K. S. R. M. College of Engineering

(AUTONOMOUS)

Kadapa, Andhra Pradesh, India – 516003.

Approved by AICTE & New Delhi, Affiliated to JNTUA, Ananthapuramu.

Department of Electrical & Electronics Engineering

List of Open Electives Offering to Other Branches
(B. Tech., R18)

S. No.	Subject Code	SUBJECT	SC	L	T	P	IM	EM	CR
		Open Elective Course - I (OEC-I)							
1	18OE201	Fundamentals of Control Systems	OEC	3	0	0	30	70	3
2	18OE202	MATLAB Programming	OEC	3	0	0	30	70	3
		Open Elective Course – II (OEC-II)							
3	18OE203	Energy Conversion Systems	OEC	3	0	0	30	70	3
4	18OE204	Internet of Things	OEC	3	0	0	30	70	3
		Open Elective Course - III (OEC-III)							
5	18OE205	Intelligent Control Techniques	OEC	3	0	0	30	70	3
6	18OE206	Electrical System Estimation & Costing	OEC	3	0	0	30	70	3
		Open Elective Course - IV (OEC-IV)							
7	18OE207	Basics of Power Electronics	OEC	3	0	0	30	70	3
8	18OE208	System Reliability Concepts	OEC	3	0	0	30	70	3

<table>
<tr><td>Course Title</td><td colspan="5">Fundamentals of Control Systems</td><td colspan="3">B. Tech. EEE
Open Elective - 1</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">18OE201</td><td rowspan="2">Open Elective (OEC)</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>3</td><td>0</td><td>0</td><td>3</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td colspan="6">Mid Exam Duration : 2Hrs</td><td colspan="3">End Exam Duration : 3Hrs</td></tr>
<tr><td colspan="9">Course Objectives: The objective of the course is to learn mathematical modeling of physical systems, electrical systems, time response of first order and second order Systems, stability analysis using time domain and frequency domain and design compensator in frequency domain to improve the performance.</td></tr>
<tr><td colspan="9">Course Outcomes: On successful completion of this course, the students will be able to,</td></tr>
<tr><td>CO 1</td><td colspan="8">Understand modeling of physical systems, time and frequency domain specifications and stability of the system.</td></tr>
<tr><td>CO 2</td><td colspan="8">Analyze the stability of the system in time and frequency domains.</td></tr>
<tr><td>CO 3</td><td colspan="8">Block diagram construction and evaluate the transfer function using signal flow graph, steady state error and static error constants.</td></tr>
<tr><td>CO 4</td><td colspan="8">Design lag, lead compensators in frequency domain.</td></tr>
</table>

UNIT I

Control System Concepts: Introduction to control systems, classification, transfer function, mathematical modeling of physical systems, block diagram, signal flow graphs and mason's gain formula.

UNIT II

Time Domain Analysis: Standard test signals, time response of first and second order systems- time response specifications, steady state error and error constants.

UNIT III

Concept of Stability and Root Locus: The concept of stability, necessary conditions for stability – Routh Hurwitz's criterion – limitations of Routh's stability – Root locus concept – construction of Root loci - Effect of Poles & Zeros on stability.

UNIT IV

Frequency Domain Analysis: Introduction, frequency domain specifications, bode plots, gain and phase margin.

UNIT V

Compensation Techniques: System design and compensation – realization of basic lag and lead compensations in frequency domain.

Text Books

1. Control Systems Engineering by I. J. Nagrath and M. Gopal, New Age International (P) Limited, Publishers, 5th edition, 2007.
2. Automatic Control Systems by B. C. Kuo and Farid Goinaraghi – John Wiley and Sons, 8th edition, 2003.

Reference Books

1. Modern Control Engineering by Katsuhiko Ogata, Prentice Hall of India Pvt. Ltd., 5th edition, 2010.
3. Control Systems Engineering by NISE, 5th edition, John Wiley.
2. Control Systems by A. Anand Kumar, Prentice Hall of India Pvt. Ltd.

