

Semester: IV		
Probability Distribution, Optimization and Complex Variables (Theory)		
Course Code:	MVJ21MA41D (common to ECE, EEE and IOT)	CIE Marks: 50
Credits:	L: T:P: 2:2:0	SEE Marks: 100
Hours:	40L	SEE Duration: 3 Hrs.
Course Learning Objectives: The students will be able to		
1	Apply discrete and continuous probability distributions in analyzing the probability models arising in engineering field.	
2	Learn the mathematical formulation of linear programming problem	
3	Learn the mathematical formulation of transportation problem.	
4	Understand the concepts of Complex variables and transformation for solving Engineering Problems.	
5	Learn the solutions of partial differential equations numerically	

UNIT-I	
<p><b>Probability Theory:</b> Random variables (discrete and continuous), probability density function, cumulative density function.</p> <p><b>Probability Distributions:</b> Binomial distribution, Poisson distribution. Normal distribution, Exponential distribution.</p> <p>Joint probability distributions.</p> <p><b>Self-study:</b> Discrete and continuous probability problems</p> <p><b>Applications:</b> Discrete and continuous probability distributions help in analyzing the probability models arising in engineering field.</p> <p><b>Video Links:</b> <a href="https://youtu.be/cp7_ZF2kNi4">https://youtu.be/cp7_ZF2kNi4</a></p>	8 Hrs
UNIT-II	
<p><b>Optimization:</b> Linear Programming, mathematical formulation of linear programming problem (LPP), Types of solutions, Graphical Method, simplex method, big-M method, Dual – simplex method.</p> <p><b>Self-study:</b> Two phase simplex method</p> <p><b>Applications:</b> Applications of transportation Problems</p> <p><b>Video Links:</b> <a href="https://youtu.be/WZlyL6pcItY">https://youtu.be/WZlyL6pcItY</a></p>	8 Hrs
UNIT-III	
<p>The transportation problem: Initial Basic Feasible Solution (IBFS) by Least Cost Method, North West Corner Rule method, Vogel's Approximation Method, MODI method (Optimal Solution), Salesman problem, Assignment problem.</p> <p><b>Self-Study Topic:</b> Matrix Minima Method</p> <p><b>Video Links:</b> <a href="http://nptel.ac.in/courses.php?disciplineID=111">http://nptel.ac.in/courses.php?disciplineID=111</a></p>	8 Hrs
UNIT-IV	
<p><b>Complex Variables:</b> Functions of complex variables, Analytic function, Cauchy-Riemann equations in Cartesian and polar coordinates, Construction of analytic function (Using Milne-Thomson method)</p>	8 Hrs

<p>Consequences of Cauchy-Riemann equations, Properties of analytic functions.</p> <p>Application to flow problems- complex potential, velocity potential, equipotential lines, stream functions, stream lines.</p> <p><b>Self-study:</b> Unique Expression Method</p> <p><b>Applications:</b> Application to flow problems</p> <p>Video Links: <a href="https://youtu.be/b5VUnapu-qs">https://youtu.be/b5VUnapu-qs</a></p>	
<b>UNIT-V</b>	
<p><b>Numerical solutions of PDE</b> – Classification of second order equations, finite difference approximation to derivatives, solution of heat equations, solution of wave equations and solution of Laplace equation.</p> <p><b>Self-study:</b> Crank Nicolson method – problems.</p> <p><b>Applications:</b> To solve boundary value problems</p> <p>Video Links: <a href="https://youtu.be/nNnnBMF03II">https://youtu.be/nNnnBMF03II</a></p>	<b>8 Hrs</b>

<b>Course Outcomes: After completing the course, the students will be able to</b>	
C209.1	Apply discrete and continuous probability distributions in analyzing the probability models arising in engineering field.
C209.2	Learn the mathematical formulation of linear programming problem
C209.3	Solve the applications of transport problems
C209.4	Use the concepts of analytic function and complex potentials to solve the problems arising in electromagnetic field theory
C209.5	Learn the numerical solutions of partial differential equations

<b>Reference Books</b>	
1.	B.S. Grewal, "Higher Engineering Mathematics" Khanna Publishers, 44 <sup>th</sup> Edition, 2013.
2.	Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley-India publishers, 10 <sup>th</sup> edition, 2014.
3.	Prof G. B. Gururajachar "Engineering Mathematics-III, Academic Excellent series Publications, 2016-17
4.	Bali N. P. & Manish Goyal, "A text book of Engineering Mathematics", Laxmi Publications, 8 <sup>th</sup> Edition

### Continuous Internal Evaluation (CIE):

#### Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for



Semester: IV		
Power System Engineering-I (Theory)		
Course Code	MVJ21EE42	CIE Marks: 50
Credits:	L:T:P: 3:0:0	SEE Marks: 50
Hours:	40L	SEE Duration: 3 Hrs.
Course Learning Objectives: The students will be able to		
1	Understand the different types of power generating sources and structure.	
2	Illustrate the economic aspects of power generation and tariff methods.	
3	Evaluate the performances of transmission line and parameters calculations.	
4	Understand mechanical design of transmission lines.	
5	Examine A.C. and D.C. distribution systems.	

