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24.02.2021

Board of Studies

Meeting held on

28-11-2020

Proceedings

Electrical Engineering Department
MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR
(A Govt. Aided UGC Autonomous & NAAC Accredited Institute Affiliated to RGPV, Bhopal, MP)

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR

(A Govt. Aided UGC Autonomous & NAAC Accredited Institute Affiliated to RGPV, Bhopal)

Agenda of the BoS

(Approved by the Academic Development Cell for all BoS Meetings Scheduled in November 2020)

Item 1:	To propose the list of courses which the students can opt from SWAYAM/ NPTEL/ MOOC Platform, to be offered in ***online mode under Departmental Elective (DE) category,*** for credit transfer in the ***VIII Semester*** *(Batch admitted in 2017-18): applicable during January-June 2021 academic session*
Item 2:	To propose the list of courses which the students can opt from SWAYAM/ NPTEL/ MOOC Platform to be offered *(*for students of other departments) in ***online mode under Open Category (OC)*** for credit transfer in the ***VIII Semester*** *(Batch admitted in 2017-18): applicable during January-June 2021 academic session*
Item 3:	To propose the list of "Additional Courses" which can be opted for getting an ***(i) Honours (for students of the host department)*** ***(ii) Minor Specialization (for students of other departments)*** *[These will be offered through SWAYAM/NPTEL/MOOC based Platforms for the* ***VI semester (for the batch admitted in 2018-19) and for VIII semester students*** *(for the batch admitted in 2017-18)]applicable during January-June 2021 academic session*
Item 4:	To review and finalize the list and syllabi for all ***Departmental Elective (DE) Courses*** of ***VI Semester*** *to be offered to* ***(the batch admitted in 2018-19)*** under the flexible curriculum along with their COs ; { *applicable during January-June 2021 academic session}*
Item 5:	To review and finalize the list of Courses from SWAYAM/NPTEL/MOOC Platform to be offered ***(for batch admitted in 2018-19)*** in online mode under ***Departmental Elective (DE) Courses*** for credit transfer in the ***VI Semester*** *{applicable during January-June 2021 academic session}*
Item 6:	To review and finalize the Courses & Syllabi to be offered ***(for batch admitted in 2018-19)*** under the ***Open Category (OC) Courses*** for ***VI semester*** students of other departments along with their COs
Item 7:	To review and finalize the *Courses & Syllabi* to be offered *(to the batch admitted in 2018-19)* under *Departmental Core (DC)* Courses for the *IV & VI semester* students along with their COs
Item 8:	To review and finalize the ***Scheme & Syllabi (I & II semester)*** **of the NEW *B. Tech.* programme(s)** to be started by the departments w.e.f. the batch admitted in 2020-21
Item 12:	To identify ***gaps in CO attainment levels*** for ***Jan-June 2020 semester*** and propose corrective measures for improvement
Item 13:	To prepare and propose the equivalence list of courses for B. Tech programmes (for 2017-18, 2018-2019, 2019-2020 & the 2020 admitted batch)
Item 14:	Any other matters Panel of Examiners. - P.G. List of Courses from SWAYAM/NPTEL/MOOC Platform to be offered ***(for batch admitted in 2020-2021)*** in online mode under ***Departmental Elective (DE) Courses*** for credit transfer in the **ME(ISD), II Semester**. List of Courses from SWAYAM/NPTEL/MOOC Platform to be offered *(*for students of other departments) in ***online mode under Open Category (OC)*** for credit transfer in the **ME/MTech, II Semester** *(Batch admitted in 2020-2021).*

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR

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Electrical Engineering Department

Date: 28-11-2020

Minutes of Meeting Board of Studies

The Board of Studies (BoS) meeting of Electrical Engineering department was held Online on 28th November 2020 at 3:00 pm onwards. Following external members were invited in addition to the faculty members of the department:

1. **Dr. A.K. Sharma**, Principal, JEC Jabalpur **(VC, RGPV nominee)**
2. **Dr. Mukhtiar Singh**, Professor, Department of Electrical Engineering, DTU Delhi **(Subject Expert)**
3. **Dr. D.K. Chaturvedi**, Professor, Electrical Engineering Department, DEI Agra, **(Subject Expert)**
4. **Er. R.K Mahapatra**, AGM, BHEL, Jhansi **(Industry Expert)**
5. **Er. Dileep Dixit**, DGM, NTPC, Delhi, **(Alumnus)**

Above mentioned External experts and the following internal members attended the meeting:

Dr. L. Srivastava	Dr. H. M. Dubey	Prof. Kuldeep Swarnkar	Prof. Nipun Gupta	Prof. Saurabh Kumar
Dr. M. Pandit	Dr. Shishir Dixit	Prof. Praveen Bansal	Prof. Rahul Sagwal	Prof. Shweta Kumari
Dr. A.K. Wadhwani	Prof. Rakesh Narvey	Prof. Vishal Chaudhary	Prof. Tarun Shrivastava	Prof. Aprajita Kumari
Dr. S. Wadhwani	Dr. Himmat Singh	Prof. Punjan Dohare	Prof. Bhavna Rathore	Prof. Manoj Kumar
Prof. Ashish Patra	Dr. Vijay Bhuria	Dr. Vikram	Prof. Shailendra Pratap	

Agenda-wise summary of the BoS meeting is as follows:

Item EE 1: To propose the list of courses which the students can opt from SWAYAM/ NPTEL/ MOOC Platform, to be offered in online mode under Departmental Elective (DE) category, for credit transfer in the VIII Semester (Batch admitted in 2017-18): applicable during January-June 2021 academic session

B. Tech. VIII Semester

DE 5: Courses _ SWAYAM/NPTEL/MOOC

Code	Name of the course	Offered By	Duration of the course	Course Registration		Examination date	Name of the Mentor faculty
				Start Date	End date		
130851	Fuzzy Logic and Neural Networks	IIT KGP	8 Weeks	February 15, 2021	April 9, 2021	April 25, 2021	Prof. P. Bansal Prof. Nipun Gupta
130852	Waste to Energy Conversion	IITR	08 Weeks	January 18, 2021	March 12, 2021	March 21, 2021	Dr. Himmat Singh Dr. Vikram
130853	Renewable Energy Engineering: Solar, Wind and Biomass Energy Systems	IITG	08 Weeks	January 18, 2021	March 12, 2021	March 21, 2021	Dr. Himmat Singh Prof. S. Rajput

Note: Credit for Opting a Particular NPTEL Course will be given only once during the tenure of B.Tech. Program.

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR

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Electrical Engineering Department

Item EE 2: To propose the list of courses which the students can opt from SWAYAM/ NPTEL/ MOOC Platform to be offered (for students of other departments) in ***online mode under Open Category (OC)*** for credit transfer in the ***VIII Semester*** *(Batch admitted in 2017-18): applicable during January-June 2021 academic session*

B. Tech. VIII Semester OC-4

Code	Name of the course	Offered By	Duration of the course	Course Registration		Exam. date	Name of the Mentor faculty
				Start Date	End date		
900301	Waste to Energy Conversion	IITR	8 Weeks	January 18, 2021	March 12, 2021	March 21, 2021	Dr. H. Singh Dr. Vikram
900302	Fuzzy Logic and Neural Networks	IIT KGP	8 Weeks	February 15, 2021	April 9, 2021	April 25, 2021	Prof. P. Bansal Prof. Nipun Gupta

Note: Credit for Opting a Particular NPTEL Course will be given only once during the tenure of B.Tech. Program.

B. Tech. Semester – VIII OC-5

Code	Name of the course	Offered By	Duration of the course	Course Registration		Examination date	Name of the Mentor faculty
				Start Date	End date		
900311	Renewable Energy Engineering: Solar, Wind and Biomass Energy Systems	IITG	08 Weeks	January 18, 2021	March 12, 2021	March 21, 2021	Dr Vijay Bhuria Prof. S. Rajput
900312	Non-Conventional Energy Resources	IITM	12 Weeks	January 18, 2021	April 9, 2021	April 25, 2021	Prof. Vishal Chaudhary Prof. Rahul Sagwal

Note: Credit for Opting a Particular NPTEL Course will be given only once during the tenure of B.Tech. Program.

Item EE 3: To propose the list of "Additional Courses" which can be opted for getting an

(i) Honours (for students of the host department)

(ii) Minor Specialization (for students of other departments)

*[These will be offered through SWAYAM/NPTEL/MOOC based Platforms for the **VI semester (for the batch admitted in 2018-19)and for VIII semester students** (for the batch admitted in 2017-18)]applicable during January-June 2021 academic session*

B. Tech. VI Semester (**Honours**)

Name of the course	Offered By	Course Duration	Course Registration		Examination date	Name of Faculty Mentor
			Start Date	End date		
The Joy of Computing using Python	IIT Ropar	12 Weeks	January 18, 2021	April 9, 2021	April 24, 2021	Prof. Rahul Sagwal
Introduction to Robotics	IITK	12 Weeks	January 18, 2021	April 9, 2021	April 25, 2021	Prof. A. Patra Dr. Vikram
Linear Dynamical Systems	IIT Mandi	08 Weeks	January 18, 2021	March 12, 2021	March 21, 2021	Prof. SP Singh
Fundamentals of semiconductor devices	IISc, BLR	12 Weeks	January 18, 2021	April 9, 2021	April 25, 2021	Dr. HM. Dubey Prof. Manoj Kumar

Non-Conventional Energy Resources	IITM	12 Weeks	January 18, 2021	April 9, 2021	April 25, 2021	Prof. Vishal Chaudhary Prof. S. kumar Rajput
Power System Dynamics, Control and Monitoring	IIT, KGP	12 Weeks	January 18, 2021	April 9, 2021	April 25, 2021	Dr. S. Dixit Prof. Rahul Sagwal
Sensors and Actuators	IISc, BLR	12 Weeks	January 18, 2021	April 9, 2021	April 25, 2021	Dr. A.K. Wadhwani Prof. Aprajita Kumari
Robotics and Control: Theory and Practice	IITR	8 Weeks	January 18, 2021	March 12, 2021	March 21, 2021	Dr. S. Wadhwani Dr. Vikram
Biomedical Signal Processing	IIT, KGP	12 Weeks	January 18, 2021	April 9, 2021	April 24, 2021	Dr. A.K. Wadhwani Prof. Punjan Dohare

Note: Credit for opting a particular NPTEL course will be given only once throughout the tenure of B.Tech. program.

B.Tech. VI Semester
Minor Specialization

Name of the course	Offered By	Course Duration	Course Registration		Examination date	Name of Faculty Mentor
			Start Date	End date		
Fundamentals of semiconductor devices	IISc, BLR	12 Weeks	January 18, 2021	April 9, 2021	April 25, 2021	Dr. HM. Dubey Prof. Manoj Kumar
Power System Engineering	IIT KGP	12 Weeks	January 18, 2021	April 9, 2021	April 24, 2021	Dr. S. Dixit Prof. Rahul Sagwal
Non-Conventional Energy Resources	IITM	12 Weeks	January 18, 2021	April 9, 2021	April 25, 2021	Prof. Vishal Chaudhary Prof. S. kumar Rajput
Fundamental of Power Electronics	IISc, BLR	12 Weeks	January 18, 2021	April 9, 2021	April 25, 2021	Dr. HM. Dubey Prof. Manoj Kumar
Principles of Signals and Systems	IITK	12 Weeks	January 18, 2021	April 9, 2021	April 25, 2021	Prof. Kuldeep Swarnkar Dr. Vikram
Control engineering	IITM	12 Weeks	January 18, 2021	April 9, 2021	April 24, 2021	Prof. A. Patra Prof. P. Dohare
Electrical Machines	IITD	12 Weeks	January 18, 2021	April 9, 2021	April 25, 2021	Prof. P. Bansal Prof. Nipun Gupta
Biomedical Signal Processing	IIT KGP	12 Weeks	January 18, 2021	April 9, 2021	April 24, 2021	Dr. A.K. Wadhwani Prof. P. Dohare

Note: Credit for opting a particular NPTEL course will be given only once throughout the tenure of B.Tech. program.

B. Tech. VIII Semester (**Honours**)

Name of the course	Offered By	Course Duration	Course Registration		Examination date	Name of Faculty Mentor
			Start Date	End date		
The Joy of Computing using Python	IIT Ropar	12 Weeks	January 18, 2021	April 9, 2021	April 24, 2021	Prof. Rahul Sagwal
Introduction to Robotics	IITK	12 Weeks	January 18, 2021	April 9, 2021	April 25, 2021	Prof. A. Patra Dr. Vikram
Linear Dynamical Systems	IIT Mandi	08 Weeks	January 18, 2021	March 12, 2021	March 21, 2021	Prof. SP Singh
Fundamentals of semiconductor devices	IISc, BLR	12 Weeks	January 18, 2021	April 9, 2021	April 25, 2021	Dr. HM. Dubey Prof. Manoj Kumar
Non-Conventional Energy Resources	IITM	12 Weeks	January 18, 2021	April 9, 2021	April 25, 2021	Prof. Vishal Chaudhary Prof. S. kumar Rajput
Power System Dynamics, Control and Monitoring	IIT, KGP	12 Weeks	January 18, 2021	April 9, 2021	April 25, 2021	Dr. S. Dixit Prof. Rahul Sagwal
Sensors and Actuators	IISc, BLR	12 Weeks	January 18, 2021	April 9, 2021	April 25, 2021	Dr. A.K. Wadhwani Prof. Aprajita Kumari
Robotics and Control: Theory and Practice	IITR	8 Weeks	January 18, 2021	March 12, 2021	March 21, 2021	Dr. S. Wadhwani Dr. Vikram
Biomedical Signal Processing	IIT, KGP	12 Weeks	January 18, 2021	April 9, 2021	April 24, 2021	Dr. A.K. Wadhwani Prof. Punjan Dohare

Note: Credit for opting a particular NPTEL course will be given only once throughout the tenure of B.Tech. program.

