UNIVERSITY OF CALICUT

SCHEME AND SYLLABI

FOR

SIXTH SEMESTER

OF

BACHELOR OF TECHNOLOGY

IN

ELECTRICAL & ELECTRONICS ENGG.

FROM 2004 ADMISSION ONWARDS

CALICUT UNIVERSITY (P.O), THENHIPALAM

EE: ELECTRICAL ENGINEERING

SIXTH SEMESTER

Code	Subject	Hours/ Week			Sessional Marks	University Exam	
		L	T	P/D		Hrs	Marks
EE04 601	Engineering economics and Principles of Management	3	1	-	50	3	100
EE04 602	Microprocessors and Microcontrollers	3	1	-	50	3	100
EE04 603	Control Systems I	3	1	-	50	3	100
EE04 604	Power Systems II	3	1	-	50	3	100
EE04 605	Electrical Machine design	3	1	-	50	3	100
EE04 606	Electrical Engineering Drawing	1	-	3	50	3	100
EE04 607(P)	Electrical Machines Lab II	-	-	3	50	3	100
EE04 608(P)	Mini Project	-	-	3	50	3	-
	TOTAL	**16**	**5**	**9**	**400**		**700**

SIXTH SEMESTER

EC04 601: ENGINEERING ECONOMICS & PRINCIPLES OF MANAGEMENT

(Common with AI 04 601,BM 04 601,EC 04 601,CE 04 601)

3 hours lecture and 1 hour tutorial per week

PART A: ENGINEERING ECONOMICS

Objective: To create general awaremness on the basic principles of Economics with special reference to India.

Module I (13 Hours)

1. Introductory Background – Nature and scope of Economics, Science, Engineering and Technology, their relationship with economic development.
2. Basic Economic Concepts – Wants and utility, Demand and supply, Elasticity of demand and supply, concept of cost and revenue, concept of equilibrium and margin, wealth and capital.
3. Money and Banking – Functions of money – Functions of banks – Commercial and Central Banks. Monetary policy of the Reserve Bank of India.

Module II (13 Hours)

4. Industrialisation and Economic Planning in India – Need for industrialization, Development of Indian Industry since independence, Role of public sector in India, Industrial Policy of the Government of India. A brief study of Five Year Plans of India.
5. Agriculture – Role of Agriculture in Indian Economy – Problems of Indian Agriculture – Green Revolution in Indian Features and effects.
6. Foreign exchange and International Trade – Determination of rate of exchange – Balance of payments and Trade – India's Foreign Trade Policy – A short note on International Monetary Fund (I.M.F.).

PART B: PRINCIPLES OF MANAGEMENT

Objective: An elementary level exposure of management principles relevant for industrial sector.

Module III (13 hours)

Need for management – principles of management – management functions – span of control – delegation – directing – leadership and motivation (basic concepts only)

Theories of scientific management (an overview only expected) - Fredric Taylor's theory – Frank Gilbreth's theory – Henry Foyal's theory – present concepts of management.

Financial management – objectives and functions – time value of money (numerical examples included) – basics of financial accounting (problem solving not required) – profit and loss account – balance sheet (only introduction) – sources of industrial finance – shares – debentures – public deposits – bank loans – financial institutions.

Module IV (13 hours)

Marketing management –concept of market and marketing – marketing mix – market research – advertising and sales promotion.

Scope and objective of Human Resource Management – manpower recruitment analysis – recruitment and training – job analysis – job evaluation – wages and incentives.

Decision making – Introduction and definition – techniques of decision making – decision making process – under certainty, uncertainty and risk (problems not included).

Network analysis – CPM and PERT (analysis of simple networks).

Text Books

1. F. Mazda, *Engineering management*, Addison Wesley, Longman Ltd., 1998
2. O. P. Khanna, *Industrial Engineering and Management*, Dhanpat Rai and Sons, Delhi, 2003.
3. P. Kotler, *Marketing Management: Analysis, Planning, Implementation and Control*, Prentice Hall, New Jersey, 2001
4. Venkata Ratnam C.S & Srivastva B.K, *Personnel Management and Human Resources*, Tata McGraw Hill.
5. Prasanna Chandra, *Financial Management: Theory and Practice*, Tata McGraw Hill.
6. K.K.Dewett, Modern Economic Theory
7. Ishwar.C.Dhingra, The Indian Economy (Resources Planning development and Problem)

