Metric No. 2.6.1

Programme Outcomes (POs) and Course Outcomes (COs) for all Programmes offered by the institution are stated and displayed on website and attainment of POs and COs are evaluated.

P.R. Pote Patil College of Engineering & Management, Amravati

Self-Study Report

2.6.1. Programme Outcomes (POs) and Course Outcomes (COs) for all Programmes offered by the institution are stated and displayed on website and attainment of POs and COs are evaluated.

Index

S. No.	Description
1	Display Material of COs, POs, PSOs
2	Course Outcomes s of all departmental courses
3	Attainment of programme outcomes and course outcomes are evaluated by the institution • Attainment Procedure of Pos and Cos with Sample data • Overall CO-PO attainment of an Academic Year • Overall CO-PSO attainment of an Academic Year

P. R. Pote Patil Edu. & Welf. Trust's Group of Institutions Code-1107 AMRAVATI

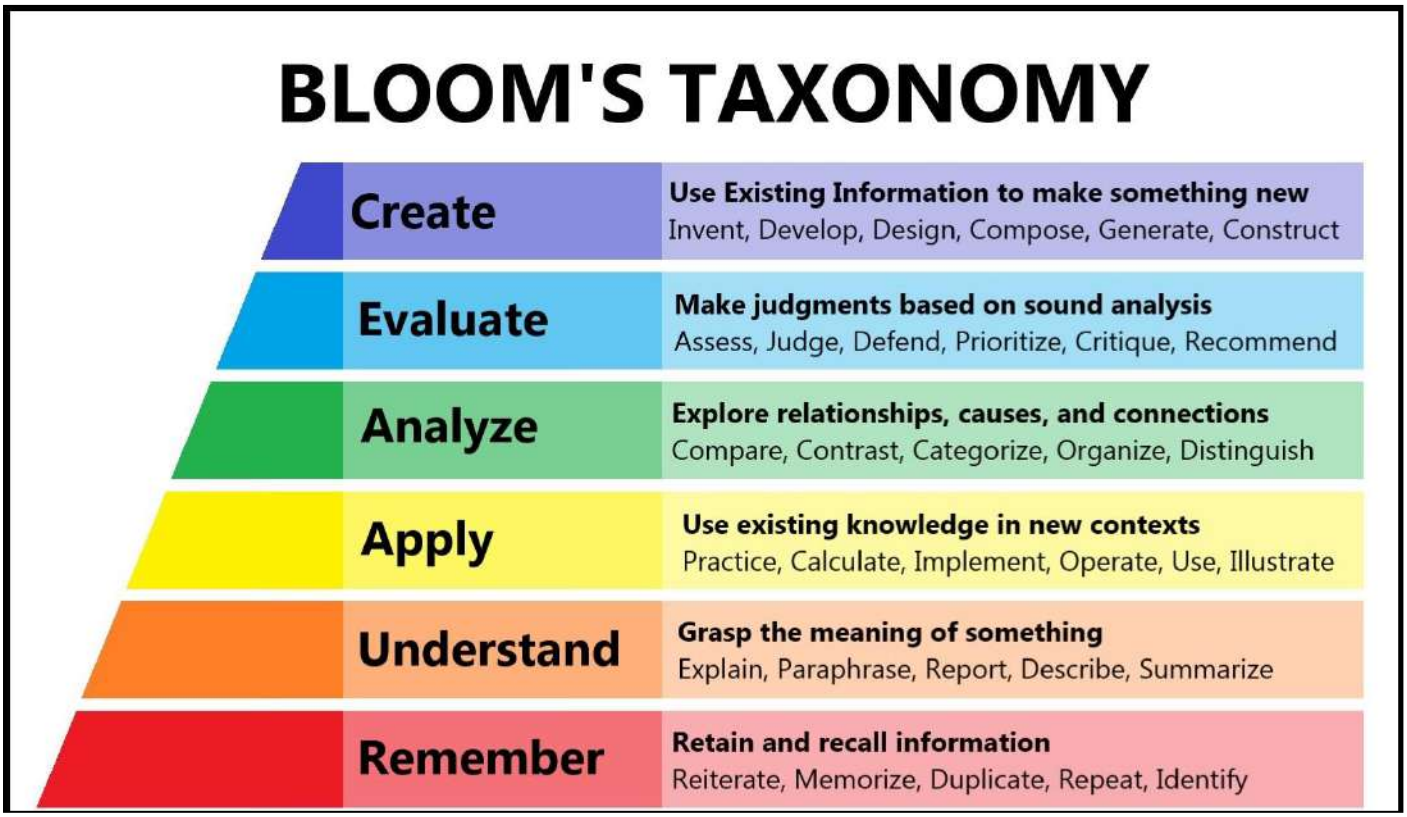
Principal
P. R. Pote (Patil)
College of Engineering & Management
Amravati

Program Outcomes as defined by NBA (PO)

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

2. Bloom's Taxonomy Levels of Learning used for CO-PO Mapping



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Amravati

Display Material of COs, POs and PSOs

1] College Website: https://prpotepatilengg.ac.in/

2] Departmental homepage on college website:
https://prpotepatilengg.ac.in/civil/program-outcomes/
https://prpotepatilengg.ac.in/computerscience/program-specific-outcomes/
https://prpotepatilengg.ac.in/mechanical/program-education-objectives/
https://prpotepatilengg.ac.in/mba/program-outcomes/
https://prpotepatilengg.ac.in/electrical/program-education-objectives/
https://prpotepatilengg.ac.in/electronics/program-outcomes/
https://prpotepatilengg.ac.in/mca/program-outcomes/

3] Principal Office:

P. R. Pote (Patil) Edu. & Welf. Trust's Group of Inst. Code-1107 Amravati

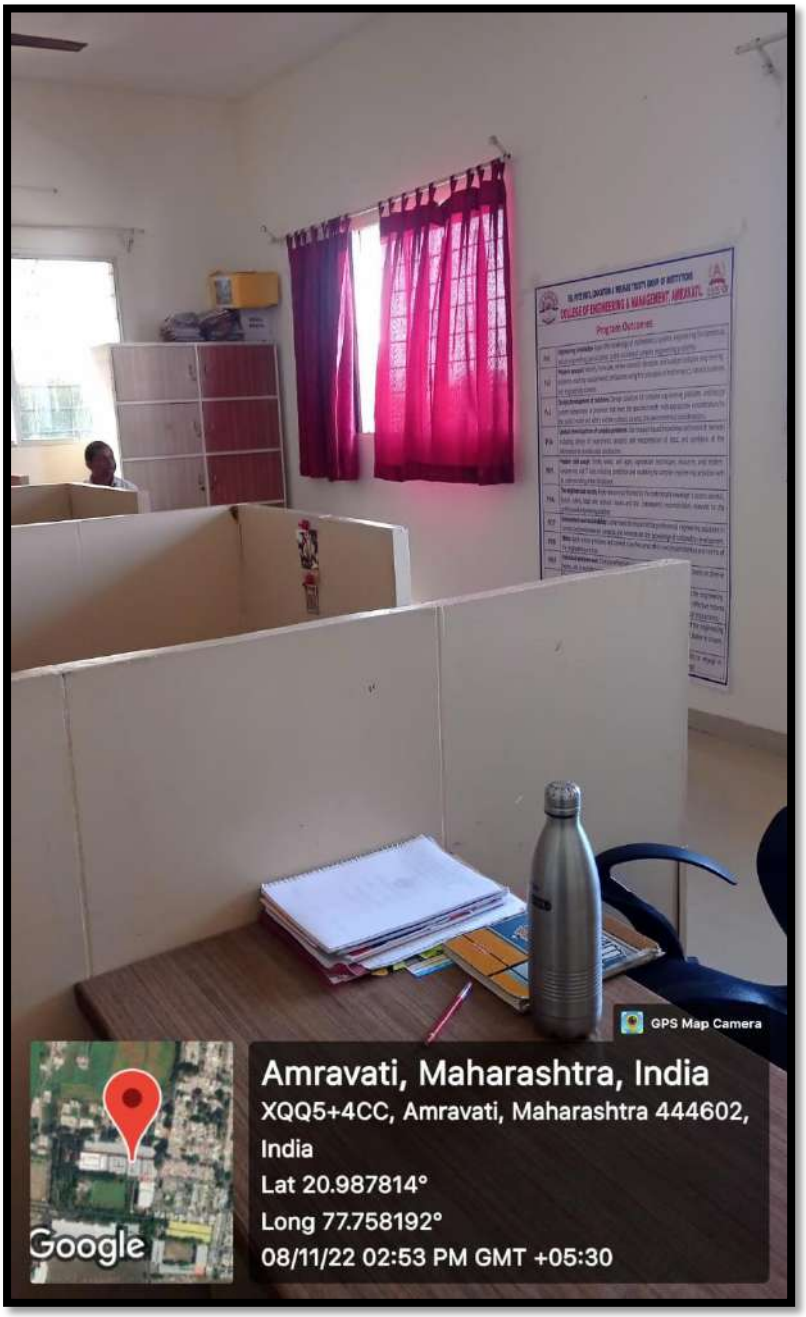
Principal
P. R. Pote (Patil)
College of Engineering & Management
Amravati