UNIT-I	
<p><b>GENERATION OF ELECTRIC POWER:</b></p> <p><b>Conventional generation Sources:</b> Layout of Hydro power station, block diagram of thermal power station and Nuclear Power Plant, brief description of components. Advantages and disadvantage of power plants.</p> <p><b>Non-Conventional Sources:</b></p> <p>Solar Power Generation: Role and Potential of Solar Energy Options, Principles of Solar Radiation, Flat Plate and Concentrating Solar Energy Collectors.</p> <p>Wind Power Generation: Role and potential of Wind Energy Option, Horizontal and Vertical Axis Wind Mills.</p> <p>Introduction to geothermal and ocean energy.</p> <p><b>Laboratory Sessions/ Experimental learning:</b> Visit near any power station to get practical knowledge on working of power station.</p> <p><b>Applications:</b> All industrial applications</p> <p><b>Video link:</b>  <a href="http://nptel.iitm.ac.in">http://nptel.iitm.ac.in</a><a href="https://youtu.be/Yg6XsepGCKY">https://youtu.be/Yg6XsepGCKY</a></p>	8 Hrs
UNIT-II	
<p><b>ECONOMICS ASPECTS OF POWER GENERATION:</b></p> <p>Introduction to load curve, load duration and integrated load duration, load demand, maximum demand, load factor, diversity factor, capacity factor, utilization and plant use factors. Base load and peak load plants. Cost of generation and their division into fixed and running cost, introduction to Tariff methods and numerical problems. Introduction to underground cables, types of cables.</p> <p><b>Laboratory Sessions/ Experimental learning:</b> Load estimating using software</p> <p><b>Applications:</b> Energy auditing of industry and other institutes.</p> <p><b>Video links:</b>  <a href="http://nptel.iitm.ac.in">http://nptel.iitm.ac.in</a>  <a href="https://youtu.be/GRwJqD4StEU">https://youtu.be/GRwJqD4StEU</a></p>	8Hrs
UNIT-III	
INDUCTANCE & CAPACITANCE CALCULATIONS OF TRANSMISSION LINES	8Hrs

<p>Calculation of Line constants of single phase and three phase lines of symmetrical configuration.</p> <p>Classification of Transmission Lines -Short, Medium and Long line and their model representations, Nominal-T, Nominal-<math>\pi</math> and A, B, C, D Constants for symmetrical networks, Numerical Problems.</p> <p><b>Laboratory Sessions/ Experimental learning:</b> Calculation of inductance and capacitance of transmission line using MAT LAB -Simulink software.</p> <p><b>Applications:</b> Design of transmission line for different voltages.</p> <p>Video link / Additional online information (related to module if any):</p> <p><a href="http://nptel.iitm.ac.inhttps://youtu.be/lr1jgbR5ca8">http://nptel.iitm.ac.inhttps://youtu.be/lr1jgbR5ca8</a></p>	
<b>UNIT-IV</b>	
<p><b>PERFORMANCE OF FACTORS AFFECTING THE TRANSMISSION LINE:</b></p> <p>Skin and proximity effects, Ferranti effect, charging current, corona, Factors affecting corona, critical voltages and power loss.</p> <p>Introduction to overhead line insulators, types of insulators, string efficiency, calculation of string efficiency.</p> <p>Introduction to sag and tension calculations, effect of wind and ice on weight of conductor, numerical problems.</p> <p><b>Laboratory Sessions/ Experimental learning:</b> Insulation test of materials for high voltage- HVE Lab</p> <p><b>Applications:</b> Design of insulators for different voltage value.</p> <p><b>Video link:</b></p> <p><a href="http://nptel.iitm.ac.inhttps://youtu.be/gd1nruo4_iA">http://nptel.iitm.ac.inhttps://youtu.be/gd1nruo4_iA</a></p>	<b>8Hrs</b>
<b>UNIT-V</b>	
<p><b>A.C DISTRIBUTION SYSTEM</b></p> <p>Introduction, AC distribution, Single phase, 3-phase, 3 phase 4 wire system, bus bar arrangement, Selection of site for substation. Voltage Drop Calculations (Numerical Problems) in A.C. Distributors for the following cases: Power Factors referred to receiving end voltage.</p> <p><b>D.C DISTRIBUTION SYSTEM:</b></p> <p>Introduction to D.C distribution system, Comparison of DC vs. AC, and Under-Ground vs. Over- Head Distribution Systems. - Requirements and Design features of Distribution Systems.</p> <p><b>Laboratory Sessions/ Experimental learning:</b> Visit near AC power distribution substation to get practical knowledge on working of power substation</p> <p><b>Applications:</b> Domestic and industrial applications</p> <p><b>Video link / Additional online information (related to module if any):</b></p> <p><a href="http://nptel.iitm.ac.inhttps://youtu.be/_iz8ZkjD7z8">http://nptel.iitm.ac.inhttps://youtu.be/_iz8ZkjD7z8</a></p>	<b>8Hrs</b>

<b>Course Outcomes: After completing the course, the students will be able to</b>	
C210.1	Discuss the operation of conventional generating stations and renewable sources of electrical power.
C210.2	Evaluate the economic aspects of power generation and tariff methods

C210.3	Discuss the performance of typical transmission and distribution system components.
C210.4	Determine the electrical circuit parameters of transmission lines
C210.5	Analyze A.C. and D.C. distribution systems for different loads.

Reference Books	
1.	A Text Book on Power System Engineering, M.L.Soni, P.V.Gupta, U.S.Bhatnagar, A.Chakrabarthy, ,1999, Dhanpat Rai & Co Pvt. Ltd., ISBN: 978-8177000207.
2.	Power System Engineering, D P Kothari & I J Nagrath, Second Edition,2007, MC Graw Hill Education, ISBN: 9780070647916, 9780070647916
3.	Principles of Power system, V.K Mehta & Rohith Mehta, Revised Edition, 2010, S Chand, ISBN: 8121900964, 9788121900966
4.	Electrical Power Systems, C.L. Wadhwa,Fifth Edition,2009,New Age International, ISBN:9788122424683

#### Continuous Internal Evaluation (CIE):

##### Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

#### Semester End Examination (SEE):

**Total marks: 50+50=100**

SEE for 50 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C210.1	2	1	2	2	2	-	2	-	-	-	-	-
C210.2	2	1	2	3	2	-	-	-	-	-	-	-
C210.3	2	1	2	1	2	-	-	-	-	-	-	-