Reference Books

1. Koontz H, O'Donnel C & Weihrich H, Essentials of Management, McGraw Hill.
2. Satya Raju R & Parthasarathy A, Management: Text & Cases, Prentice Hall.
3. Ramaswamy V.S & Namakumari S, Marketing Management *:* Planning, Implementation and Control,

Internal assessment:

Assignments		=	**15 Marks**
Economics:Assignments should help students to appreciate necessity of economics in Engineering Management:Individual documentation of best management practices by various organizations			
2 Tests	2x15	=	30 Marks
Regularity		=	5
Total		=	50 Marks

University examination Pattern:

(Part A and Part B should be written on separate answer books)

Part A

Q I - 4 short type questions of 5 marks each , 2 from module I and II
Q II - 2 questions A and B of 15 marks each , 2 from module I with choice to answer any one
Q III - 2 questions A and B of 15 marks each , 2 from module II with choice to answer any one

Part B

Q I - 4 short type questions of 5 marks each , 2 from module III and IV
Q II - 2 questions A and B of 15 marks each , 2 from module III with choice to answer any one
Q III - 2 questions A and B of 15 marks each , 2 from module IV with choice to answer any one

EE04 602: MICROPROCESSORS AND MICROCONTROLLERS

3 hours lecture and 1 hour tutorial per week

Objective:

Understanding the architecture and programming of different microprocessors.
Interfacing the microprocessor with the peripherals for a specific application
Understanding the architecture, programming and interfacing of basic microcontrollers.

Module 1 (14 hours)
Architecture of Intel 8086/8088 processors – Memory Segmentation – Addressing nodes – Introduction set – Assembly language programming – Assembler directives – Basic concepts of modular programming – minimum node configuration of 8086 – Interrupt system of 8086 – maximum node – Queue station and lock facility – Multi processor Configuration – Co Processor – loosely coupled and closely coupled configurations – 8087 numeric data processor - 8089 Input Output Processor

Module 2 (Hours 12)
Interfacing – Programmable Peripheral Interface (8255) – Serial communication – Programmable communication interface(8251) – Programmable timer (8253) – DMA controller (8257) – Interrupt controller (8259) – key board and display interface (8279) – Data acquisition system – interfacing of A/D and D/A converters.

Module 3 (Hours 12)
Advancements in microprocessor Architecture – 80386 processor Architecture – real addressing mode – protected virtual addressing mode – 80286 Bus Interface – Instruction set - features – Introduction to Pentium processors – Special features – (Basic Concepts only) – hyper threading Technology.

Module 4 (Hours 14)
Micro controllers – overview of 8051 Microprocessor – Architecture – Basic Assembly language Programming concepts – Arithmetic and Logic Operators – Jump and CALL instructions – interfacing memory to 8051 – 8051 micro controller design – Application

Text Books

1. Lio Y C & Gibson.C.A Micro computer Systems – 8086/8088 family
2. Gaonker R.S Micro Processor Architecture – Programming and Application
3. Brey B.B The Intel Microprocessor system – Architecture, Programming and interfacing
4. Ayaila K.J, The 8051, Micro controller – Architecture – Programming and Application

Reference Books

1. Hall DV Microprocessor & Interfacing
2. Ray A.K & Bhun chandi K.W. Advanced microprocessor and peripherals
3. Avter System – Microprocessor and Application
4. Mohammed Ali Ma and Janva Githspie

Sessional work assessment

2Assignments 30%
2 tests 60%
Regularity &Participation in class 10%
Total marks = 50

University examination pattern

Q I - 8 short type questions of 5 marks, 2 from each module
Q II - 2 questions A and B of 15 marks from module I with choice to answer any one
Q III - 2 questions A and B of 15 marks from module II with choice to answer any one
Q IV - 2 questions A and B of 15 marks from module III with choice to answer any one
Q V - 2 questions A and B of 15 marks from module IV with choice to answer any one

EE04 603: CONTROL SYSTEMS I

3 hours lecture and 1 hour tutorial per week

Objective:

Representation of a classical control system problem in state space.
Analysis of a generalized control system problem in time domain and frequency domain.
Design of a controller for a particular application.

Module I: State space analysis and stability of systems (14 hours)

Concept of state – Definition and explanation of the terms State, state variables, State vector and State space – comparison with transfer function approach - State equations for typical electrical and mechanical and electromechanical systems - Representation for linear time varying and time invariant systems
Solution of state equation for typical test inputs - Zero state and zero input response –State transition matrix –Properties –Transfer function from state model- Transfer function decomposition for different state models- State diagrams
Concept of stability - Bounded input bounded output stability.