B.Tech. VIII Semester(**Minor Specialization**)

Name of the course	Offered By	Course Duration	Course Registration		Examination Date	Name of Faculty Mentor
			Start Date	End date		
Fundamentals of semiconductor devices	IISc	12 Weeks	January 18, 2021	April 9, 2021	April 25, 2021	Dr. HM. Dubey Prof. Manoj Kumar
Power System Engineering	IIT KGP	12 Weeks	January 18, 2021	April 9, 2021	April 24, 2021	Dr. S. Dixit Prof. Rahul Sagwal
Non-Conventional Energy Resources	IITM	12 Weeks	January 18, 2021	April 9, 2021	April 25, 2021	Prof. Vishal Chaudhary Prof.Saurabhkumar Rajput
Fundamental of Power Electronics	IISc	12 Weeks	January 18, 2021	April 9, 2021	April 25, 2021	Dr. HM. Dubey Prof. Manoj Kumar
Principles of Signals and Systems	IITK	12 Weeks	January 18, 2021	April 9, 2021	April 25, 2021	Prof. Kuldeep Swarnkar Dr. Vikram
Control engineering	IITM	12 Weeks	January 18, 2021	April 9, 2021	April 24, 2021	Prof. A. Patra Prof. Punjan Dohare
Electrical Machines	IITD	12 Weeks	January 18, 2021	April 9, 2021	April 25, 2021	Prof.P.Bansal Prof.Nipun Gupta
Biomedical Signal Processing	IIT KGP	12 Weeks	January 18, 2021	April 9, 2021	April 24, 2021	Dr. A.K. Wadhwani Prof.PunjanDohare

Note: Credit for opting a particular NPTEL course will be given only once throughout the tenure of B.Tech. program.

Item EE 4: To review and finalize the list and syllabi for all Departmental Elective (DE) Courses of VI Semester to be offered to (the batch admitted in 2018-19) under the flexible curriculum along with their COs ; { applicable during January-June 2021 academic session}

1. Computer Aided Power System Analysis
2. Industrial Automation
3. Transducers & Sensors
4. Solar PV System: Design and Economics (Newly added)

ANNEXURE -1

Item EE 5: To review and finalize the list of Courses from SWAYAM/NPTEL/MOOC Platform to be offered (for batch admitted in 2018-19) in online mode under Departmental Elective (DE) Courses for credit transfer in the VI Semester {applicable during January-June 2021 academic session}

DE 2: Courses _SWAYAM/NPTEL/MOOC

Code	Name of the course	Offered By	Duration of the course	Start Date	End date	Examination date	Name of the Mentor faculty
~~130651~~ 130655	Waste to Energy Conversion	IITR	08 Weeks	January 18, 2021	March 12, 2021	March 21, 2021	Prof. ~~Vishal Chaudhary~~ Kuldeep Swarnkar Prof. Bhavna Rathore
~~130652~~ 130656	Renewable Energy Engineering: Solar, Wind and Biomass Energy Systems	IITG	08 Weeks	January 18, 2021	March 12, 2021	March 21, 2021	Prof. ~~Kuldeep Swarnkar~~ Vishal Chaudhary Prof. Shweta Kumar

Note: Credit for Opting a Particular NPTEL Course will be given only once during the tenure of B.Tech. Program.

Item EE 6: To review and finalize the Courses & Syllabi to be offered (for batch admitted in 2018-19) under the Open Category (OC) Courses for VI semester students of other departments along with their COs

Open Category (OC) Courses for VI semester

1. OC-A: Energy Conservation & Management
2. OC-B: Biomedical Instrumentation

ANNEXURE -2

Item EE 7: To review and finalize the Courses & Syllabi to be offered (to the batch admitted in 2018-19) under Departmental Core (DC) Courses for the IV & VI semester students along with their COs

ANNEXURE -3

Item EE 8: To review and finalize the Scheme & Syllabi (I & II semester) of the NEW B. Tech. programme(s) to be started by the departments w.e.f. the batch admitted in 2020-21

ANNEXURE -4

MADHAV INSTITUTE OF TECHNOLOGY AND SCIENCE, GWALIOR

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Department of Electrical Engineering

An online Board of Studies (BoS) meeting was held on 28/11/2020. During the discussion the following summer internship modules were finalized as a part of summer internship – I to be offered for 2020-21 admitted students

Modules Run in May-June 2021 (Electrical Engineering)		
S.No.	**Module Name**	**Code**
1.	Electricity usage for Domestic & Industrial applications.	EE0318S1
2.	Introduction to Solar systems & Solar Photovoltaic (PV) Modeling using PVsyst Software and Simulink	EE0320S1
3.	Hands-on Training on MATLAB / SIMULINK	EE0320S2
Modules Run in May-June 2021 (Internet of Things)		
1.	Electricity usage for Domestic & Industrial applications.	EO0318S1
2.	Introduction to Solar systems & Solar Photovoltaic (PV) Modeling using PVsyst Software and Simulink	EO0320S1
3.	Hands-on Training on MATLAB / SIMULINK	EO0320S2

Dr.Laxmi Srivastava

Dr.Laxmi Srivastava
Prof. & Head, EED

Detail of Annexure

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR

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Electrical Engineering Department

Scheme of Examination

B.Tech. VIII Semester (Electrical Engineering)

S. No.	Subject Code	Category	Subject Name & Title	Maximum Marks Allotted							Total Marks	Contact Hours per week			Total Credits
				Theory Slot			Practical Slot		MOOC						
				End Sem.	Mid Sem. Exam	Quiz/ Assignment	End Sem.	Term Work							
								Lab Work & Sessional	Assignment	Exam		L	T	P	
1.	130851 to 130853	DE	DE* (DE-5)	-	-	-	-	-	25	75	100	2	-	-	2
2.	900301 to 900302	OC	OC* (OC-4)	-	-	-	-	-	25	75	100	2	-	-	2
3.	900311 to 900312	OC	OC* (OC-5)	-	-	-	-	-	25	75	100	2	-	-	2
4.	130801	DLC	Internship/Project (DLC-9)	-	-	-	250	150	-	-	400	-	-	6	3
5.	130802	-	Professional Development#	-	-	-	-	50	-	-	50	-	-	2	1
			Total	-	-	-	250	200	75	225	750	6	-	8	10
Additional Courses for obtaining Honours or minor Specialization by desirous students			Permitted to opt for maximum two additional courses for the award of (i) Honours in parent discipline or (ii) Honours with Minor Specialization in engineering discipline other than the parent discipline.												

*All of these courses will run through SWAYAM/ NPTEL/ MOOC

#Evaluation will be based on participation/awards brought by the students to the institution in national/state level technical and other events during the complete tenure of the UG program(no separate in professional chapter activities, club activities, cultural events, sports, personality development activities, collaborative events, MOOCs & technical events)

DE-5 *(SWAYAM/NPTEL)		OC-4* (For students of other branches)		OC-5* (For students of other branches)	
130851	Fuzzy Logic and Neural Networks	900301 900605	Waste to Energy Conversion	900311 900607	Renewable Energy Engineering: Solar, Wind and Biomass Energy Systems
130852	Waste to Energy Conversion	900302	Fuzzy Logic and Neural Networks	900312	Non-Conventional Energy Resources
130853	Renewable Energy Engineering: Solar, Wind and Biomass Energy Systems		-		-

130851 Introduction to Internet of things

DEAN (ACADEMICS)
M.I.T.S
GWALIOR

Annexure-1

DE-1A (130611)

Computer Aided Power System Analysis

L	T	P	Total Credits	Theory End Sem	Mid Sem	Quiz/Assignment
04	-	-	04	70	20	10

Course Objectives:

- To familiarize the students with the engineering and economic aspects of planning, operation & control of power generation and transmission systems.
- To provide the basic understanding of Artificial Neural Networks and their applications in power system.

Unit I: Unit Commitment and Economic Dispatch: Introduction to unit commitment, statement of unit commitment problem, priority list method, forward dynamic programming, formulation of economic dispatch problem, input-output cost characterization, incremental cost curve, coordination equations with and without loss, solution by direct method and lambda iteration method.

Unit II: Reactive Power Control: Concept of reactive power, control of active power and reactive power - active power and frequency control, flow of reactive power, real power balance and its effect on system frequency; Static VAR systems and their application.

Unit III: Automatic Generation Control (AGC): Frequency dependence of loads, Turbine and speed-governors, Droop control and power sharing, Generation control loops, Load frequency control, AGC, tie-line bias control, AGC in isolated and interconnected power systems, AGC with economic dispatch.

Unit IV: Power System Security: An overview of Power System security, Functions of Operations Control Centre: System monitoring (Normal, Alert, Emergency, Extremis states of a Power System), Contingency Analysis, Security constrained Optimal Power Flow, Factors affecting power system security, Linear sensitivity factors, Application of AC/DC power flow methods, Contingency selection.

Unit V: Applications of Artificial Neural Networks in Power System: Introduction to Artificial neural network (ANN), Types of artificial neural networks, Feed-forward and Feedback ANNs, training and testing of ANNs, Training set generation, ANN applications to power system problems: load forecasting, fault detection, economic load dispatch and voltage security & stability etc.

Recommended Books:

1. Modern Power System Analysis by I.J. Nagrath and D.P. Kothari, Tata McGraw-Hill, 4th ed. 2011.
2. Power System Stability and Control by P. Kundur, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 10th reprint, 2010.
3. Electric Energy Systems theory –An introduction by Olle. I. Elgerd, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2nd ed. 2004.
4. Power Generation, Operation and Control by Allen. J. Wood and Bruce F. Wollenberg, John Wiley & Sons, Inc., 2006.
5. Power System Analysis Operation and Control by Abhijit Chakrabarti and SunitaHalder, PHI learning Pvt. Ltd., New Delhi, 3rd ed. 2010.

6. Neural computing Theory and Practice by P.D. Wasserman, Coriolis Group, 1989.
7. Introduction to neural networks using Matlab 6.0 by S.N. Sivanandam, S. Sumathi and S.N. Deepa, Tata McGraw Hill Education Pvt. Ltd., New Delhi 2006.

Course Outcomes

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

CO1 **Explain** unit commitment and different methods for Solving UC problem
CO2 **Apply** direct method and lambda iteration method for solving economic dispatch problem
CO3 **Discuss** the concept of reactive power, control of active power and reactive power and SVC
CO4 **Solve** the AGC problem in isolated and interconnected power systems
CO5 **Describe** Operations Control Centre functions, System monitoring and Contingency Analysis.
CO6 **Describe** various types of ANN and their applications to power system.

DE-1B (130612)

Industrial Automation

L	T	P	Total Credits	Theory End Sem	Mid Sem	Quiz/Assignment
04	-	-	04	70	20	10

Course Objective:

- To familiarize the students with the Industrial aspects of automation, planning and model making
- To provide the understanding of the control of a different PLCs and their applications in various low ,medium and high power drives
- To expose the students to understand various sensors, transducers and data acquisition systems and IoT

Pre-requisite: Basics of Power Electronics, digital electronics and Electrical Drives

Course Contents:

Unit I: Introduction: Overview of industry environment, Different type of switches & their operation, Architecture of industrial automation system, Relay and contactor logic, AC and DC relays and their role for load control. Review of starters: Power and Auxiliary contactors and their usage for load control. Overview of standards (BIS, ISO) & star and delta starters and their rating.

Unit II:Sensors: Temperature& speed Measurement, Humidity,Pressure, Force and Torque Sensors, Motion Sensing(speed sensor), proximity sensor, Signal Conditioning, Data Acquisition Systems,Characteristics of Sensors and control logic, control using potential free output sensors, linear potentiometer timer hardware architecture, Controlling industrial system using timers and counters (case study)

Unit III:Industrial Drives: AC & DC Drive basics, Electrical specifications and hardware architecture .AC drive and AC motor specification matching (sizing of drive),Load characteristics and its types, Servo Drives Stepper motor drive and VFD(Variable frequency drives) drives.AC drive power wiring and Interfacing input and output signals. Energy Savings with Variable Speed & multi motor Drives. Braking motoring and regenerative operation of drives Selection of power, motor and signal cables for AC drive application. Heat management of Drives, Drives protection

Unit IV: Programmable Logic Controllers: Programmable controllers, Programmable logic controllers, Analog/Digital input and output modules, PLC programming, Ladder diagram, Sequential flow chart, PLC Communication and networking, PLC selection, , Advantage of using PLC for Industrial automation, Application of PLC to process control industries.Different types of Network Communication Protocol, DH-485, Ethernet, Device Net, Control Net, Modbus, Profibus Proprietary Protocol, open Protocol.

Unit V: Automatic Control: Introduction to P-I-D Control, manual and auto PID Control Tuning, Feed forward Control Ratio Control, Time Delay Systems and Inverse Response Systems, PWM control in drives.

Recommended Books:

1. Lingefeng Wang, Kay Chen Tan,"Modern Industrial Automation and Software Design" John Wiley & Sons Inc.
2. K. L.S. Sharma, "Overview of Industrial Process Automation", Elsevier
3. KokKiong"Drives and Control for Industrial Automation", Springer
4. John Webb, "Programmable Logic Controllers Principles & Applications", PHI
5. John G. Webster,"The Measurement, Instrumentation and Sensors Handbook", CRC Press.

