



# Shri Vaishnav Vidyapeeth Vishwavidyalaya

## Diploma (Electrical Engineering)

### SEMESTER IV

COURSE CODE	CATEGORY	COURSE NAME	L	T	P	CREDITS	TEACHING & EVALUATION SCHEME				
							THEORY			PRACTICAL	
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
DTEE401		<b>POWER ELECTRONICS</b>	3	1	2	5	60	20	20	30	20

**Legends:** L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit;

\***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

#### Course Objectives:

To introduce the students with the

1. Various semiconductor devices.
2. Construction and the working principle of the devices.
3. Applications of various semiconductor devices.

#### Course Outcomes:

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

1. Identify various types of Semiconductor devices.
2. Adequate knowledge of operation and applications of high power switching devices as well as of power electronics and equipment.

#### Syllabus

##### UNIT I

##### Power Semiconductor Devices

Role of power electronics in the field of electric power control, Characteristics and symbols of power semiconductor devices, Types of power electronic circuits, Characteristics and applications of general purpose diode, fast recovery diode and schottky diode.

Characteristics and application of Bipolar Junction Transistor, Power MOSFET, Performance parameter, construction, characteristics and application of SCR, GTO, DIAC, TRIAC.

##### UNIT II

##### Uncontrolled and Controlled Rectifiers

Rectifier operation on resistive loads, Single phase and Three phase uncontrolled, controlled and fully controlled bridge rectifiers, Performance parameters, Simple numerical problems on controlled rectifiers.

##### UNIT III

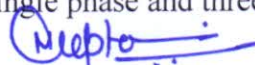
##### Choppers

Principle of chopper operation, various control techniques of chopper, Step up and Step down chopper and its applications.

##### UNIT IV

##### Inverters

Single phase series and parallel inverters, Output voltage and current waveforms, Principle of operation of Single phase and three phase bridge inverter, Performance parameters.

  
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#### UNIT V

Single phase (midpoint & bridge configuration) cyclo converter configuration and operating principles, Single phase full wave AC voltage controllers with R load, Dual converter.

#### Text Books:

1. Bimbhra, P.S, 'Power Electronics', Khanna Publisher, 4 rd Edition, 2013.
2. M.D.Singh and K.B.Kanchandhani, 'Power Electronics', Tata McGraw-Hill Publishing Company Limited, 2nd Edition, 2006.

#### Reference Books:

1. Rashid, M.H, 'Power Electronics - Circuits, Devices and Applications', Prentice Hall Publications, 3 rd Edition, 2003.
2. Vedam Subramaniam, 'Power Electronics', New Age International (P) Ltd Publishers, 2001.
3. Philip T. Krein, 'Elements of Power Electronics', Oxford University Press, 1st Edition, 2012.
4. V. R. Moorthi, 'Power Electronics- Devices, Circuits and Industrial Applications', Oxford University Press, 1st Edition, 2005. 4. P.S. Bimbhra, 'Power Electronics', Khanna Publishers, 3rd Edition, 13th Reprint, 2004

#### List of Practicals:

1. V-I characteristics of SCR.
2. V-I characteristics of DIAC.
3. V-I characteristics of TRIAC.
4. Study of Power Diode as a switch
5. Study of Power MOSFET as a switch.
6. Study of Power Transistor as a switch.
7. Study of SCR as a switch.
8. Fabrication and testing of Half Controlled Bridge Rectifier circuit.
9. Fabrication and testing of SCR Chopper Circuit.
10. Fabrication and Testing of Inverter circuit.

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DTEE402		AC MACHINES	3	1	2	5	60	20	20	30	20

**Legends:** L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit;

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#### Course Objectives:

1. To provide comprehensive knowledge of AC motors and their industrial applications.
2. To acquire hands on experience of conducting various tests on AC machines and obtaining their performance indices using standard analytical as well as graphical methods.

**Course Outcomes:** Upon completion of the course, the student shall be able:

1. To acquaint with AC machines fundamentals and the working of three phase induction motors.
2. To get the knowledge of single phase induction motor and its application for diverse approaches to sustainability.
3. To acquaint with the technical knowledge of alternator used in power plants.
4. To acquire hands on experience of conducting various tests on AC machines and obtaining their performance that can give lifelong learning.

