M.D. UNIVERSITY, ROHTAK

SCHEME OF STUDIES AND EXAMINATION

B. TECH Minor Degree in Electrical Engineering

(For branches other than Electrical engineering)

Scheme effective from 2026-27

(Applicable in UIET, MDU, Rohtak only)

B. TECH Minor Degree in Electrical Engineering
(Forbranches other than EE)
Scheme effective from 2026-27
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Sr. No	Semester	Course Code	Subject	Teaching Schedule			Examination Schedule (Marks)				Duration of Exam (Hours)	No of hours/ week
				L	P	Total Credits	Marks of Class works	Theory	Practical	Total		
1	3	26EEM-201-H	Electric Circuit Analysis	3	-	3	25	50	-	75	3	3
2	3	26EEM-203-H	Electric Circuit Analysis Lab	0	2	1	5	-	20	25	3	2
3	4	26EEM-202-H	Electrical Machine	3	-	3	25	50	-	75	3	3
4	4	26EEM-204-H	Electrical Machine Lab	0	2	1	5	-	20	25	3	2
5	5	27EEM-301-H	Power system	3	-	3	25	50	-	75	3	3
6	5	27EEM-303-H	Power system Lab	0	2	1	5	-	20	25	3	2
7	6	27EEM-302-H	Control System	3	_	3	25	50	-	75	3	3
8	6	27EEM-304-H	Control System Lab	0	2	1	5	-	20	25	3	2
9	7	28EEM-401-H	Power Electronics and Drives	3		3	25	50	-	75	3	3
10	7	28EEM-403-H	Power Electronics and Drives Lab	0	2	1	5	-	20	25	3	2
			TOTAL			20				500	30	25

Name of the Program	B.Tech (Minor Degree in Electrical Engineering)	**Program Code**	BMEE
Name of the Course	**Circuit Analysis**	**Course Code**	26EEM-201-H
L-T-P	3-0-0	**External marks**	50
Credits	3	**Internal marks**	25
Duration of Examination:	3H	**Total marks**	75

Note:

1. The examiner has to set a total of nine questions (two from each unit and one compulsory question consisting of short answer from all units. The candidate has to attempt one question each from each unit along the compulsory question (5 x 15 = 75 marks)
2. The students in the examination will be allowed to use only non-programmable scientific calculator. However, sharing/exchange of calculator is prohibited in the examination.

COURSE OUTCOMES :

By the end of the Course, Students will be able to:

1. Understand the concepts of magnetic circuits, Operation of dc machines, Single phase and three phase transformers.
2. Analyse the differences in operation of different dc machine configurations and Transformers.
3. Evaluate the electrical parameters of DC machines and Transformers for different working conditions.
4. Improve the design of DC machines and Transformers considering the electrical parameters like losses, Loading, Testing and cooling.

CO - PO mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2										3		
CO2		3										3		
CO3	2	3											2	
CO4			3										3	2
WT. AVG	2.5	2.67	3									3	2.5	2
									Overall Mapping of Subject					2.61

Section A

Network Theorems (AC Circuit)

Superposition theorem, Thevenin theorem, Norton theorem, Maximum power transfer theorem, Reciprocity theorem, Compensation theorem. Analysis with dependent current and voltage sources. Node and Mesh Analysis. Concept of duality and dual networks.

Section B

Two Port Network and Network Functions

Two Port Networks, terminal pairs, relationship of two port variables, impedance parameters, admittance parameters, transmission parameters and hybrid parameters, interconnections of two port networks. Synthesis of Y21 and Z21 with R ohm terminations Network Tropology and Graph Theory.

Section C

Poly-phase Circuits Three phase balanced circuits, voltage and current relations in star and delta connections. Power Measurement by two wattmeter method.

Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

Section D

Measuring Instruments Construction, operating and uses of moving iron type and moving coil type, induction type voltmeter, Ammeter, watt meter, energy meter. Electrical Installations Components of LT Switchgear: Introduction to Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing.

