DEPARTMENT OF ELECTRICAL ENGINEERING

Vision of the Department	To strive for excellence towards education and research in Electrical Technologies by inculcating life-long learning.
Mission of the Department	The mission elements of Electrical Engineering Department are: M-1. To prepare students for fundamentals in Electrical and Computational Technology, keeping environmental aspects. M-2. To undertake the foundation of research for systems involving emerging fields of Electrical Engg. i.e the renewable enrgy concept. M-3. To impart professional skills for solving real-life problems.
Program Educational Objectives (PEOs)	**PEO: 1** To prepare students with a good foundation in mathematics, science and engineering fundamentals required for finding and analysing solutions for real life engineering problems **PEO: 2** To inculcate effective communication skills and an ability to lead and work in a team environment. **PEO: 3** To provide academic environment so as to promote the life-long learning needed for a successful professional career. **PEO: 4** To facilitate the students to pursue higher studies and to find entry level position in industries.
Program Specific Outcomes (PSOs)	**PSO: 1** The ability to apply the analytical techniques for studying the electrical systems and machines. **PSO: 2** The ability to apply principles of discrete systems in respect of the systems based on electrical engineering. **PSO: 3** To gain skills in the above so as to reach positions for their career growth.
Program Outcomes (POs)	a) Ability to apply knowledge of Mathematics, Science and Engineering b) Ability to design, experiments, analyse and interpret data for an engineering problem c) Ability to Design a system, component or process to meet desired needs within realistic constraints d) Ability to work in multidisciplinary team e) Ability to identify, formulate and solve engineering problems f) Understanding of professional and ethical accountability. g) Ability to communicate effectively. h) Understand the impact of engineering solution in global economy, environmental and societal perspective. i) Recognize the need for the ability to engage in lifelong learning j) Awareness of modern-day issues k) Ability to use the techniques, skills and modern engineering tools essential for engineering practice l) Ability to work on projects by handling financial resources

Bachelor of Technology (Electrical Engineering) w.e.f. Session 2018-19												
Scheme of Studies/ Examination VIII semester												
S. No.	Course No.	Course Title	Teaching Schedule				Allotment of Marks					Duration of Exam(hrs)
			L	T	P	Hrs/Week	Theory	Sessional	Practical	Total		
1	EE-402N	Computer Methods in Power System	4	1		5	75	25		100		3
2	EE-404N	HVDC Transmission	4	1		5	75	25		100		3
3	**EE-406N***	**Special Electrical Machines**	3	1		4	75	25		100		3
4	**	Elective-III	4	1		5	75	25		100		3
5	***	Elective- IV	3	1		4	75	25		100		3
6	EE-416N	Power System Lab			2	2		40	60	100		3
7	EE-418N	Computer methods in Power System Lab			3	3		40	60	100		3
8	EE-420N	Major Project			6	6		75	75	150		3
9	EE-422N****	General Fitness & Professional Aptitude							100	100		3
		Total	18	5	11	34	375	280	295	950		

Note: 1. * Subjects Common with VIII Semester. B.Tech. [Electrical Engg.] Scheme, K.U.K.

2. The Major project should be initiated by the student in continuation of the VII semester and will be evaluated in the end of the semester on the basis of a presentation and Report.
3. **** A viva of the students will be taken by external examiner (Principal/Director/Professor/or any senior Person with Experience more than 10 years) at the end of the semester.

****Elective-III**	EE-408N	Electrical Energy Conservation and Auditing
	EE-410N	Fuzzy logic and Neural Network
*****Elective-IV**	EE-412N	Embedded system
	EE-414N	Power Management

Code	Nomenclature of Subject	L	T	Int.	Ext.	Total	Time
EE-402N	**Computer Methods In Power System**	**4**	**1**	**25**	**75**	**100**	**3 Hr**

Paper Setter Note: 8questions of 15 marks each distributed in four sections are to be set taking two from each unit. The candidate is required to attempt five questions in all, taking at least one from each of the four sections

UNIT-I

General: Impact of computers, orientation of engineering problems to computers, review of matrices and matrix operations.

Incidence and Network Matrices: Network graph, various incidence matrices, generalized element representation, primitive network and primitive network matrices, formation of various network matrices by singular transformations, inter- relations between various incidence matrices and network.

UNIT-II

Bus Impedance and admittance matrices: Building algorithms for bus impedance matrix, modification of bus impedance matrix for change of reference bus and for network changes, formation of bus admittance matrix and modification of three-phase network elements, treatment under balanced and unbalanced excitation, transformation matrices, and unbalanced elements.

UNIT-III

Short-Circuit Studies: Introduction, network short circuit studies using Z bus, short circuit calculations using symmetrical components for various types of faults.
Load-Flow Studies: Introduction, importance of load flow studies, classification of buses, load flow equations, iterative methods, computer algorithms and load flow solutions using Gauss Seidel and Newton Raphson methods, decoupled and fast decoupled load flow solutions, representation of regulating and off nominal ration transformers, comparison of load flow solution methods.

UNIT-IV

Sparsity: Introduction, optimally ordered triangular factorization, schemes of optimal ordering Stability Studies: Algorithms flow chart and transient stability solution using modified Euler method.
Power System Security: introduction, contingency analysis using Z bus and various distribution factors.

