E.G.S. PILLAY ENGINEERING COLLEGE

(Autonomous)

Approved by AICTE, New Delhi | Affiliated to Anna University, Chennai
Accredited by NAAC with 'A' Grade |Accredited by NBA

NAGAPATTINAM – 611002

B.E. ELECTRICAL AND ELECTRONICS ENGINEERING

Full Time Curriculum and Syllabus

Third Year – Sixth Semester

Course Code	Course Name	L	T	P	C	Maximum Marks		
						CA	ES	Total
Theory Course								
1902EE601	Solid State Drives	3	0	0	3	40	60	100
1902EE602	Power System Analysis	3	2	0	4	40	60	100
1902EE603	Microprocessors and Microcontrollers	3	0	0	3	40	60	100
-	Elective-II (PEC-II)	3	0	0	3	40	60	100
-	Elective-III (HSSC Elective-I)	3	0	0	3	40	60	100
-	Elective-IV (Open Elective-I)	3	0	0	3	40	60	100
Laboratory Course								
1902EE651	Power Electronics and Drives Laboratory	0	0	2	1	50	50	100
1902EE652	Microprocessors and Microcontrollers Laboratory	0	0	2	1	50	50	100
1904EE653	Mini Project-II	0	0	2	1	100	0	100
1904GE651	Life Skills: Aptitude- II	0	0	2	1	100	0	100
1904EE654	Industrial Visit Presentation	0	0	0	1	100	0	100
Total		18	02	08	24	640	460	1100

L – Lecture | T – Tutorial | P – Practical | CA – Continuous Assessment | ES – End Semester

1902EE601	SOLID STATE DRIVES	L	T	P	C
		3	0	0	3

PREREQUISITE:

1. Power Electronics
2. Electrical Machinery – I & II

COURSE OBJECTIVES:

1. To understand the fundamentals of motor load system
2. To explain about power converters fed DC and AC drives
3. To design a controllers for closed loop operation of DC and AC drives

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

CO1 Remember the fundamentals of motor load system

CO2 Explain about single and multi-quadrant operation of power converter fed dc drives.

CO3 Describe the speed control techniques of induction motor and synchronous motor drives

CO4 Calculate the Voltage, Current, Speed and Torque parameters of DC and AC drives

CO5 Analyze the design procedure of speed & current controllers and able to explain the closed loop operation of Dc and AC drives

MODULE I DRIVE CHARACTERISTICS 8 Hours

Electric drives - Classification, elements of electrical drive, equations governing motor load, torque components; Classes of duty-Thermal overloading, load variations; Steady state stability; Multi quadrant dynamics; Typical load torque characteristics - Constant torque, torque proportional to speed, fan load, torque inversely proportional to speed; Thermal model of electrical motors and load equalization; Selection of motor rating.

MODULE II DC MOTOR DRIVE 9 Hours

History of DC drives; Ward-Leonard control; Constant torque and constant HP operation of DC drives

Converter fed drive- Review of one and two quadrant converter and its characteristics; Steady state analysis of single phase and three phase converter fed separately excited dc motor drive - Continuous and discontinuous conduction, four quadrant operations of converter; Armature control, field control and regenerative braking in DC motors using phase angle control.

Chopper fed drive- Review of dc chopper and its control strategies; Motoring mode, braking mode and four quadrant operation of chopper fed drive.

MODULE III CLOSED LOOP CONTROL OF DC DRIVE 8 Hours

Control structure of dc drive; Armature voltage and field control of separately excited dc motor drive; Transfer function of separately excited dc motor and converter; Design of controllers - Speed controller and current controller.

MODULE IV INDUCTION MOTOR DRIVE 12 Hours

Review of induction motor equivalent circuit and torque speed characteristics; Speed control of induction motor drive - Stator voltage control, v/f control, VSI fed induction motor drive, cyclo converter control and vector control - Block diagram approach; Impact of rotor resistance on induction motor speed torque curve; Closed loop control of induction motor drive- Slip power recovery schemes.

