MOHAMED SATHAK A J COLLEGE OF ENGINEERING

Sponsored by Mohamed Sathak Trust

(Approved by AICTE, New Delhi and Affiliated to Anna University, Chennai)

Siruseri IT Park, Egattur, Chennai 603 103

S.No	Name of the course that include experimental learning through Project Work/Internship/Mini Project 2016-2017
1	IC6003-Principles of Robotics
2	EE6005-Power Quality
3	IC6601-Advanced Control System
4	EE6008-Microcontroller Based System Design
5	EE6703-Special Electrical Machines
6	EE6009-Power Electronics for Renewable Energy Systems
7	EE6801-Electric Energy Generation,Utilization and Conservation
8	EE6007-Micro Electro Mechanical Systems
9	EE6003-Optimisation Techniques
10	ME6701-Power Plant Engineering
11	EE6602-Embedded Systems
12	GE6081-Fundamentals of Nanoscience
13	MA6468-Probability and Statistics

PRINCIPAL
MOHAMED SATHAK A.J.COLLEGE OF ENGINEERING
34, Rajiv Gandhi Road (OMR), Siruseri, IT Park
Chennai-603 103.

MOHAMED SATHAK A J COLLEGE OF ENGINEERING

(Approved by AICTE, New Delhi and affiliated to Anna University, Chennai)
Siruseri IT Park, Egattur, Chennai - 603 103

S.No.	Subject Code	Subject Name	Contents that included Experimental Learning through Project Work
1	IC6003	Principles of Robotics	Manipulator Control Problem - Linear control schemes - Force control of robotic manipulator.

PRINCIPAL
MOHAMED SATHAK A.J.COLLEGE OF ENGINEERING
34, Rajiv Gandhi Road (OMR), Siruseri, IT Park
Chennai-603 103.

IC6003

PRINCIPLES OF ROBOTICS

L T P C
3 0 0 3

OBJECTIVES:

- To introduce the functional elements of Robotics
- To impart knowledge on the direct and inverse kinematics
- To introduce the manipulator differential motion and control
- To educate on various path planning techniques
- To introduce the dynamics and control of manipulators

UNIT I BASIC CONCEPTS 9

Brief history-Types of Robot–Technology-Robot classifications and specifications-Design and control issues- Various manipulators – Sensors - work cell - Programming languages.

UNIT II DIRECT AND INVERSE KINEMATICS 9

Mathematical representation of Robots - Position and orientation - Homogeneous transformation- Various joints- Representation using the Denavit Hattenberg parameters -Degrees of freedom-Direct kinematics-Inverse kinematics-PUMA560 & SCARA robots- Solvability - Solution methods-Closed form solution.

UNIT III MANIPULATOR DIFFERENTIAL MOTION AND STATICS 9

Linear and angular velocities-Manipulator Jacobian-Prismatic and rotary joints–Inverse -Wrist and arm singularity - Static analysis - Force and moment Balance.

UNIT IV PATH PLANNING 9

Definition-Joint space technique-Use of p-degree polynomial-Cubic polynomial-Cartesian space technique - Parametric descriptions - Straight line and circular paths - Position and orientation planning.

UNIT V DYNAMICS AND CONTROL 9

Lagrangian mechanics-2DOF Manipulator-Lagrange Euler formulation-Dynamic model -Manipulator control problem-Linear control schemes-PID control scheme-Force control of robotic manipulator.

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to understand and analyze Instrumentation systems and their applications to various industries.

TEXT BOOKS:

1. R.K.Mittal and I.J.Nagrath, Robotics and Control,Tata McGraw Hill,New Delhi,4th Reprint, 2005.
2. JohnJ.Craig ,Introduction to Robotics Mechanics and Control, Third edition, Pearson Education, 2009.
3. M.P.Groover, M.Weiss,R.N. Nageland N. G.Odrej, Industrial Robotics, McGraw-Hill Singapore, 1996.

REFERENCES:

1. Ashitava Ghoshal, Robotics-Fundamental Concepts and Analysis', Oxford University Press, Sixth impression, 2010.
2. K. K.Appu Kuttan, Robotics, I K International, 2007.
3. Edwin Wise, Applied Robotics, Cengage Learning, 2003.
4. R.D.Klafter,T.A.Chimielewski and M.Negin, Robotic Engineering–An Integrated Approach, Prentice Hall of India, New Delhi, 1994.
5. B.K.Ghosh, Control in Robotics and Automation: Sensor Based Integration, Allied Publishers, Chennai, 1998.
6. S.Ghoshal, " Embedded Systems & Robotics" – Projects using the 8051 Microcontroller", Cengage Learning, 2009.

MOHAMED SATHAK A J COLLEGE OF ENGINEERING

(Approved by AICTE, New Delhi and affiliated to Anna University, Chennai)
Siruseri IT Park, Egattur, Chennai - 603 103

S.No.	Subject Code	Subject Name	Contents that include Experimental Learning through Project Work
2	EE6005	Power Quality	Flicker meters Applications of expert systems for power quality monitoring

PRINCIPAL
MOHAMED SATHAK A.J.COLLEGE OF ENGINEERING
34, Rajiv Gandhi Road (OMR), Siruseri, IT Park
Chennai-603 103.

EE6005 **POWER QUALITY** **L T P C**
3 0 0 3

OBJECTIVES:

- To introduce the power quality problem
- To educate on production of voltages sags, over voltages and harmonics and methods of control.
- To study overvoltage problems
- To study the sources and effect of harmonics in power system
- To impart knowledge on various methods of power quality monitoring.

UNIT I INTRODUCTION TO POWER QUALITY **9**

Terms and definitions: Overloading - under voltage - over voltage. Concepts of transients - short duration variations such as interruption - long duration variation such as sustained interruption. Sags and swells - voltage sag - voltage swell - voltage imbalance - voltage fluctuation - power frequency variations. International standards of power quality. Computer Business Equipment Manufacturers Associations (CBEMA) curve.

UNIT II VOLTAGE SAGS AND INTERRUPTIONS **9**

Sources of sags and interruptions - estimating voltage sag performance. Thevenin's equivalent source - analysis and calculation of various faulted condition. Voltage sag due to induction motor starting. Estimation of the sag severity - mitigation of voltage sags, active series compensators. Static transfer switches and fast transfer switches.

UNIT III OVERVOLTAGES **9**

Sources of over voltages - Capacitor switching – lightning - ferro resonance. Mitigation of voltage swells - surge arresters - low pass filters - power conditioners. Lightning protection – shielding – line arresters - protection of transformers and cables. An introduction to computer analysis tools for transients, PSCAD and EMTP.

UNIT IV HARMONICS **9**

Harmonic sources from commercial and industrial loads, locating harmonic sources.Power system response characteristics - Harmonics Vs transients. Effect of harmonics - harmonic distortion - voltage and current distortion - harmonic indices - inter harmonics – resonance. Harmonic distortion evaluation - devices for controlling harmonic distortion - passive and active filters. IEEE and IEC standards.

UNIT V POWER QUALITY MONITORING **9**

Monitoring considerations - monitoring and diagnostic techniques for various power quality problems - modeling of power quality (harmonics and voltage sag) problems by mathematical simulation tools - power line disturbance analyzer – quality measurement equipment - harmonic / spectrum analyzer - flicker meters - disturbance analyzer. Applications of expert systems for power quality monitoring.

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to understand and analyze power system operation, stability, control and protection.

TEXT BOOKS:

1. Roger. C. Dugan, Mark. F. McGranagham, Surya Santoso, H.Wayne Beaty, 'Electrical Power Systems Quality' McGraw Hill,2003.(For Chapters1,2,3, 4 and 5).
2. Eswald.F.Fudis and M.A.S.Masoum, "Power Quality in Power System and Electrical Machines," Elseviar Academic Press, 2013.
3. J. Arrillaga, N.R. Watson, S. Chen, 'Power System Quality Assessment', Wiley, 2011.

REFERENCES:

1. G.T. Heydt, 'Electric Power Quality', 2nd Edition. (West Lafayette, IN, Stars in a Circle Publications, 1994). (For Chapter 1, 2, 3 and 5)
2. M.H.J Bollen, 'Understanding Power Quality Problems: Voltage Sags and Interruptions', (New York: IEEE Press, 1999). (For Chapters 1, 2, 3 and 5)
3. G.J.Wakileh, "Power Systems Harmonics – Fundamentals, Analysis and Filter Design," Springer 2007.
4. E.Aeha and M.Madrigal, "Power System Harmonics, Computer Modeling and Analysis," Wiley India, 2012.
5. R.S.Vedam, M.S.Sarma, "Power Quality – VAR Compensation in Power Systems," CRC Press 2013.
6. C. Sankaran, 'Power Quality', CRC press, Taylor & Francis group, 2002.

MOHAMED SATHAK A J COLLEGE OF ENGINEERING

(Approved by AICTE, New Delhi and affiliated to Anna University, Chennai)
Siruseri IT Park, Egattur, Chennai - 603 103

S.No.	Subject Code	Subject Name	Contents that included Experimental Learning through Project Work
3	IC6601	Advanced Control System	Common physical Non - Linearities Describingfunction analysis of non-linear systems

PRINCIPAL
MOHAMED SATHAK A.J.COLLEGE OF ENGINEERING
34, Rajiv Gandhi Road (OMR), Siruseri, IT Park
Chennai-603 103.

