional and remaining half for second sessional exam. Question No 1 which carries 6 marks contains three short answer questions of two marks each. The remaining three questions shall be EITHER/OR type questions carrying 8 marks each.

End Exam

Question Paper Contains Six Questions. Question 1 contains 5 short Answer questions each of 2 marks. (Total 10 marks) covering one question from each unit. The remaining five questions shall be EITHER/OR type questions carrying 10 marks each. Each of these questions is from one unit and may contain sub-questions. i.e there will be two questions from each unit and the student should answer any one question

ADVANCED POWER ELECTRONICS (APE)

VII Semester : EEE						Scheme : 2017		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
EE407	Professional Elective - III	L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
		3	0	0	3	40	60	100
Sessional Exam Duration : 2 Hrs					End Exam Duration: 3 Hrs			

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

CO1: Understand the structure, operation and characteristics of power MOSFET, Thyristor, IGBT and GTO

CO2: Understand protection, gate driver circuits of power MOSFET, Thyristor, IGBT and GTO

CO3: Understand modeling of inverter and PWM methods

CO4: Understand the principle of multilevel inverter, conventional topologies and its PWM methods

CO5: Understand the operation of conventional DC-DC converters and resonant converters.

CO6: Understand the working of SMPC,UPS, battery charger, voltage regulator and twelve pulse Converters.

UNIT – I	
Solid State Devices	Introduction, Basic structure, I-V characteristics, physics of device operation, switching characteristics, Power MOSFETs, Thyristors, GTOs and IGBTs. Intelligent power modules, protection, gating circuits, digital signal processors and controllers used in their control.
UNIT - II	
Two-level, 3-ϕ Inverter	Relation between phase voltage, line voltage, pole voltage and common mode voltages, Mathematical modeling of inverter.
PWM Control of two-level Inverter	Review of basic sinusoidal PWM technique, Third harmonic elimination and space vector pulse width modulation technique. Concept of fixed and variable switching frequency PWM methods.
UNIT - III	
Multilevel Inverters	Introduction to multilevel concept, different types of multilevel inverter topologies-diode clamped, cascaded H-bridge topologies.
PWM Control of 3-level Inverter	Sinusoidal and space vector pulse width modulation techniques for 3-level inverter.
UNIT - IV	
DC to DC Converters	Buck converter, Boost converter, Buck- Boost converter – simple problems, Resonant Converters, Zero current and zero voltage switching resonant converters (Elementary treatment only).
UNIT - V	
Power Electronic Applications	Switched mode power converters - fly back, push pull, half bridge and full-bridge configurations. UPS, Battery charging circuits, Voltage regulator and Twelve pulse converter configuration for HVDC transmission.

Text Books :

1. M.H. Rasheed, “Power Electronics Circuits Devices and Applications”, 3rd Edition, PHI publishers. 2004
2. B.K.Bose , “Modern Power electronics and ac drives”, Pearson Education Publishers. 2003
3. P. S. Bhimbra, “Generalized Theory of Electric Machines”, Khanna Publication.

Reference Books :

. P.C. Krause, O. Wasynczuk, and S. D. Sudhoff, “Analysis of Electric Machinery”, McGraw-Hill Book Company.
2. R. Krishnan, “Electric Motor Drives: Modeling, Analysis and Control”, Prentice Hall.

Web References:

1. https://archive.swayam.gov.in/courses/5440-jan-2019-fundamental-of-power-electronics

2. https://archive.swayam.gov.in/courses/5435-jan-2019-advance-power-electronics-and-control

Question Paper Pattern:

Sessional Exam

The question paper for sessional examination is for 30 marks, covering half of the syllabus for first sessional and remaining half for second sessional exam. Question No 1 which carries 6 marks contains three short answer questions of two marks each. The remaining three questions shall be EITHER/OR type questions carrying 8 marks each.

End Exam

Question Paper Contains Six Questions. Question 1 contains 5 short Answer questions each of 2 marks. (Total 10 marks) covering one question from each unit. The remaining five questions shall be EITHER/OR type questions carrying 10 marks each. Each of these questions is from one unit and may contain sub-questions. i.e there will be two questions from each unit and the student should answer any one question

POWER QUALITY (PQ)

VII Semester : EEE						Scheme : 2017		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
EE408	Professional Elective - III	L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
		3	0	0	3	40	60	100
Sessional Exam Duration : 2 Hrs						End Exam Duration: 3 Hrs		

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

CO1: Understand the concepts of power quality.

CO2: Understand the long interruption.

CO3: Understand the short interruption.

CO4: Understand the mitigation methods.

CO5: Understand the concept of harmonics.

	UNIT - I
Introduction	Introduction of the Power Quality (PQ) problem, Terms used in PQ: Voltage, Sag, Swell, Surges, Harmonics, Over voltages, Spikes, Voltage fluctuations, Transients, Interruption, Overview of power quality phenomenon - Remedies to improve power quality
	UNIT - II
Long Interruptions	Interruptions-Definitions, Difference between failure, outage, Interruptions, causes of Long Interruptions, Origin of Interruptions, Limits for the Interruptions frequency, Limits for the interruption duration.
	UNIT - III
Short Interruptions	origin of short interruptions, basic principle, fuse saving, voltage magnitude events due to re-closing, Voltage during the interruption, monitoring of short interruptions
	UNIT - IV
Mitigation of Interruption and Voltage Sags	Overview of mitigation methods – from fault to trip - reducing the number of faults, reducing the fault clearing time changing the power system - installing mitigation equipment - improving equipment immunity - different events and mitigation methods.
	UNIT - V
Fundamentals of Harmonics	Harmonic Distortion – Voltage verses Current distortion – Harmonics verses Transients – Harmonic Indexes – Harmonic Sources from Commercial Loads – Harmonic Sources from industrial Loads –Locating harmonic sources.

Text Books :

1. Math H J Bollen," Understanding Power Quality Problems", IEEE Press, 1999
2. R C Dugan, M.F,M Granghar, H.W.Beaty," Electrical power quality" ,TMH. 1993
3. G. T. Heydt, "Electric Power Quality", Stars in a Circle Publications, 1991.

Reference Books :

1.Arindam Ghosh and Gerard Ledwich,"Power Quality Enhancement using custom power devices"-Kulwer academicpublishers. 2002

2. C.Sankaran ,"Power quality", CRC Press 2002.

3.Eswald F.Fudis and M.A.S.Masoum ,"Power Quality in Power System and Electrical Machines", Elseviar Academic Press , 2013.

Web References:

1.https://www.bharathuniv.ac.in/colleges1/downloads/courseware_eee/Notes/CE3/BEE044%20PQ.pdf

2. http://electrical-engineering-portal.com/9-most-common-power-quality-problems

3. http://onlinelibrary.wiley.com/book/10.1002/9781118922064

4. https://www.slideshare.net/mayurdhande11/voltage-sag-and-its-mitigation-54121698

5. https://www.slideshare.net/DheerajSuri/pq4-fundamentals-of-harmonics

Question Paper Pattern:

Sessional Exam

The question paper for sessional examination is for 30 marks, covering half of the syllabus for first sessional and remaining half for second sessional exam. Question No 1 which carries 6 marks contains three short answer questions of two marks each. The remaining three questions shall be EITHER/OR type questions carrying 8 marks each.

End Exam

Question Paper Contains Six Questions. Question 1 contains 5 short Answer questions each of 2 marks. (Total 10 marks) covering one question from each unit. The remaining five questions shall be EITHER/OR type questions carrying 10 marks each. Each of these questions is from one unit and may contain sub-questions. i.e., there will be two questions from each unit and the student should answer any one question

HVDC AND FACTS (HVDC & FACTS)

VII Semester : EEE					Scheme : 2017			
Course Code	Category	Hours/Week			Credits	Maximum Marks		
EE409	Professional Elective - III	L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
		3	0	0	3	40	60	100
Sessional Exam Duration : 2 Hrs					End Exam Duration: 3 Hrs			

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

CO1: Understand the significance of DC transmission over AC transmission system, types and application of HVDC links.

CO2: Analyze characteristics of 6 and 12 pulse converter for power flow control.

CO3: Understand the converter faults and protection in HVDC system.

CO4: Understand the importance of controllable parameters and role of FACTS controllers in AC System

CO5: Understand the significance of shunt, series compensation for the improvement of System Stability.

UNIT - I	
Basic concepts	Economics and terminal equipment of HVDC transmission systems, Types of HVDC links, Apparatus required for HVDC systems, Comparison of AC and DC Transmission , Application of DC Transmission System
UNIT – II	
HVDC Converters	Choice of converter configurations, Analysis of Graetz circuit, characteristics of 6-pulse and 12-pulse converters, principle of DC link control
Converter control	Converter control characteristics, firing angle control, current and extinction angle control, effect of source inductance on the systems.
UNIT - III	
Converter faults & protection	Converter faults, Protection against over currents & over voltages in converter station, surge arresters, smoothing reactors, DC breakers, Effects of proximity of AC & DC transmission lines
UNIT - IV	
FACTS concept and General System considerations	Transmission Interconnections- Flow of power in an AC system- What limits the loading capability? power flow and dynamic stability considerations of a transmission interconnection – relative importance of controllable parameters- basic types of FACTS controllers- Brief description and definitions of FACTS controllers.
UNIT - V	
Static Series Compensation	Objectives of series compensation – Concept of series capacitive compensation – voltage stability - Improvement of Transient Stability – power oscillation Damping – sub synchronous Oscillation Damping.
Static Shunt Compensation	Objectives of shunt compensation – Mid point voltage Regulation for Line segmentation – end line voltage support to prevent voltage Instability – Improvement of Transient Stability – Power Oscillation Damping.

Text Books :

1. K.R. Padiyar , " HVDC Power Transmission Systems", NewAge Publishers. 1992
2. E.W. Kimbark, "Direct current Transmission" , Wiley-Blackwell; Volume 1 edition, 1971
3. Hingorani , "Understanding Facts Concepts", IEEE Publications 2000

Reference Books :

1.S.Kamakshiah, Kamaraju.V " HVDC Transmission", McGraw Hill Education India Ltd.
2.K. R. Padiyar, "FACTS Controllers in Power Transmission and Distribution", New Age International (P)Ltd. 2007.
3.Vijay K. Sood," HVDC and FACTS Controllers" , Springer Science & Business Media, 2006 .

Web References:

1. https://www.electronicshub.org/high-voltage-dc-transmission-system/
2. https://www.slideshare.net/maheshbabu252/hvdc-notes
3. https://www.scribd.com/doc/106817743/Converter-Faults-Protection
4. https://www.slideshare.net/ayyarao/basic-types-of-facts-controllers
5. https://en.wikipedia.org/wiki/Flexible_AC_transmission_system

Question Paper Pattern:

Sessional Exam

The question paper for sessional examination is for 30 marks, covering half of the syllabus for first sessional and remaining half for second sessional exam. Question No 1 which carries 6 marks contains three short answer questions of two marks each. The remaining three questions shall be EITHER/OR type questions carrying 8 marks each.

End Exam

Question Paper Contains Six Questions. Question 1 contains 5 short Answer questions each of 2 marks. (Total 10 marks) covering one question from each unit. The remaining five questions shall be EITHER/OR type questions carrying 10 marks each. Each of these questions is from one unit and may contain sub-questions. i.e there will be two questions from each unit and the student should answer any one question.

EMBEDDED APPLICATIONS TO ELECTRICAL ENGINEERING (EAEE)

VII Semester: EEE						Scheme : 2017		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
EE410	Professional Elective - IV	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	40	60	100
Sessional Exam Duration : 2 Hrs						End Exam Duration: 3 Hrs		

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

CO1: Understand the need and characteristics of Embedded Systems.

CO2: Understand the design and inner interfaces of Embedded System

CO3: Understand the Processor and software divisions in an embedded system.

CO4: Understand the inter process communication and functions of RTOS.

CO5: Understand real time embedded applications.

	UNIT - I
Basics of Embedded System	Definition, Attributes, Characteristics, Applications, Examples of Embedded Systems. Skills required for an Embedded System.
	UNIT - II
Core of Embedded Systems	Processor Embedded System, Embedded Hardware Units and Devices in a system, Structural units in processor, Embedded Software in a System. Design Process in Embedded System.
	UNIT - III
Hardware and Software	Processor selection for an embedded system, Programming languages for embedded systems, Board memory: ROM – RAM – cache – auxiliary memory – memory management – memory performance.
	UNIT - IV
RTOS & Inter process Communication	RTOS Kernel & Process Management. Create, Ready, Run, Interrupt, Wait and Terminate States. Inter task Communication & Synchronization, Context Switching.IPC through Semaphores, Mutex, Mailboxes, Message Queues or Pipes and Event Flags.
	UNIT - V
Embedded Applications	Hard Real-time systems, Soft Real-time systems. Time based application, Event Triggered applications, Elevator, Digital Camera, Mobile Phone, A set of Robots

Text Books

3. Raj Kamal, Embedded Systems Architecture, Programming and design, 2nd Edition, TMH, 2006.
4. Frank Vahid, Tony Givargis, "Embedded System Design" Wiley- India 3rd Edition, 2009.

Reference Books

1. Embedded system architecture, Tammy Noergaard, Elsevier, 2006.
2. Arnold S Burger, Embedded System Design An Introduction to Processes, Tools and Techniques, 1st Edition, CMP Books, 2007.

Web References

1. www.nptel.onlinecourse.ac.in/embeddedsystemsdesgin.
2. www.nptel.onlinecourse.ac.in/microcontrollersapplications.

Sessional Exam:

The question paper for sessional examination is for 30 marks, covering half of the syllabus for first sessional and remaining half for second sessional exam. Question No 1 which carries 6 marks contains three short answer questions of two marks each. The remaining three questions shall be EITHER/OR type questions carrying 8 marks each.

End Exam:

Question Paper Contains Six Questions. Question 1 contains 5 short Answer questions each of 2 marks. (Total 10 marks) covering one question from each unit. The remaining five questions shall be EITHER/OR type questions carrying 10 marks each. Each of these questions is from one unit and may contain sub-questions. i.e there will be two questions from each unit and the student should answer any one question

IoT APPLICATIONS TO ELECTRICAL ENGINEERING (IEE)

VII Semester : EEE					Scheme : 2017			
Course Code	Category	Hours/Week			Credits	Maximum Marks		
EE411	Professional Elective - IV	L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
		3	0	0	3	40	60	100
Sessional Exam Duration : 2 Hrs					End Exam Duration: 3 Hrs			

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

CO1: Understand characteristics, terminology in IoT like, physical and logical design, functional and Communication models.

CO2: Understand working of software define network, concept of Machine to Machine

CO3: Understand domain specific applications in IoT like home automation, surveillance, industry and smart grid applications.

CO4: Understand the features, challenges, functionality of the smart grid.

CO5: Understand the safety, hardware and Power Quality issues in Smart Grid.

	UNIT - I
Introduction to IoT	Defining IoT, Characteristics of IoT, Physical design of IoT, Logical design of IoT, Functional blocks of IoT, Communication models & APIs
	UNIT - II
IoT & Machine to Machine	Machine to Machine, Difference between IoT and M2M, Software define Network
	UNIT - III
Domain specific applications of IoT	Home automation, Industry applications, Surveillance applications, Smart Grid, Other IoT applications
	UNIT - IV
Introduction to Smart Grid	Introduction, Evolution of conventional grid and Indian national grid, Smart gird-operations and key features, smart grid features, challenges, comparison of smart grid and conventional grid, working of smart grid, need for smart gird, functions of smart grid, grid resiliency and self healing, functional model of smart grid.
	UNIT - V
Power quality management in smart grid	EMC in smart grid, equipment required for grid connection systems, addressing safety and power quality for grid connection, power quality conditioner, smart grid with power quality conditioner, PQ monitoring, PQ audit in web based system

Text Books :

1.Vijay Madisetti, Arshdeep Bahga, “Internet of Things: A Hands-On Approach”, VPT; 1 edition.

2.Bharat Modi, Anu Prakash, Yogesh, "Kumar, Fundamentals of Smart Grid Technology", S.K. Kataria & Sons; 2015 edition

Reference Books :

1.Waltenegus Dargie,Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice"

Web References:

1. https://www.electricaltechnology.org/2016/07/internet-of-things-iot-and-its-applications-in-electrical-power-industry.html
2. https://acadpubl.eu/jsi/2018-118-18/articles/
3. http://www.nptelvideos.in/2012/11/internet-technologies.html

Question Paper Pattern:

Sessional Exam

The question paper for Sessional examination is for 30 marks, covering half of the syllabus for first Sessional and remaining half for second Sessional exam. Question No 1 which carries 6 marks contains

three short answer questions of two marks each. The remaining three questions shall be EITHER/OR type questions carrying 8 marks each. A continuous assessment for 10 marks for assignment/quiz/both. 2 assignments/1 quiz

End Exam

Question Paper Contains Six Questions. Question 1 contains 5 short Answer questions each of 2 marks. (Total 10 marks) covering one question from each unit. The remaining five questions shall be EITHER/OR type questions carrying 10 marks each. Each of these questions is from one unit and may contain sub-questions. i.e there will be two questions from each unit and the student should answer any one question

INDUSTRIAL AUTOMATION AND CONTROL (IAC)

VII Semester : EEE						Scheme : 2017		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
EE412	Professional Elective - IV	L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
		3	0	0	3	40	60	100
Sessional Exam Duration : 2 Hrs					End Exam Duration: 3 Hrs			

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

CO1: Understand concept of industrial automation and its tools.

CO2: Understand PLC programming using ladder logic and other programming standards.