MODULE V SYNCHRONOUS MOTOR DRIVE 8 Hours

V/f and self-control of synchronous motor drive; Margin angle control and power factor control; VSI and CSI fed synchronous motor drive; Permanent magnet synchronous motor - Construction, types, BLPM DC motor and BLPM AC motor.

TOTAL: 45 HOURS

REFERENCES:

1. G.K Dubey, "Fundamentals of Electrical Drives", 2nd Edition, Narosa Book Distributors, 2013.
2. N. K. De, P. K. Sen, "Electric Drives", 16th Edition, PHI Learning Pvt. Ltd., 2014.
3. R. Krishnan, "Electric Motor Drives: Modeling, Analysis and Control", Pearson Education, 2015.
4. Bimal K. Bose "Modern Power Electronics and AC Drives", Pearson Education, Second Edition, 2003.
5. P.C Sen "Thyristor DC Drives", John wiely & Sons, New York, 1981.
6. R. Krishnan, "Permanent Magnet Synchronous and Brushless DC motor Drives", CRC Press, New York, 2010.
7. https://nptel.ac.in/courses/108/104/108104140/

1902EE602	POWER SYSTEM ANALYSIS	L	T	P	C
		3	2	0	4

PREREQUISITE:

1. Transmission and Distribution
2. Electric circuit analysis

COURSE OBJECTIVES:

1. To model the power system under steady state operating condition. To apply efficient Numerical methods to solve the power flow problem.
2. To model and analyze the power systems under abnormal (or) fault conditions.
3. To model and analyze the transient behavior of power system when it is subjected to a fault.

COURSE OUTCOME:

After completion of the course, Student will be able to

CO1 Explain the fundamentals of power system with the aid of single line diagram and per unit analysis.

CO2 Develop power flow models by addressing various power flow problems using iterative techniques.

CO3 Apply the symmetrical fault calculation methods for the unbalanced network using z bus matrix

CO4 Apply the unsymmetrical fault calculation methods for the unbalanced network using sequence network analysis

CO5 Make use of power system stability studies for planning and operation of network through various solution techniques

MODULE I MODELING OF POWER SYTEM COMPONENTS 12 Hours

Power system components; Indian power scenario; Single line diagram - Per unit representation, per unit impedance diagram; Representation of off nominal transformers; Formation of bus admittance matrix.

MODULE II LOAD FLOW ANALYSIS 12 Hours

Need for load flow studies; Buses - Classification of Buses; Formulation of power flow problems; Power flow solutions - Gauss seidel method, Newton Raphson method, Fast decoupled method; comparison of methods.

MODULE III SYMMETRICAL FAULT ANALYSIS 12 Hours

Nature of symmetrical fault; Short circuit capacity; Bus impedance matrix using building algorithm; Sequence impedances of transmission lines, Transformers and synchronous machines; Symmetrical fault calculation using bus impedance matrix.

MODULE IV UNSYMMETRICAL FAULT ANALYSIS 12 Hours

Symmetrical component; Sequence impedance; Bus impedance matrix of zero sequence, positive sequence and negative sequence network; Analysis of unsymmetrical fault - Single line to ground fault, line to line fault, double line to ground fault.

MODULE V STABILITY STUDIES & COMPUTATIONAL METHODS IN ELECTRICAL POWER SYSTEM 12 Hours

Need for stability studies; Swing equation; Equal area criterion; Critical clearing angle and time; Step by step procedure for solving swing equation; Pre-conditions for iterative methods - Sparse matrix solution techniques, numerical stability analysis, least square state estimation, eigen value problems; Methods to improve the stability.