IC6601

ADVANCED CONTROL SYSTEM

L	T	P	C
3	0	0	3

OBJECTIVES :

- To provide knowledge on design in state variable form
- To provide knowledge in phase plane analysis.
- To give basic knowledge in describing function analysis.
- To study the design of optimal controller.
- To study the design of optimal estimator including Kalman Filter

UNIT I STATE VARIABLE DESIGN 9

Introduction to state Model- effect of state Feedback- Necessary and Sufficient Condition for Arbitrary Pole-placement- pole placement Design- design of state Observers- separation principle- servo design: -State Feedback with integral control.

UNIT II PHASE PLANE ANALYSIS 9

Features of linear and non-linear systems - Common physical non-linearities – Methods of linearization Concept of phase portraits – Singular points – Limit cycles – Construction of phase portraits – Phase plane analysis of linear and non-linear systems – Isocline method.

UNIT III DESCRIBING FUNCTION ANALYSIS 9

Basic concepts, derivation of describing functions for common non-linearities – Describing function analysis of non-linear systems – limit cycles – Stability of oscillations.

UNIT IV OPTIMAL CONTROL 9

Introduction - Time varying optimal control – LQR steady state optimal control – Solution of Ricatti's equation – Application examples.

UNIT V OPTIMAL ESTIMATION 9

Optimal estimation – Kalman Bucy Filter-Solution by duality principle-Discrete systems- Kalman Filter- Application examples.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to apply advanced control theory to practical engineering problems.

TEXT BOOKS :

1. K. P. Mohandas, "Modern Control Engineering", Sanguine Technical Publishers, 2006.
2. G. J. Thaler, "Automatic Control Systems", Jaico Publishing House, 1993.
3. M.Gopal, Modern Control System Theory, New Age International Publishers, 2002.

REFERENCES:

1. William S Levine, "Control System Fundamentals," The Control Handbook, CRC Press, Tayler and Francies Group, 2011.
2. Ashish Tewari, 'Modern Control Design with Matlab and Simulink', John Wiley, New Delhi, 2002.
3. K. Ogata, 'Modern Control Engineering', 4th edition, PHI, New Delhi, 2002.
4. T. Glad and L. Ljung, "Control Theory –Multivariable and Non-Linear Methods", Taylor & Francis, 2002.
5. D.S.Naidu, "Optimal Control Systems" First Indian Reprint, CRC Press, 2009.

MOHAMED SATHAK A J COLLEGE OF ENGINEERING

(Approved by AICTE, New Delhi and affiliated to Anna University, Chennai)
Siruseri IT Park, Egattur, Chennai - 603 103

S.No.	Subject Code	Subject Name	Contents that included Experimental Learning through Project Work
4	EE6008	Microcontroller Based System Design	State machines and Key Switches Embedded ARM Applications

PRINCIPAL
MOHAMED SATHAK A.J.COLLEGE OF ENGINEERING
34, Rajiv Gandhi Road (OMR), Siruseri, IT Park
Chennai-603 103.

EE6008 **MICROCONTROLLER BASED SYSTEM DESIGN** **L T P C**
3 0 0 3

OBJECTIVES:

- To introduce the architecture of PIC microcontroller
- To educate on use of interrupts and timers
- To educate on the peripheral devices for data communication and transfer
- To introduce the functional blocks of ARM processor
- To educate on the architecture of ARM processors

UNIT I INTRODUCTION TO PIC MICROCONTROLLER **9**

Introduction to PIC Microcontroller–PIC 16C6x and PIC16C7x Architecture–PIC16cxx— Pipelining - Program Memory considerations – Register File Structure - Instruction Set - Addressing modes – Simple Operations.

UNIT II INTERRUPTS AND TIMER **9**

PIC micro controller Interrupts- External Interrupts-Interrupt Programming–Loop time subroutine - Timers-Timer Programming– Front panel I/O-Soft Keys– State machines and key switches– Display of Constant and Variable strings.

UNIT III PERIPHERALS AND INTERFACING **9**

I^2C Bus for Peripherals Chip Access– Bus operation-Bus subroutines– Serial EEPROM—Analog to Digital Converter–UART-Baud rate selection–Data handling circuit–Initialization - LCD and keyboard Interfacing -ADC, DAC, and Sensor Interfacing.

UNIT IV INTRODUCTION TO ARM PROCESSOR **9**

ARM Architecture –ARM programmer's model –ARM Development tools- Memory Hierarchy –ARM Assembly Language Programming–Simple Examples–Architectural Support for Operating systems.

UNIT V ARM ORGANIZATION **9**

2-Stage Pipeline ARM Organization– 5-Stage Pipeline ARM Organization–ARM Instruction Execution-ARM Implementation– ARM Instruction Set– ARM coprocessor interface– Architectural support for High Level Languages – Embedded ARM Applications.

TOTAL: 45 PERIODS

OUTCOMES:

- To understand and apply computing platform and software for engineering problems.
- To understand ethical issues, environmental impact and acquire management skills.

TEXT BOOKS:

1. Peatman,J.B., "Design with PIC Micro Controllers"PearsonEducation,3rdEdition, 2004.
2. Furber,S., "ARM System on Chip Architecture" AddisonWesley trade Computer Publication, 2000.

REFERENCE:

1. Mazidi, M.A.,"PIC Microcontroller" Rollin Mckinlay, Danny causey Printice Hall of India, 2007.

PRINCIPAL
MOHAMED SATHAK A.J.COLLEGE OF ENGINEERING
34, Rajiv Gandhi Road (OMR), Siruseri, IT Park
Chennai-603 103.

MOHAMED SATHAK A J COLLEGE OF ENGINEERING

(Approved by AICTE, New Delhi and affiliated to Anna University, Chennai)
Siruseri IT Park, Egattur, Chennai - 603 103

S.No.	Subject Code	Subject Name	Contents that included Experimental Learning through Project Work
5	EE6703	Special Electrical Machines	Magnetic circuit analysis Power Converter Circuits and their controllers

PRINCIPAL
MOHAMED SATHAK A.J.COLLEGE OF ENGINEERING
34, Rajiv Gandhi Road (OMR), Siruseri, IT Park
Chennai-603 103.

EE6703 **SPECIAL ELECTRICAL MACHINES** **LT P C 3 0 0 3**

OBJECTIVES:

- To impart knowledge on Construction, principle of operation and performance of synchronous reluctance motors.
- To impart knowledge on the Construction, principle of operation, control and performance of stepping motors.
- To impart knowledge on the Construction, principle of operation, control and performance of switched reluctance motors.
- To impart knowledge on the Construction, principle of operation, control and performance of permanent magnet brushless D.C. motors.
- To impart knowledge on the Construction, principle of operation and performance of permanent magnet synchronous motors.

UNIT I SYNCHRONOUS RELUCTANCE MOTORS **9**

Constructional features – Types – Axial and Radial flux motors – Operating principles – Variable Reluctance Motors – Voltage and Torque Equations - Phasor diagram - performance characteristics – Applications.

UNIT II STEPPER MOTORS **9**

Constructional features – Principle of operation – Variable reluctance motor – Hybrid motor – Single and multi stack configurations – Torque equations – Modes of excitation – Characteristics – Drive circuits – Microprocessor control of stepper motors – Closed loop control-Concept of lead angle– Applications.

UNIT III SWITCHED RELUCTANCE MOTORS (SRM) **9**

Constructional features – Rotary and Linear SRM - Principle of operation – Torque production – Steady state performance prediction- Analytical method -Power Converters and their controllers –Methods of Rotor position sensing – Sensor less operation – Characteristics and Closed loop control – Applications.

UNIT IV PERMANENT MAGNET BRUSHLESS D.C. MOTORS **9**

Permanent Magnet materials – Minor hysteresis loop and recoil line-Magnetic Characteristics – Permeance coefficient -Principle of operation – Types – Magnetic circuit analysis – EMF and torque equations –Commutation - Power Converter Circuits and their controllers – Motor characteristics and control– Applications.

UNIT V PERMANENT MAGNET SYNCHRONOUS MOTORS (PMSM) **9**

Principle of operation – Ideal PMSM – EMF and Torque equations – Armature MMF – Synchronous Reactance – Sine wave motor with practical windings - Phasor diagram – Torque/speed characteristics - Power controllers - Converter Volt-ampere requirements– Applications.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to model and analyze electrical apparatus and their application to power system

TEXT BOOKS:

1. K.Venkataratnam, 'Special Electrical Machines', Universities Press (India) Private Limited, 2008.
2. T.J.E. Miller, 'Brushless Permanent Magnet and Reluctance Motor Drives', Clarendon Press, Oxford, 1989.
3. T. Kenjo, 'Stepping Motors and Their Microprocessor Controls', Clarendon Press London, 1984.

REFERENCES:

1. R.Krishnan, 'Switched Reluctance Motor Drives – Modeling, Simulation, Analysis, Design and Application', CRC Press, New York, 2001.
2. P.P. Aearnley, 'Stepping Motors – A Guide to Motor Theory and Practice', Peter Perengrinus London, 1982.
3. T. Kenjo and S. Nagamori, 'Permanent Magnet and Brushless DC Motors', Clarendon Press, London, 1988.
4. E.G. Janardanan, 'Special electrical machines', PHI learning Private Limited, Delhi, 2014.

