

# 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 (CSE, EEE, MECH)

NAGAPATTINAM – 611 002



## B.E.ELECTRICAL AND ELECTRONICS ENGINEERING

Third Year – Fifth Semester

SEMESTER V										
Course Code	Course Name	L	T	P	C	Maximum Marks			Category	
						CA	ES	Total		
<b>Theory Course</b>										
1702EE501	Electrical Machine Design	3	2	0	4	40	60	100	PC	
1702EE502	Linear Control Systems	3	2	0	4	40	60	100	PC	
1702EE503	Power Electronics	3	0	0	3	40	60	100	PC	
1703EE001	Elective-I(Special Electrical machines)	3	0	0	3	40	60	100	PE	
1703EE002	Elective-II(Electrical Safety and Management)	3	0	0	3	40	60	100	PE	
1702CS504	Object Oriented Programming	3	0	0	3	40	60	100	PC	
<b>Laboratory Course</b>										
1702CS554	Object Oriented Programming Laboratory	0	0	2	1	50	50	100	PC	
1702EE551	Measurement and Control Laboratory	0	0	2	1	50	50	100	PC	
1704EE552	Mini Project - I	0	0	2	1	100	0	100	EEC	
1704GE551	Life Skills: Aptitude-I	0	0	2	1	100	0	100	EEC	
<b>Total</b>		<b>18</b>	<b>4</b>	<b>8</b>	<b>24</b>	<b>540</b>	<b>460</b>	<b>1000</b>		

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

1702EE501

**ELECTRICAL MACHINE DESIGN**

L	T	P	C
3	2	0	4

**PREREQUISITE :**

1. Electrical Machinery-I
2. Electrical Machinery-II

**COURSE OBJECTIVES:**

1. To study MMF calculation and thermal rating of various types of electrical machines.
2. To understand the design methods of armature and field systems for D.C. machines.
3. To analyze the design details of core, yoke, windings and cooling systems of transformers.
4. To analyze design of stator and rotor of induction and synchronous machines

**UNIT I INTRODUCTION TO MACHINE DESIGN 12 Hours**

Major considerations in electrical machine design, electrical engineering materials; space factor, choice of specific electrical and magnetic loadings, thermal considerations, rating of machines; standard specifications.

**UNIT II DC MACHINES 12 Hours**

Design of DC machines: general considerations, output equation, main dimensions, choice of specific electric and magnetic loading, magnetic circuits calculations; Carter's coefficient, net length of iron, real & apparent flux densities ; selection of number of poles - design of armature - design of commutator and brushes.

**UNIT III TRANSFORMERS 12 Hours**

Design of transformers: general considerations, output equation, KVA output for single phase and three phase transformers, window space factor; design of core and winding, overall dimensions, operating characteristics, no load current; temperature rise in transformers - design of tank- methods of cooling of transformers.

**UNIT IV INDUCTION MOTORS 12 Hours**

Design of induction motors: general considerations, output equation, choice of average flux density, main dimensions, length of air gap; rules for selecting rotor slots of squirrel cage machines, design of rotor bars & slots, design of end rings, design of wound rotor ; magnetic leakage calculations, leakage reactance of poly phase machines, magnetizing current, short circuit current.

**UNIT V SYNCHRONOUS MACHINES 12 Hours**

Design of synchronous machines: general considerations, output equation, choice of electrical and magnetic loading, main dimensions, short circuit ratio, stator design, stator parameters, estimation of air gap length, design of rotor, design of damper winding, determination of full load field mmf, design of field winding, design of turbo alternators, rotor design.

**TOTAL: 60 Hours**

**FURTHER READING / CONTENT BEYOND SYLLABUS / SEMINAR :**

1. Case study/seminar on simulated design of machines using MAGNET software
2. Design of turbo generator

**COURSE OUTCOMES:**

After completion of the course, Student will be able to

- CO1 Explain the fundamental concepts in machine design.
- CO2 Derive the output equation and various parameters related machine design.
- CO3 Calculate the temperature rise of machines under different loading conditions.
- CO4 Analyze the design details for different parts of D.C. Machines and Transformer.
- CO5 Analyze the design details for the different parts of Synchronous and Induction Machines.