Course Outcomes:

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

CO1 **Analyse** architecture of industrial automation system
CO2 **Select** appropriate sensors
CO3 **Acquire** PLC knowledge
CO4 **Acquire** the knowledge of PID control technique
CO5 **Develop** small application using PLC & transducer,
CO6 **Compare** AC and DC drives for particular applications.

DE-1C (130613)
Transducers & Sensors

L	T	P	Total Credits	Theory End Sem	Mid Sem	Quiz/Assignment
02	-	-	02	70	20	10

Course Objective:

- To make students familiar with the constructions and working principle of different types of sensors and transducers.
- To make students aware about the measuring instruments and the methods of measurement and the use of different transducers.

Unit I: Mechanical and Electromechanical transducer & sensor:
Principle of sensing & transduction, classification, Resistive (Potentiometric type): Strain gauge:. Inductive Transducer: Reluctance change type, Mutual inductance change type, transformer action type, Magnetostrictive type, LVDT: Proximity sensor

Unit II: Capacitive transducers & sensors:
Variable distance-parallel plate type, variable area- parallel plate, serrated plate/teeth, type and cylindrical type, variable dielectric constant type, Stretched diaphragm type: microphone, Piezoelectric element: piezoelectric effect, charge and voltage co-efficient, crystal model, force & stress sensing, ultrasonic sensors.

Unit III: Thermal transducers & sensors:
Solid, liquid, gas &vapour, Resistance change type: RTD materials, tip sensitive & stem sensitive type, ThermisterThermoemf sensor: types,Junction semiconductor type IC and PTAT type. Radiation sensors: types, characteristics and comparison. Pyroelectric type.

Unit IV: Magnetic transducers & sensor:
Sensor based on Villari effect for assessment of force, torque, proximity, Wiedemann effect for yoke coil sensors, Thomson effect, Hall effect, and Hall drive, performance characteristics. Radiation sensors: LDR, Photovoltaic cells, photodiodes, photo emissive cell types, Geiger counters, Scintillation detectors, Introduction to smart sensors

Unit V: Smart Sensors:
Architecture of Smart Sensors: Features, Fabrication of Sensor and Smart Sensor: Electrode fabrication: Screen printing, Photolithography, Electroplating Sensing film deposition: Physical and chemical Vapor, Anodization, Sol-gel Selection of Sensors for Practical Applications, Usefulness of Silicon Technology in Smart Sensor And Future scope of research in smart sensor

Recommended Books:
1. Sensor & transducers, D. Patranabis, 2nd edition, PHI
2. Instrument transducers, H.K.P. Neubert, Oxford University press.
3. Measurement systems: application & design, E.A.Doebelin, Mc Graw Hill
4. Electronics and Electrical Measurements & Instrumentation, J.B.Gupta, S.K.Kataria& Sons.
5. A Course in Electrical and Electronic Measurements and Instrumentation, A.K. SawhneyDhanpat Rai & Co.
6. Transducers and Instrumentation by D.V.S. Murty.

Course Outcomes:

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

- **CO1** **Describe**the converting principle of a physical parameter into an electrical quantity
- **CO2** **Classify** transducers for measurement of temperature, strain, motion, position and light
- **CO3** **Choose** proper sensor to make sensitive measurements of physical parameters like displacement, force, pressure, temperature, acceleration etc.
- **CO4** **Predict** correctly the expected performance of various sensors

CO5 **Identify** different type of sensors used in real life applications and paraphrase their importance

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DE-1D (130614)
Solar PV System: Design& Economics

Course Objective: To impart the industry-oriented knowledge of solar photovoltaic (PV) systems to the students and develop their understanding for economic & planning of PV plant.

Unit I: Solar PV technology: Basics & performance parameters
Introduction to solar energy scenario, Solar cell material selection and working, concept of fill factor and I-V Curve, Solar modules and its types, Series and parallel connections of solar modules, Solar PV array, Solar PV performance parameters as per IEC 61724 standards: array yield, reference yield, final yield, performance ratio, array capture loss, system loss, cell temperature losses, PV module efficiency, system efficiency, inverter efficiency, capacity factor.

Unit II: Solar PV power plant: Components, design & types
Solar PV power plant components & their size selection as per load requirements: DC/ AC cables, junction box, solar converter, charge controller and battery system; concept of MPPT; Different types of sensors used in weather data measurements. Role of IOT in monitoring the PV generated power and power quality parameters. Single line diagram representation and working of different types of solar plants: Grid connected PV plant, off grid PV plant, Building integrated PV plant and their Comparison; net metering and gross metering. Introduction to PVsyst software

Unit III: Solar PV power quality and its impact on transformer performance
Power and power quality parameters produced by solar PV plant: measurement, analysis &Instruments used; impact of solar plant on power/ distribution transformer performance: effect on transformer sizing (IEEE C57.91-1995), impact of harmonics on transformer performance (IEEE C57.110-2018), Hot spot temperature & ageing of transformer, impact on OLTC operation and single/ three phase transformer, Electricity bill analysis.

Unit IV: Energy metrics of solar PV system
Embodied energy: material production energy, system installation energy, maintenance energy, administration energy; hourly energy production curve, matching of energy production with load curve, energy gap; seasonal variation of energy production & concept of clear days; Energy payback time (EPBT), Electricity production factor (EPF), Life cycle conversion efficiency (LCCE).

Unit V: Economics of solar PV systems
Basic terminology of economics: capital cost, cost of operation, cost of maintenance & replacement, incremental cost (property)- tax; Concept of benefit, cost &Cash flow diagram; Time value of money, Salvage value; Profit cost analysis, Simple &discounted payback period; Net present value; Internal rate of return (IRR); Unit cost analysis of solar PV plant &Levelized cost of electricity (LCOE).

Recommended Books:

1. Renewal Energy Resources by John T widell and Tony Weir, BSP Publications, 3rd Edition, 2015.
2. Solar Photovoltaics; Fundamentals, Technologies and Applications by C.S. Solanki, PHI Learning, 3rd Revised Edition, 2015.
3. Financial Evaluation of Renewable Energy Technologies by T.C. Kandpal and H.P. Garg, Macmillan publishers India limited, 1st Edition, 2003.

4. Solar Energy: Fundamental, Economic and Energy Analysis by S.K. Rajput, NITRA publication, 1st Edition, 2017.
5. IEEE standards: IEEE C57.110-2018 & IEEE C57.91-1995.

Course Outcomes:

After completing this course, the students will be able to:

CO 1. **Explain**the principles and the performance characteristics of solar photovoltaic systems.
CO 2. **Derive** the electrical equivalent circuits of solar PV system.
CO 3. **Differentiate** the different types of solar PV based power plants.
CO 4. **Apply** the knowledge of solar PV technology for finding its impact on associated electrical appliances.
CO 5. **Apply** the energy & economic analysis for Solar PV system planning
CO 6. **Recognize** process billing, energy tariff, power & power quality improvements to achieve techno-economic efficient systems.

Annexure-2

Courses & Syllabi to be offered under Open Category (OC) Courses for VI semester

1. OC1-A: 900103: Energy Conservation & Management
2. OC1-B :900104: Biomedical Instrumentation
   900115

OC1-A Energy Conservation &Management: 900103

L	T	P	Total Credits	Theory End Sem	Mid Sem	Quiz/Assignment
02	1	-	03	70	20	10

Course Objectives:

- To familiarize the students to the concepts of Energy Audit, various terminology, rules and regulations, policy, energy economics, energy tariff, analysis techniques and energy conservation.

Unit I: Energy Scenario: Classification of Energy, Indian energy scenario, energy needs of growing economy, long term energy scenario, energy conservation and its importance, Energy conservation Act 2001 and its features, Schemes of Bureau of Energy Efficiency (BEE) including Designated consumers, Electricity Acts, National action plan on climate change.

Unit II: Energy Sources & conservation: Conventional &Non-Conventional sources of energy, Renewable &non-renewable source of energy, Various methods of energy Conservation, Generation of Electrical Energy using non-conventional Sources.

Unit III: Energy Audit: Introduction, Energy Audit- Need, Scope, Methodology, Types of Energy Audit, Energy Flow Diagram, Baseline data for energy audit, Instruments for energy auditing. Sankey Diagram, Questionnaire for energy audit, Preparations & presentations of energy audit reports, Functions of Energy Auditor

Unit IV: Energy Management: Definition and objective of energy management, General Principles of energy Management, Energy Management Approach, Energy supply side Management, Management of energy distribution, Functions of energy management team.

Unit V: Energy Economics: Introduction, Parameters for energy economics, Energy Tariff, Economic Analysis Technique- Simple payback period, Discounted Cash Flow Method or Time Audited Technique (Net present value NPV, Present value index method PI, Internal rate of return Method IRR), Return on Investment (ROI).

Recommended Books:

1. Energy Management by W. R. Murphy, G. A. Mckay, Butterworth, 2nd ed., 2009.
2. Energy Management Principles by C.B. Smith, Pergamon Press, 2nd ed., 2015.
3. Electrical Energy Conservation & Utilization by S.C. Tripati, McGraw Hill Edu. India, 1st ed., 1980.
4. Non-Conventional Energy Resources by N. K. Bansal, Laxmi Publication, 1st ed., 2014.
5. Energy Management Hand book by W.C. Turner, John Wikey& Sons, 6th ed., 2006.
6. Energy Conservation guide book by Pattrick, Prentice Hall, 1st ed. 1993.

Course Outcomes:

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

CO 1. **Explain** the basic concepts of Energy Audit & its various terminologies, rules and regulations, policy and how to write reports.
CO 2. **Discuss** the conventional and non-conventional energy technologies
CO 3. **Describe** different energy auditing methods and the implementation procedures
CO 4. **Identify** present scenario of energy utilization, management and corresponding ACT of regulatory commission
CO 5. **Apply** energy tariff and power factor improvements to achieve energy efficient systems.

OC1-B Biomedical Instrumentation: 900104 115

L	T	P	Total Credits	Theory End Sem	Mid Sem	Quiz/Assignment
02	-	-	02	70	20	10

Course Objectives: To introduce students to the basic biomedical engineering technology and different biological signals, their acquisition, measurements and related constraints.

Unit I: Introduction to Biomedical Electrodes & Transducers: Development of biomedical instrumentation, Man-Instrument System, Problems Encountered in Measuring a Living System, transducers for biomedical applications; origin of biopotential and its propagation, sources of bioelectric potentials, electrocardiogram, electro encephalogram, electromyogram and other bioelectric potentials. Biopotential Electrodes, the nervous system, Instrumentation for sensory measurements.

Unit II: Cardiovascular System & Measurement: The Cardiovascular system, ECG lead configuration, ECG recording, (Einthoven Triangle) Mechanical & electrical Activity of the Heart, electrocardiography, measurement of blood pressure, blood flow and cardiac output, plethysmography, heart sounds, pacemakers and defibrillators.

Unit III: Measurements in the Respiratory System: Respiratory Mechanism, measurements of gas volume, flow rate, carbon dioxide and oxygen concentration in exhaled air, respiration controller, spirometer, respiratory therapy equipments, inhalators, ventilators & respirations, humidifiers, nebulizers &Aspirators.

Unit IV: Patient Care, Monitoring and Safety: Elements of intensive care, Monitoring, Hospital System & components, Electrical safety of patients & medical equipment, physiological effects of electric current, shock hazards from equipments, Patient care and monitoring: elements of intensive care unit, safety measures.

Unit V: Noninvasive Diagnostic Instrumentation : Ultrasonic Waves and Ultrasonic Vibrations , Propagation, Acoustic Intensity, Applications, Super Imposition, Potential Health Hazard,Measurement of Velocity, Ultrasonic Scanning techniques for bone fracture detection, Applications, Comparison between X-rays and ultrasonic scanning, Applications, Ultrasonic Cleaning, digital radiography Medical Imaging equipments Method.

Recommended books:

1. Biomedical Instrumentation and Measurement by Leslie Cromwell, Fred J. Weibell, Erich A. Pfeiffer, 2nd ed., 1980.
2. Biomedical Instrumentation: Technology and Applications by Raghbir Singh, McGraw-Hill Education, 1st ed., 2004.
3. Medical Instrumentation for Health Care by Leslie Cromwell, Prentice Hall, 1sted, 1976.
4. Analysis and Application of Analog Electronic Circuits to Biomedical Instrumentation by Robert B. Northrop, CRC Press, 2nd ed., 2012.
5. Introduction to Bioinstrumentation: With Biological, Environmental, and Medical Application by Clifford D. Ferris, 2nd ed., 1978.
6. Clinical Neurophysiology, U K Mishra, Elsevier.

Course Outcomes:

After completing this course, the students will be able to:

CO 1. Describe the origin of bio potentials and the role of bio potential electrodes & transducers
CO 2. Analyze common biomedical signals and distinguish characteristic features;
CO 3. Describe the physical and medical principles used as a basis for biomedical Instrumentation
CO 4. Explain measurement principles for blood flow, pressure and volume and respiratory variables
CO 5. Identify the patient safety issues related to biomedical instrumentation
CO 6. Explain the different ultrasonic scanning & medical imaging systems

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Annexure-3

Flexible
Scheme & Syllabus

2018-2022

&

2019-2023

B.Tech.

in

Electrical Engineering

(IV & VI Semester)

Electrical Engineering Department

Madhav Institute of Technology & Science

Gwalior-474005

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR

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

Electrical Engineering Department

Scheme of Examination (B.Tech.)