C210.4	3	2	2	2	2	-	-	-	-	-	-	-
C210.5	2	2	2	1	2	-	-	-	-	-	-	-

<b>Semester: IV</b>		
<b>OOPS with C++ for Electrical Engineering (Theory)</b>		
Course Code:	MVJ21EE43	CIE Marks: 50
Credits:	L:T:P: 3:0:0	SEE Marks: 50
Hours:	40L	SEE Duration: 3 Hrs.
<b>Course Learning Objectives: The students will be able to</b>		
1	Become familiar with OOPs concept	
2	Become familiar with C++ concepts, classes and usage	
3	Write effective C++ programs for big projects	
4	Become familiar with using and implementing C++ math libraries	
5	Learn how to program for embedded platforms	

<b>UNIT-I</b>	
<p><b>INTRODUCTION TO OOP and C++:</b> Procedure and Object-Oriented Programming, Basic Concepts and Benefits of OOP, Introduction to C++, C++ statements, Structure of C++ program, Compiling and Linking</p> <p><b>Laboratory Sessions/ Experimental learning:</b></p> <p><b>Applications:</b> Applications Layer, Middleware, Firmware, Embedded Systems</p> <p><b>Web Link and Video Lectures:</b></p> <p>1. C++ Tutorial for Beginners: Full Course, <a href="https://youtu.be/vLnPwxZdW4Y">https://youtu.be/vLnPwxZdW4Y</a></p>	<b>8 Hrs</b>
<b>UNIT-II</b>	
<p><b>Tokens, Expressions, Control Structure, Functions:</b> Introduction, Keywords, Identifiers, Constants, Basic data types, User Defined data types, Derived data types, Variables, Operators, Expressions, Overloading, Control Structures, Details of functions, Overloading, Friend and Virtual Functions, Math Library functions</p> <p><b>Laboratory Sessions/ Experimental learning:</b> Experimentation with simple C++ programs</p> <p><b>Applications:</b> Applications Layer, Middleware, Firmware, Embedded Systems</p> <p><b>Web Link and Video Lectures:</b></p> <p>1. C++ Tutorial for Beginners: Full Course, <a href="https://youtu.be/vLnPwxZdW4Y">https://youtu.be/vLnPwxZdW4Y</a></p>	<b>8 Hrs</b>
<b>UNIT-III</b>	
<p><b>Classes, Objects, Constructors, Destructors:</b> Specifying, Member functions, Nesting, Private members, Arrays, Memory allocation, Static members, Friendly functions, Local classes, Details about constructors, Types, Dynamic initialization, Two dimensional arrays</p> <p><b>Laboratory Sessions/ Experimental learning:</b> Experimentation for C++ programs on Classes and Objects</p> <p><b>Applications:</b> Applications Layer, Middleware, Firmware, Embedded Systems</p> <p><b>Web Link and Video Lectures:</b></p> <p>1. C++ Tutorial for Beginners: Full Course, <a href="https://youtu.be/vLnPwxZdW4Y">https://youtu.be/vLnPwxZdW4Y</a></p> <p>2. C++ Full Course for Beginners, <a href="https://youtu.be/GQp1zzTwrIq">https://youtu.be/GQp1zzTwrIq</a></p>	<b>8 Hrs</b>
<b>UNIT-IV</b>	



<p>Operator Overloading, Type conversion, Inheritance, Extending Classes, Pointers, Virtual functions, Polymorphism, Console I/O operations, Working with Files.</p> <p>Laboratory Sessions/ Experimental learning: Experimentation for C++ programs on Operator Overloading, Virtual functions, Polymorphism, Console I/O, File Operations</p> <p>Applications: GUI, Applications Layer, Middleware, Firmware, Embedded Systems, IoT</p> <p>Web Link and Video Lectures:</p> <ol style="list-style-type: none"> <li>1. C++ Tutorial for Beginners: Full Course, <a href="https://youtu.be/vLnPwxZdW4Y">https://youtu.be/vLnPwxZdW4Y</a></li> <li>2. C++ Full Course for Beginners, <a href="https://youtu.be/GQp1zzTwrIg">https://youtu.be/GQp1zzTwrIg</a></li> </ol>	<b>8 Hrs</b>
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#### UNIT-V

<p>Applications to Electrical Engineering problems: Examples of Matrix operations, Writing Matrix Classes, Embedded C++ programming, C++ for solving electrical circuit problems</p> <p>Laboratory Sessions/ Experimental learning: Experimentation on Circuit and Power System Analysis, Embedded Systems</p> <p>Applications: Circuit Analysis, Power System Analysis, Embedded Systems, IoT</p> <p>Web Link and Video Lectures:</p> <ol style="list-style-type: none"> <li>1. C++ Tutorial for Beginners: Full Course, <a href="https://youtu.be/vLnPwxZdW4Y">https://youtu.be/vLnPwxZdW4Y</a></li> <li>2. C++ Full Course for Beginners, <a href="https://youtu.be/GQp1zzTwrIg">https://youtu.be/GQp1zzTwrIg</a></li> </ol>	<b>8 Hrs</b>
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<b>Course Outcomes: After completing the course, the students will be able to</b>	
C211.1	Become familiar with various concepts of OOP and C++
C211.2	Become well versed in C++ Programming on Desktop or Laptop
C211.3	Will be able to write C++ programs for GUI, Circuit analysis, Power System analysis
C211.4	Become familiar with C++ programming on Embedded platform and IoT
C211.5	Execute small to medium complexity C++ Projects