Suggested books:

1. Glenn W.Stagg and Ahmed El-Abiad, “Computer Methods in Power System Analysis”, McGraw Hill.
2. George L.Kusic, “computer-Aided Power Systems Analysis”, PHI.
3. John J Grainger and William D. Stevenson, “ Power System Analysis”, Jr. McGraw Hill.
4. IJ Nagrath and D.P. Kothari, “Power System Engg.”, Tata McGraw Hill

Lecture Plan

Lecture	Topic
L1	Impact of computers
L2	Orientation of engineering problems to computers
L3	Review of matrices and matrix operations
L4	Network graph
L5	Various incidence matrices
L6	Generalized element representation
L7	primitive network and primitive network matrices
L8	formation of various network matrices by singular transformations
L9	inter- relations between various incidence matrices and network
L10	Building algorithms for bus impedance matrix
L11	modification of bus impedance matrix
L12	Treatment under balanced and unbalanced excitation
L13	Transformation matrices
L14	Unbalanced elements
L15	Network short circuit studies using Z bus
L16	Short circuit calculations using symmetrical components
L17	Importance of load flow studies
L18	Classification of buses
L19	load flow equations
L20	iterative methods
L21	computer algorithms and load flow solutions
L22	Gauss Seidel
L23	Newton Raphson methods
L24	Decoupled and fast decoupled load flow solutions
L25	Regulating and off nominal ration transformers
L26	Comparison of load flow solution methods.
L27	Sparsity
L28	Introduction
L29	Optimally ordered triangular factorization
L30	Schemes of optimal ordering
L31	Stability Studies
L32	Transient stability solution using modified Euler method
L33	Power System Security
L34	Introduction
L35	Contingency analysis using Z bus and various distribution factors

Tutorial Sheet

Unit-I

1. What are impacts of computers in power system?
2. Explain in detail about orientation of engineering problems to computers.
3. The incidence matrix of a graph is given by

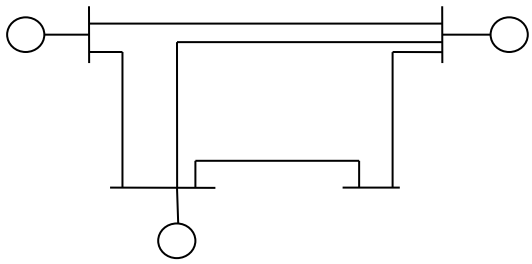
$$[A_i] = \begin{matrix} -1 & 0 & 0 & +1 & -1 & 0 \\ +1 & -1 & 0 & 0 & 0 & -1 \\ 0 & +1 & -1 & 0 & +1 & 0 \\ 0 & 0 & +1 & -1 & 0 & +1 \end{matrix}$$

Unit-II

1. Write down the various steps for the modification of Z_{bus} due to change of reference bus.
2. What do you understand by symmetrical components of unbalanced phasor?
3. Write down the expressions for symmetrical components.
4. Show that the symmetrical components of the fault impedance matrix Z_{ABC} can be represented by a diagonal matrix if the fault is balanced.

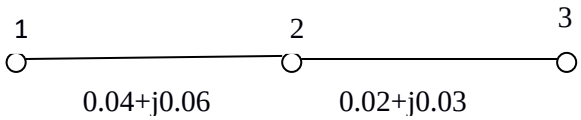
Unit-III

1. For the power system shown in Fig. given below, obtain the bus incidence matrix A. Take ground as reference. Is this matrix unique? Explain.

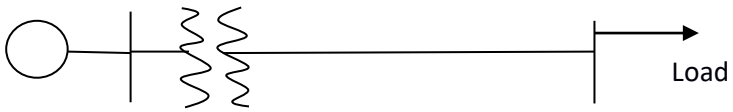


2. For the network shown in Fig. below, obtain the complex bus bar voltage at bus at the end of the first iteration. Use the GS method. Line impedances shown are in pu. Given: Bus 1 is slack bus with $V_1=1.0\angle 0^0$
   $P_2+jQ_2=-5.96+j1.46$

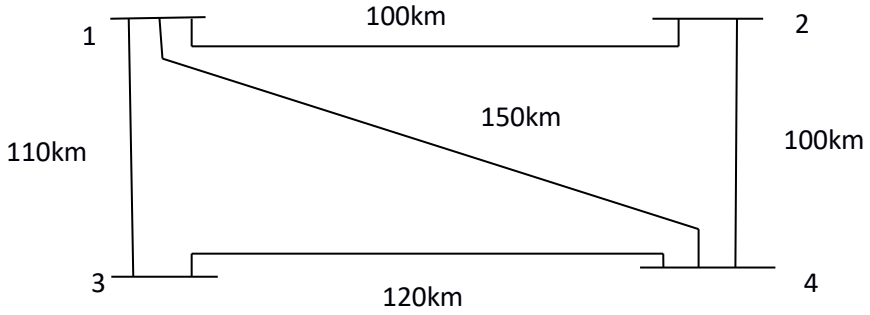
   $|V_3|=1.02$



3. For the system of Fig. given below, find the voltage at the receiving bus at the end of the first iteration. Load is 2+j0.8 pu. Voltage at the sending end (slack) is 1+j0 pu. Line admittance is 1.0-j4.0 pu. Transformer reactance is j0.4 pu. Off-nominal turns ratio is 1/1.04. Use the GS technique. Assume $V_R=1\angle 0^0$.