B.Tech. IV Semester (Electrical Engineering)

S. No.	Subject Code	Category Code	Subject Name	Maximum Marks Allotted					Total Marks	Contact Hours per week			Total Credits
				Theory Slot			Practical Slot						
				End Sem.	Mid Sem. Exam.	Quiz/ Assignment	End Sem.	Term work / Lab Work & Sessional		L	T	P	
1.	100003	BSC	Mathematics- III[$] (BSC-5)	70	20	10	-	-	100	2	2	-	4
2.	130401	DC	Digital Electronics & Microprocessor (DC-5)	70	20	10	30	20	150	2	1	2	4
3.	130402	DC	Electrical Machines-I (DC-6)	70	20	10	30	20	150	2	1	2	4
4.	130403	DC	Control System (DC-7)	70	20	10	-	-	100	3	1	-	4
5.	130404	DC	Power System-I (DC-8)	70	20	10	-	-	100	3	1	-	4
6.	100004	MC	Cyber Security (MC)	70	20	10	-	-	100	2	1	-	3
7.	130405	DLC	Software Lab-II[^] (DLC-2)	-	-	-	30	20	50	-	-	6	3
		Total		420	120	60	90	60	750	14	7	10	26
NSS/NCC				Qualifier									
Summer Internship Project-II (Soft Skills Based) for two weeks duration: Evaluation in V Semester													

[$] This course will run for GroupA/ B in IV/III semester respectively.

[^] Virtual Lab to be conducted along with the traditional lab

Digital Electronics & Microprocessor: 130401

L	T	P	Total Credits	Theory End Sem	Mid Sem	Quiz/ Assignment	Practical End Sem	Lab Work & Sessional
02	01	02	4	70	20	10	30	20

Course Objectives:

- To introduce the concepts and techniques associated with the number systems and codes, basic idea about microprocessor and its programming.
- To minimize the logical expressions using Boolean postulates and to apply the techniques and mathematics used in microprocessors for various control applications.
- To design various combinational and sequential circuits.

Unit- I

Number System and Binary Codes: Various number systems-decimal, Binary, Hexadecimal and Octal with mutual conversion, binary arithmetic in computers, addition, subtraction, multiplication and division, subtraction using 1's and 2's compliment, Excess 3, Gray code.

Unit- II

Minimization of Logic Function: AND, OR, NOT, NAND, NOR, EXOR, operations and gates, laws of Boolean algebra, deduction of Boolean expression, logic diagram, universal building blocks, negative logic, Minterms and Maxterms, Truth table and Karnaugh mapping, reduction of Boolean expression with SOP, POS and mixed terms.

Unit- III

Logic Hardware: Diode as switch, Bipolar transistor as switch, FET as switch, logic families (RTL, DTL, TTL, ECL, HTL, TSL, CMOS &Schottky logic).

Unit- IV

Combinational Logic Circuits: Encoders, Decoders, Multiplexers, Demultiplexer, Code Convectors, Parity Checker Generator, Arithmetic Circuit like Adder etc. Sequential circuits: State tables and diagrams, Flip Flop and its various types – JK, RS, T,D pulse and edge triggered flip flops transition and excitation tables, timing diagrams, Shift Registers, Series and Parallel Data Transfer, Ripple Counters, Synchronous Counters, Modulo N counter design, Up Down Counters Ring counter. Types and characteristics of semi conductor memories, static and dynamics memory.

Unit- V

Intel 8085 Microprocessor: Introduction to 8-bit 8085 microprocessor, Architecture of 8085 microprocessor, Pin Configuration, instruction set and Addressing modes, General application program.

Recommended Books:

1. Digital Systems by Tocci, Tata Mograw Hills Publishing company
2. Digital Computer and Electronics by Malvino, brown, TMH Publishing company
3. Digital Design by Morris Mano, Pearson Education
4. Digital computer Fundamentals by T.C. Bratee, 6th Edn. McGraw Hill.
5. An Introduction to Digital Computer Design by V. Rajaraman, and Radhakrishnan, 3rd Edn. PHI.
6. Digital Principles and Applications by A.P. Malvino and B.P. Leach 4th Edn McGraw Hill.
7. Microprocessor & Interfacing by D.V. Hall, McGraw Hill International Edition.
8. Microprocessor Architecture, Programming and Applications by Gaonkar, Wiley Eastern Ltd.

9. Introduction to Microprocessors by A.P. Mathur, McGraw Hill International Edition.

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

CO 1. **Explain** the concept of different Number systems, logic family and Microprocessor.

CO 2. **Design** the logic expressions using logic gates after simplifying the expression using Boolean laws and K-map method.

CO 3. **Design** different types of logic circuits such as combinational circuits, sequential circuits.

CO 4. **Describe** the working of logic families such (RTL, DTL,TTL,ECL,HTL,TSL, C-MOS &Schottky logic).

CO 5. **Describe** an 8 bit microprocessor architecture & explain the concepts of memory and I/O interfacing with microprocessor

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Digital Electronics & Microprocessor Lab: 130401
List of Experiments

1. Verification of truth tables of

(a) OR, AND, NOT gates (By using 7400-series)
(b) NAND & NOR gates.
(c) EX-NOR & EX-OR gates.

2. Verification of De-Morgan's Theorem using ICs.
3. Implementations of Multiplexer &Demultiplexer using logic gates (ICs) and verify truth table.
4. Implementations of Encoder & Decoder using logic gates (ICs) and verify truth table.
5. Implementations of Half Adder & Full Adder using logic gates (ICs) and verify truth table.
6. Implementations of Half Subtractor& Full Subtractor using logic gates (ICs) and verify truth table.
7. Implementation of Binary to Gray Code & Excess- 3 to BCD Converter using logic gates.
8. Operation and verifying truth tables of flip- flops- RS, D, and JK using ICs.
9. To perform addition & subtraction of two 8 bit numbers using 8085.
10. To perform the multiplication & division of two 8 bit numbers using 8085.

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

CO 1. Develop skill to build, and troubleshoot digital circuits.
CO 2. Correctly operate standard electronic test equipment.
CO 3. Apply troubleshooting techniques to test digital circuits.
CO 4. Prepare and present an organized written engineering report on electronic testing of digital circuits.
CO 5. Develop the ability to work is team and learns professional ethics.
CO 6. Identify the importance for verification & testing of digital circuits.

Electrical Machines-I: 130402

L	T	P	Total Credits	Theory End Sem	Mid Sem	Quiz/ Assignment	Practical End Sem	Lab Work & Sessional
02	01	02	4	70	20	10	30	20

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 Basic Concepts of Rotating Electrical Machines: Physical concepts of torque production. Electromagnetic and reluctance torque, Constructional features of rotating machines i.e. DC machine. Induction machine and synchronous machine.EMF generation in dc and ac machines, MMF production on a distributed winding, Production of rotating magnetic field. AC & DC windings short pitching and distribution of winding. Fractional slot winding. Winding factors & harmonic elimination, Ratings and loss dissipation.

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 Lenonard method); Efficiency and Testing of D.C. machines (Hopkinson's and Swinburn's Test).

Unit- IV 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- V Three Phase Induction Motor I: 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

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 Outcomes:

After completing this course the student will be able to:

- **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: 130402

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
6. To perform load test on DC shunt motor (Mechanically loaded)
7. To perform load test on DC series motor (Mechanically loaded)
8. To perform load test on DC compound motor (Electrically loaded)
9. To perform Hopkinson's test on two identical dc machines
10. To perform load test on induction motor
11. To obtain speed torque characteristics of 3 phase induction motor.
12. A virtual lab simulation of conventional electrical machines.

Course Outcomes:

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

CO 1. Draw characteristics ofelectric machinefor aspecific 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

CO 5. Prepare an organized written engineering report on electronic testing of digital circuits.

Control System: 130403

L	T	P	Total Credits	Theory End Sem	Mid Sem	Quiz/Assignment
03	01	-	4	70	20	10

Course Objective:

- To familiarize the students with the fundamental concepts of control system problems and their solution possibilities,
- To expose the students to the mathematical modeling of the various physical systems,the concept of time-domain response (transient and steady-state response) and frequency-domain analysis of the systems,stability analysis of the systems, specifications of controller and compensator design and its implementations.

Unit-I Modeling of Physical Systems: Translational & Rotational Transfer Function of Electrical and Mechanical systems. Feedback characteristics of control systems, Open loop and closed loop systems, effect of feedback sensitivity to parameter variations, Block diagram representation and reduction techniques, Signal flow graphs, Mason's rule. Control systems and its components, error sensing devices: Potentiometers, Tacho generators and Synchros, A.C. & D.C. servomotor.

Unit-II Time Response Analysis: Transient Response Analysis: Transient and steady-state response analysis for first and second order systems and their qualitative analysis; error analysis and error constants., Derivative and Integral error compensation, P, PI, PD, PID Controller.

Unit-III Frequency Response Analysis: Frequency domain specifications of second order system, Polar plot, Bode plots, M Circles, N Circles. Compensator Design: Lead, lag and lag-lead compensation using frequency response methods.

Unit-IV State Variable Analysis: Concept of state, state variables and state models, state equations and state transition matrix, relationship between transfer function and state equations, control system with state variable feedback, controllability & observability.

Unit-V Stability: Stability, Absolute and relative stability, Routh Hurwitz stability criteria, Root Locus Analysis: Development of root loci, effects of pole/zero on loci, Nyquist plot & Nyquist stability criterion

Recommended Books:

1. Control System Engineering by I.J. Nagrath and M. Gopal, New Age International Publication.
2. Control Systems by U. A. Bakkshi, Technical Publication, Pune.
3. Linear Control Systems by B. S. Manke, Khanna Publishers
4. Automatic Control System by S.C. Gupta, New Age International Publication.
5. Control System Engineering by Norman Wiley Publication.
6. Automatic Control System by B.C. Kuo, Oxford University Press & Pearson Education.
7. Modern Control Engineering by K. Ogata, Pearson Education, Asia.

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

- **CO 1.** **Develop** mathematical models of mechanical, electrical and electromechanical systems
- **CO 2.** **Represent** the complex system into standard canonical form by signal flow graph and block diagrams reduction rules
- **CO 3.** **Compute** the time and frequency-domain responses of first and second-order systems to standard inputs.
- **CO 4.** **Formulate** control engineering problems in state-variable form
- **CO 5.** **Evaluate** the stability of a closed-loop control system in time-domain as well as in frequency-domain
- **CO 6.** **Predict** the nature of response for the given input

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Power System -I:130404

L	T	P	Total Credits	Theory End Sem	Mid Sem	Quiz/Assignment
03	01	-	04	70	20	10

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 toConventional and non-conventional energy resources; Availability of resources; National and International energy trends; Global warming and greenhouse effects. Generation of electrical power, 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, overhead versus underground systems, choice of working voltages for transmission and distribution, transmission and distribution system architecture. 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, PHI, 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 of power systems
- **CO 2.** **Develop** the knowledge of generation of electricity based on conventional and nonconventional energy sources
- **CO 3.** **Determine** the transmission line parameters
- **CO 4.** **Analyze** the performance of overhead transmission line
- **CO 5.** **Describe** the concept of power plant economics
- **CO 6.** **Explain** different types of tariffs and power factor economics

Software Lab-II: 130405

L	T	P	Total Credits	Practical End Sem	Lab work & Sessional
-	-	6	3	30	20

List of Experiments

1. To develop Simulink model of separately excited DC motor and draw its speed-torque characteristics
2. To write MATLAB code for calculation of efficiency and voltage regulation of a single phase transformer
3. To compare step & impulse responses of type '0', type '1', type '2' systems
4. To draw Root Locus plot and Nyquist Plot using MATLAB control system toolbox
5. To observe the effects of PI, PD & PID controllers on performance of second order system
6. Calculation of ABCD parameters of transmission lines
7. Implementation of Boolean expression using MATLAB simulink
8. To determine voltage regulation and efficiency of short and medium transmission lines
9. To determine the string efficiency using MATLAB code
10. To determine point of minimum potential in a radial distribution system fed at both ends
11. To obtain time response of the system given in state space model form for unit step input
12. To determine controllability & observability of a given system

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

- **CO 1.** **Simulate** the performance of DC motor using MATLAB Simulink environment.
- **CO 2.** **Validate** the concepts of Induction motor by writing MATLAB codes.
- **CO 3.** **Analyze** the waveforms on parameter variation of PV Array module using MATLAB Environment.
- **CO 4.** **Compare** the performance of renewable energy sources using MATLAB environment.
- **CO 5.** **Design** engineering problem and validate the results using MATLAB environment.