<b>Reference Books</b>	
1	E Balagurusamy "OBJECT ORIENTED PROGRAMMING WITH C++", The McGraw Hill Companies, 4 <sup>th</sup> Edition
2	Stanley Lippman, C++ Primer", 5 <sup>th</sup> Edition, Addison Wesley
3	Michael Barr, "Programming Embedded Systems in C & C++", O'Reilly Media, Inc.
4	Guido Buzzi Ferraris, "Scientific C++: Building Numerical Libraries the Object Oriented Way", Addison Wesley Longman

#### Continuous Internal Evaluation (CIE):

##### Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes

effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

**Semester End Examination (SEE):**

**Total marks: 50+50=100**

SEE for 50 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C211.1	1	1	1	1	2	-	-	-	-	-	-	1
C211.2	2	2	2	2	1	-	-	-	-	-	-	1
C211.3	2	2	2	1	2	-	-	-	-	-	-	1
C211.4	3	2	2	1	2	-	-	-	-	-	-	1
C211.5	2	2	2	3	3	-	-	-	-	-	-	1

Electrical Machines-II (Theory and Practice)		
Course Code:	MVJ21EE44	CIE Marks:50+50
Credits:	L:T:P: 3:0:2	SEE Marks: 50 +50
Hours:	40 L+ 26 P	SEE Duration: 03+03 Hours
Course Learning Objectives: The students will be able to		
1	Understand the detailed working of synchronous motor.	
2	Explain the concept of voltage regulation in alternator.	
3	Explain the detailed working of permanent magnet synchronous motor.	
4	Explain the construction and working of servo motor and BLDC motor.	
5	Explain the construction and working of stepper motor and Linear Electric Machines.	

UNIT-I	
<p><b>Synchronous Motors:</b> Theory of operation, principle of operation, construction of salient and non-salient pole machines, methods of starting, phasor diagram, excitation methods, synchronous condenser, mathematical analysis for power developed, hunting and its suppression.</p> <p><b>Laboratory Sessions/ Experimental learning:</b> Open Circuit Test to calculate core loss and to draw open circuit curve for Three Phase Alternator</p> <p><b>Application:</b> Power generation plant.</p> <p><b>Web Link and Video Lectures:</b>  <a href="https://youtu.be/59Jg5zEguVY">https://youtu.be/59Jg5zEguVY</a>  <a href="https://youtu.be/nu8wtbxKCRM">https://youtu.be/nu8wtbxKCRM</a></p>	8Hrs
UNIT-II	
<p><b>Synchronous Generator:</b> armature windings, coil span factor, distribution factor, chorded coils and EMF equation.</p> <p><b>Voltage Regulation:</b> Significance, EMF, MMF and ZPF method.</p> <p><b>Salient Pole Synchronous Machine:</b> Two reaction theory, slip test.</p> <p><b>Synchronization:</b> Parallel operation of alternators -synchronization.</p> <p><b>Laboratory Sessions/ Experimental learning:</b> Study the Synchronization of the alternator with infinite bus bar.(<a href="https://vp-dei.vlabs.ac.in/Dreamweaver/exp1.html">https://vp-dei.vlabs.ac.in/Dreamweaver/exp1.html</a>)</p> <p><b>Application:</b> Power Factor corrections.</p> <p><b>Web Link and Video Lectures:</b>  <a href="https://youtu.be/b24jORRoxEc">https://youtu.be/b24jORRoxEc</a>  <a href="https://youtu.be/edJFTap0zYw">https://youtu.be/edJFTap0zYw</a></p>	8Hrs
UNIT-III	
<p><b>Permanent Magnet Synchronous Motor (PMSM):</b> Construction, Principle of Operation, EMF Equation of PMSM, Control of PMSM, Comparison of Conventional and PM Synchronous Motors, Applications of PMSM-Study of application of PMSM as traction motor for electric vehicles.</p> <p><b>Laboratory Sessions/ Experimental learning:</b> MATLAB simulation of speed control of PMSM.</p> <p><b>Applications:</b> Robotics, machine tools, actuators.</p>	8Hrs

Video link: <a href="https://nptel.ac.in/courses/108/102/108102156/">https://nptel.ac.in/courses/108/102/108102156/</a>	
<b>UNIT-IV</b>	
<p><b>Servo Motors:</b> DC Servo Motors – Construction, Principle of Operation, AC Servo Motors – Construction &amp; Working, Analysis of Two-phase AC Servo Motor, Torque speed characteristics.</p> <p><b>Brushless D.C. Motors:</b> Principle of Operation, Types, Magnetic circuit analysis, EMF equation, Commutation, Motor characteristics and control, Torque/speed characteristics</p> <p><b>Laboratory Sessions/ Experimental learning:</b> Speed torque characteristics of AC &amp; DC servo motor.</p> <p><b>Applications:</b> Robotics, Solar Tracking System, Metal Cutting Metal Forming Machines, Industrial robots, CNC machine tools.</p> <p><b>Video link:</b>  <a href="https://www.youtube.com/watch?v=UmHtWX2XYSM">https://www.youtube.com/watch?v=UmHtWX2XYSM</a>  <a href="https://www.youtube.com/watch?v=EQzm51BK6UE&amp;list=PLA5CA7D35114BA425&amp;index=23">https://www.youtube.com/watch?v=EQzm51BK6UE&amp;list=PLA5CA7D35114BA425&amp;index=23</a></p>	<b>8Hrs</b>
<b>UNIT-V</b>	
<p><b>Stepper Motor:</b> Introduction, Variable Reluctance Stepper Motor, Permanent Magnet Stepper Motor, Hybrid Stepper Motor, Windings in Stepper Motors, Characteristics of Stepper Motor, Open – loop Control of Stepper Motor, closed – loop Control of Stepper Motor, Microprocessor – Based Control of Stepper Motor, Applications of Stepper Motor.</p> <p><b>Linear Electric Machines:</b> Linear Induction motor, DC Linear Motor, Linear Reluctance and Levitation Machines.</p> <p><b>Laboratory Sessions/ Experimental learning:</b> Demonstration with an experiment, microprocessor-based control of stepper motor.</p> <p><b>Applications:</b> 3D printing equipment, Textile machines, CNC milling machines, Welding equipment, overhead traveling cranes and beltless conveyors, , maglev (magnetic levitation) trains</p> <p><b>Video link:</b>  <a href="https://www.youtube.com/watch?v=UmHtWX2XYSM">https://www.youtube.com/watch?v=UmHtWX2XYSM</a>  <a href="https://www.youtube.com/watch?v=Tp724MgrosA">https://www.youtube.com/watch?v=Tp724MgrosA</a></p>	<b>8Hrs</b>
<b>LABORATORY EXPERIMENTS</b>	
<ol style="list-style-type: none"> <li>1. Load test on three phase Induction Motor.</li> <li>2. Conduct suitable test to draw the equivalent circuit of single-phase induction motor.</li> <li>3. Load test on a single-phase induction motor.</li> <li>4. No-load &amp; Blocked rotor test on three phase Induction motor.</li> <li>5. Brake test on three phase Induction Motor.</li> <li>6. Regulation of a three –phase alternator by synchronous impedance &amp; m.m.f. methods.</li> <li>7. Determination of <math>X_d</math> and <math>X_q</math> of a salient pole synchronous machine.</li> <li>8. V and Inverted V curves of a three-phase synchronous motor.</li> </ol>	