4] Library

P. R. Pote Patil Edu. & Welf. Trust's Group of Inst. Code-1107 AMRAVATI

Principal
P. R. Pote (Patil)
College of Engineering & Management
Amravati

5] Faculty Room:



P. R. Pote (Patil) Trust's Group of Instt. Code-1107 AMRAVATI

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Amravati

6] Course File Handouts:

P. R. Pote (Patil) College of Engineering & Management, Amravati
Department of Electrical Engineering
Course files Contents

1) Vision & Mission of the Institute.
2) Vision & Mission of the Department.
3) PO, PSO, PEO
4) Teaching scheme & Syllabus with course code, Course objective & course outcomes.
5) Academic planner/Calendar.
6) Master Time table & class timetable.
7) Teaching plan
8) Executed teaching plan
9) Roll List/ Attendance.
10) Assessment method of attainment of CO & PO.
11) CO-PO, CO-PSO mapping with justification.
12) Attainment of CO-PO, CO-PSO.
13) Best Practices in Teaching & learning
14) Feedback of students for assessment of attainment of CO & PO.
15) Topics beyond syllabus.
16) - Unit test-I & II Papers & Answer sheet.
    - Scheme of Evaluation & Model answer sheet.
    - Re-test –I & II Papers & Answer sheet
    - Scheme of Evaluation & Model answer sheet.
    - Assignment of Failed students in Re-test.
17) Test marks & Result/ analysis.
18) Assignment on Unit 5 & 6 & its record
19) Result Analysis (University Result).
20) Internal marks analysis
21) University papers.
22) List of Academically Bright & weak students.
23) Corrective measures to improve the result (Include extra classes/guest lecture/ Assignment/quiz/industrial visit)
24) Course material.

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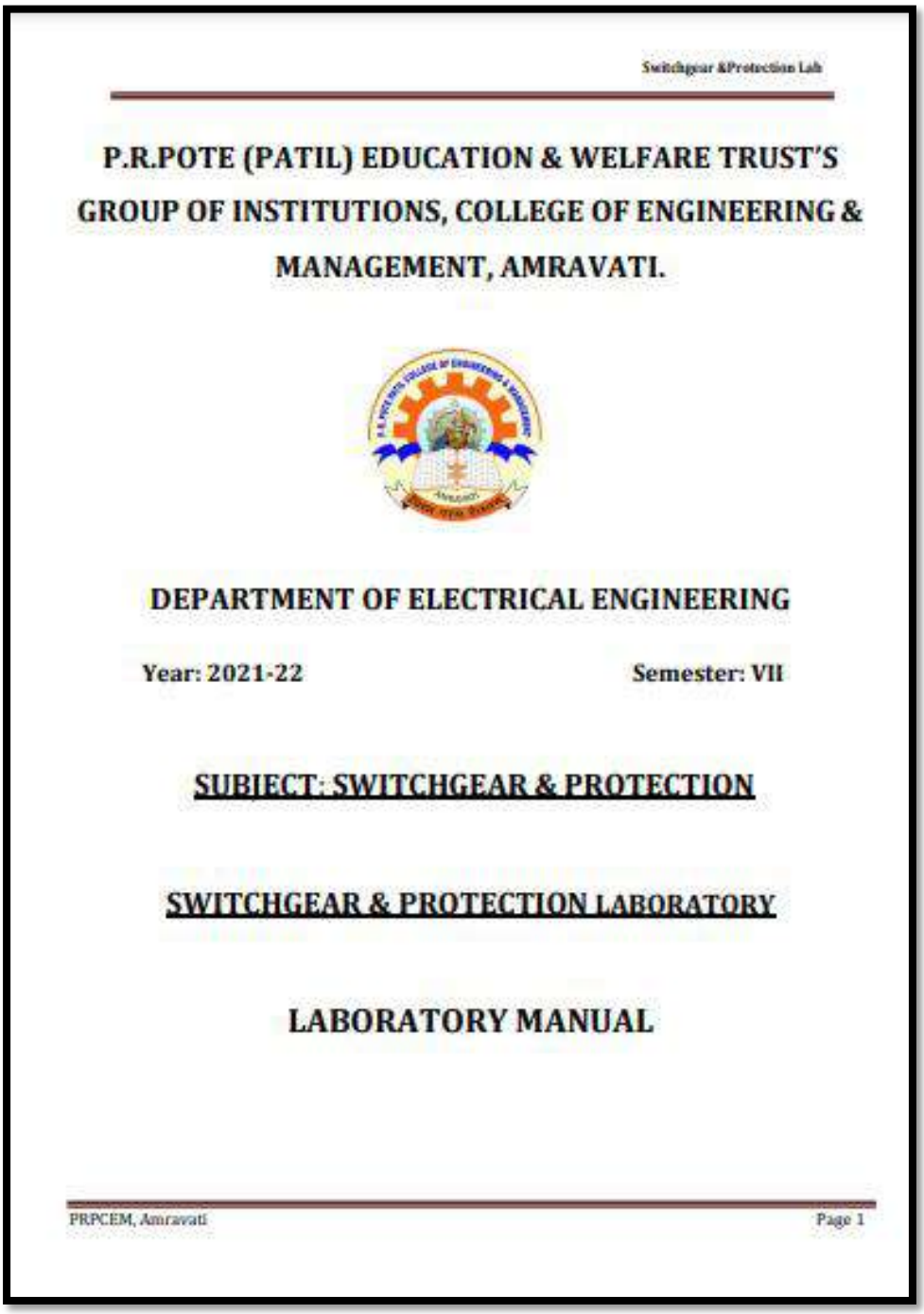
7] Laboratory Manual



Switchgear &Protection Lab

P.R.POTE (PATIL) EDUCATION & WELFARE TRUST'S
GROUP OF INSTITUTIONS, COLLEGE OF ENGINEERING &
MANAGEMENT, AMRAVATI.

DEPARTMENT OF ELECTRICAL ENGINEERING

Year: 2021-22 Semester: VII

SUBJECT: SWITCHGEAR & PROTECTION

SWITCHGEAR & PROTECTION LABORATORY

LABORATORY MANUAL

PRPCEM, Amravati Page 1

P. R. Pote (Patil) College of Engineering & Management, Amravati

Department of Electrical Engineering

Name of the Program: B. E. (Electrical & Electronics) Engineering	**Academic Year:**
Class: VII Sem-Section-A	**Section:** A
Course/Subject: Switch Gear & Protection Lab	**Course Code:**
Course Owner: Dr. S. B. Warkad	**Designation:** Professor

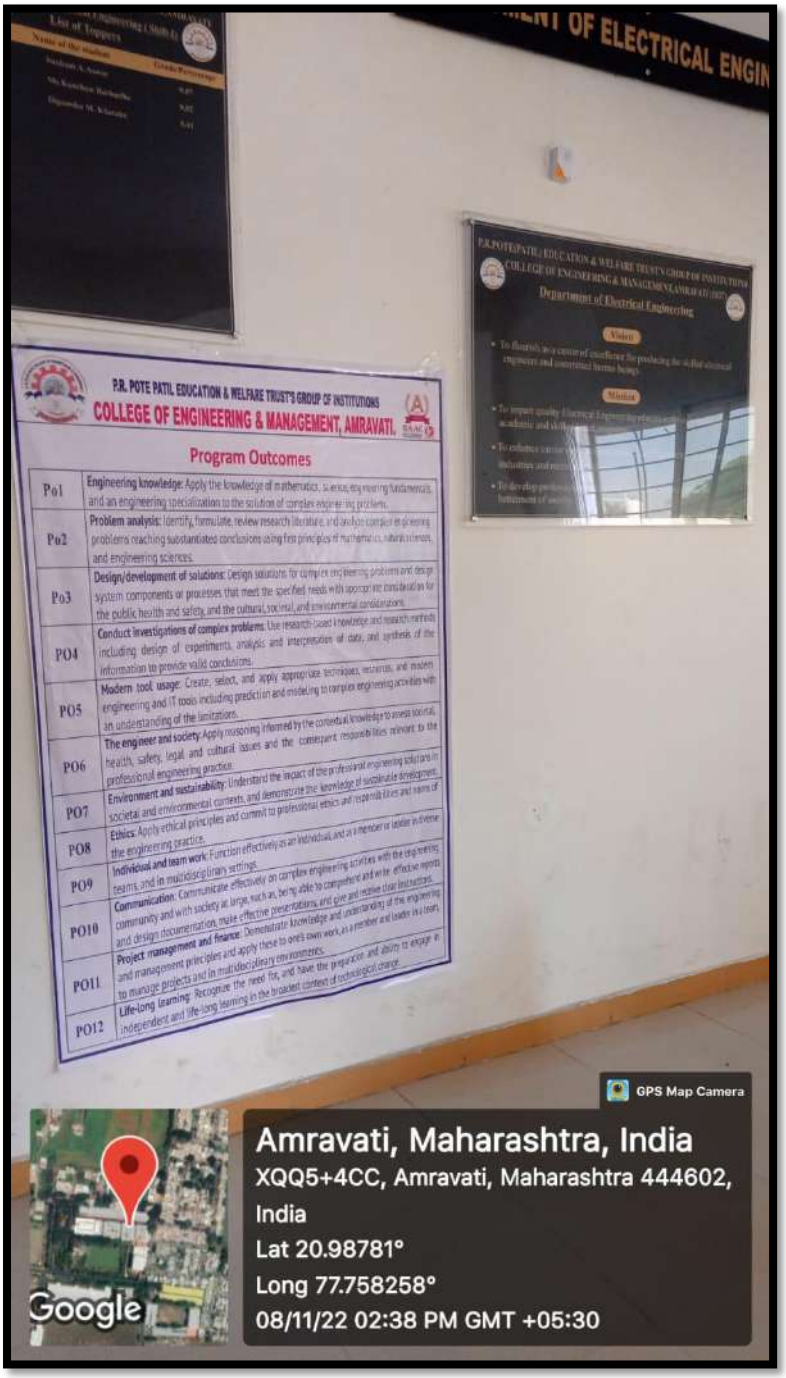
SN	List of Experiment
1	To study different equipment used in electrical power system/switchgear and protection laboratory
2	To study the Arc extinguish phenomenon using MATLAB tool.
3	To plot the characteristics of Fuses and Miniature Circuit Breaker
4	To Study Transformer Differential Protection using Numerical Relay
5	To plot the characteristics of Electromagnetic IDMT Relay.
6	To plot the characteristics of Directional Over Current Relay.
7	To study the operation of Numerical Overvoltage and Undervoltage Relay.
8	To study the operation of Numerical Overcurrent Relay.
9	To study the earth fault and phase protection in power system.
10	To simulate Protection of Three phase line against different types of faults using MATLAB