**REFERENCES:**

1. Sawhney, A.K., 'A Course in Electrical Machine Design', Dhanpat Rai & Sons, New Delhi, 2013
2. M.V.Deshpande, "Design and Testing of Electrical Machine Design" Wheeler Publications, 2010.
3. A. E. Clayton, NN Hancock "The Performance and Design of Direct Current Machines" CBS Publisher, First Edition, 2004.
4. R.K.Agarwal, "Principles of Electrical Machine Design", Esskay Publications, Delhi, 2002.
5. Sen, S.K., 'Principles of Electrical Machine Designs with Computer Programmes', Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 1987.
6. <http://nptel.ac.in/108106023/>

1702EE502

**LINEAR CONTROL SYSTEMS**

**L T P C**

**3 2 0 4**

**PREREQUISITE :**

1. Electric circuit analysis
2. Engineering Mathematics

**Course Objectives:**

1. To understand the basic components of control systems
2. To gain the knowledge in time and frequency domain tools for the design and analysis of feedback control systems.
3. To understand the design of compensator and concepts of state variable analysis.

**Unit I SYSTEMS AND THEIR REPRESENTATION 12 Hours**

Basic elements in control systems; open and closed loop systems; Electrical analogy of mechanical system; Transfer function, Block diagram reduction techniques, Signal flow graph.

**Unit II TIME RESPONSE 12 Hours**

Time response - time domain specifications; types of test input, first and second order system response; error coefficients, steady state error; effects of P, PI, PID modes of feedback control.

**Unit III FREQUENCY RESPONSE 12 Hours**

Frequency response - Bode plot, Polar plot; determination of closed loop response from open loop response; correlation between frequency domain and time domain specifications.

**Unit IV STABILITY AND COMPENSATOR DESIGN 12 Hours**

Characteristics equation; Routh Hurwitz criterion, Root locus construction, Nyquist stability criterion; lag, lead and lag-lead networks; lag/lead compensator design using bode plots.

**Unit V STATE VARIABLE ANALYSIS 12 Hours**

Concept of state variables, state models for linear and time invariant systems; solution of state and output equation in controllable canonical form, concepts of controllability and observability.

**Total: 60 Hours**

**FURTHER READING / CONTENT BEYOND SYLLABUS / SEMINAR :**

1. Lead, Lag compensator of frequency response.
2. AC and DC servomotor for control system applications.

**COURSE OUTCOMES:**

After completion of the course, Student will be able to

- CO1 1. Understand the various methods of representation of systems.
- CO2 2. Apply time response analysis and to determine steady state error.
- CO3 3. Analyze the stability of the system using frequency response plots and able to adjust the gain of the system to satisfy the desired specifications.
- CO4 4. Determine the stability of the system by applying various stability criteria.
- CO5 5. Design a suitable compensator to stabilize the system and to obtain the desired performance.

**REFERENCES:**

1. M. Gopal, "Control Systems, Principles and Design", 4<sup>th</sup> Edition, Tata McGraw Hill, New Delhi, 2012
2. S.K.Bhattacharya, "Control System Engineering" 3<sup>rd</sup> Edition, Pearson, 2013.
3. Dhanesh. N. Manik, "Control System" Cen gage Learning, 2012
4. Richard C. Dorf and Robert H. Bishop, "Modern Control Systems", Pearson Prentice Hall, 2012.
5. K. Ogata, "Modern Control Engineering", 5th edition, PHI, 2012.
6. Nagrath I.J and Gopal M, "Control Systems Engineering", New Age Publishers, 5<sup>th</sup> Edition, 2009.
7. [https://onlinecourses.nptel.ac.in/noc18\\_ee20/preview](https://onlinecourses.nptel.ac.in/noc18_ee20/preview)

<b>1702EE503</b>	<b>POWER ELECTRONICS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**PREREQUISITE :**

1. Electron Devices and Circuits
2. Linear Integrated Circuits

**COURSE OBJECTIVES:**

1. To study the important aspects of power semiconductor devices
2. To understand the concepts of power conversion and control using power electronic devices
3. To analyze the performance of power modulators

**UNIT I POWER SEMICONDUCTOR DEVICES 9 Hours**

**Power semiconductor devices** – Power Diodes, Power Transistors, Power MOSFETs ,IGBTs , TRIACs, GTOs, IGCT, Working , Static and Dynamic characteristics;

**SCR** – Two transistor analogy, Turn on and Turn off characteristics, Snubber circuits, Series and parallel operation of SCRs, Driver circuits.