TOTAL: 60HOURS

REFERENCES:

1. John J. Grainger and W.D. Stevenson Jr., "Power System Analysis", 6th Reprint, Tata McGraw-Hill, 2010.
2. Hadi Sadat, "Power System Analysis", 21st Reprint, Tata McGraw Hill Education Pvt. Ltd., New Delhi,2010.
3. lle. I. Elgerd, "Electric Energy Systems Theory – An Introduction", 2nd Edition Tata McGraw HillPublishing Company Limited, New Delhi, 2012.
4. C.A.Gross, "Power System Analysis," Wiley India,2011.
5. Dr. S. Sivanagaraju, B.V. Rami Reddy, "Electrical Power System Analysis", Laxmi Publications (P) Ltd 2007.
6. https://nptel.ac.in/courses/108/105/108105067/

1902EE603	MICROPROCESSORS AND MICROCONTROLLERS	L	T	P	C
		3	0	0	3

PREREQUISITE:

1. Digital Electronics.
2. Linear Integrated Circuits.

COURSE OBJECTIVES:

1. To study the architecture of commonly used µp and µc.
2. To develop skill in assembly language program writing for 8085, 8086, and its applications.
3. To the applications of µp and µc based systems.

COURSE OUTCOMES:

After completion of the course, Student will be able to

- CO1 Explain the architecture, memory organization, timing diagram and interrupt structure of microprocessor
- CO2 perform mathematical operation using 8085 & 8051instruction set
- CO3 Explain the architecture, interrupt, memory organization and addressing modes of 8051
- CO4 Practice interfacing of commonly used programmable peripheral devices using 8085 and 8051.
- CO5 Make use of 8051 controller for the control of simple electrical systems

MODULE I 8085 MICROPROCESSOR 9 Hours

Evolution of microprocessors; 8085 Microprocessor - Pin diagram, architecture, interrupts, memory organization and I/O organization; Introduction to Zilog and Motorola based 8-bit processors-features.

MODULE II PROGRAMMING OF 8085 9 Hours

Instruction set - Data transfer, data manipulation and control instructions; Addressing modes; Timing diagram; Programming concepts: Simple programs - Arithmetic, code conversion, lookup tables and time delay.

MODULE III 8051 MICROCONTROLLER 9 Hours

Microcontroller - 8051 Architecture, pin details, memory, ports, counters / timers, interrupts; Instruction set of 8051- Data manipulation instructions, arithmetic, logical and branch control instructions; Addressing modes; Simple programs - Arithmetic, logical, lookup tables and time delay; Comparison- Process and control, programming of 8085 and 8051.

MODULE IV PERIPHERAL INTERFACING 9 Hours

Peripherals and interfacing - Serial and parallel I/O (8251 and 8255), Programmable DMA controller, Programmable interrupt controller, Key board and Display controller, ADC/DAC interfacing.

MODULE V MICROCONTROLLER BASED SYSTEM DESIGN 9 Hours

Applications - Washing machine control, speed control of stepper motor and DC motor, traffic light control; Bluetooth, Zigbee modules integration; SPIC and I^2C; Introduction to PIC controllers.

TOTAL: 45 HOURS

REFERENCES:

1. Ramesh S. Gaonkar, "Microprocessor Architecture, Programming, and Applications with 8085", 6th Edition, Penram Intl. Publications, 2013.
2. Kenneth Ayala, "The 8051 Microcontroller", 3rd Edition, Cengage Learning Publications, 2007.
3. Muhammad Ali Mazidi, Janice GillispieMazidi, RolinMcKinlay, "The 8051 Microcontroller and Embedded Systems using Assembly and C", 2nd Edition, Prentice Hall Publications, 2008.
4. Ray A. K., Bhurchandi K. M., "Advanced Microprocessor and Peripherals", 3rd Edition, Tata McGraw-Hill Publications, 2013.
5. SencerYeralan, Helen Emery, "Programming and interfacing the 8051 Microcontroller", 1st Edition, Addison-Wesley Publications, 2000.
6. Krishna Kant, "Microprocessors and Microcontrollers, Architecture, Programming and System Design-8085, 8086, 8051, 8096", 1st Edition, Prentice Hall India Ltd Publications, 2010.
7. https://www.nptel.ac.in/courses/106/105/106105193/
8. https://www.nptel.ac.in/courses/108/102/108102045/

1902EE651	POWER ELECTRONICS AND DRIVES LABORATORY	L	T	P	C
		0	0	2	1

PREREQUISITE:

1. Power Electronics
2. Electrical Machinery – I &II

COURSE OBJECTIVES:

1. To determine the characteristics of power electronic devices.
2. To design a power converter for electrical drives.
3. To analyze the performance of power converter fed drives.

