**Lecture Schedule**

**Department of ELECTRICAL AND ELECTRONICS Engineering**

# Branch & Section : III B.Tech - II Sem & EEE Regulation : R13

**Subject : POWER SEMICONDUCTOR DRIVES Academic Year : 2017 -18**

**Name of the Faculty : G.S.S.SRI HARSHA**

**Course Objectives**

* To learn the fundamentals of electric drive and different electric braking methods.
* To analyze the operation of three phase converter controlled dc motors and four quadrant operation of dc motors using dual converters.
* To discuss the converter control of dc motors in various quadrants.
* To understand the concept of speed control of induction motor by using AC voltage controllers and voltage source inverters.
* To learn the principles of static rotor resistance control and various slip power recovery schemes.
* To understand the speed control mechanism of synchronous motors.

**Course Outcomes**

* Explain the fundamentals of electric drive and different electric braking methods.
* Analyze the operation of three phase converter controlled dc motors and four quadrant operation of dc motors using dual converters.
* Explain the converter control of dc motors in various quadrants.
* Explain the concept of speed control of induction motor by using AC voltage controllers and voltage source inverters.
* Explain the principles of static rotor resistance control and various slip power recovery schemes

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| **UNIT** | **TOPIC** | **No. of Periods** |
| **I** | **Fundamentals of Electric Drives** |  |
|  | Introduction to Electrical Drive and advantages, Parts of Electrical Drives | 3 |
| Fundamental torque equations, Components of Load Torque | 2 |
| Nature and classification of load torques, Steady state stability | 1 |
| Load equalization | 2 |
|  | Four quadrant operation of a motor driving a hoist control | 1 |
|  | Braking methods: Dynamic, Plugging, Regenerative methods (contd...) | 1 |
|  | Braking methods: Dynamic, Plugging, Regenerative methods. | 1 |
|  | Total number of periods | **11** |
| **II** | **Three phase converter controlled DC motors** |  |
|  | DC motors and their Performance | 1 |
| Revision of speed control techniques (contd..) | 1 |
| Revision of speed control techniques (contd..) | 1 |
| Separately excited DC motor controlled by 1 phase full converter | 1 |
| Separately excited DC motor controlled by 3 phase fully controlled converter (contd..) | 1 |
| Separately excited DC motor controlled by 3 phase fully controlled converter | 1 |
| Separately excited DC motor controlled by 3 phase Half controlled converter | 1 |
| Numerical Problems | 1 |
| DC series motor controlled by 3 phase fully controlled converter | 1 |
| DC series motor controlled by 3 phase Half controlled converter, Problems | 1 |
| Four quadrant operation using dual converters (contd...) | 1 |
| Four quadrant operation using dual converters | 1 |
| Numerical Problems | 1 |
| Total number of Periods | **13** |
| **III** | **Control of DC motors by DC-DC converters(Type C & Type D)** |  |
|  | Chopper control of Seperately Excited DC motor (contd..) | 1 |
| Chopper control of Seperately Excited DC motor (contd..) | 2 |
| Chopper control of DC series motor (contd..) | 2 |
| Chopper control of DC series motor | 1 |
| Numerical Problems | 1 |
| Four quadrant operation of chopper fed DC motor ( contd...) | **2** |
|  | Four quadrant operation of chopper fed DC motor |  |
|  | Closed-loop speed control scheme for control below and above base speed | **1** |
|  | Numerical Problems | **2** |
|  | Total periods | **12** |

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| **IV** | **Induction motor control - Stator side** |  |
|  | Induction Motor equivalent circuit, Equations, Performance characteristics | 1 |
| Speed Control of Induction Motor | 1 |
| Control of Induction Motor by AC Voltage Controllers (contd...) | 1 |
| Control of Induction Motor by AC Voltage Controllers | 1 |
| Variable Voltage-Variable Frequency control of induction motor by voltage source inverter – PWM control (contd..) | 1 |
| Variable Voltage-Variable Frequency control of induction motor by voltage source inverter –PWM control (contd..) | 1 |
| Variable Voltage-Variable Frequency control of induction motor by voltage source inverter –PWM control | 1 |
| Numerical Problems | 1 |
| Variable Frequency control of induction motor by current source inverter (contd..) | **1** |
|  | Variable Frequency control of induction motor by current source inverter | **1** |
|  | Closed loop operation of induction motor drives (contd...) | **1** |
|  | Closed loop operation of induction motor drives | **1** |
|  | Numerical Problems | **1** |
|  | total | **13** |
| **V** | **Control of Induction motor - Rotor side** |  |
|  | Static rotor resistance control (contd...) | 1 |
| Static rotor resistance control | 1 |
| Slip power recovery schemes | 2 |
| Static Scherbius drive (contd...) | 2 |
| Static Scherbius drive | **1** |
|  | Static Kramer drive (contd...) | **1** |
|  | Static Kramer drive | **1** |
|  | Advantages , Applications | **1** |
|  | total | **10** |
| **VI** | **Control of Synchronous Motors** |  |
|  | Commonly used Synchronous motors | 1 |
| Separate control &self control of synchronous motors | 1 |
| Operation of self controlled synchronous motors by VSI (contd...) | 2 |
| Operation of self controlled synchronous motors by VSI | 1 |
| Closed Loop control operation of synchronous motor drives (contd..) | 2 |
| Closed Loop control operation of synchronous motor drives | **1** |
|  | Variable frequency control–Pulse width modulation(contd...) | **1** |
|  | Variable frequency control–Pulse width modulation | **1** |
|  | total | **10** |

**Total No. of Periods**: 11+13+12+13+10+10 = 69

**BOOKS:**

**Text Books:**

1. Fundamentals of Electric Drives – by G K Dubey Narosa Publications

2. Power Semiconductor Drives, by S.B. Dewan, G.R.Slemon,

A.Straughen, Wiley-India Edition.

**Reference Books:**

1. Electric Motors and Drives Fundamentals, Types and Apllications, by

Austin Hughes and Bill Drury, Newnes.

2. Thyristor Control of Electric drives – Vedam Subramanyam Tata

McGraw Hill Publications.

3. Power Electronic Circuits, Devices and applications by M.H. Rashid,

PHI.

4. Power Electronics handbook by Muhammad H.Rashid, Elsevier.