NAAC Criterion-I

Curricular Aspects

Key Indicator -1.1 Curriculum Design and Development

Sub-Criteria -1.1.2

Department of Electrical Engineering

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR

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

Gola ka Mandir, Gwalior - 474005, Madhya Pradesh, India

Department of Electrical Engineering

SEMESTER	2019-2023 BATCH		2020-2024 BATCH		Percentage Change
	COURSE CODE	COURSE NAME	COURSE CODE	COURSE NAME	
I	100201	Engineering Physics	100011	Engineering Mathametics-I	
	100202	Society	100013	Engineering Physics	
	100203	Basic Computer Engineering	100014	Engineering Graphics	
	100204	Basic Mechanical Engineering	100015	Energy, Environment, Ecology & Society	
	100205	Basic Civil Engineering & Mechanics	100016	Technical Language	
	100206	Language Lab. & Seminars	100017	Language Lab	
			130111	Mini Project	
II	100101	Engineering Chemistry	130211	Engineering Material	
	100102	Engineering Mathematics-I	100020	Basic Civil Engineering and Mechanics	
	100103	Technical English	100021	Basic Mechanical Engineering	
	100104	Basic Electrical & Electronics Engineering	100022	Basic Electrical and Electronics Engineering	
	100105	Engineering Graphics	100023	Basic Computer Engineering	
	100106	Manufacturing Practices	100024	Electrical Workshop	
III	100001	Engineering Mathametics-II	100025	Engineering Mathametics-II	
	130301	Electromagnetic Field Theory	130311	Electromagnetic Field Theory	
	130302	Measurement and Instrumentation	130312	Electrical and Electronics Measurement	
	130303	Network Analysis	130313	Network Analysis	
	130304	Analog Electronics	130314	Analog Electronics	
	130305	Software Lab-I	130315	Software Lab	
	130306	Self-learning/Presentation (SWAYAM/NPTEL/MOOC)#	130316	Self-learning/Presentation (SWAYAM/NPTEL/MOOC)	
	130309	Summer Internship Project–I (Institute Level) (Evaluation)	200xxx	Novel Engaging Course (Informal Learning)	
	100002	Biology for Engineers	130317	Summer Internship Project–I (Institute Level) (Evaluation)	
			1000001	Indian Constitution and Traditional Knowledge	
IV	100003	Engineering Mathametics-III	100003	Engineering Mathametics-III	
	130401	Digital Electronics & MicroProcessor	130411	Digital Electronics & MicroProcessor	
	130402	Electrical Machines -I	130412	Electrical Machines -I	
	130403	Control System	130413	Power System-I	
	130404	Power System-I	100009	Cyber Security	
	100004	Cyber Security	130414	Python Programming Lab	
	130405	Software Lab-II	130415	Renewable Energy Lab	
			200xxx	Novel Engaging Course (Informal Learning)	
			1000002	Indian Constitution and Traditional Knowledge	
V	100005	Ethics, Economics,Enterpreneurship and Management	130511	Signals and Systems	
	130501	Signal and System	130512	Power System-II	
	130502	Power System-II	130513	Electrical Machines -II	
	130503	Electrical Machines -II	130514	Power Electronics	
	130504	Power Electronics	130515	Data Science	
	130505	Minor Project-I	130516	Minor Project-I	
	130506	Summer Internship Project-II (Evaluation)	130517	Self-learning/Presentation (SWAYAM/NPTEL/ MOOC)	
	130507	Self-learning/Presentation (SWAYAM/NPTEL/MOOC)	200XXX	Novel Engaging Course (Informal Learning)	
	100006	Indian Constitution & Traditional Knowledge (Audit Course)	130518	Summer Internship Project-II (Evaluation)	
			1000005	Project Management & Financing	
			1000006	Disaster Management	
	130601	Switchgear and Protection	130601	Switchgear and Protection	
	130602	Electrical Engineering Material	130602	Control System	
	DE	130611 Computer Aided Power System Analysis 130612 Industrial Automation 130613 Transducers and Sensors	DE	130656 Renewable Enerry Engineering: Solar, Wind and Biomass Energy Systems 130657 Non-Conventional Energy Resources 130658 Microprocessor and Interfacing 130659 Industrial Automation and Control	