Lab Course Outcomes

After Successful completion of Laboratory course, the students will able to

SN	Outcomes
1	understand and list various equipment used in electrical power system/switchgear and protection laboratory.
2	explain and demonstrate Arc extinguish phenomenon using MATLAB tool.
3	explain or illustrate the characteristics of Fuses and Miniature Circuit Breaker used for protection.
4	understand and demonstrate working of Transformer Differential Protection, Overvoltage, Undervoltage, Overcurrent, earth fault and phase protections using Numerical Relays.
5	explain or illustrate the characteristics of IDMT, and directional overcurrent electromagnetic Relays.
6	simulate Protection of Three phase line against different types of faults using modern tools i.e. MATLAB

8] Corridors:



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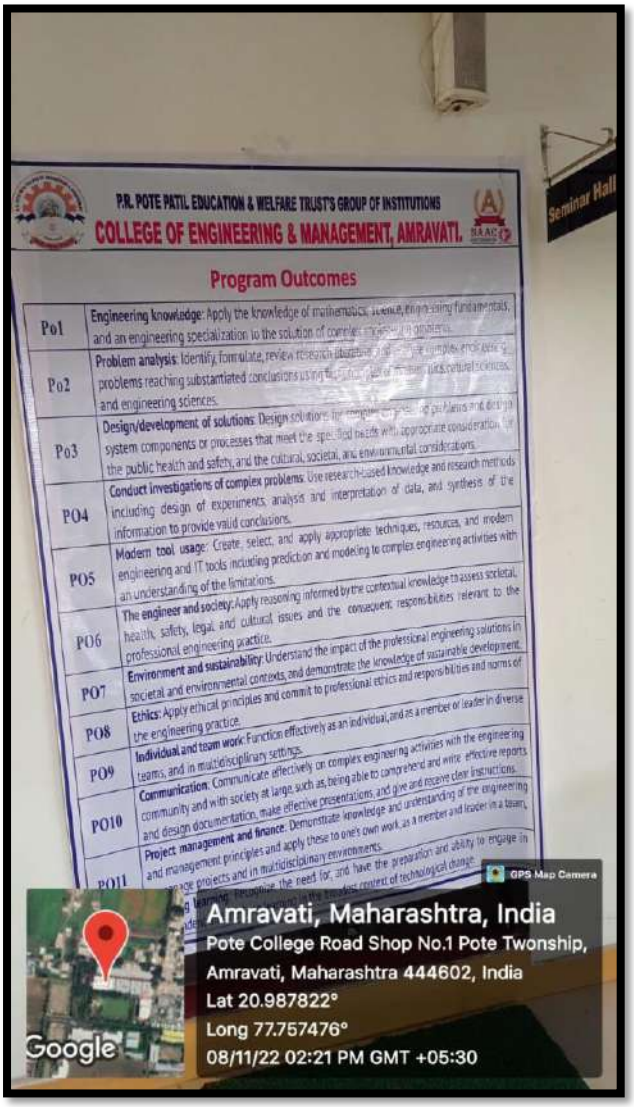
Amravati

9] Seminar Hall:



P. R. Pote (Patil)
College of Engineering & Management
Amravati

P. R. Pote Patil Edu. & Welf. Trust's, Group of Institutions,
College of Engineering & Management, Amravati
(Recognized by AICTE, New Delhi, Approved by Govt. of Maharashtra & Affiliated to SGBAU, Amravati)
• Kathora Road, Amravati, Maharashtra, India
• Ph. No. : +91-721-2a76116, Fax No. : +91-721-2530849, Email : prpotepaticollege@gmail.com
• Web. : www.prpcem.org, www.prpatilcollege.org

Course Outcomes

Department of Computer Science & Engineering

P. R. Pote College of Engineering and Technology, Amravati.

Department of Computer Science and Engineering

Third Semester

Second Year (Third Semester)	**Academic Year: 2019-20**
Course/Subject: PROGRAMMING METHODOLOGY	**Course Code:** 3KS02

On completion of this Subject/Course the student shall be able to

SN	Outcomes	Bloom's Taxonomy Levels
3KS02.1	Understand implementation of object oriented principles in software design process.	L1
3KS022	Comprehend Java programs for real applications using java constructs and libraries.	L2
3KS02.3	Understand and apply various object oriented features like inheritance, data abstraction, encapsulation and polymorphism to solve various computing problems using Java language.	L3
3KS02.4	Gained knowledge related to implementation of Exception Handling in java.	L1
3KS02.5	Comprehend graphical user interface and Event Handling in java.	L2
3KS02.6	Understand object oriented principles in software design process.	L1

Syllabus

Unit I:

Introduction to Object Oriented Programming: Introduction, Need of OOP, Principles of Object-Oriented Languages, Procedural Language Vs OOP, Application of OOP, Java Virtual Machine, Java features, Program Structures. Java Programming Constructs: Variables, Primitive data types, Identifier, Literals, Operators, Expressions, Precedence Rules and Associativity, Primitive Type Conversion and Casting, Flow of Control.

Unit II:

Classes and Objects: Classes, Objects, Creating Objects, Methods, Constructors, Cleaning up Unused Objects, Class Variable and Methods, this keyword, Arrays, Command Line Arguments.

Unit III:

Inheritance: Inheritance vs. Aggregation, Method Overriding, super keyword, final keyword, Abstract class. Interfaces, Packages and Enumeration: Interface, Packages, java.lang package, Enum type.

Unit IV:

Exception: Introduction, Exception handling Techniques, User-defind exception, Exception Encapsulation and Enrichment. Input/Output: The java.io.file Class, Reading and Writing data, Randomly Accessing a file, Reading and Writing Files using I/O Package.

Unit V:

Applets: Introduction, Applet Class, Applet structure, Applet Life cycle, Common Methods used in displaying the output, paint (), update () and repaint (), More about applet tag, get Document Base () and get Code Base () methods, Applet Context Interface, Audio clip, Graphic Class, Color, Font, Font Metrics.

Unit VI:
Event Handling: Introduction, Event delegation Model, java.awt.event Description, Sources of events, Event Listeners, Adapter classes, Inner Classes. Abstract Window Toolkit: Introduction, Components and Containers, Button, Label, Checkbox, Radio Buttons, List Boxes, Choice Boxes, Textfield and Textarea, Container Class, Layouts, Menu, Scrollbar.

Text Book: Sachin Malhotra and Saurabh Choudhary: Programming in Java, Oxford University Press 2010.

Reference Books:
1. Herbert Schildt: Java Complete References (McGraw Hill)
2. E. Balagurusamy: Programming with Java (McGraw Hill)
3. Khalid Mughal: A Programmer's Guide to Java Certification, 3rd Edition (Pearson)
4. Liang: A text Book of Java Programming, (PHI)
5. Sharnam Shah and Vaishali Shah: Core Java for Beginners,(SPD),2010.

