B.Tech. Third Semester

Scheme & Syllabus

(2022 Admitted batch)

DEPARTMENT OF ELECTRICAL ENGINEERING

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR
(A Govt. Aided UGC Autonomous Institute Affiliated to RGPV, Bhopal)
NAAC Accredited with A++ Grade
Race Course Road, Gola Ka Mandir, Gwalior, M.P. 474005
Website: https://web.mitsgwalior.in/

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR

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Scheme of Evaluation B.Tech. III Semester
(Electrical Engineering)

(for batch admitted in academic session 2022-23)

S. No.	Subject Code	Category Code	Subject Name	Maximum Marks Allotted							Total Marks	Contact Hours per week			Total Credits	Mode of Teaching	Mode of Exam
				Theory Slot				Practical Slot									
				End Term Evaluation		Continuous Evaluation		End Sem. Exam	Continuous Evaluation			L	T	P			
				End Sem. Exam	$Proficiency in subject /course	Mid Sem. Exam.	Quiz/ Assignment		Lab Work & Sessional	Skill Based Mini Project							
1.	2100025	BSC	Engineering Mathematics – II	50	10	20	20	-	-	-	100	2	1	-	3	Offline	PP
2.	2130311	DC	Electromagnetic Field Theory	50	10	20	20	-	-	-	100	2	1	-	3	Blended	PP
3.	2130312	DC	Electrical Machine-I	50	10	20	20	60	20	20	200	2	1	2	4	Blended	PP
4.	2130313	DC	Power System -I	50	10	20	20	60	20	20	200	2	1	2	4	Blended	PP
5.	2130314	DC	Analog & Digital Electronics	50	10	20	20	60	20	20	200	2	1	2	4	Blended	MCQ
6.	2130315	DLC	Self-learning/ Presentation (SWAYAM/NPTEL/MOOC)#	-	-	-	-	-	40	-	40	-	-	2	1	Online +Mentoring	SO
7.	200xxx	CLC	Novel Engaging Course (Informal Learning)	-	-	-		50	-	-	50	-	-	2	1	Interactive	SO
8.	2130316	DLC	Summer Internship Project–I (Institute Level Evaluation)	-	-	-	-	60	-	-	60	-	-	4	2	Offline	SO
Total				**250**	**50**	**100**	**100**	**290**	**100**	**60**	**950**	**10**	**5**	**14**	**22**	**-**	**-**
9.	3000002	Natural Sciences & Skills	Engineering Chemistry	50	10	20	20	30	10	10	150	1	-	2	Grade	Blended	MCQ
10.	1000001	MAC	Indian Constitution and Traditional Knowledge	50	10	20	20	-	-	-	100	2	-	-	Grade	Online	MCQ
Summer Internship Project – I (Institute Level) (Qualifier): Minimum two-week duration: Evaluation in III Semester.																	

$Proficiency in course/subject – includes the weightage towards ability/ skill/ competency /knowledge level /expertise attained etc. in that particular course/subject.

Natural Sciences& Skills: Engineering Physics / Engineering Chemistry / Environmental Science/ Language.

Credits of Natural Sciences & Skills will be added in the VI Semester.

MCQ: Multiple Choice Question **AO:** Assignment + Oral **OB:** Open Book **PP:** Pen Paper **SO:** Submission + Oral

Electromagnetic Field Theory: 2130311

Course Objectives:

1. To provide the knowledge of electromagnetic fields and its use in understanding the working principles of various power apparatus and machines.
2. To lay the foundations of electromagnetism and its practice in modern communications such as wireless, guided wave principles etc.
3. To provide the basic concepts of vectors and fields, electrostatics, electric current flow, magnetic fields, Maxwell's equations, and electromagnetic wave propagation.

Unit I: Electrostatics – I
Sources and effects of electromagnetic fields – Coordinate Systems –Vector fields –Gradient, Divergence, Curl – theorems and applications - Coulomb's Law – Electric field intensity –Field due to discrete and continuous charges – Gauss 's law and applications.