MOHAMED SATHAK A J COLLEGE OF ENGINEERING

(Approved by AICTE, New Delhi and affiliated to Anna University, Chennai)
Siruseri IT Park, Egattur, Chennai - 603 103

S.No.	Subject Code	Subject Name	Contents that included Experimental Learning through Project Work
6	EE6009	Power Electronics for Renewable Energy Systems	Hybrid Renewable Energy Systems – PWM Inverters

PRINCIPAL
MOHAMED SATHAK A.J.COLLEGE OF ENGINEERING
34, Rajiv Gandhi Road (OMR), Siruseri, IT Park
Chennai-603 103

EE6009 **POWER ELECTRONICS FOR RENEWABLE ENERGY SYSTEMS** **LT P C 3 0 0 3**

OBJECTIVES:

- To Provide knowledge about the stand alone and grid connected renewable energy systems.
- To equip with required skills to derive the criteria for the design of power converters for renewable energy applications.
- To analyse and comprehend the various operating modes of wind electrical generators and solar energy systems.
- To design different power converters namely AC to DC, DC to DC and AC to AC converters for renewable energy systems.
- To develop maximum power point tracking algorithms.

UNIT I INTRODUCTION **9**

Environmental aspects of electric energy conversion: impacts of renewable energy generation on environment (cost-GHG Emission) - Qualitative study of different renewable energy resources: Solar, wind, ocean, Biomass, Fuel cell, Hydrogen energy systems and hybrid renewable energy systems.

UNIT II ELECTRICAL MACHINES FOR RENEWABLE ENERGY CONVERSION **9**

Reference theory fundamentals-principle of operation and analysis: IG, PMSG, SCIG and DFIG.

UNIT III POWER CONVERTERS **9**

Solar: Block diagram of solar photo voltaic system -Principle of operation: line commutated converters (inversion-mode) - Boost and buck-boost converters- selection of inverter, battery sizing, array sizing Wind: Three phase AC voltage controllers- AC-DC-AC converters: uncontrolled rectifiers, PWM Inverters, Grid Interactive Inverters-matrix converters.

UNIT IV ANALYSIS OF WIND AND PV SYSTEMS **9**

Stand alone operation of fixed and variable speed wind energy conversion systems and solar system-Grid connection Issues -Grid integrated PMSG, SCIG Based WECS, grid Integrated solar system

UNIT V HYBRID RENEWABLE ENERGY SYSTEMS **9**

Need for Hybrid Systems- Range and type of Hybrid systems- Case studies of Wind-PV Maximum Power Point Tracking (MPPT).

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand and analyze power system operation, stability, control and protection.
- Ability to handle the engineering aspects of electrical energy generation and utilization.

TEXT BOOK:

1. S. N. Bhadra, D.Kastha, S.Banerjee, "Wind Electrical Systems", Oxford University Press, 2005.
2. B.H.Khan Non-conventional Energy sources Tata McGraw-hill Publishing Company, New Delhi,2009.

REFERENCES:

1. Rashid .M. H "power electronics Hand book", Academic press, 2001.
2. Ion Boldea, "Variable speed generators", Taylor & Francis group, 2006.
3. Rai. G.D, "Non conventional energy sources", Khanna publishes, 1993.
4. Gray, L. Johnson, "Wind energy system", prentice hall linc, 1995.
5. Andrzej M. Trzynnadlowski, 'Introduction to Modern Power Electronics', Second edition, wiley India Pvt. Ltd, 2012.

PRINCIPAL
MOHAMED SATHAK A.J.COLLEGE OF ENGINEERING
34, Rajiv Gandhi Road (OMR), Siruseri, IT Park
Chennai-603 103.

MOHAMED SATHAK A J COLLEGE OF ENGINEERING

(Approved by AICTE, New Delhi and affiliated to Anna University, Chennai)
Siruseri IT Park, Egattur, Chennai - 603 103

S.No.	Subject Code	Subject Name	Contents that included Experimental Learning through Project Work
7	EE6801	Electric Energy Generation, Utilization and Conservation	Train Movement and energy consumption flood lighting

PRINCIPAL
MOHAMED SATHAK A.J.COLLEGE OF ENGINEERING
34 Rajiv Gandhi Road (OMR), Siruseri, IT Park
Chennai-603 103

EE6801 ELECTRIC ENERGY GENERATION, UTILIZATION AND CONSERVATION **LT P C 3 0 0 3**

OBJECTIVES:

- To analyze the various concepts behind renewable energy resources.
- To introduce the energy saving concept by different ways of illumination.
- To understand the different methods of electric heating and electric welding.
- To introduce knowledge on Solar Radiation and Solar Energy Collectors
- To introduce concepts of Wind Energy and its utilization

UNIT I ELECTRIC DRIVES AND TRACTION **9**

Fundamentals of electric drive - choice of an electric motor - application of motors for particular services - traction motors - characteristic features of traction motor - systems of railway electrification - electric braking - train movement and energy consumption - traction motor control - track equipment and collection gear.

UNIT II ILLUMINATION **9**

Introduction - definition and meaning of terms used in illumination engineering - classification of light sources - incandescent lamps, sodium vapour lamps, mercury vapour lamps, fluorescent lamps – design of illumination systems - indoor lighting schemes - factory lighting halls - outdoor lighting schemes - flood lighting - street lighting - energy saving lamps, LED.

UNIT III HEATING AND WELDING **9**

Introduction - advantages of electric heating – modes of heat transfer - methods of electric heating - resistance heating - arc furnaces - induction heating - dielectric heating - electric welding – types - resistance welding - arc welding - power supply for arc welding - radiation welding.

UNIT IV SOLAR RADIATION AND SOLAR ENERGY COLLECTORS **9**

Introduction - solar constant - solar radiation at the Earth's surface - solar radiation geometry – estimation of average solar radiation - physical principles of the conversion of solar radiation into heat flat-plate collectors - transmissivity of cover system - energy balance equation and collector efficiency - concentrating collector - advantages and disadvantages of concentrating collectors - performance analysis of a cylindrical - parabolic concentrating collector – Feedin Invertors.

UNIT V WIND ENERGY **9**

Introduction - basic principles of wind energy conversion - site selection considerations - basic components of a WECS (Wind Energy Conversion System) - Classification of WECS - types of wind Turbines - analysis of aerodynamic forces acting on the blade - performances of wind.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand and analyze power system operation, stability, control and protection.
- Ability to handle the engineering aspects of electrical energy generation and utilization.

TEXT BOOKS:

1. N.V. Suryanarayana, "Utilisation of Electric Power", Wiley Eastern Limited, New Age International Limited, 1993.
2. J.B.Gupta, "Utilisation Electric power and Electric Traction", S.K.Kataria and Sons, 2000.
3. G.D.Rai, "Non-Conventional Energy Sources", Khanna Publications Ltd., New Delhi, 1997.

REFERENCES:

1. R.K.Rajput, Utilisation of Electric Power, Laxmi publications Private Limited.,2007.
2. H.Partab, Art and Science of Utilisation of Electrical Energy", Dhanpat Rai and Co., New Delhi, 2004.
1. C.L.Wadhwa, "Generation, Distribution and Utilisation of Electrical Energy", New Age International Pvt.Ltd., 2003.
2. S. Sivanagaraju, M. Balasubba Reddy, D. Srilatha,' Generation and Utilization of Electrical Energy', Pearson Education, 2010.
3. Donals L. Steeby,' Alternative Energy Sources and Systems', Cengage Learning, 2012

MOHAMED SATHAK A J COLLEGE OF ENGINEERING

(Approved by AICTE, New Delhi and affiliated to Anna University, Chennai)
Siruseri IT Park, Egattur, Chennai - 603 103

S.No.	Subject Code	Subject Name	Contents that included Experimental Learning through Project Work
8	EE6007	Micro Electro Mechanical Systems	Case studies of MEMS in magnetic actuators, piezoelectric materials

PRINCIPAL
MOHAMED SATHAK A.J.COLLEGE OF ENGINEERING
34, Rajiv Gandhi Road (OMR), Siruseri, IT Park

EE6007 **MICRO ELECTRO MECHANICAL SYSTEMS** LT P C 3 0 0 3

OBJECTIVES:

- To provide knowledge of semiconductors and solid mechanics to fabricate MEMS devices.
- To educate on the rudiments of Micro fabrication techniques.
- To introduce various sensors and actuators
- To introduce different materials used for MEMS
- To educate on the applications of MEMS to disciplines beyond Electrical and Mechanical engineering.

UNIT I INTRODUCTION 9

Intrinsic Characteristics of MEMS – Energy Domains and Transducers- Sensors and Actuators – Introduction to Micro fabrication - Silicon based MEMS processes – New Materials – Review of Electrical and Mechanical concepts in MEMS – Semiconductor devices – Stress and strain analysis – Flexural beam bending- Torsional deflection.

