

33081- POWER ELECTRONICS

DETAILED SYLLABUS

UNIT- I OVERVIEW OF POWER ELECTRONICS

Power electronics-Definition (A-1.1)-Scope and Applications (B-1.3)-Power Electronic Switch Specifications (A1.4.3)-Types of Power Electronic Circuits (A-1.5)-Design of Power Electronics Equipment (A-1.6)-Power module (A-1.9)-Intelligent module (A-1.10). Silicon Controlled Rectifier(D-2.4.1)-Forward Blocking Region(D-2.4.2)-Forward Conducting Region(D-2.4.3)-Reverse Blocking Region(D-2.4.4)-Effect of dv/dt and Snubber Circuits (D-2.4.7)-Effect of Rate of Rise in Current(di/dt)(D-2.4.8)-Thyristor Ratings(D-2.4.11) -Thyristor Gate Requirements(D-3.2)-Triggering Circuits for Thyristor(D-3.3)-Resistance Triggering Circuits(D3.4.1)-RC Trigger Circuits(D-3.4.1)-UJT based Trigger Circuits Driver and Buffer Circuits for Thyristor(D-3.4.7) Thyristor Commutation Techniques-Class A, Class B, Class C, Class D, Class E Types(C-5.1 to C-5.6)-Power Devices – MOSFET (A.8.3)-IGBT (A.8.5) – GTO (A.4.8.3)

UNIT- II LINE COMMUTATED POWER CONTROL CIRCUITS

Line Commutated Converters(Controlled Rectifiers)- Principle of Phase Controlled Converter Operation(A-10.2)-Single Phase Full Converters(A-10.3)-Single Phase Dual Converters (A-10.3)-Three Phase Full Converters(A-10.6)-Three Phase Dual Converters(A-10.7)-12 Pulse converters(A-10.12) AC Voltage Controllers-Principle of Phase Control(A11.3)-Single phase Bidirectional controllers with Resistive Load(A11.4)-Single Phase Controller with Inductive Load(A-11.5)-Three Phase Full Wave Controllers(A-11.6)- Cyclo Converters-Single Phase Cyclo Converters(A-11.9.1)-Three Phase Cyclo Converters(A-11.9.2) 13 Curriculum Development Centre, DOTE. Page

UNIT- III FORCED COMMUTATED POWER CONTROL CIRCUITS

DC-DC Switch-Mode Converters(Choppers)-Control of DCDC Converters(B-7.2)-Step-Down(BUCK) Converter(B-7.3)- Continuous-Conduction Mode(B-7.3.1) - Step-Up(BOOST) Converters(B-7.4)-Continuous Conduction Mode (B-7.4.1) –BUCKBOOST Converters (B-7.5) – Continuous Conduction Mode (B7.5.1) - Cuk DC-DC Converters(B-7.6) DC-AC Switch-Mode Inverters-Pulse Width Modulated Inverters Introduction(A-6.1)-Principle of Operation(A-6.2)-Single Phase Bridge Inverters(A-6.4)-Three Phase Inverters(A-6.5)-1800 Conduction Mode(A-6.5.1)-1200 Conduction Mode(A-6.5.2)- Voltage Control of Single Phase Inverters(A-6.6)-Single Pulse Width Modulation(A-6.6.1)-Multiple Pulse Width Modulation(A6.6.2)-

Sinusoidal Pulse Width Modulation(A-6.6.3)-Voltage Control of Three Phase Inverters(A-6.8)-Sinusoidal PWM(A.6.8.1).

UNIT- IV APPLICATIONS OF POWER ELECTRONICS

Switch Mode Power Supplies-Full Bridge Converter type(C-11.1.4)-Uninterrupted Power Supply-ON line(No Break) and OFF line(Short-Break) types(C-11.2)-Static AC Circuit Breaker(C-11.5.1)-AC Solid State Relays(C-11.6.2). High Frequency Fluorescent Lighting (B -16.2.2)- Induction Heating(B16.3.1)-Electric Welding(B -16.3.2)-High Voltage DC Transmission(B -17.2)-Wind and Small Hydro Interconnection(B -17.4.2)-Static VAR Compensators(B -17.3)- Thyristor Controlled Inductors (B -17.3.1)-Thyristor Switched Capacitors(B -17.3.2).

UNIT- V MOTOR DRIVE APPLICATIONS

DC Drives-DC Motor with a Separately Excited Field Winding(B -13.4)-Line Frequency Converters (B-13.7.2)-Effect of Discontinuous Armature Current(B -13.7.3)-Control of Adjustable Speed Drives(B -13.7.4)-Switch-Mode DC-DC Converters(B - 13.7.1) Induction Motor Drives-Introduction(B -14.1)-Basic Principle of Induction Motor Operation (B -14.2)- Induction Motor Characteristics at rated(line) frequency and rated voltage(B -14.3)- Speed Control by Varying Stator frequency and voltage(B -14.4)- Torque-Speed Characteristics(B - 14.4.1)-Start-Up Considerations(B -14.4.2)-Voltage Boost required at low frequencies(B - 14.4.3)-Induction Motor Capability below and above the rated speed(B -14.4.4)-Variable frequency Converter Classifications(B -14.6)-Variable frequency PWM-VSI Drives (B - 14.7)- Line frequency Variable-Voltage Drives(B -14.11)-Reduced Voltage Starting("Soft Start") of Induction Motors(B -14.12)-Speed Control by Static Slip-Power Recovery(B -14.13).

OBJECTIVES

On completion of these units, the student should be able to

- Explain the scope and application of power electronics
- Explain the operating region and rating of SCR.
- Draw, explain and state the application for commutation circuits and trigger circuits of SCR.
- Familiarize the phase controlled rectifier and know the applications of the phase controlled rectifier.

- Draw and describe the working of half wave controlled rectifier circuit with R and RL load, single phase Semi Converter Bridge, Single phase full Converter Bridge for RL load, single phase and three phase full converter with RL load.
- Familiarizes the dual converter and twelve pulse converters.
- Study the complete protection of converter circuits.
- Understand the working choppers and inverters.
- Know the applications of choppers and inverters.
- Explain the various types of choppers with circuit diagram.
- Describe the various methods of inverters with circuit diagram.
- Failure of AC voltage controller & cyclo converter.
- Understand the application of power electronics devices as CB,UPS and VAR compensator
- Understand the control of DC Drives.
- Know the various methods of speed control of DC drives.
- Familiarize the control of AC drives.
- Know the torque - speed characteristics of three phase induction motor.
- Study the speed control of three phase induction motor using PWM and slip power recovery scheme.
- Understand the closed loop control of AC drive.
- Know the operation of single phase and three phase cyclo converter.
- Understand the micro controller based fault diagnosis in three phase thyristor converter circuits.
- Study the need of DSP based motor control.