Unit II: Electrostatics – II
Electric potential – Electric field and equipotential plots, Uniform and Non-Uniform field, Utilization factor – Electric field in free space, conductors, dielectrics - Dielectric polarization- Dielectric strength- Electric field in multiple dielectrics – Boundary conditions, Poisson's and Laplace's equations, Capacitance, Energy density, Applications.

Unit III: Magnetostatics
Lorentz force, magnetic field intensity (H) – Biot Savart's Law -Ampere's Circuit Law – H due to straight conductors, circular loop, infinite sheet of current, Magnetic flux density (B) – B in free space, conductor, magnetic materials – Magnetization, Magnetic field in multiple media – Boundary conditions, scalar and vector potential, Poisson's Equation, Magnetic force, Torque, Inductance, Energy density, Applications.'

Unit IV: Electrodynamic Fields
Magnetic Circuits - Faraday's law – Transformer and motional EMF –Displacement current Maxwell's equations (differential and integral form) – Relation between field theory and circuit theory– Applications.

Unit V: Electromagnetic Waves
Electromagnetic wave generation and equations – Wave parameters; velocity, intrinsic impedance, propagation constant – Waves in free space, lossy and lossless dielectrics, conductors- skin depth– Pointing vector – Plane wave reflection and refraction – Standing Wave –Applications.

Recommended Books:

1. Elements of Electromagnetic by Mathew N.O Sadiku, Oxford.
2. Electromagnetic Fields by P.V. Gupta, Dhanpat Rai.
3. Element of Engineering Electromagnetic by N.N. Rao, PHI.
4. Engineering Electromagnetic by William H. Hayt; TMH.
5. Electromagnetic by John D. Kraus, TMH.
6. Electromagnetic wave & Radiating System by Jordan Balmian, PHI.
7. Fields and Wave Electromagnetic by David K. Cheng, Addison Wesley.
8. Electromagnetic Field by S.P. Seth, Dhanpat Rai & Sons

Course Outcomes

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

CO1: **Apply** vector calculus to understand the behavior of static electric fields in engineering configurations

CO2: **Describe** Maxwell's equations in differential and integral forms and apply them to diverse engineering problems

CO3: **Formulate** engineering problems of Electromagnetic, Electrostatic and Magnetic to Static circuits using Basic relations.

CO4: **Explain** the nature of Electromagnetic wave propagation and wave polarization.

CO5: **Solve** engineering problems of Electromagnetic.

Electrical Machines-I: 2130312

Course Objectives:

- To develop basic concepts of AC and DC machines, their constructional details and working principles and
- To familiarize the students with the practical applications and operational issues of transformer, induction motor and DC machines.

Unit- I Single Phase Transformer: Phasor diagram, Efficiency and voltage regulation, All day efficiency. Testing of Transformers-O.C. and S.C. tests, Sumpner's test, and Polarity test. Auto Transformer- Single phase and three phase auto transformers, Volt-amp relation, Efficiency, Merits &demerits and applications.

Unit- II D.C. Machines I: Construction of DC Machines, Armature winding, EMF and torque equations, Armature reaction, Commutation, Interpoles and compensating windings, Performance characteristics of DC generators.

Unit- III D.C. Machines II: Performance characteristics of DC motors, Starting of DC motors; 3point and 4 point starters, Speed control of DC motors; Field control, Armature control and Voltage control (Ward Leonardo method); Efficiency and Testing of D.C. machines (Hopkinson's and Swinburn's Test).

Unit- IV Three Phase Induction Motor: Review of constructional details. Principle of operation, Slip. Production of torque, Steady state analysis. Phasor diagram, equivalent circuit. Power flow diagram and Torque speed characteristics. Starting methods.

Unit-V: 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.