UNIT II SENSORS AND ACTUATORS-I 9

Electrostatic sensors – Parallel plate capacitors – Applications – Interdigitated Finger capacitor – Comb drive devices – Micro Grippers – Micro Motors - Thermal Sensing and Actuation – Thermal expansion – Thermal couples – Thermal resistors – Thermal Bimorph - Applications – Magnetic Actuators – Micromagnetic components – Case studies of MEMS in magnetic actuators- Actuation using Shape Memory Alloys.

UNIT III SENSORS AND ACTUATORS-II 9

Piezoresistive sensors – Piezoresistive sensor materials - Stress analysis of mechanical elements – Applications to Inertia, Pressure, Tactile and Flow sensors – Piezoelectric sensors and actuators – piezoelectric effects – piezoelectric materials – Applications to Inertia , Acoustic, Tactile and Flow sensors.

UNIT IV MICROMACHINING 9

Silicon Anisotropic Etching – Anisotrophic Wet Etching – Dry Etching of Silicon – Plasma Etching – Deep Reaction Ion Etching (DRIE) – Isotropic Wet Etching – Gas Phase Etchants – Case studies - Basic surface micro machining processes – Structural and Sacrificial Materials – Acceleration of sacrificial Etch – Striction and Antistriction methods – LIGA Process - Assembly of 3D MEMS – Foundry process.

UNIT V POLYMER AND OPTICAL MEMS 9

Polymers in MEMS– Polimide - SU-8 - Liquid Crystal Polymer (LCP) – PDMS – PMMA – Parylene – Fluorocarbon - Application to Acceleration, Pressure, Flow and Tactile sensors- Optical MEMS – Lenses and Mirrors – Actuators for Active Optical MEMS.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand the operation of micro devices, micro systems and their applications.
- Ability to design the micro devices, micro systems using the MEMS fabrication process.

TEXT BOOKS:

1. Chang Liu, 'Foundations of MEMS', Pearson Education Inc., 2012.
2. Stephen D Senturia, 'Microsystem Design', Springer Publication, 2000.
3. Tai Ran Hsu, "MEMS & Micro systems Design and Manufacture" Tata McGraw Hill, New Delhi, 2002.

REFERENCES:

1. Nadim Maluf," An Introduction to Micro Electro Mechanical System Design", Artech House, 2000.
2. Mohamed Gad-el-Hak, editor, " The MEMS Handbook", CRC press Baco Raton, 2001.
3. Julian w. Gardner, Vijay K. Varadan, Osama O.Awadelkarim, Micro Sensors MEMS and Smart Devices, John Wiley & Son LTD, 2002.
4. James J.Allen, Micro Electro Mechanical System Design, CRC Press Publisher, 2005.
5. Thomas M.Adams and Richard A.Layton, "Introduction MEMS, Fabrication and Application," Springer, 2010.

MOHAMED SATHAK A J COLLEGE OF ENGINEERING

(Approved by AICTE, New Delhi and affiliated to Anna University, Chennai)
Siruseri IT Park, Egattur, Chennai - 603 103

S.No.	Subject Code	Subject Name	Contents that included Experimental Learning through Project Work
9	EE6003	Optimization Techniques	Duality theory Traveling sales man problem

PRINCIPAL
MOHAMED SATHAK A.J.COLLEGE OF ENGINEERING
34, Rajiv Gandhi Road (OMR), Siruseri, IT Park
Chennai-603 103

EE6003 **OPTIMISATION TECHNIQUES** L T P C
3 0 0 3

OBJECTIVES:

- To introduce the basic concepts of linear programming
- To educate on the advancements in Linear programming techniques
- To introduce non-linear programming techniques
- To introduce the interior point methods of solving problems
- To introduce the dynamic programming method

UNIT I LINEAR PROGRAMMING 9

Introduction - formulation of linear programming model-Graphical solution–solving LPP using simplex algorithm – Revised Simplex Method.

UNIT II ADVANCES IN LPP 9

Dualit theory- Dual simplex method - Sensitivity analysis—Transportation problems–Assignment problems-Traveling sales man problem -Data Envelopment Analysis.

UNIT III NON LINEAR PROGRAMMING 9

Classification of Non Linear programming – Lagrange multiplier method – Karush – Kuhn Tucker conditions–Reduced gradient algorithms–Quadratic programming method – Penalty and Barrier method.

UNIT IV INTERIOR POINT METHODS 9

Karmarkar's algorithm–Projection Scaling method–Dual affine algorithm–Primal affine algorithm Barrier algorithm.

UNIT V DYNAMIC PROGRAMMING 9

Formulation of Multi stage decision problem–Characteristics–Concept of sub-optimization and the principle of optimality–Formulation of Dynamic programming–Backward and Forward recursion– Computational procedure–Conversion offinal value problem in to Initial value problem.

TOTAL: 45 PERIODS

OUTCOMES:

- To understand ethical issues, environmental impact and acquire management skills.

TEXT BOOKS:

1. Hillier and Lieberman "Introduction to Operations Research", TMH, 2000.
2. R.Panneerselvam, "Operations Research", PHI, 2006
3. Hamdy ATaha, "Operations Research –An Introduction", Prentice Hall India, 2003.

REFERENCES:

1. Philips, Ravindran and Solberg, "Operations Research", John Wiley, 2002.
2. Ronald L.Rardin, "Optimization in Operation Research" Pearson Education Pvt. Ltd. New Delhi, 2005.

MOHAMED SATHAK A J COLLEGE OF ENGINEERING

(Approved by AICTE, New Delhi and affiliated to Anna University, Chennai)
Siruseri IT Park, Egattur, Chennai - 603 103

S.No.	Subject Code	Subject Name	Contents that included Experimental Learning through Project Work
10	ME6701	Power Plant Engineering	Combined Cycle Power Plants Hydro Electric Power Plants

PRINCIPAL
MOHAMED SATHAK A.J.COLLEGE OF ENGINEERING
34, Rajiv Gandhi Road (OMR), Siruseri, IT Park
Chennai-603 103.

ME6701 **POWER PLANT ENGINEERING** **L T P C**
3 0 0 3

OBJECTIVES:

- Providing an overview of Power Plants and detailing the role of Mechanical Engineers in their operation and maintenance.

UNIT I COAL BASED THERMAL POWER PLANTS **10**

Rankine cycle - improvisations, Layout of modern coal power plant, Super Critical Boilers, FBC Boilers, Turbines, Condensers, Steam & Heat rate, Subsystems of thermal power plants – Fuel and ash handling, Draught system, Feed water treatment. Binary Cycles and Cogeneration systems.

UNIT II DIESEL, GAS TURBINE AND COMBINED CYCLE POWER PLANTS **10**

Otto, Diesel, Dual & Brayton Cycle - Analysis & Optimisation. Components of Diesel and Gas Turbine power plants. Combined Cycle Power Plants. Integrated Gasifier based Combined Cycle systems.

UNIT III NUCLEAR POWER PLANTS **7**

Basics of Nuclear Engineering, Layout and subsystems of Nuclear Power Plants, Working of Nuclear Reactors : B*oiling Water Reactor* (BWR), P*ressurized Water Reactor* (PWR), CANada Deuterium- Uranium reactor (CANDU), Breeder, Gas Cooled and Liquid Metal Cooled Reactors. Safety measures for Nuclear Power plants.

UNIT IV POWER FROM RENEWABLE ENERGY **10**

Hydro Electric Power Plants – Classification, Typical Layout and associated components including Turbines. Principle, Construction and working of Wind, Tidal, *Solar* Photo Voltaic (SPV), Solar Thermal, Geo Thermal, Biogas and Fuel Cell power systems.

UNIT V ENERGY, ECONOMIC AND ENVIRONMENTAL ISSUES OF POWER PLANTS **8**

Power tariff types, Load distribution parameters, load curve, Comparison of site selection criteria, relative merits & demerits, Capital & Operating Cost of different power plants. Pollution control technologies including Waste Disposal Options for Coal and Nuclear Power Plants.

TOTAL : 45 PERIODS

OUTCOMES:

- Upon completion of this course, the Students can able to understand different types of power plant, and its functions and their flow lines and issues related to them.
- Analyse and solve energy and economic related issues in power sectors.

TEXT BOOK:

1. P.K. Nag, Power Plant Engineering, Tata McGraw – Hill Publishing Company Ltd., Third Edition, 2008.

REFERENCES:

1. M.M. El-Wakil, Power Plant Technology, Tata McGraw – Hill Publishing Company Ltd., 2010.
2. Black & Veatch, Springer, Power Plant Engineering, 1996.
3. Thomas C. Elliott, Kao Chen and Robert C. Swanekamp, Standard Handbook of Power Plant Engineering, Second Edition, McGraw – Hill, 1998.
4. Godfrey Boyle, Renewable energy, Open University, Oxford University Press in association with the Open University, 2004.

PRINCIPAL
MOHAMED SATHAK A.J.COLLEGE OF ENGINEERING
Road (OMR), Siruseri, IT Park
103.

MOHAMED SATHAK A J COLLEGE OF ENGINEERING

(Approved by AICTE, New Delhi and affiliated to Anna University, Chennai)
Siruseri IT Park, Egattur, Chennai - 603 103

S.No.	Subject Code	Subject Name	Contents that included Experimental Learning through Project Work
11	EE6602	Embedded Systems	Watchdog Timer Automotive Application

PRINCIPAL
MOHAMED SATHAK A.J.COLLEGE OF ENGINEERING
34 Rajiv Gandhi Road (OMR), Siruseri, IT Park
Chennai-603 103.