Along with mandatory experiments students are advised to complete two open ended experiments. The following are some suggestions for open ended experiments.

9. Efficiency of a three-phase alternator.
10. Speed control of 3 phase slip ring Induction motor- rotor Resistance control, stator voltage control.
11. Regulation of three-phase alternator by Z.P.F. method.

Course Outcomes: After completing the course, the students will be able to	
C212.1	Determine the regulation of an alternator by various methods
C212.2	Describe the importance of Synchronization of Alternator and discuss V and inverted V curves.
C212.3	Explain the operation and control of permanent magnet synchronous motors.
C212.4	Explain Servo motors and brushless DC motors.
C212.5	Analyse the performance of stepper motors and linear electric machines.

Reference Books	
1	Electric Machines, D. P. Kothari, et al, 4th Edition, 2011.
2	Special Electrical Machines, E.G. Janardanan, PHI, 1 st Edition 2014.
3.	Brushless Permanent Magnet and Reluctance Motor Drives, T J E Miller, Clarendon Press, Oxford 1989.
4.	Electrical Technology, B.L Theraja, Volume2, S. Chand, 22nd Edition.

#### Continuous Internal Evaluation (CIE):

##### Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the self -study are 20 (2 presentations are held for 10 marks each). The marks obtained in test, quiz and self -studies are added to get marks out of 100 and report CIE for 50 marks.

##### Laboratory- 50 Marks

The laboratory session is held every week as per the time table and the performance of the student is evaluated in every session. The average of the marks over number of weeks is considered for 30 marks. At the end of the semester a test is conducted for 10 marks. The students are encouraged to implement additional innovative experiments in the lab and are awarded 10 marks. Total marks for the laboratory is 50.

#### Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks are executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the complete syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

**Laboratory- 50 Marks**

Experiment Conduction with proper results is evaluated for 40 marks and Viva is for 10 marks. Total SEE for laboratory is 50 marks.

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C212.1	3	2	-	-	-	-	-	-	3	-	-	1
C212.2	3	2	-	-	-	-	-	-	3	-	-	1
C212.3	3	2	-	-	-	-	-	-	3	-	-	1
C212.4	3	2	-	-	-	-	-	-	3	-	-	1
C212.5	3	2	-	-	-	-	-	-	3	-	-	1

Semester: IV		
MICROCONTROLLER AND ARM PROCESSOR		
Course Code:	MVJ21EE45	CIE Marks:50+50
Credits:	L:T:P:S:3:0:2:0:Y	SEE Marks: 50+50
Hours:	40 L+ 26 P	SEE Duration: 03Hours
Course Learning Objectives: The students will be able to		
1	Explain the working of different microcontrollers and internal organization of 8051.	
2	Understand the various instructions to write assembly language program for different applications.	
3	Understand C data types to develop 8051 timer, counter and serial port programs.	
4	Explain the various interrupts and interfacing of parallel peripheral devices to 8051.	
5	Understand the basics of ARM Embedded systems.	

UNIT-I	
<p><b>8051 Microcontroller Basics:</b> Review of numbering systems, Architecture and pin configuration of 8051, PSW and Flag Bits, 8051 Register Banks, Stack, Stack pointer, Program counter, Data pointer, Internal Memory Organization of 8051, Special Function Registers, Addressing Modes</p> <p><b>Laboratory Sessions/ Experimental learning:</b> Conduct a review on different types of microcontrollers available in market.</p> <p><b>Applications:</b> Selection of different microcontrollers for various applications/projects.</p> <p><b>Video link:</b>  <a href="https://youtube.videoken.com/embed/SUusup7FfJo">https://youtube.videoken.com/embed/SUusup7FfJo</a></p>	<b>8Hrs</b>
UNIT-II	
<p><b>Assembly programming and instructions of 8051:</b> Introduction to 8051 assembly programming, Assembling and running an 8051 program, Data types and Assembler directives, Arithmetic, logic instructions and programs, and program control instruction.</p> <p><b>Laboratory Sessions/ Experimental learning:</b></p> <ol style="list-style-type: none"> <li>1. Simulate a program using Keil to find number of zeroes and ones in a given number.</li> <li>2. Simulate a program to find whether a number is odd or even using Keil.</li> </ol> <p><b>Applications:</b> Generating assembly language algorithms for various applications</p> <p><b>Video link :</b>  <a href="https://youtube.videoken.com/embed/oRPluYsxF28">https://youtube.videoken.com/embed/oRPluYsxF28</a></p>	<b>8Hrs</b>
UNIT-III	
<p><b>8051 programming in C:</b> Data types and time delay, I/O programming, Logic operations, TMOD and TCON, Timer Programming in mode 1and 2, Counter programming, SCON and SBUF, Serial port programming.</p> <p><b>Laboratory Sessions/ Experimental learning:</b> Generate a Program for reading and manipulating port data.</p>	<b>8Hrs</b>