CO3: Understand Standard Protocols in industrial automation.

CO4: Understand basics of distributed control systems.

CO5: Understand process safety and safety management systems related to automation system.

UNIT - I	
Introduction to Industrial Automation	Introduction to Industrial Automation, Role of automation in industries, types of manufacturing industries, types of automation system, Benefits of automation. Introduction to Automation pyramid, Introduction to automation tools like PAC, PLC, SCADA, DCS, Hybrid DCS with reference to automation pyramid. Functional Design Specifications (FDS) for automation tools.
UNIT - II	
Sensors and PLC Configuration	Introduction to Sensors and actuators, types of sensors, Industrial examples using PLC, sensors and pneumatics. Programmable logic controllers (PLC) Introduction, PLC programming methods as per IEC 61131, Advantages & disadvantages of PLC with respect to relay logic, PLC architecture, Input Output modules, PLC interfacing with plant, memory structure of PLC.
UNIT - III	
PLC functions	Developing programs using ladder logic, bit logic instructions, ladder diagram examples, PLC Timer & Counter functions on-delay timer, off-delay timers, retentive on-delay timers, pulse timers, timer examples, up-counter, down-counter and up-down counter.
Standard Protocols	Definition of protocol, Introduction to Open System Interconnection (OSI) model, Communication standard (RS232, RS485), Modbus (ASCII/RTU), Introduction to third party interface, concept of OPC (Object linking and embedding for Process Control).
HART Protocol	Introduction, frame structure, programming, implementation examples, benefits, advantages and limitation. Industrial Ethernet.TCP I/P Protocol.
UNIT - IV	
Distributed Control System Basics	DCS introduction, various function Blocks, DCS components/block diagram, DCS Architecture of different makes, comparison of these architectures with automation pyramid, DCS specification. DCS detail Engineering, configuration and programming, functions including database management, reporting, alarm management, diagnosis, Historical database management, security and user access management, communication, third party interfaces ,control, display etc.
UNIT - V	
Process safety and Safety Management Systems	Introduction to process safety, risk, risk terminologies, consequence and risk, risk measurement, Process Hazard Analysis (PHA), Hazard and operability study (HaZOp),Redundant system, Master/slave from master, Dual Redundant, Triple Redundant, Safety Integrity Level (SIL), Introduction to IEC61511 standard for Functional safety , protection layers, Safety Instrumented System: function,

	architecture, safety life cycle, Application of safety system

Text Books :

3. The management of control system: Justification and Technical Auditing, N.E. Bhttiha, ISA
4. Computer aided process control, S.K.Singh, PHI.
5. Understanding Distributed Process Systems For Control, Samuel Herb, ISA.
6. Programmable Logic Controllers: Principles and Applications, Webb &Reis, PHI.

Reference Books :

1. Introduction to Programmable Logic Controllers, Garry Dunning, Thomson Learning.
2. Distributed computer control for industrial automation, Ppovik Bhatkar, Dekkar Pub.
3. Computer Based Process control, Krishna Kant, PHI

Web References:

1. https://onlinecourses.nptel.ac.in/noc18_ee12/preview
2. http://nptel.ac.in/courses/108105062/
3. http://nptel.ac.in/courses/Webcoursecontents/IIT%20Kharagpur/Industrial%20Automation%20control/New_index1.html

Question Paper Pattern:

Sessional Exam

The question paper for sessional examination is for 30 marks, covering half of the syllabus for first sessional and remaining half for second sessional exam. Question No 1 which carries 6 marks contains three short answer questions of two marks each. The remaining three questions shall be EITHER/OR type questions carrying 8 marks each.

End Exam

Question Paper Contains Six Questions. Question 1 contains 5 short Answer questions each of 2 marks. (Total 10 marks) covering one question from each unit. The remaining five questions shall be EITHER/OR type questions carrying 10 marks each. Each of these questions is from one unit and may contain sub-questions. i.e there will be two questions from each unit and the student should answer any one question

ELEMENTS OF DIGITAL SIGNAL PROCESSING (EDSP)

VIII Semester : EEE						Scheme : 2017		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
EE413	Professional Elective - V	L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
		3	0	0	3	40	60	100
Sessional Exam Duration : 2 Hrs					End Exam Duration: 3 Hrs			

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

CO1: Understand the classification of discrete time systems, Linear constant coefficient difference equation and Discrete time Fourier transform.

CO2: Apply Discrete Fourier transform technique to digital signals.

CO3: Apply Fast Fourier transform techniques to digital signals.

CO4: Design of IIR &FIR digital filters.

CO5: Understand the realization of IIR and FIR digital filters.

CO6 : Understand the internal architecture, addressing modes of TMS320C67XX digital signal Processor.

UNIT – I	
Introduction to Digital Signal Processing	Discrete time signals & sequences, Static & dynamic systems, linear shift invariant systems, stability, and causality. Linear constant coefficient difference equations. Frequency domain representation of discrete time signals and systems. Discrete Time Fourier Transforms (DTFT).
Discrete Fourier Transform	Discrete Fourier Transform, Properties of DFT, Computation of DFT, linear convolution of sequences using DFT.
UNIT – II	
Fast Fourier Transform	Fast Fourier transform (FFT) - Radix-2 decimation in time and decimation in frequency FFT Algorithms, Inverse FFT,comparision of DFT and FFT computations.
UNIT – III	
IIR Digital Filters	Analog filter approximations –Design of Butter worth and Chebyshev filters, Analog-Digital transformations -Design of IIR Digital filters from analog filters.
FIR Digital Filters	Characteristics of FIR Digital Filters, frequency response. Design of FIR Digital Filters using Window Techniques, Comparison of IIR & FIR filters.
UNIT – IV	
Realization Of Digital Filters	Basic structures of IIR systems-Direct form I & II , Cascade, parallel forms. Basic structures of FIR systems.
UNIT – V	
Architecture of TMS 320C67XX	Introduction to DSP processor, Internal architecture, addressing modes, peripherals.

Text Books :

1. John G. Proakis, Dimitris G. Manolakis , “Digital Signal Processing, Principles, Algorithms, and Applications”, Pearson Education / PHI. 2007.
2. A.V.Oppenheim and R.W. Schaffer, “Discrete Time Signal Processing”, PHI.
3. . B.Venkataramani, M. Bhaskar , “Digital Signal Processors – Architecture, Programming and Applications”, TATA McGraw Hill. 2002.
4. Emmanuel C.Ifearchar, Barrie W.Jervis, “DSP A Practical Approach”, Pearson Ed.

Reference Books :

1. Andreas Antoniou , “Digital Signal Processing”, TATA McGraw Hill. 2006
2. Robert J. Schilling, Sandra L. Harris, “Fundamentals of Digital Signal Processing using Matlab”, Thomson,. 2007.
4. C. Britton Rorabaugh,"DSP Primer”, Tata McGraw Hill, 2005.

Web References:

1. https://nptel.ac.in/courses/nptel_download.php?subjectid=117102060
2. https://lecturenotes.in/subject/44/digital-signal-processing-dsp
3. https://www.dspguide.com/ch28/1.htm

Question Paper Pattern:

Sessional Exam

The question paper for sessional examination is for 30 marks, covering half of the syllabus for first sessional and remaining half for second sessional exam. Question No 1 which carries 6 marks contains three short answer questions of two marks each. The remaining three questions shall be EITHER/OR type questions carrying 8 marks each.

End Exam

Question Paper Contains Six Questions. Question 1 contains 5 short Answer questions each of 2 marks. (Total 10 marks) covering one question from each unit. The remaining five questions shall be EITHER/OR type questions carrying 10 marks each. Each of these questions is from one unit and may contain sub-questions. i.e there will be two questions from each unit and the student should answer any one question

BIOMEDICAL INSTRUMENTATION (BMI)

VIII Semester : EEE					Scheme : 2017			
Course Code	Category	Hours/Week			Credits	Maximum Marks		
EE414	Professional Elective - V	L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
		3	0	0	3	40	60	100
Sessional Exam Duration : 2 Hrs					End Exam Duration: 3 Hrs			

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

CO1: Understand the terminology in biomedical instrumentation

CO2: Understand the working of the biomedical transducers, electrodes

CO3: Understand the working of amplifiers used in bio-signal acquisition

CO4: Understand the working of bio-potential recorders

CO5: Understand the working of BP meters, pacemakers, defibrillators, ventilators, stimulators.

UNIT – I	
Fundamentals Of Biomedical Instrumentation	Development of Biomedical Instrumentation, biometrics, introduction to man-instrument system, components of man-instruments, Physiological systems of the body, Problems encounters in measuring a living system
UNIT – II	
Transducers and Electrodes	Transducers – Principles – Active - Passive-Applications in biomedical instrumentation, Resting and action potentials, propagation of action potential, bioelectric potentials. Electrodes – theory - biopotential - biochemical transducers.
UNIT - III	
Biosignal Acquisition	Introduction-Physiological signal amplifiers-isolation amplifiers-bridge amplifiers-line driving amplifiers-current amplifier-chopper amplifier-drift compensation in operational amplifiers
UNIT - IV	
Biopotential Recorders	Characteristics of the recording system-ECG-EEG-EMG-ERG and EOG, Recorders with high accuracy-Recorders for off line analysis.
UNIT - V	
Patient care and monitoring	Measurement of blood pressure- blood flow meters- cardiac output measurements-pacemakers- defibrillators- ventilators- Nerve and muscle stimulators

Text Books :

3. Leslie Cromwell, Biomedical Instrumentation and Measurement, Prentice hall of India, New Delhi, 2007.
4. Joseph J.carr and John M. Brown, Introduction to Biomedical Equipment Technology, John Wiley and sons, New York, 4th Edition, 2012.
5. Khandpur R.S, Handbook of Biomedical Instrumentation, , Tata McGraw-Hill, New Delhi, 2nd Edition, 2003.

Reference Books :

5. John G. Webster, Medical Instrumentation Application and Design, John Wiley and sons, New York, 1998.
6. Ed. Joseph D. Bronzino, The Biomedical Engineering Hand Book, Third Edition, Boca Raton, CRC Press LLC, 2006.
7. M.Arumugam, 'Bio-Medical Instrumentation', Anuradha Agencies, 2003.

Web References:

1. https://libguides.wits.ac.za/c.php?g=281089&p=1872483
2. https://onlinelibrary.wiley.com/doi/book/10.1002/9780471740360
3. http://www.nptelvideos.in/2012/11/micro-and-smart-systems.html

4. http://www.nptelvideos.in/2012/11/industrial-instrumentation.html

Question Paper Pattern:

Sessional Exam

The question paper for Sessional examination is for 30 marks, covering half of the syllabus for first Sessional and remaining half for second Sessional exam. Question No 1 which carries 6 marks contains three short answer questions of two marks each. The remaining three questions shall be EITHER/OR type questions carrying 8 marks each. A continuous assessment for 10 marks for assignment/quiz/both. 2 assignments/1 quiz

End Exam

Question Paper Contains Six Questions. Question 1 contains 5 short Answer questions each of 2 marks. (Total 10 marks) covering one question from each unit. The remaining five questions shall be EITHER/OR type questions carrying 10 marks each. Each of these questions is from one unit and may contain sub-questions. i.e there will be two questions from each unit and the student should answer any one question

INTRODUCTION TO HYBRID & ELECTRIC VEHICLES (IHEV)

VIII Semester : EEE						Scheme : 2017		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
EE415	Professional Elective - V	L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
		3	0	0	3	40	60	100
Sessional Exam Duration : 3 Hrs					End Exam Duration: 3 Hrs			

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

CO1: Understand the need for Electrical Vehicle (EV), advantages and compare with conventional vehicle.

CO2: Understand the dynamics of EV and its characteristics

CO3: Understand the battery terminology and performance parameters.

CO4: Understand transmission components and configurations of an electric drive train.

CO5: Understand types of hybrid vehicles and their performance parameters

UNIT - I

Introduction to Electric Vehicles	EV System -Recent EVs and HEVs - EV Advantages - Efficiency Comparison - Pollution Comparison - Capital and Operating Cost Comparison - EV Market.

UNIT - II

Vehicle Mechanics	Roadway Fundamentals - Laws of Motion -Vehicle Kinetics-Dynamics of Vehicle Motion -Propulsion Power - Force-Velocity Characteristics- Maximum Gradability-Velocity and Acceleration -Constant F_{TR}, Level Road-Velocity Profile-Distance Traversed -Tractive Power - Energy Required –Non-constant F_{TR}, General Acceleration -Propulsion System Design –Problems.

UNIT - III

Energy Source: Battery	Battery Basics - Lead-Acid Battery -Cell Discharge Operation - Cell Charge Operation-Construction-Battery Parameters - Battery Capacity-Discharge Rate - State of Charge- State of Discharge- Depth of Discharge-Technical Characteristics - Practical Capacity -Battery Energy -Constant Current Discharge -Specific Energy - Battery Power -Specific Power -Battery Pack Design - Ragone Plots - Targets and Properties of Batteries –Batteries for EV applications.

UNIT - IV

Electric Vehicle Drive train	Electric Vehicle Drive train - EV Transmission Configurations - Transmission Components – Gears- Automobile Differential – Clutch- Brakes -Ideal Gearbox: Steady State Model -Gear Ratio (GR)- Torque-Speed Characteristics- EV Motor Sizing -Initial Acceleration - Rated Vehicle Velocity -Maximum Velocity-Maximum Gradability – Simple Problems

UNIT - V

Hybrid Electric Vehicles	Types of Hybrids-Series and Parallel HEVs -Advantages and Disadvantages- Series-Parallel Combination - Example IC Engines in HEVs- Gas Turbine Engine - Hybrid Drive trains-Sizing of Components - Rated Vehicle Velocity - Initial Acceleration-Maximum Velocity- Maximum Gradability-Simple Problems.

Text Books :

1. Mehrdad Ehsani, Yimin Gao, Ali Emadi, “Modern Electric, Hybrid Electric, and Fuel Cell Vehicles_ Fundamentals, Theory, and Design”, Second Edition, CRC Press
2. Ali Emadi, “Advanced-Electric-Drive-Vehicles” , CRC Press
3. Mehrdad Ehsani, Yimin Gao, Sebastien E. Gay, Ali Emadi, “Modern Electric, Hybrid Electric &

Fuel Cell Vehicles", CRC Press

Reference Books :

1. James Larminie, John Lowry," Electric-Vehicle-Technology-Explained", John Wiley & Sons Ltd,
2. Sheldon. S.Williamson, "Energy Management Strategies for Electric and Plug-in Hybrid Electric Vehicles" Springer

Web References:

1. http://nptel.ac.in/courses/108103009/1
2. https://www.telegraph.co.uk/cars/advice/difference-hybrid-plug-in-hybrid-electric-ev-car/
3. https://nptel.ac.in/courses/108102121/

Question Paper Pattern:

Sessional Exam

The question paper for sessional examination is for 30 marks, covering half of the syllabus for first sessional and remaining half for second sessional exam. Question No 1 which carries 6 marks contains three short answer questions of two marks each. The remaining three questions shall be EITHER/OR type questions carrying 8 marks each.

End Exam

Question Paper Contains Six Questions. Question 1 contains 5 short Answer questions each of 2 marks. (Total 10 marks) covering one question from each unit. The remaining five questions shall be EITHER/OR type questions carrying 10 marks each. Each of these questions is from one unit and may contain sub-questions. i.e there will be two questions from each unit and the student should answer any one question

RENEWABLE AND DISTRIBUTED ENERGY SYSTEMS (RDES)

VIII Semester: EEE						Scheme: 2017		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
EE416	Professional Elective - VI	L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
		3	0	0	3	40	60	100
Sessional Exam Duration: 2 Hrs					End Exam Duration: 3 Hrs			

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

CO1: Understand the concept of renewable distributed generation and its optimal location.

CO2: Understand the impact of grid integration and control aspects of DGs

CO3: Understand the impacts of Renewable DGs on the existing distribution system

C04: Understand the economical, power quality and reliability issues of DGs

CO5: Understand the modeling of micro grid and its protection

UNIT - I	
Need for distributed generation	Renewable sources in distributed generation – Current scenario in distributed generation – Planning of DGs – Site selection and sizing of DGs – Optimal placement of DG sources in distribution systems.
UNIT - II	
Grid integration of DGs	Different types of interfaces – Inverter based DGs and rotating machine based interfaces – Aggregation of multiple DG units – Energy storage elements – Batteries, ultracapacitors, flywheels.
UNIT – III	
Technical impacts of DGs	Transmission systems, Distribution systems, De-regulation – Impact of DGs upon protective relaying – Impact of DGs upon transient and dynamic stability of existing distribution systems.
UNIT - IV	
Economic and control aspects of DGs	Market facts, issues and challenges – Limitations of DGs – Voltage control techniques, Reactive power control, Harmonics, Power quality issues – Reliability of DG based systems – Steady state and Dynamic analysis.
UNIT - V	
Introduction to micro-grids	Types of micro-grids – Autonomous and non-autonomous grids – Sizing of micro-grids – Modeling & analysis – Micro-grids with multiple DGs – Micro-grids with power electronic interfacing units – Transients in micro-grids – Protection of micro-grids.

Text Books :

1.H. Lee Willis, Walter G. Scott , 'Distributed Power Generation – Planning and Evaluation', Marcel Decker Press, 2000.

2.M.Godoy Simoes, Felix A.Farret, 'Renewable Energy Systems – Design and Analysis with Induction Generators', CRC press.

3.Robert Lasseter, Paolo Piagi, ' Micro-grid: A Conceptual Solution', PESC 2004, June 2004.