4. Find the bus incidence matrix A for the four-bus system in Fig. given below. Take ground as a reference



Unit-IV

1. What do you mean by sparsity? Explain optimally ordered triangular factorization in brief.
2. Define the term steady state and transient stabilities.
3. Explain the various techniques for improving transient stability.
4. Explain power system security. What are the different factors on which it depends?

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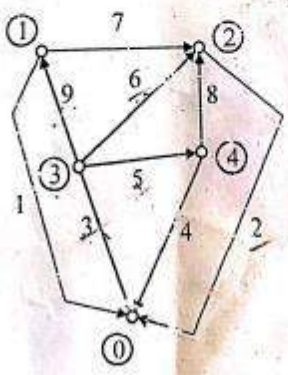
COMPUTER METHODS IN POWER SYSTEM
EE-402N

Time : Three Hours] [Maximum Marks : 75

Note : Attempt *Five* questions in all, selecting at least *one* question from each Unit.

Unit I

1. For the graph shown in the figure, find out bus incidence matrix A, basic cut set matrix B, basic loop matrix C and branch path incidence matrix K. 15



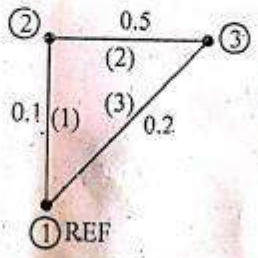
2. (a) Derive the relationship $Z_{loop} = C^T[Z]C$. 8

(b) Prove $A_B K^T = U$ for the above network shown in Q. No. 1. 7

Unit II

3. (a) Derive the generalized algorithms equations for finding the new elements of Z_{BUS} matrix, when added element to partial network is branch. 8

(b) For the network graph shown in figure, determine Z_{BUS} with node 1 as reference, using building algorithm. Neglect mutual coupling, self-impedance of elements are marked on the diagram. Add elements in the order specified. 7



4. (a) What do you understand by symmetrical components of unbalanced phasor ? Deduce the expressions for symmetrical components. 8

(b) What is Power Invariant Transformation ? Also show how symmetrical components transformation matrix diagonalizes the impedance of a balanced 3 phase rotating element. 7

Unit III

5. (a) Write the three phase representation of power system for short circuit studies and briefly explain. 5

(b) Derive the expressions for bus voltages, line currents when a three phase symmetrical faults through a fault impedance occurs at a particular bus, using bus impedance matrix. 10

6. (a) Give the initial conditions assumed for the power flow studies by GS method. 5

(b) Explain clearly with a detailed flow chart the computational procedure for load flow solution using decoupled method deriving necessary equations. 10

Unit IV

7. (a) Distinguish between steady state, transient and dynamic stability. 8

   (b) Discuss the methods to improve steady state and transient state stability limits. 7

8. (a) Discuss with the help of suitable expressions. How the transient stability studies are obtained using modified Euler's method. 8

   (b) Write a brief note on Contingency analysis. 7

Code	Nomenclature of Subject	L	T	Int.	Ext.	Total	Time
EE-404N	**HVDC Transmission**	**4**	**1**	**25**	**75**	**100**	**3 Hr**

Paper Setter Note: 8questions of 15 marks each distributed in four sections are to be set taking two from each unit. The candidate is required to attempt five questions in all, taking at least one from each of the four sections

UNIT-I

DC Power Transmission Technology: Introduction; comparison of AC and DC transmission; application of DC transmission; description of DC transmission system; planning for HVDC transmission; modern trends in DC transmission.

UNIT-II

Thyristor Valve & Analysis of HVDC Converters: Introduction; thryistor device; thyristor value; value tests; recent trends; pulse number; choice of converter configuration;simplified analysis of Graetz circuit; converter bridge characteristics; characteristics of twelve pulse converter; detailed analysis of converters.

UNIT-III

Converter and Hvdc System Control: General; principles of DC link control; converter control characteristics; system control hierarchy; firing angle control; current and extinction angle control; starting and stopping of dc link; power control; higher level controllers; telecommunication requirements.

UNIT-IV

Reactive Power Control, Harmonic and Filters: **I**ntroduction; reactive power requirement in steady state; sources of reactive power; static var systems; reactive power control during transients; introduction of harmonic and filters; generation of harmonics; design of AC filters; DC filters; carrier frequency and RI noise

Suggested Books:

1. Padiyar, K.R., “HVDC Power Transmissions Systems”, New Age International, 2001

2. Rao,S., “EHV-AC, HVDC Transmission & Distribution Engineering”, Khanna Publishers, 1999

3. Tagare, D.M., “Reactive Power Management”, Tata McGraw Hill, 1996

4. Dubey, G.K., “Power Semi-conductor Controlled Drives”, Prentice Hall, 1999.

5. Arrillaga, J., “High Voltage D.C.Transmission”, Peter Peregrinus Ltd, 1996

Lecture No.	**Topic**
L 1	**UNIT-I: BASIC CONCEPTS OF HVDC** Introduction
L2	Description of power sector in India
L 3	Why we are moving from ac to dc
L 4	Comparison of AC &DC Transmission
L5	Application of DC Transmission Systems
L6	Configurations of HVDC systems
L7	Components of HVDC systems
L8	Planning of HVDC Transmission System
L9	Modern Trends in HVDC systems
L10	Assignment/Test
L11	**UNIT-II: THYRISTOR VALVE and ANALYSIS OF HVDC CONVERTERS** Thyristor devices
L12	Thyristor valve
L13	Valve Testes
L14	Resents trends of valves
L15	Choice of Converter configuration
L16	Analysis of Graetz Circuit
L17	characteristics of 12 pulse converter
L18	Principle of DC Link Control
L19	Converters Control characteristics
L20	Delayed analysis of convertor
L21	Assignment/Test
L22	**UNIT-III: CONVERTERS AND HVDC CONTROL** Generals principles of HVDC link control
L23	System control hierarchy
L24	Firing angle control.

