National Institute of Technology Meghalaya

(An Institute of National Importance)

CURRICULUM

Programme	**Bachelor of Technology in Electrical and Electronics Engineering**	Year of Regulation	**2019 – 20**
Department	**Electrical Engineering**	Semester	**V**

Course Code	Course Name	Credit Structure				Marks Distribution			
		L	T	P	C	INT	MID	END	Total
EE 301	**Power System II**	**3**	**1**	**0**	**4**	**50**	**50**	**100**	**200**

Course Objectives	Course Outcomes	
To understand the economics of power system operation and perform load flow analysis.	CO1	Formulation of large power systems and understand the stability issues.
To develop an ability and skill to analyse power system faults and stability.	CO2	Understand and carry out load flow analysis and compute faults in the transmission network.
To understand the requirements and methods of real and reactive power control in power system.	CO3	Able to compute fault current and analyse its sequence components in transmission network.
To realize optimal scheduling of hydro-thermal generation.	CO4	Perform economic load dispatch for thermal units and understand the frequency and voltage control of power systems.
	CO5	Solve the unit commitment problem considering various constraints and perform hydro-thermal generation scheduling.

No.	COs	Mapping with Program Outcomes (POs)												Mapping with PSOs		
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	CO1	**3**	**3**	**2**	**2**	**2**	**0**	**1**	**0**	**0**	**0**	**0**	**1**	**3**	**0**	**0**
2	CO2	**3**	**3**	**3**	**3**	**3**	**0**	**1**	**1**	**0**	**0**	**0**	**1**	**3**	**0**	**3**
3	CO3	**3**	**3**	**3**	**3**	**3**	**0**	**0**	**1**	**0**	**0**	**0**	**1**	**3**	**0**	**3**
4	CO4	**3**	**3**	**3**	**3**	**3**	**0**	**2**	**1**	**0**	**0**	**0**	**1**	**3**	**0**	**3**
5	CO5	**3**	**3**	**3**	**3**	**3**	**0**	**2**	**1**	**0**	**0**	**0**	**1**	**2**	**0**	**3**

SYLLABUS

No.	Content	Hours	COs

I	**Representation of Power System** Introduction, single phase solution of balanced three phase networks, one line diagram and impedance or reactance diagram, per-unit (p.u.) system, complex power, synchronous machine, representation of loads, construction of bud matrices.	**06**	**CO1**
II	**Power Flow Formulation** Network model formulation, Formation of Y bus, Power flow problem, Different types of buses, Approximate power flow, Gauss Seidel method, Newton-Raphson method, Decoupled Power flow studies, Fast Decoupled power flow studies, Comparison of power flow methods.	**07**	**CO2**
III	**Fault Analysis** Introduction, transient on a transmission line, short circuit of a synchronous machine on no load and, balanced three phase fault analysis using bus impedance matrix, selection of protective equipments, Symmetrical component transformation, construction of sequence networks of power systems, Symmetrical component analysis of unsymmetrical faults, single line to ground (LG) fault, line to line (LL) fault, double line to ground (LLG) fault, open conductor faults, bus impedance matrix method for analysis of unsymmetrical faults.	**10**	**CO3**
IV	**Power System Stability** Introduction to stability, dynamics of a synchronous machine, power angle equation, power angle curve, simple systems, steady state stability, transient stability, equal area criteria, numerical solution of swing equation, some factors affecting transient stability.	**08**	**CO1**
V	**Economic Dispatch** Economic dispatch without line losses, Economic dispatch with line losses, Lambda iteration method, Gradient method, Newton's method, Base point and participation factors, Transmission losses, Co-ordination equations, Incremental losses, Penalty factors, B matrix loss formula (without derivation), and Methods of calculating penalty factors including losses.	**04**	**CO4**
VI	**Active Power and Voltage Control** Introduction to real and reactive power control loop, Automatic voltage regulator, Load frequency control, Droop Characteristics, Single area system, Bias Control, Telemeter measurements, Multi-area system, Tie line control, static and dynamic analysis.	**07**	**CO4**
VII	**Generation Scheduling** Hydrothermal co-ordination, Scheduling energy, Short term hydrothermal scheduling, Lambda-gamma iteration method, Gradient method, Cascaded hydro plants, Pumped storage hydro scheduling.	**03**	**CO5**
VIII	**Unit Commitment** Constraints in unit commitment, Priority list method, Dynamic programming method and Lagrange relaxation methods.	**03**	**CO5**
Total Hours		**48**	

Essential Readings

1. I.J Nagrath & D.P. Kothari, "Modern Power System Analysis", Tata McGraw Hill, 4th Edition, 2011.

2. O.I. Elgerd, “Electrical Energy System Theory: An introduction”, 2nd Edition, 1983, TMH.
3. W. D. Stevenson, “Element of Power System Analysis”, McGraw Hill, 4th Edition, 1982.
4. P Kundur, “Power System Stability and Control”, Tata McGraw-Hill, 1st Edition, 2006.

Supplementary Readings

1. Hadi Saadat, “Power System Analysis”, McGraw Hill, 1st Edition, 1991.
2. S. Sivanagaraju & G. Sreenivasan, “Power System Operations & Control”, Pearson, 1st Edition, 2009.
3. G. W. Stagg and A. H. EI-Abaid, “Computer Methods in Power System Analysis”, McGraw Hill, 1st edition, 1971
4. C.L. Wadhwa, “Electric Power System”, New Age International Publishers, 6th Edition, 2010.