

## SEMESTER VII

(Applicable to the students admitted from the Academic year 2006 – 2007 onwards)

<b>THEORY</b>			<b>L</b>	<b>T</b>	<b>P</b>	<b>M</b>
1.		High Voltage Engineering	3	1	0	100
2.		Protection & Switch gear	3	1	0	100
3.		Solid State Drives	3	1	0	100
4.		Environmental Science & Engineering	3	1	0	100
5.		Elective – II	3	1	0	100
6.		Elective – III	3	1	0	100
<b>PRACTICAL</b>						
1.		Power System Simulation Laboratory	0	0	3	100
2.		Comprehension	0	0	3	100



## **PROTECTION AND SWITCHGEAR**

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|----------|---|-----------|
| <b>1</b> | <b>RELAYS</b><br>Need for protection – essential qualities of protective relays. Over current relays directional, distance and differential, under frequency, negative sequence relays - static relays – microprocessor-based relays. | <b>12</b> |
| <b>2</b> | <b>APPARATUS PROTECTION</b><br>Apparatus Protection - generator and Transformer Protection, Protection of bus bars, transmission lines, CT's & PT's and their application in protective schemes.                                      | <b>9</b>  |
| <b>3</b> | <b>THEORY ARC QUENCHING</b><br>Theory of arcing and arc quenching – RRRV – current chopping and capacitive current breaking – D.C. circuit breaking.  | <b>9</b>  |
| <b>4</b> | <b>CIRCUIT BREAKERS</b><br>Switchgear – fault clearing and interruption of current - various types of circuit breakers - selection of circuit breakers - intelligent circuit breakers.  | <b>9</b>  |
| <b>5</b> | <b>PROTECTION AGAINST OVERVOLTAGES</b><br>Different methods of protection against over voltages – lightning arresters.  | <b>6</b>  |

**Total Hours = 45**

### **TEXT BOOKS**

1. Ravindranath, B and Chander, N, 'Power System Protection and Switchgear', Wiley Eastern Ltd., 1977
2. Chakrabarti .A, Soni .M.L, Gupta .P.V, 'A text book on power system Engineering', Dhanpat rai & Co. pvt. Ltd., 1998.

### **REFERENCES**

1. Wadhwa, C.L., 'Electrical Power Systems', New Age International (P) Ltd., Publishers, 1995.
2. Patra, S.P., Basu , S.K. and Chowduri, S., 'Power systems Protection', Oxford and IBH Publishing Co, 1983.
3. Sunil.S.Rao, 'Switchgear and Protection', Khanna Publishers, New Delhi, 1986.

## **SOLID STATE DRIVES**

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|----------|--|-----------|
| <b>1</b> | <b>DRIVE CHARACTERISTICS</b><br>Mechanical characteristics- constant torque and constant HP operations - Four quadrant operation – Rating of motors – selection of drives.                                   | <b>6</b>  |
| <b>2</b> | <b>DC DRIVES</b><br>Single phase and three-phase converter fed drives – continuous and discontinuous conduction modes – chopper fed drives- four-quadrant operation – closed loop drive system.              | <b>10</b> |
| <b>3</b> | <b>STATOR CONTROLLED INDUCTION MOTOR DRIVES</b><br>Voltage controlled drive – V/f control – VSI and CSI fed drives – closed loop control – braking methods for induction motors.                             | <b>12</b> |
| <b>4</b> | <b>ROTOR CONTROLLED INDUCTION MOTOR DRIVES</b><br>Rotor resistance control – slip power recovery scheme - sub synchronous and super synchronous operations – power factor improvement – closed loop control. | <b>8</b>  |
| <b>5</b> | <b>SYNCHRONOUS MOTOR DRIVES</b><br>Adjustable frequency and controlled current operation- self controlled synchronous motor – closed loop control - power factor control – brushless excitation              | <b>9</b>  |

**Total Hours = 45**

### **TEXT BOOKS**

1. Dubey. G.K., 'Power Semiconductor Drives', Prentice Hall International, 1989.
2. Vedam Subrahmaniam, 'Electric drives concepts and applications', TMH Pub. Co.Ltd., 1994.

