Lesson Plan

Name of faculty : Mr. Puneet Chawla

Discipline : Electrical Engineering

Semester : 5th

Subject : Power Electronics-I (EE-303-L)

Lesson plan duration : 15 weeks

|  |  |  |
| --- | --- | --- |
| **Week** | **Theory** | **Actual Lesson Plans Covered**  |
| **Lecture** **Day** | **Topic (Including assignment / Test)** | **Dates**  | **HOD Sign.** | **Director-Principal** |
| **Unit-I** |
| 1st | 1. | Introduction & role of Power Electronics, concepts of power electronics, applications of power electronics, advantage and disadvantages of power electronics converter circuits, Power Electronics systems, types of power electronics converters, Power Electronics module.  |  |  |  |
| 2. | p-n junction, construction and structure of power diodes, characteristics of power diodes (I-V characteristics)  |  |  |  |
| 3. | characteristics of power diodes (I-V characteristics), reverse recovery characteristics, types of power diodes |  |  |  |
| 4. | Power Transistors and its structure, steady state characteristics, switching performance and other characteristics  |  |  |  |
| 2nd  | 5. | Power Transistors and its structure, steady state characteristics, switching performance and other characteristics  |  |  |  |
| 6. | Power MOSFETs and its structure, steady state characteristics, applications  |  |  |  |
| 7. | Insulated gate Bipolar Transistor (IGBT), its basic structure, working of IGBT, Equivalent circuit of IGBT, IGBT characteristics, switching characteristics, applications of IGBT |  |  |  |
| 8. | Comparison of BJT, MOSFET and IGBT, Static Induction Transistor (SIT) |  |  |  |
| 3rd  | 9. | Introduction about thyristors, terminal characteristics of thyristor, Static I-V characteristics of thyristors,  |  |  |  |
| 10. | Switching characteristics of thyristor, thyristor gate characteristics,  |  |  |  |
| 11. | 2 transistor model of thyristor,  |  |  |  |
| 12. | Other members of thyristors family: PUT, SUS, SCS, LASCR, DIAC, TRIAC |  |  |  |
| 4th  | 13. | GTO and its structure, turn-on & turn off processes, I-V characteristics, switching performance of GTO, applications of GTO |  |  |  |
| **UNIT-II** |
| 14. | Thyristor Turn-on methods |  |  |  |
| 15. | Thyristor ratings: voltage, current, I2t, di/dt and other ratings  |  |  |  |
| 16. | Thyristor protection-di/dt and dv/dt protection, design of snubber circuits  |  |  |  |
| 5th  | 17. | Overvoltage, overcurrent, cowbar and gate protections of thyristor |  |  |  |
| 18. | Series operation of thyristor |  |  |  |
| 19. | Series operation of thyristor |  |  |  |
| 20. | Series operation of thyristor |  |  |  |
| 6th  | 21. | Parallel operation of thyristor |  |  |  |
| 22. | Firing circuits of thyristors and its main features, R and RC firing circuits  |  |  |  |
| 23. | UJT firing circuits and UJT characteristics  |  |  |  |
| 24. | UJT firing circuits, cosine firing circuits,  |  |  |  |
| 7th  | 25. | Pulse Transformer in firing circuits, opto-coupler firing circuits  |  |  |  |
| 26. | Thyristor Commutations techniques-Class A, Class B, Class C |  |  |  |
| 27. | Thyristor Commutations techniques-Class D, Class E and Class F |  |  |  |
| 28. | Principles of various types of AC regulators, Single phase voltage controllers with various loads |  |  |  |
| 8th  |  |  |  |  |  |
| **Minor Test-I** |
| 29. | Single phase voltage controllers with various loads, Synchronous Transformer Tap changers, 3-phase AC regulators.  |  |  |  |
| **UNIT-III** |
| 30. | Phase controlled rectifiers, principles of phase control, One pulse 1-phase half wave circuit with R, RL and RL with freewheeling loads  |  |  |  |
| 31. | One pulse 1-phase half wave circuit with RLE loads, 2 pulse fully controlled rectifiers, 3-pulse and six pulse full converters  |  |  |  |
| 32. | 1-phase two pulse full wave semiconverter with continuous and discontinuous conduction  |  |  |  |
| 9th  | 33. | 1-phase six pulse mid-point full wave controlled converter with continuous and discontinuous conduction  |  |  |  |
| 34. | 1-phase six pulse full wave bridge converter with continuous conduction |  |  |  |
| 35. | 1-phase six pulse full wave bridge converter with discontinuous conduction |  |  |  |
| 36. | Performance parameters and output voltage equation for two-pulse converters.  |  |  |  |
| 10th  | 37. | 6-pulse 3-phase Half wave controlled converter- Introduction, R load, RL load,  |  |  |  |
| 38. | 12-pulse 3-phase Full converter with RLE load  |  |  |  |
| 39. | 12-pulse 3-phase semiconverter with RLE load  |  |  |  |
| 40. | Performance parameter of 3-phase full converter  |  |  |  |
| 11th  | 41. | Effect of source impedance on the performance of converters |  |  |  |
| 42. | Four quadrant converters/ dual converters- Ideal dual converter, Practical dual converter with circulating and non-circulating currents,  |  |  |  |
| 43. | Effect of poor power factor, methods of reactive power compensation/ power factor improvement- Capacitor banks, synchronous condensers,  |  |  |  |
| 44. | Thyristor Controlled reactors (TCR), Static VAr Compensation,  |  |  |  |
| 12th  | 45. | MOSFET and transistor based low and medium power converter  |  |  |  |
| **UNIT-IV** |
| 46. | Cycloconverters- Introduction, Principle of operation, Single phase to Single phase circuit Step-up cycloconverter (mid point type)  |  |  |  |
| 47. | Single phase to Single phase circuit Step-up cycloconverter (bridge type), Single phase to Single phase circuit Step-down cycloconverter (mid point and bridge types) with continuous and discontinuous load current.  |  |  |  |
| 48. | Three phase Half wave cycloconverters- 3-phase to 1-phase cycloconverter,  |  |  |  |
| 13th  | 49. | Cosine Wave crossing technique. |  |  |  |
| 50. | 3-phase to 3-phase cycloconverter- Bridge circuit,  |  |  |  |
| 51. | 3-phase to 3-phase cycloconverter,  |  |  |  |
| 52. | Output voltage equation for a Cycloconverter  |  |  |  |
| 14th  | **Minor Test-II** |
| 15th  | 53 | Numerical problems  |  |  |  |
|  | 54. | Numerical problems  |  |  |  |
|  | 55. | Old question paper-Discussions |  |  |  |
|  | 56. | Old question paper-Discussions |  |  |  |