2018 - VI

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR

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

Electrical Engineering Department

Scheme of Examination

B.Tech. VI Semester (Electrical Engineering)

S. No	Subject Code	Category Code	Subject Name	Maximum Marks Allotted							Total Marks	Contact Hours per week			Total Credits
				Theory Slot			Practical Slot		MOOC						
				End Sem.	Mid Sem Exam.	Quiz/ Assignment	End Sem.	Lab work & Sessional	Assignment	Exam		L	T	P	
1.	130601	DC	Switchgear & Protection (DC-13)	70	20	10	30	20	-	-	150	2	1	2	4
2.	130602	DC	Electrical Engineering Materials (DC-14)	70	20	10	-	-	-	-	100	4	-	-	4
3.	130611/ 130612/ 130613	DE	DE (DE-1)	70	20	10	-	-	-	-	100	4	-	-	4
4.	130651/ 130652/ ~~130653~~	DE	DE* (DE-2)	-	-	-	-	-	25	75	100	4	-	-	4
5.	900103	OC	OC (OC-1) [Energy Conservation & Management] #	70	20	10	-	-	-	-	100	2	1	-	3
6.	100007	MC	Disaster Management (MC)	70	20	10	-	-	-	-	100	3	-	-	3
7.	130603	DLC	Minor Project-II (DLC-5)	-	-	-	50	50	-	-	100	-	-	4	2
			Total	450	100	50	80	70	25	75	750	19	2	6	24
			Summer Internship-III (On Job Training) for Four weeks duration: Evaluation in VII Semester												
			Additional Courses for obtaining Honours/ Honours with Minor Specialization by desirous students	Permitted to opt for maximum two additional courses for the award of Honours or Minor specialization											

*This course run through SWAYAM/NPTEL/ MOOC platform # ECM is only opted by other department students

DE-1	
130611	Computer Aided Power System Analysis
130612	Industrial Automation
130613	Transducers & Sensors
130614	Solar PV System: Design & Economics

DE-2 (SWAYAM/NPTEL)	
130655	Waste to Energy Conversion
130656	Renewable Energy Engineering: Solar, Wind and Biomass Energy Systems

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DEAN (ACADEMICS)
M.I.T.S
GWALIOR

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR

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

Electrical Engineering Department

For batches admitted in Academic Session 2018-2019 & 2019-2020

Departmental Core (DC13)

Switchgear and Protection: 130601

L	T	P	Total Credits	Theory End Sem	Mid Sem	Quiz/Assignment	Practical End Sem	Lab Work & Sessional
02	1	2	04	70	20	10	30	20

Course Objectives:

- To familiarize the students with the learn standard terms and definitions
- To expose the student to the need for protection and various protective devices, their construction, operating principle, torque equation, characteristics and field of application for different types of equipment to identify reasons for mal operation and their remedies

Unit I. Arc Interruption: Arc properties, Formation and extinction of arc, Restrikingand recovery voltage RRRV, different methods and control devices for arc extinction, Current chopping, Interruption of capacitive currents, Resistance switching. Type and classification of circuit breakers. Oil circuit breaker.

Unit II. Air blast and SF6 circuit breakers: Vacuum circuit breakers, duties and rating Maintenance and testing of OCB 's. Isolators, HRC fuse. Protective Relays: introduction, Definition of terms associated with protective relaying. Construction and characteristics of electromagnetic relays.

Unit III. Elements of static relays: Comparator, induction, distances and differential relays, microprocessor based relays. Modern trends in power system protection, Auto reclosure, under and over frequency relays and their applications. Digital Protection. Numerical protection Introduction, block diagram of numerical relay, numerical over current protection.

Unit IV. Protection schemes: Protection of generators and transformers, percentage differential relay, Buchholz relay, different protections provided for generator and transformer, transmission line protection using over current relays, distance relays and carrier current protection, protection of motors and bus bars.

Unit V. Protection against Over Voltages: Power System transients, Over voltage in transmission lines, fault clearance and lightning and switching surges, ground wire, lightning arrestors, basic impulse insulation level(BIL) , insulation coordination, grounding of P.S. current limiting reactors, their uses and location protection against traveling waves.

Recommended Books:

1. Switchgear protection and power systems by Sunil S. Rao, Khanna publication, 13th edition, 2008.
2. Power system protection & Switchgear by Badriram, TMH publication, 2nd edition, 2011.
3. Switchgear and protection by Ravindranath and Chander, Newage publication, 2nd edition, 2012
4. Switchgear and protection by Deshpande , TMH Publication, 2004
5. Digital Protection by L.P. Singh New Age Publication, 2nd edition, 1997.

Course Outcomes:

After completing this course the students will be able to:

- **CO 1.** **Explain** the concepts, theories and features associated with protective relays and circuit breakers
- **CO 2.** **Classify** relays and circuit breakers based on criteria such as construction, type of supply, working principle, actuating quantities
- **CO 3.** **Select** relays and circuit breakers for specific equipments and applications
- **CO 4.** **Design** protection schemes for generators, motors, transformers and transmission lines
- **CO 5.** **Analyze** the behavior and performance of relays under different loading levels and faults
- **CO 6.** **Select** the protective devices and their locations for protecting power systems against over voltages

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Electrical Engineering Department

For batches admitted in Academic Session 2018-2019 & 2019-2020

Switch Gear & Protection Lab- 130601

List of Experiments

1. To plot the characteristics & analyze the performance of under voltage relay
2. To plot the characteristics & analyze the performance of microprocessor based over voltage relay
3. To plot the characteristics & analyze the performance of electromechanical over current relay
4. To plot the characteristics of percentage biased differential relay (Static) at different biasing
5. To plot the characteristics of percentage biased differential relay (Electro-mechanical) at different biasing
6. To test the over current relay using the relay test bench
7. To operate Motor protection simulation panel
8. To operate Feeder protection simulation panel
9. To simulate distance relay and plot the characteristic by using MATLAB
10. To simulate IDMT relay and plot the characteristic using MATLAB

Course Outcomes:

After completing the lab course the students will be able to:-

CO 1. **Operate** the Over/Under voltage & over current relays and observe the performance for different settings

CO 2. **Analyze** the effect oftime and current settings on the operating characteristics of an Inverse Definite Minimum Time (IDMT) relay

CO 3. **Validate** the characteristics of percentage biased differential relay for different bias settings

CO 4. **Prepare** an organized written report.

CO 5. **Develop** the ability to work is team and learns professional ethics.

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Electrical Engineering Department

For batches admitted in Academic Session 2018-2019 & 2019-2020

Departmental Core (DC14)

Electrical Engineering Materials: 130602

L	T	P	Total Credits	Theory End Sem	Mid Sem	Quiz/Assignment
04	-	-	04	70	20	10

Course Objective: The Objective is to familiarize the students with different types of materials and their use in the field of Electrical Engineering.

Unit I. Conducting Materials: The conductivity of metals and alloys, Generals properties, Classification of conducting materials, Low resistivity and high resistivity materials, their properties and applications, Electrical and mechanical properties and applications of Cu, Al, Steel, Brass, Bronze, ACSR conductor , AAAC conductor , Tungsten, Molybdenum, Platinum, mercury, lead, manganin, alloys for application in resistances, lamps and electric furnaces, soldering materials, metals and Alloys for fuses, contact materials and their applications, Graphite materials, its properties and application, superconductivity and its applications.

Unit II. Semiconductor Materials: Classification of materials based on atomic structure, conductors, insulators and semiconductors, Electron energy and energy band theory, Excitation of atoms, Semiconductor materials, Intrinsic semiconductors, Extrinsic semiconductor, N type materials, P type materials, minority and majority carriers. Formation of PN junction by alloying, Merits of semiconductor materials for use in electrical Engg, Factors affecting semiconductors, application of semiconductor materials, Hall effect with mathematical treatment.

Unit III. Magnetic Materials: Different terms associated with magnetic materials. Classification of magnetic materials, Diamagnetic, Paramagnetic and ferromagnetic materials, Curie point, Magnetostriction, electromagnet and its uses, Magnetization curve, Hysteresis and eddy current loss, Soft and hard magnetic materials, their properties and applications, alloying silicon to steel, its advantage and disadvantages, requirements of magnetic materials for use in Electrical machines, Grain oriented sheet steel, Magnetic anisotropy, Spontaneous magnetization.

Unit IV. Dielectric materials: Behaviour of dielectrics in static and alternating fields, effect of a dielectric on the behaviour of a capacitor , polarization, Dielectric constant of mono atomic gases, ionic polarization, Dipolar polarization, internal fields in solids and liquids, Polaris ability catastrophe, Frequency dependence of electronic polarization, permittivity, ionic polarization, dielectric losses, significance of the loss tangent dipolar relaxation, frequency and temperature dependence of the dielectric constant of polar dielectric, Ferro electricity, piezoelectricity.

Unit V. Insulating materials: General electrical, mechanical, thermal and chemical properties of insulating materials, classification of insulating materials on the basis of temperature rise. Gaseous insulating materials properties and application of nitrogen, liquid insulating materials, their main features, Transformer oil, testing the dielectric strength of transformer oil, Fibrous insulating materials, insulating textiles, impregnated fibrous insulating materials, Insulating resins, Classification of synthetic resins (Plastics), thermosetting and thermoplastic resins, adhesives, varnishes and other insulating materials such as mica, ceramic, Bakelite, Ebonite glass, PVC, Rubber.

Recommended Books:

1. A text book of Electrical Engineering materials by P.L. Kapoor, Khanna Publication
2. Electrical Engineering materials by A.J. Dekker , PHI
3. An introduction to Electrical Engineering materials by C.L. Indulkar, S. Thiravengadam, S. Chand & Co.

Course Outcomes:

After completing this course the student will be able to:

CO 1. **Describe** properties and applications of conducting materials

CO 2. **Explain** behavior of semiconductor materials, their classification and applications.

CO 3. **Explain** application of magnetic materials, different terms, classification, hysteresis and eddy current losses.

CO 4. **Explain** dielectric materials, their behavior in different fields, polarization and dielectric losses

CO 5. **Select** appropriate material depending upon specific requirement

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Annexure-4

Flexible
Scheme & Syllabus

2020-2021

B.Tech.

in

Electrical Engineering

Electrical Engineering Department
Madhav Institute of Technology & Science
Gwalior-474005

Electrical Engineering

Abbreviations used

L	Lecture
T	Tutorial
P	Practical
HSMC	Humanities and Social Sciences including Management Courses
BSC	Basic Science Courses
ESC	Engineering Science Courses
DC	Departmental Core
DE	Departmental Elective
OC	Open Category
DLC	Departmental Laboratory Courses
MC	Mandatory Course
MOOC	Massive Open Online Courses

Definition of Credit:

1 Hr. Lecture (L) per week	1 credit
1 Hr. Tutorial (T) per week	1 credit
2 Hours Practical(Lab)/week	1 credit

***Minor variation is allowed as per need of the respective disciplines. Please consult the AICTE model curriculum as a standard reference, if needed.*

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Electrical Engineering Department

Scheme of Examination
GROUP X: I Semester
B. Tech. I Semester (Civil, Mechanical, Automobile, Electrical)

For batches admitted in academic session 2020 – 21 onwards

S. No.	Subject Code	Category Code	Subject Name	Maximum Marks Allotted					Total Marks	Contact Hours per Week			Total Credits
				Theory Slot			Practical Slot						
				End Sem.	Mid Sem.	Quiz/Assignment	End Sem.	Lab work / Sessional		L	T	P	
1.	100011	BSC	Engineering Mathematics –I	60	20	20	-	-	100	3	1	-	4
2.	100013	BSC	Engineering Physics	60	20	20	60	40	200	2	1	2	4
3.	100014	ESC	Engineering Graphics	60	20	20			100	1	2	-	3
4.	100015	HSMC	Energy, Environment, Ecology & Society	60	20	20	-	-	100	3	-	-	3
5.	100016	HSMC	Technical Language	60	20	20	-	-	100	3	-	-	3
6.	100017	HSMC	Language Lab	-	-	-	60	40	100	-	-	2	1
7.	130111	DC	Mini Project	-	-	-	60	40	100	-	-	2	1
			Total	300	100	100	180	120	800	12	4	6	19

Induction programme of three weeks duration: Physical activity, Creative Arts,Universal Human Values,Literary,ProficiencyModules,Lectures by Eminent People, Visits to local Areas, Familiarization to Dept./Branch & Innovations.

NSS / NCC	Qualifier

GROUP X: (Civil, Mechanical,Electrical, and Automobile)
GROUP Y: (Electronics, Computer Science& Engineering, Information Technology, Electronics & Telecommunication, Chemical)
01Theory Period=1 Credit; 02 Practical Periods =1 Credit

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR

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Electrical Engineering Department

Scheme of Examination

GROUP X: II Semester

B. Tech. II Semester (Civil, Mechanical, Automobile, Electrical)

For batches admitted in academic session 2020 – 21 onwards

S. No.	Subject Code	Category Code	Subject Name	Maximum Marks Allotted					Total Marks	Contact Hours per Week			Total Credits
				Theory Slot			Practical Slot						
				End Sem.	Mid Sem.	Quiz/ Assignment	End Sem.	Lab work / Sessional		L	T	P	
1.	130211	DC	Engineering Materials	60	20	20	-	-	100	4	-	-	4
2.	100020	ESC	Basic Civil Engineering &Mechanics	60	20	20	-	-	100	3	-	-	3
3.	100021	ESC	Basic Mechanical Engineering	60	20	20	-	- 20 20	100	1	2	-	3
4.	100022	ESC	Basic Electrical & Electronics Engineering	60	20	20	60	40	200	2	1	2	4
5.	100023	ESC	Basic Computer Engineering	60	20	20	60	40	200	2	1	2	4
6.	130212	DC	Electrical Workshop	-	-	-	60	40 20	100	-	-	2	1
			Total	300	100	100	180	120	800	12	4	6	19
Summer Internship Project – I (Institute Level) (Qualifier): Minimum two-week duration:Evaluation in III Semester.													
NSS / NCC				Qualifier									

GROUP X: (Civil, Mechanical, Electrical and Automobile)
GROUP Y: (Electronics, Computer Science& Engineering, Information Tech. Electronics & Telecommunication, Chemical); 0

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Electrical Engineering Department

Scheme of Examination

B.Tech. (Internet of Things), Offered by Department of Electrical Engineering

I Semester

S. No.	Subject Code	Category Code	Subject Name	Maximum Marks Allotted					Total Marks	Contact Hours per week			Total Credits
				Theory Slot			Practical Slot						
				End Sem	Mid Sem Exam.	Quiz/ Assignment	End Sem.	Lab work & Sessional		L	T	P	
1.	220101	DC	Basics of Internet of Things	60	20	20	-	-	100	4	-	-	4
2.	230102	DC	Introduction to Computer Programming	60	20	20	60	40	200	2	1	2	4
3.	100022	ESC	Basic Electrical & Electronics Engineering	60	20	20	60	40	200	2	1	2	4
4.	250100	BSC	Linear Algebra	60	20	20	-	-	100	3	1	-	4
5.	100015	HSMC	Energy, Environment, Ecology & Society	60	20	20	-	-	100	3	-	-	3
Total				300	100	100	120	80	700	13	3	4	19
NSS/NCC				Qualifier									
Induction program of first three weeks (MC): Physical activity, Creative Arts, Universal Human Values, Literary, Proficiency Modules, Lectures by Eminent People, Visit / Virtual Visit to local Areas, Familiarization to Dept./Branch & Innovations													