<table>
<tr><td>Course Title</td><td colspan="5">MATLAB Programming</td><td colspan="3">B. Tech. EEE
Open Elective - 1</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">18OE202</td><td rowspan="2">Open Elective (OEC)</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>3</td><td>0</td><td>0</td><td>3</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td colspan="5">Mid Exam Duration : 2Hrs</td><td colspan="4">End Exam Duration : 3Hrs</td></tr>
<tr><td colspan="9">Course Objectives: The main objective of the course is to make the students familiar with scripts, functions, control flow and plotting in MATLAB and use it to solve various Engineering problems.</td></tr>
<tr><td colspan="9">Course Outcomes: On successful completion of this course, the students will be able to,</td></tr>
<tr><td>CO 1</td><td colspan="8">Able to understand basic MATLAB features, arrays and symbolic algebra.</td></tr>
<tr><td>CO 2</td><td colspan="8">Able analyze various control flow structures.</td></tr>
<tr><td>CO 3</td><td colspan="8">Able solve linear equations</td></tr>
<tr><td>CO 4</td><td colspan="8">Able to plot two-dimensional graphics</td></tr>
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UNIT-I

Basics of MATLAB: Basic features, script M-files, code cells, arrays creation, addressing and array operations; multi dimensional arrays.

UNIT-II

Control Flow: Arithmetic & Logical operators, control flow - if, if-else, for, while, switch case constructions and functions.

UNIT-III

Mathematical Operations: Matrix algebra and solutions to systems of linear equations, polynomials, Numerical integration, numerical differentiation

UNIT-IV

MATLAB Graphics & Numerical techniques: Two dimensional graphics, basics of three dimensional graphics, interpolation, curve fitting.

UNIT-V

Symbolic Mathematics: Symbolic aigebra, equation solving, differentiation and integration.

Text Books

1. Hanselman and Littlefield, "Masterig MATLAB 7", Pearson Education Etter,
2. Kuncickly,Hull, "Introduction to MATLAB 6", Pearson Education.

Course Title	**Energy Conversion Systems**				**B. Tech. EEE Open Elective - 3**		
Course Code	**Category**	**Hours/Week**		**Credits**	**Maximum Marks**		
18OE203	**Open Elective (OEC)**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**Total**
		3	**0**	**0**	**3**	**30**	**70**	**100**
Mid Exam Duration : 2Hrs					**End Exam Duration : 3Hrs**		
Course Objectives: The objective of the course is to learn about energy conversion techniques, sources of electrical energy production and impact of energy conversion systems on environment.							
Course Outcomes: On successful completion of this course, the students will be able to							
CO 1	Understand various energy conversion systems, fuel cells & batteries						
CO 2	Analyze solar and wind energy conversion process						
CO 3	Illustrate Ocean Energy Conversion systems						
CO 4	Explain the environmental effects of Energy Conversion Systems.						

UNIT I

Photo Voltaic Power Generation: Spectral distribution of energy in solar radiation, solar cell configurations, voltage developed by solar cell, photo current and load current, practical solar cell performance, test specifications for PV systems.

UNIT II

Wind Energy Conversion: Power from wind, properties of air and wind, types of wind Turbines, operating characteristics.

UNIT III

Tidal Power Station: Tides and Tidal power stations - modes of operation of Tidal project - Turbines and Generators for Tidal Power generation.

Ocean Thermal Energy Conversion: Types of ocean thermal energy conversion systems, Application of OTEC systems examples.

UNIT IV

Miscellaneous Energy Conversion Systems: Biomass conversion, Geothermal energy, Thermo electric energy conversion: Seebeck effect, Peltier and Thomson effects and their coefficients – Thermo-Electric Generator – Peltier Cooling

UNIT V

Fuel Cells & Batteries: Introduction - principles of EMF generation - description of fuel cells - Batteries, Description of batteries, Battery applications for large power.

Environmental Effects: Environmental Effects of Energy Conversion Systems, Pollution from coal and preventive measures - steam stations and pollution - pollution free energy systems.

Text Books

1. "Energy conversion systems" by Rakosh das Begamudre, New age international Private Ltd., publishers, 1st Edition, 2000.
2. "Renewable Energy Resources" by John Twidell and Tony Weir, CRC Press (Taylor & Francis).