Text / Reference Books:

1. C. K. Alexander and M. N. O. Sadiku, “Electric Circuits”, McGraw Hill Education,2004.
2. D. P. Kothari and I. J. Nagrath, “Basic Electrical Engineering”, Tata McGraw Hill, 2010.
3. M. E. Van Valkenburg, “Network Analysis”, Prentice Hall,2006.
4. D. Roy Choudhury, “Networks and Systems”, New Age International Publications,1998.
5. W. H. Hayt and J. E. Kemmerly, “Engineering Circuit Analysis”, McGraw Hill Education, 2013.

Name of the Program	B.Tech (Minor Degree in Electrical Engineering)	**Program Code**	BMEE
Name of the Course	**Electrical Circuit Analysis Laboratory**	**Course Code**	26EEM-203-H
L-T-P	0-0-2	**External marks**	20
Credits	1	**Internal marks**	5
Duration of Examination:	3H	**Total marks**	25

Notes:

(i) At least 10 experiments are to be performed by students in the semester.
(ii) At least 7 experiments should be performed from the list, remaining three experiments may either be performed from the above list or designed and set by the concerned institution as per the scope of the syllabus.
(iii) Group of students for practical should be 15 to 20 in number.

Course Outcomes:

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

1. Simulate and analyse the transient and frequency response of electrical circuits using simulation software.
2. Determine and verify the parameters of two-port networks and their interconnections.
3. Verify network theorems and analyse their applications in electrical circuits.
4. Synthesize electrical networks from given network functions and evaluate their performance through simulation and experimentation.

LIST OF EXPERIMENTS:

1. Introduction of circuit creation & simulation software like MATLAB etc.
2. Study of Transient response of RC, RL circuit.
3. To find the resonance frequency, Band width of RLC series circuit.
4. To calculate and verify "Z" & "Y" parameters and "ABCD" parameters of a two port network.
5. To determine equivalent parameter of parallel-series, cascading and parallel connections of two port network.
6. To calculate and verify Compensation theorem and Tellegen's theorem.
7. To synthesize a network of a given network function and verify its response.
8. To calculate and verify Maximum power transfer and Reciprocity theorem

Name of the Program	B.Tech (Minor Degree in Electrical Engineering)	**Program Code**	BMEE

Name of the Course	**Electrical Machine**	**Course Code**	26EEM-202-H
L-T-P	3-0-0	**External marks**	50
Credits	3	**Internal marks**	25
Duration of Examination:	3H	**Total marks**	75

Note:

1. The examiner has to set a total of nine questions (two from each unit and one compulsory question consisting of short answer from all units. The candidate has to attempt one question each from each unit along the compulsory question (5 x 15 = 75 marks)
2. The students in the examination will be allowed to use only non-programmable scientific calculator. However, sharing/exchange of calculator is prohibited in the examination.

Course Outcomes:

1. Understand the concepts of magneticcircuits.
2. Understand the operation of dcmachines.
3. Analyze single phase and three phase transformers circuits.
4. Impart knowledge on construction, principle of operation and performance of ac machine.
5. Understand the concepts of rotating magnetic fields and operation of ac machines.

CO - PO mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2										3		
CO2		3										3		
CO3	2	3											2	
CO4			3										3	2
WT. AVG	2.5	2.67	3									3	2.5	2
									Overall Mapping of Subject					2.61

Section A

Magnetic fields and magnetic circuits

Review of magnetic circuits - MMF, flux, reluctance, inductance; Faradays Law of Electromagnetic Induction, Lenz Law, Fleming LHR, Fleming RHR; B-H curve of magnetic materials;

Section B

DC machines

Basic construction of a DC machine, magnetic structure - induced EMF in an armature coil. Armature winding - lap and wave windings, construction of commutator, back EMF equation, armature reaction,

Armature circuit equation for motoring and generation, Types of field excitations - separately excited, shunt and series. Open circuit characteristic of separately excited DC generator, voltage build-up in a shunt generator, critical field resistance and critical speed. V-I characteristics and torque-speed characteristics of separately excited, shunt and series motors. Speed control of DC Motors, Losses.