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR

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Electrical Engineering Department

Scheme of Examination

B.Tech. (Internet of Things), Offered by Department of Electrical Engineering

II Semester

S. No.	Subject Code	Category Code	Subject Name	Maximum Marks Allotted					Total Marks	Contact Hours per week			Total Credits
				Theory Slot			Practical Slot						
				End Sem.	Mid Sem.	Quiz/ Assignment	End Sem.	Lab work& Sessional		L	T	P	
1.	220201	DC	Digital Electronics and Logic Design	60	20	20	-	-	100	2	1	-	3
2.	220202	DC	Sensor Technology	60	20	20	60	40	200	3	-	2	4
3.	230202	DC	Data Structures	60	20	20	60	40	200	3	-	2	4
4.	230203	DC	Object Oriented Programmingand Methodology	60	20	20	60	40	200	3	-	2	4
5.	100016	HSMC	Technical Language	60	20	20	-	-	100	3	-	-	3
6.	100017	HSMC	Language Lab	-	-	-	60	40	100	-	-	2	1
Total				300	100	100	240	160	900	14	1	8	19
NSS/NCC				Qualifier									
Summer Internship Project –I (Institute Level) (Qualifier): Minimum two-week duration (Evaluation in III Semester)													

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR

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Electrical Engineering Department

Energy, Ecology, Environment & Society (EEES):100015

L	T	Total Credits	End Sem	Mid Sem	Quiz/Assignment
03	-	03	60	20	20

Course Objectives:

To create awareness about global energy status, climate issues and sustainable development for development of society using new rand renewable energy resources for power needs, to generate an understanding of human relationships, perceptions and policies towards environment and focus on design and technology for improving environmental quality and to develop moral values and morals to conduct efficiently and ethically in society.

Unit –I:Sources of energy: Renewable and non-renewable energy, current Indian and global scenario of energy, state wise energy consumption, role of energy in economic and social development and social transformation. **Energy Polices:** National level and State level policy and International policy of G-8, G-20, OPEC and European countries, solar energy policy of India, National Solar mission energy policy issues. Energy securities and challenges in Indian context.

Unit 2:Energy conversion: Solar Energy, sun-earth angle, solar water heating, concentrated solar power, PV power: roof top; off Grid and on grid, Hydro, wind, biomass, geothermal, tidal and nuclear energy, Fossil fuels, thermal power station basic concepts. Per kilowatt hr cost of energy produced from various energy sources and its future prospects, business opportunities in various non-conventional sources.

Unit –3:Ecology: Ecosystems, concept, components, types, Atmosphere, hydrosphere, lithosphere, biosphere, cycles in Ecosystem, Water, Carbon, Nitrogen. Biodiversity, threats and conservation, Producers, composers and decomposers, Energy and matter flow, Ecological succession, Food chains webs and ecological pyramids, Characteristics, structures and functions of ecosystems such as Forest, Grassland, Desert, Aquatic ecosystems. Community ecology- Characteristics, frequency, life forms, and biological spectrum, Ecosystem structure, Biotic and a-biotic factors, food chain, food web, ecological pyramids; Population ecology

Unit- 4:Environment: Air pollution, causes, classifications, adverse effects, Greenhouse gases and effect, their major concerns, present status, emission from automobile, power, infrastructure, agriculture and transportation, environmental security. Global warming causes and effects, acid rain, ozone layer depletion, climate change, its model, impact on human health, national and international impact of climate change, Kyoto protocol, national and additional measures; flexible mechanism for reduction of carbon, clean development mission, joint implementation programme, carbon credit, carbon trading, emission trading, Voluntary Emission Rights (VER), Certified Emission Reductions (CER), and emission reduction unit (ERU), Indian initiatives of reduction in greenhouse gases. Environmental ethics.

Unit -5:Values and ethics: Definition, Sources, and approaches to ethics, Social values and individual attitudes, Work ethics and work values, philosophical and Social ethics, human values and morals, business ethics, self-concept and Johari Window, emotional intelligence, social intelligence, self-development, character strengths and virtues, Impact of waste on society, management of e-waste.

Recommended Books:

1. Cunninghan WP and MA; Principles of Environment Sciences; Tata McGraw Hill (TMH)
2. Pandey, S.N. & Mishra, S.P. Environment & Ecology, 2011,AneBooks,Pvt.Ltd,New Delhi

3. Svakumar; Energy Environment & Ethics in Society;TMH
4. Bukhootsow, B., Energy Policy and Planning, Prentice Hall of India, New Delhi, 2003.
5. Jose Goldenberg, Thomas Johanson, and Reddy, A.K.N., Energy for Sustainable World, WileyEastern, 2005.
6. Charles E. Brown, World Energy Resources, Springer Publication, New York, 2002.
7. Culp, A.W., Principles of Energy Conversion, McGraw Hill New York, 2004.
8. BalaKrishnamoorthy; "Environmental management", PHI
9. Gerard Kiely, "Environmental Engineering" ;TMH
10. BharuchaErach, Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmadabad, 2002.
11. Chakraborty, S.K., Values and Ethics for Organizations, Theory and Practice, Oxford University Press, New Delhi, 2001.
12. Leary M.R., "The Curse of Self: Self-awareness, Egotism and the Quality of Human Life", Oxford University Press. 2004
13. Louis P. P., "The Moral Life: An Introductory Reader in Ethics and Literature", Oxford Univ.Press. 2007

Course Outcomes:
After successfully completing this course the students will be able to

CO 1. Describe various energy resources, their conversion to electrical power and role in technological & economic development.
CO 2. Update with national/international power status and renewable power development targets & missions.
CO 3. Recognize the impact of pollution on the ecosystem and control policies adopted at national/international levels.
CO 4. Illustrate the concepts of ecosystems and their conservation.
CO 5. Solve practical problems of society in a sustainable and ethical manner.
CO 6. Fulfill professional duties keeping in mind the environmental safety, health, and welfare of public.

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Electrical Engineering Department

Mini-Project:130111

L	T	P	Total Credits	End Sem	Lab Work/Sessional
-	-	2	01	60	40

Course Content:

1. To get familiarized with Electrical Symbols, Electrical components and their use.
2. To identify right tools and measurement devices for different tasks.
3. Connect resistor, capacitor and inductor in series and parallel circuits
4. Appropriate wire size selection and PVC conduit wiring.
5. To be familiar with different types of connectors, switches and bulbs.
6. To identify different resistors based on color coding.

List of Projects:

a. Designing of warehouse electrical wiring.
b. Designing of hostel electrical wiring.
c. Wiring of fluorescent lamps and lights sockets (6A) with power circuit for controlling power device. (16 A socket)
d. Designing of extension board for various applications.
e. Designing of testing board to detect faulty appliances.
f. Wiring of Inverter connection for backup supply.
g. Wiring of power distribution arrangement using single phase MCB distribution board with ELCB, Main switch and Energy Meter.

Course Outcomes

After the completion of the course, the student will be able to –

CO 1. **Design** household wiring circuits

CO 2. **Distinguish**between healthy and faulty electrical appliances

CO 3. **Select**appropriate tools and devices for various real-life electrical applications

CO 4. **Develop** teamwork skills for working effectively in groups

CO 5. **Prepare** thetechnical report on projectsprepared in the lab

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Electrical Engineering Department

Basic Electrical & Electronics Engineering: 100022

L	T	P	Total Credits	End Sem	Mid Sem	Quiz/Assignment
03	-	2	04	70	20	10

Course Objectives:

- To impart the basic knowledge of the DC and AC circuits and their applications.
- To familiarize the students with the basic knowledge of magnetic circuits and its terminology, the importance of transformers in transmission and distribution of electric power.
- To expose the students to the working of DC Machine, various electronic circuits and its importance.

Unit I - D.C. Circuits Analysis:
Voltage and Current Sources: Dependent and independent source, Source conversion, Kirchhoff's Law, Mesh and Nodal analysis. Network theorems: Superposition theorem, Thevenin's theorem & Norton's theorem and their applications.

Unit II –Single-phase AC Circuits:
Generation of sinusoidal AC voltage, definitions: Average value, R.M.S. value, Form factor and Peak factor of AC quantity, Concept of Phasor, analysis of R-L, R-C, R-L-C Series and Parallel circuit, Power and importance of Power factor.

Unit III- Magnetic Circuits:
Basic definitions, AC excitation in magnetic circuits, self-inductance and mutual inductance, Induced voltage, laws of electromagnetic Induction, direction of induced E.M.F. Flux,MMF and their relation, analysis of magnetic circuits.

Unit IV- Single-phase Transformer &Rotating Electrical Machines:
Single phase transformer, Basic concepts, construction and working principal, Ideal Transformer and its phasor diagram at No Load, Voltage, current and impedance transformation, Equivalent circuits and its Phasor diagram, voltage regulation, losses and efficiency, testing of transformers, Construction & working principle of DC and AC machine.

Unit V - Digital Electronics, Devices & Circuits:
Number systems used in digital electronics, decimal, binary, octal, hexadecimal, their complements, operation and conversion, Demorgan's theorem, Logic gates- symbolic representation and their truth table, Introduction to semiconductors, Diodes, V-I characteristic, Bipolar junction transistors and their working, Introduction to CB, CE & CC transistor configurations

Recommended Books:

1. Basic Electrical and Electronics Engineering, Tata McGraw Hill - D.P. Kothari & I.J. Nagrath
2. Basic Electrical and Electronics Engineering, Tata McGraw Hill – V N Mittle& Arvind Mittal
3. Electrical Machinery- A.E. Fitzgerald, C. Kingsley and Umans - TMH
4. Principles of Electrical Engineering- Vincdent Del Toro- Prentice Hall.
5. Basic Electrical engineering -A,E. Fitzgerald, Higginbotham and Grabel -TMH
6. Integrated Electronics- Millmann&Halkias
7. Electronics Devices & circuits- Sanjeev Gupta, Dhanpat Rai Publication
8. Basic Electrical and Electronics Engineering, Tata McGraw Hill - D.C Kulshreshtha

Course Outcomes

After the completion of the course, the student will be able to –

CO 1. **Solve** DC& AC circuits by applying fundamental laws & theorems
CO 2. **Analyze** the response of linear electrical and magnetic circuits for given input
CO 3. **Explain** the working principle, construction, applications of rotating electrical machines
CO 4. **Explain** the working principle, constructional details, losses & applications of single phase transformer.
CO 5. **Select** the logic gates for various applications in digital electronic circuits.
CO 6. **Explain** characteristics of Diode and Transistor.

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Electrical Engineering Department

Basic Electrical & Electronics Engineering Lab (100022)

LIST OF EXPERIMENT

1. To verify Kirchhoff's Current Law & Kirchhoff's Voltage Law.
2. To verify Superposition Theorem
3. To determine resistance & inductance of a choke coil.
4. To determine active & reactive power in a single phase A.C circuit.
5. To determine voltage ratio & current ratio of a single phase transformer.
6. To determine the polarity of a single phase transformer.
7. To perform open circuit & short circuit test on a single phase transformer.
8. To study multimeter& measure various electrical quantities
9. To study of constructional details of DC machine.
10. To determine the V-I characteristics of diode in forward bias & reverse bias condition.

Course Outcomes:

After the completion of the lab, the student will be able to -

CO 1. Verify circuit theorems.

CO 2. Perform tests on transformer for determination of losses, efficiency & polarity.

CO 3. Demonstrate the constructional features of electrical machines

CO 4. Acquire teamwork skills for working effectively in groups

CO 5. Prepare an organized technical report on experiments conducted in the laboratory.

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Electrical Engineering Department

Engineering Materials:130211

L	T	P	Total Credits	Theory End Sem	Mid Sem	Quiz/Assignment
4	0	0	4	60	20	20

Course Objectives:

The Objective is to familiarize the students with different types of Engineering materials and their use in the field of Electrical Engineering.

Unit I. Conducting Materials: The conductivity of metals and alloys, Generals properties, Classification of conducting materials, Low resistivity and high resistivity materials, their properties and applications, Electrical and mechanical properties and applications of Cu, Al, Steel, ACSR conductor, AAAC conductor, Tungsten, Molybdenum, Platinum, mercury, lead, manganin, metals and Alloys for fuses, superconductivity and its applications.

Unit II. Semiconductor Materials: Classification of materials based on atomic structure, conductors, insulators and semiconductors, Electron energy and energy band theory, Semiconductor materials, Intrinsic semiconductors, Extrinsic semiconductor, N type materials, P type materials, minority and majority carriers. Formation of PN junction by alloying, Merits of semiconductor materials for use in electrical Engg., Factors affecting semiconductors, application of semiconductor materials, Hall effect with mathematical treatment.

Unit III. Magnetic Materials: Different terms associated with magnetic materials. Classification of magnetic materials, Diamagnetic, Paramagnetic and ferromagnetic materials, Curie point, Magnetostriction, electromagnet and its uses, Magnetization curve, Hysteresis and eddy current loss, Soft and hard magnetic materials, their properties and applications, its advantage and disadvantages, requirements of magnetic materials for use in Electrical machines, Magnetic anisotropy, Spontaneous magnetization.