#### Syllabus

##### UNIT I

###### Transformer:

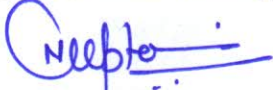
Principle, construction and classification. EMF equation turns ratio, name plate rating, phasor diagram, no load and on load equivalent circuit. Voltage regulation, polarity ratio, open and short circuit tests, losses and efficiency, condition of maximum efficiency. All day efficiency and its numerical.

Three phase transformer: Connections, groups, open delta connection. Comparison of three phase transformer with bank of three single phase transformers.

##### UNIT II

###### Three-Phase Induction Motors:

Classification of ac motors, Induction motor: general principal, construction, Phase-wound rotor, Relation between torque and rotor power factor, Condition for maximum starting torque, Rotor e.m.f and reactance under running conditions, Condition for maximum torque under running

  
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conditions, Relation between torque and slip, Starting torque and maximum torque, Torque/speed characteristic under load, Power stages in an induction motor.

#### UNIT III

##### Testing and Speed Control of Induction Motor:

No-load test, Blocked rotor test, starting of Squirrel-cage motors, Starting of slip-ring motors, crawling, cogging or magnetic locking, Double Squirrel-cage motor, Speed control of induction motor.

#### UNIT IV

##### Single Phase Induction Motors:

Types of single-phase motors, Single-phase induction motor: construction, principle of operation Speed torque characteristics, Double-field revolving theory, Equivalent circuit of single-phase induction motor without core loss, Equivalent circuit with core loss, Split phase induction motor: Principle, phasor diagram, speed-torque characteristic, Capacitor start Motor: Principle, phasor diagram, speed-torque characteristic, Types of capacitors start motors, Capacitor start-and- run motor: construction, Role of capacitor, Application, Shaded-pole single-phase motor: construction, operation, Application, Repulsion type motors, Repulsion motor, Repulsion principle.

#### UNIT V

##### Alternators:

Principle of working and construction.- Salient and Cylindrical rotor , Equivalent circuit and phasor diagram , Voltage regulation by synchronous impedance method, Open circuit and Short circuit characteristics , Parallel operation of an Alternator ,Synchronization of alternator with bus bar.

##### Text Books:

1. B. L. Thereja "A text book of Electrical Technology – Vol - II" – S. Chand Publications.

##### Reference Books:

1. J. B. Gupta – "Theory and Performance of Electrical Machines", S. K. Kataria and Sons.
2. S. J. Chapman - "Electric Machinery Fundamentals", Mcgraw Hill.
3. M. G. Say - "The performance and Design of Alternating Current Machines", CBS Publishers & Distributors.
4. D. P. Kothari & I. J. Nagrath - "Electrical Machines", TMH publication.
5. A. E. Fitzgerald, C. Kingsley, S. D. Umans - "Electric Machinery"- 6th Edition, Tata Mcgraw Hill.
6. Dr. P. S. Bimbhra – "Electrical Machinery", Khanna Publisher.
7. J. J. Winders, Jr. – "Power Transformers: Principles and Applications", CRC Press.

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DTEE403		UTILIZATION OF ELECTRICAL ENERGY	3	0	0	3	60	20	20	0	0

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P - Practical; C - Credit;

\*Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

#### Course Objectives:

The course will provide a comprehensive idea in utilization of electrical power such as drives, electric heating, electric welding and illumination, electric traction, electrolysis, refrigeration air-conditioning and automobile electric system.

#### Course Outcomes:

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

1. Identify a heating/ welding scheme for a given application.
2. Explain various lamps and fittings in use.
3. Explain different schemes of traction schemes and its main components.
4. Identify the job/higher education / research opportunities in electric utilization industry.

#### Syllabus:

##### UNIT I

Electric drives Merits and demerits of electric drives, factors governing selection of motors, drive requirements. Group and individual drive, starting and running characteristics of various motors. Selection of starters, hand operated and contactor type starters, liquid resistor type starter. Speed control of motors, load equalization, use of fly wheel. Motor enclosures, selection of motors for particular service, size and rating of motors.

