Course code	Course Name	L-T-P - Credits	Year of Introduction
MR402	Soft Computing Techniques	3-0-0:3	2016

Prerequisite : NIL

Course Objectives

- To introduce the concepts of fuzzy sets and fuzzy logic
- To make students familiar with neural networks that can learn from available examples

Syllabus

Introduction to Neuro – Fuzzy and Soft Computing – Fuzzy Rules and Fuzzy Reasoning – Extension Principle and Fuzzy Relations - Fuzzy Inference Systems – Fuzzy Models -Derivative-based Optimization – Genetic Algorithms – Radial Basis Function Networks – Adaptive Neuro-Fuzzy Inference Systems – Coactive Neuro Fuzzy Modeling – Framework Neuron Functions for Adaptive Networks – Neuro Fuzzy Spectrum- Printed Character Recognition – Inverse Kinematics Problems – Automobile Fuel Efficiency Prediction – Soft Computing for Color Recipe Prediction.

Expected outcome .

- The students will be familiar with the techniques of soft computing and adaptive neuro fuzzy inferencing systems and will be able to use the techniques to simulate and optimize engineering systems.

Text Book:

1. J.S.R.Jang, C.T.Sun and E.Mizutani, "Neuro-Fuzzy and Soft Computing", PHI, 2004, Pearson Education 2004.
2. S.N.Sivanandam & S.N.Deepa "Principles of Soft Computing" Wiley India Pvt. Ltd., 2007

References:

1. Timothy J.Ross, "Fuzzy Logic with Engineering Applications", McGraw-Hill, 1997.
2. Davis E.Goldberg, "Genetic Algorithms: Search, Optimization and Machine Learning", Addison Wesley, N.Y., 1989.
3. S. Rajasekaran and G.A.V.Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithms", PHI, 2003.
4. R.Eberhart, P.Simpson and R.Dobbins, "Computational Intelligence - PC Tools", AP Professional, Boston, 1996.

Course Plan

Module	Contents	Hours	Sem. Exam Marks
I	Introduction to Neuro – Fuzzy and Soft Computing – Fuzzy Sets – Basic Definition and Terminology – Set-theoretic Operations – Member Function Formulation and Parameterization – Fuzzy Rules and Fuzzy Reasoning – Extension Principle and Fuzzy Relations .	7	15%
II	Fuzzy Inference Systems – Mamdani Fuzzy Models – Sugeno Fuzzy Models – Tsukamoto Fuzzy Models. Derivative-based Optimization – Descent Methods – The Method of Steepest Descent – Classical Newton's Method	7	15%

FIRST INTERNAL EXAMINATION			
III	Step Size Determination – Derivative-free Optimization – Genetic Algorithms – Simulated Annealing – Random Search – Downhill Simplex Search. Supervised Learning Neural Networks – Perceptrons - Adaline – Back propagation Mutilayer Perceptrons	7	15%
IV	Radial Basis Function Networks – Unsupervised Learning Neural Networks – Competitive Learning Networks – Kohonen Self-Organizing Networks – Learning Vector Quantization – Hebbian learning.	7	15%
SECOND INTERNAL EXAMINATION			
V	Adaptive Neuro-Fuzzy Inference Systems – Architecture – Hybrid Learning Algorithm – Learning Methods that Cross-fertilize ANFIS and RBFN – Coactive Neuro Fuzzy Modeling – Framework Neuron Functions for Adaptive Networks – Neuro Fuzzy Spectrum.	7	20%
VI	Printed Character Recognition – Inverse Kinematics Problems – Automobile Fuel Efficiency Prediction – Soft Computing for Color Recipe Prediction.	7	20%
END SEMESTER EXAM			

QUESTION PAPER PATTERN:

QUESTION PAPER PATTERN

Maximum Marks : 100 Exam Duration:3 hours

PART A: FIVE MARK QUESTIONS
8 compulsory questions –1 question each from first four modules and 2 questions each from last two modules (8 x 5= 40 marks)