COURSE OUTCOMES:

After completion of the course, Student will be able to

CO1 Construct experiments on power electronic component for obtaining characteristics curve
CO2 Make use of half-controlled converter for DC motor
CO3 Identify the characteristic plot of IGBT based PWM inverter
CO4 Infer the operation of AC voltage controller and Switched mode power converter
CO5 Make use of Simulation of PE circuits

LIST OF EXPERIMENTS

1. Gate Pulse Generation using R, RC and UJT.
2. Characteristics of SCR and Triac.
3. Characteristics of MOSFET and IGBT.
4. AC to DC half-controlled converter fed DC motor.
5. AC to DC full-controlled converter fed DC motor.
6. Step down and step up MOSFET based choppers.
7. IGBT based single phase PWM inverter.
8. IGBT based three phase PWM inverter fed three phase AC Motor.
9. AC voltage controller.
10. Switched mode power converter.
11. Simulation of PE circuits (1Φ & 3Φ semiconverters, 1Φ & 3Φ full converters, DC-DC converters).
12. V/F control of induction motor drive

TOTAL: 30 Hours

REFERENCES:

1. K.Nandakumar, R.Anandaraj, “Power Electronics and Drives Laboratory Manual”, 2018
2. Krishnan.R, “Electric Motor and Drives Modeling, Analysis and Control”, Prentice Hall of India, 2001.
3. Pillai, S.K., “A First Course on Electrical Drives”, Wiley Eastern Limited, 1993.

1902EE652	MICROPROCESSORS AND MICROCONTROLLERS LABORATORY	L	T	P	C
		0	0	2	1

PREREQUISITE:

1. Analog and Digital Integrated Circuits Laboratory
2. Microprocessor, Microcontroller And Its Applications

COURSE OBJECTIVES:

1. To provide training on programming of microprocessors and microcontrollers and understand the interface requirements.
2. To provide training on programming of microcontrollers.
3. To understand the requirements of interfacing.

COURSE OUTCOMES:

After completion of the course, Student will be able to

CO1 Perform mathematical operations and control instructions using 8085 processor
CO2 Practice interfacing of commonly used programmable peripheral interfaces using 8085
CO3 Perform arithmetical operations using 8051 microcontroller
CO4 Practice interfacing of commonly used programmable peripheral interfaces using 8051
CO5 Develop assembly language program to control simple electrical system using 8085, 8051

LIST OF EXPERIMENTS

1. Arithmetic operations (8/ 16 bit) using 8085.
2. Finding maxima and minimum numbers in an array using 8085
3. Code conversion using 8085
4. Interfacing with 8085 (ADC, DAC)
5. Arithmetic operations (8 bit) using 8051
6. Pulse generation using 8051.
7. Interfacing 8279 with 8085.
8. Traffic light controller using 8085.
9. Speed control of stepper motor using 8051.
10. Speed control of DC motor using 8051.
11. PWM pulse generation using look up table and microcontroller
12. Arithmetic operations (8/ 16 bit) using 8085.

TOTAL: 30 Hours

REFERENCES:

1. S.Latha, “Microprocessor and microcontroller laboratory Manual”, 2018.
2. G.T.Swamy, “Microprocessor 8085 lab manual”, Laxmi publications, 1st Edition, 2006.
3. Microprocessor Lab Manual, Rajesh Hegde, Kindle Edition.

		L	T	P	C
1904EE653	**MINI PROJECT – II**	**0**	**0**	**2**	**1**

GUIDELINE FOR REVIEW AND EVALUATION

The students may be grouped into 2 to 4 and work under a project supervisor. The device / system / component(s) to be designed and developed using modeling software, may be decided in consultation with the supervisor and if possible, with an industry. A project report to be submitted by the group and the soft copy of the report, which will be reviewed and evaluated for internal assessment by a committee constituted by the Head of the Department. At the end of the semester examination the project work is evaluated based on oral presentation and the project report examined by the internal examiner constituted by the Head of the Department.