Module 2: System models – Discrete time (12 hours)

Sample data control systems – sampling process – Mathematical analysis of the sampling process – Data reconstruction and hold circuits – Zero and first order hold – z-transform – Inverse z-transform – Solution of difference equations – Pulse transfer function – System time response - Discrete time state equations– z-transform decomposition – Discrete time state models. Stability in the z-plane – Bilinear transformation and the w-plane - Routh's stability criterion for discrete data systems – Jury's stability test.

Module 3: Time and frequency domain analysis (12 Hours)

Root locus method – Construction of root locus – Effect of poles and zeros and their locations on the root locus – Extension to discrete data systems.
Frequency response representation – Polar plot – Logarithmic plots – Frequency domain specifications – Non-minimum phase systems – Transportation lag.
Nyquist stability criterion – Stability from polar and Bode plots – Relative stability – Gain margin and phase margin – M-N circles – Nichol's chart.
Extension of frequency response methods to discrete-data systems.

Module 4: Design using conventional methods (12 Hours)

Cascade compensation – PI, PD and PID control – Lead, lag and lag-lead compensation using RC networks – Design of lead, lag and lead-lag compensators using Frequency response and root locus methods – Design of discrete-data systems using frequency response and root locus methods – Effect of sampling period on time response. Introduction to CS Tool box in MATLAB.

Text Books

1. K. Ogata : Modern control engineering, Prentice Hall
2. K. Ogata : Discrete-time control systems, Prentice Hall
3. Kuo : Automatic control systems, Prentice Hal
4. Kuo : Analysis and synthesis of sampled data systems,

References:

1. Nagarath and Gopal : Control system engineering, Wiley Eastern, Prentice Hall
2. Sushil Das Gupta : Control System , Khanna Publishers
3.Gibson and Tutter : Control system components, Mc Graw Hall

Sessional work assessment	
2Assignments	30%
2 tests	60%
Regularity &Participation in class	10%
Total marks	= 50

University examination pattern

Q I - 8 short type questions of 5 marks, 2 from each module
Q II - 2 questions A and B of 15 marks from module I with choice to answer any one
Q III - 2 questions A and B of 15 marks from module II with choice to answer any one
Q IV - 2 questions A and B of 15 marks from module III with choice to answer any one
Q V - 2 questions A and B of 15 marks from module IV with choice to answer any one

EE04 604: POWER SYSTEMS II

3 hours lecture and 1 hour tutorial per week

Objective:

Development of a power system model.
Analyzing the power system model under normal and abnormal conditions.

Module 1(12 Hours)
Representation of power systems – one line diagrams , impedance and reactance diagrams ,per unit and percent quantities , primitive networks , y-bus matrix formulation by singular transformation and Direct determination , z-bus matrices – Building algorithm.

Load flow studies : problem formulation ,classification of buses , Gauss –Siedal method, Newton - Raphson method and fast decoupled load flow method.

Module 2 (14 Hours)
Economic load dispatch : system constraints , economic dispatch of thermal plants neglecting line losses , optimum load dispatch including transmission line losses , exact transmission loss formula , automatic load dispatching .
Speed governing mechanism : speed governing of turbo generator , load sharing and governor characteristics , transfer function model , load frequency Control ,Automatic voltage regulation

Module 3 (12 Hours)
Short circuit studies : Faults on power systems , three phase to ground faults, SLG , DLG , LL faults, Sequence impedance and sequence networks ., symmetrical component methods of analysis of unsymmetrical faults at the terminals of an unloaded generator , Faults on power systems ,fault analysis using z-bus , faults through impedance , short circuit capacity of a bus and circuit breaker rating .

Module 4(14 Hours)
Power system stability studies : steady state , dynamic and transient stability , electrical stiffness, Swing equation, inertia constant , equal area criterion, Step by step method of solution of swing equation , factors affecting stability.
Voltage stability problem , causes and improvement methods
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Text books
1. Stevenson Jr : Elements of power system analysis: Tata Mc Graw Hill.
2. J.Nagrath & D.P.Kothari: Modern Power systwem analysis: Tata Mc Graw Hill.

References

1.O.I. Elgard : Electric energy system theory- an introduction : Tata Mc Graw Hill.
2. B.F.Wollenberg: Power System Engineering
3. B .R.Gupta :Power system analysis and design: Wheeler Publishing & Co.NewDelhi.

