Flexible Scheme & Syllabus

2020-2021

B.Tech.

in

Electrical Engineering

(V Semester)

Madhav Institute of Technology & Science

Gwalior-474005

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR

(A Govt. Aided UGC Autonomous Institute Affiliated to RGPV, Bhopal, MP)

Electrical Engineering Department

Signals & Systems: 130511

Course Objectives:

To develop an understanding of fundamental characteristics of signals and systems in both time and transform domains and to develop mathematical skills to solve problems involving convolution, filtering, modulation and sampling.

Unit I. Dynamic Representation of Systems: Definition & Classification of signals, Systems Attributes, Causality linearity, Stability, time invariance. Special Signals, Complex exponentials, Singularity functions (impulse and step functions). Linear Time-Invariant Systems: Differential equation representation convolution Integral. Discrete form of special functions. Discrete convolution and its properties, Realization of LTI system (differential and difference equations).

Unit II. Fourier Analysis of Continuous Time Signals and Systems: Fourier Series, Fourier Transform and properties, Parseval's theorem, Frequency response of LTI systems, Sampling Theorem.

Unit III. Fourier Analysis of Discrete Time Signals & Systems: Discrete-Time Fourier series, Discrete-Time Fourier Transform (including DFT) and properties, Frequency response of discrete time LTI systems.

Unit IV. Laplace Transform: Laplace Transform and its inverse: Definition, existence conditions, Region of Convergence and properties, Application of Laplace transform for the analysis of continuous time LTI system (stability etc.) Significance of poles & zeros. Z-Transform: Z-Transform and its inverse: Definition, existence, Region of convergence and properties, Application of Z-Transform for the analysis of Discrete time LTI Systems, Significance of poles and zeros.

Unit V. Sampling: The sampling theorem, reconstruction of signal from its samples, sampling in the frequency domain, sampling of discrete-time signals.

Recommended Books:

1. Signal and systems by Oppenheim AV, Willisky AS and Nawab SH, Pearson
2. Signals and systems by Hwel. P. Hsu, Schaum's outlines, TME
3. Digital Signal Processing Principles by Proakis JP, Manolaxis, Pearson
4. Fundamentals of Signals & Systems by Michael J Roberts, McGraw Hill

Course outcomes focused on employability/entrepreneurship and skill development

Course Outcomes:

S No.	Course Outcome (CO)	Mapping
1	**Explain** the process of sampling and the effects of under sampling.	Skill Development
2	**Classify** systems based on their properties and determine the response of LSI system using convolution.	Skill Development
3	**Apply** the concepts of linear algebra to signals.	Skill Development
4	**Analyze** the spectral characteristics of continuous-time periodic and a periodic signal using Fourier analysis.	Skill Development
5	**Analyze** system properties based on impulse response and Fourier analysis.	Skill Development
6	**Apply** the Laplace transform and Z- transform for analysis of continuous-time and discrete-time signals and systems.	Skill Development

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Electrical Engineering Department

Power System-II: 130512

Course Objectives:

- To expose the students to the concepts of Load Flow Studies, Symmetrical and Unsymmetrical Faults, Power System Stability, Power System Control, Underground Cables and HVDC Transmission System.
- To enable the students to solve problems related to Load Flow Studies, Fault analysis, Power System Stability, Power System Control and Underground Cables.

Unit I. System Representation and Load Flow Analysis: Single line representation, Per unit system, Network Model formulation, Formulation of Y_{BUS}, Formation of static load flow equations, solution of load flow problem by Gauss-Seidel, Newton-Raphson (polar and rectangular) and fast decoupled load flow methods.

Unit II. Symmetrical and unsymmetrical fault: Review of symmetrical components, sequence networks, symmetrical fault analysis, unsymmetrical fault analysis, analysis of open conductor fault, fault calculations for symmetrical and unsymmetrical faults.

Unit III. Power System Stability: Basic concepts of steady state, dynamic and transient stability, power angle equation, synchronizing power coefficient, equal area criterion, critical clearing angle, Swing equation, Concept of multi-machine transient stability studies with classical machine representation,factor affecting stability and methods of its improvement.