PART B: 10 MARK QUESTIONS
6 questions uniformly covering the first four modules. Each question can have maximum of three sub questions, if needed. Student has to answer any 3 questions (3 x10 = 30 marks)

PART C: 15 MARK QUESTIONS
3 questions uniformly covering the last two modules. Each question can have maximum of four sub questions, if needed. Student has to answer any two questions
(2 x15 = 30 marks)

Course code	Course Name	L-T-P - Credits	Year of Introduction
MR 404	Power Electronics and Drives	3-0-0:3	2016

Prerequisite : Nil

Course Objectives

- To give an overview of different types of power semiconductor devices and their switching characteristics.
- To understand the operation, characteristics and performance parameters of controlled rectifiers.
- To study the operation, switching techniques and basic topologies of switching regulators

Syllabus

Power semi conductor devices- characteristics of power diodes- SCR- TRIAC- GTO- power BJT- power MOSFET and IGBT –- phase controlled converters-single phase full converters- 3 phase half converter and 3 phase full converter – input power factor – thyristor triggering circuits- dc to dc choppers-dc chopper – step up and step down chopper – forced commutation – different techniques – voltage- current and load – commutated choppers – inverters-voltage source inverters – series- parallel and bridge inverters – PWM inverters – current source inverters- ac voltage controllers and cyclo converters-single phase ac voltage controller – multistage sequence control – step up and step down cyclo converters –introduction to electric drives– advantages- parts of electrical drives – fundamental torque equation – four quadrant operation – components of load torque

Expected outcome .

The students will be able to

- analyse the dynamic and switching characteristics of power semiconductor devices.
- determine the performance parameters of controlled rectifiers and AC voltage controllers.
- design Choppers and Switching Regulators.
- understand the working of Fixed DC to Variable AC converters and learn the Modulation Techniques employed in Inverters

Text Books:

1. Bhimbra P S, *Power Electronics,* Khanna Publishers, 2001
2. Reshid M.H., Power Electronics – Circuits Devices and Application, Prentice Hall International, New Delhi, 3rd Edition, 2004

References:

1. Dubey, G.K., Doradia, S.R., Joshi, A. and Singh, R.M., Thyristorised Power Controllers, Wiley Eastern Limited, 1986.
2. Joseph Vithayathil, Power Electronics – Principle and Applications, and Robbins, McGraw-Hill Inc, New York, 1995.
3. Lander, W., Power Electronics, McGraw-Hill and Company, 3rd Edition, 1993.
4. Mohan Undeland and Robbins, Power Electronics, John Wiley and Sons, New York, 1995
5. Singh, M.D., Khanchandani, K.B., Power Electronics, Tata McGraw-Hill, 1998.

Course Plan

Module	Contents	Hours	Sem. Exam Marks
I	**POWER SEMI CONDUCTOR DEVICES** Principle of operation – Characteristics of power diodes- SCR- TRIAC- GTO- Power BJT- Power MOSFET and IGBT – Thyristor protection circuits.	7	15%

II	**PHASE CONTROLLED CONVERTERS** Single phase full converters- 3 phase half converter and 3 phase full converter – inverter operation – input power factor – effect of source inductance – Thyristor triggering circuits.	7	15%
FIRST INTERNAL EXAMINATION			
III	**DC TO DC CHOPPERS** DC Chopper – Principle of operation – step up and step down chopper – Forced commutation – different techniques – voltage- current and load – commutated choppers – step up and step down chopper.	7	15%
IV	**INVERTERS** Voltage source inverters – series- parallel and bridge inverters – PWM inverters – current source inverters.	7	15%
SECOND INTERNAL EXAMINATION			
V	**AC VOLTAGE CONTROLLERS AND CYCLOCONVERTERS** Single phase AC voltage controller – multistage sequence control – step up and step down cyclo converters – three phase to single phase and three phase cyclo converters.	7	20%
VI	**INTRODUCTION TO ELECTRIC DRIVES** Electrical Drives – advantages of electric drives - parts of electrical drives – fundamental torque equation – four quadrant operation – components of load torque - friction- windage & load torques – steady state stability	7	20%
END SEMESTER EXAM			