Course Title	**Internet of Things**				**B. Tech. EEE Open Elective - 2**		
Course Code	**Category**	**Hours/Week**		**Credits**	**Maximum Marks**		
18OE204	**Open Elective (OEC)**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**Total**
		3	**0**	**0**	**3**	**30**	**70**	**100**
Mid Exam Duration : 2Hrs					**End Exam Duration : 3Hrs**		
Course Objectives: The objective of the course is to learn basic components of IoT & its Applications.							
Course Outcomes: On successful completion of this course, the students will be able to							
CO 1	Understanding IoT technology						
CO 2	Understating the elements used in IoT						
CO 3	Understanding basics of python programming						
CO 4	Applying the basic concepts of IoT with Arduino and Raspberry pi board						

UNIT-I

Introduction to Internet of Things: Introduction- Definition and Characteristics of IOT, Physical Design of IOT-Things in IOT, IOT Protocols, Logic Design of IOT-Functional Blocks,

Communication Models, IOT Enabled Technologies-Wireless Sensor Networks, Communication protocols, Embedded Systems, IOT Levels and Templates

UNIT-II

Elements of IoT: What is IOT Device, Basic Building blocks of an IOT Device, Sensors, Actuators, Details of Arduino - About Board Peripherals, Details of Raspberry Pi-About Board Peripherals.

UNIT-III

Logic Design: Introduction to Python, Python Data Types-Numbers, Strings, Lists, Tuples, Dictionaries, Type Conversions, Control Flow, Functions, Modules.

UNIT-IV

IoT Application Development: Programming Arduino- Controlling LED, Interfacing an LED and Switch, Interfacing a Light Sensor. Programming Raspberry Pi- Controlling LED, Interfacing an LED and Switch, Interfacing a Light Sensor.

UNIT-V

Case Studies of IoT: Smart Lighting, Smart Irrigation, Weather Monitoring System, Smart Parking.

Text Books:

1. "INTERNET OF THINGS a Hand on Approach" by Arshdeep Bahga, Vijay Madisetti, Universities Press.
2. "Getting Started with the Internet of Things" by Cuno Pfister, o'REYLLY

Course Title	**Intelligent Control Techniques**				**B. Tech. EEE Open Elective - 3**		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**	
18OE205	**Open Elective (OEC)**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**Total**
		3	**1**	**0**	**3**	**30**	**70**	**100**
Mid Exam Duration: 2 Hrs						**End Exam Duration : 3Hrs**		
Course Objectives: The objective of the course is to learn neural network and fuzzy logic concepts and foster their abilities in designing and implementing soft computing based solutions for real-world and engineering problems.								
Course Outcomes: On successful completion of this course, the students will be able to								
CO 1	Understand architecture and approach to Artificial intelligence							
CO 2	Understand the fundamental theory and concepts of neural networks, Identify different neural network architectures, algorithms and their models							
CO 3	Understand the concepts of fuzzy sets, knowledge representation using fuzzy rules, approximate reasoning, fuzzy inference systems, and fuzzy logic							

	systems
CO 4	Understand the Bio-inspired and Swarm Intelligence Algorithms

UNIT I

Introduction to Artificial Intelligence: Introduction and motivation – Approaches to AI – Architectures of AI – Symbolic Reasoning System –Rule based Systems – Knowledge Representation.

UNIT II

Artificial Neural Networks: Basics of ANN - Comparison between Artificial and Biological Neural Networks – Basic Building Blocks of ANN – Artificial Neural Network Terminologies – McCulloch Pitts Neuron Model – Learning Rules.

UNIT III

ADALINE and MADALINE Models – Perceptron Networks – Back Propagation Neural Networks – Associative Memories Neural Networks as Associative Memories

UNIT IV

Fuzzy Logic: Classical Sets – Fuzzy Sets – Fuzzy Properties and Operations – Fuzzy Logic System – Fuzzification – Defuzzification – Membership Functions – Fuzzy Rule base – Fuzzy Logic Controller Design.

UNIT V

Evolutionary Computation - Overview of other Bio-inspired Algorithms - Swarm Intelligence Algorithms

Text Books

1. Introduction to Neural Networks using MATLAB by S. N. Sivanandam, S. Sumathi and S. N. Deepa, Tata McGraw Hill Edition, 2006.
2. Kumar S., "Neural Networks - A Classroom Approach", Tata McGraw Hill, 2004.
3. Fuzzy Logic with Engineering Applications by Timothy J. Ross, WILEY India Edition, 3rd Edition, 2012.