EE6602 **EMBEDDED SYSTEMS** **LT P C**
3 0 0 3

OBJECTIVES:

- To introduce the Building Blocks of Embedded System
- To Educate in Various Embedded Development Strategies
- To Introduce Bus Communication in processors, Input/output interfacing.
- To impart knowledge in Various processor scheduling algorithms.
- To introduce Basics of Real time operating system and example tutorials to discuss on one real- time operating system tool

UNIT I INTRODUCTION TO EMBEDDED SYSTEMS **9**

Introduction to Embedded Systems – The build process for embedded systems- Structural units in Embedded processor , selection of processor & memory devices- DMA – Memory managementmethods- Timer and Counting devices, Watchdog Timer, Real Time Clock, In circuit emulator, Target Hardware Debugging.

UNIT II EMBEDDED NETWORKING **9**

Embedded Networking: Introduction, I/O Device Ports & Buses– Serial Bus communication protocols - RS232 standard – RS422 – RS485 - CAN Bus -Serial Peripheral Interface (SPI) – Inter Integrated Circuits (I^2C) –need for device drivers.

UNIT III EMBEDDED FIRMWARE DEVELOPMENT ENVIRONMENT **9**

Embedded Product Development Life Cycle- objectives, different phases of EDLC, Modelling of EDLC; issues in Hardware-software Co-design, Data Flow Graph, state machine model, Sequential Program Model, concurrent Model, object oriented Model.

UNIT IV RTOS BASED EMBEDDED SYSTEM DESIGN **9**

Introduction to basic concepts of RTOS- Task, process & threads, interrupt routines in RTOS, Multiprocessing and Multitasking, Preemptive and non-preemptive scheduling, Task communication-shared memory, message passing-, Inter process Communication – synchronization between processes-semaphores, Mailbox, pipes, priority inversion, priority inheritance, comparison of Real time Operating systems: Vx Works, µC/OS-II, RT Linux.

UNIT V EMBEDDED SYSTEM APPLICATION DEVELOPMENT **9**

Case Study of Washing Machine- Automotive Application- Smart card System Application,.

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to understand and analyse, linear and digital electronic circuits.

TEXT BOOKS:

1. Rajkamal, 'Embedded System-Architecture, Programming, Design', Mc Graw Hill, 2013.
2. Peckol, "Embedded system Design", John Wiley & Sons,2010
3. Lyla B Das," Embedded Systems-An Integrated Approach", Pearson, 2013

REFERENCES:

1. Shibu. K.V, "Introduction to Embedded Systems", Tata Mcgraw Hill,2009.
2. Elicia White," Making Embedded Systems", O' Reilly Series,SPD,2011.
3. Tammy Noergaard, "Embedded Systems Architecture", Elsevier, 2006.
4. Han-Way Huang, "Embedded system Design Using C8051", Cengage Learning,2009.
5. Rajib Mall "Real-Time systems Theory and Practice" Pearson Education, 2007.

MOHAMED SATHAK A J COLLEGE OF ENGINEERING

(Approved by AICTE, New Delhi and affiliated to Anna University, Chennai)
Siruseri IT Park, Egattur, Chennai - 603 103

S.No.	Subject Code	Subject Name	Contents that included Experimental Learning through Project Work
12	GE6081	Fundamentals of Nanoscience	Bottom - up Synthesis – Top - down Approach: Co-Precipitation, Ultrasonication, Mechanical Milling Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE.

PRINCIPAL
MOHAMED SATHAK A.J.COLLEGE OF ENGINEERING
34, Rajiv Gandhi Road (OMR), Siruseri, IT Park
Chennai-603 103.

GE6081 **FUNDAMENTALS OF NANOSCIENCE** L T P C
3 0 0 3

OBJECTIVES:
To learn about basis of nanomaterial science, preparation method, types and application

UNIT I INTRODUCTION 8
Nanoscale Science and Technology- Implications for Physics, Chemistry, Biology and Engineering-Classifications of nanostructured materials- nano particles- quantum dots, nanowires-ultra-thinfilms-multilayered materials. Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties. Introduction to properties and motivation for study (qualitative only).

UNIT II GENERAL METHODS OF PREPARATION 9
Bottom-up Synthesis-Top-down Approach: Co-Precipitation, Ultrasonication, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE.

UNIT III NANOMATERIALS 12
Nanoforms of Carbon - Buckminster fullerene- graphene and carbon nanotube, Single wall carbon Nanotubes (SWCNT) and Multi wall carbon nanotubes (MWCNT)- methods of synthesis(arc-growth, laser ablation, CVD routes, Plasma CVD), structure-property Relationships applications- Nanometal oxides-ZnO, TiO2,MgO, ZrO2, NiO, nanoalumina, CaO, AgTiO2, Ferrites, Nanoclays-functionalization and applications-Quantum wires, Quantum dots-preparation, properties and applications.

UNIT IV CHARACTERIZATION TECHNIQUES 9
X-ray diffraction technique, Scanning Electron Microscopy - environmental techniques, Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques- AFM, SPM, STM, SNOM, ESCA, SIMS-Nanoindentation.

UNIT V APPLICATIONS 7
NanoInfoTech: Information storage- nanocomputer, molecular switch, super chip, nanocrystal, Nanobiotechlogy: nanoprobes in medical diagnostics and biotechnology, Nano medicines, Targetted drug delivery, Bioimaging - Micro Electro Mechanical Systems (MEMS), Nano Electro Mechanical Systems (NEMS)- Nanosensors, nano crystalline silver for bacterial inhibition, Nanoparticles for sunbarrier products - In Photostat, printing, solar cell, battery.

TOTAL : 45 PERIODS

OUTCOMES:
- Will familiarize about the science of nanomaterials
- Will demonstrate the preparation of nanomaterials
- Will develop knowledge in characteristic nanomaterial

TEXT BOOKS :

1. A.S. Edelstein and R.C. Cammearata, eds., "Nanomaterials: Synthesis, Properties and Applications", Institute of Physics Publishing, Bristol and Philadelphia, 1996.
2. N John Dinardo, "Nanoscale Charecterisation of surfaces & Interfaces", 2nd edition, Weinheim Cambridge, Wiley-VCH, 2000.

REFERENCES:

1. G Timp, "Nanotechnology", AIP press/Springer, 1999.
2. Akhlesh Lakhtakia,"The Hand Book of Nano Technology, Nanometer Structure, Theory, Modeling and Simulations". Prentice-Hall of India (P) Ltd, New Delhi, 2007.

MOHAMED SATHAK A J COLLEGE OF ENGINEERING

(Approved by AICTE, New Delhi and affiliated to Anna University, Chennai)
Siruseri IT Park, Egattur, Chennai - 603 103

S.No.	Subject Code	Subject Name	Contents that included Experimental Learning through Project Work
13	MA6468	Probability and Statistics	Tests based on T, Chi-square and F distributions for mean, variance and proportion One way and Two way classifications - Completely randomized design

PRINCIPAL
MOHAMED SATHAK A.J.COLLEGE OF ENGINEERING
34, Rajiv Gandhi Road (OMR), Siruseri, IT Park
Chennai-603 103.

MA6468 **PROBABILITY AND STATISTICS** **L T P C**
3 1 0 4

OBJECTIVES

- This course aims at providing the required skill to apply the statistical tools in engineering problems.

UNIT I RANDOM VARIABLES **9 + 3**

Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions.

UNIT II TWO - DIMENSIONAL RANDOM VARIABLES **9 + 3**

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and Linear regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).

UNIT III TESTING OF HYPOTHESIS **9 + 3**

Sampling distributions - Estimation of parameters - Statistical hypothesis - Large sample test based on Normal distribution for single mean and difference of means -Tests based on t, Chi-square and F distributions for mean, variance and proportion - Contingency table (test for independent) - Goodness of fit.

UNIT IV DESIGN OF EXPERIMENTS **9 + 3**

One way and Two way classifications - Completely randomized design – Randomized block design – Latin square design - 2^2 factorial design.

UNIT V STATISTICAL QUALITY CONTROL **9 + 3**

Control charts for measurements (X and R charts) – Control charts for attributes (p, c and np charts) – Tolerance limits - Acceptance sampling.

TOTAL (L:45+T:15): 60 PERIODS

OUTCOMES:

- The students will have a fundamental knowledge of the concepts of probability. Have knowledge of standard distributions which can describe real life phenomenon. Have the notion of sampling distributions and statistical techniques used in engineering and management problems.

TEXT BOOKS:

1. Milton. J. S. and Arnold. J.C., "Introduction to Probability and Statistics", 4th Edition, Tata McGraw Hill, 2007.
2. Johnson. R.A. and Gupta. C.B., "Miller and Freund's Probability and Statistics for Engineers", 7th Edition, Pearson Education, Asia, 2007.
3. Papoulis. A and Unnikrishnapillai. S., "Probability, Random Variables and Stochastic Processes " 4th Edition, Mc Graw Hill Education India , New Delhi , 2010.