Recommended Books:

1. Electric Machines by D.P. Kothari &I.J. Nagrath, Tata McGraw Hill
2. Electric Machines by Ashfaq Hussain, Dhanpat Rai & Company
3. Electric Machinery by A.E Fitzerald, Kingsley and S.D. Umans, McGraw Hill.
4. Electrical Machinery by P.S. Bimbhra, Khanna Publisher
5. Generalized Theory of Electrical Machines by P.S. Bimbhra, Khanna Publishers
6. Alternating Current Machines by M.G.Say, Pitman & Sons

Course Outcome (CO)

CO 1. Explain the principles and construction of different AC and DC machines.

CO 2. Discuss the fundamental control practices such as starting, reversing, braking, plugging etc. associated with AC and DC machines.

CO 3. Analyze the performance of AC and DC machines.

CO 4. Develop the equivalent circuits and compute the induced emf, torque, efficiency, losses etc.

CO 5. Describe various tests conducted for evaluating the performance of AC and DC machines.

CO 6. Evaluate the performance of machines under different operating conditions.

Electrical Machines-I Lab: 2130312

LIST OF EXPERIMENTS

1. To Perform direct load test on single phase transformer
2. To perform parallel operation on two single phase transformers
3. To obtain magnetization characteristics of DC shunt generator
4. To obtain internal and external characteristics of DC shunt generator
5. To control the speed of DC shunt motor(Armature and Field Control)
6. To perform load test on DC shunt motor (Mechanically loaded)
7. To perform load test on DC compound motor (Electrically loaded)
8. To perform various three phase transformer connections
9. To perform load test on induction motor
10. To conduct No Load & Blocked Rotor Test on 3-Ph Slip Ring Induction Motor and plot performance curve.
11. To obtain speed torque characteristics of 3 phase induction motor.
12. A virtual lab simulation of conventional electrical machines.

Course outcomes

CO 1. Draw characteristics of electric machine for a specific purpose, requirement.
CO 2. Determine the efficiency of any transformer, regulation of any transformer.
CO 3. Conduct Load sharing by two or more machines
CO 4. Develop the ability to work in team and learns professional ethics

Skill Based Mini Project

Electrical Machines-I

1. Draw the LAP connected winding arrangement of DC Machines
2. Draw the WAVE connected winding arrangement of DC Machines
3. Draw the construction of DC Machines and also explain its parts
4. Draw the construction of Induction Machines and also explain its parts
5. Draw the phasor diagram of single-phase transformers in lagging, leading and unity power factor load
6. Draw the phasor diagram of 3-phase Induction motor in lagging, leading and unity power factor load
7. Draw the MMF diagram of DC Machines and also explain the effect of Armature reaction
8. How are torque are produced in DC and AC Machines.
9. Discuss with suitable diagrams compare AC and DC Machines
10. Write applications of DC and AC machines in various domestic and Industrial applications

Power System –I: 2130313

Course Objectives

- To Familiarize the students with conventional and Non-Conventional energy sources and their use in electrical power generation.
- To expose the students with Transmission and distribution system, line parameters, performance of transmission lines, power plant economics and different types of tariffs.

Unit 1: Energy Resources and Electrical Power Generation: Introduction to Conventional and non-conventional energy resources; National and International energy trends; Global warming and greenhouse effects. Generation of electrical power, overview of conventional power generation: Hydro, Thermal, Nuclear and Gas Power; Renewable energy generation.

Unit 2: Transmission and Distribution Systems: Introduction, electrical supply system, comparison of AC and DC systems : conductor volume etc., overhead versus underground systems, choice of working voltages for transmission and distribution, transmission and distribution systems, Overhead line insulators, types of insulators pin, suspension and strain insulators, insulator materials, insulator string; Calculation of voltage distribution and string efficiency, methods of equalizing voltages, use of guard rings. Corona.

Unit 3: Line Parameters: Types of conductor, Inductance of a conductor due to internal flux, Inductance of a single phase & three phase transmission line, Self & mutual G.M.D., Inductance of three phase symmetrical and unsymmetrical spaced lines, transposed lines. Bundle conductors, skin effect, capacitance of single & three phase transmission line, effect of earth and charging current, transmission line communication and line interference.