Unit IV.Dielectric materials: Behavior of dielectrics in static and alternating fields, polarization, Dielectric constant of mono atomic gases, ionic polarization, Dipolar polarization, internal fields in solids and liquids, Polaris ability, Frequency dependence of electronic polarization, permittivity, dielectric losses, significance of the loss tangent dipolar relaxation, Ferro electricity, piezoelectricity.

Unit V. Insulating materials: General electrical, mechanical, thermal and chemical properties of insulating materials, classification of insulating materials on the basis of temperature rise. Gaseous insulating materials properties and application of nitrogen, liquid insulating materials, their main features, Transformer oil, testing the dielectric strength of transformer oil.Ferrous metals and non ferrous metals.

Recommended Books:

1. 1.Science Of Engineering Materials By C.M.Srivastava&C.Srinivasan,New Age International Publisher,2010.
2. A Text Book Of Electrical Engineering Materials By P.L. Kapoor, Khanna Publication,2016
3. Electrical Engineering Materials By A.J. Dekker, PHI,2015
4. An Introduction To Electrical Engineering Materials By C.L. Indulkar, S. Thiravengadam, S. Chand & Co,2006

Course Outcomes

After completing this course, the student will be able to:

CO1:Describe the properties and applications of conducting materials.

CO2 : Explain behavior of semiconductor materials, their classification and applications.

CO3: Select appropriate Magnetic materials for given applications.

CO4 : Explain dielectric materials, their behavior in different fields, polarization and dielectric losses

CO5: Select appropriate insulating material depending upon specific requirement

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MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR

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Electrical Engineering Department

Electrical Workshop: 130212

L	T	P	Total Credits	End Sem	Lab Work/Sessional
-	-	2	01	60	40

LIST OF EXPERIMENTS

1. To get familiarized with the testing bench
2. To identify and test different types of cables and connectors
3. To identify and use different types of Fuses, MCB, ELCB, MCCB, Insulators and relays with their ratings
4. To design basic electronic circuits using soldering and analyze their waveforms
5. To get familiarized with safety practices and maintenance techniques followed in Industries
6. To determine Realtime domestic and industrial electrical load
7. To understand and demonstrate process of electrical power generation, transmission and distribution in co-relation with real time power grid
8. To determine Lux for different applications as per illumination requirements (BEE Standards)
9. To measure phase and line parameters of a three phase AC circuit
10. To get familiarized with different types of earthing and earth resistance determination

Course Outcomes

After the completion of the course, the student will be able to –

CO 1. Identify different types of electrical loads
CO 2. Apply illumination standards and safety practices for various applications
CO 3. Select cables, switches and protective devices for specific applications
CO 4. Develop teamwork skills for working effectively in groups
CO 5. Prepare thetechnical report on experiments conducted in the lab

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Basics of Internet of Things:220101

L	T	P	Total Credits	Theory End Sem	Mid Sem	Quiz/Assignment
4	0	0	4	60	20	20

Course Objectives:

- To familiarize the students to the basics of Internet of things and protocols.
- It expose the students to some of the electrical engineering application areas where Internet of Things can be applied.

Unit I. Introduction to Internet of Things: IoT: Definition and importance, Characteristics of IoT, Physical design of IoT, Logical design of IoT, Functional blocks of IoT, Three-layer and Five-layer model of IoT.

Unit II. IoTCommunication network: Architecture of IoT, Communication network:Home Area Network (HAN), Neighborhood Area Network (NAN), Field Area Network (FAN), Wide Area Network (WAN), Wireless Sensor Networks (WSNs)

Unit III. IoTProtocols: IoT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and LoRaWAN, Network Layer: IP versions, Constrained Nodes and Constrained Networks, Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks, Application Transport Methods: Supervisory Control and Data Acquisition, Application Layer Protocols: CoAP and MQTT

Unit IV. IoT Sensors/Actuators and IoTChallenges: IoT: Sensor Technology, Mobile Phone Based Sensors, Medical Sensors, Neural Sensors, Environmental and Chemical Sensors, Radio Frequency Identification, Actuators,IoTChallenges:Design challenges, Development challenges, Privacy and Security challenges, Data Management and Other challenges

Unit V. Application of IoT: Smart Homes: SmartAppliances,Security and Safety.Smart Energy: Smart Meters, Automatic Meter Reading (AMR), Advanced Metering Infrastructure (AMI), Real Time Pricing, Smart grid, Smart Cities: Smart Vehicles, Smart Lighting, Smart Parking etc.

Recommended Books:

1. Internet of ThingsBy Rajkamal, Tata McGraw Hill publication
2. Internet of things(A-Hand-on-Approach) ByVijay Madisetti and ArshdeepBahga1st Edition, Universal Press
3. The Internet of Things: Connecting Objects By HakimaChaouchiWiley publication
4. The Internet of Things – Key applications and Protocols By Olivier Hersent, David Boswarthick, Omar Elloumi,, Wiley, 2012

Course Outcomes:

After the completion of the course, the student will be able to –

CO 1. Explain the function blocks, three layer model and five layer model of IoT
CO 2. Illustrate various communication network: HAN, NAN, FAN, WAN and WSNs
CO 3. Describe privacy,securityand design related challenges of IoT
CO 4. Select proper sensor technology for IoT application
CO 5. Describe IoTapplications in the field of Electrical Engineering

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Electrical Engineering Department

Digital Electronics and Logic Design: 220201

L	T	P	Total Credits	Theory End Sem	Mid Sem	Quiz/ Assignment
4	0	0	4	60	20	20

Course Objectives:

- To familiarize the students with the number representation and conversion between various representations in digital electronic circuits.
- To expose the students to the logical operations using combinational logiccircuits, sequential logiccircuits and the characteristics of memory and theirclassification.

Unit 1. Number System: Representation of Binary numbers, octal and hexadecimal numbers, complements, signed binary numbers, Binary codes, code conversion, floating point numbers and arithmetic and the conversion process. Subtraction using 1's and 2's complement, Excess 3, Gray code, Hamming Code.

Unit 2. Boolean Algebra andLogicGates: Basic theorems and properties of Boolean algebra, Boolean functions, canonical and standard forms- SOP & POS. Logical operations, truth tables, logic gates, logic levels and pulsewaveforms.Simplification ofBooleanfunctions:The map method-the Karnaugh map, minimal SOP & POS, Don't care conditions, multiple output minimization, tabular method, , determination and selection of prime implicants.

Unit 3. Combinational Logic Circuits: Introduction: Design Procedure, adder, subtractor, Magnitude Comparator, Universal Gate ,Encoders, Decoders, Multiplexers, Demultiplexer, Parity Checker Generator.

Unit 4. SequentialLogicCircuits: State tables and diagrams, Flip Flop and its various types -S-R, J-K, D and T Flip Flops, Excitation table, Triggering of FFs & Latches. Registers: - Shift – Registers, Ripple Counters, Synchronous Counters. RingCounters. Timing Sequences, DesignProcedure.

UNIT 5: Memory and Programmable Logic Device: Introduction to Digital Logic families (RTL, DTL, TTL, ECL, CMOS &Schottky logic) and their special characteristics: Fan Out, Fan in, power dissipation, figure of merit, Noise Margin; Circuits of Logic Families, RAM, ROM, A/D And D/A converters and their types.

Recommended Books:

1. Digital Design by Morris Mano, Pearson Education, 6th edition 2018
2. Logic Design Theory by NNBiswas,Prentice Hall India Learning Private Limited,1993
3. Digital Fundamental by TLFloyd, Pearson Education, 11th edition, 2017
4. Digital Electronics by R. P.Jain, McGraw Hill Education; 4 edition ,2009
5. Digital Logic Design by MansafAlam,PHI Learning Pvt. Ltd., 2015

Course Outcomes:

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

- **CO 1.** **Perform** conversion among Different number systems and codes.
- **CO 2.** **Simplify** the logic expressions using Boolean laws, map method and design them by using logic gates.
- **CO 3.** **Design** a given digital combinational circuits using basic gates for different applications.
- **CO 4.** **Analyze** different types of flip-flops and design a sequential logic circuit .
- **CO 5.** **Understand** basics of Logic family and converter like A/D and D/A.

Sensor Technology: 220202

L	T	P	Total Credits	Theory End Sem	Mid Sem	Quiz/ Assignment	Practical End Sem	Lab Work & Sessional
3	0	2	4	60	20	20	60	40

Course Objective: To familiarize the students with various types of sensors and the design of basic circuit building blocks.

Unit I. Principle of Sensing & Transduction: Sensor, actuator and transducer; Classification, Fundamentals and Characteristics of Sensors/Transducers, Resistive (potentiometric type), Strain gauge, Inductive sensor: common types- Reluctance change type, LVDT, Capacitive Sensors, Thermal Sensors, Magnetic Sensors, Proximity Sensor.

Unit II. Smart Sensor: Architecture of Smart Sensor: Features, Fabrication Of Sensor And Smart Sensor, Electrode Fabrication, Screen Printing, Photolithography, Electroplating Sensing Film Deposition, Physical And Chemical Vapor, Anodization, Sol-Gel, Selection Of Sensors For Practical Applications, Usefulness Of Silicon Technology In Smart Sensor And Future Scope Of Research In Smart Sensor.

UnitIII. MEMS, Intelligent and Network Sensors: Concept and methods of making MEMS devices, sensors and actuators; Concept and architecture of intelligent sensors; Concept and architecture of network sensors, Wireless sensor networks, sensor cloud, virtual sensor

UNIT IV: Sensor Networking: 7-Layer OSI model of communication system, device-level networks, introduction to protocols and technologies for wired and wireless LANs; Ethernet, RS-485 and Foundation Fieldbus protocols; Wi-Fi; Zigbee and Bluetooth protocols; Concept of adhoc networks; Smart Transducer Interface Standard IEEE 1451

Unit IV.Sensors in Different Application Areas: Neuro-sensors; Biosensors, Intelligent Instrumentation: Introduction meaning and advantages; Interfacing: Analog Signal conversion, Interface components: Amplification, waveform generators, voltage to frequency & frequency to voltage converter.

Recommended Books:

1. Measurement System Application and Design by Ernest O. Deobelin, Macgrawhill Publication,2000
2. Intelligent Instrumentation Microprocessor Applications in Measurement and Control by George C.Barney,PHI,2002
3. Transducer and Instrumentation ByD.V.S Murty,PHI,2010
4. Sensors and Signal Conditioning,by Ramon P. A. And Webster J. G., John Wiley and Sons,2015
5. Wireless Sensor Networks, Feng Z. And Leonidas G.Elsevier, Eastern Limited. 2007
7. Intelligent Sensors, by Yamasaki H., Elsevier Eastern Limited. 1996.

Course Outcomes:

After completing this course the student will be able to:

CO 1. Explain fundamentals of Sensors & Transducers.
CO2.Describe smart sensor technology.
CO3.Design the MEMS, Intelligent and network sensors.
CO4.Apply protocols and technology for wired and wireless LANs, Ethernet.
CO5.Discuss intelligent instrumentation techniques.

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Electrical Engineering Department

Sensor Technology Lab- 220202

Lab

List of Experiments

1. Characterize the temperature sensor (RTD)
2. Simulate the performance of a bio-sensor
3. Measurement of level in a tank using capacitive type level probe
4. Characterize the LVDT
5. Design an orifice plate for a typical application
6. Simulate the performance of a chemical sensor
7. Characterize the strain gauge sensor
8. Characterize the temperature sensor (Thermocouple)
9. Study of LDR
10. Study of Photo Diodes & Photo Voltaic cells

Course Outcomes:

After completing this course the student will be able to:

CO1: **Conduct** experiments and measurements in laboratory and on real components and sensors

CO2: **Interpret** the acquired data and measured results

CO3: **Demonstrate**team work and be able to independently present various professional materials.