**UNIT II PHASE- CONTROLLED CONVERTERS 12 Hours**

Principle of phase control – single phase and three phase half wave and full wave converter with R,RL,RLE load, Continuous and Discontinuous conduction, Estimation of average & RMS values of load voltage, load current ; Performance parameters for converters – Effect of freewheeling diodes , Effect of source inductance, Dual converter.

**UNIT III DC TO DC CONVERTER 8 Hours**

DC Choppers – Principle of step up and step down chopper operation , Control strategies , Classification & operation of choppers , Single quadrant, Two quadrant and four quadrant DC choppers – Buck , Boost and Buck boost converters ; Introduction to Multilevel Inverter – single phase cascaded H-Bridge MLI.

**UNIT IV INVERTERS 8 Hours**

Types of inverters – operation of single phase VSI, Three phase VSI (120 , 180 ) degree modes – Inverter output voltage control, Pulse Width Modulation Techniques, single, multiple, sinusoidal modulation-Harmonic elimination Techniques.

**UNIT V AC TO AC CONVERTERS 8 Hours**

**AC Voltage Controllers** (Single phase and three phase) – half wave with R, RL loads, Expression for Load voltage and current, sequence control of AC regulators ;

**Cyclo converters** – Single phase to single phase, three phase to single phase cyclo converter, Control strategies; Introduction to Matrix converter.

**Total: 45 Hours**

**FURTHER READING / CONTENT BEYOND SYLLABUS / SEMINAR:**

1. Space vector pulse width modulation
2. Advanced resonant converters

**COURSE OUTCOMES:**

After completion of the course, Student will be able to

- CO1 Understand the structure and characteristics of power semiconductor devices.
- CO2 Elucidate the operation of power modulators.
- CO3 Analyze the control techniques used in power modulators
- CO4 Analyze the performance parameters of power converters
- CO5 Explain the operation and characteristics of various power electronics converters.

**REFERENCES:**

1. Rashid M H, “Power Electronics-Circuits, Devices and Applications”, Prentice Hall of India, New Delhi, 2011.
2. P.S.Bimbhra, “Power Electronics”, Khanna Publishers, New Delhi, 2006.
3. Vedam Subramanyam, “Power Electronics”, New Age International, New Delhi, 1996.
4. V.Jagannathan, “Power electronic devices and circuits”, PHI Publications.
5. Ned Mohan, Tore.M.Undeland, and William.P.Robbins, “Power Electronics: Converters, applications and Design”, John Wiley and sons, third edition, 2003.
6. <http://nptel.ac.in/courses/108108077/>

1703EE001

**SPECIAL ELECTRICAL MACHINES**

L	T	P	C
3	0	0	3

**PREREQUISITE:**

1. Electrical Machinery – I & II
2. Power Electronics
3. Microprocessor and Microcontroller

**COURSE OBJECTIVES:**

1. To understand the construction and operation of Special electrical machines.
2. To analyze the performance parameters of special electrical machines.
3. To design a closed loop control circuit for special electrical machines

**UNIT I SYNCHRONOUS RELUCTANCE MOTOR 9 Hours**

Constructional features, types – axial & radial flux motors, operating principles, variable reluctance motors – voltage and torque equations, phasor diagram, performance characteristics, applications.

**UNIT II STEPPER MOTORS 9 Hours**

Constructional features, principal 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 9 Hours**

Evolution of switched reluctance motors, 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 DC MOTORS 9 Hours**

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 MOTOR 9 Hours**

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 HOURS**

**FURTHER READING / CONTENT BEYOND SYLLABUS / SEMINAR :**

1. Design of BLPM Motors and SRM
2. DSP Based Motion Control

**COURSE OUTCOMES:**

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

- CO1 Explain the constructional features and operation of special electrical machines.
- CO2 Draw and explain the phasor diagram and characteristics of special electrical machines.
- CO3 Determine the torque and voltage equations of special electrical machines.
- CO4 Describe the operations of circuits associated with special electrical machines.
- CO5 Explain the closed loop control of special electrical machines and able to list its applications.

**REFERENCES:**

1. K. Venkataratnam, “Special Electrical Machines”, 1<sup>st</sup> Edition, CRC Press, 2009.
2. E. G. Janardanan, “Special Electrical Machines”, PHI PVT LTD, 2014.
3. R.Krishnan, ‘Switched Reluctance Motor Drives – Modeling, Simulation, Analysis, Design and Application’, CRC Press, New York, 2001.
4. J.R. Hendershot and T.J.E. Miller, “Design of Brushless Permanent Magnet Machines”, Motor Design Books, 2010.
5. T.J.E. Miller, ‘Brushless Permanent Magnet and Reluctance Motor Drives’, Clarendon Press, Oxford, 1989.
6. T. Kenjo, ‘Stepping Motors and Their Microprocessor Controls’, Clarendon Press London, 1984.