Reference Books :

1.F. Katiraei, M.R. Iravani, 'Transients of a Micro-Grid System with Multiple Distributed Energy Resources', International Conference on Power Systems Transients (IPST'05) in Montreal, Canada on June 19-23, 2005.

2.Z. Ye, R. Walling, N. Miller, P. Du, K. Nelson, 'Facility Microgrids', General Electric Global Research Center, Niskayuna, New York, Subcontract report, May 2005.

Web References:

1. https://www.sciencedirect.com/topics/engineering/distributed-renewable-generation

2.https://alcse.org/distributed-generation-benefits/

3.https://www.energy.gov/eere/wind/renewable-systems-integration

4.http://research.economics.unsw.edu.au/ctseng/editorial_3.pdf

5.https://search.yahoo.com/search?p=Introduction+to+micro grids&fr=yset_chr_syc_oracle&type=default

Question Paper Pattern:

Sessional Exam

The question paper for sessional examination is for 30 marks, covering half of the syllabus for first sectional and the remaining half for the second seasonal exam. Question No 1 which carries 6 marks contains three short answer questions of two marks each. The remaining three questions shall be EITHER/OR type questions carrying 8 marks each.

End Exam

Question Paper Contains Six Questions. Question 1 contains 5 short Answer questions each of 2 marks. (Total 10 marks) covering one question from each unit. The remaining five questions shall be EITHER/OR type questions carrying 10 marks each. Each of these questions is from one unit and may contain sub-questions. i.e there will be two questions from each unit and the student should answer any one question

SMART GRID TECHNOLOGIES (SGT)

VIII Semester: EEE						Scheme : 2017		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
EE417	Professional Elective - VI	L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
		3	0	0	3	40	60	100
Sessional Exam Duration : 2 Hrs						End Exam Duration: 3 Hrs		

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

CO1: Understand the concept of Smart Grid, compare with conventional grid, and identify its opportunities and barriers.

CO2: Understand the concept of Smart Meter, Smart Appliances, Automatic Meter Reading, Outage Management System, Plug in Hybrid Electric Vehicles, Vehicle to Grid, Smart Sensors, Home & Building Automation, Phase Shifting Transformers.

CO3: Understand the concept of Substation Automation, Feeder Automation. Intelligent Electronic Devices, Smart storage like Battery, Pumped Hydro, Compressed Air Energy Storage, Wide Area Measurement System, Phase Measurement Unit

CO4: Understand the concept of microgrid

CO5: Understand the concept of Power Quality and its issues of Grid connected Renewable Energy Sources, Communication Technologies in smart grid

UNIT - I	
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, Drivers of SG in India, Challenges for SG, Difference between conventional & smart grid, Smart Grid Vision & Roadmap for India, Concept of Resilient and Self Healing Grid, Present development & International policies in Smart Grid, Smart Cities, Pilot projects in India.
UNIT - II	
Smart Grid Technologies	Remote Terminal Unit (RTU), Intelligent Electronic Devices (IED), Phase Measurement Unit (PMU). Smart Substations, Substation and Feeder Automation, application for monitoring, protection and control, Plug in Hybrid Electric Vehicles(PHEV), Vehicle to Grid(V2G), Grid to vehicles(G2V), Smart storage technologies – Battery(flow and advanced), SMES, Super Capacitors, Pumped Hydro, Compressed Air Energy Storage(CAES) and its comparison.
UNIT - III	
Smart Meters and Advance Metering Infrastructure	Introduction to Smart Meters, Advanced Metering Infrastructure (AMI), Real Time Pricing, Automatic Meter Reading (AMR), Outage Management System (OMS) Smart Sensors, Smart Appliances, Home & Building Automation, Demand Response management systems.
UNIT - IV	
Microgrids	Concept of Microgrid, need & applications of Microgrid, Microgrid Architecture, DC Microgrid, Formation of Microgrid, Issues of interconnection, protection & control of Microgrid, Integration of renewable energy sources, Smart Microgrid, Microgrid and Smart Grid Comparison, Smart Microgrid Renewable Green Energy System, Cyber Controlled Smart Grid
UNIT - V	
Power Quality Management and Communications in Smart Grid	Power Quality and EMC in Smart Grid, Power Quality issues of Grid connected Renewable Energy Sources, Power Quality Conditioners for Smart Grid, Communication Architecture of SG, Wide Area Measurement System (WAMS), Home Area Network (HAN), Neighbourhood Area Network (NAN), Wide Area Network (WAN), Cyber Security for Smart Grid .

Text Books :

1. Ali Keyhani, Mohammad N. Marwali, Min Dai "Integration of Green and Renewable Energy in Electric Power Systems", Wiley Publications

2.Clark W. Gellings, "The Smart Grid: Enabling Energy Efficiency and Demand Response",CRC Press

3.Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, Jianzhong Wu, Akihiko Yokoyama, "Smart Grid: Technology and Applications", Wiley Publications

4.Stuart Borlase, "Smart Grids-Infrastructure, Technology and Solutions", CRC Press, Taylor and Francis group

Reference Books :

1. Nikos Ziargyriour, "Micro grid, Architecture and Control", IEEE Press, Wiley Publications

2.Yang Xiao, "Communication and Networking in Smart Grids", CRC Press, Taylor and Francis group

3. Lars T. Berger and Krzysztof Iniewski, "Smart Grid-Applications, Communications and Security", Wiley Publications

Web References:

1.https://www.smartgrid.gov/files/sg_introduction.pdf

2. https://www.elprocus.com/overview-smart-grid-technology-operation-application-existing-power-system/

3. http://www.indiasmartgrid.org/Advanced-Metering-Infrastructure.php

4. https://en.wikipedia.org/wiki/Microgrid

5. https://www.slideshare.net/Abhi4kismat/smart-grid-60973775

Question Paper Pattern:

Sessional Exam

The question paper for sessional examination is for 30 marks, covering half of the syllabus for first sessional and remaining half for second sessional exam. Question No 1 which carries 6 marks contains three short answer questions of two marks each. The remaining three questions shall be EITHER/OR type questions carrying 8 marks each.

End Exam

Question Paper Contains Six Questions. Question 1 contains 5 short Answer questions each of 2 marks. (Total 10 marks) covering one question from each unit. The remaining five questions shall be EITHER/OR type questions carrying 10 marks each. Each of these questions is from one unit and may contain sub-questions. i.e there will be two questions from each unit and the student should answer any one question

ELECTRICAL ESTIMATION & COSTING (EEC)

VIII Semester : EEE						Scheme : 2017		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
EE418	Professional Elective - VI	3	0	0	3	40	60	100
Sessional Exam Duration : 2 Hrs						End Exam Duration: 3 Hrs		

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

CO1: Understand the basic principles of estimation and costing for residential and commercial electrification.

CO2: Understand the detailed estimation and costing of residential and commercial electrification.

CO3: Understand method of installation, estimation and testing of underground and overhead service Connections.

CO4: Understand detail estimate and costing of a overhead transmission line and underground distribution system.

CO5: Understand the design and estimation of a substation and its switchgear installations.

UNIT - I

General Principles Of Estimation	Introduction to estimation & costing, Electrical Schedule. Catalogues, Market Survey and source selection. Recording of estimates, Determination of quantity of material required Labor conditions. Determination of material cost and labor Contingencies. Overhead charges, Profit, Purchase system, Purchase enquiry and selection of appropriate purchase mode. Comparative statement, Purchase orders, Payment of bills. Tender form, General idea about IE rule, Indian Electricity Act and major applicable I.E rules.

UNIT - II

Electrification of Residential and Commercial installations	General Rules guidelines for wiring of residential and commercial installation and positioning of equipments**,** Principles of circuit design in lighting and power circuits Procedures for designing the circuits and deciding the number of circuits, Method of drawing single line diagram. Selection of type of wiring and rating of wires and cables Load calculations and selection of size of conductor, selection of rating of main switch Distribution board, protective switchgear ELCB and MCB and wiring accessories for residential installations, Deciding the size of the cables, bus bar and bus bar chambers, Mounting arrangements and positioning of switchboards, distribution boards main switch for commercial installations. Earthing of residential and commercial Installations, Sequence to be followed for preparing estimate, Preparation of detailed estimates and costing of residential and commercial installation.

UNIT - III

Service Connection, Inspection And Testing Of Installation	Concept of service connection, Types of service connection and their features, Method of installation of service connection, Estimates of underground and overhead service connections, Inspection of internal wiring installations, Inspection of new installations, testing of installations, testing of wiring installations, reason for excess recording of energy consumption by energy meter

UNIT - IV

Design And Estimation Of Overhead Transmission & Distribution Lines	Introduction: Typical AC electrical power system, Main components of overhead lines, Line supports. Factors governing height of pole, Conductor materials, Determination of size of conductor for overhead transmission line, Cross arms, Pole brackets and clamps, Guys and Stays, Conductors configuration spacing and clearances, Conductors configuration spacing and clearances, Span lengths, Overhead line insulators, Insulator materials, Types of insulators, Lightning Arrestors, Phase plates, Danger plates, Anti

	climbing devices, Bird guards, Beads of jumpers. Anti climbing devices, Bird guards, Beads of jumpers. Muffs, Points to be considered at the time of erection of overhead lines, Erection of supports, setting of stays, Fixing of cross arms, Fixing of insulators, Conductor erection, Repairing and jointing of conductor, Dead end clamps, Positioning of conductors and attachment to insulators Jumpers, Tee-offs, Earthing of transmission lines. Guarding of overhead lines, Clearances of conductor from ground Spacing between conductors, Testing and commissioning of overhead distribution lines, some important specifications.
UNIT - V	
Design And Estimation Of Substations	Introduction, Classification of substation, Indoor substations, Outdoor substations, Selection and location of site for substation, Main Electrical Connections, Graphical symbols for various types of apparatus and circuit elements on substation main connection diagram. Key diagram of typical substations. Equipment for substation and switchgear installations, Substation auxiliaries supply, Substation Earthing.

Text Books :

1. "Electrical Installation Estimating & Costing",.J.B.Gupta,VIII Edition ,K. Katria & Sons New Delhi .
2. "Electrical Estimating and Energy Management" K.R Gangadhara Rao,Sapna. Publications

Reference Books :

1. "Electrical Design Estimating and Costing",K.B.Raina S.K.Bhattacharya,New Age International
2. "Electrical Wiring Estimating and Costing", S.L.Uppal , G.C Garg ,Khanna Publishers,New Delhi.

Web References:

1. https://lincoln.ne.gov/city/ltu/engine/dconst/gpp/pdf/costest.pdf
2. https://www.slideshare.net/gauravhtandon1/electrical-systems-in-a-building
3. http://engineering.electrical-equipment.org/safety/inspection-and-testing-of-wiring-installations.html
4. https://www.puc.nh.gov/2008IceStorm/Final%20Reports/2009-10-30%20Final%20NEI%20Report%20With%20Utility%20Comments/Chapter%204%20-%20System%20Planning,%20Design,%20Construction%20and%20Protection.pdf
5. https://www.academia.edu/6909375/Design_and_Costs_Estimation_of_Electrical_Substations_Based_on_Three-Dimensional_Building_Blocks.

Question Paper Pattern:

Sessional Exam

The question paper for sessional examination is for 30 marks, covering half of the syllabus for first sessional and remaining half for second sessional exam. Question No 1 which carries 6 marks contains three short answer questions of two marks each. The remaining three questions shall be EITHER/OR type questions carrying 8 marks each.

End Exam

Question Paper Contains Six Questions. Question 1 contains 5 short Answer questions each of 2 marks. (Total 10 marks) covering one question from each unit. The remaining five questions shall be EITHER/OR type questions carrying 10 marks each. Each of these questions is from one unit and may contain sub-questions. i.e there will be two questions from each unit and the student should answer any one question

Open Elective-I

OE301	Artificial Intelligence & Expert Systems
OE302	Introduction to information Systems
OE303	Web Development Programming
OE304	Introduction to cyber Security
OE305	Internet of Things
OE306	Nano Technology
OE307	Remote Sensing & GIS
OE308	Optimization techniques
OE309	Renewable Energy Systems
OE310	Introduction to JAVA

Open Elective-II

OE311	Object Oriented Programming through JAVA
OE312	Ethical Hacking
OE313	Principles of programming Languages
OE314	Advanced Information Systems
OE315	Scientific Programming with Python
OE316	Fuzzy Logic & Neural networks
OE317	Building Information Modeling
OE318	Product Life Cycle Management
OE319	Simulation of Engineering Systems

Open Elective-III

OE401	Image Processing
OE402	Machine Learning
OE403	Digital Design with FPGA

Open Elective-IV

OE404	Robotics
OE405	3D Printing
OE406	Virtual Reality

ARTIFICIAL INTELLIGENCE & EXPERT SYSTEMS (AIES)

V Semester: B.Tech					Scheme: 2017			
Course Code	Category	Hours/Week			Credits	Maximum Marks		
OE301	Open Elective - 1	L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
		3	0	0	3	40	60	100
Sessional Exam Duration:2 Hrs					End Exam Duration:3 Hrs			

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

CO1: Understand how to formulate an efficient problem state space for a problem

CO2: Discuss how search strategies will find solutions to problems by systematically generating new states and testing them against goals

CO3: Apply Hill-climbing, simulated annealing, Local Beam Search, Genetic Algorithms (Local search problems) for Agent's Problems

CO4: Describes how to solve unpredictability, contingencies of agent's problem-solving process, in which the agents' GAME goals are in conflict

CO5: Understand the features and working of Expert System.

UNIT– I

Introduction: What Is AI?, The Foundations of Artificial Intelligence

Intelligent Agents: Agents and Environments, Good Behaviour: The Concept of Rationality, The Nature of Environments, And the Structure of Agents.

Solving Problems by Searching: Problem-Solving Agents, Example Problems, Searching for Solutions

UNIT– II

***Uninformed Search Strategies*:** BFS, DFS, Depth –limited search, IDA, Bidirectional search

Informed (Heuristic) Search Strategies- Greedy best-first search, A* search, Memory-bounded heuristic search, Learning to search better. Heuristic Functions.

UNIT– III

Beyond Classical Search: Local Search Algorithms and Optimization Problems, Local Search In Continuous Spaces, Searching With Partial Observations. Searching with Nondeterministic Actions

UNIT– IV

Adversarial Search: Games, Optimal Decisions In Games, Alpha—Beta Pruning

Constraint Satisfaction Problems: Defining Constraint Satisfaction Problems, Constraint Propagation: Inference In Csps, Backtracking Search For Csps, Local Search For Csps, The Structure Of Problems

UNIT– V

Introduction to Expert System: What are Expert Systems, Features of Expert system, Features of good expert system, Role of human in Expert system, Expert system organization, Difference between expert system and conventional program, Basic activities of expert system and the areas in which they solve problems, Prospector system features, working.

Text Books:

1. Stuart Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach", Third Edition, 2010. Pearson Education.
2. Donald A.Water man," A Guide to expert systems", Addison Wesley publishing company.

Reference Books:

1. Elaine Richie Kevin Knight [2008], [3rd Edition], Artificial Intelligence, TMH

Web References:

1. https://onlinecourses.nptel.ac.in/noc18_cs51
2. https://www.geeksforgeeks.org/artificial-intelligence-an-introduction/
3. https://www.tutorialspoint.com/artificial_intelligence/artificial_intelligence_expert_systems.htm

Question Paper Pattern:

Sessional Exam

The question paper for sessional examination is for 30 marks, covering half of the syllabus for first Sessional and remaining half for second sessional exam. Question No 1 which carries 6 marks contains three short answer questions of two marks each. The remaining three questions shall be EITHER/OR type questions carrying 8 marks each.

End Exam

Question Paper Contains Six Questions. Question 1 contains 5 short Answer questions each of 2marks. (Total 10 marks) covering one question from each unit. The remaining five questions shall be EITHER/OR type questions carrying 10 marks each. Each of these questions is from one unit and may contain sub-questions. i.e there will be two questions from each unit and the student should answer any one question.

INTRODUCTION TO INFORMATION SYSTEMS (IIS)

V Semester: B.Tech						Scheme: 2017		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
OE302	Open Elective - 1	L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
		3	0	0	3	40	60	100
Sessional Exam Duration:2 Hrs						End Exam Duration:3 Hrs		

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

CO1: Understand the concepts of Computer architecture and functionalities of System software

CO2: Understand the page replacement and CPU Scheduling Algorithms

CO3: Understand the phases of software development life cycle and process models.

CO4: Design ER model for real life scenarios

CO5: Apply SQL commands to create, update, modify and retrieve data from the data bases.

CO6: Apply normalization techniques to normalize the database.

UNIT– I

Fundamentals of Computers & Computer Architecture:
Introduction, Organization of a smallcomputer, Central Processing Unit, Execution cycle, Instruction categories, measure of CPU performance, Memory, Input/output devices, BUS, addressing modes
System Software:
Assemblers, Loaders and linkers, Compilers and interpreters.

UNIT– II

Operating System:
Introduction, Memory management schemes, Page replacement algorithms, Process management, CPU scheduling algorithms.
Software engineering:
Software engineering: Introduction to Software engineering, Life cycle of a software project, software Development models.

UNIT– III

Relational Database Management System:
Introduction to DBMS, the database technology, datamodels, Database Users.
***Entity Relationship (E-R) Modelling*:**
Introduction, Notations, Modelling E-R Diagrams, CaseStudies, Merits and Demerits of E-R modelling.