Sessional work assessment

2Assignments	30%
2 tests	60%
Regularity &Participation in class	10%
Total marks	= 50

University examination pattern

Q I - 8 short type questions of 5 marks, 2 from each module
Q II - 2 questions A and B of 15 marks from module I with choice to answer any one
Q III - 2 questions A and B of 15 marks from module II with choice to answer any one
Q IV - 2 questions A and B of 15 marks from module III with choice to answer any one
Q V - 2 questions A and B of 15 marks from module IV with choice to answer any one

EE04 605 : ELECTRICAL MACHINE DESIGN

3 hours lecture and 1 hour tutorial per week

Objective:

Design of electrical machines and transformers for the given specifications.

Module I (14 Hours)

DC Machines: Output equation - Main dimensions - Choice of specific electric and magnetic loadings - Choice of speed and number of poles – Design of armature conductors, slots and winding - Design of air-gap, field system, commutator, interpoles, compensating winding and brushes - Carter's coefficient - Real and apparent flux density – Design examples.

Module II (14 Hours)

Transformers: Single phase and three phase power transformers - Output equation - Main dimensions - Choice of specific electric and magnetic loadings- Design of core, LV winding, HV winding, tank and cooling tubes - Prediction of no load current, forces on winding during short circuit, leakage reactance and equivalent circuit based on design data – Design examples - Design principles of current transformers - Temperature rise calculations -Continuous and intermittent rating.

Module III (12 Hours)
Alternators: Salient pole and Turbo alternators - Output equation - Main dimensions - Choice of specific electric and magnetic loadings - Choice of speed and number of poles – Design of armature conductors, slots and winding - Design of air-gap, field system and damper winding – Prediction of open circuit characteristics and regulation of the alternator based on design data-Design examples.

Module IV (12 Hours)
Induction Machines: Output equation - Main dimensions - Choice of specific electric and magnetic loadings – Design of Stator and rotor windings, Stator and rotor slots and air-gap of slip ring and squirrel cage motors - Calculation of rotor bar and end ring currents in cage rotor- Calculation of equivalent circuit parameters and prediction of magnetising current based on design data - Design examples.

Text Book

Sawhney A.K : Electrical Machine Design, Dhanpath Rai &Sons

Reference Books

1. Clayton and Hancock : Performance and design of dc machines, ELBS.
2. Say M.G. : Performance and design of AC machines, Pitman, ELBS.
3. Bhattacharya ,. Electrical Machine Design,

Sessional work assessment

2Assignments 30%	
2 tests	60%
Regularity &Participation in class	10%
Total marks	50

University examination pattern

Q I - 8 short answer type questions of 5 marks, 2 from each module.
Q II - 2 questions A and B of 15 marks from module I with choice to answer any one.
Q III - 2 questions A and B of 15 marks from module II with choice to answer any one.
Q IV - 2 questions A and B of 15 marks from module III with choice to answer any one.
Q V - 2 questions A and B of 15 marks from module IV with choice to answer any one.

EE04 606: ELECTRICAL ENGINEERING DRAWING

1 hour lecture and 3 hours drawing per week

Objective:

1. **To make the students to be able to plan and draw different views of electrical machines and transformers**
2. **To make the students to draw different types of windings used in electrical machines.**
3. **Introduction to auto cad in electrical engineering drawing**

Module I (10 Hours)

DC Windings

Simplex lap and wave dc armature windings.

AC Windings

Mush and concentric type single layer three phase ac armature windings.
Simplex lap and wave, integral and fractional slot, double layer three phase ac armature windings.

Introduction to AUTOCAD- Developed winding diagrams(Auto Cad not included for Examination)

Module II (14 Hours)

Transformers:

1.Sectional plan and elevation of a transformer limb with windings.
2.Sectional plan and elevation of the core assembly of a power transformer .
3.Sectional plan and elevation of a distribution transformer tank with its accessories .
4. Sketches of capacitor and oil filled type transformer bushings.
5.Layout and single line diagram of a distribution transformer.

Substation Layouts:

1.Layouts and single line diagrams of outdoor and indoor substations .
2.Layout of a 220KV substation.
3.Layout of a captive power substation.
4.Single line diagram of a distribution centre.

Module III (12 Hours)

DC Machines:

1.Sectional front and side elevation of armature with commutator of a dc machine.
2.Sectional front and side elevation of the yoke and pole assembly with field winding of a dc machine.
3.Sectional front and side elevation of an assembled dc Machine.

Module IV(16 hours)

Alternators:

1.Sectional front and side elevation of a water wheel rotor assembly with winding.
2.Sectional front and side elevation of a salient pole alternator.
3.Sectional front and side elevation of a Turbo alternator
4.Sketches of the methods of pole fixing and slot details of Turbo and Water wheel alternators**.**

Induction motors:

1. Sectional front and side elevation of a slip ring induction motor.
2. Sectional front and side elevation of a squirrel cage induction motor.