REFERENCES:

1. Devore. J.L., "Probability and Statistics for Engineering and the Sciences", 8th Edition, Cengage Learning, New Delhi, 2012.
2. Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., "Probability and Statistics for Engineers and Scientists", 8th Edition, Pearson Education, Asia , 2007.
3. Ross, S.M., "Introduction to Probability and Statistics for Engineers and Scientists", 3rd Edition, Elsevier, 2004.

PRINCIPAL
MOHAMED SATHAK A.J.COLLEGE OF ENGINEERING
Rajiv Gandhi Road (OMR), Siruseri, IT Park
Chennai-603 103.

REAL TIME DYNAMIC ROVER

A PROJECT REPORT

Submitted by

S. MOHAMMED BILAL (311813105014)

S.J. AASIQ SYED ABDUL KADAR (311813105301)

H. SEYED MOHAMED MUSTAFA (311813105304)

In partial fulfillment for the award of the degree

of

BACHELOR OF ENGINEERING

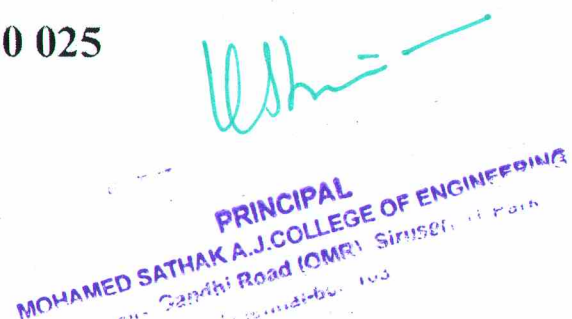
in

ELECTRICAL AND ELECTRONICS ENGINEERING

MOHAMED SATHAK A.J.COLLEGE OF ENGINEERING

ANNA UNIVERSITY: CHENNAI 600 025

APRIL 2017



BONAFIDE CERTIFICATE

Certified that this project report for **"REAL TIME DYNAMIC ROVER"** is the bonafide work of **S. MOHAMMED BILAL (311813105014), S.J. AASIQ SYED ABDUL KADAR (311813105301), H. SEYED MOHAMED MUSTAFA (311813105304)** who carried out the project work under our supervision. Certified further, that to the best of our knowledge the work reported herein does not form part of any other project report or dissertation on the basis of which a degree or award was conferred on an earlier occasion on this or any other candidate.

SIGNATURE 03/04/2017

Dr. S. THANGALAKSHMI

HEAD OF DEPARTMENT

Department of EEE

MSAJCE

EGATTUR

CHENNAI - 603103

SIGNATURE

Mr. M. DINESH

PROJECT ADVISOR

Department of EEE

MSAJCE

EGATTUR

CHENNAI - 603103

MOHAMED SATHAK A.J. COLLEGE OF ENGINEERING - CHENNAI - 603 103.

PRINCIPAL
MOHAMED SATHAK A.J.COLLEGE OF ENGINEERING
34, Rajiv Gandhi Road (OMR), Siruseri, IT Park
Chennai-603 103.

ABSTRACT

In the recent years, the increasing use of wireless applications and the demand for a system that could easily connect devices for transfer of data over a long distance without cables became worldwide. This project presents the Build and interface of a real time wheeled mobile robot installed above it an arm and a camera. Software system can be built in three various programming languages and controlled via the internet using webpage protected with a username and password to make sure it cannot be hacked. The webpage is designed to control the mobile robot remotely through the internet by any web browser. Camera is mounted on the animated base in two axes in order to have better visibility. The designed mobile robot can be remotely operated from everywhere around the world without being near the robot. It can be controlled by using any device, whether a laptop, a mobile or a tablet. It can move forward, reverse, turn right and left for a specific distance according to the controller specification. The mobile robot system is used to transfer foreign objects and access to areas that are unable to be accessed by humans. It is also used for purposes of monitoring to fit a camera. The development of this robot is based on Raspberry Pi and Motor Shield control which will be interfaced with the microcomputer that is placed on the robot running as a server. Finally, this prototype of the robot is expected to solve many problems such as placing or picking objects that are far away from the user, picking and placing hazardous objects in the fastest and easiest way.

6.2 CONCLUSION

The main objective of this project has been achieved which is to build Internet mobile robot and to interface hardware and software for mobile robot arm controlled via the internet from any place. Controlling the robot does not require specific software. It just demands Internet service. Overlap does not occur when a command is sent to the robot from a server and an image is sent to a server from the robot. Easy to control without the need of any complex hardware and only the need of laptop or smart phone. Generally the robot server runs smoothly as planned and also the controller. By analyzing and comparing the time delay, it has been noticed that it would be very small in case of LAN (wire and wireless), the more increases in case of use the Internet the more increase the distance between the robot and the user .The increase depends on the distance, type and strength of the Internet package used. The use of a secure wireless connection (username and password) helps to minimize the penetration by hackers.

6.3 FUTURE WORK

Working in the field of mobile robot is still open for research where there are many areas of study such as, mobile robot mechanical drive design according to its wheels, types of sensors used, types of controllers that are used, real world modeling...etc. As for the current research, the following suggestions are given for further developments of the work:

1- Add a solar cell to the robot to be able to charge itself automatically.

2- Add a second camera to the robot in order to increase the clarity and precision.

3- Use a joystick instead of a web page to control the robot allowing more flexibility, accuracy and ease in completing assigned tasks.

4- Using image processing to automatically treatment objectives robot at the same time.

OPTIMUM ENERGY HARVESTING AND ANALYSIS OF AN INTEGRATED SOLAR PV PANEL

A PROJECT REPORT

Submitted by

P DHIVYA (311813105006)

S NABEEN (311813105019)

H SHAHEEN SALMA (311813105022)

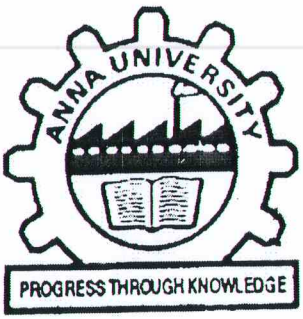
In partial fulfillment for the award of the degree

of

BACHELOR OF ENGINEERING

in

ELECTRICAL AND ELECTRONICS ENGINEERING



MOHAMED SATHAK A.J.COLLEGE OF ENGINEERING

ANNA UNIVERSITY: CHENNAI 600 025

APRIL 2017

PRINCIPAL
MOHAMED SATHAK A.J.COLLEGE OF ENGINEERING
34 - Rajiv Gandhi Road (OMR), Sirusseri, IT Park
Chennai-603 103.

BONAFIDE CERTIFICATE

Certified that this project report for **"OPTIMUM ENERGY HARVESTING AND ANALYSIS OF AN INTEGRATED SOLAR PV PANEL"** is the bonafide work of **P DHIVYA (311813105006), S NABEEN (311813105019), H SHAHEEN SALMA (311813105022)** who carried out the project work under our supervision. Certified further, that to the best of our knowledge the work reported herein does not form part of any other project report or dissertation on the basis of which a degree or award was conferred on an earlier occasion on this or any other candidate.

SIGNATURE 05/04/2017

Dr. S. THANGALAKSHMI

HEAD OF DEPARTMENT

Department of EEE

MSAJCE

EGATTUR

CHENNAI - 603103

MOHAMED SATHAK A.J. COLLEGE OF ENGINEERING * CHENNAI * 603 103

SIGNATURE 5/4/17

Mr. J. MADHAVAN

PROJECT ADVISOR

Department of EEE

MSAJCE

EGATTUR

CHENNAI - 603103

PRINCIPAL
MOHAMED SATHAK A.J.COLLEGE OF ENGINEERING
34, Rajiv Gandhi Road (OMR), Siruseri, IT Park
Chennai-600 103.

ABSTRACT

MPPT algorithms are necessary because PV arrays have a non-linear voltage-current characteristic with a unique point where the power produced is maximum. This point depends on the temperature of the panels and on the irradiance conditions. Both conditions change during the day and are also different depending on the season of the year. Furthermore, irradiation can change rapidly due to changing atmospheric conditions such as clouds. It is very important to track the MPP accurately under all possible conditions so that the maximum available power is always obtained. This project presents the hardware design and implementation of a system that ensures a perpendicular profile of the solar panel with the sun in order to extract maximum energy falling on it. Renewable energy is rapidly gaining importance as an energy resource as fossil fuel prices Fluctuate. The unique feature of the proposed system is that instead of taking the earth as its reference, it takes the sun as a guiding source. Its active sensors constantly monitor the sunlight and rotate the panel towards the direction where the intensity of sunlight is maximum. Temperature sensor is used to measure the temperature value and is displays in the LCD. The information can be viewed in PC. Due to the limited fossil energy and greenhouse effect, more and more countries are devoting to development and promotion of renewable energy sources. Among the various renewable energy sources, solar energy has the advantages of being inexhaustible and noiseless. Hence, installation of photovoltaic (PV) energy harvesting systems keeps a rather high growing rate in recent years. However, the output voltage current of the solar cells changes rapidly with the irradiance.

```
COM9

|
4.19V

Panel Temperature increased ....

Cooling System Activated...
Solar:2.76V
C = 38.00
F = 100.40
4.19V

panel temperature  Normal....
C = 36.75
F = 98.15
4.19V

panel temperature  Normal....
C = 38.75
F = 101.75
4.19V

Panel Temperature increased ....

Cooling System Activated...
Solar:2.76V
C = 92.50
F = 198.50
4.18V

panel temperature  Normal....
C = 36.25
F = 97.25
4.19V

panel temperature  Normal....
C = 36.50
F = 97.70
4.24V

Autoscroll
```

6.3 CONCLUSION

Renewable energy rapidly gaining importance as an energy resource as fossil fuel prices fluctuate. In this proposed system we are reducing the power loss in solar panel.