L25	Current angle control.
L26	Current and extinction angle control
L27	Starting of DC link
L28	Stopping of DC link
L29	Power control
L30	Higher level controller
L31	Telecommunication
L32	Assignment/Test
L33	**UNIT –IV: Fundamentals of Harmonics and Filters**
L34	Harmonic Distortion
L35	Generation of harmonics
L36	Reactive power
L37	Sources of reactive power
L38	Static and var. System
L39	Reactive power control
L40	Design of filters
L41	Design of AC filters
L42	Design of DC filters
L43	Carrier frequency and RI noise
L44	Assignment/Test
L45	Revision

Roll No. 12167886 Total Pages : 02

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HVDC TRANSMISSION

EE-404N

Time : Three Hours] [Maximum Marks : 100

Note : Attempt *Five* questions in all, selecting at least *one* question from each Unit. All questions carry equal marks.

Unit I

1. With a neat schematic diagram, state the various apparatus required for HVDC station and explain the purpose of each.

2. What are the limitations of DC line ? How have these limitations been surmounted in modern HVDC lines ?

Unit II

3. A Gr etz bridge operates with a delay angle of 15°. The leakage reactance of a transformer is 10 ohms. The line to the line AC voltage is 85 kV. Compute the overlap angle and DC voltage for (i) I_d = 2000 A, (ii) I_d = 4500 A.

4. Explain the typical valve arrangement in HVDC converters using thyristors. How is (i) triggering, (ii) protection, and (iii) voltage equilisation during switching achieved ?

Unit III

5. Discuss the basic principles of DC link control in detail. Derive the formula for steady state current in DC link.

6. A bipolar HVDC link operates with ±300 kV, 500 MW at the rectifier ends. The resistance of each line conductor is 25 ohms. The converter transformers have a leakage reactance of 0.20 p.u. on their own bases. There are two series connected converter bridge per pole. The AC bus voltage at both rectifier and inverter buses are regulated at 220 kV. Find the reactive power supplied at the rectifier and the inverter stations. Assume operating values of $\alpha_r = \gamma_i = 20$ degree.

Unit IV

7. Explain the need to employ filter circuit in HVDC systems. Derive an expression for minimum cost of tuned AC filters used in HVDC systems.

8. Estimate the magnitude of 6th and 12th harmonic voltage in a 6-pulse converter operating at $V_{do} = 200$ kV with (a) $\alpha = 10°$, $\mu = 0$; (b) $a = 10°$, $\mu = 15°$.

TUTE SHEET:-1

1. Draw schematic diagram of a typical HVDC converter station and explain the function of Various components available?
2 Draw the layout of a Bi-polar HVDC substation and briefly discuss about various Components present.
3 What are the merits & demerits of HVDC power transmission?
4 Mention the advantages of HVDC technical economical reliability aspects

TUTE SHEET:-2

1. With a neat sketch explain the working of 12pulse converter circuit.

2. Explain the thyrister valve control techniques
3. Explain analysis of greatz circuits
4. Explain converter bridge characteristics

TUTE SHEET:-3

1 Explain Telecommunication Requirements
2 Write short notes on the following terms
   a. Individual phase
   b. Constant extinction angle
3 Explain principles of DC Link control
4 Explain Higher level controllers

TUTE SHEET:-4

1 Explain the techniques of reactive power controls
2 What are the filters used for the elimination of harmonics.

3 Discuss the list of dominant harmonics present in the various types of HVDC Converters.
4 Explain The procedure of design AC and DC filters With de

Code	Nomenclature of Subject	L	T	Int.	Ext.	Total	Time
EE-406N*	**Special Electrical Machines**	**3**	**1**	**25**	**75**	**100**	**3 Hr**

Paper Setter Note: 8questions of 15 marks each distributed in four sections are to be set taking two from each unit. The candidate is required to attempt five questions in all, taking at least one from each of the four sections

UNIT I

Different types of FHP motors and uses in domestic & industrial applications, Single phase Induction motor, Qualitative examination starting and running performance of I-Phase Induction Motors.

UNIT II

Linear Induction Motors and Actuators and its principle of operation, Linear Levitated machine & applications, Permanent magnet motors, High performance energy efficient machines, Effect of E.M.F injected into secondary circuits , quantitative study, discharge motor.

UNIT III

Special Induction generations, Special motors and generators associated with Wind, Solar, Tidal, Biogas and other unconventional energy forms and their applications.

UNIT IV

Synchronous motors, Series universal motors, Stepper motor, Permanent magnet D.C. motor, Permanent magnet AC motors, Switch reluctance motors. Servo motor, shaded pole motor, brush less D.C motor, Typical applications in Computers, Electronics, Communications and Information Technologies.

