BRANCH:*Electrical & Electronics Engineering*

SEMESTER - 8

Course Code	*Course Name*	*L-T-P*	*Credits*	*Exam Slot*
EE402	Special Electric Machines	3-0-0	3	A
EE404	Industrial Instrumentation &Automation	3-0-0	3	B
	Elective 4	3-0-0	3	C
	Elective 5 (Non Departmental)	3-0-0	3	D
EE492	Project		6	S

Total Credits = 18 **Hours: 29** **Cumulative Credits= 180**

Elective 4:-

1. EE462 Design of Digital Control Systems
2. EE464 FACTS
3. EE466 Digital Image Processing
4. EE468 Computer Networks
5. EE472 Internet of Things
6. EE474 Energy Management and Auditing

Course code	Course Name	L-T-P - Credits	Year of Introduction
EE402	Special Electrical Machines	3-0-0-3	2016

Prerequisite: Nil

Course Objectives

- To get an overview of some of the special machines for control and industrial applications

Syllabus

AC Servomotors – construction – operation - DC servomotors – Stepper motor – operation – types-modes of excitation – AC series motor – Universal motor – Hysteresis motor – Reluctance motor – Switched reluctance motor – Permanent magnet DC motor – Brushless DC motor – Linear motors – Linear induction motors.

Expected outcome.

- The students will gain knowledge in the construction and principle of operation of certain special electrical machines having various applications.

Text Book:

E. G. Janardhanan, '*Special Electrical Machines*' PHI Learning Private Limited.

References:

1. Irving L. Kosow.'*Electrical Machinery and Transformers*', Oxford Science Publications.
2. T. J. E. Miller, '*Brushless PM and Reluctance Motor Drives*'.C.Larendon Press, Oxford.
3. Theodore Wildi, '*Electric Machines, Drives and Power Systems*', Prentice Hall India Ltd.
4. Veinott & Martin,'*Fractional & Subfractional hp Electric Motors*'.McGraw Hill International Edn.

Course Plan

Module	Contents	Hours	Sem. Exam Marks
I	AC Servomotors- Construction-principle of operation – performance characteristics – damped AC servomotors – Drag cup servomotor – applications. DC servomotors – field and armature controlled DC servomotors – permanent magnet armature controlled – series split field DC servomotor.	7	15%
II	Stepper motors – Basic principle – different types – variable reluctance- permanent magnet – hybrid type – comparison – theory of operation – monofilar and bifilar windings – modes of excitation – drive circuits – static and dynamic characteristics – applications	7	15%
	FIRST INTERNAL EXAMINATION		
III	Single phase special electrical machines – AC series motor-construction – principle of working – phasor diagram – universal motor Hysteresis motor- constructional details- principle of operation – torque-slip characteristics – applications.	7	15%
IV	Reluctance motors – principle of operation – torque equation – torque slip characteristics-applications. Switched reluctance motors – principle of operation – power converter circuits – torque equation – different types – comparison – applications.	7	15%

SECOND INTERNAL EXAMINATION			
V	Permanent Magnet DC Motors – construction – principle of working. Brushless dc motor – construction – trapezoidal type-sinusoidal type – comparison – applications.	7	20%
VI	Linear motors – different types – linear reluctance motor – linear synchronous motors – construction – comparison. Linear induction motors – Expression for linear force – equivalent circuit – applications.	7	20%
END SEMESTER EXAM			

QUESTION PAPER PATTERN:

Maximum Marks: 100 Exam Duration: 3Hourrs.

Part A: 8 compulsory questions.

One question from each module of Modules I - IV; and two each from Module V & VI.

Student has to answer all questions. (8 x5)=40

Part B: 3 questions uniformly covering Modules I & II. Student has to answer any 2 from the 3 questions: (2 x 10) =20. Each question can have maximum of 4 sub questions (a,b,c,d), if needed.

Part C: 3 questions uniformly covering Modules III & IV. Student has to answer any 2 from the 3 questions: (2 x 10) =20. Each question can have maximum of 4 sub questions (a,b,c,d), if needed.

Part D: 3 questions uniformly covering Modules V & VI. Student has to answer any 2 from the 3 questions: (2 x 10) =20. Each question can have maximum of 4 sub questions (a,b,c,d), if needed.