Unit IV. Power System Control: Elementary idea of load-frequency control, automatic generation control, reactive power and voltage control. Series and shunt compensation techniques, tap changing transformers, phase shifting transformers, Induction regulator, Economic limit of VAR control.

Unit V. Underground Cables and HVDC Transmission: Types of cables, Insulation resistance of cable, Electrostatic stress and grading of cables, rating and power factor of cables, Brief history of DC transmission, comparison of HVDC with EHV AC transmission systems, Basic converter circuit used in HVDC system, types of HVDC links.

Recommended Books:

1. Advanced Power System Analysis and Dynamics, L.P. Singh, Wiley Eastern Ltd, 6th Ed. 2017.
2. Modern Power System Analysis, Nagrath& Kothari, TMH Publishers, 4th Ed. 2016.
3. Elements of Power System Analysis, W.D. Stevenson, McGraw-Hill, 4th Ed. 2017.
4. Power system operation and control, A.J. Wood &Woollenberg, 2nd Ed. 2010.
5. HVDC Power Transmission Systems: Technology and System Interactions, K. R. Padiyar, New Age International, 3rd Ed. 2017.

Course outcomes focused on employability/entrepreneurship and skill development

Course Outcomes:

S No.	Course Outcome (CO)	Mapping
1	**Explain** the concepts of single line diagram and per unit system	Skill Development
2	**Apply** different load flow techniques to solve load flow problem	Employability
3	**Perform** fault calculations for symmetrical and unsymmetrical faults	Employability
4	**Explain** the theoretical and practical aspects of Power System Stability and its enhancement	Skill Development
5	**Elucidate** the automatic generation control reactive power, voltage control, series and shunt compensation	Skill Development
6	**Discuss** the insulation resistance, capacitance of various types of cables and the need of HVDC transmission	Employability

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Electrical Engineering Department

Power System-II Lab: 130512

List of Experiments:

1. To study EHV AC Transmission Line Simulation Panel.
2. To measure resistance, inductance and capacitance of EHV AC Transmission Line Simulation Panel.
3. To study cables, insulators and line supports used in transmission and distribution system
4. To calculate generalized circuit constants for short, medium and long transmission line of EHV AC Transmission Line Simulation Panel.
5. To simulate L-G, L-L, L-L-G, L-L-L, L-L-L-G faults using MATLAB
6. To write MATLAB code to determine the maximum power without loss of synchronism using equal area criterion
7. To write MATLAB code for determination of the critical clearing angle and critical clearing time.
8. To determine the system stability from the swing curve.
9. To determine stability of the system using MATLAB.
10. A visit and study of 33kV Substation.

Course Outcomes:

At the end of the Laboratory work the students will be able to

CO1 **Demonstrate** the different components and working of EHV AC transmission of simulation panel.
CO2 **Determine** transmission line parameters.
CO3 **Simulate** the different types of faults in transmission lines using MATLAB.
CO4 **Identify** the different components of substation & their applications
CO5 **Familiar** with construction & application of various insulators, cables & line support.
CO6 **Prepare a report** for presentation.

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Electrical Engineering Department

Electrical Machines-II: 130513

Course Objective:

- To develop basic concepts about AC machines, their constructional details and working principles and to understand the practical applications and operational issues of three phase transformer and other rotating machines

UNIT-I Transformer: Three phase transformers, Special construction features, Single phase Transformers connected as 3 phase bank, Phasor diagram of star/star, Star/delta, Delta/delta, Delta/star, connected 3 phase transformers and their uses, Phase conversion, Three to two phase open delta or V connection, Parallel operation of single phase and three phase Transformers, load sharing, harmonics in transformer, Magnetization current wave form, Tertiary winding**.**

UNIT-II Induction Motor II: Circle diagram and its experimental determination, cogging and Crawling Losses, Efficiency and Testing I.M, Double cage induction motor, Operation on unbalanced voltages, Speed control, Rotor resistance control, pole changing method, Frequency control, Induction generator, Introduction to Single phase Induction motor.