Suggested Books:

1. Generalized Electrical Machines by P. S. Bhimbra
2. Generations of Electrical Energy by A. E. Fitzgerald/Charles, Kingsley J. R.
3. The Performance &design of A.C Commutator Motor by O.E .Taylor
4. Performance & Design of A.C machines by M.G. Say.

Lesson Plan (special Electric Machines)

L-1	Introduction to Subject, Different types of FHP motors
L-2	FHP motors and uses in domestic & industrial applications
L-3	Qualitative examination of I-Phase Induction Motors
L-4	Starting performance of I-Phase Induction Motors
L-5	running performance of I-Phase Induction Motors
L-6	Linear Induction Motors
L-7	Actuators and its principle of operation
L-8	Linear Levitated machine & applications
L-9	Permanent magnet motors
L-10	High performance energy efficient machines
L-11	Effect of E.M.F injected into secondary circuits
L-12	quantitative study
L-13	scharge motor
L-14	Special Induction generations
L-15	Disscussion Regarding Sessional
L-16	Special motors and generators associated with Wind, Solar
L-17	Continue----
L-18	Continue----
L-19	Special motors and generators associated with Tidal, Biogas
L-20	Continue----
L-21	Special motors and generators associated with other unconventional energy forms
L-22	Revision
L-23	Synchronous motors,
L-24	Continue----
L-25	Series universal motors
L-26	Stepper motor,
L-27	Continue----

L-28	Permanent magnet D.C. motor
L-29	Permanent magnet AC motors,
L-30	Switch reluctance motors
L-31	Servo motor,
L-32	Continue----
L-33	shaded pole motor,
L-34	Continue----
L-35	brush less D.C motor
L-36	Typical applications in Computers, Electronics, Communications and Information Technologies

Tutorial Sheet -1

1. Discuss the various types of FHP motors?
2. Briefly describe the operation of a single-phase induction motor?
3. What is the difference between the running and starting operation of the single-phase induction motor?
4. Discuss the running and starting characteristics of induction motor?

Tutorial Sheet –II

1. Discuss the operation of a linear induction motor?
2. Describe a linear levitated machine and enumerate its applications?
3. What is working principle of permanent magnet motors?
4. Discuss the operation of a Scharge Motor?

Tutorial Sheet-III

1. Discuss the operation of a special induction generator?
2. What are the motors used for wind turbines. Discuss.
3. State the principle of operation of motors used for solar plants. Explain.
4. Describe the motors used for biogas plants.
5. Explain the working of motors used for non-conventional energy forms?

Tutorial Sheet –IV

1. State the principle of working of Universal motor?
2. Discuss the operation of a stepper motor?
3. Explain the working of switched-reluctance motor?
4. Describe the operation of servo motor?
5. Discuss the working of shaded pole motor?

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SPECIAL ELECTRICAL MACHINES

EE-406N

Time : Three Hours] [Maximum Marks : 75

Note : Attempt *Five* questions in all, selecting at least *one* question from each Unit.

Unit I

1. (a) What do you mean by FHP ? Write down the different types of motors used in domestic appliances. 8

   (b) A single phase induction motor when excited by a single-phase produces two equal and opposite revolving fields. Justify the statement. 7

2. (a) A 220 V, 4-pole, 50 Hz single-phase induction motor gave the following test results :

   Blocked Rotor test : 110V, 10A, 400 Watt

   No-load test : 220 V, 4A, 100 Watt

   (i) Find the parameters to develop equivalent circuits. State necessary assumption.

(ii) Considering the speed of the motor as 1440 rpm, determine (1) Line current, (2) power factor. **10**

(b) Derive the torque equation of single phase induction motor. **5**

Unit II

3. (a) What do you mean by linear induction motor ? Explain its construction in detail. **8**

(b) Draw and explain equivalent circuit of linear induction motor. **7**

4. (a) What do you mean by actuator ? Explain them in brief. **8**

(b) Write a short note on discharge motor. **7**

Unit III

5. (a) Draw and explain the torque speed curve of induction generator. Give some applications of induction generator. **10**

(b) Differentiate between induction generator and motor in brief. **5**

6. What do you mean by biogas plant ? Write down the various motor/generator used in the plant for energy production. **15**

Unit IV

7. (a) Mention some advantages, disadvantages and applications of synchronous reluctance motor. **8**

   (b) Describe the working of a single-phase series motor. Name the two electrical gadgets where these motors are used. **7**

8. (a) Discuss permanent magnet DC motor in detail with its characteristics and application. **8**

   (b) What do you mean by servo motor ? Explain it with various appliations. **7**

Code	Nomenclature of Subject	L	T	Int.	Ext.	Total	Time
EE-408N	**Electrical Energy Conservation and Auditing**	**4**	**1**	**25**	**75**	**100**	**3 Hr**

Paper Setter Note: 8 questions of 15 marks each distributed in four sections are to be set taking two from each unit. The candidate is required to attempt five questions in all, taking at least one from each of the four sections

UNIT-I

Introduction: Energy Scenario, Energy Analysis of Fuels, Energy Needs of Growing Economy, Long Term Energy Scenario, Energy Pricing, Energy Sector Reforms, Energy and Environment: Air Pollution, Climate Change, Energy Security, Energy Conservation and its Importance, Energy Strategy for the Future, Energy Conservation Act-2001 and its Features.