Course code	Course Name	L-T-P - Credits	Year of Introduction
EE404	INDUSTRIAL INSTRUMENTATION AND AUTOMATION	3-0-0-3	2016

Prerequisite: Nil

Course Objectives

- To impart knowledge about Industrial instrumentation and automation

Syllabus:

Dynamic characteristic of instrumentation- Transducers: Characteristics, Applications – Nano instrumentation - signal conditioning, MEMS, Virtual instrumentation-Automation system - actuators – sequence control, PLC

Expected Outcome:

After the completion of the course, the students will be able to:

i. Select instruments and transducers for various physical variables.
ii. Get an insight on data acquisition, processing and monitoring system
iii. Design various signal conditioning systems for transducers.
iv. Analyze dynamic responses of various systems.
v. Get the concepts of virtual instrumentation
vi. Understand the programming realization of PLC

Text books:

1. Curtis D Johnson ," *Process Control Instrumentation Technology"*, PHI, 1986
2. Doeblin E.O, 'Measurement Systems: Application and Design, Fourth Edition, McGraw Hill, Newyork, 1992
3. DVS. Murty, 'Transducers and Instrumentation' Second Edition, PHI Learning Pvt Ltd New Delhi ,2013
4. Madhuchhanda Mitra, Samarjit Sengupta, 'Programmable Logic Controllers and Industrial Automation An Introduction', Penram International Publishing (India) Pvt Ltd., 2009
5. Mickell. P. Groover 'Automation, Production and computer integrated manufacturing' Prentice Hall of India, 1992
6. Patranabis, D., 'Principles of Industrial Instrumentation', Second Edition Tata McGraw Hill Publishing Co. Ltd.. New Delhi
7. Robert B. Northrop, 'Introduction to instrumentation and measurements', CRC, Taylor and Francis 2005

References:

1. G.K.McMillan, 'Process/Industrial Instrument and control and hand book' McGraw Hill, New York,1999
2. Michael P .Lucas, 'Distributed Control system', Van Nastrant Reinhold Company, New York

Course Plan

Module	Contents	Hours	Sem. Exam Marks
I	Introduction to Process Control - block diagram of process control loop, definition of elements. Sensor time response - first and second order responses. Review of Transducers: Characteristics and Choice of transducer-	6	15%

	factors influencing choice of transducer		
II	Applications of Transducers Displace measurement: Resistance potentiometer, Capacitive and Inductive. Capacitive differential pressure measurement Torsional, shearing stress and rotating shaft Torque measurement using strain gauge. Flow measurement :Hotwire anemometer, constant resistance Constant current type Eddy current sensors, Variable reluctance tachometers Phase measurement :Analog and digital phase detectors Nano Instrumentation	8	15%
FIRST INTERNAL EXAMINATION			
III	Signal conditioning circuits-Instrumentation amplifiers- Unbalanced bridge. Bridge linearization using op amp Precision rectifiers, Log amplifiers, Charge amplifiers, Isolation amplifier, Switched capacitor circuits, Phase sensitive detectors, Noise problem in instrumentation and its minimisation	7	15%
IV	Micro Electromechanical system (MEMS) Advantages and Applications, MEMS micro sensors and actuators, Manufacturing process: Bulk micro machining and surface micromachining, MEMS accelerometers Virtual instrumentation system: architecture of virtual instruments – Virtual instruments and traditional instruments – concepts of graphical programming	7	15%
SECOND INTERNAL EXAMINATION			
V	Overview of Automation System - Architecture of Industrial Automation Systems, Different devices used in Automation Actuators, definition, types, selection. Pneumatic, Hydraulic, Electrical, Electro-Pneumatic and valves , shape memory alloys	7	20%
VI	Introduction to Sequence Control, PLCs - Working, Specifications of PLC Onboard/Inline/Remote IO's, Comparison of PLC & PC, Relay Ladder Logic- PLC Programming- realization of AND, OR logic, concept of latching, Introduction to Timer/Counters, Exercises based on Timers, Counters. Basic concepts of SCADA, DCS and CNC	7	20%
END SEMESTER EXAM			

QUESTION PAPER PATTERN:

Maximum Marks: 100 Exam Duration: 3Hourrs.

Part A: 8 compulsory questions.

One question from each module of Modules I - IV; and two each from Module V & VI.

Student has to answer all questions. (8 x5)=40

Part B: 3 questions uniformly covering Modules I & II. Student has to answer any 2 from the 3 questions: (2 x 10) =20. Each question can have maximum of 4 sub questions (a,b,c,d), if needed.

Part C: 3 questions uniformly covering Modules III & IV. Student has to answer any 2 from the 3 questions: (2 x 10) =20. Each question can have maximum of 4 sub questions (a,b,c,d), if needed.