UNIT-III Synchronous Machine I: Constructional features, Salient pole and cylindrical synchronous machines, Relation between speed, Frequency and no. of poles, excitation, Voltage generation, Generator mode, Interaction between excitation flux and armature EMF, Voltage regulation, phasor diagram on load, Leakage reactance and synchronous reactance, Steady state parameters of synchronous machines, open circuits, short circuit and zero power factor tests, Determination of voltage regulation by synchronous impedance method, MMF method and Potier triangle method.

UNIT-IV Synchronous Machine II: Two reaction theory, Slip test, Expression for power developed and power angle curves, Synchronization of alternators Dark and bright lamp method**,** Synchro scope Parallel operation and load string, Effect of governor characteristics on load sharing, Operation on infinite bus bar.

UNIT-V Synchronous Machine III: Motoring mode, transition from motoring to generating mode, V curves starting, Synchronous condenser, Hunting, damper winding synchronizing torque and power analysis under sudden short circuit, Transient parameters of synchronous machines, Various transient and sub transient reactance, Time constant, Expression of transient and sub transient reactance Analysis of 3 phase short circuit oscillogram and determination of transient parameters from oscillogram, Short circuit ratio.

Recommended Books:

1. Theory of Alternating current Machinery by Alexender S Langsdorf.
2. The performance and design of AC machines by M.G. Say, CBS Publication.
3. Electric machine by Nagrath and Khotari. TMH.
4. Generalized theory of electrical machine by P.S. Bimbhra, Khanna publication
5. Electrical machines by P.S. Bimbhra, Khanna publication
6. The Performance and Design of AC Commutator Machines by Openshaw Taylor. CBS Publication

Course outcomes focused on employability/entrepreneurship and skill development

Course Outcomes:

S No.	Course Outcome (CO)	Mapping
1	**Analyze** the performance of 3-phase induction and synchronous machines using equivalent circuits & phasor diagrams under different loading conditions.	Skill Development
2	**Explain** the constructional details and working principle of three phase transformer and synchronous machine**.**	Skill Development

3	**Develop** phasor diagram and determine voltage regulation of an alternator and its steady state performance.	Skill Development
4	**Determine** time constant, various sequence reactance and equivalent circuit parameters under transient conditions for synchronous machines.	Skill Development
5	**Analyze** the behavior of synchronous machine connected to infinite bus and parallel operation of alternators.	Skill Development
6	**Analyze** the performance of 3-phase induction and synchronous machines using equivalent circuits & phasor diagrams under different loading conditions	Employability

Electrical Machines-II Lab: 130513

List of Experiments:

1. To conduct No Load & Blocked Rotor test on 3-Phase squirrel Cage Induction Motor and plot circle diagram.
2. To conduct Load Test on 3-Ph Sq. Cage Induction Motor and plot performance curve.
3. To conduct No Load & Blocked Rotor Test on 3-Ph Slip Ring Induction Motor and plot performance curve.
4. To conduct Load Test on 3-Ph Slip Ring Induction Motor and plot performance curve.
5. To study the cascaded connection of two 3-Phase Slip Ring induction motor.
6. To find out OCC and SCC of an Alternator and its regulation using synchronous impedance method.
7. To find regulation of Alternator using Zero Power Factor (ZPF) method.
8. To draw V Curves of Synchronous motor.
9. To perform Synchronization of Alternators.
10. (a) Determination of Xd&Xq of an alternator using Slip Test.

(b) Determination of Xd" &Xq" of an alternator (Positive sequence Reactance).

11. Virtual lab simulation of Conventional Electrical Machines.

Course Outcomes:

At the end of the Laboratory work the students will be able to

- **CO 1. Demonstrate** an understanding of the fundamental control practices associated with AC machines (starting, reversing, braking, plugging, etc.).
- **CO 2. Use** accepted national and international standards (such as NEMA, IE Code) to select appropriate electrical machines to meet specified performance requirements.
- **CO 3. Conduct** testing and experimental procedures on different types of electrical machines.
- **CO 4. Develop** the ability to work is team and learns professional ethics
- **CO 5. Prepare** an organized written report

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Electrical Engineering Department

Power Electronics: 130514

Course Objective:

- To introduce the students the basic theory of power semiconductor devices and passive components, their practical application in power electronics and
- To familiarize the operation principle of AC-DC, DC-DC, DC-AC conversion circuits and their applications. Also to provide the basis for further study of power electronics circuits and systems.