UNIT– IV

Structured Query Language (SQL):
Introduction to SQL, Data types, Data Definition languagecommands, Data Manipulation Language Commands and Data control Language Commands, Candidate Key, Primary key, Foreign key, Select Clause, Where Clause, Logical Connectives – AND, OR, Range Search, Pattern Matching, Order By, Group By, Set Operations – Union, Intersect and Minus, Aggregate Functions, Join Operations.

UNIT– V

Normalization:
Introduction, Need for Normalization, Process of Normalization, Types of NormalForms (1 NF, 2 NF, 3 NF & BCNF), Merits and Demerits of Normalization.

Text Books:

1. Campus Connect Foundation Program – Computer Hardware and System Software Concepts, Programming Fundamentals- Vol. – 1, INFOSYS.

2.Campus Connect Foundation Program – Relational Database Management System, Client Server Concepts, Introduction to Web Technologies - Vol. – 4, INFOSYS

3.Henry F. Korth& Abraham Silberschatz, - Data Base System Concepts, 5th Edition, 2005, Mc Graw ill

Reference Books:

1. M. Morris Mano [2011], [3 rd Edition], Computer system architecture, Pearson Education, 2011
2. Sommerville [2008], [7th Edition], Software Engineering, Pearson education.
3. Raghu Ramakrishna and Johannes Gehrke [2003], [3rd Edition], Data Base Management Systems, TATA Mc GrawHil
4. Tanenbaum [2000], Modern Operating System, Pearson Education.

Web References:

1. https://www.w3schools.com/sql/
2. https://www.geeksforgeeks.org/dbms/
3. https://www.tutorialride.com/software-engineering/software-engineering-tutorial.htm

Question Paper Pattern:

Sessional Exam

The question paper for sessional examination is for 30 marks,covering half of the syllabus for first Sessional and remaining half for second sessional exam. Question No.1 which carries 6 marks contains three short answer questions of two marks each. The remaining three questions shall be EITHER/OR type questions carrying 8 marks each.

End Exam

Question Paper Contains Six Questions. Question 1 contains 5 short Answer questions each of 2 marks. (Total 10 marks) covering one question from each unit. The remaining five questions shall be EITHER / OR type questions carrying 10 marks each. Each of these questions is from one unit and may contain sub-questions. i.e. there will be two questions from each unit and the student should answer any one question.

WEB DEVELOPMENT PROGRAMMING (WDP)

V Semester: B.Tech						Scheme: 2017		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
OE303	Open Elective - 1	L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
		3	0	0	3	40	60	100
Sessional Exam Duration: 2 Hrs						End Exam Duration: 3 Hrs		

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

CO1: Understand the fundamental concepts of web designing.

CO2: Design a static web page using HTML tags and attributes.

CO3: Develop web pages using HTML and Cascading Styles sheets.

CO4: Understand the concepts of server side programming.

CO5: Create dynamic and interactive websites using database connection.

UNIT– I

Web Technology Fundamentals: Introduction to the Web, Web servers and Clients, Resources, URL and itsAnatomy, Message Format, Persistent and Non-persistent connections, Web Caching, Proxy, Java and the Net, Java Network Classes and Interfaces, Looking up Internet Address.

UNIT– II

HTML: HTML and its Flavors, HTML basics, Elements, Attributes and Tags, Basic Tags,Advanced Tags, Frames, Images, Meta tag, Planning of Web page, Model and Structure for a Website, Designing Web pages, Multimedia content.

UNIT– III

Cascading style sheets: Advantages, Adding CSS, Browser compatibility, CSS and page layout,Selectors.

UNIT– IV

Server side programming: Server-side Java, Advantages over Applets, Servlet alternatives, Servlet strengths, Servlet architecture, Servlet life cycle, Generic and HTTP Servelet, First servlet, Passing parameters to servlets, Retrieving parameters, Server-side include, Cookies, Filters, Problems with servlet, Security issues, JSP and HTTP, JSP Engines, How JSP works, JSP and Servlet, Anatomy of a JSP page, JSP syntax, JSP components.

UNIT– V

Database Connectivity: Database connectivity, JDBC drivers, Basic steps, Loading a driver, Making a connection, Execute and SQL statement, SQL statements, Retrieving the result, Getting database information.

Text Books :

1. UtamK.Roy, "Web Technologies", Oxford Higher Education, 1st Edition, Seventh Impression.
2. K.L.James, "The Internet- A User Guide", 2nd Edition, PHI Publications.

Reference Books :

1. Introduction to Java Programming‖, Y.Daniel Liang, 6th Edition, Pearson Education, 2007
2. Web Technologies Srinivasan, Pearson Education, 2012.
3. Kognet Learning Solutions inc.,"HTML5 in Simple Steps", DreamTech press.
4. Java EE 5 for Beginners, Ivan Bayross, Sharanam Shah, Cynthia Bayrossand. Vaishalishai,SPD.

Web References:

1. https://www.tutorialspoint.com/html/
2. https://www.tutorialspoint.com/css/
3. https://www.javatpoint.com/java-tutorial

Question Paper Pattern:

Sessional Exam

The question paper for sessional examination is for 30 marks, covering half of the syllabus for first Sessional and remaining half for second sessional exam. Question No 1which carries 6 marks contains three short answer questions of two marks each. The remaining three questions shall be EITHER/OR type questions carrying 8 marks each.

End Exam

Question Paper Contains Six Questions. Question 1 contains 5 short Answer questions each of 2 marks. (Total 10 marks) covering one question from each unit. The remaining five questions shall be EITHER/OR type questions carrying 10 marks each. Each of these questions is from one unit and may contain sub-questions i.e there will be two questions from each unit and the student should answer any one question.

INTRODUCTION TO CYBER SECURITY(ICS)

V Semester: B.Tech						Scheme: 2017		
CourseCode	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	EndExam	TOTAL
OE304	Open Elective - 1	3	0	0	3	40	60	100
Sessional ExamDuration:2 Hrs						End Exam Duration:3 Hrs		

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

CO1: Cyber Security architecture principles

CO2: Identifying different classes of attacks

CO3: Understand about cybercrime with mobile and wireless devices

CO4: Understand about the tools and methods used in cybercrime.

CO5: Understand about cyber security and social media marketing.

UNIT– I

Introduction to Cybercrime

Introduction, Cybercrime: Definition and Origins of the Word, Cybercrime and Information Security, Who are Cybercriminals? Classifications of Cybercrimes, Cybercrime: The Legal Perspectives, Cybercrimes: An Indian Perspective, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes, Cybercrime Era: Survival Mantra for the Netizens.

UNIT– II

Cyber offenses

How Criminals Plan Them –Introduction, How Criminals Plan the Attacks, Social Engineering, Cyber stalking, Cyber cafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector Cloud Computing.

UNIT– III

Cybercrime Mobile and Wireless Devices

Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication Service Security, Attacks on Mobile/Cell Phones.Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops.

UNIT– IV

Tools and Methods Used in Cybercrime

Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Key loggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks, Phishing.

UNIT– V

Cyber Security:

Organizational Implications Introduction, Cost of Cybercrimes and IPR issues, Web threats for Organizations, Security and Privacy Implications, Social media marketing**:** Security Risks and Perils for Organizations, Social Computing and the associated challenges for Organizations.

Text Books:

1. Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Nina Godbole, SunitBelapure, Wiley.
2. Principles of Information Security, MichealE.Whitman and Herbert J.Mattord, Cengage Learning.

Reference Books:

1. Information Security, Mark Rhodes, Ousley, MGH.
2. Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press

Web References:

1.https://www.tutorialspoint.com/fundamentals_of_science_and_technology/cyber_crime_and_cyber_security.htm

Question Paper Pattern:

Sessional Exam

The question paper for sessional examination is for 30 marks, covering half of the syllabus for first Sessional and remaining half for second sessional exam. Question No1which carries 6 marks contains three short answer questions of two marks each. The remaining three questions shall be EITHER/OR type questions carrying 8 marks each.

End Exam

Question Paper Contains Six Questions. Question 1 contains 5 short Answer questions each of 2 marks. (Total 10 marks) covering one question from each unit. The remaining five questions shall be EITHER/OR type questions carrying 10 marks each. Each of these questions is from one unit and may contain sub-questions.i.e. there will be two questions from each unit and the student should answer any one question.

INTERNET OF THINGS (IOT)

V Semester: B.Tech						Scheme: 2017		
Course Code	Course Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
OE305	Open Elective - 1	3	0	0	3	40	60	100
Sessional Exam Duration: 2 Hrs					End Exam Duration: 3 Hrs			

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

CO1: Understand the basic knowledge of Internet of things and its design

CO2: Understand the purpose of sensors and Actuators in IoT

CO3: Analyze Various IoT Protocols

CO4: Design IoT Projects Using Arduino

CO5: Understand Raspberry-Pi Processor and Raspbian Operating Systems

UNIT – I

Introduction to IoT:
Definition and Characteristics of IoT, Physical Design and Logical Design, IoT Enabling Technologies, IoT Levels and Deployment Templates, IoT Vs M2M

UNIT – II

Sensing and Actuation:
Definition of Sensor, Sensor features, Resolution, Classes, Different types of sensors, Actuator, Different types of Actuators, purpose of Sensors and Actuators in IoT

UNIT – III

Wireless Technologies and Data Transmission for IoT:
Wi-Max, Wi-Fi (802.11), Bluetooth/Bluetooth smart,Zigbee/Zigbee smart, Cellular, NFC,Serial Transmission, RS-232, RS-485, I2C Inter-Integrated Circuit, Ethernet, CAN bus, USB, Firewall, Serial ATA, Parallel Transmission.

UNIT – IV

Building IoT with Arduino:Arduino IDE, Programming of Arduino, Interfacing LED, switch, potentiometer, Sensors, LCD, Bluetooth, Wi-Fi, GPS, RFID with Arduino

UNIT –V

Raspberry Pi:
Linux basics, Linux File system, Navigating the File system, Text Editors, Accessing Files, Permissions, Processes, Linux Graphic user Interface, Raspberry Pi Processor, Raspberry Pi Vs Arduino, Operating system benefits, Raspberry Pi Set up, Configuration.

Text Books:

1. ArsheepBahga , Vijay Madisetti ,Internet of Things: A Hands-On Approach Paperback,2015
2. RajkumarBhuyya,Internet of Things: Principles and Paradigms ,2016
3. AdeelJaved, Building Arduino Projects for the Internet of Things,Apress,2016
4. Wolfram Donat, Learn Raspberry-Pi with Python,Apress,2016

Reference Books:

1. Charles Bell,Beginning Sensor Networks with Arduino and Raspberry-Pi,Apress,2016
2. AndrianMcEwen , Hakim Casimally,Designing of Internet of Things, John Wiley,2014
3. Warren Gay,Masteringthe Raspberry-Pi,Apress,2016

Web References:

1. https://nptel.ac.in/courses/106105166/
2. https://onlinecourses.nptel.ac.in/noc17_cs22/course
3. https://nptel.ac.in/courses/108108098/4
4. https://onlinecourses.nptel.ac.in/noc19_ee28

Question Paper Pattern:

Sessional Exam:

The question paper for sessional examination is for 30 marks, covering half of the syllabus for first sessional and remaining half for second sessional exam. Question No 1 which carries 6 marks contains hree short answer questions of two marks each. The remaining three questions shall be EITHER/ORtype questions carrying 8 marks each

End Exam:

Question Paper Contains Six Questions. Question 1 contains 5 short Answer questions each of 2 marks. (Total 10 marks) covering one question from each unit. The remaining five questions shall be EITHER/OR type questions carrying 10 marks each. Each of these questions is from one unit and maycontain sub-questions. i.e. there will be two questions from each unit and the student should answer any one question.

NANO TECHNOLOGY (NNT)

V Semester: B.Tech					Scheme: 2017			
Course Code	Course Category	Hours/Week			Credits	Maximum Marks		
OE306	Open Elective - 1	L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
		3	0	0	3	40	60	100
Sessional Exam Duration: 2 Hrs					End Exam Duration: 3 Hrs			

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

CO1: Acquire some of the fundamental principles behind nanotechnology and nanomaterials andtheir vital role in novel sensing properties and applications.

CO2: Understand the fabrication, characterization, and manipulation of nanomaterials,Nanosensors and introduction to sensors.

CO3: Understand about metal nanoparticle based sensors and nanowire based sensors.

CO4: Understand about sensors based on nanostructures of metal oxides.

UNIT – I

Introduction to Nanotechnology:

Definition of nanotechnology; main features of nanomaterials; types of nanostructures (0D, 1D, and 2D structures); nanocomposites; and main chemical/physical/electrical/optical properties of nanomaterials.Methods for characterizing the nanomaterials: Atomic Force Microscopy (AFM), Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), and spectroscopy- and spectrometry-based surface analysis techniques. Fabrication of sensors by bottom-up and top-down approaches; self-assembly of nanostructures; and examples for nanotechnology application

UNIT – II

Introduction to Sensors' Science and Technology:

Definition of sensors; main elements of sensors; similarities between living organisms and artificial sensors; working mechanism of physical sensation (seeing, hearing, and feeling) and chemical sensation (smelling and tasting); the parameters used for characterizing the performance of sensors: accuracy, precision, sensitivity, detection limit, dynamic range, selectivity, linearity, resolution, response time, hysteresis, and life cycle

UNIT – III

Metal nanoparticle-based Sensors:

Definition of nanoparticle; features of nanoparticles; and production of nanoparticles by physical approach (laser ablation) and chemical approaches (Brust method, seed-mediated growth, etc.).Quantum Dot Sensors. Definition of quantum dot; fabrication techniques of quantum dots; Macroscopic and microscopic photoluminescence measurements; applications of quantum dots as multimodal contrast agents in bioimaging; and application of quantum dots as biosensors.

UNIT – IV

Nanowire-based Sensors:

Definition of nanowires; features of nanowires; fabrication of individual nanowire by top-down approaches and bottom-up approaches; and fabrication of nanowire arrays (fluidic channel, blown bubble film, contact printing, spray coating, etc.).Carbon Nanotubes-based Sensors: Definition of carbon nanotube; features of carbon nanotubes; synthesis of carbon nanotubes; fabrication and working principles of sensors based on individual carbon nanotube; fabrication and working principles of sensors based on random array of carbon nanotubes.

UNIT – V

Sensors Based on Nanostructures of Metal Oxide:

Synthesis of metal oxide structures by dry and wet methods; types of metal oxide gas sensors (0D, 1D, and 2D); defect chemistry of the metal oxide sensors; sensing mechanism of metal-oxide gas sensors; and porous metal-oxide structures for improved sensing applications.

Text Books :

1. Jiří Janata, Principles of Chemical Sensors, Springer, 2d Edition (1989). 2. Roger George Jackson, Novel Sensors and Sensing, CRC Press (2004).

Reference Books :

1. Florinel-Gabriel Banica, Chemical Sensors and Biosensors: Fundamentals and Applications, John Wiley and Sons (2012).
2. Ramsden Jeremy, Nanotechnology, an Introduction. Elsevier (2011).

Question Paper Pattern:

Sessional Exam:

The question paper for sessional examination is for 30 marks, covering half of the syllabus for first sessional and remaining half for second sessional exam. Question No 1 which carries 6 marks contains three short answer questions of two marks each. The remaining three questions shall be EITHER/OR type questions carrying 8 marks each

End Exam:

Question Paper Contains Six Questions. Question 1 contains 5 short Answer questions each of 2 marks. (Total 10 marks) covering one question from each unit. The remaining five questions shall be EITHER/OR type questions carrying 10 marks each. Each of these questions is from one unit and may contain sub-questions. i.e. there will be two questions from each unit and the student should answer any one question.

REMOTE SENSING AND GEOGRAPHIC INFORMATION SYSTEMS(RSGIS)

V Semester : B.Tech						Scheme : 2017		
Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	Total
OE307	Open Elective - 1	2	1	-	3	40	60	100
Sessional Exam Duration: 2 Hrs						End Exam Duration : 3 Hrs		

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

CO1: Understand the concept of electromagnetic radiation and its interaction with earth's surface

CO2: Understand air borne and space borne platforms, space imaging satellites of different Countries.

CO3: Understand the image processing techniques and applications of remote sensing.

CO4: Understand the concept of GIS and organization of GIS data structures.

CO5: Understand primary and secondary methods of capturing spatial and attribute data.

UNIT - I

Introduction to Remote Sensing: Concept and Scope of Remote Sensing:Definition – Physics of Remote Sensing – Electro Magnetic Radiation (EMR), Process and Characteristics of Remote Sensing System – Energy Interaction with the atmosphere and Earth Surface Features – Vegetation, soils, water– Spectral Reflectance Curves, atmospheric windows, Advantages and limitations of remote sensing.

UNIT - II

Platforms and Sensors: Remote Sensing Systems: Platforms: Introduction – Types – Satellites and orbits,Passive and Active sensors– Spatial, spectral, radiometric and temporal resolution of satellites, Whiskbroomand Push-broom scanners, Multi-band concepts and False Color Composites - Some remote sensing satellites and their features.

UNIT - III

Image Processing Techniques and Remote Sensing Applications: Digital Image Processing: Image enhancement – Contrast stretch, Spatial filtering and edge enhancement; Classification – Supervised and unsupervised classification – Visual image interpretation techniques.

Remote Sensing Applications - Applications in land use and land cover analysis - Mapping of forest and agriculture -Watershed management - Drought Assessment - Environmental modeling and other applications.

UNIT - IV

Geographic Information System: Basic Concepts*:* Definition - Components - Functions of GIS - Areas of GIS application - Advantages and Limitations of GIS - Information Organization and Data Structures – Raster and Vector data structures - Data file organization and formats - Data Base Management Systems.