Unit 4: Performance of Overhead Transmission Line: Single line diagram of power system, ABCD constant and equivalent circuits of short, medium and long transmission line, regulation and efficiency of short, medium, transmission line, Ferranti effect, surge impedance loading. Long transmission line, Generalized circuit equation relation between generalized circuit constant for simple network

Unit-5 Power plants Economics and Tariff: Size and number of generating units. Effect of load factor on cost of generation, Load curves, Maximum demand, Load factor, diversity factor, Plant capacity and plant use factor, type of tariffs and economics of power factor improvements.

Recommended Books:

1. Electric Power Generation, Transmission and Distribution by S.N. Singh, Prentice Hall of India, 2nd Edition.

2. Power system Analysis by A. Husain A, CBS Pub & Distributor.

3. Power System Analysis by B.R. Gupta B.R, S Chand & Co.

4. Electrical Power by S.L. Uppal, Khanna Publishers Limited, New Delhi.

5. Electrical Power Systems by C.L.Wadhwa, New Age International Publishers Ltd., New Delhi

Course Outcomes

After the completion of this course, students will be able to:

CO 1. **Describe** the general structure and supply systems used in power systems
CO 2. **Develop** the knowledge of generation of electricity based on conventional and nonconventional energy sources
CO 3. **Evaluate** the string efficiency, corona losses etc.
CO 4. **Determine** the transmission line parameters
CO 5. **Analyze** the performance of overhead transmission line
CO 6. **Describe** the concept of power plant economics, types of tariffs and power factor economics

Power System-I Lab: 2130313
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 **Determine** transmission line parameters.

CO2 **Simulate** the different types of faults in transmission lines using MATLAB.

CO3 **Identify** the different components of substation & their applications

CO4 **Familiar** with construction & application of various insulators, cables & line support.

CO5 **Prepare a report** for presentation.

Analog & Digital Electronics: 2130314

Course Objectives:

The course intends to provide an understanding of the principles, operation and application of the analog building blocks like diodes, BJT, FET etc. for performing various functions. Furthermore, the course is likely to impart knowledge of various techniques of digital electronics like K-map for simplified analysis, understanding of combinational & sequential circuits.

Unit- I: Diodes and Transistors

Diodes, their characteristics & applications, clipper, clamper circuits, BJT, transistor biasing, CE, CB, CC configurations, input output characteristics, DC load line, small signal analysis.

Unit-II: Amplifiers& FETs

BJT usage as switch & amplifier, Darlington pair, differential amplifier using BJT, Operational Amplifiers their types & applications, JFET, V-I characteristics, MOSFET& its types, ADC & DAC converters, Multivibrators, 555 timer.

Unit-III: Digital Circuits

Digital (binary) operations of a system, OR gate, AND gate, NOT, EXCLUSIVE OR gate, De Morgan Laws, NAND and NOR DTL gates, Comparison of logic families, properties of Boolean Algebra

Unit-IV: Combinational Logic Circuits

K-Map: Sum-of-Products Method, Truth Table to Karnaugh Map, Pairs Quads, and Octets, Karnaugh Simplifications, Don't-care Conditions, Product-of-sums Method, Product-of-sums simplifications. Multiplexers, three state buffers, decoders and encoders, Programmable Logic devices

Unit-V: Sequential Logic Circuits

Sequential Circuits, Storage Elements: Latches and flip flops, FLIP-FLOP Timing, SR, JK Master-slave, Analysis of Clocked Sequential Circuits, State Reduction and Assignment, Shift Registers, Asynchronous, Ripple& Ring Counters, Synchronous Counters, Random-Access Memory, Read-Only Memory.