UNIT-II

Basics of energy and it's various forms: (a) thermal (b) Electricity (c) Non-Conventional Sources Thermal: Different Fuels & its Energy Contents, Temperature & Pressure, Heat Capacity. Steam and Moist Air.

Electricity: AC & DC, Load Management, Maximum Demand Control, Aggregated Technical & Commercial Losses (ATC), Electricity Tariffs.

UNIT-III

Energy Management: Need for Energy Management, Various Approaches, Cost Effectiveness, Bench Marking, Optimization of Energy Requirements and Maximization of System Efficiencies. Fuel and Energy Substitution.. A Few Case Studies of Real Systems.

UNIT-IV

Energy Audit: Definition, Requirements for Energy Audit, Different Approaches viz, Preliminary and Detailed Energy Audit, Case Studies for Real Systems.

Suggested Books:

.1Albert : Plant Engineers & Managers Guide to Energy Conservation.

2. Wayne C. Turner Energy management handbook, John Wiley and Sons.

3. Guide to Energy Management, Cape Hart, Turner and Kennedy

4. Cleaner Production – Energy Efficiency Manual for GERIAP, UNEP, Bangkok prepared by National Productivity Council

5. M.K.Lahiri : Saving of Electricity by System Management. M.K. Lahiri Publication

Electrical Energy Conservation and Auditing (EE-408N)

Lesson Plan

L-1	Introduction about the subject
L-2	**Unit 1**:- Energy Scenario, Energy Analysis of Fuels
L-3	Energy Needs of Growing Economy
L-4	Long Term Energy Scenario
L-5	Energy Pricing, Energy Sector Reforms
L-6	Energy and Environment: Air Pollution
L-7	Climate Change, Energy Security
L-8	Energy Conservation and its Importance
L-9	Energy Strategy for the Future
L-10	Energy Conservation Act-2001 and its Features
L-11	Class test of Unit- 1
L-12	**Unit- 2** Basics of energy and it's various forms: (a) thermal
L-13	Basics of energy and it's various forms: (b) Electricity
L-14	Basics of energy and it's various forms: (c) Non-Conventional Sources
L-15	Thermal: Different Fuels & its Energy Contents
L-16	Temperature & Pressure
L-17	Heat Capacity
L-18	Steam and Moist Air
L-19	Electricity: AC & DC
L-20	Load Management
L-21	Maximum Demand Control, Aggregated Technical & Commercial Losses (ATC)
L-22	Electricity Tariffs
L-23	Class test of Unit- 2
L-24	**Unit- 3** Energy Management: Need for Energy Management
L-25	Various Approaches, Cost Effectiveness

L-26	BenchMarking, Optimization of Energy Requirements
L-27	Maximization of System Efficiencies
L-28	Fuel andEnergy Substitution
L-29	A Few Case Studies of Real Systems
L-30	**Unit- 4** Energy Audit: Definition
L-31	Requirements for Energy Audit
L-32	Different Approaches
L-33	Preliminary Energy Audit
L-34	Detailed Energy Audit
L-35	Case Studies for Real Systems
L-36	Class Test of unit – 4

Tutorial sheet- 1

Q.1 Classify the types of the energy available on the earth? Briefly mention about primary sources of energy?

Q.2 Describe the presently energy scenario in India and also discuss sector wise energy consumption in India.

Q.3 Mention some of the long-term energy strategies available for the better energy secured nation and Explain?

Q.4 How energy pricing is done in India? How do an Industry, nation and globe would benefit from energy efficiency programs?

Q.5 Briefly describe the economic reforms in Coal, oil and natural gas and electricity sectors

Q.6 Discuss Energy and Environment and also Explain the principle pollutants produced by industrial, domestic and traffic sources?

Q.7 What is Energy Security? List the strategies for better energy security of the nation?

Q.8 What is Energy conservation? What are the importance of energy conservation. How do an Industry, nation and globe would benefit from energy efficiency programs?

Q.9 Classify the energy Strategy for Future and also explain the various components of these strategies?

Q.10 Explain the Energy conservation act 2001 and its features.

Tutorial Sheet- 2

Q.1 Write a note on various forms of energy with examples. What are the various grades of energy with an example?

Q.2 What are the characteristics of Direct current and Alternating current? What is 'Reactive power' and 'Active power'? What is power factor and how it is evaluated in the electrical system?

Q.3 what are the need for electrical load management? Describe the step by step approach for Maximum Demand Control.

Q.4 Write a short note on Aggregated Technical & Commercial Losses (ATC).

Q.5 Explain the electrical and Thermal Energy Basics in detail?

Q.6 Define the term temperature and pressure. What is heat transfer? Briefly explain three primary modes of heat transfer.

Tutorial Sheet- 3

Q.1 Define Energy Management. What are the objectives and need for Energy Management and also list the principles of energy management.

Q.2 Briefly explain with examples on fuel and energy substitution.

Q.3 Explain the steps involved in 'Energy management Strategy'?

Q.4 Write a short note on

(i) benchmarking and energy performance

(ii) Matching energy usage to requirement

(iii) Maximising system efficiency.

Tutorial Sheet- 4

Q.1 What is an energy audit? What are need of energy audit?