UNIT - V

GIS Data Input & Editing: Method of Spatial and Attribute data capture– Primary and Secondarydigitization and scanning method - Techniques and procedure for digitizing, Topology– Errors of Digitization and rectification - Re-projection - Transformation and Generalization - Edge matching and Rubber sheeting - Proximity - Buffering and overlay.

Text Books :

1. M. Anji Reddy, Text Book of Remote Sensing and Geographic Information System, BS Publication.
2. Lo C.P. & Yeung A.K.W., (2004), Concepts and Techniques of GIS, Prentice-Hall of India, New Delhi.
3. Thomas Lillesand, Ralph W Kiefer and Jonathan Chipman "Remote Sensing and Image Interpretation", John Wiley & Sons, India

Reference Books :

1. B.Bhatta, *Remote sensing and Geographic Information System*, Oxford Publications.
2. Siddiqui, M.A.(2006), *Introduction to Geographical Information System*, ShardaPustakBhavan, Allahabad.
3. Curran, Paul J (1985), *Principles of Remote Sensing*, Longman, London.
4. Floyd F Sabins Jr., *Remote Sensing Principles and Interpretation*, Freeman and Co., San Franscisco.

Web References:

1. www.nptel.ac.in/courses

Question Paper Pattern:

Sessional Exam:

The question paper for sessional examination is for 30 marks, covering half of the syllabus for first sessional and remaining half for second sessional exam. Question No. 1 which carries 6 marks contains three short answer questions of two marks each. The remaining three questions shall be EITHER/OR type questions carrying 8 marks each.

End Exam:

Question paper contains Six questions. Question 1 contains 5 short Answer questions each of 2 marks (Total 10 marks) covering one question from each unit. The remaining five questions shall be EITHER/OR type questions carrying 10 marks each. Each of these questions is from one unit and may contain sub-questions i.e. there will be two questions from each unit and the student should answer any one question.

OPTIMIZATION TECHNIQUES (OT)

V Semester:	B.Tech				Scheme: 2017			
Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
OE308	Open Elective - 1	3	-	-	3	40	60	100
Sessional Exam Duration: 2 Hrs					End Exam Duration: 3 Hrs			

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

CO 1:	Understand basics of operations research, linear programming models
CO 2:	Solve transportation related problems
CO 3:	Solve assignment problems and sequencing problems
CO 4:	Solve queuing and game theory related problems
CO 5:	Solve project management problems

UNIT – I

Introduction: Definition, Significance of Operations Research, Models in Operations Research, Application Areas of Operations Research

Linear Programming: Model Formulation, Graphical solution of L.P.P, Slack, Surplus and Artificial variables, Simplex method, Big M method, Degeneracy in L.P.P, Duality Concept

UNIT – II

Transportation Problems: IntroductionBalanced and unbalanced Transportation problems, Initial basic feasible solution using N-W corner rule, least cost method and Vogel's approximation method, Optimal Solution (MODI method), Degeneracy in Transportation Problem

UNIT – III

Assignment Problems: Introduction, The Assignment Algorithm (Hungarian Assignment method), Balanced and Unbalanced Assignment Problems, Travelling Salesman Problem as an Assignment Problem

Sequencing Models: Introduction, General assumptions, processing n jobs through 2 machines, processing 'n' jobs through m machines, Processing 2 jobs through m machines

UNIT – IV

Game Theory: Definitions and Terminology, Two Person Zero Sum Games, Pure Strategy Games (with Saddle Point), Principle of Dominance, Solution for Mixed Strategy Games (Games without Saddle Point) Graphical method

Queuing Theory: Introduction, single channel - poisson arrivals - exponential service times with infinite population, and Multi-channel - poisson arrivals - Exponential service times with infinite population**.**

UNIT – V

Project Management: Phases of project management, guidelines for network construction, critical path, forward and backward pass, floats and their significance, crashing for optimum duration.

Text Books:

1. Hamdy, A. Taha, Operations Research-An Introduction, Prentice Hall of India Pvt. Ltd
2. S.D. Sharma, Operations Research, Kedarnath, Ramnath& Co., Meerut,
3. R. Paneer Selvam, Operations Research , PHI Learning Pvt. Ltd., New Delhi

Reference Books:

1. Hillier / Lieberman, Introduction to Operations Research , Tata McGraw Hill Edition
2. J.K. Sharma, Operations Research-Problems and Solutions, Macmillan India Ltd
3. Billy E Gillett, Introduction to Operations Research A Computer Oriented Algorithmic Approach, Tata McGraw Hill Edition
4. V.K. Kapoor, Operation research

Question Paper Pattern:

Sessional Exam

The question paper for Sessional examination is for 30 marks, covering halfof the syllabus for first Sessional and remaining half for second Sessional exam. Question No 1 which carries 6 marks contains three short answer questions of two marks each. The remaining three questions shall be EITHER/OR type questions carrying 8 marks each

End Exam

Question Paper Contains Six Questions. Question 1 contains 5 short Answer questionseach of 2 marks (Total 10 marks) covering one question from each unit. The remaining five questions shall be EITHER/OR type questions carrying 10 marks each. Each of these questions is from one unit and may contain sub questions. i.e. there will be two questions from each unit and the student should answer any one question

RENEWABLE ENERGY SYSTEMS (RES)

V Semester: B.Tech						Scheme: 2017		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
OE309	Open Elective - 1	L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
		3	0	0	3	40	60	100
Sessional Exam Duration: 2 Hrs					End Exam Duration: 3 Hrs			

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

CO1: Understand the basics terms, definitions related to solar energy conversion, solar radiation measuring instruments.

CO2: Understand different types of Solar Collectors and their applications.

CO3: Understand the fundamental principles of Wind energy types and its characteristics.

CO4: Understand the methods to harness Electrical Energy from Geothermal and Ocean energies.

CO5: Understand the principles of bio conversion, types, combustion characteristics and its applications

CO6: Understand Direct Energy Conversion principle from Fuel cells and MHD generators.

	UNIT - I
Principles of Solar Radiation	The role and potential of new and renewable source, the solar energy option, Environmental impact of solar power, physics of the sun, the solar constant, extraterrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sunshine, solar radiation data.
	UNIT - II
Solar Energy Collection	Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors.
Solar Energy Storage And Applications	Different methods, Sensible, latent heat and stratified storage, solar ponds. Solar Applications- Solar heating/cooling techniques. Solar distillation and drying, photovoltaic energy conversion.
	UNIT – III
Wind Energy	Sources and potentials, horizontal and vertical axis windmills, performance characteristics, Betz criteria.
Biomass	Principles of Bio-Conversion, Anaerobic/aerobic digestion, types of Bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking, I.C.Engine operation and economic aspects.
	UNIT - IV
Geothermal Energy	Resources, types of wells, methods of harnessing the energy, potential in India.
Ocean Energy	OTEC, Principles utilization, setting of OTEC plants, thermodynamic cycles. Tidal and wave energy: Potential and conversion techniques, mini-hydel power plants and their economics.
	UNIT - V
Direct Energy Conversion	MHD generators, principles, dissociation and ionization, Hall effect, magnetic flux, MHD accelerator, MHD Engine, power generation systems. Fuel cells, principle. Faradays laws, thermodynamic aspects, selection of fuels and operating conditions.

Text Books:

1.G.D. Rai , “Non-Conventional Energy Sources”. 2011

2.Ramesh & Kumar, “Renewable Energy Technologies”, Narosa. 1997

Reference Books :

1.Tiwari and Ghosal , “Renewable energy resources”, Narosa.2005

2.Ashok V Desai, “Non-Conventional Energy”, Wiley Eastern.1990

3.K Mittal ,“Non-Conventional Energy Systems”, Wheeler. 1997

4.Sukhatme, “Solar Energy”. TMH, 2008

Web Resources:

1.https://en.wikipedia.org/wiki/Solar_irradiance
2.http://sfera.sollab.eu/downloads/Schools/Eduardo_Zarza_Basic_concepts.pdf
3.https://en.wikipedia.org/wiki/Solar_energy
4.https://en.wikipedia.org/wiki/Solar_energy
5.https://solarprofessional.com/articles/design-installation/solar-energy-storage
6.https://www.energy.gov/science-innovation/energy-sources/renewable-energy/wind
7.https://www.eia.gov/energyexplained/?page=biomass_home
8.https://en.wikipedia.org/wiki/Geothermal_energy
9.https://www.renewableenergyworld.com/ocean-energy/tech.html
10.http://www.mhdenergy.com/

Question Paper Pattern:

Sessional Exam

The question paper for sessional examination is for 30 marks, covering half of the syllabus for first sessional and remaining half for second sessional exam. Question No 1 which carries 6 marks contains three short answer questions of two marks each. The remaining three questions shall be EITHER/OR type questions carrying 8 marks each.

End Exam

Question Paper Contains Six Questions. Question 1 contains 5 short Answer questions each of 2 marks. (Total 10 marks) covering one question from each unit. The remaining five questions shall be EITHER/OR type questions carrying 10 marks each. Each of these questions is from one unit and may contain sub-questions. i.e there will be two questions from each unit and the student should answer any one question

INTRODUCTION TO JAVA

V Semester: B.Tech						Scheme: 2017		
CourseCode	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	EndExam	TOTAL
OE310	Open Elective - 1	2	1	-	3	40	60	100
Sessional ExamDuration:2 Hrs						EndExamDuration:3 Hrs		

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

CO1: Understand fundamentals of oops concepts, input and output

CO2: Understand the classes and objects.

CO3: Understand the Inheritance and interfaces

CO4: Understand the string handling methods

CO5: Understand the exception handling

UNIT– I

Object oriented concepts: Fundamentals, Overview of Java, Data types, variables, Operators, control statements, Reading console input, writing console output, arrays.

UNIT– II

Introducing Classes: Class fundamentals, declaring objects, introducing methods, Constructors, this keyword, finalize

UNIT– III

Inheritance: Inheritance basics, using super, method overriding, abstract class, using final with inheritance, Interfaces: Defining interface, implementing interface

UNIT– IV

String Handling: String constructors, Special string operations, character extraction, string comparison, searching strings, modifying strings. StringBuffer class and its methods.

UNIT– V

Exception Handling: Fundamentals, exception types, try, catch, throw, throws, finally. Java built-in exceptions, creating your own exception subclasses.

TextBooks :

1. Herbert Schildt [2008], [9th Edition], The Complete Reference Java2, TATA McGraw-Hill.
2. E Balaguruswamy [2007], [3 rd Edition], Programming with Java, A Primer, TATA McGraw-Hil.

ReferencebBooks :

3. Bruce Eckel [2008], [2nd Edition], Thinking in Java, Pearson Education.
4. H.M Dietel and P.J Dietel [2008], [6th Edition], Java How to Program, Pearson Ed.

WebReferences:

5. https://www.tutorialspoint.com/java/index.html

QuestionPaperPattern:

Sessional Exam:

ThequestionpaperforSessionalexaminationisfor30marks,coveringhalfofthesyllabusforfirst sessionalandremaininghalffor secondSessionalexam.QuestionNo1which carries6marks contains three shortanswer questionsof twomarks each.The remainingthree questions shallbe EITHER/OR typequestions carrying8marks each.

EndExam

Question Paper ContainsSixQuestions. Question 1 contains 5 short Answer questions each of 2marks. (Total10marks)covering onequestionfromeachunit.Theremaining fivequestionsshallbe EITHER/ORtypequestionscarrying 10markseach.Eachofthesequestionsisfromoneunitandmay containsub-questions.i.e. therewillbe twoquestionsfromeachunitandthestudentshouldanswerany onequestion.

OBJECT ORIENTED PROGRAMMING THROUGH JAVA (OOP)

VI Semester: B.Tech						Scheme: 2017		
CourseCode	Category	Hours/Week			Credits	Maximum Marks		
OE311	Open Elective -2	L	T	P	C	Continuous Internal Assessment	EndExam	TOTAL
		3	0	0	3	40	60	100
Sessional ExamDuration:2 Hrs						EndExamDuration:3 Hrs		

CourseOutcomes: At the end of the course students will be able to

CO1: Understand the basic programming constructs and object oriented paradigms.

CO2: Comprehend the java concepts packages and interfaces.

CO3: Implement programs on string handling methods.

CO4: Understand the fundamentals of exception handling mechanism.

CO5: Implement programs on multithreading concepts.

UNIT– I

Fundamentals of Object –Oriented Programming: Introduction, Object-Oriented Paradigm, Basic Concepts of Object Oriented programming, Benefits of OOP, and Applications of OOP.
Introduction to Java: Overview of java, Java Buzzwords, Data types, Variables, Operators.
Decision Making-Branching & Looping: simple if statement, if-else statement,nested if-else, else if ladder,switch statement, While, do-while, for statements, Arrays, Classes, objects and methods.

UNIT– II

I/O: I/O Basics, Reading Console input, writing Console output.
Inheritance: Basic concepts, method overriding, super keyword, dynamic method dispatch, Abstract class, final keyword.
Packages and Interfaces: Packages, Access protection, Importing packages, Interfaces.

UNIT– III

String Handling: String Constructors, Special String Operations-String Literals, String Concatenation, Character Extraction, String Comparisons. Searching Strings, Modifying a string.

UNIT– IV

Exception Handling: Fundamentals, Types of Exceptions, Usage of try, catch, throw throws and finally keywords.

UNIT– V

Multithreading: Concepts of multithreading, Creating threads by extending Thread class and implementing Runnable interface, isAlive( ) and join ( ) methods, Thread Priorities, Synchronization, Inter thread communication.

TextBooks :

1. Herbert Schildt [2017], [10th Edition], Java -T*he Complete Reference* , TATA McGraw-Hill.

ReferenceBooks :

1. Bruce Eckel [2014], [2nd Edition], *Thinking in Java*, Pearson Education.
2. E.Balagurusamy, *Programming with Java: A primer, 5th Edition*, Tata McGraw-Hill, 2017.
3. H.M Dietel and P.J Dietel [2017], [11th Edition], Java How to Program, Pearson Ed.

WebReferences:

1. https://nptel.ac.in/courses
2. https://www.tutorialspoint.com/java/
3. https://www.javatpoint.com

QuestionPaperPattern:

Sessional Exam

Thequestionpaperforsessionalexaminationisfor30marks,coveringhalfofthesyllabusforfirstSessionalandremaininghalffor secondsessionalexam.QuestionNo 1which carries6marks contains three shortanswer questionsof twomarks each.The remainingthreequestionsshallbe EITHER/OR typequestions carrying8marks each.

EndExam

Question Paper Contains Six Questions. Question 1 contains 5 short Answer questions each of 2 marks. (Total 10 marks) covering one question from each unit. The remaining five questions shall be EITHER/OR type questions carrying 10 marks each. Each of these questions is from one unit and may contain sub-questions. i.e there will be two questions from each unit and the student should answer any

ETHICAL HACKING (EH)

VI Semester: B.Tech					Scheme: 2017			
CourseCode	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	EndExam	TOTAL
OE312	Open Elective - 2	3	0	0	3	40	60	100
Sessional ExamDuration:2 Hrs					EndExamDuration:3 Hrs			

CourseOutcomes: At the end ofthecoursestudents willbe able to

CO1: Understand the importance of security and ethical hacking.

CO2: Understand about foot printing and types of attacks in social engineering.

CO3: Understand about sniffers and DoS attacks.

CO4: Understand the importance of Session Hijacking types and SQL Injection.

CO5: Understand about buffer overflow attacks and Wireless Hacking Techniques.

UNIT– I

Introduction to Ethical Hacking

Introduction, Ethical hacking terminology, Types of hacking technologies, phases of ethical hacking **Essential Terminologies-Threat, Attack, Vulnerabilities, Target of Evaluation, Exploit.**

UNIT– II

Foot printing

Footprinting, Information Gathering Methodology , Competitive Intelligence, DNS Enumeration, Whois and ARIN Lookups, Types of DNS Records, How Traceroute Is Used in Footprinting Contents, How E-Mail Tracking Works, Web Spiders Work.

Social Engineering

Social Engineering, Types Of Attacks, Insider Attacks, Identity Theft, Phishing Attacks, Online Scams, URL Obfuscation, Social-Engineering Countermeasures.

UNIT– III

Sniffers

Understand the Protocols Susceptible to Sniffing, Active and Passive Sniffing, ARP Poisoning, Ethereal Capture and Display Filters, MAC Flooding, DNS Spoofing Techniques, Sniffing Countermeasures.

Denial of Service

Denial of Service, Types of DoS Attacks, How DDoS Attacks Work, How BOTs/BOTNETs Work, "Smurf" Attack, SYN Flooding, DoS/DDoS Countermeasures.

UNIT– IV

Session Hijacking

Spoofing vs. Hijacking, Types of Session Hijacking, Sequence Prediction, Steps in Performing Session Hijacking, Describe How You Would Prevent Session Hijacking.

SQL Injection

SQL Injection, Steps to Conduct SQL Injection, SQL Server Vulnerabilities, SQL Injection Countermeasures.

UNIT– V

Buffer Overflows

Different Types of Buffer Overflow, Methods of Detection, Overview of Stack-Based Buffer Overflows , Overview of Buffer Overflow Mutation Techniques.

Wireless Hacking

Overview of WEP, WPA Authentication Mechanisms, and Cracking Techniques, Wireless Sniffers and Locating SSIDs, MAC Spoofing, Rogue Access Points, Wireless Hacking Techniques, Methods Used to Secure Wireless Networks.

TextBooks :

1. Kimberly graves “CEHOfficial Certified Ethical Hacker Review Guide,” Wiley
2. MichealGregg,“Certified ethical hacker (CEH) Cert guide”,Pearson education, 2014.