Part D: 3 questions uniformly covering Modules V & VI. Student has to answer any 2 from the 3 questions: (2 x 10) =20. Each question can have maximum of 4 sub questions (a,b,c,d), if needed.

Course Code	Course Name	L-T-P-Credits	Year of Introduction
CE488	DISASTER MANAGEMENT	3-0-0-3	2016

Course Objectives

- To provide an overview of the common hazards and their dynamics
- To inculcate the basic concepts of disaster management

Syllabus

Fundamental concepts of hazards and disasters - Basic concept of Earth as a system and its component sub systems - . Climate Change - Introduction to key concepts and terminology of hazard, vulnerability, exposure, risk, crisis, emergencies, Disasters, Resilience - Natural Disasters - Earth quakes, Landslides. Floods, Coastal disasters, Tidal waves, Tsunamis. Nature of Impacts - Anthropogenic Disasters – Soil degradation and desertification -water and atmospheric pollution -Hazard and disaster management plans for floods, tidal waves.

Expected Outcome

The students will

i. get general ideas about the processes involved in natural and anthropogenic disasters
ii. understand the concepts of disaster management and measures to mitigate and contain common episodes of disasters

References:

1. Andrew, S., "Environmental Modeling with GIS and Remote Sensing", John Willey and sons, 2002
2. Ariyabandu, M. and Sahni P. (Eds), "Disaster Risk Reduction in South Asia", Prentice-Hall (India), 2003.
3. Bell, F.G., "Geological Hazards: Their assessment, avoidance and mitigation", E & FN SPON Routledge, London. 1999
4. Bossler, J.D., "Manual of Geospatial Science and Technology", Taylor and Francis, London, 2001
5. David Alexander, "Natural Disasters", Research Press, New Delhi, 1993
6. Matthews, J.A., "Natural hazards and Environmental Change", Bill McGuire, Ian Mason, 2002
7. Nick Carter. W., "Disaster Management - A Disaster Manager's Handbook". Asian Development Bank, Philippines. 1991
8. United Nations , Mitigating Natural Disasters, Phenomena, Effects and options, A Manual for policy makers and planners, New York, 1991

COURSE PLAN

Module	Contents	Hours	End Sem. Exam Marks
I	Fundamental concepts of hazards and disasters: Introduction to key concepts and terminology of hazard, vulnerability, exposure, risk, crisis, emergencies, Disasters, Resilience. Basic concept of Earth as a system and its component sub systems. Climate Change vis-a-vis the interrelationships of the subsystems- Green House Effect and Global warming, basic	7	15%

	ideas about their causes and effects.		
II	Types of Natural Disasters I- Earth quakes, Landslides. Nature of impacts.	7	15%
FIRST INTERNAL EXAMINATION			
III	Types of Natural Disasters II- Floods, Coastal disasters- Cyclones, Tsunamis. Nature of impacts.	7	15%
IV	Types of Anthropogenic Disasters I– soil and soil degradation, desertification.	7	15%
SECOND INTERNAL EXAMINATION			
V	Types of Anthropogenic Disasters II-Fundamental concepts of water and atmospheric pollution.	7	20%
VI	Hazard and disaster management plans for floods, tidal waves.	7	20%
END SEMESTER EXAMINATION			

QUESTION PAPER PATTERN (End Semester Examination)

Maximum Marks :100 **Exam Duration: 3 Hrs**

Part A -Module I & II : 2 questions out of 3 questions carrying 15 marks each

Part B - Module III & IV: 2 questions out of 3 questions carrying 15 marks each

Part C - Module V &VI : 2 questions out of 3 questions carrying 20 marks each

Note : 1.Each part should have at least one question from each module

2.Each question can have a maximum of 4 subdivisions (a,b,c,d)

Course code	Course Name	L-T-P - Credits	Year of Introduction
EE474	ENERGY MANAGEMENT AND AUDITING	3-0-0-3	2016

Prerequisite : Nil

Course Objectives

- To enable the students to understand the concept of energy management and energy management opportunities
- To understand the different methods used to control peak demand
- To know energy auditing procedure
- To understand the different methods used for the economic analysis of energy projects.

Syllabus

General principles of Energy management and Energy management planning - Peak Demand controls - Energy management opportunities in electrical systems and HVAC systems – Reactive power management – Energy audit – cogeneration system – Economic analysis of energy projects

Expected outcome .