An increase in the operating temperature of the panel affects the solar cell efficiency of the system.

A PWM PLUS PHASE SHIFT CONTROLLED BOOST CONVERTER BASED ON SEMI-ACTIVE QUADRUPLER FOR HIGH STEP-UP APPLICATIONS

A PROJECT REPORT

Submitted by

MOHAMED IMRAN SHAH.M (311813105015)

MOHAMED SUHALE.SK(311813105023)

KISHORE.G (311813105011)

MOTHI.V (311813105017)

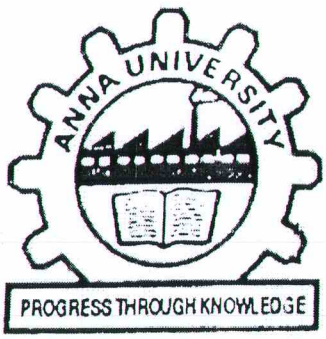
In partial fulfillment for the award of the degree

of

BACHELOR OF ENGINEERING

in

ELECTRICAL AND ELECTRONICS ENGINEERING



MOHAMED SATHAK A.J.COLLEGE OF ENGINEERING

ANNA UNIVERSITY: CHENNAI 600 025

APRIL 2017

PRINCIPAL
MOHAMED SATHAK A.J.COLLEGE OF ENGINEERING
34, Rajiv Gandhi Road (OMR), Siruseri, IT Park
Chennai-603 103.

BONAFIDE CERTIFICATE

Certified that this project report for **"A PWM PLUS PHASE SHIFT ONTROLLED INTERLEAVED ISOLATED BOOST CONVERTER ASED ON SEMI-ACTIVE QUADRUPLER RECTIFIER FOR HIGH TEP-UP APPLICATIONS"** is the bonafide work of **MOHAMED IMRAN HAH.M(311813105015), MOHAMMAD SUHALE.SK(311813105023), ISHORE.G(311813105011), MOTHI.V(311813105017)** who carried out the oject work under our supervision.Certifiedfurther,that to the best of our nowledge the work reported herein does not form part of any other project port or dissertation on the basis of which a degree or award was conferred on n earlier occasion on this or any other candidate.

07/04/17

IGNATURE

)r. S.THANGALAKSHMI
IEAD OF DEPARTMENT
)epartment of EEE
ISAJCE
:HENNAI - 603103

06/04/17

SIGNATURE

Mr. MAHABOOB BASHA QURESHI
PROJECT ADVISOR
Department of EEE
MSAJCE
CHENNAI-603103

PRINCIPAL
MOHAMED SATHAK A.J.COLLEGE OF ENGINEERING
34 Rajiv Gandhi Road (OMR), Siruseri, IT Park
Chennai-603 103.

MOHAMED SATHAK A.J. COLLEGE OF ENGINEERING * CHENNAI - 603 103*

ABSTRACT

Semi-active quadrupler rectifiers (SAQRs) are proposed in this paper to erve as the secondary rectification circuits, which make the secondary-side oltages be controllable and help to reduce current stress and conduction osses.An interleaved isolated boost converter is developed based on the roposed SAQRs. By utilizing the pulse-width-modulation (PWM) plus phase-hift control strategy, the primary and secondary-side voltages are well matched o reduce the current values and circulating conduction losses.With the roposed SAQRs, the voltage gain is extended and the voltage stresses on ower devices and passive components used in rectification circuits are reduced o the half of the high output voltage.Hence, the efficiency is improved by using transformer with a smaller turns ratio and reduced parasitic parameters, and by mploying low voltage rating devices with better switching and conduction erformance. With optimal design, lower voltage and current stresses on the rimary-side switches, minimized input current ripple can be realized. Moreover, the zero-voltage turn on switching of the active switches and the ero-current turn off switching of the diodes can be achieved over a wide load nd voltage range by the proposed SAQR based converter and the control trategy. Meanwhile, the higher voltage gain, and the lower voltage and current tresses on power devices can be obtained with the proposed SAQR based onverter compared with passive quadrupler rectifier based converter.The easibility and effectiveness of the proposed SAQRs and the derived converter re verified by a 380V output prototype.

CONCLUSION

The semi-active quadrupler rectifiers (SAQRs) and the derived interleaved isolated boost converter have been proposed to fulfill the requirements of high step up conversions. The secondary-side voltages are controlled to match the primary-side voltages, and to reduce current stress and conduction losses, by using the PWM plus phase-shift modulation. The voltage stresses on the components in SAQRs are reduced to half of the output voltage, which extends the voltage conversion ratio. And hence, low voltage rating switching devices with better conduction and switching performance have been used to improve efficiency. Moreover, the ZVS turn on of the active switches and the ZCS turn off have been achieved by the proposed PWM plus phase-shift modulation. With optimal design, low voltage stresses on the primary-side switches together with the reduced input current ripple and peak/RMS values have been obtained to improve the conversion efficiency. The operating principles, the output characteristics, and the soft-switching performance of the proposed SAQR based interleaved isolated boost converter are presented in detail. Meanwhile, the advantages of the proposed converter with SAQR compared with the passive rectifier based converter are analyzed and verified by experimental results. The
analysis and performance have been fully validated experimentally on a 20-28V-input, 380V-output hardware prototype. Experimental results demonstrate that the proposed SAQR based converter is an excellent candidate for high efficiency high step-up applications.

PRINCIPAL
MOHAMED SATHAK A.J.COLLEGE OF ENGINEERING
34, Rajiv Gandhi Road (OMR), Siruseri, IT Park
Chennai-603 103.

MOHAMED SATHAK A.J. COLLEGE OF ENGINEERING * CHENNAI - 603 103

DIGITAL ORDERING AND DRONE DELIVERY SYSTEM IN THE RESTAURANT

A PROJECT REPORT

Submitted by

M.BAVITHRAN (311813105005)

K.PIRAISOODAN (311813105020)

K.SUBRAMANI (311813105027)

in partial fulfillment for the award of the degree

of

BACHELOR OF ENGINEERING

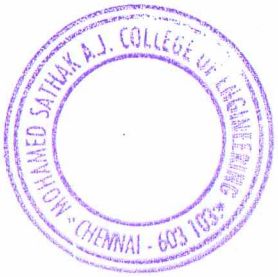
in

ELECTRICAL AND ELECTRONICS ENGINEERING

MOHAMED SATHAK A.J. COLLEGE OF ENGINEERING

ANNA UNIVERSITY: CHENNAI 600 025

APRIL 2017



PRINCIPAL
MOHAMED SATHAK A.J.COLLEGE OF ENGINEERING
34, Rajiv Gandhi Road (OMR), Siruseri, IT Park
Chennai-603 103.

BONAFIDE CERTIFICATE

Certified that this project report for **"DIGITAL ORDERING AND DRONE DELIVERY SYSTEM IN THE RESTAURANT"** is the bonafide work of **M BAVITHRAN (311813105005), K PIRAISOODAN (311813105020), K SUBRAMANI (311813105027)** who carried out the project work under our supervision. Certified further, that to the best of our knowledge the work reported herein does not form part of any other project report or dissertation on the basis of which a degree or award was conferred on an earlier occasion on this or any other candidate.

SIGNATURE

Dr. S. THANGALAKSHMI

HEAD OF DEPARTMENT

Department of EEE

MSAJCE

EGATTUR

CHENNAI - 603103

SIGNATURE

Ms. B. KALAI SELVI

PROJECT ADVISOR

Department of EEE

MSAJCE

EGATTUR

CHENNAI - 603103

PRINCIPAL
MOHAMED SATHAK A.J.COLLEGE OF ENGINEERING
Siruseri, IT Park
Chennai-603 103.

ABSTRACT

Traditional restaurant service is typically passive: Waiters must interact with customers directly before processing their orders. However, a high-quality service system should be customer centered; it should immediately recognize customer identities, favorite menus, and expenditure records to provide customer-centric services. To achieve this goal, this study integrates camera based virtual reality, wireless local area network, database technologies, and a menu recommender to develop an intelligent e-restaurant for customer-centric service.

CHAPTER 8

CONCLUSION

8.1 CONCLUSION:

Technology is introducing an advanced level of restaurant management solution for the enhancement of Restaurant and Hospitality Industry. Digital Restaurant Menu is an innovative that can manage the entire field.