Q.2 Distinguish between 'preliminary energy audit' and 'detailed energy audit'?

Q.3 Explain the steps involved in 'detailed energy audit?

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ELECTRICAL ENERGY CONSERVATION AND AUDITING

EE-408N

Time : Three Hours] [Maximum Marks : 75

Note : Attempt *Five* questions in all, selecting at least *one* question from each Unit. All questions carry equal marks.

Unit I

1. (a) Write a short note on energy sector reforms in India. 8

   (b) What do you mean by energy pricing ? Explain its different components in brief. 7

2. (a) Explain the relationship between energy and environment. Explain it in view of pollution climate change etc. 8

   (b) Describe the Energy Conservation Act, 2001 in detail. 7

Unit II

3. (a) What do you mean by Energy ? Explain the different types of energy in brief. 8

   (b) What do you mean by Conventional and Non-conventional sources ? Explain the various components to promote the use of non-conventional sources. 7

4. (a) Explain the following terms :
   (i) Demand side management
   (ii) Peak demand limiting. 8

   (b) Write a short note on ATC losses in brief. What is its effect on power system economic ? 7

Unit III

5. What do you mean by energy management ? Explain the organizational structure of energy management process. 15

6. (a) Write a brief note on cost effectiveness and bench marking. 8

   (b) Explain energy management opportunities in illumination and industrial sector. 7

Unit IV

7. What do you mean by energy audit ? Write down its different stages and explain them in brief. 15

8. Describe energy audit system with a case study of any real system. 15

Code	Nomenclature of Subject	L	T	Int.	Ext.	Total	Time
EE-414N	**Power Management**	**3**	**1**	**25**	**75**	**100**	**3 Hr**

Paper Setter Note: 8 questions of 15 marks each distributed in four sections are to be set taking two from each unit. The candidate is required to attempt five questions in all, taking at least one from each of the four sections

UNIT-I

Introduction: Power scenario; power development; planning; power resources; environment- power matters plan; pre-feasibility and feasibility studies; state relations for power etc; electricity industry structure and safety regulations bill - state and central power boards / power corporations.

UNIT-II

Resources: Resources; geophysical study; Seismic considerations; environmental restraints; resettlement and rehabilitation.

Procurement: Contracting and procurement; consulting services; types of contracts; project management; organization and economy management; organizational planning and time scheduling; project cost control.

UNIT-III

Engineering: Engineering and general layout of equipments; generator; transformer and switch gear and control equipment; construction methods; operation and maintenance principle; maintenance organization and planning; availability; life cycle cost and future development; visits to sites.

UNIT-IV

Power Sector: Power sector structure in different states; regulatory regime in those states; power utilities in Haryana; grid management; power financing; visit to sites.

Power Station: Management of fuel; water resource electricity deviend scenario; storage and handling; pricing; contract etc.; human resource management; visit to sites..

Suggested Books:

1. Subranmanyam,B. “Power Plant Engineering”, Dhanpat Rai Pub., 1995

2. Sharma P.C., “Power Plant Engineering”, Dhanpat Rai Pub., 1997

3. Decenzo, David A., Robbins, Stephen P. ,” Human Resource Management”, Prentice Hill of India, 2004.

4. Nag, P.K., “Power Plant Engg”. Tata McGraw Hill, 2003.

5. Gill, A.B., “Power Plant Performance Management”, British Electricity Authority, 1984.

Lesson Plan

L-1	Introduction about the subject
L-2	**Unit-1**:- Power scenario; power development
L-3	planning; power resources
L-4	environment- power matters plan
L-5	pre-feasibility and feasibility studies
L-6	state relations for power etc
L-7	electricity industry structure
L-8	safety regulations bill
L-9	state and central power boards / power corporations
L-10	Class Test of unit- 1
L-11	**Unit- 2** Resources; geophysical study
L-12	Seismic considerations
L-13	environmental restraints
L-14	resettlement and rehabilitation
L-15	Procurement:Contracting and procurement
L-16	consulting services
L-17	types of contracts; project management
L-18	organization and economy management
L-19	organizational planning and time scheduling
L-20	project cost control
L-21	Class test of unit- 2
L-22	**Unit-3** Engineering and general layout of equipments
L-23	generator; transformer
L-24	switch gear and control equipment
L-25	construction methods
L-26	operation and maintenance principle

L-27	maintenance organization and planning
L-28	availability; life cycle cost
L-29	future development; visits to sites
L-30	Class Test of unit-3
L-31	**Unit- 4:-** Power sector structure in different states
L-32	regulatory regime in those states
L-33	power utilities in Haryana; grid management
L-34	power financing; visit to sites
L-35	Power Station:Management of fuel
L-36	water resource electricity deviend scenario
L-37	storage and handling
L-38	pricing; contract etc
L-39	human resource management; visit to sites
L-40	Class test of unit 4

TUTORIAL SHEET-1

Q.1 (a)What is total installed capacity of electricity sector in India?

(b) Which state consumes the maximum power in India?

(c) Which state consumes the minimum power in India?

(d) How much power is generated in India by renewable sources?

(e) How much power is generated in India by conventional sources?

Q.2 Briefly explain the scope of various renewable sources in India.

Q.3 What are the various problems with power sector?

Q.4 Briefly explain resource potential in electricity sector.