Reference Books

1. Intelligent System – Modeling, Optimization & Control by Yung C. Shin and Chengying Xu, CRC Press, 2009.
2. Eiben A. E. and Smith J. E., "Introduction to Evolutionary Computing", Second Edition, Springer, Natural Computing Series, 2007.
3. Engelbrecht A. P., "Fundamentals of Computational Swarm Intelligence", John Wiley & Sons, 2006.

Course Title	**Electrical System Estimation & Costing**					**B. Tech. EEE Open Elective - 3**		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
18OE206	Open Elective (OEC)	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**Total**

		3	0	0	3	30	70	100
Mid Exam Duration: 2 Hrs						**End Exam Duration : 3Hrs**		
Course Objectives: The objective of the course is to learn about estimating and costing of wiring systems, earthing systems, various light schemes and its calculations.								
Course Outcomes: On successful completion of this course, the students will be able to								
CO 1	Understand principles of wiring systems and its estimation based on choice of wiring system							
CO 2	Understand the concepts of earthing systems							
CO 3	Understand various lightening schemes and its calculations used for domestic and industrial applications							
CO 4	Analyze estimation of wiring to residential & commercial buildings							

UNIT-I

General principles of estimating: Estimating – purpose of estimating and costing – catalogues – market survey and source selection - determination of required quantity of materials – determination of cost material and labor.

Wiring systems: Introduction – Systems of distribution of electrical energy – methods of wiring – systems of wiring – choice of wiring systems.

UNIT – II

Earthing Systems: Earthing – Points to be earthed – Factors influencing earth resistance – methods od reducing Earth resistance – Design data on earth electrodes – Methods of earthing – determination of size of earth wire and earth plate – Effects of electric current on Human body – Measurement of earth resistance.

UNIT - III

Lighting schemes and calculations: Types of lighting circuits – Various circuit diagrams – Two way switching – Aspects of good lighting service – Types of lighting schemes – Filament Lamps- Gas filled Lamps – Fluorescent Tubes - LED lamp – Compact Fluorescent lamp (CFL) – comparison between LED and CFL – terms used in illumination – laws of illumination.

UNIT - IV

Estimation of lighting schemes: Design of lighting schemes - Factory lighting – Public lighting installations: Classification – General principles – Design – Selection of equipment - Street lighting – Methods of lighting calculations.

UNIT-V

Internal wiring estimation: General rules for wiring – determination of number of points – determination of total load – determination of sub circuits – determination of ratings of main switch and distribution board – determination of size of conductor – layout – simple problems.

Text books

1. Electrical installation estimating & Costing – J.B.Gupta, S.K.Kataria& sons.

2. Electrical design estimating and costing – K.B.Raina&S.K.Bhattacharya, NewAge International (P) Limited publishers.

Reference Books

1. Power System Analysis and Design – Dr.B.R.Gupta, S.Chand Publications
2. Electrical Estimating methods – Wayne J.Del Pico, Wiley Publishers

Course Title	**Basics of Power Electronics**				**B. Tech. EEE Open Elective - 4**		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**	
18OE207	Open Elective (OEC)	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**Total**
		3	**0**	**0**	**3**	**30**	**70**	**100**
Mid Exam Duration : 2Hrs						**End Exam Duration : 3Hrs**		

Course Objectives: The objective of the course is to learn basic fundamentals of power electronics devices and to classify the different kinds of power electronics circuits as a function of the input source and loads.

Course Outcomes: On successful completion of this course, the students will be able to,

CO 1	To understand the characteristics of different power switches.
CO 2	To understand the single phase and three phase controlled rectifier with different loads
CO 3	To understand the operating principle of cyclo converters, choppers and inverters
CO 4	To understand harmonic content in output voltage and current waveforms of an inverter.

UNIT I

Fundamentals of Power Semi-conductor devices: SCR – static characteristics –turn on and off mechanism – MOSFET, IGBT, GTO Characteristics.

UNIT II

Phase controlled Rectifiers(AC to DC): Phase controlled rectifiers – single phase half and fully controlled converters – midpoint and bridge connections with R and RL loads – effect of source inductance- three phase half controlled converters with R load .

