

**FOR ENGINEERING DEGREE LEVEL ELECTIVE SUBJECT**

**For Electronics/ Electrical Engineering**

1. **Subject Code:**                      **Course Title: Automation In Water Resources**  
**And**

**Hydropower Plant**

2. **Contact Hours:      L:      T:      P:**

3. **Examination Duration (Hrs.): Theory :**                      **Practical :**

4. **Relative Weightage : CWS                      PRS                      MTE                      ETE**  
**PRE**

5. **Credit:**

6. **Semester:**

**Autumn**

**Spring**

**Both**

7. **Pre-requisite: NIL**

8. **Subject Area:**

9. **Details of Course:**

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Sl. No.	Particulars	Contact Hours
1.	INTRODUCTION: Sources and forms of energy, types of power plants, elements of hydropower scheme, hydropower development in India, Hydro Powerhouse structures-substructure and superstructure Layout and dimensions, Hydropower plants classification: Surface and underground power stations, Low, medium and high head plants-layout and components, microhydel units, Different curves: Load curves, load duration curve, Connected load, maximum load, peak load, base load and peak load power plants, load factor, plant capacity factor, plant use factor, demand factor, diversity factor.	6
2.	CIVIL STRUCTURES: (Limited only to the introduction of each term), civil engineering works: dams, earth fill, water conduits, spillways, and other open channels, surge tanks, general construction, hydraulic structure for power plants: Control of water delivery to turbines, control gates, Pumped storage installations. Penstocks; discharge tubes for hydraulic turbines, head losses, energy losses and efficiency.	
3.	Water resources	
4.	HYDRAULIC TURBINES: Turbines for electric power generation, basics of Pelton wheel impulse units, Francis mixed flow, Propeller, Kaplan and Cross flow, power and efficiency; high, medium and low head applications,	
5.	Control of frequency and power loading, turbine instrumentation: speed calculation, Valve actuation, auto-start-up, thermal stress	

	control, condition monitoring and power distribution instrumentation.	
6.	MONITORING regulation and monitoring: Hydroelectric power generation, automatic regulation and monitoring of voltage and frequency, modelling & Simulation: Computerized modeling & simulation of Electric Machines, data acquisition and logging.	8
7.	CONTROL ASPECTS feedback Systems: Cascaded feedback systems. Feed forward control systems, servomechanisms: Hydraulic servomechanisms, Introduction to oil hydraulics. Valve controlled hydraulic motors. Pump controlled hydraulic motors. Electrohydraulic servo systems. Electrohydraulic position servo.	8
8.	PROTECTION: Principles of power system protection: system Vs apparatus protection, analog Vs digital protection, protection system components: potential and current sensors, relays, fuses, circuit breakers, Computerized status monitoring, zone protection, back up schemes, protective relays: Type and classification of relays, different types of relays: differential and percentage differential relay, impedance, admittance, reactance relays, distance protection concept, Carrier and pilot wire systems, Significance of computerized protection systems. power circuit breakers: Arc characteristics, arc interruption, arc gaps, types of circuit breakers: air, oil, vacuum, SF6, automatic circuit re-closers, Apparatus protection: generator, transformer, transmission lines protection systems.	8

### **Suggested Readings:**

Badri Ram, D.N. Vishwakarma: Power System Protection and Switchgears, TMH  
 Varshney R.S. Hydro Power Structures, Nem Chand & Bros.  
 Sunil S. Rao *Switch gear and protection*  
 Elgerd *Electrical Energy System Theory* McGraw Hill  
 Stevenson *Elements of Power System Analysis* McGraw Hill  
 Elgerd, *Electrical Energy System Theory*, Mc Graw-Hill  
 Deshpande, *Elements of Electrical Power, Station Designs* Pitman & sons.  
 Willenbrock and Thomas, *Planning, Engineering and Construction of Electrical power generating facilities* John Wiley and Sons.