Section C

Transformers

Single-phase transformers-Principle, construction and operation of single-phase transformers, equivalent circuit, phasor diagram, voltage regulation, losses and efficiency, Testing - open circuit and short circuit tests,

Three-phase transformer - construction, types of connection and their comparative features,

Autotransformers - construction, principle, applications and comparison with two winding transformer,

Section D

Poly-phase Induction Motor: Constructional features, Principal of operation, production of rotating magnetic field, induction motor action, Methods of speed control ,

Single Phase Induction motors: Double revolving field theory,

Synchronous Generator: Principle, construction of cylindrical rotor and salient pole machines,

Synchronous Motor: Principles of synchronous motor, V-curve, starting, damper winding, synchronous condenser, applications.

Text / Reference Books:

1. A. E. Fitzgerald and C. Kingsley, "Electric Machinery", New York, McGraw Hill Education, 2013.
2. A. E. Clayton and N. N. Hancock, "Performance and design of DC machines", CBS Publishers, 2004.
3. M. G. Say, "Performance and design of AC machines", CBS Publishers,2002.
4. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers,2011.
5. I. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education,2010.

B.L Theraja, "A Textbook of Electrical Technology - Volume II", S. Chand, 2020

Name of the Program	B.Tech (Minor Degree in Electrical Engineering)	**Program Code**	BMEE
Name of the Course	**Electrical Machine Laboratory**	**Course Code**	26EEM-204-H
L-T-P	0-0-2	**External marks**	20
Credits	1	**Internal marks**	5
Duration of Examination:	3H	**Total marks**	25

Notes:

(i) At least 10 experiments are to be performed by students in the semester.
(ii) At least 7 experiments should be performed from the list, remaining three experiments may either be performed from the above list or designed and set by the concerned institution as per the scope of the syllabus.
(iii) Gruoup of students for practical should be 15 to 20 in number.

Course Outcomes:

1. Understand the concepts of magneticcircuits and operation of dcmachines.
2. Understand the operation of single phase transformers circuits.
3. Understand the principle of operation and performance of Induction machine.
4. Understand the principle of operation and performance of Synchronous machine.

LIST OF EXPERIMENTS:

1. To study Parallel operation of two 1-phase transformers.
2. To perform load test on DC shunt generator.
3. To study Speed controls of DC shunt motor.
4. To perform load test on Shunt Generator.
5. To study the connections of DC Machines.
6. To study the speed control of induction motor by rotor resistance control.
7. To perform the open circuit test and block rotor test on single-phase induction motor.
8. To perform O.C. test on synchronous generator and determine the full load regulation of a three phase synchronous generator by synchronous impedance method.
9. To plot V- Curve of synchronous motor.
10. Synchronization of two Three Phase Alternators by
    a) Synchroscope
    b) Three dark lamp Method
    c) Two bright one dark lamp Method

Name of the Program	B.Tech (Minor Degree in Electrical Engineering)	**Program Code**	BMEE

Name of the Course	**Power System**	**Course Code**	27EEM-301-H
L-T-P	3-0-0	**External marks**	50
Credits	3	**Internal marks**	25
Duration of Examination:	3H	**Total marks**	75

Note:

1. The examiner has to set a total of nine questions (two from each unit and one compulsory question consisting of short answer from all units. The candidate has to attempt one question each from each unit along the compulsory question (5 x 15 = 75 marks)
2. The students in the examination will be allowed to use only non-programmable scientific calculator. However, sharing/exchange of calculator is prohibited in the examination.

Course Outcomes:

1. Understand the concepts of power systems.
2. Understand the various power system components.
3. Analyses of transmission line parameters.
4. Understand basic protection schemes and circuit breakers.

CO - PO mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	2								3	2	
CO2		3	3	2								3	2	2
CO3	3		3		2	2							2	
CO4	3		2		3						2	3	2	2
WT. AVG	3	2.5	2.5	2	2.5						2	3	2	2
									Overall Mapping of Subject					2.53

SECTION A

Energy sources, their availability, recent trends in Power Generation, Interconnected Generation of Power Plants.Conventional and non-conventional energy sources, classification and layout of different generating station, spinning reserve and efficiency.