VI	DE	Resources 130652 DC Power Transmission Systems 130653 Fuzzy Logic and Neural Networks 130656 Renewable Energy Engineering: Solar, Wind, and Biomass Energy Systems	130605	Artificial Intelligence and Machine Learning	
	OC	900103 Energy Conservation and Management 900115 Biomedical Instrumentation	130603	Minor Project-II	
	100007	Disaster Management	200xxx	Novel Engaging Course (Informal Learning)	
	130603	Minor Project-II	100008	Intellectual Property Rights (IPR)	
VII	DE	130713 IoT in Microgrid 130715 Electric Vehicles 130716 Biomedical Instrumentation	DE	160714 Data Mining & Predictive Modelling 160715 Soft Computing 160716 Mobile Computing	
	DE	130751 Introduction to Smart Grid 130755 Fundamentals of Electrical Drives	DE	130751 Introduction to Smart Grid 130755 Fundamentals of Electrical Drives	
	OC	900205 Applications of Electrical Equipments and Motors 900230 Sensor Technology	OC	900205 Applications of Electrical Equipments and Motors 900230 Sensor Technology	
	OC	900216 IoT in Microgrid 900217 Electric Vehicles	OC	900216 IoT in Microgrid 900217 Electric Vehicles	
	100008	Intellectual Property Rights (IPR)	100008	Intellectual Property Rights (IPR)	
	130704	Departmental Lab	160701	Departmental Lab	
	130702	Summer Internship Project-III (04 weeks) (Evaluation)	160702	Summer Internship Project-III (04 weeks) (Evaluation)	
	130703	Creative Problem Solving (Evaluation)	160703	Creative Problem Solving (Evaluation)	
VIII	DE	130851 Introduction to Internet of Things 130855 Power System Dynamics Control and Monitoring 130556 Microprocessors and Interfacing 130857 Industrial automation and Control	DE	130851 Introduction to Internet of Things 130855 Power System Dynamics Control and Monitoring 130556 Microprocessors and Interfacing 130857 Industrial automation and Control	
	OC	900607 Renewable Enerry Engineering: Solar, Wind and Biomass Energy Systems 900608 Non-Conventional Energy Resources 900633 Smart Grid: Basics to Advanced Technologies 900605 Waste to Energy Conversion	OC	900607 Renewable Enerry Engineering: Solar, Wind and Biomass Energy Systems 900608 Non-Conventional Energy Resources 900633 Smart Grid: Basics to Advanced Technologies 900605 Waste to Energy Conversion	
	130801	Internship/Project	160801	Internship/Project	
	130802	Professional Development	160802	Professional Development	
					27.42

OLD SYLLABUS	REVISED SYLLABUS	

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Electrical Engineering Department

Power System-II: 130502 (Old)

Course Objectives:

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

Unit I. System Representation and Load Flow Analysis: Single line representation, Per unit syste Network Model formulation, Formulation of YBUS, Formation of static load flow equations, solut of load flow problem by Gauss-Seidel, Newton-Raphson (polar and rectangular) and fast decoup load flow methods.

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

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

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

Unit V.

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

Recommended Books:

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

Course Outcomes

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

CO 1. Explain the concepts of single line diagram and per unit system
CO 2. Apply different load flow techniques to solve load flow problem
CO 3. Perform fault calculations for symmetrical and unsymmetrical faults
CO 4. Explain the theoretical and practical aspects of Power System Stability and its enhancement
CO 5. Elucidate the automatic generation control reactive power, voltage control, series and compensation
CO 6. Discuss the insulation resistance, capacitance of various types of cables and the need of transmission.

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Electrical Engineering Department

Power System-II: 130502 (Revised)

Course Objectives:

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

Unit I.

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

Unit II.

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

Unit III.

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

Unit IV.

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

Unit V.

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

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Electrical Engineering Department

ELECTRICAL MACHINES-II: 130503 (Old)

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

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

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

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

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

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

Recommended Books:

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

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Electrical Engineering Department

ELECTRICAL MACHINES-II: 130503 (Revised)

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

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

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

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

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

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

Recommended Books:

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

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Electrical Engineering Department

Power Electronics: 130504 (Old)

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

Unit I. Power Semiconductor Devices: Power diodes, Transistors, Power MOSFET, IGBT, Thyristor TRIAC and GTO. Thyristor static and dynamic characteristics. Two transistor equivalent model, turn on and turn off. Thyristor performance parametcrs, Thyristor types Ratings and protection, Firing circuits, Design of snubber circuit. Series and parallel operation.

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

Unit III. Cyclo-Converter: practical cyclo-converter circuits, Single phase to single phase, three phase to single phase, three phase to three phase out put voltage control circuit, Cyclo-converter drives, circulating and non-circulating type dual converters.

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

Unit V. Chopper: Thyristor commutation schemes, Principles of single quadrant, Two quadrant, four quadrant chopper. Control strategies, Pulse width modulation, Frequency modulation, Voltage commutated Chopper, switched mode power supplies, buck-boostregulators.

Recommended Books:

1. Power Electronics by P.C. Sen, McGrawHill, 1st Ed., 2001
2. Power Electronics by P.S. Bimbhra, Khanna Publishers, 5th Ed., 2012
3. Power Electronics: Circuits, Devices & Applications by MH Rashid, Pearson, 5th Ed., 2012
4. Power Electronics by Cyril W. Lander, McGraw-Hill; 2nd Ed.,1987
5. Power Electronics Principles and Applications by Josheph Vidyathil, TMH,2010.

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Electrical Engineering Department

Power Electronics: 130504 (Revised)

urse Objective: To introduce the students the basic theory of power semiconductor ices and passive components, their practical application in power electronics and to iliarize the operation principle of AC-DC, DC-DC, DC-AC conversion circuits and their lications. Also to provide the basis for further study of power electronics circuits and tems.

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

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

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

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

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

commended Books:

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

urse Outcomes:

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

- O 1. **Name** power electronics devices and explain their static/ dynamic characteristics.
- O 2. **Ability** to analyze the configuration of AC to DC converter, Dual converter, chopper, cyclo-converter.
- O 3. **Classify** converters and identify their applications.
- O 4. **Develop** different model of different converters to calculate their performance parameter
- O 5. **Identify** the problems/limitations of power electronics devices, converters and suggest solutions.