Second Year (Third Semester)		**Academic Year: 2019-20**
Course/Subject: ELECTRONIC DEVICES AND CIRCUITS		**Course Code:** 3KS 03
On completion of this Subject/Course the student shall be able to		
SN	**Outcomes**	**Bloom's Taxonomy Levels**
3KS03.1	To explain basic electronic devices and its application.	L2
3KS03.2	To describe the structure of BJT and compare its configuration	L2
3KS03.3	To analyze different biasing and compensation technique.	L4
3KS03.4	To examine the performance of FETs on the basis of their types and working.	L4
3KS03.5	To demonstrate and explain working of different types of oscillators.	L3
3KS03.6	To interpret the operation of different optoelectronic devices	L3

Syllabus

Unit I:
pn-Junction Diode, Characteristics and Parameters, Diode Approximation, DC load line analysis, Temperature effects, Diode AC models, Zener diodes, Half- Wave Rectifications, Full-Wave Rectifications, Half-Wave Rectifier Power Supply, Full-Wave Rectifier Power Supply, RC and AC Power Supply Filters.
Unit II:
BJT operation, BJT Voltages and Currents, BJT Amplification: Current and Voltage, BJT Switching, Common-Base Characteristics, Common-Emitter Characteristics, CommonCollector Characteristics, Transistor testing.
Unit III:
DC Load Line and Bias Point, Base Bias, Collector-to-Base Bias, Voltage-Divider Bias, Comparison of Basic Bias Circuits, Troubleshooting BJT Bias Circuits, Bias Circuit Design.
SECTION-B
Unit IV:
Junction Field Effect Transistors, n-Channel and p-Channel JFET, JFET Characteristics, JFET

tables, Predicate calculus, Inference theory of the Predicate Calculus.

UNIT III:

Set Theory: Basic concepts, Venn Diagrams, Representation of Discrete Structure, Relation and ordering, Partial Ordering, Functions, Recursions, Sets and predicates.

UNIT IV:

Algebraic Structures: Semi-groups and Monoids, Product & Quotients of semi-groups, Polish expression & their compilation, Groups, Product and Quotients of Groups.

UNIT V:

Lattice & Boolean Algebra: Lattices, partially ordered sets, Boolean algebra, Functions on Boolean Algebra, Boolean Functions as Boolean Polynomials, Minimization of Boolean Functions.

UNITVI:

Graph Theory: Basic concepts, Paths, Reachability & connectedness, Matrix representation of graphs, Trees: tree searching, Undirected trees, Minimal spanning trees.

Text Book: J.P.Trembley,R.Manohar:"Discrete Mathematical Structures with application to Computer Science" 1988(MCG)

Reference Books:

1. C.L.Liu : "Combinational Mathematies" Mc Graw Hill, 1988
2. Stanant "Discrete Structure" Prentice Hall.
3. C.L.Liu "Element of Discrete Mathematics" Second Edition McGraw Hill, 1987
4. Norman L.Biggs "Discrete Mathematics" Second Edition,Oxford University Press, Indian Edition.
5. N. Chandrasekaran & M. Umaparvathi, "Discrete Mathematics" PHI (EEE) 2010.
6. Purna Chandra Biswal, "Discrete Mathematics & Graph Theory" Second Edition, PHI (EEE)2009.
7. Chakraborty and Sarkar," Discrete Mathematics" Oxford University Press, Indian Edition,2011.

Second Year (Third Semester)	**Academic Year: 2019-20**
Course/Subject: COMPUTER ORGANIZATION	**Course Code:** 3KS 05

On completion of this Subject/Course the student shall be able to

SN	Outcomes	Bloom's Taxonomy Levels
3KS05.1	To understand the relationship between instruction set architecture, micro architecture, and system architecture and their roles in the development of the computer. ·	L1
3KS05.2	Be aware of the various classes of instruction: data movement, arithmetic, logical and flow control. ·	L2
3KS05.3	Explain how interrupts are used to implement I/O control and data transfers. ·	L2
3KS05.4	Understand how a CPU's control unit interprets a machine –level instructions. ·	L3
3KS05.5	Identify various types of buses in Computer systems. ·	L3
3KS05.6	Understand memory hierarchy. ·	L4

		Taxonomy Levels
4KS 03.1	To Understand the difference between the top-down and bottom-up approach and describe the object-oriented programming in connection with C++	L2
4KS 03.2	To explain the concept of operator overloading, Data Conversion, Pointers & Arrays	L1
4KS 03.3	To demonstrate the use of Inheritance & containership in C++.	L1
4KS 03.4	To implement the concept of Abstract Classes & Virtual functions	L1
4KS 03.5	To demonstrate the concept of streams and file handling in C++	L1

List of Practical's

1. Write a Program in C++ to read and display student information.

2. Write a Program in C++ to demonstrate the use of scope resolution operator.

3. Write a Program in C++ to implement the concept of array of objects.

4. Write a Program in C++ to demonstrate the use of different types of constructor & destructor

5. Write a Program in C++ to implement concept of passing objects

6. Write a program to implement the concept unary operator overloading.

7. Write a program to implement the concept of binary operator overloading

8. Write a Program in C++ to implement the concept of function overloading.

9. Write a program in C++ to demonstrate the type conversion from basic type to class type.

10. Write a program in C++ to demonstrate the type conversion from class type to

Second Year (Fourth Semester)	**Academic Year: 2019-20**
Course/Subject: Assembly Language Programming Lab.	**Course Code:** 4KS 09

On completion of this Subject/Course the student shall be able to

SN	Outcomes	Bloom's Taxonomy Levels
4KS 09.1	Describe 8086 microprocessor and its architecture; also understand instruction processing during the fetch-decode-execute cycle.	L2
4KS 09.2	Design and Test assembly language programs using 8086 microprocessor instruction set.	L4, L5
4KS 09.3	Demonstrate the implementation of standard programming constructs, including control structures and functions, in assembly language.	L3

Inheritance, Interfaces and Packages: Inheritance: Inheritance vs. Aggregation, Method Overriding, super keyword, final keyword, Abstract class. Interfaces: Defining interfaces, Implementing interfaces, Accessing interface variables, Extending interfaces. Packages: Packages, java.lang package, Enum type.

Unit IV:

Exception handling and Input/Output : Exception: Introduction, Exception handling Techniques, User-defind exception, Exception Encapsulation and Enrichment. Input/Output: The java.io.file Class, Reading and Writing data, Randomly Accessing a file, Reading and Writing Files using I/O Package.

Unit V:

Applets :Introduction, Applet Class, Applet structure, Applet Life cycle, Common Methods used in displaying the output, paint (), update () and repaint (), More about applet tag, getDocumentBase() and getCodeBase () methods, Applet Context Interface, Audio clip, Graphic Class, Color, Font, Font Metrics.

Unit VI:

Unit Title:Event Handling :Introduction, Event delegation Model, java.awt.event Description, Sources of events, Event Listeners, Adapter classes, Inner Classes. Abstract Window Toolkit: Introduction, Components and Containers, Button, Label, Checkbox, Radio Buttons, List Boxes, Choice Boxes, Textfield and Textarea, Container Class, Layouts, Menu, Scrollbar.

Text Book:

1. SachinMalhotra and SaurabhChoudhary: Programming in Java, Oxford University Press 2010.
2. Herbert Schildt: Java Complete References (McGraw Hill)

Reference Books:

1. H.M.Dietel and P.J.Dietel, "Java How to Program" Pearson Education/PHI, Sixth Edition.
2. E. Balagurusamy: Programming with Java (McGraw Hill)
3. Dr. R. NageswaraRao: Core Java An Integrated Approach (Dreamtech)
4. Khalid Mughal: A Programmer's Guide to Java Certification, 3rdEdition (Pearson)
5. Sharnam Shah and Vaishali Shah: Core Java for Beginners,(SPD),2010.

Second Year (Third Semester)		**Academic Year: 2019-2020**
Course/Subject: Data Structure		**Course Code: 3KS04/3KE04**
On completion of this Subject/Course the student shall be able to		
SN	**Outcomes**	**Bloom's Taxonomy Levels**
3KS04.1	1. Apply various linear and nonlinear data structures	L3
3KS04.2	2. Demonstrate operations like insertion, deletion, searching and traversing on various data structures	L3
3KS04.3	2. Demonstrate operations like insertion, deletion, searching and traversing on various data structures	L3
3KS04.4	4. Choose appropriate data structure for specified problem domain	L1

Syllabus

UNIT I:

Introduction to Data Structures: Introduction to Data structures, Data Structure Operations, Algorithmic Notation, Complexity of algorithms. String processing: storing strings, character data type, string operations, word processing, and pattern matching algorithms.

Unit II:
Array & Record Structure: Linear arrays : Memory Representation of arrays, traversing linear arrays, insertion & deletion operations, Bubble sort, Linear search and Binary search algorithms. Multi dimensional arrays, Pointer arrays. Record structures and Matrices.
Unit III:
Linked lists : Linked lists: Memory Representation of Linked List, traversing a linked list, searching a linked list. Memory allocation & garbage collection. Insertion & deletion operations on linked lists. Header linked lists, Two- way linked lists.