SECTION B

Introduction to Distribution Systems, definition of basic terms like demand factor, utilization factor, load factor, plant factor, diversity factor, relationship between the load factor and loss factor - Classification of loads (Residential, Commercial, Agricultural and Industrial).

SECTION C

Distribution Feeders and Substations: Design consideration of distribution feeders: Radial and loop types of primary feeders, Design practice of the secondary distribution system, transmission line parameters, classification, voltage regulation and efficiency.

SECTION D

CIRCUIT BREAKERS: Theory of arc interruption, circuit breaker, circuit breaker ratings, restriking voltage transients, air circuit breaker, bulk oil, minimum oil, air blast, SF6 CB, vacuum circuit breakers. PROTECTIVE RELAYS: Nature and causes of faults, types of shunt fault, essential qualities, primary and backup protections, electro mechanical relay classification.

TEXT BOOKS:

1. A.S. Pabla, "Electric Power Distribution", Tata McGraw Hill Publishing Co. Ltd., FourthEdition.
2. M.K. Khedkar, G.M. Dhole, "A Text Book of Electrical power Distribution Automation", University Science Press, NewDelhi.
3. Electric Power Generation, B.R.Gupta
4. Power System Engineering, Nagrath & Kothari, Tata Mc-Graw Hill, New Delhi
5. Electrical Power system by C L Wadhwa, new age international pvt. Ltd.
6. Switchgear And Protection Sunil S Rao Khanna Publishers

Name of the Program	B.Tech (Minor Degree in Electrical Engineering)	**Program Code**	BMEE
Name of the Course	**Power system Laboratory**	**Course Code**	27EEM-303-H
L-T-P	0-0-2	**External marks**	20
Credits	1	**Internal marks**	5
Duration of Examination:	3H	**Total marks**	25

Notes:

(iv) At least 10 experiments are to be performed by students in the semester.

(v) At least 7 experiments should be performed from the list, remaining three experiments may either be performed from the above list or designed and set by the concerned institution as per the scope of the syllabus.

(vi) Group of students for practical should be 15 to 20 in number.

(vii)

Course Outcomes

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

1. Perform experiments on protective relays and analyse their operating characteristics.
2. Determine the performance and parameters of transmission lines under different operating conditions.
3. Analyse the performance of DC distribution systems and understand the mechanical aspects of transmission lines.
4. Evaluate the electrical characteristics and performance of photovoltaic (PV) modules under varying environmental conditions.

LIST OF EXPERIMENTS:

1. To study the IDMT over current relay and determine the time current characteristics
2. To study percentage differential relay.
3. To study the different type of distance relays.
4. To find ABCD parameters of a model of transmission line.
5. To study performance of a transmission line under no load condition & under load at different power factors.
6. To observe the Ferranti effect in a model of transmission line.
7. To study performance characteristics of typical DC distribution system in radial & ring main configuration.
8. To study mechanical design of transmission line.
9. To understand PV modules and their characteristics like open circuit voltage, short circuit current, Fill factor, Efficiency,
10. To understand I-V and P-V characteristics of PV module with varying radiation and temperature level

Name of the Program	B.Tech (Minor Degree in Electrical Engineering)	**Program Code**	BMEE
Name of the Course	**Control System**	**Course Code**	27EEM-302-H
L-T-P	3-0-0	**External marks**	50
Credits	3	**Internal marks**	25
Duration of Examination:	3H	**Total marks**	75

Note:

3. The examiner has to set a total of nine questions (two from each unit and one compulsory question consisting of short answer from all units. The candidate has to attempt one question each from each unit along the compulsory question (5 x 15 = 75 marks)
4. The students in the examination will be allowed to use only non-programmable scientific calculator. However, sharing/exchange of calculator is prohibited in the examination.

Course Outcomes:

1. Understand the modelling of linear-time-invariant systems using transfer function and state-space representations.
2. Understand the concept of stability and its assessment for linear-time invariant systems.
3. Design simple feedback controllers.