##### UNIT II

Electric heating Advantages and disadvantages of electric heating, methods of electric heating. Principle of electric heating. Resistance heating, heating elements and alloys. Causes of failures of heating elements. Arc furnaces, principle, construction, working and uses. Induction heating principle, construction and use of Ajax Wyatt (core type) and coreless type. L.F. and H.F. induction furnaces. Dielectric heating principles and uses.

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**UNIT III**

Electric welding Definition, classification of electrical welding, principle of arc welding. Qualities of a good weld. Welding defects. Resistance welding, advantages, classification, principle and working, comparison of resistance and arc welding process, A.C. & D.C. arc welding.

**UNIT IV**

Illumination Electromagnetic wave spectrum, solid and plane angle, definition of electrical terms in use, sensitivity of human eye. Luminous efficiency, horizontal and vertical laws of illumination, definition of terms used in lighting, lighting scheme, various types of lamps, their use and fittings.

**UNIT V**

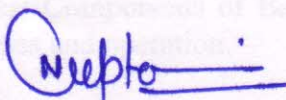
Power factor improvements Causes of low P.F., effects of low P.F., methods of improvement of P.F. and its economics. Electro-chemical processes and storage batteries Electro deposition and faraday's laws of electrolysis, various electro-chemical processes like electroplating, electro-extraction, regions. Storage batteries, classification, construction. Battery maintenance, battery charging, circuit diagram. Application of storage batteries.

**Text Books**

1. Gupta, J.B., Utilization of Elect. Energy, S.K. Kataria & Sons; 2012 Edition (2012)
2. Rajput R.K., Utilisation of Electrical Power, Laxmi Publications, second Edition 2017

**Reference Books:**

1. H. Pratap, Art and Science of Utilization of Electrical Energy, Dhanpat Rai & co., 2014
2. Suryanarayan N.V., Utilization of Elect. Power: Electric Drives and Elect. Traction, New Age International, Second edition 2014.
3. Garg, G.C., Utilization of Elect. Power and Elect. Traction., Khanna publisher, New Delhi. 10<sup>th</sup> Edition. 2016
4. Open Shaw, Taylor, Utilization of electrical energy., Orient Longmans, 1962.



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							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
<b>DTEE404</b>		<b>BATTERIES AND FUEL CELLS</b>	3	0	0	3	60	20	20	0	0

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#### Course Objectives:

This course is design for students interested in the scientific challenges of electrochemical power sources like batteries and fuel cells.

#### Course Outcomes:

After learning the course the students should be able to:

1. Understand electrochemical energy conversion (fuel cells) and storage (batteries).
2. Develop system which can convert chemical energy to electrical energy more efficiently and quietly than internal combustion engines.
3. Engage students in engineering design issues related to the battery and fuel cell technologies.
4. Understand how super capacitor is different from a capacitor.

#### Syllabus:

##### UNIT I

**Introduction:** Electrochemical Device- electrode phase, electrolyte phase, charge transfer Energy storage in Batteries, fundamentals of batteries, their history and development, applications.

##### UNIT II

**Batteries:** Components of Batteries, Classification of Batteries- Primary, Secondary batteries- their types and operation.

##### UNIT III

**Rechargeable Lithium Batteries:** Principle of Lithium Battery, Components of Rechargeable Lithium Battery, Applications of Lithium Batteries.

##### UNIT IV

**Fuel Cells**—Principle of Operation—Chemical Process (with Acidic Electrolyte)—Schematic Diagram—Array for Large outputs—Highlights .

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#### UNIT V

**Super capacitors-** Introduction to Super capacitor, Difference between capacitor and super capacitor, materials used and applications.