Unit I. Power Semiconductor Devices: Classification of Power electronic switches, Power diodes, Transistors, Power MOSFET, IGBT, Thyristor TRIAC and GTO, Thyristor static and dynamic characteristics, two transistor equivalent model, Turn on and turn off. Firing circuits and protection, Design of snubber circuit, Series and parallel operation.

Unit II. Controlled Rectifiers: Principle of phase-controlled converter operation, Single phase half wave, full wave and semi converters. Three phase half wave, full wave and semi converters and inverters, Power factor improvement, Symmetrical angle control. Pulse width modulation control, Effect of load and source inductance.

Unit III. Chopper: Principles of single quadrant, Two quadrant, four quadrant chopper, Control strategies, Pulse width modulation, Frequency modulation, Thyristor commutation schemes, switched mode power supplies, buck-boost regulators.

Unit IV. AC voltage controller: Principle of Ac phase control, Single and three phase Ac voltage controllers, practical cyclo-converter circuits, Single phase to single phase, three phase to single phase, three phase to three phase out put voltage control circuit, Cyclo-converter, Circulating and Non Circulating type, Dual converters.

Unit V. Inverter circuits: Principle of operation of voltage source inverter, Single phase and three phase inverters, Voltage control using PWM technique, Forced commutated thyristors, Current source inverters, Series inverter, Inverter applications.

Recommended Books:

1. Power Electronics by P.S. Bimbhra, Khanna Publishers, 5th Ed., 2012
2. Power Electronics: Circuits, Devices & Applications by MH Rashid, Pearson, 5th Ed. 2012
3. Power Electronics by Cyril W.Lander ,McGraw-Hill; 2nd Ed.,1987
4. Power Electronics Principles and Applications by JosephVidyathil, TMH,2010
5. Bose, B.K., Handbook of Power Electronics, IEEE Publications.

Course outcomes focused on employability/entrepreneurship and skill development

S No.	Course Outcome (CO)	Mapping
1	**List**power electronics devices and explain their static/ dynamic characteristics**.**	Skill Development
2	**Ability** to analyze the configuration of AC to DC converter, Dual converter, chopper, cyclo-converter.	Skill Development
3	**Classify** converters and identify their applications**.**	Skill Development
4	**Develop** different model of different converters to calculate their performance parameter	Skill Development
5	**Identify** the problems/limitations of power electronics devices, converters and suggest solutions.	Employability

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Electrical Engineering Department

Power Electronics Lab: 130514

List of Experiments

1. To observe the performance of SCR using
   (i) R-triggering Circuit (Half-wave phase control)
   (ii) RC-triggering Circuit (Half-wave phase control and full wave phase control)
2. TRIAC/ SCR Triggering with series transistor-controlled ramp based on UJT/PUT
3. To determine the dv/dt capacity of SCR and design Snubber Circuits.
4. To observe the performance of Half controlled bridge rectifier (semi converter)
   (i) With Reactive load.
   (ii) With reactive load & freewheeling diode.
5. To observe the performance of fully controlled bridge converter operates underrectification& inverter mode.
6. To study the operation of AC phase controller using R and RL load
7. To observe the performance of MOSFET based Buck Boost converter in open and closed loop
8. Study of Force Commutation of SCR
   (i). Class-A or self-commutation by resonating the load.
   (ii). Class-B or self-commutation by LC Circuit.
   (iii). Class-C or Complementary commutation.
   (iv). Class-D or Auxiliary commutation.
   (v). Class-E or External pulse commutation.
9. Realization of Half-wave Rectifier and Full-wave Rectifier with RL, RLE, FD Loadusing MATLAB.
10. Realization of Voltage Source Inverter with three phase Load in MATLAB.
    (i). 1800 Conduction Mode
    (ii). 1200 Conduction Mode

Course Outcomes:

After completing the LAB course, the students will be able to

CO1 Demonstrate VI characteristics of Semiconductor Devices and Various Firing scheme of SCR.
CO2 Demonstrate the performance of various converters AC to DC and DC to ACconverter
CO3 Compare the performance of single and three phases VSI Inverter.
CO4 Demonstrate the performance of converters in its different modes of operation.
CO5 Prepare an organized written report.
CO6 Develop the ability to work is team and learns professional ethics.