1703EE002

**ELECTRICAL SAFETY AND MANAGEMENT**

L	T	P	C
3	0	0	3

**PREREQUISITE :**

1. Transmission & Distribution

**COURSE OBJECTIVES:**

1. To Understand the concepts of Indian rules and earthing.
2. To get knowledge in first aid and fire extinguishers operating procedures.
3. To understand the safety policy in management & organizations.

**UNIT I RULES & REGULATIONS**

**9 Hours**

Power sector organization and their roles; significance of IE rules & IE acts; general safety requirements: span, conductor configuration, spacing and clearing, sag, erection, hazards of electricity.

**UNIT II INSTALLATION AND EARTHING OF EQUIPMENTS**

**9 Hours**

Classification of electrical installation; earthing of equipment bodies; electrical layout of switching devices and SC protection; safety in use of domestic appliances; safety documentation and work permit system; flash hazard calculations; tools and test equipments.

**UNIT III SAFETY MANAGEMENT AND FIRST AID**

**9 Hours**

Safety aspects during commissioning-safety clearance notice before energizing, safety during maintenance, maintenance schedule; special tools; security grand; check list for plant security; effects of electric and electromagnetic fields in HV lines and substations; safety policy in management & organizations; first aid; basic principles; action taken after electrical shock; artificial respiration and methods.

**UNIT IV FIRE EXTINGUISHERS**

**9 Hours**

Fundamentals of fire- initiation of fires, types; extinguishing techniques, prevention of fire, types of fire extinguishers, fire detection and alarm system ;CO<sub>2</sub> and Halogen gas schemes; foam schemes.

**UNIT V ENERGY MANAGEMENT & ENERGY AUDITING**

**9 Hours**

Objectives of energy management; energy efficient electrical systems; energy conservation and energy policy; renewable source of energy; energy auditing; types and tips for improvement in industry.

**Total: 45 Hours**

**FURTHER READING / CONTENT BEYOND SYLLABUS / SEMINAR :**

1. Brief about role of Bureau of Energy Efficiency (BEE) in energy conservation.
2. Implementation of engineering ethics in safety management.

**COURSE OUTCOMES:**

After completion of the course, Student will be able to

- CO1 Gain basic knowledge on Indian power sector organization and their roles.
- CO2 Understand the concepts of earthing and its standards.
- CO3 Acquire the basic knowledge on first aid and safety during electrical installation.
- CO4 Distinguish various fire extinguishers and their classification.
- CO5 Explain the safety policy in management & organizations.

**REFERENCES:**

1. Rao.S, Khanna.R.C, "Electrical safety, Fire safety engineering and safety management", Hanna publisher, Delhi, 2<sup>nd</sup> edition, 1998.
2. Cooper.W.F, "Electrical safety Engineering", Newnes-Butterworth company, 1978.
2. Power Engineering Hand book, TNEB Engineers officers, Chennai, 2002.
3. John Codick, "Electrical safety hand book", McGraw Hill Inc., New Delhi, 2000.
4. The Indian electricity rules, 1956, authority regulations, 1979, Commercial Law Publication, Delhi, 1999.
5. V. Manoilov, "Fundamentals of electrical safety", Mir Publishers, MOSCOW,1975

**1702CS504**

**OBJECT ORIENTED  
 PROGRAMMING**

L	T	P	C
3	0	0	3

**PREREQUISITE:**  
 1. Programming in C  
 2. Introduction to Computer

**Course Objectives:**

- To demonstrate adeptness of object oriented programming in developing solutions to problems demonstrating usage of data abstraction, encapsulation, and inheritance.
- To understand the concepts behind object-oriented programming using C++
- To analyze and understand the functionality of program code written in Java.

**Unit I INTRODUCTION TO OOP'S AND C++ 9 Hours**

Object oriented programming concepts – objects – classes – methods and messages –abstraction and encapsulation – inheritance – abstract classes – polymorphism.