CO - PO mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2										3		
CO2	3	3	2									3	2	
CO3		2	3		3							3		2
CO4	3			2								3	2	
WT. AVG	3	2.33	2.5	2	3							3	2	2
									Overall Mapping of Subject					2.48

Section-A

Introduction to control problem

Industrial Control examples. Mathematical models of physical systems. Transfer function models of linear time-invariant systems. Feedback Control: Open-Loop and Closed-loop systems. Benefits of Feedback. Block diagram algebra.

Time Response Analysis

Standard test signals. Time response of first and second order systems for standard test inputs. Concept of Stability. Routh-Hurwitz Criteria. Root-Locus technique.

Section-B

Frequency-response analysis

Relationship between time and frequency response, Polar plots, Bode plots. Nyquist stability criterion.

Section-C

Introduction to Controller Design

Stability, steady-state accuracy, transient accuracy, disturbance rejection, insensitivity and robustness of control systems. Proportional, Integral and Derivative Controllers, Lead and Lag compensation.

Section-D

State variable Analysis

Concepts of state variables. State space model. Diagonalization of State Matrix. Eigenvalues. Concept of controllability and observability.

Text / Reference Books:

1. B.S.Manke, “Linear Control Systems: with MATLAB application”, Khanna Publication.

2. B. C. Kuo, “Automatic Control System”, Prentice Hall, 1995.

3. K. Ogata, “Modern Control Engineering”, Prentice Hall, 1991.

4. I. J. Nagrath and M. Gopal, “Control Systems Engineering”, New Age International, 2009

Name of the Program	B.Tech (Minor Degree in Electrical Engineering)	**Program Code**	BMEE
Name of the Course	**Control system Laboratory**	**Course Code**	27EEM-304-H
L-T-P	0-0-2	**External marks**	20
Credits	1	**Internal marks**	5
Duration of Examination:	3H	**Total marks**	25

Notes:

(i) At least 10 experiments are to be performed by students in the semester.

(ii) At least 7 experiments should be performed from the list, remaining three experiments may either be performed from the above list or designed and set by the concerned institution as per the scope of the syllabus.

(iii) Group of students for practical should be 15 to 20 in number.

Course Outcomes

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

1. Analyse the characteristics and performance of servo motors and closed-loop control systems.
2. Implement and evaluate PID controllers, stepper motor control, and industrial PLC-based control applications.
3. Analyse the response and stability of first- and second-order control systems using experimental methods.
4. Use MATLAB Control System Toolbox to model, analyse, and simulate the performance of control systems using time and frequency response techniques.

LIST OF EXPERIMENTS

1. To study speed Torque characteristics of

a) A.C. servo motor b) DC servo motor.

2. To study and demonstrate simple closed loop control system.

4. To study a stepper motor & to execute microprocessor or computer-based control of the same by changing number of steps, direction of rotation & speed.

5. To implement an application based PID controller.

6. To study behavior of 1 order,2 order type 0, type 1 system.

7. To study control action of light control device.

8. To study water level control using a industrial PLC.

MATLAB BASED (ANY FOUR EXPT.)

10. Introduction to MATLAB (Control System Toolbox), Implement at least any

- Different Toolboxes in MATLAB, Introduction to Control Systems Toolbox.
- Determine transpose, inverse values of given matrix.
- Plot the pole-zero configuration in s-plane for the given transfer function. Plot unit step response of given transfer function and find peak overshoot, peak time.
- Plot unit step response and to find rise time and delay time.
- Plot locus of given transfer function, locate closed loop poles for different values of k.
- Plot root locus of given second order transfer.
- Plot bode plot of given transfer function.
- Plot the Nyquist plot for given transfer function.

Name of the Program	B.Tech (Minor Degree in Electrical Engineering)	**Program Code**	BMEE
Name of the Course	**Power Electronics and Drives**	**Course Code**	28EEM-401-H
L-T-P	3-0-0	**External marks**	50
Credits	3	**Internal marks**	25
Duration of Examination:	3H	**Total marks**	75

Note:

1. The examiner has to set a total of nine questions (two from each unit and one compulsory question consisting of short answer from all units. The candidate has to attempt one question each from each unit along the compulsory question (5 x 15 = 75 marks)
2. The students in the examination will be allowed to use only non-programmable scientific calculator. However, sharing/exchange of calculator is prohibited in the examination.