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Electrical Engineering Department

Data Science: 130515

Course Objectives:

- To provide the fundamental knowledge of Data Science.
- To present the basic representation and exploratory data analysis used in Data Science.
- To understand the working of techniques used in Data Science.

- **Course outcomes focused on employability/entrepreneurship and skill development**

S No.	Course Outcome (CO)	Mapping
1	**Define** different Data Science techniques.	Skill Development
2	**Illustrate** various tools used for Data Science technique.	Skill Development
3	**Apply** data visualization techniques to solve real world problems.	Skill Development
4	**Build** exploratory data analysis for Data Science methods.	Employability
5	**Apply** Data Science techniques for solving real world problems.	Employability
6	**Evaluate** the performance of algorithms in data science.	Employability

Unit 1: Need for data science, benefits and uses, facets of data, data science process, Introduction ofbasics python tool, Setting working Directory, Creating and saving a script file, Fileexecution, removing variables from environment, clearing environment, Commenting scriptfiles, Variable creation, Data types and associated operations, Arithmetic and logicaloperators.

Unit 2: Control structures, loop, Functions, data structures: Lists, Arrays, Tuples, Dictionary, Sets,NumPylibrary, Data Collection: Getting to know your data, Types of Data, Data collectionstrategies, Data Pre-processing, Feature engineering, Exploratory Data Analytics.

Unit 3: Descriptive Statistics, Mean, Standard Deviation, Skewness and Kurtosis, inferentialstatistics: hypothesis testing, probability: probability theory, conditional probability, Pandaslibrary, data frame and data frame related operations, Reading files.

Unit 4: Data Cleaning and Preparation, Handling Missing Data, Data Transformations using pandasand sklearn library, Removing Duplicates, Replacing Values, Detecting Outliers. Datavisualization on different dataset using matplotlib and seaborn libraries, Scatter plot, Lineplot, Bar plot, Histogram, Box plot, Pair plot.

Unit 5: Supervised learning: Regression, classification, Linear regression, logistic regression,decision tree, tree creation with entropy and information gain, ID3 algorithm, random forest,naïve bayes theorem, K-nearest neighbor and ensemble methods for solving real world problems, Unsupervised learning: Clustering, Reinforcement learning.

Recommended Books:

1. Mastering python for data science, Samir Madhavan
2. Introduction to linear algebra - by Gilbert Strang
3. Applied statistics and probability for engineers – by Douglas Montgomery
4. Pattern Recognition and Machine Learning, Christopher M. Bishop

Course outcomes focused on employability/entrepreneurship and skill development

S No.	Course Outcome (CO)	Mapping
1	**List**power electronics devices and explain their static/ dynamic characteristics**.**	Skill Development
2	**Ability** to analyze the configuration of AC to DC converter, Dual	Skill Development

	converter, chopper, cyclo-converter.	
3	**Classify** converters and identify their applications**.**	Skill Development
4	**Develop** different model of different converters to calculate their performance parameter	Skill Development
5	**Identify** the problems/limitations of power electronics devices, converters and suggest solutions.	Employability

Data Science (Lab): 130515

1. To write a program using arithmetic operators & logical operators each.
2. Write a function using recursion to print a factorial of number.
3. To write a program in python for demonstrating various functions (creating, appending, extending, etc.) of a list and dictionary.
4. To write a program to create one array using two existing NumPy arrays.
5. To write a program for the creation and manipulation of NumPy arrays- Indexing, Slicing, Reshaping, Joining and Splitting.
6. To write a program to create a 10 x 10 array with random values and find the minimum and maximum values.
7. To write a program to create the following data frame and fill in the missing values with last three digits of your enrolment number. Also, perform various operations (like describe, replacing values, removing null values, etc.)