<p><b>Applications:</b> Generating baud rates and time delays for various embedded applications.</p> <p><b>Video link :</b></p> <ul style="list-style-type: none"> <li>• <a href="https://youtube.videoken.com/embed/2AVOxLPKjeA">https://youtube.videoken.com/embed/2AVOxLPKjeA</a></li> <li>• <a href="https://youtube.videoken.com/embed/NhurqshD0HA">https://youtube.videoken.com/embed/NhurqshD0HA</a></li> </ul>	
<b>UNIT-IV</b>	
<p><b>8051 Interrupts:</b> 8051 interrupts, Interrupt priority, Interrupt enable register.</p> <p><b>Interfacing:</b> Stepper motor interfacing, DC motor interfacing, ADC 0808 interfacing to 8051, DAC interfacing, LCD and keyboard interfacing.</p> <p><b>Laboratory Sessions/ Experimental learning:</b> Simulate a program using Keil to generate a square wave of frequency 100KHz on pin P2.3. Use timer 1 in mode 1. Take crystal frequency of 22MHz.</p> <p><b>Applications:</b> Interfacing of external devices to microcontrollers.</p> <p><b>Video link:</b></p> <ul style="list-style-type: none"> <li>• <a href="https://youtube.videoken.com/embed/DpMxQzHhyyc">https://youtube.videoken.com/embed/DpMxQzHhyyc</a></li> <li>• <a href="https://youtube.videoken.com/embed/MqhxeOi8R1Q">https://youtube.videoken.com/embed/MqhxeOi8R1Q</a></li> </ul>	<b>8 Hrs</b>
<b>UNIT-V</b>	
<p><b>ARM Embedded Systems:</b> Microprocessors versus Microcontrollers, The RISC design philosophy, The ARM Design Philosophy, Embedded System Hardware, Embedded System Software, operating system.</p> <p><b>ARM Processor Fundamentals:</b> Registers, Current Program Status Register, Pipeline.</p> <p><b>Laboratory Sessions/ Experimental learning:</b></p> <ol style="list-style-type: none"> <li>1. Simulate a program using keil to toggle Led's connected to Port 1 continuously with some delay.</li> <li>2. Develop any simple project using Microcontroller.</li> <li>3. Virtual lab experiment: Interface DAC and LCD to 8051</li> </ol> <p><b>Video link:</b> ARM controllers for embedded applications.</p> <ul style="list-style-type: none"> <li>• <a href="https://nptel.ac.in/courses/106105193/">https://nptel.ac.in/courses/106105193/</a></li> <li>• <a href="https://nptel.ac.in/courses/117106111/">https://nptel.ac.in/courses/117106111/</a></li> </ul>	<b>8Hrs</b>
<b>LABORATORY EXPERIMENTS</b>	



1. Develop code for data movement and block exchange.
2. Find largest or smallest numbers in a series and sorting numbers in ascending / descending order.
3. Develop data conversion programs.
4. Develop counters using conditional statements and loop structure.
5. Perform 16-bit addition, subtraction, Multiplication and division.
6. Control the speed of a DC motor using PWM.
7. Rotate the Stepper motor in specified direction (clockwise or counter-clockwise).
8. Generate waveforms using DAC.

Along with mandatory experiments students are advised to complete two open ended experiments. The following are some suggestions for open ended experiments.

9. Hardware implementation of a LCD control using 8051 microcontrollers.
10. Interface of Seven segment LED display with 8051 Microcontroller.
11. Interface an Elevator with 8051 Microcontroller.

Course Outcomes: After completing the course, the students will be able to	
C213.1	Select microcontrollers for different applications and explain the functional units of 8051.
C213.2	Develop algorithm and formulate assembly language program for a given task.
C213.3	Develop program for timers and serial port using C.
C213.4	Design interfacing circuitry to interface various peripheral devices to microcontroller.
C213.5	Explain the basics of ARM Embedded systems.

Reference Books	
1	Embedded Systems: Architecture, Programming and Design by Rajkamal , Tata McGraw-Hill, 7th Edition, 2006.
2	The 8051 Microcontroller Architecture Programming & Applications by Kenneth J. Ayala, Penram International, 1996.
3	8051 Microcontroller and Embedded Systems– using assembly and C by Muhammad Ali Mazidi, Janice Gillespie Mazidi, Rollin D. McKinlay, Pearson Education, 2nd Edition.
4	ARM Systems Developers Guide by Andrew.N. Sloss, Elsevier Publications, 2008.

### Continuous Internal Evaluation (CIE):

#### Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes

and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

### Laboratory- 50 Marks

The laboratory session is held every week as per the time table and the performance of the student is evaluated in every session. The average of the marks over number of weeks is considered for 30 marks. At the end of the semester a test is conducted for 10 marks. The students are encouraged to implement additional innovative experiments in the lab and are awarded 10 marks. Total marks for the laboratory is 50.

### Semester End Examination (SEE):

**Total marks: 50+50=100**

SEE for 50 marks are executed by means of an examination.