Unit IV:
Stack & Queue : Stacks: Sequential Memory Representation of Stack, Arithmetic expressions: Polish notation. Quick sort, Recursion, Tower of Hanoi. Queues: Sequential Memory Representation of Queue, DeQueue, Priority queues.
Unit V:
Trees: Introduction to Trees, Binary trees, Memory Representation of Binary Tree, Traversing binary trees, Header nodes, Binary Search Tree, Heap and heapsort, Path length & Huffman"s algorithm.
Unit VI:
Graphs & Sorting Algorithms: Introduction to Graphs, Memory representation of graphs, Warshalls" algorithm, operations on Graphs, Breadth First Search, Depth First Search
Sorting : Insertion Sort, Selection Sort, Radix sort, Merge Sort.
Text Book:

1. Seymour Lipschutz: Data Structures , Schaum"s Outline Series, McGraw-Hill, International Editions.
2. Trembley, Sorenson: An Introduction to Data Structures with Applications, McGraw Hill

Reference Books:

1. Ellis Horowitz, SartajSahni: Fundamentals of Data Structures, CBSPublications.
2. Data Structure Using C, Balagurusamy.
3. Standish: Data Structures in Java, Pearson Education.

Second Year (Third Semester)		**Academic Year: 2019-2020**
Course/Subject: Analog & Digital Electronics		**Course Code: 3KS05**
On completion of this Subject/Course the student shall be able to		
SN	**Outcomes**	**Bloom's Taxonomy Levels**
3KS05.1	1. Explain basic concepts of semiconductor devices and its application.	L2
3KS05.2	2. Compare different Number System and basics of conversion of number systems.	L4
3KS05.3	3. Realize different minimization technique to obtain minimized expression.	L1
3KS05.4	4. Design Combinational Circuits.	L3
3KS05.5	5. Design and Develop Sequential Circuits.	L3

Syllabus

Unit-I:
PN Junction Diode and Bipolar Junction Transistor : PN-Junction Diode, Characteristics and Parameters, BJT operation, BJT Voltages and Currents, BJT Amplification: Current and Voltage, BJT Switching, Common-Base Characteristics, Common-Emitter Characteristics,

On completion of this Subject/Course the student shall be able to		
SN	**Outcomes**	**Bloom's Taxonomy Levels**
6KS09.1	Install and setup of Jenkins on your systems.	L1, L6
6KS09.2	Create and run jobs in Jenkins	L5
6KS09.3	Add and manage plugins. Use plugins in jobs	L5
6KS09.4	Create and run pipelines in Jenkins	L5
6KS09.5	Setup, configure, deploy jobs	L2

List of Practical's

1. Study and implement Linux commands
2. Study practical on installation of java, Tomcat Server
3. Study practical on software development life cycle
4. Study practical on DevOps life cycle & stages
5. Study practical on DevOps Tools (Docker, Jenkins, Git, Jira, copado)
6. Learn about DevOps Pipeline (CI /CD) using any tool
7. Study Practical on AWS for DevOps
8. Study Practical on Microsoft Azur for DevOps
9. Study Practical on Google Cloud for DevOps
10. Study Practical on Salesforce with Copado for DevOps
11. To setup and configure of Jenkins
12. To create Job and manage it using Jenkins
13. To experiment plugin management with jenkins
14. To study and demonstrate User role creation and management using Jenkins
15. To study and demonstrate Integration with Git using Jenkins
16. To study and demonstrate Automated deployments using Jenkins
17. To study and demonstrate Build and delivery pipelines using Jenkins
18. To study and demonstrate Job Parameterization using Jenkins
19. To study and demonstrate Command line executions using Jenkins
20. To study and demonstrate Jenkins node management

H.O.D. (Comp. Dept.)
P.R.Pote (Patil) Col... Engg.& Management

Final Year (Seventh Semester)

Final Year (Seventh Semester)	Academic Year: 2019-20	
Course/Subject DIGITAL SIGNAL PROCESSING	Course Code: 7KS01	
On completion of this Subject/Course the student shall be able to		
SN	Outcomes	Bloom's Taxonomy Levels
7KS01.1	Understand the meaning and implications of the properties of signals and systems.	L1, L3
7KS01.2	understand the operations on signal, obtain the response of LIT discrete time system, significance of Transform, its application.	L1
7KS01.3	understand the frequency domain analysis of discrete time system, understanding the importance of Discrete Fourier Transform & Fast Fourier Transform in analysis.	L1
7KS01.4	to transform the analog filters to digital filters, realization of Discrete Time systems, FIR & IIR filters.	L2

Syllabus

Unit I: Discrete –Time Signals and Systems: Introduction to DSP, Advantages, basic elements of DSP system, sampling theorem, A/D, D/A conversion, quantization. Elementary discrete-time sequences. Discrete-time systems: description, representation, classification (linear, time-invariant, static, casual, stable)

Unit II: Analysis of DTLTI systems: The convolution sum, properties of convolution, Analysis of causal LTI systems, stability of LTI systems, step response of LTI systems, difference equation, recursive & non recursive discrete time systems, solution of difference equations, Impulse response of LTI recursive system. Correlation of discrete time signals.

Unit III: z- Transform and Analysis of LTI Systems: Definition of z-Transform, properties, rational z-Transforms, evaluation of the inverse z- Transforms, analysis of linear time invariant systems in z-domain, transient and steady-state responses, causality, stability, pole-zero cancellation, the Schur-Cohn stability test.

Unit IV: Fourier Transforms, the DFT and FFT: Definition & properties of Fourier transform, relation with z-transform. Finite duration sequences and the discrete Fourier transform(DFT), properties, circular convolution, Fast algorithms for the computation of DFT: radix-2 and radix-4 FFT algorithms

Unit V: Design of Digital Filters: Classification of filters: LP, HP, BP, FIR and IIR filters, filter specifications. Design of FIR filters using Windows and by Frequency sampling methods. Design of IIR filters from Analog filters using approximation of derivatives, Impulse invariant transformation, Bilinear transformation and
Matched z-Transformation, Commonly used Analog filters and IIR Filter design example.

Unit VI: Realization of Discrete-Time systems: Structures for realization of Discrete-Time systems, realization of FIR systems: Direct Form, Cascade Form, Frequency sampling and Lattice structures. Realization of IIR filters: Direct Form, Signal flow graph and Transposed structures, Cascade form, Lattice and Lattice ladder. Realization for IIR systems.

Text Book: J G Prokis and D G Manolokis, "Digital Signal Processing: rinciples Algorithms and applications (Pearson Education).

Reference Books:

1. S K Mitra: "Digital Signal Processing: A Computer-Based Approach" (McGraw Hill)
2. E C Ifeacthor and B W Jervis "Digital Signal Processing A Practical Approach" (Pearson)
3. A V Oppenheim, R W Schafer with J R Buck "Discrete Time Signal Processing"(PHI)
4. P Ramesh Babu: " Digital Signal Processing" Scitech Publications.

Final Year (Seventh Semester)	**Academic Year: 2019-20**	
Course/Subject COMPUTER NETWORKS	**Course Code: 7KS02**	
On completion of this Subject/Course the student shall be able to		
SN	**Outcomes**	**Bloom's Taxonomy Levels**
7KS02.1	To **Identify** and **Explain** fundamental concepts of different layers of computer networks and application layer protocols.	L2
7KS02.2	To **Analyze** and **Explain** the issues of Transport layer and applications of all transport layer protocols to understand end to end communication over the network..	L2,L4
7KS02.3	To **Demonstrate** basic understanding of network layer protocols and data routing algorithms.	L3
7KS02.4	To **understand** the concepts of functional and procedural means to transfer data between network entities and Data Link protocols..	L2
7KS02.5	To **Understand and Identify** Authentication protocols and security issues in Computer Networks..	L2,L4
7KS02.6	To **Determine** mechanism for effective network management framework to control various devices in network	L1

Syllabus

UNIT I: Introduction: Brief history of computer networks & Internet, Layered architecture, Internet protocol stack, Network entities & layers, Application layer: Principles of protocols, HTTP, FTP, SMTP and DNS protocols.

UNIT II: Transport layer: services & principles, multiplexing & de multiplexing applications, UDP, principles of reliable data transfer, TCP details, principles of congestion control, TCP congestion control.

UNIT III: Network layer: network service model, routing principles, hierarchical routing, Internet Protocol (IP) & ICMP details, routing in the Internet, router internals, IPV6.

UNIT IV: Link layer: Introduction, services, multiple access protocol, LAN addresses & ARP, CSMA / CD, PPP details.

UNIT V: Network security: Basic issues, principles of cryptography, authentication and authentication protocol, version, integrity: digital signatures, message digests, hash function algorithm, key distribution & certification, secure e- mail, E-Commerce: SSL & SET, IP Sec details.

UNIT VI: Firewalls: Packet filtering and Application gateway. Network Management: Basic principles, infrastructure for network management, The Internet Network – management

framework: SMI, MIB, SNMP details, security and administration, ASN.1

Text Book: James F. Kurose & K W Ross: Computer Networking, Pearson Education

Reference Books:

1. Douglas E. Comer: Computer Network & Internet, Addison Wesley.
2. Andrew S. Tanenbaum: Computer Networks, PHI (5E)
3. Leon Garcia & Widjaja: Communication Networks, TMH
4. William Stallings: Data & Computer Communication, Pearson Education.