TOTAL: 30 Hours

1904GE651 **LIFE SKILLS: APTITUDE – II** (Common to All Branches)

L	T	P	C
0	0	2	1

COURSE OBJECTIVES:

1. To brush up problem solving skill and to improve intellectual skill of the students.
2. To be able to critically evaluate various real life situations by resorting to Analysis of key issues and factors.
3. To be able to demonstrate various principles involved in solving mathematical problems and thereby reducing the time taken for performing job functions.
4. To enhance analytical ability of students.
5. To augment logical and critical thinking of Students.

MODULE I PARTNERSHIP, MIXTURES AND ALLEGATIONS, PROBLEM ON AGES, SIMPLE INTEREST, COMPOUND INTEREST **6 Hours**

Introduction Partnership - Relation between capitals, Period of investments and Shares- Problems on mixtures - Allegation rule - Problems on Allegation – Problems on ages - Definitions Simple Interest - Problems on interest and amount - Problems when rate of interest and time period are numerically equal - Definition and formula for amount in compound interest - Difference between simple interest and compound interest for 2 years on the same principle and time period.

MODULE II BLOOD RELATIONS, CLOCKS, CALENDARS **6 Hours**

Defining the various relations among the members of a family - Solving Blood Relation puzzles - Solving the problems on Blood Relations using symbols and notations - Finding the angle when the time is given - Finding the time when the angle is known - Relation between Angle, Minutes and Hours - Exceptional cases in clocks - Definition of a Leap Year - Finding the number of Odd days - Framing the year code for centuries - Finding the day of any random calendar date .

MODULE III TIME AND DISTANCE, TIME AND WORK **6 Hours**

Relation between speed, distance and time - Converting kmph into m/s and vice versa - Problems on average speed - Problems on relative speed - Problems on trains - Problems on boats and streams - Problems on circular tracks - Problems on races - Problems on Unitary method - Relation between Men, Days, Hours and Work - Problems on Man-Day-Hours method - Problems on alternate days - Problems on Pipes and Cisterns.

MODULE IV DATA INTERPRETATION AND DATA SUFFICIENCY **6 Hours**

Problems on tabular form - Problems on Line Graphs - Problems on Bar Graphs - Problems on Pie Charts - Different models in Data Sufficiency - Problems on data redundancy

MODULE V ANALYTICAL AND CRITICAL REASONING **6 Hours**

Problems on Linear arrangement - Problems on Circular arrangement - Problems on Double line-up - Problems on Selections - Problems on Comparisons - Finding the Implications for compound statements - Finding the Negations for compound statements- Problems on assumption - Problems on conclusions - Problems on inferences - Problems on strengthening and weakening of arguments.

TOTAL 30 Hours

REFERENCES:

1. Arun Sharma, 'How to Prepare for Quantitative Aptitude for the CAT', 7th edition, McGraw Hills publication, 2016.
2. Arun Sharma, 'How to Prepare for Logical Reasoning for CAT', 4th edition, McGraw Hills publication, 2017.
3. R S Agarwal, 'A modern approach to Logical reasoning', revised edition, S.Chand publication, 2017.
4. R S Agarwal, 'Quantitative Aptitude for Competitive Examinations', revised edition, S.Chand publication, 2017.
5. Rajesh Verma, "Fast Track Objective Arithmetic", 3rd edition, Arihant publication, 2018.
6. B.S. Sijwalii and Indu Sijwali, "A New Approach to REASONING Verbal & Non-Verbal", 2nd edition, Arihnat publication, 2014.

ASSESSMENT PATTERN :

1. Two tests will be conducted (25 * 2) - 50 marks
2. Five assignments will be conducted (5*10) - 50 Marks.

		L	T	P	C
1904EE654	**INDUSTRIAL VISIT PRESENTATION**	**0**	**0**	**0**	**1**

GUIDELINE FOR EVALUATION

In order to provide the experiential learning to the students, shall take efforts to arrange at least two industrial visit / field visits in a year. A presentation based on Industrial visits shall be made in this semester and suitable credit may be awarded.