QUESTION PAPER PATTERN

Maximum Marks : 100 Exam Duration:3 hours

PART A: FIVE MARK QUESTIONS
8 compulsory questions –1 question each from first four modules and 2 questions each from last two modules (8 x 5= 40 marks)

PART B: 10 MARK QUESTIONS
5 questions uniformly covering the first four modules. Each question can have maximum of three sub questions, if needed. Student has to answer any 3 questions (3 x10 = 30 marks)

PART C: 15 MARK QUESTIONS
4 questions uniformly covering the last two modules. Each question can have maximum of four sub questions, if needed. Student has to answer any two questions
(2 x15 = 30 marks)

Course code	Course Name	L-T-P - Credits	Year of Introduction
MR462	Industrial Electronics and Applications	3-0-0:3	2016

Prerequisite : NIL

Course Objectives

- To introduce the application of electronic devices for conversion control and conditioning of electric power in industrial environment

Syllabus

Concept of thyristor technology- turn on methods and turn off methods of thyristors- diacs- SCS- SVS SBS- LASCR- Traics and MOSFETS-IGBT-IGCT- Concept of regulation- Principles of series and shunt regulators- Three terminal voltage regulator ICs - Concepts of CV- CC and foldback limiting- short circuit and overload protection – Major specifications of a regulated power supply and their significance-- switched mode power supply –floating and grounded power supplies -Fly back converter-UPS-dual tracking power supply- Resistance heating- Induction heating- Electronic heaters employed for Induction heating- Thyristorised supplies used in Induction Furnances- Dielectric heating- Electric Welding- Switching circuits – Automatic battery charger – Emergency light – Time delay relay circuit – Fan Speed control – Temperature control – Speed control of Dc and small DC motors – Speed control of DC shunt motor using thyristor technology – Over-voltage protection and over load protection of DC motors- Speed control of single phase induction motor- three phase induction motor- and universal series motor- Traic as a starter for single phase induction motors.

Expected outcome .

The students will be able to

- Understand the use of Basic electronic devices, their circuits and applications to bring about faster and more accurate responses in industrial installations.

Text Books:

1. P.C Sen , Power electronics , , Tata McGraw Hill 2008
2. S K Bhattacharya, S Chattertji; *Industrial electronics and control*, Tata McGraw Hill New Delhi.

References:

1. G K Mithal , Industrial Electronics, , Khanna Publishers, New Delhi-1994
2. Noel Morris , Industrial Electronics, , TMH, New Delhi 1999
3. T.E Kissel , Industrial Electronics, , PHI learning, New Delhi 2011

Course Plan

Module	Contents	Hours	Sem. Exam Marks
I	Concept of thyristor technology- ratings- symbol- characteristics- turn on methods and turn off methods of thyristors- diacs- SCS- SVS SBS- LASCR- Traics and MOSFETS-IGBT-IGCT	7	15%
II	Concept of regulation- Principles of series and shunt regulators- Three terminal voltage regulator ICs (positive- negative and variable applications)- Concepts of CV- CC and foldback limiting- short circuit and overload protection – Major specifications of a regulated power supply and their significance (line and load regulation- output ripple and transients)	7	15%
FIRST INTERNAL EXAMINATION			

III	Basic working principles of a switched mode power supply – concept of floating and grounded power supplies and their interconnections to obtain multiple output supplies-Fly back converter-UPS-dual tracking power supply	7	15%
IV	Resistance heating- Induction heating- Electronic heaters employed for Induction heating- Thyristorised supplies used in Induction Furnances- Dielectric heating- Electric Welding	7	15%
SECOND INTERNAL EXAMINATION			
V	Principle of operation and working of following switching circuits – Automatic battery charger – Emergency light – Time delay relay circuit – Fan Speed control – Temperature control – Speed control of Dc and small DC motors – SMPS – UPS	7	20%
VI	Speed control of DC shunt motor using thyristor technology – Over-voltage protection and over load protection of DC motors- Speed control of single phase induction motor- three phase induction motor- and universal series motor- Traic as a starter for single phase induction motors	7	20%
END SEMESTER EXAM			