Introduction to C++ – classes – access specifiers – function and data members – default arguments – function overloading – friend functions – const and volatile functions – static members – Objects – pointers and objects – constant objects – nested classes – local classes

**Unit II CONSTRUCTORS 9 Hours**

Constructors – default constructor – Parameterized constructors – Constructor with dynamic allocation – copy constructor – destructors – operator overloading – overloading through friend functions – overloading the assignment operator – type conversion – explicit constructor

**Unit III EXCEPTION HANDLING AND INHERITANCE 9 Hours**

Function and class templates - Exception handling – try-catch-throw paradigm – exception specification – terminate and Unexpected functions – Uncaught exception. Inheritance – public, private, and protected derivations – multiple inheritance – virtual base class – abstract class

**Unit IV OVERVIEW OF JAVA 9 Hours**

Data types, Variables and Arrays, Operators, Control Statements, Classes, Objects, Methods - Inheritance

**Unit V EXCEPTION HANDLING IN JAVA 9 Hours**

Packages and Interfaces, Exception Handling, Multithreaded Programming, Strings, Input/output

**Total: 45 Hours**

**FURTHER READING / CONTENT BEYOND SYLLABUS / SEMINAR :**

RTTI, Runtime Polymorphism, ANSI String Objects,

**Course Outcomes:**

After completion of the course, Student will be able to

- CO1 Define the features of C++ supporting object oriented programming
- CO2 Understand the major object-oriented concepts such that constructor and operator overloading in C++
- CO3 Identify to implement error handling techniques using exception handling
- CO4 Identify classes, objects, methods of a class and relationships among them in Java
- CO5 Understand the principles of Packages, Interfaces, Multithreading in Java

**References:**

- B. Trivedi, “Programming with ANSI C++”, Oxford University Press, 2007.
- H.M.Deitel, P.J.Deitel, “Java how to program”, Fifth edition, Prentice Hall of India private limited,2003.
- Ira Pohl, “Object-Oriented Programming Using C++”, Pearson Education Asia, 2003.
- K.R.Venugopal, RajkumarBuyya, T.Ravishankar, “Mastering C++”, TMH, 2003.
- Herbert Schildt, “The Java 2: Complete Reference”, Fourth edition, TMH, 2002

1702CS554

**OBJECT ORIENTED PROGRAMMING LAB**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**PREREQUISITE :**

- 1.Basic Computer knowledge.
- 2.Programming in C Lab

**Course Objectives:**

Justify the philosophy of object-oriented programming and the concepts of encapsulation, abstraction, inheritance, and polymorphism.

To make the student learn an object oriented way of solving problems using java.

To make the students to write programs using multithreading concepts and handle exceptions.

**List of Experiments:**

1. Static Data Members
2. Multiple constructor in a class
3. Operator overloading for Unary and binary operator
4. Multiple Inheritance
5. Constructor in derived classes
6. Virtual Base class
7. Friend Function
8. Control Statements in Java
9. Multi-threaded programming in Java
10. Exception handling in Java

**Total: 45 Hours**

**Additional Experiments:**

1. Program to overload unary and binary operator as Nonmember function.
2. Write a Java program to develop simple application using OOP's concept.

**Course Outcomes:**

After completion of the course, Student will be able to

CO1 Develop program to illustrate basic concept of OOP features and C++ concept

CO2 Implement the program using unary and binary operator overloading in C++

CO3 Write program to implement concept of inheritance and polymorphism in C++

CO4 Understand and Apply Object oriented features and Java concepts

CO5 Develop and implement program using exception handling and templates in Java

**References:**

1. <https://lecturenotes.in/practicals/19363-lab-manuals-for-object-oriented-programming>
2. <http://studentsfocus.com/cs6461-object-oriented-programming-lab-manual>
3. <http://bietbvrn.ac.in/public/testimonia>
4. <http://www.srmuniv.ac.in/sites/default/files>



<b>1702EE551</b>	<b>MEASUREMENT AND CONTROL LABORATORY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**PREREQUISITE;**

- 1.Measurement and Instrumentation
- 2.Linear Control system

**COURSE OBJECTIVES:**

- 1.Knowledge on analysis and design of control system
- 2.Knowledge on analysis and design of instrumentation
- 3.Provide analysis and design of controller and compensators