Text Book

1.Narang K.L.: A Text Book of Electrical Engineering Drawing, Tech India Publications
2. C.R.Dargan ,Electrical Drawing and Estimation ,New Asian Publishers

Reference Books

1. Bhattacharya S.K. :Electrical Engineering Drawing, Wiley Eastern.
2. Clayton and Hancock : Performance and design of dc machines, ELBS.
3. Sawhney: Electrical Machine Design, Dhanpath Rai &Sons.
4. Say M.G. : Performance and design of AC machines, Pitman, ELBS.

Sessional work assessment

2Assignments (Class Work)	30%
2 tests	60%
Regularity &Participation in class	10%
Total marks	= 50

University examination pattern

Q I - 2 questions A and B of 25 marks from module I with choice to answer any one.

Q II - 2 questions A and B of 25 marks from module II with choice to answer any one.

Q III - 1 question of 50 marks from module III or module IV .(No choice)

EE04 607(P): ELECTRICAL MACHINES LABORATORY – II

3 Hours Laboratory per Week

Objectives

Conduct various tests on different ac machines and study the performance characteristics.

1. No load and Blocked rotor tests on a 3 Ø squirrel cage Induction motors and slip ring Induction motors.
    1. Conduct no load blocked rotor tests on both types of M/C s.
    2. Determine the equivalent circuit parameters and draw the equivalent circuit.
    3. Draw the circle diagram and there from predetermine the performance characteristics.

2. Load tests on 3 Ø squirrel cage and slip ring Induction motors.
    1. Conduct the brake test on both types of machines.
    2. Obtain and plot the various performance characteristics.
    3. Find the KVAR required to improve the power factor to 0.95 at various loads.

3. Performance of Induction machine as a generator and motor.
    1. To operate the given 3 Ø Induction machine coupled with a DC machine as
        a) An Induction motor
        b) An Induction generator working in supply mains.

    2. To conduct load test in both generating and motoring modes and plot the following characteristics on the same graph – efficiency, line current, power factor and slip as a function of output power.

    3. Plot output vs slip and obtain hysteresis, power and corresponding torque.

4. Pole changing as a method of speed control and load test on pole changing induction motor .
    1. To study the different modes of operation of a 3 Ø pole changing Induction motor.
    2. Perform load test and obtain the performance characteristics and compare the results obtained for different pole combinations at different load condition.

5. Speed control of 3 Ø Induction motor by variable frequency method..
    1. Plot speed vs frequency characteristics of a 3 Ø cage Induction motor under variable frequency method of speed control, under no load and constant load conditions.
    2.Plot the different load and load conditions parameters.

6. Alternator
    1.Slip test on Salient pole alternator.

    Objectives

1.Conduct the slip test on 3 Ø salient pole alternator to obtain direct axis and quadrature axis reactance.
2.Predetermine the regulation at different loads and power factors and to derive the power vs torque angle diagram

7. V curves of a 3 Ø synchronous machine.

    Objectives

    1.Synchronise a 3 phase alternator to the supply mains using Dark or Bright lamp method.
    2.Plot the V curves and inverted V curves as a generator and motor under no load condition

8. Voltage regulation of a 3 alternator
9.Single Phase Induction Motor

Sessional work assessment
Record & Class work =25
Attendance & Regularity =5
Test =20
Total =50

EE04 608 (P) : MINI PROJECT

3 hours per week per week

Objective:

The mini project is aimed at improving the professional competency of the students, touching those areas which otherwise are not covered in the normal course. The work practice here will help student to develop the ability to apply theoretical and practical tools/techniques to solve real life problems related to industry and current research

The project work can be modeling /design project, experimental project or computer simulation project in the topics of electrical and electronics engineering interest. It can be allotted as a group project with group consisting of three to five students.

The assessment of all the mini projects should be done at the end of the semester by a committee consisting of three or four faculty members specialized in the various fields of Electrical Engineering. The students shall present their project work before the committee for about 20 to 30 minutes duration. The complete project report is to be submitted to the department through the guide at the end of the sixth semester. The committee will fix the group average marks for the various projects. The project guides will award the marks for the individual students in a project group maintaining the group average. The Head of the Department will certify the copies and shall retain one copy in the Department.

Sessional work assessment	
Design & development	= 20
Testing and installation	= 15
Regularity	= 05
Report	= 10
Total marks	= 50