QUESTION PAPER PATTERN

Maximum Marks : 100 Exam Duration:3 hours

PART A: FIVE MARK QUESTIONS
8 compulsory questions –1 question each from first four modules and 2 questions each from last two modules (8 x 5= 40 marks)

PART B: 10 MARK QUESTIONS
5 questions uniformly covering the first four modules. Each question can have maximum of three sub questions, if needed. Student has to answer any 3 questions (3 x10 = 30 marks)

PART C: 15 MARK QUESTIONS
4 questions uniformly covering the last two modules. Each question can have maximum of four sub questions, if needed. Student has to answer any two questions
(2 x15 = 30 marks)

Course code	Course Name	L-T-P - Credits	Year of Introduction
MR464	Agile Manufacturing Systems	3-0-0:3	2016

Prerequisite : NIL

Course Objectives

- To acquaint with basic concepts of agile manufacturing.
- To understand the conceptual and theoretical basis for the design and implementation of Advanced Manufacturing Systems.
- To design and evaluate the performance of agile manufacturing systems.

Syllabus

Introduction, conceptual framework, core concepts, Change Management, product costing, performance, Measurement and control systems, Agile Manufacturing Enterprise Design -Skill & Knowledge Enhancing Technologies For Agile Manufacturing, scheduling, technology design strategic, Design Concepts , Problems and Future Development.

Expected outcome .

The students will

i. understand the scope of Agile manufacturing systems.

ii. understand the concepts of designing agile manufacturing systems

Text Book:

1. Gunasekaran A, "Agile Manufacturing, 21st Strategy Competitiveness Strategy", Elsevier Publications, 2001.
2. Paul T Kidd , Concurrent Engg, Addison Wesley Publication, 1994
3. Paul T Kidd ,World Class manufacturing, Addition Wesley Pub., 1994
4. Paul T. Kidd , Agile Manufacturing -Forging new Frontiers, Addison Wesley Publication, 1994.

References:

1. Brian H Maskell, "Software and the Agile Manufacturer, Computer Systems and World Class Manufacturing, Productivity Press, 1993.
2. Goldman S L, Nagal R N and Preiss K, "Agile Competitors and Virtual Organizations", Van Nostrand Reinhold, 1995.
3. S. R. Devadasan, V. Sivakumar, R. Murugesh, P. R. Shalij; Lean and Agile manufacturing: Theoretical, practical and research futurities, PHI learning private ltd.

Course Plan

Module	Contents	Hours	Sem. Exam Marks
I	Introduction: Need for agile Manufacturing -Competitive environment of the future- the business case for agile manufacturing conceptual framework for agile manufacturing	7	15%
II	Four Core Concepts: strategy driven approach- integrating organization- people technology interdisciplinary design methodology	7	15%
	FIRST INTERNAL EXAMINATION		
III	Agile Manufacturing and Change Management: The change implications- post failures in advanced manufacturing- changes	7	15%

	on the way- traditional management accounting- paradigm- investment appraisal- product costing - performance- Measurement and control systems		
IV	Control technological and Design paradigms - traditional problems in workplace- organizational issues -role of technology	7	15%
SECOND INTERNAL EXAMINATION			
V	Agile Manufacturing Enterprise Design: Agile manufacturing – enterprise design -system concepts as the basic manufacturing theory-joint technical & organizational design as a model for the design of agile manufacturing enterprise-- enterprise design process -insights into design processes	7	20%
VI	Skill & Knowledge Enhancing Technologies For Agile Manufacturing: Skill and Knowledge enhancing Technologies - scheduling -technology design strategic- Design Concepts- Historical Overview- Lessons- Problems and Future Development	7	20%
END SEMESTER EXAM			

QUESTION PAPER PATTERN

Maximum Marks : 100 Exam Duration:3 hours

PART A: FIVE MARK QUESTIONS
8 compulsory questions –1 question each from first four modules and 2 questions each from last two modules (8 x 5= 40 marks)