ReferenceBooks :

1. **Network Security and Ethical Hacking, RajatKhare, Luniver Press, 2006.**
2. Patrick Engebretson,“The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made Easy”,2ed, Syngress Media, 2012.

WebReferences:

1. https://www.tutorialspoint.com/ethical_hacking/ethical_hacking_pdf_version.htm

QuestionPaperPattern:

Sessional Exam:

The question paper for Sessional examination is for 30 marks, covering half of the syllabus for first Sessional and remaining half for second Sessional exam. Question No 1, which carries 6 marks, contains three short answer questions of two marks each. The remaining three questions shall be EITHER/OR type questions carrying 8 marks each.

End Exam:

Question Paper Contains Six Questions. Question 1 contains 5 short Answer questions each of 2 marks. (Total 10 marks) covering one question from each unit. The remaining five questions shall be EITHER/OR type questions carrying 10 marks each. Each of these questions is from one unit and may contain sub-questions. i.e. there will be two questions from each unit and the student should answer any one question.

PRINCIPLES OF PROGRAMMING LANGUAGES (PPL)

VI Semester: B.Tech						Scheme: 2017		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
OE313	Open Elective - 2	3	0	0	3	40	60	100
Sessional Exam Duration:2 Hrs						End Exam Duration:3 Hrs		

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

CO1: Understand the importance of Programming Languages.

CO2: Describe the syntax and semantics of a programming language.

CO3: Understand programming constructs and data types.

CO4: Develop Programs in Lisp and prolog.

CO5: Understand and adopt a new programming language.

UNIT– I

Preliminaries

Reasons for studying concepts of programming languages, Programming domains, Language Evolution criteria, Influences on Language Design, Language categories, Language Design Trade-offs, Implementation methods, Programming Environments.

UNIT– II

Syntax and Semantics

Introduction, The general problem of Describing Syntax, Formal methods of describing syntax, Attribute Grammars, Describing the Meanings of programs-Dynamic Semantics, Lexical analysis, Parsing problem, Recursive Descent parsing, Bottom up parsing.

UNIT– III

Names, Binding, Type checking, Scopes and Data Types

Introduction, Names, Variables, The concept of binding, Type checking, Strong Typing, Type Compatibility, Scope, Scope and Lifetime, Referencing Environments, Named constants, Data types, Primitive data types, Character string types, User defined ordinal types, Array types, Associative arrays, Record types, Union types, Pointer and reference types.

UNIT– IV

Functional Programming Languages

Introduction, Mathematical functions, Fundamentals of functional programming languages, LISP, An Introduction to Scheme, ML, Haskell.

UNIT– V

Logic Programming Languages

Introduction, A brief introduction to Predicate calculus, Predicate calculus and Proving theorems, An Overview of logic programming, The origins of prolog, Basic elements of prolog, The deficiencies of prolog, Applications of logic programming.

Text Books :

1.Robert W. Sebesta, [Eighth Edition], “Concepts of Programming Languages”, Addison Wesley, 2007.

Reference Books :

1. Allen B Tucker, Robert E Noon,[2nd Edition],“Programming Languages, Principles & Paradigms”, TMH.

Web References:

1. https://cs.fit.edu/~ryan/cse4250/

Question Paper Pattern:

Sessional Exam

The question paper for sessional examination is for 30 marks, covering half of the syllabus for first Sessional and remaining half for second sessional exam. Question No1 which carries 6 marks contains three short answer questions of two marks each. The remaining three questions shall be EITHER/OR type questions carrying 8 marks each.

End Exam

Question Paper Contains Six Questions. Question 1 contains 5 short Answer questions each of 2 marks. (Total 10 marks) covering one question from each unit. The remaining five questions shall be EITHER/OR type questions carrying 10 marks each. Each of these questions is from one unit and may contain sub-questions.i.e. there will be two questions from each unit and the student should answer any one question.

ADVANCED INFORMATION SYSTEMS (AIS)

VI Semester: B.Tech						Scheme: 2017		
CourseCode	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	EndExam	TOTAL
OE314	Open Elective - 2	3	0	0	3	40	60	100
Sessional ExamDuration:2 Hrs						EndExamDuration:3 Hrs		

CourseOutcomes: At the end ofthecoursestudents willbe able to

CO1:Demonstrate the Object oriented concepts.

CO2:Interpret different types of Inheritance and Polymorphism

CO3: Classify layer functionalities of OSI reference model and TCP Protocol suite

CO4: Summarize the concepts of internetworking, security and IP addressing

CO5:Demonstrate different types of protocols and web contents used in web design

UNIT– I

Introduction to Object Oriented Concepts:Introduction, Programming Techniques, Introduction to Object OrientedConcepts, Concept of Structured Procedural Programming, Class, Object

***Characteristics of Objects*:** Data Abstraction, Classification, Encapsulation and Message Passing. Access Specifiers in Class, UML Class Diagrams.

UNIT– II

Advanced Concepts in Object Oriented Technology: Relationships, Inheritance- Protected Access Specifier, Multiple and Multilevel Inheritance, Generalization and Specialization, Abstract classes, Polymorphism, Implementation of OOC through C++.

UNIT– III

Introduction to computer Networks:Introduction, Network Topology, OSI Reference Model,TCP Protocol Suite, Routing Devices, Types of Networks.

UNIT– IV

Internetworking: Protocols for Internetworking, Internet Address and Domains, Packets, Packet Switched Networks, Virtual Private Network, Working of Internet.

Network Security: Authentication, Authorization, Encryption, Security on Web

UNIT– V

Introduction to Web Technology:Introduction, Hyper Text Transfer Protocol(HTTP), File Transfer Protocol (FTP), Domain Name Server(DNS), Web Applications, Types of Web Content, Multi-Tier Web Applications, Performance of Web Applications.

TextBooks :

1. Campus Connect Foundation Programme – Object Oriented Concepts – System Development
2. Campus Connect Foundation Programme – Computer Hardware and System Software Concepts, Programming Fundamentals- Vol. – 1, INFOSYS**.**
3. Campus Connect Foundation Programme – Relational Database Management System, Client Server Concepts, Introduction to Web Technologies - Vol. – 2, INFOSYS
4. E.Balaguruswamy, *Object Oriented programming with C++*, 2017
5. *Data Communications & Networking*,Forouzan, Tata McGrawHill, Fifth edition, 2017

Reference Books :

1. Herbert Schildt , *The Complete Reference C++*,McGraw Hill Education, Seventh Edition,2017
2. M.P. Bhave and S.A. Patekar, *Object Oriented Programming with C++*, Pearson Education, 2008
3. Andrew S. Tenenbaum, *Computer networks*,Pearson education, Fifth edition, 2013

Web References:

1. https://www.tutorialspoint.com/cplusplus/

2. https://www.geeksforgeeks.org/computer-network-tutorials/

Question Paper Pattern:

Sessional Exam

The question paper for sessional examination is for 30marks,covering half of the syllabus for firstsessional and remaining half for second sessional exam.QuestionNo1which carries 6marks contains three short answer questions of two marks each. The remaining three questions shall be EITHER/OR type questions carrying8marks each.

EndExam

Question Paper Contains Six Questions. Question 1 contains 5 short Answer questions each of 2marks. (Total10marks) covering one question from each unit. The remaining five questions shall be EITHER/OR type questions carrying 10markseach. Each of these questions is from one unit and may contain sub-questions. i.e.; there will be two questions from each unit and the student should answer any one question.

Note:

1. Wireshark tool can be used to demonstrate ISO/OSI model in UNIT-III
2. Assignment Questions to be given from UNIT-II that maps POs like PO2, PO3.

SCIENTIFIC PROGRAMMING WITH PYTHON (SCIPYP)

VI Semester: B.Tech						Scheme: 2017		
CourseCode	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	EndExam	TOTAL
OE315	Open Elective - 2	3	0	0	3	40	60	100
Sessional ExamDuration:2 Hrs						EndExamDuration:3 Hrs		

CourseOutcomes: At the end ofthecoursestudents willbe able to

CO1: Understand fundamentals of programming –variables, conditions, Lists, Tuples &Dictionaries.

CO2: Understand Arithmetic, Relational, Assignment, Logical, Bitwise, Membership, Identity Operators

CO3: Impart Functions, Scope of variables, Modules, Packages.

CO4: Comprehend Concepts of File I/O, Exception Handling, Classes and Objects.

CO5: Develop general scientific programming through Matplotlib, NumPy and SciPy packages.

UNIT– I

Introduction

History of Python, Features, Advantages, Environment setup and Interaction using Command prompt, IDLE, Script mode, IPython Notebook.

Basic Syntax: Keywords, Identifiers, Variables.

Data Types: Strings, Numbers, Booleans, Date and Time, Lists, Tuples, Dictionaries

UNIT– II

Operators: Arithmetic Operators, Comparison (Relational) Operators, Assignment Operators, Logical Operators, Bitwise Operators, Membership Operators, Identity Operators.

Conditional Statements: if, if-elif-else

Loops: for, while

Control Statements: break, continue, pass

UNIT– III

Functions: Defining Functions, Calling a Function, Function Arguments: Required arguments, Keyword arguments, Default Arguments, Variable-length arguments, Anonymous Functions, The Return Statement, Scope of the Variables in a Function - Global and Local Variables.

Modules: Defining module, namespacing, Importing modules and module attributes, from. Import statement, Module built-in functions, Introduction to Packages.

UNIT– IV

Error and Exceptions: Difference between an error and Exception, Detecting and Handling Exceptions, Raising Exceptions, Assertions, Built-in Exceptions, User Defined Exceptions

Classes and Objects: Overview of OOP terminology, Creating Classes, Creating Instance Objects, Inheritance, Overriding Methods, Overloading Methods, Operators, Data hiding.

UNIT– V

Simple plotting with pylab: Basic plotting, Labels, legends and customization, More advanced plotting

Matplotlib: Matplotlib basics, Contour plots, heatmaps and 3D plots.

NumPy: Basic array methods, Reading and writing an array to a file, Statistical methods, Polynomial, Linear algebra, Matrices, Random sampling, Discrete Fourier transforms

SciPy: Physical constants and special functions, Integration and ordinary differential equations, Interpolation, Optimization, data-fitting and root-finding.

General scientific programming: Floating point arithmetic, Stability and conditioning, Programming techniques and software development.

TextBooks :

1. Learning To Program With Python- 2011 Richard L. Halterman
2. Learning Scientific Programming with Python, Christian Hill, Cambridge University Press (2016)

ReferenceBooks :

1. Python Programming-An Introduction to Computer Science 2nd edition-John Zelle 2010
2. Python -The Ultimate Beginner's Guide! , Andrew Johansen
3. Core Python Programming, Wesley J. Chun, Pearson.

WebReferences:

1. https://www.tutorialspoint.com/python3/
2. https://realpython.com/

QuestionPaperPattern:

Sessional Exam

ThequestionpaperforSessionalexaminationisfor30marks,coveringhalfofthesyllabusforfirst Sessionalandremaininghalffor secondSessionalexam.QuestionNo1which carries6marks contains three shortanswer questionsof twomarks each.The remainingthree questions shallbe EITHER/OR typequestions carrying8marks each.

EndExam

Question Paper ContainsSixQuestions. Question 1 contains 5 short Answer questions each of 2marks. (Total10marks)covering onequestionfromeachunit.Theremaining fivequestionsshallbe EITHER/ORtypequestionscarrying 10markseach.Eachofthesequestionsisfromoneunitandmay containsub-questions.i.e. therewillbe twoquestionsfromeachunitandthestudentshouldanswerany onequestion.

Note:

1. Python IDLE, Ipython notebook tools can be used to develop programs in UNIT-1& UNIT-5.
2. Scope for develop type questions for assignment from UNIT-V

FUZZY LOGIC & NEURAL NETWORKS (FLNN)

VI Semester : B.Tech						Scheme : 2017		
Course Code	Course Category	Hours/Week			Credits	Maximum Marks		
OE316	Open Elective - 2	L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
		3	0	0	3	40	60	100
Sessional Exam Duration: 2 Hrs						End Exam Duration: 3 Hrs		

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

CO1: To Expose the students to the concepts of Neural networks

CO2: To provide adequate knowledge about Supervised Learning feedback networks

CO3: To provide adequate knowledge about Unsupervised Learning feedback networks

CO4: To teach about the concept of fuzziness involved in various systems and to provide adequate knowledge about fuzzy set theory

CO5: To provide adequate knowledge of application in Neural Networks &fuzzylogic to real time systems.

UNIT – I

Introduction to Neural Networks and its Basic Concepts

Biological neurons and McCulloch and Pitts models of neuron, Types of activation functions, Neural networks architectures, Linearly separable and linearly non-separable systems and their examples, Features and advantages of neural networks over statistical techniques, Knowledge representation, learning process, error-correction learning, concepts of supervised, learning, and unsupervised learning

UNIT – II

Supervised Learning Neural Networks:

Single layer perception and multilayer perceptron neural networks, their architecture, Error back propagation algorithm, generalized delta rule, learning factors, step learning, Momentum learning, Concept of training, testing and cross-validation data sets for design and validation of theNetworks

UNIT – III

Unsupervised Learning Neural Networks:

Competitive Learning networks, kohonen self-organizing networks, K-means and LMS algorithms, RBF neural network, its structure and Hybrid training algorithm for RBF neural networks, Comparison of RBF and MLP networks Learning, Hebbian learning, Hopfield networks.

UNIT – IV

Fuzzy logic

Basic Fuzzy logic theory, sets and their properties, Operations on fuzzy set, Fuzzy relation and operations on fuzzy relations and extension principle, Fuzzy membership functions and linguistic variables, Fuzzy rules and fuzzy reasoning, Fuzzification and defuzzification and their methods, Fuzzy inference systems

UNIT – V

Applications:

Applications of Neural Networks: Pattern classification, Handwritten character recognition, Face recognition, Image compression and decompression

Applications of Fuzzy Logic & Fuzzy System: Fuzzy pattern recognition, Fuzzy image processing, Simple applications of Fuzzy knowledge-based controllers like washing machines, traffic regulations, and lift control

Text Books :

1. Timothy J. Ross, Fuzzy Logic with Engineering Applications, John Wiley and sons, III Ed, 2010.

2. S. Haykin, "Neural Networks, A Comprehensive Foundation", Pearson Education Inc., III Ed 2008.

3. Jacek. M. Zurada, "Introduction to Artificial Neural Systems", Jaico Publishing House, 2006.

4. LaureneFausett, Fundamentals of Neural Networks-Architectures, algorithms and applications, Pearson Education Inc., 2004.

5. J.S.R. Jang, C.T. Sun, E. Mizutani,, "Neuro Fuzzy and Soft Computing - A computational Approach to Learning and Machine Intelligence", Pearson Education Inc., 2002..

6. Laurence Fausett, —Fundamentals of Neural Networks‖, Pearson Education

7. Bart Kosko, —Neural networks and Fuzzy Systems", Pearson Education

Reference Books :

1. S. Rajsekaran and G. A. VijaylakshmiPai, —Neural Networks, Fuzzy Logic, and Genetic Algorithms‖, PHI

2. N. Sivanandam, S. Sumathi, and S. N. Deepa, —Introduction to Neural Network Using MATLAB", Tata McGraw-Hill Publications

3. S.N.Sivanandam. M.PaulRaj, - Introduction to Artificail Neural Networks, Vikas Publication House Pvt.Ltd, New Delhi.

Question Paper Pattern:

Sessional Exam:

The question paper for sessional examination is for 30 marks, covering half of the syllabus for first sessional and remaining half for second sessional exam. Question No 1 which carries 6 marks contains three short answer questions of two marks each. The remaining three questions shall be EITHER/OR type questions carrying 8 marks each.

End Exam:

Question paper contains Six questions; question 1 contains 5 short answer questions each of 2 marks. (Total 10 marks) covering one question from each unit. The remaining five questions shall be EITHER/OR type questions carrying 10 marks each. Each of these questions is from one unit and may contain sub-questions. i.e. there will be two questions from each unit and the student should answer any one question

BUILDING INFORMATION MODELLING (BIM)

VI Semester :						Scheme : 2017		
Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	Total
OE317	Open Elective - 2	1	2	-	3	40	60	100
Sessional Exam Duration: 2 Hrs						End Exam Duration : 3 Hrs		

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

CO1: Understand the basics of BIM and their applications

CO2: Understand the usage of BIM tools and Toolbar

CO3: Use advanced editing tools in making a 3D model of any residential/commercial building

CO4: Prepare templates, create basic walls, curtain walls and also edit the walls like divide, creating openings, etc.

CO5: Apply tools like creating floors, roofs, walls, etc. in making 3D models of any type of structure.

UNIT - I

Introduction: The Basics of BIM - What is Revit? - Understanding a BIM Workflow –Leveraging BIM processes - Visualizing – Analyzing - Strategizing - Focusing Your Investment in BIM - Staffing for BIM - Understanding Project Roles - Establishing a BIM Execution Plan - Accessing and Using the Application Menu - Using the Quick Access Toolbar - Getting toKnow the Ribbon - Defining Project Organization - Introducing Datum Objects (Relationships).

UNIT - II

The Basics of the Toolbox: Selecting, Modifying, and Replacing Elements - Selecting Elements - Selection Options - Filtering Your Selection - Using Selection-based Filters - Selecting All Instances – Using the Properties Palette - Matching Properties – Using the Context Menu – Editing Elements Interactively - Moving Elements - Copying Elements – Rotating and Mirroring Elements - Arraying Elements - Scaling Elements – Aligning Elements - Trimming or Extending Lines and Walls - Splitting Lines and Walls - Offsetting Lines and Walls.