Recommended Books:

1. Microelectronics Circuits by A.S. Sedra & K.C. Smith, Oxford University Press (1997)

2. Electronic Principles by A.P. Malvino, Tata Mcgraw Hill Publications

3. Electronic Devices & Circuit Theory by Robert L. Boylestad & Louis Nashelsky,

4. Digital Electronics by William Kleitz, Prentice Hall International Inc.

5. Introduction to Electronic Devices Michael Shur by John Wiley & Sons Inc., 2000.

6. Op-Amps and Linear Integrated Circuits by Ramakant Gayakwad, Pearson

7. Digital Logic and Computer Design by Morris Mano, Pearson

Course Outcomes:

After the completion of this course students will be able to:

CO1. Explain working principles of electronic devices e.g. Diode, Transistor, Amplifier, and Op-Amp.

CO2.Categorize the different types of diode, Amplifier, Op-Amp, Flip-flop, logic gates and counters.

CO3.Describe the various mathematical models of transistors

CO4.Apply the various principles of digital electronics to design different types of Digital Electronics circuits for various applications.

CO5.Understand working of various digital electronics circuits like multiplexer, coder circuits, shift registers & counters

Analog & Digital Electronics :2130314

List of Experiments

1. To measure and plot the forward and reverse V-I characteristics of diode.
2. To measure and plot the forward and reverse V-I characteristics of the SCR.
3. To test and plot input and output common emitter transistor characteristics.
4. To verify the operation of Darlington pair and determine the gain, input and output Impedances.
5. To design and test differential and two stage RC coupled Amplifier using Transistor.
6. Verification of truth tables of

   (a)OR, AND NOT gates (By using 7400-series) (b)NAND &

   NOR gates.

   (c)EX-NOR & EX-OR gates.
7. Verification of De-Morgan's Theorem using ICs.
8. Implementations of Multiplexer & Demultiplexer using logic gates (ICs) and verify truth table.
9. Implementations of Half Adder & Full Adder &Half Subtractor& Full Subtractor using logic gates (ICs) and verify truth table.
10. Operation and verifying truth tables of flip- flops- RS, D, and JK using ICs.

Course Outcomes

CO1. Develop skill to build and troubleshoot analog and digital circuits.

CO2. Examine the input-output characteristics of analog circuits SCR, Transistor and Amplifier.

CO3. Apply Boolean algebra techniques to verify and implement the digital circuits

CO4. Develop teamwork skills for working effectively in groups

CO5. Prepare technical report on experiments conducted in the lab.

Skill Based Mini Project

1. Construct a 6x6x6 or a 7x7x7 LED cube that will be operated through multiplexing.
2. Implement a four-way intersection with an intelligent traffic regulation method using logic gates.
3. Construct a calculator to do addition and subtraction of binary numbers.
4. Design a parking counter, having a main entrance and the entire area should be split into at least 3 sections.

5. Design a vending machine with full display for cash as well as items dispensed.

6. Design a generator circuit that generates pulses of varying duty cycle depending on user selection.

7. Design a parking counter, having a main entrance and a main exit.

8. Construct a 16-bit Pseudo Random Number Generator.

9. Street Light Circuit using analog circuit methodology.

10. Air Flow Detector Circuit using analog circuit methodology.

List of courses from SWAYAM/NPTEL/MOOC Platforms to be offered (for the batch admitted in 2022-23) in online mode under Self-Learning/ Presentation, in the III Semester

S. No.	Course Name	Offered By	Duration of course	Start date	End date
1.	Business And Sustainable Development	IITB	4 Weeks	August 21, 2023	September 15, 2023
2.	C Programming And Assembly Language	IITM	4 Weeks	August 21, 2023	September 15, 2023
3.	Laplace Transform	IMSc	4 Weeks	July 24, 2023	August 18, 2023
4.	Moral Thinking: An Introduction To Values And Ethics	IITK	4 Weeks	August 21, 2023	September 15, 2023
5.	Sociology And Resource Management	IITKGP	4 Weeks	August 21, 2023	September 15, 2023
6.	Water, Society And Sustainability	IITKGP	4 Weeks	August 21, 2023	September 15, 2023