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COURSE CODE	CATEGORY	COURSE NAME	TEACHING &EVALUATION SCHEME								
			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
DTEE401	DCC	Power Electronics	60	20	20	30	20	3	0	2	4

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 Educational Objectives (CEOs):
To introduce the students with the
1. Various power electronics devices.
2. Construction and the working principle of the devices.
3. Applications of various power electronics devices.

Course Outcomes(COs):
After the successful completion of this course students will be able to
1. Identify various types of power electronics devices.
2. Adequate knowledge of operation and applications of high power switching devices as well as of power electronics and equipment.

Syllabus

UNIT I **9 Hrs.**

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 **8 Hrs.**

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.

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DTEE401	DCC	Power Electronics	60	20	20	30	20	3	0	2	4

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.

UNIT III **7 Hrs.**

Choppers

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

UNIT IV **8 Hrs.**

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.

UNIT V **9 Hrs.**

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

Textbooks:

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.

References:

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. 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

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DTEE401	**DCC**	**Power Electronics**	60	20	20	30	20	3	0	2	4

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

List of Experiments:

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	DCC	AC Machines	60	20	20	30	20	3	1	2	5

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 Educational Objectives (CEOs):
The objective of this course is -

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 (COs):
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 andobtaining their performance that can give lifelong learning.

Syllabus

UNIT I **9 Hrs.**

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.

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DTEE402	DCC	AC Machines	60	20	20	30	20	3	1	2	5

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.

UNIT II **9 Hrs.**

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

UNIT III **8 Hrs.**

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 **9 Hrs.**

Single Phase Induction Motors: Types of single-phase motors, Single-phase induction motor: construction, principle of operation Speed torque characteristics, Double-field revolving theory, Split phase induction motor: Principle, phasor diagram, speed-torque characteristic. Capacitor start Motor: Principle, phasor diagram, speed-torque characteristic, Capacitor start-and- run motor: construction, Application, Shaded-pole single-phase motor: construction, operation, Application, Repulsion motor.

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DTEE402	DCC	AC Machines	60	20	20	30	20	3	1	2	5

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UNIT V **8 Hrs.**

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.

Textbooks:

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

References:

1. J. B. Gupta – "Theory and Performance of Electrical Machines", S. K. Kataria andSons.
2. S. J. Chapman - "Electric Machinery Fundamentals", Mcgraw Hill.
3. M. G. Say - "The performance and Design of Alternating Current Machines", CBSPublishers & Distributors.
4. D. P. Kothari & I. J. Nagrath - "Electrical Machines", TMH publication.
5. A. E.Fitzerald, C. Kingsley, S. D. Umans - "Electric Machinery"- 6th Edition, TataMcgraw 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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DTEE402	DCC	AC Machines	60	20	20	30	20	3	1	2	5

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.

List of Experiments:
Experiments can cover any of the above topics, following is a suggestive list:

1. Evaluation of turn's ratio and polarity test on 1-phase transformer.
2. Performance analysis of OC and SC tests on a 3-phase transformer and determine its equivalent circuit. Also find its efficiency and regulation at different load and power factor.
3. Performance analysis of No-load and block rotor test on a 3-phase IM and determine its equivalent circuit.
4. Perform load test on a 3-phase IM and plot its performance characteristics.
5. Study various types of starters used for 3-IMs.
6. Perform No-load and block rotor test on a 1-phase IM and determine its equivalent circuit.
7. Realization of Scott connection.
8. Draw & verify open circuit characteristics of 3-Ø synchronous generator.
9. Draw & verify short circuit characteristics of 3-Ø synchronous generator.
10. Draw & verify external load characteristics of 3-Ø synchronous generator.

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DTEE403	DCC	Utilization of Electrical Energy	60	20	20	0	0	3	0	0	3

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

Course Educational Objectives (CEOs):
The course will provide a comprehensive idea in utilization of electrical power such asdrives, electric heating, electric welding and illumination, electric traction, electrolysis, refrigeration air-conditioning and automobile electric system.

Course Outcomes (COs):
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 **9 Hrs.**

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 service, size and rating of motors.

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DTEE403	DCC	Utilization of Electrical Energy	60	20	20	0	0	3	0	0	3

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
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UNIT II **9 Hrs.**

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.

UNIT III **8 Hrs.**

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 are welding process, A.C. & D.C. arc welding.

UNIT IV **8 Hrs.**

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 **9 Hrs.**

Power factor improvement, 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.

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DTEE403	**DCC**	**Utilization of Electrical Energy**	60	20	20	0	0	3	0	0	3

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.

Textbooks:

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

References:

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. 10th Edition. 2016
4. Open Shaw , Taylor, .Utilization of electrical energy., Orient Longmans, 1962.

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DTEE404	DCC	Batteries and Fuel Cells	60	20	20	0	0	3	0	0	3

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 Educational Objectives (CEOs):
This course is design for students interested in the scientific challenges of electrochemical power sources like batteries and fuel cells.

Course Outcomes (COs):
After learning the course, students will 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 **8 Hrs.**

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

UNIT II **7 hrs.**

Batteries: Components of Batteries, Classification of Batteries- Primary, Secondary batteries- their types and operation. Storage batteries, classification, construction. Battery maintenance, battery charging, circuit diagram. Application of storage batteries.

UNIT III **8 Hrs.**

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

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DTEE404	DCC	Batteries and Fuel Cells	60	20	20	0	0	3	0	0	3

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.

UNIT IV **7 Hrs.**

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

UNIT V **8 Hrs.**

Super Capacitors: Introduction to Super capacitor, Difference between capacitor and super capacitor, materials used and applications.

Textbooks:

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

References:

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.

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DTEE405	DCC	Fundamentals of Microprocessor	60	20	20	30	20	2	0	2	3

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 Educational Objectives (CEOs):
The objective of this course is to develop an understanding of the operations of microprocessors and machine language programming.

Course Outcomes (COs):
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.

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UNIT-I **9 Hrs.**

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 **8 Hrs.**

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.

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COURSE CODE	CATEGORY	COURSE NAME	TEACHING &EVALUATION SCHEME								
			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
DTEE405	DCC	Fundamentals of Microprocessor	60	20	20	30	20	2	0	2	3

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.

UNIT-III **8 Hrs.**

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

UNIT-IV **8 Hrs.**

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

UNIT-V **8 Hrs.**

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

Textbooks:

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

References:

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

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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 to 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 microprocessor.
10. Design an application for pressure monitoring through microprocessor.

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