Course Outcomes

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

1. Describe the operation of power semiconductor devices and firing circuits.
2. Analyse the performance of rectifiers, converters, inverters, and choppers.
3. Explain the operation and control of electrical drives.
4. Evaluate the performance of DC motor drives, including speed control, starting, and braking.

CO - PO mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2										3		
CO2	3	3	2		3							3	2	
CO3	2		3		3							3	2	
CO4	3	2		2	3							3		
WT. AVG	2.75	2.33	2.50	2	3							3	2	2
									Overall Mapping of Subject					2.45

Section-A

INTRODUCTION: Role of power electronics, review of construction and characteristics of power diode, Shottky diode, power transistor, DIAC, Triac, GTO.

SCR: construction and characteristics of SCR,Ratings and protections, series and parallel connections, SCR firing circuits. Pulse transformer & optocoupler.

Section-B

THYRISTOR RECTIFIER: Single-phase full-bridge thyristor rectifier with R-load.CONVERTERS: One, two, three, six and twelve pulse converters, fully and half controlled converters, introduction to four quadrant / dual converter.

INVERTERS: Basic circuit, 120 degree mode and 180 degree mode conduction schemes. CHOPPERS : Basic scheme, output voltage control techniques, one, two, and four quadrant choppers, step up chopper.

Section-C

ELECTRICAL DRIVES: Introduction, classification, advantages, choice of electrical drive machines, status of ac and dc drives.

CONTROL OF ELECTRICAL DRIVES: Modes of operation, inner current loop and outer speed loop, closed loop control of multi-motor drives, sensing of current and speed, Microprocessor based control of electric drives

Section-D

DYNAMICS OF ELECTRICAL DRIVES: Fundamental torque equation, multi-quadrant operation, equivalent values of drive parameters, load torque components, types of load.

DC MOTOR DRIVES: Review of emf and torque equations, review of speed-torque characteristics, speed control methods, starting and braking methods, converter fed dc drive and chopper fed dc drive.

TEXT BOOK:

1. Power Electronics: P.S Bhimra

2. Power Electronics : MH Rashid; PHI

3. Fundamental of Electrical Drives: G.K. Dubey, Narosa Publishing House, New Delhi, 1995

4. Electric Drives: Concept and applications- V. Subrahmaniyam, TMH, New Delhi

Name of the Program	B.Tech (Minor Degree in Electrical Engineering)	**Program Code**	BMEE
Name of the Course	Power electronics and Drives Laboratory	**Course Code**	28EEM-403-H
L-T-P	0-0-2	**External marks**	20
Credits	1	**Internal marks**	5
Duration of Examination:	3H	**Total marks**	25

Notes:

(iv) At least 10 experiments are to be performed by students in the semester.

(v) At least 7 experiments should be performed from the list, remaining three experiments may either be performed from the above list or designed and set by the concerned institution as per the scope of the syllabus.

(vi) Gruoup of students for practical should be 15 to 20 in number.

Course Outcomes

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

1. Analyse the characteristics of power semiconductor devices and their firing circuits.
2. Perform experiments on pulse transformer, optocoupler, and converter-based power electronic circuits.
3. Evaluate the speed control performance of DC motors using converters and choppers.
4. Analyse the speed–torque characteristics and operating performance of DC motor drives under different firing angles and control modes.

LIST OF EXPERIMENTS

1. Static Characteristics of Power diode &Shottky diode

2. Characteristics of GTO

3. To study R, RC and UJT firing Circuit with Pulse transformer

4. To Study of Pulse transformer & optocoupler technique.

5. Speed control of small motor using Single Phase Half wave & Full wave fully controlled Converter

6. Speed control of small motor using Single Phase Dual Converter.

7. Speed control of a small DC motor using Chopper with output voltage control technique.

8.To study single phase bridge converter drive & study ramp comparator firing circuit for same.

9.To study single phase Half converter drive & study ramp comparator firing circuit for same.

10. To draw speed-torque characteristics of 1 H.P. DC series motor in open/close loop using single phase converter and to observe current and voltage waveform at different firing angle.