It is a simple operative application that has been equipped with innovative restaurant features that can definitely make guests dining experience better and increase the revenue of the business. From this we conclude that benefits of Digital Restaurant Menu for Restaurants and Hotels are,

8.2 FUTURE SCOPE:

- Interactive with costumers
- Reduce man power
- Time management
- Feedback system and ordering

POSITION SENSORLESS CONTROL WITHOUT PHASE SHIFTER FOR HIGH-SPEED BLDC MOTORS WITH LOW INDUCTANCE AND NON-IDEAL BACK EMF

A PROJECT REPORT

Submitted by

A ANTONY ALVIN (311813105003)

M MOAMED SULTAN (311813105013)

S VENGATESAN (311813105028)

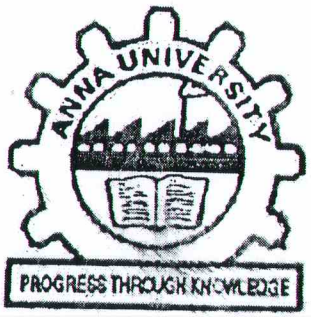
In partial fulfillment for the award of the degree

of

BACHELOR OF ENGINEERING

in

ELECTRICAL AND ELECTRONICS ENGINEERING



MOHAMED SATHAK A.J.COLLEGE OF ENGINEERING

ANNA UNIVERSITY: CHENNAI 600 025

APRIL 2017

PRINCIPAL
MOHAMED SATHAK A.J.COLLEGE OF ENGINEERING
34, Rajiv Gandhi Road (OMR), Siruseri, IT Park
Chennai-603 103.

BONAFIDE CERTIFICATE

Certified that this project report for "**POSITION SENSORLESS CONTROL WITHOUT PHASE SHIFTER FOR HIGH-SPEED BLDC MOTORS WITH LOW INDUCTANCE AND NON-IDEAL BACK EMF**"is the bonafide work of **ANTONY ALVIN.A(311813105003),MOHAMED SULTAN.M(311813105013),VENGATESAN.S(311813105028)** who carried out the project work under our supervision.Certified further,that to the best of our knowledge the work reported here in does not form part of any other project report or dissertation on the basis of which a degree or award was conferred on an earlier occasion on this or any other candidate.

SIGNATURE 03/04/17

Dr. S.THANGALAKSHMI
HEAD OF DEPARTMENT

Department of EEE

MSAJCE

EGATTUR

CHENNAI-603103

06/04/17

SIGNATURE

Mr.SYED MUZAFAR AHMED.S
PROJECT ADVISOR

Department of EEE

MSAJCE

EGATTUR

CHENNAI-603103

MOHAMED SATHAK A.J. COLLEGE OF ENGINEERING * 603 103 * CHENNAI

PRINCIPAL
MOHAMED SATHAK A.J.COLLEGE OF ENGINEERING
Rajiv Gandhi Road (OMR), Siruseri, IT Park
Chennai-603 103.

ABSTRACT

This paper presents a novel method for position sensorless control of high-speed brushless DC motors with low inductance and nonideal back electromotive force (EMF) in order to improve the reliability of the motor system of a magnetically suspended control moment gyro for space application. The commutation angle error of the traditional line-to-line voltage zero-crossing points detection method is analyzed. Based on the characteristics measurement of the nonideal back EMF, a two-stage commutation error compensation method is proposed to achieve the high-reliable and high-accurate commutation in the operating speed region of the proposed sensorless control process. The commutation angle error is compensated by the transformative line voltages, the hysteresis comparators, and the appropriate design of the low-pass filters in the low-speed and high-speed region, respectively. High-precision commutations are achieved especially in the high-speed region to decrease the motor loss in steady state. The simulated and experimental results show that the proposed method can achieve an effective compensation effect in the whole operating speed region.

The following are properties of BLDC Motor

Electronic commutation based on Hall position sensors

Less required maintenance due to absence of brushes

Speed/Torque- flat, enables operation at all speeds with rated load

High efficiency, no voltage drop across brushes

High output power/frame size.

CHAPTER 6

CONCLUSION

6.1 System performance

In order to test the quality of this drive, two brushless motors connected to the same shaft are used. Both motors are of Italian company moog. First is FAST K2, nominal speed 3000 rpm, with 2 pair of poles. Second is FAST T1, with 3 pairs of poles, nominal speed is 4500 rpm. Our drive can work with both motors, though significantly better with the first one, as BEMF to winding resistance ratio is much higher, for the same load (chapter 3). While one of these motors is connected to the drive, the other is connected to variable resistors. By decreasing the resistance we are increasing the load and vice versa. Loading motor can be connected to one resistor via 3 phase Graz junction. This is much simpler than using three variable resistors.

When working with a bigger motor (FAST K2), maximum load that it can support at speeds lower than 2000 rpm is higher than the maximum that we can apply (short circuit). At this speed BEMF effective value of the other motor is around 38V. When we apply maximum load at this speed, speed drops to 1660 rpm. One phase current through short circuit of other motor is 3,8A. Power conversion is:

Three ohms is resistance of one phase. 130W corresponds to loading torque M=0.77Nm

There is a limitation in PWM duty ratio change dynamic. At low speeds PWM duty ratio has to be changed gradually, otherwise motor will block. This occurs because sudden rise of PWM impulse causes noise in our system that prevents our position detection circuit to work properly. As speed gets higher BEM forces rise and this noise becomes

ANALYSIS AND RECTIFICATION OF FIXTURE PROBLEM IN BORING MACHINE

A PROJECT REPORT

Submitted by

L GHOUSE MOHIDEEN (311813105008)

S JANANI (311813105010)

K MOHAMMED SAMEER (311813105016)

J SENTHAMIZH SELVI (311813105021)

In partial fulfillment for the award of the degree

of

BACHELOR OF ENGINEERING

in

ELECTRICAL AND ELECTRONICS ENGINEERING

MOHAMED SATHAK A.J.COLLEGE OF ENGINEERING

ANNA UNIVERSITY: CHENNAI 600 025

APRIL 2017

PRINCIPAL
MOHAMED SATHAK A.J.COLLEGE OF ENGINEERING
Gandhi Road (OMR), Siruseri, IT P.
603 103

BONAFIDE CERTIFICATE

Certified that this project report for **"ANALYSIS AND RECTIFICATION OF FIXTURE PROBLEM IN BORING MACHINE"** is the bonafide work of **GHOUSE MOHIDEEN (311813105008), S JANANI (311813105010), MOHAMMED SAMEER (311813105016), J SENTHAMIZH SELVI (311813105021),** who carried out the project work under our supervision. Certified further, that to the best of our knowledge the work reported herein does not form part of any other project report or dissertation on the basis of which a degree or award was conferred on an earlier occasion on this or any other candidate.

SIGNATURE 06/04/2017
Dr. S. THANGALAKSHMI
HEAD OF DEPARTMENT
Department of EEE
MSAJCE
EGATTUR
CHENNAI - 603103

SIGNATURE 06/04/2017
Dr. S. THANGALAKSHMI
PROJECT ADVISOR
Department of EEE
MSAJCE
EGATTUR
CHENNAI - 603103

PRINCIPAL
MOHAMED SATHAK A.J.COLLEGE OF ENGINEERING
Rajiv Gandhi Road (OMR), Siruseri, IT Park
Chennai-603 103.

ABSTRACT

The main purpose of this project **is to eliminate the quality defects and reak down of the differential case component during boring process**. This ıality defects arises due to improper positioning of the fixture and butting pad. To ınse the positioning of the fixture on the butting pad, **limit switches** were used ıt it was not appropriate and leads to tool breakage and break down of spindle. his will make the whole component unfit for further process. In the present ɔmpetitive business scenario a small defect in a component will also make a huge roduction loss. Hence to avoid such serious problems and to improve the cost ffectiveness in this system we implemented a technology called **Low Pressure – ıir Catch Sensor technology.** The specialty of this sensor is that it can detect .01 to 0.5 mm of variation in the work piece. On implementing air catch sensor in he system, the 0.01to 0.5 mm of variation in the fixture and butting pad can be letected and now the system is in safer side. No more breakdown losses and tool ɔreakage is witnessed. Thus, we have implemented this technology in machine ;hop of TAFE Ltd., Chennai with the help of our industry guide Mr. Indrajithu (TPM) and team. In fabrication process we faced many problems and it took weeks :o solve all the problems and now finally the system is installed in the industry and :unning successfully without any interruption and it is highly cost effective. The given task was completed before date as per the company records.

7.4 CONCLUSION

This project focuses on proper alignment of the fixture in the boring machine to reduce the breakdown loss and to eliminate the quality defects of the component. After analysis the various problem like inappropriate indication of limit switch in electric panel (at improper positioning of component) even when the fixture is not positioned properly, while the component touches the limit switch has been reduced.

The various defects in the boring machine such as improper positioning of a fixture in the butting pad, improper fixture alignment which causes the tool breakage, improper component clamping due to low hydraulic pressure has been rectified by introducing Air Catch Sensor and also by providing a Indicator Switch, by providing oil level indicator with buzzer. After the modification, the breakdown loss of the component was reduced from 1600 per day to 0 and the fixture is aligned properly. The compressed air is used, thus it powers cylinders, air motors, and other pneumatic devices when the electricity is shut down.

7.5 SCOPE OF THE PROJECT

The future scope of the project is very bright as it is most wanted concept for the world. As you see in the additional project, there are designs for many types of equipment which can be implemented in the machine shop. So, definitely there is no doubt in the scope of the project.