Final Year (Seventh Semester)	**Academic Year: 2019-20**
Course/Subject : DESIGN AND ANALYSIS OF ALGORITHMS	**Course Code: 7KS03**

On completion of this Subject/Course the student shall be able to

SN	Outcomes	Bloom's Taxonomy Levels
7KS03.1	Improve efficiency of Algorithm and understand asymptotic notations for denoting time and space complexity of Algorithms.	L2
7KS03.2	Comprehend and understand the divide-and-conquer strategy for various algorithms	L2
7KS03.3	Understand and apply greedy method to various algorithms in order to compute optimal solution	L3
7KS03.4	Understand principle of optimality; Interpret and analyze dynamic programming approach for solving overlapping sub problems.	L4
7KS03.5	Design and analyze concept of backtracking for combinatorial problems	L4
7KS03.6	Apply the knowledge gained to infer the efficiency of algorithms considering time and space trade off.	L3

Syllabus

Unit I : Iterative Algorithm Design Issue: Introduction, Use of Loops, Efficiency of Algorithms, Estimating & Specifying Execution Times, Order Notations, Algorithm Strategies, Design using Recursion.

Unit II: Divide And Conquer: Introduction, Multiplication Algorithm and its analysis, Introduction to Triangulation, Covex Hulls, Drawbacks of D & C & Timing Analysis.

Unit III: Greedy Methods: Introduction, Knapsack Problem, Job sequencing with deadlines, Minimum Spanning Trees, Prim's Algorithms, Kruskal's Algorithm, Dijkstras Shortest Path Algorithm.

Unit IV: Dynamic Programming: Introduction, Multistage Graphs, Traveling Salesman, Matrix multiplication, Longest Common Sub-Sequences, Optimal Polygon Triangulation, Single Source Shortest Paths.

Unit V: Backtracking: Combinational Search, Search & Traversal, Backtracking Strategy, Backtracking Framework, and Some typical State Spaces.

Unit VI: Efficiency of Algorithm: Polynomial Time & Non Polynomial Time Algorithms, Worst and Average case Behavior, Time Analysis of Algorithm, Efficiency of Recursion, Complexity, Examples of Complexity Calculation for Various Sorting algorithms. Time-Space Trade off and Time-Space Trade off in algorithm research.

Text Book: Dave and Dave: "Design and Analysis of Algorithms" Pearson Education

Reference Books:

1. Aho,Hopcroft & Ullman "The Design & Analysis of Computer Algorithms", Addison-Wesley
2. G. Brassard, P.Bratley: "Fundamentals of Algorithmics" , PHI
3. Horowitz & Sahani: " Fundamental Algorithms" , Galgotia.
4. Cormen, T.H, Lierson & Rivest: " Introduction to Algorithms", Mc Graw-Hill.

Final Year (Seventh Semester)	**Academic Year: 2019-20**
Course/Subject OBJECT ORIENTED ANALYSIS AND DESIGN	**Course Code: 7KS04**

On completion of this Subject/Course the student shall be able to

SN	Outcomes	Bloom's Taxonomy Levels
7KS04.1	To **define** and **explain** object-oriented modeling concept and class	L2
7KS04.2	To **distinguish** advanced class modeling and advance state modeling	L4
7KS04.3	To **discuss** interaction modeling and advanced	L2
7KS04.4	To **analyze** and **design** the process overview, system conception	L5
7KS04.5	To **explain** object-oriented methodology for software development in the problem domain using types of application analysis	L2
7KS04.6	To **illustrate** class design concept and shows how to **select** analysis model and provide a basis for implementation	L3

Syllabus

UNIT-I: Modeling Concept: Introduction, Object orientation, OO Development, OO themes, Modeling as a design technique, Class Modeling. Abstraction, The three models, Object and class concepts, Link and association concepts, Generalization & Inheritance, Navigation of class models.

UNIT II: Advanced object and class concepts, Association Ends, N-ary association, Aggregation, Abstract classes, Multiple inheritance,Metadata, Reification, Constraints, Derived data, Packages, State Modeling: Events, States, Transitions and Conditions, State diagrams, State diagram behavior.

Unit III: Central Professional Responsibilities of Engineers

Confidentiality and Proprietary Information, Conflict of interest, Competitive bidding, rights of Engineers: fundamental, professional conscience, conscientious refusal, professional recognition, employee, privacy; types of conflict of interest, avoiding conflict of interest, competitive bidding, situations for conflict of interest, ethical corporate climate & its features.

Unit IV: Intellectual Property Rights and Ethics

Patent: IP chain of activities, IP as intangible property, protection offered by patent, right of patent owner; Trademarks (TM): purpose, what can be registered under trademark, categories of TM, industrial design, geographical indications; Copyright & related rights: advances in technology and copyright, benefits, World IP organization, TRIPS & WTO.

Unit V: Computers, Software and Digital Information

Emergence of Computer ethics, issues in Computer ethics: distribution of power issues, property issues, issues of privacy, professional issues, Computer crimes, Computer Software and Digital Information: Characteristics of digital information, s/w as IP, and challenges in information age, IEEE code of conduct and code of ethics.

Unit VI: Responsibilities and Management

Responsibility for the Environment, Engineering as Social Experimentation, Safety and Risk management, IT Professional relationship management with: Employers, Clients, Suppliers, IT Users, other professionals, and society at large.

Text Books:

1. Prof. Susmita Mukhopadhyay, 'Ethics in Engineering Practice' IIT Kharagpur
2. Mike Martin and Roland Schinzinger, 'Ethics in Engineering', Tata McGraw Hill, New York, 2005

Reference Books:

1. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, 'Engineering Ethics – Conceptsand Cases', Cengage Learning, 2009 & Thompson Learning, 2000
2. Govindarajan M., Natarajan,'Engineering Ethics', Prentice Hall of India, New Delhi, 2004
3. Stephen Byars, 'Business Ethics', USC Marshal School of Business Kurt Stanberry, Univers'ty of Houston (https://openstax.org/details/books/business-ethics)

H.O.D. (Comp. Dept.)
P.R. Pote (Patil) College of Engg. & Management
Amravati.

P. R. Pote Patil Edu. & Welf. Trust's, Group of Institutions,
College of Engineering & Management, Amravati
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• Kathoori Road, Amravati, Maharashtra, India
• Ph. No. : +91-721-2078110, Fax No. : +91-721-2535085, Email : prpcoepatilcollege@gmail.com
• Web. : www.prpcem.org, www.prpatilcollege.org

Course Outcomes

Department of Electronics & Telecommunication Engineering

P.R. Pote (Patil) College of Engineering & Management, Amravati

Department of Electronics & Telecommunication Engineering

Course Outcomes
3ETC1 Course Name: Engineering Mathematics-III

Course Outcomes:

Upon successful completion of this course, the student will be able to:

SN	Outcomes	Bloom's Taxonomy Levels
3ET1.1	Demonstrate the knowledge of differential equations to solve engineering problems of analog systems.	L4
3ET1.2	Apply Laplace transform to solve differential equations.	L4
3ET1.3	Apply knowledge of vector calculus.	L3
3ET1.4	Comprehend knowledge of complex analysis in terms of complex variables, harmonic functions and conformal mapping.	L5
3ET1.5	Apply numerical methods to obtain approximate solutions to mathematical problems.	L5
	Syllabus	Lect.
Unit-1	**Vector Calculus:** - Scalar and Vector point functions, Differentiation of vectors, Curves in space, Gradient of a scalar point function, Directional derivatives, Divergence and curl of a vector point function and their physical meaning, expansion formulae (without proof), irrotational and solenoidal vector fields. **Fourier transforms:** Fourier sine and Fourier cosine transforms and integrals	10
Unit-2	**Complex Analysis:** - Functions of complex variables, Analytic function, Cauchy- Reimann conditions, Harmonic function, Harmonic conjugate functions, Milne's method. **Conformal Mappings**: Translation, Rotation, Magnification, Inversion and Bilinear Transformation, singular points, expansion of function in Taylor's and Laurent's series, Cauchy's integral theorem and formula, Residue theorem.	08
Unit-3	**Numerical Methods:** **Solution of Nonlinear and Polynomial Equations**: False Position, Newton RaphsonMethod. **Solution of Linear Systems Equations:** Gauss Elimination method, Gauss SeidelIterative Method, Relaxation method **Solution of Differential Equations:** Euler's method, Runge-Kutta method, Picards method.	08

Unit-4	**Ordinary Differential Equations**: - Complete solution: Operator D, Rules for finding complementary function, the inverse operator, Rules for finding the particular integral, Method of variations of parameters, Cauchy's and Legendre's linear differential equations.	10
Unit-5	a) **Difference Equation:-** solution of difference equations of first order, solution ofdifference equations of higher order with constant coefficient. b) **Partial differential equation of first order of following form**-(i) f (p, q) = 0; (ii) f (p, q, z)=0; (iii) f(x, p) = g (y, q); (iv) Pp + Qq =R (Lagrange's Form); (v) Z=px+qy+f(p, q) (Clairaut form)	08
Unit-6	**Laplace transforms**: definition, standard forms, properties of Laplace transform, inverse Laplace transform, Laplace transform of some basic functions, initial and final value theorem, convolution theorem, Solution of linear differential equations using Laplace transform.	08