Q.5 Briefly explain the scope of various conventional sources in India

Q.6 What is the current situation of India's power trading with other countries?

TUTORIAL SHEET-2

Q.1 (a) What is meant by power trading?

(b) What is meant by human resource development?

(c) How much power is lost in transmission and distribution?

(d) How can power thefts be eliminated?

(e) Which bodies funds the power comapnies?

Q.2 How can human resources be developed in power sector?

Q.3 Briefly explain regulation and administration of power sector.

Q.4 What are the various government owned power companies?

Q.5 Briefly explain grid management.

TUTORIAL SHEET-3

Q.1 What is the purpose of providing controls in a power station?

Q2 What are the main functions of instruments installed in power station?

Q3 What are the various factors considered in selecting proper type of instrumentation and control?

Q.4 What are various steps of designing a power station?

Q5Desccribe Operation and Maintenance Principle

TUTORIAL SHEET-4

Q.1 (a) What is incremental fuel cost curve?

(b) What is input/output generator cost curve?

(c) What is fuel generator cost curve?

(d) What is heat rate generator cost curve?

(e) What is incremental generator cost curve?

Q.2 What are main features of Indian electricity act?

Q.3 Give complete layout of hydroelectric power plant.

Q.4 Draw sketch of a steam power plant.

Q.5 Explain working of a thermal power plant.

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BT-8/M-19

POWER MANAGEMENT (E-IV)

EE-414N

Time : Three Hours] [Maximum Marks : 75

Note : Attempt *Five* questions in all, selecting at least *one* question from each Unit. All questions carry equal marks.

Unit I

1. (a) What is the present power position in India ? Give details as per the latest data. Show graphically the installation capacity. 7½

   (b) What do you understand by the conventional and non-conventional energy sources ? List out the changes from non-commercial to commercial in the last six plans. 7½

2. (a) Describe hydel power development in India. Show graphically. 7½

   (b) Why the nuclear power development is slow in India. Give reasons. List the capacity of nuclear plant. 7½

Unit II

3. (a) What are the basic resources for power generation in India ? List out capacities in the different regions. 7½

(b) Discuss the resettlement and rehabilities issues for hydro-power generation. 7½

4. (a) What is Project Management ? Discuss the issues related to project management. 7½

(b) Give the organization planning chart and explain with the time scheduling of project execution. 7½

Unit III

5. (a) Give general layout of hydrogenerators. Discuss the equipments for hydrogenerators. 7½

(b) List the control equipments for hydrogenerators. Explain briefly. 7½

6. (a) Discuss the operation and maintenance of thermal power stations. Give its organization chart. 7½

(b) What are the construction methods for hydro power plants ? Explain. 7½

Unit IV

7. (a) Give the power sector structure in Haryana. Explain the structure with block diagram. 7½

(b) Give the regulatory framework in Haryana. What are its keys responsibilities ? 7½

8. What do you mean by grid management ? What are the key factors for grid management ? List all of them. 15

Code	Nomenclature of Subject	L	P	Int.	Ext.	Total	Time
EE-416N	**Power System Lab**		**2**	**40**	**60**	**100**	**3 Hr**

List of Experiment

1. To find out the dielectric strength of transformer oil.

2. To find zero sequence component of three phase line.

3. To draw the characteristics of thermal overload relay.

4. To study an IDMT over current relay to obtain and plot it's characteristic curves i.e. the graph between current and time.

5. To measure the ABCD parameters of a given transmission line.

6. To plot the power angle characteristics of given transmission lines.

7. To find the string efficiency of a string insulator with/without guard rings.

8. To study the characteristics of transmission line for tNetwork & pie- network.

9. To study and testing of a current transformer.
10. To study various types of distance relay

NOTE: At least 8 experiments are to be performed.

Code	Nomenclature of Subject	L	P	Int.	Ext.	Total	Time
EE–418N	**Computer Methods In Power System Lab**		**3**	**40**	**60**	**100**	**3 Hr**

List of Experiments:

1. Develop a program to do the following mathematical operations:
   i) Transpose of a matrix
   ii) Multiplication of two matrices
   iii) Addition & subtraction of two matrices.
2. The demand estimate is the starting point for planning the further electric power Supply. Mathematical curves of the trend. One of the simplest curve is P= Po exp

   {a (t-t0)}, where a is the average per unit growth rate

   P is the demand in year 't' in GW

   P0 is the given demand at year T0 in GW.

   Develop a table to compute the system demand from 1984 to 2005 on yearly basis.

   Calculate also the average yearly demand over this period.

3. Write a program to formulate Y-Bus by non- singular transformation Y Bus = [A], T[= y] [A].
4. Develop a program to solve a set of 4 simultaneous liner equations using Gaussian Elimination method.
5. Develop a program to calculate Z bus of a given network using building algorithm. Assume that no mutual coupling is involved in between the different elements.
6. The Gauss Seidel method to find the solution of following equations

   X1 + X1X2 + X3 = 10

   X1 + X2 + X3 = 6

   X1 X2 – X3 = 2

7. You have given with a 6 bus system. Apply load flow technique using Gauss Seidel method to solve up to two iterations.
8. Develop a program to find Eigen Values for given Matrix.
9. Develop a program to determine the bus impedance matrices for the given power system network.
10. Develop a program to determine the admittance matrices for the given power system network.

NOTE: At least 8 experiments are to be performed