Annexure-5

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR

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Electrical Engineering Department

CO attainment levels for Jan-June 2020 semester

Subject	Subject Code	CO -% Attainment						Target value	% Gap in Attainment						Status of CO attainment
		CO1	CO2	CO3	CO4	CO5	CO6		CO1	CO2	CO3	CO4	CO5	CO6	
Basic Electrical & Electronics Engineering	100104-ET+IT	81.95	81.8	78.75	81.75	75.4	86.55	75	6.95	6.8	3.75	6.75	0.4	11.55	Achieved
Basic Electrical & Electronics Engineering	100104- CS	82.7	83.8	84.2	86.65	80.65	87.7	70	12.7	13.8	14.2	16.65	10.65	17.7	Achieved
Basic Electrical & Electronics Engineering	100104- EC	64.75	58.78	62.95	67.395	56.455	90.655	65	-0.25	-6.22	-2.05	2.395	-8.55	25.655	Not achieved
EEES	100202	79.66	81.5	73.5	74.6	73.86	78.25	70	9.66	11.5	3.5	4.6	3.86	8.25	Achieved
Digital Electronics & Microprocessor (A)	130401	78.676	66.542	82.052	82.98	78.073	-	70	8.676	-3.46	12.052	12.98	8.073		Not achieved
Digital Electronics & Microprocessor (B)	130401	85.86	81.06	87.68	86.83	87.1	-	75	10.86	6.06	12.68	11.83	12.1		Achieved
Control System (A)	130403	74.33	89.08	82.81	78.38	79.03	81.77	70	4.33	19.08	12.81	8.38	9.03	11.77	Achieved
Control System (B)	130403	76.05	66.26	78	70.65	73.3	68.9	70	6.05	-3.74	8	0.65	3.3	-1.1	Not achieved
Power System I	130404	66	63.333	74.333	76.333	80.5	77	70	-4	-6.67	4.333	6.333	10.5	7	Not achieved
Energy Conservation and Management	900103 (OC)	81.64	81.26	73.27	72.16	69.58	64.35	70	11.64	11.26	3.27	2.16	-0.42	-5.65	Not achieved
Switchgear & Protection (A)	130601	66.165	57.723	77	80.2	66.29	79.7	70	-3.835	-12.27	7	10.2	-3.71	9.7	Not achieved
Switchgear & Protection (B)	130601	76.5	72.33	65.333	83.5	72.667	80.5	70	6.5	2.333	-4.667	13.5	2.667	10.5	Not achieved
Electrical Engineering Materials (A)	130602	73.33	77.83	55	60.83	75.85	68	70	3.33	7.83	-15	-9.17	5.85	-2	Not achieved
Electrical Engineering Materials (B)	130602	73.33	77.83	55	60.83	75.85	68	70	3.33	7.83	-15	-9.17	5.85	-2	Not achieved
Computer Aided Power System Analysis	130611	79.33	72.33	73.66	79.5	71.5	78	70	9.33	2.33	3.66	9.5	1.5	8	Achieved
Utilization of Electrical Energy	BEL 802	82.3	77.6	72.4	71.9	69.7	65.8	70	12.3	7.6	2.4	1.9	-0.3	-4.2	Not achieved
Process Instrumentation	BEEL 803	99.4	68.8	70.8	73.2	75.7	72.5	70	29.4	-1.2	0.8	3.2	5.7	2.5	Not achieved

Annexure-6

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR

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Electrical Engineering Department

Equivalence list of courses for B. Tech. programmes
(for 2017-18, 2018-2019, 2019-2020 & the 2020 admitted batch)

B. Tech. I Year (All Branches)		
	Subject Code / Name of the equivalent subject	
S. No.	2017-18, 2018-2019, 2019-2020 Admitted Batch	2020-2021 Admitted Batch
1.	100104 / Basic Electrical & Electronics Engineering	**100022** / Basic Electrical & Electronics Engineering
2.	100202/ Energy, Environment, Ecology & Society	**100015** / Energy, Environment, Ecology & Society

Equivalence of subjects (2017-18, 2018-2019, 2019-2020 Admitted Batch) with old schemes

B.E. / B. Tech. II Year (III Sem)			
S. No.	Subject Code	Name of the Subject	Branch
3.	130301/BEEL-305	Electromagnetic Field Theory	Electrical
4.	130302/BEEL-302	Measurement & Instrumentation	
5.	130303/ BEEL-303	Network Analysis	
6.	130304/ BEEL-304	Analog Electronics	
7.	BEEL301	Electrical Engineering Materials	
B.E. / B. Tech. II Year (IV Sem)			
S. No.	Subject Code	Name of the Subject	Branch
8.	130401/BEEL403	Digital Electronics & Microprocessor	Electrical
9.	130402/BEEL402	Electrical Machines - I	
10.	130403	Control System	
11.	130404	Power System - I	
12.	BEEL 404	Linear Control System	
13.	BEEL405	Signals & System	
B.E. / B. Tech. III Year (V Sem)			
S. No.	Subject Code	Name of the Subject	Branch
14.	130501	Signals & System	Electrical
15.	130502	Power System – II	
16.	130503/BEEL506	Electrical Machines II	
17.	130504	Power Electronics	
18.	BEEL503	Non Conventional Energy Resources: Challenges & its Applications	
19.	BEEL504	Control System Design	
20.	BEEL505	Transmission and Distribution	

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Electrical Engineering Department

S. No.	Subject Code	Name of the Subject	Branch
21.	130601	Switchgear & Protection	Electrical
22.	130602	Electrical Engineering Materials	
23.	130611(DE-1)	Computer aided Power Systems Analysis	
24.	130612(DE-1)	Industrial Automation	
25.	900103(OC-1)	Energy Conservation & Management	
26.	BEEL601/EEL601/ 6331	Computer Aided Design of Power apparatus & Machines	
27.	BEEL602	Electrical Machine - III	
28.	BEEL603/EEL602/ 6332	Power Electronics	
29.	BEEL604/EEL603/ 6333	Advanced Microprocessor and Interfacing	
30.	BEEL605/EEL604/ 6334	Applied Instrumentation	
31.	BEEL606/EEL605/ 6335	Power System Analysis and Control	

B.E. / B. Tech. IV Year (VII Sem)

S. No.	Subject Code	Name of the Subject	Branch
32.	130711/ BEEL701/EEL701/ 7331	Electrical Drives	Electrical
33.	130712	Renewal Energy Systems	
34.	900205 (OC-2)	Applications of Electrical Equipments & Motors	
35.	900216	IOT & Microgrid	
36.	900217	Electric Vehicles	
37.	BEEL 702	Switchgear & Protection	
38.	BEEL703/EEL703/ 7333	Computer Aided Power System	
39.	BEEL 704A	Power System Economics	
40.	BEEL705A/EEL705 /7335	Energy Audit & Management	
41.	EEL702/7332	Control System	
42.	EEL704/7334	High Voltage Engineering	

B.E. / B. Tech. IV Year (VIII Sem)

S. No.	Subject Code	Name of the Subject	Branch
43.	BEEL801/ EEL804A/8334A	Soft Computing Techniques	Electrical
44.	BEEL802/EEL802/ 8332	Utilization of Electrical Energy	
45.	BEEL803A/EEL803 /8333A	Process Instrumentation	
46.	BEEL804A	High Voltage Engineering	
47.	EEL 801/8331	Switchgear and Protection	

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Electrical Engineering Department

ME ISD-Industrial Systems & Drives I Year - I Sem			
S. No.	**Subject Code**	**Name of the Subject**	**Branch**
48.	580112	Power Electronics Converter	ISD
49.	580113	Intelligent Control Techniques	
50.	580114/ 580105	Power Quality and FACTS Controllers	
51.	580116 (DE-1)	Industrial Instrumentation	
52.	580117 (DE-1)	Industrial Process Control	
		Old Scheme	
53.	580102	Static Power Converter	
54.	580103	Advanced Microprocessor and Applications	
55.	580104	Advanced Control Systems	
ME ISD- I Year - II Sem			
S. No.	**Subject Code**	**Name of the Subject**	**Branch**
56.	580201	Advanced Power Electronics	ISD
57.	580202	Computer Aided Protection	
58.	580203	Modeling Simulation and Evolutionary Techniques	
59.	580204	Electrical Machine modeling and Drives	
60.	580205	Restructured Power System	
ME ISD- II Year -III Sem.			
S. No.	**Subject Code**	**Name of the Subject**	**Branch**
61.	580301	Semiconductor Controlled Drives	ISD
62.	580302	Industrial Instrumentation	

Annexure-7

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR
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Electrical Engineering Department

The Panel of Examiners

(PG Level)

for

Conducting Practical Examination

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR

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Electrical Engineering Department

List of External Examiner for PG

Sr. No.	Name of External Examiner	PG		
		Designation	Postal Address	Phone No.
1.	Dr. K.T. Chaturvedi	Asst. Professor	Elect. Engg. Deptt., UIT, RGPV, Bhopal	9425763274
2.	Dr. D.C. Dubkaria	Professor	Dept. of Electronics BIET, Jhansi	9415194924
3.	Dr. R.K. Saket	Asst. Professor	IIT, BHU, Varanasi	9425106022
4.	Dr. Pradyumn Chaturvedi	Asso. Professor	Elect. Engg. Dept., VNIT, Nagpur	9826585016
5.	Dr. Arvind Mittal	Asso. Professor	Dept. of Energy, MANIT , Bhopal	9425302600
6.	Dr. R. P. Maheshwari	Professor	Elect. Engg. Deptt. IIT Roorkee	9837229406
7.	Dr. Manisha Sharma	Asst. Professor	Electrical Engg. Deptt NIT, Hamirpur	9425772937
8.	Dr. Rajeev Chaturvadi	Principal	SRCEM, Banmore, Gwalior	9425791024
9.	Dr. Arvind Jain	Asst. Professor	Elect. Engg. Deptt RJIT, Takenpur	9406576198
10.	Dr. R.R. Joshi	Prof. & Head,	Dept. of Elect. Engg MPUAT, Udaipur	9414430860
11.	Dr. A.K. Jain	Prof. & Head, EI	SATI, Vidisha	9425463116
12.	Dr. S. N. Sharma	Prof. & Head	Dept. of EC SATI, Vidisha	9425150391
13.	Dr. V.K. Giri	Director	MMM Engg College Gorakhpur	9897792404
14.	Dr. S.C. Choube	Professor	RGPV Bhopal	9630451212
15.	Dr. Amit Ojha	Asstt. Professor	Elect. Engg. Deptt., MANIT, Bhopal	9826028251
16.	Dr. AbhaRajoria	Professor	Bansal Group of College, Bhopal	8964989789
17.	Dr. D.K. Rajoria	Director	Bansal Group of College, Bhopal	8889452750
18.	Dr. KaustubhDwivedi	Lecturer	University Poly, RGPV Bhopal	8085351240
19.	Dr. Seema N. Pandey	Lecturer	BR Ambedkar Polytechnic, Gwl	9617925055
20.	Dr. Nitin Singh	Asst. Professor	EED, MNIT, Allahabad	

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Electrical Engineering Department

21.	Dr. Aditya Trivedi	Professor	IIITM, Gwalior	9425137999
22.	Dr. D.K. Chaturvedi	Professor	Dayalbagh, Agra	09456433788
23.	Dr. Jawar Singh	Asso. Professor	IIT, Patna	--
24.	Dr. Anuj Srivastava	Professor	JECRC, Jaipur	9314860660
25.	Dr Vishnu Goyal	Asst. Professor	Manipal University, Jaipur	8107177813
26.	Dr. R.K. Saxena	Professor	Director, SGSITS, Indore	9425068030
27.	Dr. Trapta Thakur	Professor	Dept. of Elect. Engg. MANIT, Bhopal	9425660696
28.	Dr. R.K. Mishra	Professor	Deptt. of Electrical Engg. IIT, BHU	--
29.	Dr. Narendra Kumar	Professor	EED, DTU, Delhi	--
30.	Dr. Pushpendra Singh	Associate Professor	RajkiyaEngg. College Banda (UP)	9827278454
31.	Dr. AsutoshBhadoria	Associate Professor	DAV, Jalandhar	
32.	Dr. Nitin Millik,	Associate Professor	Northcap University, Gurugram	8010529215
33.	Dr Rajeev Gupta	Associate Professor	MNNIT, Jaipur	9935720179
34.	Dr. Sahnajayub	Professor	BIET, Jhansi	--
35.	Dr. Amritansu Pandey	Associate Professor	IIT, BHU	9984958317
36.	Dr. PratimaWalde	Associate Professor	Galgotiya University	--
37.	Dr. L.S. Titare	Associate Professor	JEC, Elect. Engg. Dept., Jabalpur	9827757938
38.	Dr. Ranjana Singh	Professor	JEC, Elect. Engg. Dept.,	--

			Jabalpur	
39.	Dr. Sachin Tiwari	Associate Professor	OIST, Bhopal	9926706449
40.	Dr.ArunimaVerma	Associate Professor	IET, Lucknow	9415018627
41.	Dr. Sanjeev Sharma	Associate Professor	Electronics Engg. RGPV Bhopal	9407510528
42.	Dr. Sandeep Bhongade	Associate Professor	EED, SGSITS, Indore bhongadesandeep@gmail.com	9826689727
43.	Dr. Shailendra K. Sharma	Associate Professor	Dept. of Electrical Engg. SGSITS, Indore sksharma.sgsits@gmail.com	9425029100
44.	Dr. N. P. Patidar	Professor	EED,.MANIT Bhopal nppatidar@yahoo.com, patidarnp@manit.ac.in	09424454028
45.	Dr. Pankaj Swarnkar	Assistant Professor	EED, MANIT Bhopal Pankaj.Swarnkar.manit@nic.in, p_swarnkar@yahoo.co.in	09754129339
46.	Dr. Priyanka Paliwal	Assistant Professor	Electrical Engineering Department, MANIT, Bhopal Priyanka_manit@yahoo.com	0755-4051416
47.	Dr. A. R. Saxena	Asstt. Professor	Dept. of Elect Engg NIT, Delhi	9873177085

Electrical Engineering Department

M.E.(ISD) Semester – II DE-2

Name of the course	Offered By	Course Duration	Start Date	End date	Examination date	Name of Faculty Mentor
List of Courses offered						
Optimal control	IITR	08 Weeks	January 18, 2021	March 12, 2021	March 21, 2021	Prof. A patra Prof. S.P Singh
Fuzzy Sets, Logic and Systems & Applications	IITK	12 Weeks	January 18, 2021	April 9, 2021	April 24, 2021	Dr. A.K. Wadhwani Dr. Vikram
Power Quality Improvement Technique	IITR	08 Weeks	January 18, 2021	March 12, 2021	March 21, 2021	Prof. Himmat Singh Prof. Bhawana Rathor

Note: Credit for opting a particular NPTEL course will be given only once throughout the tenure of M.E. program

M.E.(ISD) Semester – II OC-2

Name of the course	Offered By	Course Duration	Start Date	End date	Examination date	Name of Faculty Mentor
List of Courses offered						
Optimal control	IITR	08 Weeks	January 18, 2021	March 12, 2021	March 21, 2021	Prof. A patra Prof. S.P Singh
Fuzzy Sets, Logic and Systems & Applications	IITK	12 Weeks	January 18, 2021	April 9, 2021	April 24, 2021	Dr. A.K. Wadhwani Dr. Vikram

Note: Credit for opting a particular NPTEL course will be given only once throughout the tenure of M.E. program

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