UNIT - III

Exploring Advanced Editing Tools: Keeping Elements from Moving - Using the Join Geometry Tool - Using the Split Face and Paint Tools - Copying and Pasting from the Clipboard – Using the Create Similar Tool - Using Keyboard Shortcuts (Accelerators) - Double-click to Edit - Modelling Site Context - Using a Toposurface - Cut/Fill Schedules.

UNIT - IV

Extended Modelling Techniques: Creating Walls and Curtain Walls - Using Extended Modelling Techniques for Basic Walls - Creating Basic Wall Types - Adding Wall Articulation - Modelling Techniques for Basic Walls - Creating Custom In-Place Walls - Creating Stacked Walls - Creating Simple Curtain Walls - Designing a Curtain Wall - Dividing the Surface - Dividing the Surface with Intersects - Applying Patterns - Editing the Pattern Surface.

Configuring Templates and Standards: Introducing Project Templates - Customizing Project - Settings for Graphic Quality - Discovering Object Styles - Using Line Settings – Defining Materials - Defining Fill Patterns – Pre-configuring Colour Schemes - Increasing Efficient view Management - Organizing Views –Saving Work - Saving at Intervals.

UNIT - V

Modelling Floors, Ceilings, and Roofs: Understanding Floor Types - Modelling a Floor - Creating a Structural Floor - Sketching for Floors, Ceilings, and Roofs - Modelling Slab Edges - Creating a Custom Floor Edge - Modelling Floor Finishes - Modelling Thick Finishes - Creating Ceilings - Creating a Roof by Face - Creating a Sloped Glazing - Using Slope Arrows - Using Additional Roof Tools - Using Advanced Shape Editing with Floors and Roofs.

Text Books :

1. Karen Kensek, Douglas Noble, *Building Information Modelling*: BIM in Current and Future Practice.
2. Danelle Briscoe [2015],*Beyond BIM - Architecture Information Modelling*, Routledge Publication, ISBN: 9781317668107.

Reference Books :

1. Chuck Eastman, Paul Teicholz, Rafael Sacks, Kathleen Liston; *BIM Handbook: A Guide to Building Information Modeling for Owners, Managers, Designers, Engineers, and Contractors*, John Wiley & Sons, Inc.
2. Bimal Kumar,*A Practical Guide to Adopting BIM in Construction Projects.*

Web References:

1. https://www.youtube.com/watch?v=LACe3vtc8dY
2. https://www.youtube.com/watch?v=LQdHkuG4do4

Question Paper Pattern:

Sessional Exam:

The question paper for sessional examination is for 30 marks, covering half of the syllabus for first sessional and remaining half for second sessional exam. Question No 1 which carries 6 marks contains three short answer questions of two marks each. The remaining three questions shall be EITHER/OR type questions carrying 8 marks each.

End Exam:

Question paper contains Six questions; question 1 contains 5 short answer questions each of 2 marks. (Total 10 marks) covering one question from each unit. The remaining five questions shall be EITHER/OR type questions carrying 10 marks each. Each of these questions is from one unit and may contain sub-questions. i.e. there will be two questions from each unit and the student should answer any one question

PRODUCT LIFECYCLE MANAGEMENT (PLM)

VI Semester:	B.Tech				Scheme : 2017			
Course Code	Category	Hours / Week			Credits	Maximum Marks		
OE318	Open Elective - 2	L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
		3	-	-	3	40	60	100
Sessional Exam Duration : 2 Hrs					End Exam Duration : 3 Hrs			

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

CO1 :	Understand basic concepts of Java such as operators, classes, objects, inheritance, packages Enumeration and various keywords
CO2 :	Understand product lifecycle management process & different steps in Product development process
CO3 :	Get knowledge on Product data management
CO4 :	Understand the implementation of PLM and its impact on the organization
CO5 :	Understand concept of PLM architecture and information authoring tools

UNIT – I

Introduction to Java (background, facts, editions), JVM, Program Structure (basics of class, object, member variables, methods, naming conventions, static, System), Installing Java, Setting PATH, Compiling & Running a minimal program. Primitive data types, cast, NaN, Two's complement, Variables (rules, types), Operators, Control Structures

UNIT – II

Arrays, Constructors, String class, Inheritance, Packages, Access modifiers, Relational Databases, SQL and JDBC

UNIT – III

PLM Introduction-Organization Business Models(MTS, MTO, CTO, ETO Etc), Basics of Enterprise Systems (PLM, ERP, MES), Background, Overview, Need, Benefits, and Concept of Product Life Cycle, Components / Elements of PLM, Emergence of PLM, Significance of PLM, Differences between PLM and PDM Integrated Product development process-Conceive-Specification, Concept design, Design-Detailed design, Validation and analysis (Simulation), Tool design , Realize-Plan manufacturing, Manufacture, Build/Assemble, Test(quality check)

UNIT – IV

PLM Components - Workflow Processes, Design Collaboration, Processes Management, Document Management, Visualization, Bill of Materials (BOM) Management, Engineering Change Control, Configuration Management, Manufacturing Process Management, Variant Management, Classification.

UNIT – V

PLM Technologies - PLM Architecture, Various PLM tools, Data Modelling, Security management,

CAD Integrations, Information authoring tools (e.g., MCAD, ECAD, Technical publishing), Core functions (e.g., data vaults), Data Flow to Other systems such as Supply chain and ERP systems

Text Books:

1. Grieves, Michael, Product Lifecycle Management, McGraw-Hill
2. Antti Saaksvuori, AnselmiImmonen**,** Product Life Cycle Management - Springer
3. Kari Ulrich and Steven D. Eppinger, Product Design & Development, McGraw Hill

Reference Books:

1. Java - The Complete Reference (English) 9th Edition-herbert-schildt-Mcgraw Hill Education
2. Head First Java (English) 2 Edition- Kathy-Sierra-Publisher: O' Reilly
3. Burden, Rodger PDM: Product Data Management, Resource Publications

Question Paper Pattern:

Sessional Exam

The question paper for Sessional examination is for 30 marks, covering halfof the syllabus for first Sessional and remaining half for second Sessional exam. Question No 1 which carries 6 marks contains three short answer questions of two marks each. The remaining three questions shall be EITHER/OR type questions carrying 8 marks each

End Exam

Question Paper Contains Six Questions. Question 1 contains 5 short Answer questionseach of 2 marks (Total 10 marks) covering one question from each unit. The remaining five questions shall be EITHER/OR type questions carrying 10 marks each. Each of these questions is from one unit and may contain sub questions. i.e. there will be two questions from each unit and the student should answer any one question

SIMULATION OF ENGINEERING SYSTEMS(SES)

<table>
<tr><td colspan="5">VI Semester:B.Tech</td><td colspan="4">Scheme : 2017</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">OE319</td><td rowspan="2">Open Elective - 2</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Continuous Internal Assessment</td><td>End Exam</td><td>Total</td></tr>
<tr><td>0</td><td>0</td><td>3</td><td>3</td><td>40</td><td>60</td><td>100</td></tr>
<tr><td colspan="5">Sessional Exam Duration:2 Hrs</td><td colspan="4">End Exam Duration: 3Hrs</td></tr>
<tr><td colspan="9">Course Outcomes: At the end of the course students will be able to</td></tr>
<tr><td colspan="9">CO1: Understand the basic features and programming in MATLAB.</td></tr>
<tr><td colspan="9">CO2: Understand control statements, functions and plotting in MATLAB.</td></tr>
<tr><td colspan="9">CO3: Understand developing simulation model using simulink library.</td></tr>
<tr><td colspan="9">CO4: Understand the graphical user interface in MATLAB.</td></tr>
<tr><td colspan="9">CO5: Understand various tool boxes used in solving engineering problems.</td></tr>
<tr><td colspan="9">UNIT-I</td></tr>
<tr><td>MATLAB Environment</td><td colspan="8">Introduction to Simulation-Installation of MATLAB-History-Use of MATLAB-Key features.
Introduction to MATLAB Software- MATLAB window- Command window-Workspace-Command history-Current directory Setting-Basic commands-Assigning variables-Operations with variables.</td></tr>
<tr><td>Data types and Operators</td><td colspan="8">Character and string- Arrays and vectors- Column vectors-Row vectors.
Arithmetic Operators- Relational Operators-Logical Operators- Operator Precedence- BODMAS Rules- Solving arithmetic equations.</td></tr>
<tr><td>Basic Operations</td><td colspan="8">Trigonometric functions- Complex numbers- Fractions & Real numbers-Complex numbers</td></tr>
<tr><td colspan="9">UNIT-II</td></tr>
<tr><td>MATLAB Programming</td><td colspan="8">Working with script tools- Writing Script file- Executing script files- The MATLAB Editor- opening and saving editor.
Creating M files, Saving m-files- Errors and Warnings- Types of errors- error handling- MATLAB Debugger- Setting Break Points- Examining Variables-Stepping through code- ending the debug session- Debugging from command line.</td></tr>
<tr><td>Loops and Conditional Statements</td><td colspan="8">Loops: for loop- nested for loop- while loop-
Branch Control Structure: if control statements, switch statement- break statement- continue statement- error statement- try catch structure- Program Termination — return</td></tr>
<tr><td>Functions</td><td colspan="8">Writing functions, Writing user defined functions- Built in Function-Function calling-Return Value- Types of Functions-Global Variables.
String Functions- Input/Output Functions.</td></tr>
</table>

Plotting	**Plots:** Plotting vector and matrix data- Plot labeling, curve labeling and editing. **2D Plots:** Basic Plotting Functions-Creating a Plot-Plotting Multiple Data Sets in One Graph-Specifying Line Styles and Colors- Graphing Imaginary and Complex Data-Figure Windows-Displaying Multiple Plots in One Figure-Controlling the Axes-Subplots **3Dplots:** Use of mesh grid function- Mesh plot-Surface plot
UNIT-III	
Simulink	Introduction to Simulink- Simulink Environment & Interface- Study of Library-Object Oriented Design-Equation Oriented Design- - Fixed Step continuous solvers- Variable step continuous solver- Data Import/ Export- Creating and masking a Subsystem- Getting help for Simulink. Simulation of Numerical Integration, Linear Algebra, Roots of Polynomials, Algebraic equations, Differential Equations-Transforms (Fourier, Laplace).
UNIT-IV	
Graphical User Interface Design	Introduction of Graphical User Interface- GUI Function Property- GUI Component Design- GUI Container- Writing the code of GUI Callback- Dialog Box- Menu Designing- Creating a database-Applications.
UNIT-V	
Applications with MATLAB	**Image Processing:** Importing and Visualizing Images- Importing and displaying images- Converting between image types- Exporting images- Interactive Exploration of Images- Obtaining pixel intensity values- Extracting a region of interest- Computing pixel statistics-Measuring object sizes. MATLAB Applications in Control Systems, Neural Networks- Machine Learning, Digital Signal Processing, Communication Systems and Fuzzy Logic Systems.
Text Books:	
1. Raj Kumar Bansal, Ashok Kumar Goel and Manoj Kumar Sharma, "MATLAB and its Applications in Engineering", Dorling Kindersly India pvt. Ltd, Pearson, 5th Edition 2012.	
2.Agam Kumar Tyagi, "MATLAB and Simulink for Engineers", Oxford University Press, 2nd Edition,2012.	
3.Jaydeep Chakravarthy, " Introduction to MATLAB Programming, Tool Box and Simulink", Universities Press, 2014.	
Reference Books:	
1. MiszaKalechman , " Practical MATLAB Basics for engineers", CRC Press, Taylor & Francis group,1st Edition, 2012.	
2.Rizwan Butt , "An Introduction to differential equations on MATLAB", Narosa Publishing house, 2016.	
Web References:	
1.https://matlabacademy.mathworks.com/	
2. https://www.edx.org/course/matlab-octave-beginners-epflx-matlabeoctavebeginnersx	
Question Paper Pattern:	
Sessional Exam: The question paper for sessional examination is for 30 marks, covering half of the syllabus for first sessional and remaining half for second sessional exam. Question No 1 which carries 6 marks contains three short answer questions of two marks each. The remaining three questions shall be EITHER/OR type	

questions carrying 8 marks each.

End Exam

Question paper contains Six questions; question 1 contains 5 short answer questions each of 2 marks. (Total 10 marks) covering one question from each unit. The remaining five questions shall be EITHER/OR type questions carrying 10 marks each. Each of these questions is from one unit and may contain sub-questions.i.e. there will be two questions from each unit and the student should answer any one question.

IMAGE PROCESSING (IP)

VII Semester: EEE						Scheme : 2017		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
OE401	Open Elective - III	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	40	60	100
Sessional Exam Duration : 2 Hrs						End Exam Duration: 3 Hrs		

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

CO1: Understand the concepts of image, image processing system and various operations that can perform on digital images.

CO2: Analyze images in the spatial and frequency domains.

CO3: Apply various image restoration techniques on images.

CO4: Analyze various image compression and segmentation techniques.

CO5: Apply the various mathematical transforms and color image concepts on digital images.

UNIT – I	
Basic Concepts	Definition, Applications Of Digital Image Processing, Fundamental Steps, Components Of Image Processing System, Human Visual System, Simple Image Formation Model, Image Sampling And Quantization, Spatial And Gray Level Resolution, Image Interpolation, Some Basic Relationships Between Pixels, Linear And Non Linear Operations.
UNIT – II	
Image Enhancement	**Spatial Domain:** Basic Gray Level Transformations, Histogram Processing, Enhancement Using Logical And Arithmetic Operations, Image Subtraction, Image Averaging, Basic Of Spatial Filtering, Smoothing And Sharpening Spatial Filters, Combining Spatial Enhancement Methods. **Frequency Domain:** Introduction To Fourier Transforms, Basics Of Filtering In Frequency Domain, Fundamental Steps In Filtering In Frequency Domain, Smoothing Frequency Domain Filters, Sharpening Frequency Domain Filters, Homomorphic Filtering.
UNIT – III	
Image Restoration	Model Of Image Degradation/Restoration Model, Noise Models, Restoration In Presence Of Noise Only-Spatial Filtering, Adaptive Filters, Periodic Noise Reduction By Frequency Domain Filtering, Linear Position Invariant Derivations, Algebraic Approach To Restoration, Inverse Filtering, Least Mean Square Filters, Constrained Least Squares Restoration.
UNIT – IV	
Image Compression	File format (bmp, tiff, pcx, gif, jpeg.), Compression fundamentals, Image Compression Models, Error Free Compression: VLC, Arithmetic Coding, LZW coding, Bit plane Coding, Lossless Predictive Coding, Lossy Compression: Lossy Predictive Coding, Block Transform coding,
Image Segmentation	Fundamentals, Detection of Discontinuities: Point, Line, Edge detection, Edge Linking and Boundary Detection: Local Processing, Global Processing via Hough Transform.
UNIT – V	
Image Transforms	Introduction One and Two Dimensional Discrete Fourier Transform (DFT), Properties of DFT, Properties of Discrete Cosine and Sine transforms, Properties of Slant, KL transforms.
Color Image	Color fundamentals, Color models: RGB, CMY and CMYK, HSI, Converting colors

Processing	from RGB to HIS, HIS to RGB manipulating HIS component images, Pseudo color Image Processing, Full Color Image Processing.

Text Books:

1. Rafael Gonzalez & Richard Woods, "Digital Image Processing", 3rd Edition. Pearson publications, 2012.
2. Anil K. Jain, "Fundamental of Digital Image Processing", PHI publication, 2013.

Reference Books :

1. Pratt, "Digital Image Processing", 2nd Edition, Wiley Publication, 1991.
2. S. Jayaraman, S. Esakkirajan & T. Veera Kumar, "Digital Image Processing", Mc. Graw Hill, 2011.
3. S. Sridhar, "Digital Image Processing", Oxford University Press, 2011.

Web References:

1.https://nptel.ac.in/courses/117105079/
2.https://nptel.ac.in/courses/117104069/
3.https://nptel.ac.in/courses/106105032/

Question Paper Pattern:

Sessional Exam:

The question paper for sessional examination is for 30 marks, covering half of the syllabus for first sessional and remaining half for second sessional exam. Question No 1 which carries 6 marks contains three short answer questions of two marks each. The remaining three questions shall be EITHER/OR type questions carrying 8 marks each

End Exam:

Question Paper Contains Six Questions. Question 1 contains 5 short Answer questions each of 2 marks. (Total 10 marks) covering one question from each unit. The remaining five questions shall be EITHER/OR type questions carrying 10 marks each. Each of these questions is from one unit and may contain sub-questions. i.e. there will be two questions from each unit and the student should answer any one question.

MACHINE LEARNING (ML)

VII Semester : EEE						Scheme : 2017		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
OE402	Open Elective - III	L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
		3	0	0	3	40	60	100
Sessional Exam Duration : 2 Hrs						End Exam Duration: 3 Hrs		

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

CO1: Understand principle of supervised, unsupervised, semi supervised and reinforcement learning.

CO2: Understand notations, definitions, rules and parameter estimation of learning process

CO3: Understand working of regression, decision, support vector machine and k-nearest learning Algorithms.

CO4: Understand the structure of learning algorithms.