3ETC02 Course Name: Object Oriented Programming

Course Outcomes

At the end of the course, students will be able to:

SN	Outcomes	Bloom's Taxonomy Levels
3ET2.1	To **Understand** the difference between the top-down and bottom-up approach and **describe** the object-oriented programming in connection with C++	L4
3ET2.2	To **explain** the concept of Class, Objects, Functions &Constructors.	L4
3ET2.3	To **demonstrate** the use of Inheritance & Overloading unary & binary Operators in C++.	L3
3ET2.4	ToUnderstand the Basic Concepts of java .	L5
3ET2.5	To **demonstrate** the concept of Class ,objects ,Methods in java.	L5
3ET2.6	To **demonstrate** the use of Multiple inheritance & interface in java	L4
	Subject: OBJECT ORIENTED PROGRAMMING	L
Unit-1	Principles of object oriented Programming: OOP'S paradigm, basic concept of OOP'S, benefits of OOP'S, structure of C++ programming, basic data types, user defined data type, derived data type operator and control statement.	8
Unit-2	Functions classes and object in C++: Functions, Function over loading, Friend Functions, types of classes and its use, concept of object and its implementation, constructor and destructors.	8

Unit-3	Operator and their definition, overloading unary and binary operator, rules for overloading operators, overloading binary operators using friends and string manipulation. Concept of Inheritance in C++	10
Unit-4	Introduction to Java programming, JVM, Java programming constructs: variables, primitive data types, identifier, literals, operators, expressions, precedence rules andassociativity, primitive type conversion and casting, flow of control.	8
Unit-5	Classes and Objects: Classes, Objects, Creating Objects, Methods, Constructors, Cleaning up unused Objects, Class variable and methods, "this" keyword, Arrays,Command line arguments	8
Unit-6	Multiple Inheritance in Java, Defining interfaces, Extending interfaces, Implementing interfaces, Accessing interface variables.	10
	Total	52

3ETC03 Course Name: Electronic Devices And Circuits

Course Outcomes:

Upon successful completion of this course, the student will be able to:

SN	Outcomes	Bloom's Taxonomy Levels
3ET3.1	Comprehend the knowledge of diode and its applications in rectifier and regulator circuits.	L4
3ET3.2	Understand basics of BJT, JFET, MOSFET, UJT and their operational parameters.	L3
3ET3.3	Understand feedback concept, topologies and their applications.	L3
3ET3.4	Implement and analyze various electronic circuits.	L5
	Syllabus	**Lect.**
Unit-1	**PN diode** : Formation of p-n junction, biasing the diode, current equation and V-I characteristics of diode, static and dynamic resistance, HWR, FWR, theory of C, L, LC and CLC filters and analysis of C-input filter, Zener diodes, its application as voltage regulator, Construction, working and characteristics of LED, photo diode, Schottky diode, and tunnel diode	10
Unit-2	**Bipolar Junction Transistors** : Operation of PNP and NPN transistor, CB, CE and CC configurations with characteristics and parameters, transistor as an amplifier, transistor biasing methods, dc load line, operating point, bias stability, analysis of various dc bias circuits, small signal analysis of voltage divider biased CE amplifiers using h-parameter model.	10

Unit-3	**Feedback amplifiers**: Feedback concept, effects of negative feedback, basic feedback topologies. **Sinusoidal oscillators**: Barkhausen's criteria, Hartley, Colpitts, RC Phase shift, Wien bridge and crystal oscillators.	8
Unit-4	**Multistage Amplifiers**: Need of multistage, direct coupled amplifier, RC coupled amplifier, transformer coupled amplifier, emitter follower, Darlington emitter follower, bootstrapping principle, Cascode stage.	8
Unit-5	**Power Amplifiers:** Classification, Class A, Transformer coupled Class A, harmonic distortion, Class B, Class AB, crossover distortion, capacitor coupled and direct coupled output stages, modifications to improve power amplifier performance, Class C amplifier and analysis.	8
Unit-6	**JFET:** Theory, construction and characteristics: parameters (μ, gm & rd), biasing ofJFET amplifiers. **MOSFET**: Theory, construction and characteristics of enhancement & depletiontype MOSFET. **UJT**: Theory, construction and characteristics; UJT as relaxation oscillator.	8

3ETC04 Course Name: Digital System Design

Course Outcomes:-
Upon successful completion of this course, the student will be able to:

SN	Outcomes	Bloom's Taxonomy Levels
3ET4.1	Use Boolean algebra to solve logic functions, minimization techniques, number systems and its conversion, arithmetic functions.	L4
3ET4.2	Identify, analyze and design combinational and sequential circuits.	L3
3ET4.3	Understand digital logic families and their characteristics.	L3
3ET4.4	Use the knowledge of semiconductor memories and mapping of memories, programmable logic devices in digital design	L5
	Syllabus	**Lect.**
Unit-1	**Number systems and codes:-** Number system and their conversions, BCD codes, Octal codes, Hexadecimal codes, Excess-3 code, Gray Code, Arithmetic Operations using 1's complement and 2's complement Introduction, Basic Digital Circuits: AND, OR, NOT, NAND, NOR, Ex-OR, Ex-NOR.	06

Subject(Th): 3ETp9 - SKILL DEVELOPMENT LAB-I (Measurements, Testing & Instrumentation)

SN	Outcomes	Bloom's Taxonomy Levels
CO1	Understand the principles and operation of different measuring instruments	L4
CO2	Select the appropriate instrument for measurement and observe, read and interpret the valuesfrom different measurements.	L4
CO3	Read the specifications from datasheets and learn the precautions & applications of theinstruments.	L3
CO4	Explore use of various transducers/sensors in measurement of various physical parameters.	L5
CO5	Design the PCB layout and prepare PCB for given circuit.	L3
CO6	Develop the skill of mounting /demounting components and testing of developedcircuits.	L4

	*Experiment List
<u>Part: A-Electronics Measurement and Testing</u>	
Expt-1	To explore the use of Digital Multi-meter for various parameter measurements and testing of the various components.
Expt -2	To explore the use of LCR- Q meter for the measurement of Resistance (R), Inductance (L), capacitance(C) and quality factor (Q) of a coil using LCR-Q meter.
Expt -3	To explore the front panel controls and specifications of typical CRO and measurement of amplitude, frequency, phase difference of the test signal using CRO and observe Lissagous pattern.
Expt -4	Testing of various components using CRO.
Expt -5	To explore the control panel of AF/RF signal/ function generator available in the lab to observe the various types of signal waveforms along with their range using CRO.
Expt -6	To explore the use of Digital Storage Oscilloscope [DSO] and to verify Half wave/ Full wave/ rectifier and Clamper circuits using DSO
Expt -7	To explore front panel controls and specifications of a typical spectrum analyzer for observing spectrum of various test signals.
Expt -8	Study and explore front panel controls and specifications of a typical spectrum analyzer for observing spectrum of various test signals.
Expt -9	Measurement of Frequency Response of various filters using spectrum analyzer.
Expt -10	To explore the use of Logic analyzer.

Unit-6	**Introduction to RISC Processors:** RISC Features, Difference between CISC and RISC, 32 bit ARM7 Philips NXPLPC2148 Microcontroller : Architecture, Registers, Pipeline	7

5ETC02: CONTROL SYSTEM

Course Outcomes:

Upon successful completion of this course, the student will be able to:

S. N.	Outcomes	Bloom's Taxonomy Levels
CO1	Understand mathematical models of electrical, mechanical and electromechanical systems.	L4
CO2	Determine transfer functions from block diagrams and signal flow graph.	L3
CO3	Evaluate transient response and steady state response parameters.	L3
CO4	Analyze stability of the LTI system using Routh criterion and root locus	L4
CO5	Analyze stability of the LTI system using bode plot and Nyquist criterion	L3
CO6	Create the state model and Evaluate response of the system using state variable method.	L2
	Syllabus	**Lect.**
Unit-1	Basics of Control system Types of control systems Classification of control system, Mathematical modeling of Physical Systems, Electrical Analogous Systems, Force - voltage analogy, force- Current analogy.	5
Unit-2	Control system Representation Block diagram reduction technique, rules for block diagram reduction. Analysis of multiple input multiple output systems, properties of signal flow graphs, Mason's gain formula basic control actions.	6
Unit-3	Time Response Analysis: Standard test signals, Time response of first order and second order system, impulse response function, Transient domain specifications, Steady state analysis: steady state error and error constants, dynamic error coefficients	6
Unit-4	Stability of Control System: Concept of stability, necessary conditions for stability, Routh stability criterion. Root locus Techniques: Introduction, Construction of root locus, construction rules, Stability analysis of systems using root locus,	7

	Ultra-reliable low-latency MTC - Device- to-device (D2D) communications - Multi-hop D2D communications - Multi-operator D2D communication - Simulation methodology: Evaluation methodology – Calibration (6) Unit-VI: INTRODUCTION TO 6G: Key building blocks of 6G – 6G use cases and System Concepts – The 6G Architecture. (6)	

H.O.D. (EXTC Dept.)
[illegible] College of Engg. & Management
[illegible]

P. R. Pote Patil Edu. & Welf. Trust's, Group of Institutions,
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Course Outcomes