The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C214.1	3	3	2	2	1	-	-	-	3	-	-	3
C214.2	3	3	3	3	3	-	-	-	-	-	-	3
C214.3	3	3	3	3	3	-	-	-	-	-	-	3
C214.4	3	3	3	3	3	-	-	-	-	-	-	3

<b>Semester: IV</b>		
<b>SAMSKRUTHIKA KANNADA</b>		
<b>(Theory)</b>		
Course Code: MVJ21KAN46		CIE Marks: 50
Credits: L:T:P: 1:0:0		SEE Marks: 50
Hours: 15L		SEE Duration: 02 Hrs.
Course Learning Objectives: This course will enable students to understand Kannada and communicate in Kannada language		

<b>UNIT-I</b>	
೧. ಕನ್ನಡ ಭಾಷೆ-ಸಂಕ್ಷಿಪ್ತ ವಿವರಣೆ. ೨. ಭಾಷಾ ಪ್ರಯೋಗಲಗ್ನಗುವ ಲೋಪದೋಷಗಳು ಮತ್ತು ಅವುಗಳ ನಿವಾರಣೆ	3 Hrs
<b>UNIT-II</b>	
೧. ಲೇಖನ ಚಿಹ್ನೆಗಳು ಮತ್ತು ಅವುಗಳ ಉಪಯೋಗ ೨. ಪತ್ರ ವ್ಯವಹಾರ.	3 Hrs.
<b>UNIT-III</b>	
೧. ಆಡಳಿತ ಪತ್ರಗಳು. ೨. ಸರ್ಕಾರದ ಆದೇಶ ಪತ್ರಗಳು	3 Hrs.
<b>UNIT-IV</b>	
೧. ಸಂಕೀಪ್ತ ಪ್ರಬಂಧರಚನೆ, ಪ್ರಬಂಧ ಮತ್ತು ಭಾಷಾಂತರ ೨. ಕನ್ನಡ ಶಬ್ದಸಂಗ್ರಹ	3 Hrs.
<b>UNIT-V</b>	
೧. ಕಂಪ್ಯೂಟರ್ ಹಾಗೂ ಮಾಹಿತಿ ತಂತ್ರಜ್ಞಾನ ೨. ಪಾರಿಭಾಷಿಕ ಆಡಳಿತ ಕನ್ನಡ ಪದಗಳು ಮತ್ತು ತಾಂತ್ರಿಕ/ಕಂಪ್ಯೂಟರ್ ಪಾರಿಭಾಷಿಕ ಪದಗಳು.	3 Hrs.

<b>Reference Books</b>	
1.	Adalitha Kannada – Dr. L Thimmesh, Prof. V Keshav Murthy

#### Continuous Internal Evaluation (CIE):

##### Theory for 50 Marks

CIE for 50 marks, executed by way of tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 40 marks and assignment is evaluated for 10 marks. The three tests are conducted for 40 marks each and the average of all the tests are calculated for 40. The marks for the assignments are 10 (2 assignments for 5 marks each). The marks obtained in test and assignment are added and report CIE for 50 marks.

##### Semester End Examination (SEE):

SEE for 50 marks, executed by means of an examination. The Question paper contains objective type questions for 50 marks covering the entire syllabus having same complexity in terms of COs and Bloom's taxonomy level.

Total marks: 50+50=100

<b>Semester: IV</b>		
<b>BALIKE KANNADA (Theory)</b>		
Course Code: MVJ21KAN46		CIE Marks: 50
Credits: L:T:P: 1:0:0		SEE Marks: 50
Hours: 15L		SEE Duration: 02 Hrs.
Course Learning Objectives: This course will enable students to understand Kannada and communicate in Kannada language		

<b>UNIT-I</b>	
Vyavharika Kannada –Parichaya (Introduction to Vyavharika Kannada )	<b>3 Hrs</b>
<b>UNIT-II</b>	
Kannada Aksharamaale haagu uchcharane(Kannada Alphabets and Pronunciation)	<b>3 Hrs.</b>
<b>UNIT-III</b>	
Sambhashanegaagi Kannada Padagalu (Kannada Vocubulary for Communication).	<b>3 Hrs.</b>
<b>UNIT-IV</b>	
Kannada Grammar in Conversations(Sambhasaneyalli Kannada Vyakarana)	<b>3 Hrs.</b>
<b>UNIT-V</b>	
Activities in Kannada	<b>3 Hrs.</b>

<b>Reference Books</b>	
1.	Adalitha Kannada – Dr. L Thimmesh, Prof. V Keshav Murthy

#### Continuous Internal Evaluation (CIE):

##### Theory for 50 Marks

CIE for 50 marks, executed by way of tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 40 marks and assignment is evaluated for 10 marks. The three tests are conducted for 40 marks each and the average of all the tests are calculated for 40. The marks for the assignments are 10 (2 assignments for 5 marks each). The marks obtained in test and assignment are added and report CIE for 50 marks.

#### Semester End Examination (SEE):

SEE for 50 marks, executed by means of an examination. The Question paper contains objective type questions for 50 marks covering the entire syllabus having same complexity in terms of COs and Bloom's taxonomy level.