**LIST OF EXPERIMENTS:**

1. Measurement of Inductance, Capacitance and Resistance using Bridge networks
2. To study the characteristics of Temperature/Pressure/Displacement sensors
3. Measurement of energy ( single and three phase)
4. Perform Signal Conditioning by using ADC and DAC
5. Study the effect of P, PI, PID controllers using MAT LAB.
6. Stability analysis (Bode, root locus, Nyquist) of linear time invariant system using MATLAB
7. Transfer function of Armature/Field controlled Dc motor
8. Design of Lag, Lead and Lag-Lead compensators using MATLAB
9. AC and DC position control systems
10. Synchro-transmitter and receiver

**Total: 30 Hours**

**ADDITIONAL EXPERIMENTS / INNOVATIVE EXPERIMENTS :**

1. Plot the pole-zero configurations in s-plane for the given transfer function using Simulink.
2. Plot unit step response of given transfer function and find peak overshoot, peak time using Simulink.

**COURSE OUTCOMES:**

After completion of the course, Student will be able to

- CO1 Understand the various characteristics of sensors and transducers
- CO2 Analyze various bridges in measurement circuits
- CO3 Understand the concept of controllers and compensators
- CO4 Analyze the stability of LTI system using software tool
- CO5 Analyze the signal conditioning circuits and power measurements

**REFERENCES:**

1. Dr.T.Suresh Padmanabhan and J.Menaka, "Measurement and Control Laboratory Manual", 2018.
2. Electrical Measurement and control manual by S.K.Bhattacharya.

1704GE551

LIFE SKILLS: APTITUDE – I

L	T	P	C
0	0	2	1

**PREREQUISITE :**

Technical English – I and II

**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 Student

**UNIT I INTRODUCTION TO NUMBER SYSTEM, BASIC SHORTCUTS OF ADDITION, MULTIPLICATION, DIVISION 6 Hours**

Classification of numbers – Types of Numbers - Divisibility rules - Finding the units digit - Finding remainders in divisions involving higher powers - LCM and HCF Models - Fractions and Digits – Square, Square roots – Cube, Cube roots – Shortcuts of addition, multiplication, Division.

**UNIT II RATIO AND PROPORTION, AVERAGES 6 Hours**

Definition of Ratio - Properties of Ratios - Comparison of Ratios - Problems on Ratios - Compound Ratio - Problems on Proportion, Mean proportional and Continued Proportion Definition of Average - Rules of Average - Problems on Average - Problems on Weighted Average - Finding average using assumed mean method.

**UNIT III PERCENTAGES, PROFIT AND LOSS 6 Hours**

Introduction Percentage - Converting a percentage into decimals - Converting a Decimal into a percentage - Percentage equivalent of fractions - Problems on percentages - Problems on Profit and Loss percentage-Relation between Cost Price and Selling price - Discount and Marked Price - Two different articles sold at same Cost Price - Two different articles sold at same Selling Price - Gain% / Loss% on Selling Price.

**UNIT IV CODING AND DECODING, DIRECTION SENSE 6 Hours**

Coding using same set of letters - Coding using different set of letters - Coding into a number - Problems on R-model - Solving problems by drawing the paths - Finding the net distance travelled - Finding the direction - Problems on clocks - Problems on shadows - Problems on direction sense using symbols and notations.

**UNIT V NUMBER AND LETTER SERIES NUMBER AND LETTER ANALOGIES, ODD MAN OUT 6 Hours**

Difference series - Product series - Squares series - Cubes series - Alternate series - Combination series - Miscellaneous series - Place values of letters - Definition of Analogy - Problems on number analogy - Problems on letter analogy - Problems on verbal analogy - Problems on number Odd man out - Problems on letter Odd man out - Problems on verbal Odd man out

**Total: 30 Hours**

**REFERENCES:**

1. Arun Sharma, 'How to Prepare for Quantitative Aptitude for the CAT', 7<sup>th</sup> edition, McGraw Hills publication, 2016.
2. Arun Sharma, 'How to Prepare for Logical Reasoning for CAT', 4<sup>th</sup> 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", 3<sup>rd</sup> edition, Arihant publication, 2018.
6. B.S. Sijwali and InduSijwali, "A New Approach to REASONING Verbal & Non-Verbal", 2<sup>nd</sup> edition, Arihant publication, 2014.

**1704EE552**

**MINI PROJECT I**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**GUIDELINE FOR REVIEW AND EVALUATION**

The students may be grouped into 2 to 4 and work under a project supervisor. The circuit / system to be designed may be decided in consultation with the supervisor and if possible with an industry. A project report to be submitted by the group, 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 by internal examiners constituted by the Head of the Department

**Total: 30 Hours**