- The students will be able to understand the different methods used to reduce energy consumption

Data Book (Approved for use in the examination):

References:

1. Albert Thumann, William J. Younger, Handbook of Energy Audits, CRC Press, 2003.
2. Charles M. Gottschalk, Industrial energy conservation, John Wiley & Sons, 1996.
3. Craig B. Smith, Energy management principles, Pergamon Press.
4. D. Yogi Goswami, Frank Kreith, Energy Management and Conservation Handbook, CRC Press, 2007
5. G.G. Rajan, Optimizing energy efficiencies in industry -, Tata McGraw Hill, Pub. Co., 2001.
6. IEEE recommended practice for energy management in industrial and commercial facilities,
7. IEEE std 739 - 1995 (Bronze book).
8. M Jayaraju and Premlet, Introduction to Energy Conservation And Management, Phasor Books, 2008
9. Paul O'Callaghan, Energy management, McGraw Hill Book Co.
10. Wayne C. Turner, Energy management Hand Book - - The Fairmount Press, Inc., 1997.

Course Plan

Module	Contents	Hours	Sem. Exam Marks
I	General principles of Energy management and Energy management planning. Peak Demand controls, Methodologies, Types of Industrial Loads, Optimal Load scheduling-Case studies.	6	15%
II	Energy management opportunities in Lighting and Motors. Electrolytic Process and Electric heating, Case studies.	8	15%
	FIRST INTERNAL EXAMINATION		
III	Types of boilers, Combustion in boilers, Performances evaluation, Feed water treatment, Blow down, Energy conservation opportunities in boiler.		

	Properties of steam, Assessment of steam distribution losses, Steam leakages, Steam trapping, Condensate and flash steam recovery system, Identifying opportunities for energy savings. Classification, General fuel economy measures in furnaces, Excess air, Heat Distribution, Temperature control, Draft control, Waste heat recovery.	8	15%
IV	HVAC system: Coefficient of performance, Capacity, Factors affecting Refrigeration and Air conditioning system performance and savings opportunities. Classification and Advantages of Waste Heat Recovery system, analysis of waste heat recovery for Energy saving opportunities	7	15%
SECOND INTERNAL EXAMINATION			
V	Energy audit -Definition, Need, Types of energy audit, Energy audit Instruments. Cogeneration-Types and Schemes, Optimal operation of cogeneration plants- Case study. Computer aided energy management.	7	20%
VI	Economic analysis methods-cash flow model, time value of money, evaluation of proposals, pay-back method, average rate of return method, internal rate of return method, present value method, life cycle costing approach, Case studies.	6	20%
END SEMESTER EXAM			

QUESTION PAPER PATTERN:

Maximum Marks: 100 Exam Duration: 3Hourrs.

Part A: 8 compulsory questions.

One question from each module of Modules I - IV; and two each from Module V & VI.

Student has to answer all questions. (8 x5)=40

Part B: 3 questions uniformly covering Modules I & II. Student has to answer any 2 from the 3 questions: (2 x 10) =20. Each question can have maximum of 4 sub questions (a,b,c,d), if needed.

Part C: 3 questions uniformly covering Modules III & IV. Student has to answer any 2 from the 3 questions: (2 x 10) =20. Each question can have maximum of 4 sub questions (a,b,c,d), if needed.

Part D: 3 questions uniformly covering Modules V & VI. Student has to answer any 2 from the 3 questions: (2 x 10) =20. Each question can have maximum of 4 sub questions (a,b,c,d), if needed.

Course code	Course Name	Credits	Year of Introduction
**492	PROJECT	6	2016

Prerequisite : Nil

Course Objectives

- To apply engineering knowledge in practical problem solving
- To foster innovation in design of products, processes or systems
- To develop creative thinking in finding viable solutions to engineering problems

Course Plan

In depth study of the topic assigned in the light of the preliminary report prepared in the seventh semester
Review and finalization of the approach to the problem relating to the assigned topic
Preparing a detailed action plan for conducting the investigation, including team work
Detailed Analysis/Modelling/Simulation/Design/Problem Solving/Experiment as needed
Final development of product/process, testing, results, conclusions and future directions
Preparing a paper for Conference presentation/Publication in Journals, if possible
Preparing a report in the standard format for being evaluated by the dept. assessment board
Final project presentation and viva voce by the assessment board including external expert

Expected outcome

The students will be able to

iii. Think innovatively on the development of components, products, processes or technologies in the engineering field
iv. Apply knowledge gained in solving real life engineering problems

Evaluation

Maximum Marks : 100

(i) Two progress assessments	20% by the faculty supervisor(s)
(ii) Final project report	30% by the assessment board
(iii) Project presentation and viva voce	50% by the assessment board

Note: All the three evaluations are mandatory for course completion and for awarding the final grade.