PART B: 10 MARK QUESTIONS
5 questions uniformly covering the first four modules. Each question can have maximum of three sub questions, if needed. Student has to answer any 3 questions (3 x10 = 30 marks)

PART C: 15 MARK QUESTIONS
4 questions uniformly covering the last two modules. Each question can have maximum of four sub questions, if needed. Student has to answer any two questions
(2 x15 = 30 marks)

Course code	Course Name	L-T-P - Credits	Year of Introduction
MR466	Special Electrical Machines and Applications	3-0-0:3	2016

Prerequisite : NIL

Course Objectives

- To impart knowledge on the working of special electrical machines and their applications in mechatronics systems.
- To impart knowledge on the characteristics of stepper motors, synchronous motors, PMDC motors and switched reluctance motors.

Syllabus

Introduction to special machines- Stepper motors- Working principle and its types- Characteristics of stepper motors- Switched reluctance motors- construction and working of SRM- Synchronous reluctance motors- construction- working- characteristics- Permanent magnet brushless dc motors- single phase induction motors- universal motors- servomotors and its application.

Expected outcome .

- The students will get knowledge on the construction , working and characteristics of of stepper motors, synchronous motors, PMDC motors and switched reluctance motors, servo motors and single phase induction motors.

Text Book:

1. Miller T J E, Switched Reluctance Motor and Their Control, Clarendon Press, Oxford,1993.
2. Miller T J E, Brushless Permanent Magnet and Reluctance Motor Drives, Clarendon Press,Oxford,1989.
3. B K Bose, Modern Power Electronics & AC drives, Pearson, 2002.
4. Athani V.V. “stepper motors – Fundamentals, Applications &Design” New Age International

References:

1. Kenjo T, Sugawara A, Stepping Motors and Their Microprocessor Control, Clarendon Press, Oxford, 1994.
2. Kenjo T, Power Electronics for the Microprocessor Age, Oxford University Press, 1990.
3. Ali Emadi (Ed), Handbook of Automotive Power Electronics and Motor Drives, CRC Press, 2005.
4. R Krishnan, Electric Motor Drives – Modeling, Analysis and Control, PHI, 2003.
5. H A Toliyat, S Campbell, DSP Based Electro Mechanical Motion Control, CRC Press, 2004.Tamil Nadu 1999.
6. Arumugam & Premkumar, Electric Circuit Theory, Khanna Publishers. 2002

Course Plan

Module	Contents	Hours	Sem. Exam Marks
I	Stepper Motors - Constructional features- principle of operation- modes of excitation- Types- single phase stepping motors- torque production in variable Reluctance (VR) stepping motor- Dynamic characteristics- Application of stepper motors in mechatronics systems	7	15%

II	Switched Reluctance Motors - Constructional features- principle of operation- Torque equation- Power controllers- Characteristics and control- Applications	7	15%
FIRST INTERNAL EXAMINATION			
III	Synchronous Reluctance Motors-Constructional features: axial and radial air gap Motors- Operating principle- reluctance torque – Phasor diagram- motor characteristics- Applications	7	15%
IV	Permanent Magnet Brushless DC Motors - Commutation in DC motors-- Difference between mechanical and electronic commutators- Hall sensors- Optical sensors- Multiphase Brushless motor- Square wave permanent magnet brushless motor drives- - Torque and emf equation- Torque speed characteristics- Controllers- Microprocessor based controller- Sensor less control	7	15%
SECOND INTERNAL EXAMINATION			
V	Permanent Magnet Synchronous Motors - Principle of operation- EMF- power input and torque expressions- Phasor diagram- Power controllers- Torque speed characteristics- Self Control- Vector control- Current control schemes- Sensor less control	7	20%
VI	**SPECIAL MACHINES / APPLICATIONS** Working principle of single phase induction motor – capacitor start & capacitor run motors – Universal motor – servomotor – Applications of Servo motors in Mechatronics.	7	20%
END SEMESTER EXAM			