### **REFERENCES**

1. Murphy, J.M.D and Turnbull.F.G., 'Thyristor control of AC Motors', Pergamon Press, 1988.
2. Sen. P.C., 'Thyristor D.C. Drives', John Wiley and Sons, 1981.
3. B. K. Bose, 'Power Electronics and AC Drives', Prentice Hall Onglewood cliffs, New Jersey, 1986.

# ENVIRONMENTAL SCIENCE AND ENGINEERING

## 1. INTRODUCTION AND COMPONENTS OF ENVIRONMENT 9

Definition - Scope and Role of Environmental Engineer - Components – Water, air and land – Inter-relationship between components – Subcomponents; Ecosystem – Structure and functional components of ecosystem – Development and evolution of ecosystem – Energy flow and material cycling in ecosystem.

## 2. ENVIRONMENTAL IMPACTS OF DEVELOPMENT 9

Natural and man made impacts on water, air and land; Environment and development – Concept of sustainable development - Environmental impacts of Development – sustainable development – Environmental pollution – Water, Air and Land.

## 3. PLANNING FOR WATER SUPPLY AND SEWERAGE SYSTEMS 9

Public water supply and sewerage systems – Objectives – Design period – Population forecasting – Water demand – Sources of water – Source Selection – Water quality – Characterization – Water quality standards – Sources of wastewater – Quantity of sanitary sewage – Estimation of storm runoff – Characteristics and composition of sewage and their significance – Effluent standards.

## 4. CONVEYANCE SYSTEM 9

Water supply – intake structures – Pipe materials - Hydraulics of flow in pipes – Transmission main design – Laying, jointing & testing of pipes – appurtenances – Pumps – Sewerage – Hydraulics of flow in sewers – Design of sanitary and storm sewers – Computer applications – Laying, jointing & testing of sewers – appurtenances – Pumps.

## 5. WATER SUPPLY AND DRAINAGE IN BUILDINGS 9

Principles of design of water supply and drainage in buildings – House service connection – Sanitary fixtures and fittings – Systems of sanitary plumbing – House drainage – House sewer connection.

**Total Hours = 45**

### Text Books:

1. Garg, S.K., Environmental Engineering, Vols. I and II, Khanna Publishers, New Delhi, 1994
2. C.S.Shah, Water Supply and Sanitation, Galgotia Publishing Company, New Delhi, 1994.

### References:

1. Manual on Water Supply and Treatment, CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 1999.
2. Manual on Sewerage and Sewage Treatment, CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 1993
3. H.S.Peavy, D.R.Rowe and George Tchobanoglous, Environmental Engineering, McGraw-Hill Book Company, New Delhi, 1995.

## POWER SYSTEM SIMULATION LABORATORY

### ***LIST OF EXPERIMENTS***

1. Computation of Parameters and Modelling of Transmission Lines
2. Formation of Network Matrices and Solution of Networks.
3. Power Flow Analysis - I : Solution of Power Flow and Related Problems Using Gauss-Seidel Method.
4. Power Flow Analysis II: Solution of Power Flow and Related Problems Using Newton-Raphson and Fast-Decoupled Methods.
5. Short Circuit Analysis.
6. Transient and Small Signal Stability Analysis: Single-Machine Infinite Bus System.
7. Transient Stability Analysis of Multimachine Power Systems.
8. Electromagnetic Transients in Power Systems.
9. Load – Frequency Dynamics of Single and Two-Area Power Systems.
10. Unit Commitment and Economic Dispatch in Power Systems.

***Total Hours = 45***

## COMPREHENSION

The objective of comprehension is to provide opportunity for the student to apply the knowledge acquired during the academic programme to real –life problems that he/she may have to face in future as an engineer.

Three periods per week shall be allotted in the time table for this activity and this time shall be utilized by the student to receive guidance form the members of faculty on solving real-life problems, practice solving these problems and on group discussions, seminar presentations, library reading as assigned by the faculty member in-charge. The continuous assessment and semester evaluation may be carried out as specified in the guidelines to be issued from time to time. For which,

1. Two written tests of objective type question from the courses up to 6<sup>th</sup> semester may be conducted.
2. Seminars on latest topics may be conducted.
3. Oral Exams on G.K, Technical knowledge, reasoning, may be conducted.
4. Group discussions may be conducted.

***Total Hours = 45***