Total marks: 50+50=100

Semester: IV		
Digital Logic Design Using Integrated Circuits (Theory and Practice)		
Course Code:	MVJ21EEA47	CIE Marks:50
Credits: L: T:P:	0:0:2	SEE Marks: 50
Hours:	5L+10P	SEE Duration: 02 Hours
<b>Course Learning Objectives: The students will be able to</b>		
1	Understanding of Basic Logic gates using IC's.	
2	Design of various combinational digital circuits using logic gates.	
3	Design of Binary to gray code and BCD to EX-3 code converters.	
4	Design and testing of various counters to count the data in a continuous loop.	
5	Design MOD-N Counters for interfacing to digital displays.	
UNIT-I		
Introduction: Study of basic logic gates using Integrated circuits, Simplification, realization of Boolean expressions using logic Gates/Universal gates.		3 Hrs
UNIT-II		
Adder and Subtractor: Realization of half/full adder using logic gates, Realization of half/full Subtractor using logic gates.		3 Hrs
UNIT-III		
Converters: Realization of Binary to Gray code converter, Realization of Gray code converters to Binary, BCD to Ex-3 code conversion and Ex-3 code to BCD conversion.		3 Hrs
UNIT-IV		
Counters: Design and testing of ring counter, Design and testing of Johnson counter,		3 Hrs
Module-V		
MOD-N Counters: Realization of 3-bit counters as a sequential circuit using 7476, Design of mod N counter using 7490		3 Hrs
<b>Course Outcomes: After completing the course, the students will be able to</b>		
215.1	Understand basic concept of Basic Logic gates and Truth Tables.	
215.2	Design of Half/full adder/subtractor.	
215.3	Design various code converters for sending signals.	
215.4	Design Ring and Johnson counters to count the data in a continuous loop.	
215.5	Design of 3-bit counters for interfacing to digital displays.	
Reference Books		
1.	Fundamentals of Digital Circuits, A Anand Kumar, 4 <sup>th</sup> Edition, PHI Publishers, 2016.	
2.	A Textbook of Digital Electronics, Dr. R. S. Sedha, S Chand & Co Ltd, 3 <sup>rd</sup> Edition, 2017.	

Semester: IV		
Additional Mathematics-II (Common to all branches)		
Course Code:	MVJ21MATDIP-II	CIE Marks:50
Credits:	L:T:P:S: 1:2:0:0	SEE Marks: 50
Hours:	40L	SEE Duration: 3 Hrs
Course Learning Objectives: The students will be able to		
1	To familiarize the important concepts of linear algebra.	
2	Aims to provide essential concepts differential calculus, beta and gamma functions.	
3	Introductory concepts of three-dimensional geometry along with methods to solve them.	
4	Linear differential equations	
5	Formation of partial differential equations.	

UNIT-I	
<p><b>Linear Algebra:</b> Introduction - Rank of matrix by elementary row operations - Echelon form. Consistency of system of linear equations - Gauss elimination method. Eigen values and eigen vectors of a square matrix. Diagonalization of a square matrix of order two.</p> <p><b>Self study:</b> Application of Cayley-Hamilton theorem (without proof) to compute the inverse of a matrix-Examples.</p> <p><b>Video Link:</b> 1. <a href="http://nptel.ac.in/courses.php?disciplineID=111">http://nptel.ac.in/courses.php?disciplineID=111</a></p>	8Hrs
UNIT-II	
<p><b>Differential calculus:</b> Indeterminate forms: L-Hospital rule (without proof), Total derivatives, and Composite functions. Maxima and minima for a function of two variables.</p> <p><b>Beta and Gamma functions:</b> Beta and Gamma functions, Relation between Beta and Gamma function-simple problems.</p> <p><b>Self study:</b> Curve tracing.</p> <p><b>Video Link:</b> 1. <a href="http://nptel.ac.in/courses.php?disciplineID=111">http://nptel.ac.in/courses.php?disciplineID=111</a></p>	8Hrs
UNIT-III	
<p><b>Analytical solid geometry :</b> Introduction –Directional cosine and Directional ratio of a line, Equation of line in space- differentforms, Angle between two line, shortest distance between two line, plane and equation of plane in different forms and problems.</p> <p><b>Video Link:</b> 1. <a href="http://nptel.ac.in/courses.php?disciplineID=111">http://nptel.ac.in/courses.php?disciplineID=111</a></p>	8Hrs
UNIT-IV	
<p><b>Differential Equations of higher order:</b> Linear differential equations of second and higher order equations with constant coefficients. Inverse Differential operator, Operators methods for finding particular integrals, and</p>	8Hrs

Euler –Cauchy equation.  <b>Self study:</b> Method of variation of parameters <b>Video Link:</b> 1. <a href="http://nptel.ac.in/courses.php?disciplineID=111">http://nptel.ac.in/courses.php?disciplineID=111</a>	
<b>UNIT-V</b>	
<b>Partial differential equation:</b> Introduction- Classification of partial differential equations, formation of partial differential equations. Method of elimination of arbitrary constants and functions. Solutions of non-homogeneous partial differential equations by direct integration. Solution of Lagrange’s linear PDE. <b>Self study:</b> One dimensional heat and wave equations and solutions by the method of separable of variable  <b>Video Link:</b> 1. <a href="http://nptel.ac.in/courses.php?disciplineID=111">http://nptel.ac.in/courses.php?disciplineID=111</a>	<b>8Hrs</b>

<b>Course Outcomes: After completing the course, the students will be able to</b>	
C217.1	Make use of matrix theory for solving system of linear equations and compute eigenvalues and eigen vectors required for matrix diagonalization process.
C217.2	Learn the notion of partial differentiation to calculate rates of change of multivariate functions and solve problems related to composite functions and Jacobians.
C217.3	Understand the Three-Dimensional geometry basic, Equation of line in space-differentforms, Angle between two line and studying the shortest distance .
C217.4	Demonstrate various physical models through higher order differential equations and solve such linear ordinary differential equations.
C217.5	Construct a variety of partial differential equations and solution by exact methods.

<b>Reference Books</b>	
1.	B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 43 <sup>rd</sup> Edition, 2013,
2.	G. B. Gururajachar, Calculus and Linear Algebra, Academic Excellent Series Publication, 2018-19
3.	Chandrashekar K. S, Engineering Mathematics-I, Sudha Publications, 2010.

### **Continuous Internal Evaluation (CIE):**

#### **Theory for 50 Marks**

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