QUESTION PAPER PATTERN

Maximum Marks : 100 Exam Duration:3 hours

PART A: FIVE MARK QUESTIONS
8 compulsory questions –1 question each from first four modules and 2 questions each from last two modules (8 x 5= 40 marks)

PART B: 10 MARK QUESTIONS
5 questions uniformly covering the first four modules. Each question can have maximum of three sub questions, if needed. Student has to answer any 3 questions (3 x10 = 30 marks)

PART C: 15 MARK QUESTIONS
4 questions uniformly covering the last two modules. Each question can have maximum of four sub questions, if needed. Student has to answer any two questions
(2 x15 = 30 marks))

Course code	Course Name	L-T-P - Credits	Year of Introduction
MR468	Research Methodology	3-0-0-3	2016

Prerequisite : NIL

Course Objectives

- To impart knowledge on the methodologies followed in engineering research.
- To impart knowledge on formulation of research problems and to apply the same in projects

Syllabus

Research Concepts-. Types of research- Research process- Research design- Data collection methods- Formulation of Research Task- Mathematical modelling and simulation- Report writing

Expected outcome .

- The student will acquire scientific, statistical and analytical knowledge for carrying out research work effectively.

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Text Books:

1 J.W Bames, Statistical Analysis for Engineers and Scientists, McGraw Hill, N.York
2. Schank Fr., Theories of Engineering Experiments, Tata Mc Graw Hill Publication.
3. C. R. Kothari, Research Methodology, New Age Publishers.
4. Willktnsion K. L, Bhandarkar P. L, Formulation of Hypothesis, Himalaya Publication.

References:

1. Donald R. Cooper and Ramela S. Schindler, Business Research Methods, Tata McGraw- Hill Publishing Company Limited, New Delhi, 2000
2. Uma Sekaran, Research Methods for Business, John Wiley and Sons Inc., New York, 2000.

Course Plan

Module	Contents	Hours	Sem. Exam Marks
I	Research Concepts – concepts – meaning – objectives – motivation- Types of research – descriptive research – conceptual research – theoretical research – applied research – experimental research	7	15%
II	Research process – Criteria for good research – Problems encountered by Indian researchers- Research design – Purpose of the study: Exploratory- Descriptive- Hypothesis Testing	7	15%
	FIRST INTERNAL EXAMINATION		
III	Data collection methods - Interviewing- Questionnaires- etc- Secondary sources of data collection- Guidelines for Questionnaire Design – Electronic Questionnaire Design and Surveys	7	15%

IV	Formulation of Research Task – Literature Review – Importance & Methods – Sources – Quantification of Cause Effect Relations- Discussions – Field Study – Critical Analysis of Generated Facts – Hypothetical proposals for future development and testing- selection of Research task	7	15%
SECOND INTERNAL EXAMINATION			
V	Mathematical modelling and simulation – Concepts of modelling – Classification of mathematical models – Modelling with – Ordinary differential equations – Difference equations – Partial differential equations – Graphs – Simulation – Process of formulation of model based on simulation.	7	20%
VI	Interpretation and report writing – Techniques of interpretation – Precautions in interpretation – Significance of report writing – Different steps in report writing – Layout of research report – Mechanics of writing research report – Layout and format – Style of writing – Typing – References – Tables – Figures – Conclusion– Appendices	7	20%
END SEMESTER EXAM			

QUESTION PAPER PATTERN

Maximum Marks : 100 Exam Duration:3 hours

PART A: FIVE MARK QUESTIONS
8 compulsory questions –1 question each from first four modules and 2 questions each from last two modules (8 x 5= 40 marks)

PART B: 10 MARK QUESTIONS
5 questions uniformly covering the first four modules. Each question can have maximum of three sub questions, if needed. Student has to answer any 3 questions (3 x10 = 30 marks)

PART C: 15 MARK QUESTIONS
4 questions uniformly covering the last two modules. Each question can have maximum of four sub questions, if needed. Student has to answer any two questions
(2 x15 = 30 marks))

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.