CO5: Understand working of Multilayer Perceptron, Feed-Forward, Convolutional, Recurrent Neural Network and Deep Learning Concepts

UNIT - I	
Introduction to machine learning	Introduction- What is Machine Learning- Types of Learning- Supervised Learning, Unsupervised Learning, Semi-Supervised Learning, Reinforcement Learning - How Supervised Learning Works - Why the Model Works on New Data
UNIT - II	
Notation and Definitions	Notation - Data Structures, Capital Sigma Notation, Capital Pi Notation, Operations on Sets, Operations on Vectors, Functions, Max and Arg Max, Assignment Operator, Derivative and Gradient- Random Variable - Unbiased Estimators - Bayes' Rule - Parameter Estimation - Parameters vs. Hyper parameters - Classification vs. Regression - Model-Based vs. Instance-Based Learning - Shallow vs. Deep Learning
UNIT - III	
Fundamental Algorithms	Linear Regression - Problem Statement, Solution - Logistic Regression - Problem Statement, Solution - Decision Tree Learning - Problem Statement, Solution - Support Vector Machine - Dealing with Noise, Dealing with Inherent Non-Linearity - k-Nearest Neighbors
UNIT - IV	
Anatomy of a Learning Algorithm	Building Blocks of a Learning Algorithm - Gradient Descent - How Machine Learning Engineers Work - Learning Algorithms' Particularities
UNIT - V	
Neural Networks and Deep Learning	Neural Networks - Multilayer Perceptron Example, Feed-Forward Neural Network Architecture - Deep Learning- Convolutional Neural Network, Recurrent Neural Network

Text Books :

1. Aurélien Géron, "Hands-On Machine Learning with Scikit-Learn and Tensor Flow: Concepts, Tools, and Techniques to Build Intelligent Systems", 1st Edition, O'Reilly Media, 2017
2. Jain V.K., "Big Data and Hadoop", Khanna Publishing House, Delhi. 2017
3. Jeeva Jose, "Machine Learning", Khanna Publishing House, Delhi. 1 edition, 2018

Reference Books :

1. Chopra Rajiv, “Machine Learning”, Khanna Publishing House, Delhi. 1 edition, 2018
2. Ian Goodfellow, Yoshua Bengio and Aaron Courville, “Adaptive Computation and Machine Learning series”, 2016

Web References:

1. https://medium.com/machine-learning-for-humans/how-to-learn-machine-learning-24d53bb64aa1
2. https://top10onlinecourses.com/best-machine-learning-online-courses/#9_Machine_Learning_A-Z_Hands-On_Python_R_In_Data_Science-Udemy
3. http://www.holehouse.org/mlclass/

Question Paper Pattern:

Sessional Exam

The question paper for Sessional examination is for 30 marks, covering half of the syllabus for first Sessional and remaining half for second Sessional exam. Question No 1 which carries 6 marks contains three short answer questions of two marks each. The remaining three questions shall be EITHER/OR type questions carrying 8 marks each. A continuous assessment for 10 marks for assignment/quiz/both. 2 assignments/1 quiz

End Exam

Question Paper Contains Six Questions. Question 1 contains 5 short Answer questions each of 2 marks. (Total 10 marks) covering one question from each unit. The remaining five questions shall be EITHER/OR type questions carrying 10 marks each. Each of these questions is from one unit and may contain sub-questions. i.e there will be two questions from each unit and the student should answer any one question

DIGITAL DESIGN WITH FPGA (DDFPGA)

VII Semester: EEE						Scheme : 2017		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
OE403	Open Elective - III	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		3	0	0	3	40	60	100
Sessional Exam Duration : 2 Hrs						End Exam Duration: 3 Hrs		

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

CO1: Understand the basics of the hardware description language, verilog.

CO2: Understand combinational and sequential modelling in verilog.

CO3: Understand FPGA functionality w.r.t to its programming technology.

CO4: Understand commercially available FPGA architectures.

CO5: Understand features of Xilinx FPGA.

	UNIT - I
VERILOG Basics-I:	Detailed Digital Design Flow, Characterizing Hardware Languages, Verilog HDL,RTL Level Design, Logic Synthesis Process, Elements of Verilog, Component Description in Verilog, Test bench basics, Module Basics, Verilog Simulation Model.
	UNIT - II
VERILOG Basics-II	Basic Compiler Directives, some useful System Tasks, Hierarchical Structures, Assign Statements, Behavioural Combinational Description examples, Sequential Model examples.
	UNIT - III
FPGA Basics-I	History of FPGAs, Position of FPGA, Components of an FPGA, Programming Technology: Flash Memory, Anti-fuse Technology, Static Memory Technology, Summary of Programming Technology.
	UNIT - IV
FPGA Basics-II	Logic Circuit Representation of FPGA: Circuit Implementation on FPGA, Logical Expression by Product Term, Logical Expression by Lookup Table, Structure of Lookup Table, Logical Expression by other Methods.
	UNIT - V
FPGA Structure	Logic Block, Logic Cluster, Adaptive LUT Routing, Switch Block, Connection Block,I/O Block,DSP Block, Hard Macros, Embedded Memory, Configuration Chain, PLL and DLL.

Text Books :

1. Zainalabedin Navabi, "Verilog Digital System Design", McGraw-Hill Professional, 2005.
2. Hideharu Amano, " Principles and Structures of FPGAs" Springer, Singapore, 2018.

Reference Books :

1. Samir Palnitka, "Verilog® HDL: A Guide to Digital Design and Synthesis", Second Edition (2nd ed.). Prentice Hall Press, Upper Saddle River, NJ, USA, 2003.
2. Pak K Chan & Samiha Mourad, "Digital design using field programmable gate arrays". PTR Prentice Hall, Englewood Cliffs, N.J., 1994.
3. Ian Grout, "Digital Systems Design with FPGAs and CPLDs", Newnes, Newton, MA, USA,

2008.

Web References:

1. https://nptel.ac.in/courses/117108040/
2. https://nptel.ac.in/courses/108105113/45

Internal Assessment:

The question paper for sessional examination is for 30 marks, covering half of the syllabus for first sessional and remaining half for second sessional exam. Question No 1 which carries 6 marks contains three short answer questions of two marks each. The remaining three questions shall be EITHER/OR type questions carrying 8 marks each.

End Exam:

Question Paper Contains Six Questions. Question 1 contains 5 short Answer questions each of 2 marks. (Total 10 marks) covering one question from each unit. The remaining five questions shall be EITHER/OR type questions carrying 10 marks each. Each of these questions is from one unit and may contain sub-questions. i.e there will be two questions from each unit and the student should answer any one question

ROBOTICS (ROB)

VII Semester :EEE						Scheme : 2017		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
OE404	Open Elective - IV	L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
		3	0	0	3	40	60	100
Sessional Exam Duration : 2 Hrs						End Exam Duration: 3 Hrs		

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

CO1: Understand the importance, classification, working and notations of a robot

CO2: Understand the drive systems and their interfacing with motors and grippers, gripper selection.

CO3: Understand working of sensors and machine vision system of Robot

CO4: Understand the kinematics and programming methods for motion control

CO5: Understand the working of industrial robot, system safety, economics of robot.

UNIT - I

Fundamentals Of Robot	Introduction To Robot – Definition - Robot Anatomy - Co-Ordinate System - Work Envelop - Robot Classification And Specification - Pitch, Yaw, Roll, Joint Notations - Speed of Motion And Pay Load - Robot Parts And Functions - Need of Robot And Its Application

Unit – II

Robot Drive Systems And End Effectors	Introduction - Mechanical Drives - Electrical Drives - Hydraulic Drives - Pneumatic Drives - Servo Motors And Stepper Motors - Ac Servo Motor - Stepper Motor – Grippers - Magnetic Grippers - Mechanical Gripper - Hydraulic Grippers - Vacuum Grippers - Two And Three-Fingered Gripper - Selection And Design Considerations

Unit – III

Sensors And Machine Vision	Introduction To Sensors - Need of Sensors - Position Sensors - Proximity Sensor - Wrist-Force Sensing -Compliant Geometry - Slip Sensing - Analog Frame Grabbers - Machine Vision System - Sensing & Digitizing Image Data - Signal Conversion - Object Tracking Software

Unit – IV

Robot Kinematics And Robort Programming	Forward Kinematics - Inverse Kinematics - Teach Pendant -Leadthrough Programming Method - Robot Programming Methods - Programming Languages For Robotics - Motion Commands And The Control of Effectors

Unit - V

Implementation And Robot Economics	Rgv (Rail Guided Vehicle) - Packmobile With Trailer - Implementation of Robot Systems - Industrial Robots And Robot System Safety - Hazards - Economic Analysis of Robot - Payback Method - EUAC Method

Text Books :

1. M.P.Groover, “Industrial Robotics – Technology, Programming and Applications”, McGraw-Hill, 2001
2. Saha, S.K., “Introduction to Robotics, 2nd Edition, McGraw-Hill Higher Education, New Delhi, 2014.
3. Ghosal, A., “Robotics”, Oxford, New Delhi, 2006.

Reference Books :

1. Fu.K.S. Gonzalz.R.C., and Lee C.S.G., “Robotics Control, Sensing, Vision and Intelligence”, McGraw-Hill Book Co., 1987
2. Yoram Koren, “Robotics for Engineers”, McGraw-Hill Book Co., 1992

3. Janakiraman.P.A., “Robotics and Image Processing”, Tata McGraw-Hill, 1995

Web References:

1. https://nptel.ac.in/downloads/112101098/
2. https://ocw.mit.edu/courses/mechanical-engineering/2-12-introduction-to-robotics-fall-2005/download-course-materials/
3. https://ocw.mit.edu/courses/mechanical-engineering/2-12-introduction-to-robotics-fall-2005/lecture-notes/

Question Paper Pattern:

Sessional Exam

The question paper for Sessional examination is for 30 marks, covering half of the syllabus for first Sessional and remaining half for second Sessional exam. Question No 1 which carries 6 marks contains three short answer questions of two marks each. The remaining three questions shall be EITHER/OR type questions carrying 8 marks each. A continuous assessment for 10 marks for assignment/quiz/both. 2 assignments/1 quiz

End Exam

Question Paper Contains Six Questions. Question 1 contains 5 short Answer questions each of 2 marks. (Total 10 marks) covering one question from each unit. The remaining five questions shall be EITHER/OR type questions carrying 10 marks each. Each of these questions is from one unit and may contain sub-questions. i.e there will be two questions from each unit and the student should answer any one question

3D PRINTING (3DP)

VII Semester : EEE						Scheme : 2017		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
OE405	Open Elective - IV	L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
		3	0	0	3	40	60	100
Sessional Exam Duration : 2 Hrs						End Exam Duration: 3 Hrs		

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

CO1: Understand the manufacturing techniques, processes and characteristics of 3D Printing

CO2: Understand 3D Printing process and steriolithography

CO3: Understand the steps involved in 3D Printing process chain

CO4: Understand extrusion-based systems and Jettings

CO5: Understand preparation of CAD models and software issues in 3D Printing

UNIT - I

3D Printing (Additive Manufacturing)	Systematics of Manufacturing Technologies- Systematics of Layer Technology- Application of Layer Technology: Additive Manufacturing and 3D Printing- Characteristics of Additive Manufacturing-Hierarchical Structure of Additive Manufacturing Processes: Rapid Prototyping, Rapid Manufacturing, Related Nonadditive Processes: Indirect or Secondary Rapid Prototyping Processes- Integration of Additive Manufacturing in the Product Development Process

UNIT - II

Basic Principles of the 3D Printing Process	Generation of Layer Information - Description of the Geometry by a 3D Data Record - Data Flow and Interfaces - Modeling 3D Bodies in a Computer by Means of 3D CAD Generating 3D Models from Measurements - Generation of Geometrical Layer Information on Single Layers - STL Format - CLI/SLC Format - PLY and VRML Formats - AMF Format-Advantages of Stereolithography -Disadvantages of Stereolithography

UNIT - III

Generalized 3D Printing Process Chain	Introduction - The Eight Steps in Additive Manufacture - Conceptualization and CAD -Conversion to STL/AMF - Transfer to AM Machine and STL File Manipulation - Machine Setup - Build - Removal and Cleanup- Post-Processing - Application - Design for AM- Application Areas That Don't Involve Conventional CAD Modeling

UNIT - IV

Extrusion-Based Systems and Jetting	Introduction - Basic principle - Fused Deposition Modeling from Stratasys - FDM Machine Types - Materials - Limitations of FDM- Evolution of Printing as an Additive Manufacturing Process - Materials for Material Jetting - Polymers - Ceramics - Metals- Solution and Dispersion-Based Deposition- Binder Jetting - Materials - Commercially Available Materials - Ceramic Materials in Research

UNIT - V

Software Issues for 3D Printing	Preparation of CAD Models: The STL File, STL File Format, Binary/ASCII, Creating STL Files from a CAD System, Calculation of Each Slice Profile, Technology-Specific Elements - Problems with STL Files - STL File Manipulation, Viewers, Manipulation on the AM Machine - Beyond the STL File Direct Slicing of the CAD Model, Color Models, Multiple Materials, Use of STL for

	Machining

Text Books :

1. Lan Gibson, David W. Rosen and Brent Stucker, “Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing”, Springer, 2010.
2. Andreas Gebhardt, “Understanding Additive Manufacturing: Rapid Prototyping, Rapid Tooling, Rapid Manufacturing”, Hanser Publisher, 2011.

Reference Books :

1. Gebhardt, Hötter, "Additive Manufacturing-3D Printing for Prototyping and Manufacturing", Hanser Publisher, 2016.
2. Ben Redwood, Filemon Schöffer, Brian Garret, “The 3D Printing Handbook: Technologies, design and applications”, 3D Hubs; 1st edition, 2017)

Web References:

1. https://3dprinting.com/what-is-3d-printing/
2. https://ocw.mit.edu/courses/mechanical-engineering/2-12-introduction-to-robotics-fall-2005/lecture-notes/
3. https://all3dp.com › Tutorials & Guides

Question Paper Pattern:

Sessional Exam

The question paper for Sessional examination is for 30 marks, covering half of the syllabus for first Sessional and remaining half for second Sessional exam. Question No 1 which carries 6 marks contains three short answer questions of two marks each. The remaining three questions shall be EITHER/OR type questions carrying 8 marks each. A continuous assessment for 10 marks for assignment/quiz/both. 2 assignments/1 quiz

End Exam

Question Paper Contains Six Questions. Question 1 contains 5 short Answer questions each of 2 marks. (Total 10 marks) covering one question from each unit. The remaining five questions shall be EITHER/OR type questions carrying 10 marks each. Each of these questions is from one unit and may contain sub-questions. i.e there will be two questions from each unit and the student should answer any one question

VIRTUAL REALITY (VR)

VII Semester : EEE						Scheme : 2017		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
OE406	Open Elective - IV	L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
		3	0	0	3	40	60	100
Sessional Exam Duration : 2 Hrs						End Exam Duration: 3 Hrs		

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

CO1: Understand components of virtual reality and commercial virtual reality technology.

CO2: Understand the working of input devices like trackers navigators and gesture interfaces.

CO3: Understand working of output devices like graphical, sound, haptic, tactile and force feedback sensor and their interfacing.

CO4: Understand the modeling management and physical, geometric and kinematics practices.

CO5: Understand Human Factors and safety issues in virtual reality.

UNIT - I	
Introduction to virtual reality	Introduction: The three I's of virtual reality, commercial VR technology and the five classic components of a VR system.
UNIT - II	
Input Devices	Input Devices: Trackers, Navigation, and Gesture Interfaces- Three-dimensional position trackers, navigation and manipulation, interfaces and gesture interfaces.
UNIT - III	
Output Devices	Graphics displays - Graphics Displays, The Human Visual System, Personal Graphics Displays, Large-Volume Displays -Sound Displays -The Human Auditory System, The Convolvotron, Speaker-Based Three-Dimensional Sound - Haptic Feedback - The Human Haptic System, Tactile Feedback Interfaces, Force Feedback Interfaces
UNIT - IV	
Modeling	Geometric modeling, kinematics modeling, physical modeling, behaviour modeling, model management.
UNIT - V	
Human Factors and safety issues in virtual reality	Human Factors: Methodology and terminology, user performance studies, VR health and safety issues.

Text Books :

1. Gregory C. Burdea & Philippe Coiffet , "Virtual Reality Technology", Second Edition, John Wiley & Sons, Inc.,
2. Andrew Davison, "Killer Game Programming in Java", Oreilly-SPD, 2005.

Reference Books :

1. Understanding Virtual Reality, interface, Application and Design, William R.Sherman, Alan Craig, Elsevier(Morgan Kaufmann).
2. Bill Fleming, "3D Modeling and surfacing ", Elsevier(Morgan Kauffman).
3. David H.Eberly, , "3D Game Engine Design ", Elsevier.
4. John Vince, "Virtual Reality Systems ", Pearson Education, 1995

Web References:

1. https://ocw.mit.edu/search/ocwsearch.htm?q=VIRTUAL%20REALITY
2. https://virtualrealitypop.com/vr-development-notes-c10a8eb74600
3. https://nwn.blogs.com/

Question Paper Pattern:

Sessional Exam

The question paper for Sessional examination is for 30 marks, covering half of the syllabus for first Sessional and remaining half for second Sessional exam. Question No 1 which carries 6 marks contains three short answer questions of two marks each. The remaining three questions shall be EITHER/OR type questions carrying 8 marks each. A continuous assessment for 10 marks for assignment/quiz/both. 2 assignments/1 quiz

End Exam

Question Paper Contains Six Questions. Question 1 contains 5 short Answer questions each of 2 marks. (Total 10 marks) covering one question from each unit. The remaining five questions shall be EITHER/OR type questions carrying 10 marks each. Each of these questions is from one unit and may contain sub-questions. i.e there will be two questions from each unit and the student should answer any one question