#### Text Books:

1. Linden, D.; Reddy, T.B, Handbook of Batteries, McGraw-Hill, 2002
2. Ronald Dell, David Anthony James Rand, Understanding Batteries, Royal Society of Chemistry, 2001
3. Xianguo Li, Principles of Fuel Cells, by, Taylor & Francis, 2006

#### Reference Books:

1. James Larminie, Andrew Dicks, Fuel cell Systems Explained, John Wiley & Sons, 2003
2. Bent Sørensen, Hydrogen and Fuel Cells, Academic Press, 2012
3. Shripad T. Revankar, Pradip Majumdar, Fuel Cells, Principles, Design and Analysis, CRC Press, 2014.
4. Cheng Zhong, Yida Deng, Wenbin Hu, Daoming Sun, Xiaopeng Han, Jinli Qiao, JiuJun Zhang, Electrolytes for Electrochemical Supercapacitors, CRC Press, 2016.

Course Outcomes: Upon completion of the course, the student shall be able to:

1. Understand and solve digital number system.
2. Recall and apply a basic concept of digital fundamentals to Microprocessor based personal computer system.
3. Analyze the Assembly language programs of 8085.

Syllabus

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#### UNIT-I

Review of Number Systems: Binary, Octal and Hexadecimal. Conversion of Binary, Octal and Hexadecimal to Decimal, Binary, Octal and Hexadecimal. Signed numbers. Semiconductor Memory: Memory Unit, Concept of memories using registers, Read only Memory, Random Access Memory, Static and Dynamic Memory, Cache Memory.

#### UNIT-II

Introduction, Organization and Block Diagram of a Simple Micro-Computer, Word-length of a Computer/Microprocessors, Schematic Diagram, Memory, Buses, Input device, Output device, Microprocessor Applications.

#### UNIT-III

Introduction to 8085 - Microprocessor: Architecture, Pin-description, System Bus, Address Bus, Data Bus, Control Bus, Instruction Cycle, Timing diagram.

#### UNIT-IV

Instruction sets of Intel 8085: Addressing Modes, Groups of Instructions. Programming on Addition, Subtraction, Multiplication, Counting, Looping.

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DTEE405		FUNDAMENTALS OF MICROPROCESSOR	3	1	2	5	60	20	20	30	20

**Legends:** L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit;

\***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

**Course Objective:** To develop an understanding of the operations of microprocessors and machine language programming.

**Course Outcomes:** Upon completion of the course, the student shall be able to:

1. Understand and solve digital number system.
2. Recall and apply a basic concept of digital fundamentals to Microprocessor based personal computer system.
3. Analyze the Assembly language programs of 8085.

#### Syllabus

##### UNIT-I

Review of Number System: Decimal, binary, octal and hexadecimal number systems. Conversion from one system to another, Binary arithmetic, signed numbers. Semiconductor Memories: Memory Unit. Concept of memories using registers. Read only Memory. Random Access Memory, Static and Dynamic Memory. Cache Memory.

##### UNIT-II

Introduction, Organization and Block-Diagram of a Simple Micro-Computer, Word-length of a Computer/Microprocessors, Schematic Diagram, Memory, Buses, Input device, Output device, Microprocessor Applications.

##### UNIT-III

Introduction to 8085 – Microprocessor : Architecture, Pin-description, System Bus, Address Bus, Data Bus, Control Bus, Instruction Cycle, Timing-diagram.

##### UNIT-IV

Instruction sets of Intel 8085: Addressing Modes, Groups of Instructions. Programming on Addition, Subtraction, Multiplication, Counting, Looping.

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#### UNIT-V

Microprocessor Applications: Industrial Examples of Temperature Control and Pressure monitoring.

#### Text Books:

1. Fundamentals of Microprocessors & Microcontrollers – By – B. Ram

#### Reference Books:

1. Digital Computer Electronics, Albert P. Malvino & Jerald A. Brown.
2. Microprocessor Architecture, Programming & Applications, R. S. Gaonkar.

#### List of Experiments:

1. Write an assembly language program to convert binary numbers to decimal numbers.
2. Write an assembly language program to convert decimal numbers binary numbers.
3. Write an assembly language program to convert binary numbers to octal numbers.
4. Write an assembly language program to convert octal numbers to decimal numbers.
5. Write an assembly language program to add two numbers.
6. Write an assembly language program for subtracting numbers.
7. Write an assembly language program for division of numbers.
8. Write an assembly language program for multiplication of numbers.
9. Design an application for temperature control through micro processor.
10. Design an application for pressure monitoring through micro processor.

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