Name	Institute	Height	Weight
AAA	**MITS**	**6**	**75**
BBB	**JEC**	**NaN**	**80**
CCC	**SATI**	**6.5**	**NaN**
DDD	**RGPV**	**5.9**	**NaN**

8. To write a program to Import Sample Dataset files (.csv,.xls) to Pandas DataFrame and perform the File Handling operations:
   a. Visualize the first and last 10 records
   b. Get the shape, index and column details
   c. Select/Delete the records (rows)/columns based on conditions.
   d. Perform ranking and sorting operations.
   e. Rename single/multiple columns.

9. To write a program to visualize the following data using Line Plots, Bar Plots, Histograms, Density Plots and Scatter Plots, pie charts etc.
11. To write a linear regression program for the following data set.
12. To write a program to perform different image processing operations on a given image.
13. To write a program to calculate the mean, mode, and median for the ODD and EVEN data series.
14. To write a program to solve second and third-order differential equations with and without initial conditions.
15. To write a program to identify the different clusters for the given data set.

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Disaster Management: 1000006

Course Objectives:

i) To understand basic concepts in Disaster Management
ii) To understand Definitions and Terminologies used in Disaster Management
iii) To understand Types and Categories of Disasters
iv) To understand the Challenges posed by Disaster
v) To understand Impact of Disasters key skills

Syllabus:

Unit 1: Introduction to disaster management, concepts and definitions: disaster, vulnerability, risk severity, frequency and details, capacity impact, prevention, mitigation.

Unit 2: Disasters – Disasters classification, demographic aspects (gender, age, special needs); hazard locations; global and national disaster trends, hazard and vulnerability profile of India.

Unit 3: Disaster Impacts – Disaster impact (environmental, physical, social, ecological, economic, political, etc.); health, psycho-social issues, impact of natural disasters (floods, draught, cyclones, volcanoes, earthquakes, tsunami, landslides etc.), impact of manmade disasters (industrial pollution, artificial flooding in urban areas, urban disasters, transportation accidents etc.).

Unit 4: Disaster Risk Reduction (DRR)- Disaster management cycle- its phases; prevention, mitigation, preparedness, relief and recovery; structural and non- structural measures; risk analysis, vulnerability and capacity assessment; early warning systems, Post disaster environmental response. Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders: Policies and legislation for disaster management. DRR programmes in India and the activities of National Disaster Management Authority.

Unit 5: Disasters, Environment and Development – Factors affecting vulnerability such as impact of development projects and environmental modifications (including of dams, land use changes, urbanization etc.), sustainable and environmental friendly recovery; reconstruction and development methods.

Course Outcomes:

After successful completion of the course, the students will be able to

CO1: Identify disaster prevention and mitigation approaches.
CO2: Classify global and national disasters, their trends and profiles.
CO3: Determine the impacts of various disasters.
CO4: Apply Disaster Risk Reduction in management.
CO5: Infer the linkage between disasters, environment and development.

Text Books:

1. Pradeep Sahni, 2004, Disaster Risk Reduction in South Asia, Prentice Hall.
2. Ghosh G.K., 2006, Disaster Management, APH Publishing Corporation

3. Srivastava H.H. & Gupta G.D., Management of Natural Disasters in developing countries, Daya Publishers Delhi, 2006.

Reference Books:

1. http://ndma.gov.in (Home page of National Disaster Management Authority)
2. http://www.ndmindia.nic.in / (National Disaster Management in India)
3. Singh B.K., 2008, Handbook of Disaster Management: Techniques & Guidelines, Rajat Publication.
4. National Disaster Management Policy, 2009, GOI.
5. Inter Agency Standing Committee (IASC) (Feb. 2007), IASC Guidelines on Mental Health and Psychosocial Support in Emergency Setting. Geneva: IA