UNIT III

AC Voltage Controllers (AC to AC): AC voltage controllers- single phase ac voltage controllers with SCR for R and RL load – cyclo converters – single phase cyclo converters (mid-point configuration) with R load.

UNIT IV

Choppers (DC to DC): Choppers – principle of operation – control strategies- types of chopper circuits – type A, type B- buck -boost converter.

UNIT V

Inverters (DC to AC): Inverters – single phase half bridge and full bridge inverters with R and RL load –output voltage control techniques - PWM techniques- harmonic reduction techniques.

Text Books

1. Power Electronics –M.D Singh & K.B. Kanchandhani, TMH publications, 1998.
2. Power Electronics - Circuits, Devices and Applications –M.H. Rashid, Prentice Hall of India, 2nd Edition 1998.

Reference Books

1. Power Electronics- P.S. Bimbhra, Khanna Publications.
2. Power Electronics –Vedam Subramanyam, New Age Information Limited, 3rd Edition.
3. Power Electronics –V.R. Murthy, Oxford University Press, 1st Edition – 2005.
4. Power Electronics –P.C Sen, Tata Mc Graw Hill Publishing.

Course Title	**System Reliability Concepts**				**B. Tech. EEE Open Elective - 4**		
Course Code	**Category**	**Hours/Week**		**Credits**	**Maximum Marks**		
18OE208	Open Elective (OEC)	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**Total**
		3	**1**	**0**	**3**	**30**	**70**	**100**
Mid Exam Duration: 2 Hrs					**End Exam Duration : 3Hrs**		
Course Objectives: The objective of the course is to learn basic probability theory, network modeling, time dependent probability, markov modeling and system reliability evaluation.							
Course Outcomes: On successful completion of this course, the students will be able to							
CO 1	Understand the concept of basic probability theory, binomial distribution, network reliability, reliability functions, time dependent probability, markov chains & process and system reliability						
CO 2	Apply probability rules to find probability distributions, network reliability for series, parallel, series-parallel, complex networks						
CO 3	Analyze the failure rate distributions, bath-tub curve, STPM, continuous markov process and frequency duration techniques for single and two repairable components						
CO 4	Evaluate transitional rates, cumulative probability and frequency n-						

	component repairable models

UNIT-I

Basic Probability Theory: Basic concepts – Rules for combining Probabilities of events – Failure Density and Distribution functions – Bernoulli's trials – Binomial distribution – Expected value and standard deviation for binomial distribution – Examples.

UNIT-II

Network Modeling and Reliability Evaluation: Basic concepts – Evaluation of network Reliability / Unreliability – Series systems, Parallel systems, Series - Parallel systems, partially redundant systems – Types of redundancies - Evaluation of network Reliability / Unreliability using conditional probability method – Paths based and Cut set based approach – Examples.

UNIT-III

Time Dependent Probability: Basic concepts – Reliability functions f(t), F(t), R(t), h(t) – Relationship between these functions – Bath tub curve – Expected value and standard deviation of Exponential distribution – Measures of reliability – MTTF, MTTR, MTBF – Evaluation of network reliability / Unreliability of simple Series, Parallel – Examples.

UNIT-IV

Discrete Markov Chains: Basic concepts – Stochastic transitional Probability matrix (STPM) – Limiting State Probability evaluation – Absorbing states.

Continuous Markov Processes: Modeling concepts – State space diagrams – time dependent reliability evaluation of single component repairable model – Evaluation of Limiting State Probabilities of one, two component repairable models – Frequency and duration concepts – Frequency balance approach.

UNIT-V

Multi Component & Approximate System Reliability Evaluation: Recursive relation for evaluation of equivalent transitional rates, cumulative probability and cumulative frequency and 'n' component repairable model - Series systems, Parallel systems, Basic reliability indices – Cut-set approach – Examples.

Text Books

1. Reliability Evaluation of Engineering Systems by Roy Billinton and Ronald N. Allan, Reprinted in India B. S. Publications, 2007.
2. System Reliability Concepts by V. Sankar, Himalaya Publishing House, 2015.

Reference Books

1. Reliability Engineering by E. Balagurusamy, Tata McGraw Hill, 2003.
2. Reliability and Maintainability Engineering by Charles E. Ebeling, Tata McGraw Hill, 2000.