Department of Mechanical Engineering

P. R. Pote (Patil) Education & Welfare Trust's Group of Institutions,College of Engineering & Management, Amravati

Department of Mechanical Engineering

Third Semester

Second Year (Third Semester)	Academic Year: 2021-22
Course/Subject: Engg Mathematics	Course Code: (3ME01)

On the completion of subject/course the student shall be able to

S.N.	Outcomes	Bloom's Taxonomy Levels
3ME01.1	Demonstrate the knowledge to solve ordinary Linear Differential equations with constant coefficient and its reducible equation using particular integral and complementary function and apply method of variation of parameter to solve ordinary Linear differential equations	L2
3ME01.2	Define the Laplace transform and its inverse transform for the basic functions. Locate the Laplace transform of periodic function. Apply the Laplace transform to solve differential equation	L3
3ME01.3	Apply False Position, Newton Raphson method to solve nonlinear & polynomial equations Apply Gauss Elimination method, Gauss Seidal iterative method, Relaxation method to solve system of linear equations, Apply Eulers method, Runge-Kutta method, Picards method to solve differential equations	L3
3ME01.4	Define Gradient, divergent and curl of vector point functions. Finds the directional derivatives of scalar point functions. Discuss the Irrotational and solenoidal vector fields. Define line surface and volume integrals	L2

SYLLABUS

SECTION-A

UNIT-I : Ordinary differential equations:- Complete solution, Operator D, Rules for finding complementary function, the inverse operator, Rules for finding the particular integral, Method of variations of parameters, Cauchy's and Legendre's linear differential equations.

UNIT-II: Laplace transforms : Definition, standard forms, properties of Laplace transform, inverse Laplace transform, initial and final value theorem, convolution theorem, Laplace transform of impulse function, Unit step function, Laplace transforms of periodic function. Solution of Linear differential equations.

UNIT-III :a) Partial differential equation of first order of following form- (i) f (p,q)=0; (ii) f (p,q,z)=0; (iii)f (x,p)=g(y,q);(iv) Pp+Qq=R (Lagranges form); (v) z=px+qy+f (p,q) (Clairaut form)

b) Statistics : Curve fitting by method of least squares (Straight and parabola only), Correlation, regression.

c)Probability Distribution:– Binomial distribution, Poisson and normal Distribution.

UNIT-IV: Complex Analysis :- Functions of complex variables, Analytic function, Cauchy-Reimann conditions, Harmonic function, Harmonic conjugate functions, Milne's method, conformal mappings (translation, rotation, magnification, inversion, bilinear transformation),

singular points, expansion of function in Tayler's and Laurent's series. Cauchy's integral theorem and formula, Residue theorem.

UNIT-V: Numerical Analysis : Solution of algebric and transcendental equations by Newton-Raphson method & method of false position. Solution of system of linear equations by Gauss-Seidal method, Relaxation method. Solution of first order ordinary differential equations by Picard's, modified Euler's, Runge-Kutta and Taylor's method.

UNIT-VI: Vector Calculus :- Scalar and vector point functions, Differentiation of vectors, Gradient of a scalar point function, Directional derivatives, Divergence and curl of a vector point function and their physical meaning, line, surface,volume integrals, irrotational andsolenoidalvector fields, Stoke's andDivergencetheorem (withoutproof).

Books Recommended

:-Text Books:

1. Text book on Applied Engineering Mathematics, Vol. II, J.N. Wartikar and P.N. Wartikar, Pune VidyarthiGriha Prakashan, Pune.
2. Higher Engineering Mathematics, B.S Grewal, Himalaya Publishing House.
3. Applied Mathematics, Vol. III, J.N. Wartikar and P.N. Wartikar, Pune Vidyarthi Griha Prakashan, Pune.

Reference Book:

Advanced Engineering Mathematics, Erwin Kreyzig, John Wiley.

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Second Year (Third Semester)	Academic Year: 2022-23
Course/Subject: Manufacturing Processes	**Course Code: 3ME02**

On completion of this Subject/Course the student shall be able to

SN	Outcomes	Bloom's Taxonomy Levels
3ME02.1	Basic concept of foundry process and related activities	L1
3ME02.2	Concept of complete sand casting process with advance casting methods	L1, L3
3ME02.3	Fundamentals of welding processes	L3
3ME02.4	Various processes like electroplating, anodizing etc and their importance in industries	L1, L3
3ME02.5	Select appropriate joining process for the given application.	L3
3ME02.6	Judge the scope and limitations of machines to perform variety of operations	L4

Syllabus

Unit I:
Introduction to manufacturing processes & classification; Introduction to pattern making Pattern materials, pattern making tools, allowances, Types of patterns, functions of patterns, General properties of moulding sands, Mould hardness. Preparation of sand moulds of different types, Moulding processes, core making, core prints, core boxes. Sand casting Processes - Basic principle and Terminology of sand casting, design of gating and riser system – by numerical approach.

Unit II:
Technology of melting and casting - Melting furnaces, crucibles, pit, open hearth, gas fired cupola, cupola operation and electric hearth furnaces, Electric furnaces - Direct Arc, Indirect arc and electric induction furnace. Defects in castings and its types, Causes and remedies of casting defects. Origin and classification of defects, shaping faults, Inclusion and sand defects, Gas defects, shrinkage defects, contraction defects, dimensional errors. Inspection and testing of castings:- Radiography, ultrasonic, Eddy current testing, fluorescent penetrant test.

Unit III :
Casting processes and their principle of operation and applications permanent mould casting, slush casting, shell moulding, Investment or lost wax casting, vacuum process, centrifugal casting, continuous casting, Die casting equipment and processes for Gravity, pressure and vacuum casting methods, cleaning of castings, Modernisation & Mechanisation of Foundries.

Unit IV:
Mechanical working of metals: Principle of hot and cold working process and its types, Extrusion, piercing, pipe and tube production, manufacture of seamless pipe and tubing. Shearing operations, tube drawing, wire drawing, spinning, embossing and coining, squeezing and bending operations, rotary swaging, load estimation for bulk forming (forging and drawing), rolling and types of rolling mills.

Unit V :
Joining processes:- Mechanical joining processes, Mechanical fastening, riveting, soldering, brazing Welding, Types of welding processes-Arc welding: principle and working, Gas welding- principle and working Types and purpose of Electrodes, Electrode coatings(flux). TIG & MIG processes – Working principles and its applications, shielding gases, MIG-Spray transfer and dip transfer processes.

Unit VI :
Submerged arc welding & resistance welding :- Heat generation in resistance welding, operational characteristics of resistance welding processes such as spot welding, projection welding, butt welding. Principle of operation of friction welding, forge welding, plasma arc, thermit welding. Welding defects, Testing and Inspection of welds, Ultrasonic, Electroslag, Electron Beam, laser welding, weldability.

Surface Treatment-Electroplating, electroforming, and iodising, metal spraying, shot peening, polishing, mechanical cleaning.

Text Book: 1. Workshop Technology Vol. I by Bawa, Tata Mc-Graw Hill Pub. 2.Workshop Technology Vol I by Hajra Chaudhary, Dhanpat Rai & Sons 2001.

Reference Books: 1. Workshop Technology Vol I by Raghuwanshi.
2. Manufacturing Processes by J.P. Kaushish; PHI
3. Processes and Materials of Manufacture by R.A.Lindberg, PHI Pub 2001.
4. Manufacturing technology Vol. I, by P. N. Rao

Second Year (Third Semester)	**Academic Year: 2022-23**
Course/Subject: Manufacturing Processes Lab	**Course Code: 3ME07**

On completion of this Subject/Course the student shall be able to

SN	Outcomes	Bloom's Taxonomy Levels
3ME7.1	Know the basic manufacturing processes used in industry for converting raw materials into finished products.	L1, L3
3ME7.2	The appropriate process parameters and identify possible defects of manufacturing processes so as to remove them.	L1, L3
3ME7.3	Develop simplified manufacturing processes with the aim of reduction of cost and manpower.	L6
3ME7.4	Acquire knowledge about the various tools, equipment, machinery and operations required for these basic manufacturing processes.	L1

List of Experiment

1. Study of safety precautions in workshop practices.
2. Foundry: - Any two of the following jobs Sand preparation and practice in moulding of various types of patterns: - Pattern making - one job, Moulding - one job Casting - one job.
3. Joining Processes: - Two composite jobs involving electric welding, gas welding and resistance welding process.
4. One job on Mechanical Working of Metals like piercing / drawing / bending/ embossing/ spinning/ upsetting.

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2. R. S. Khurmi: Strength of Material, S. Chand Publication, Delhi.
3. F. L. Singer : Strength of Materials, Harper and Row Publication, New York.

Reference Books :

1. E.P.Popov : Mechanics of Materials, Prentice Hall of India, New Delhi.
2. S. Timoshenko and O.H.Young : Elements of Strength of Materials,East West Press Private Ltd., New Delhi.
3. Shames, I. H. : Introduction to Solid Mechanics, Prentice Hall of India, New Delhi
4. Beer and Johston : Mechanics of Materials, McGraw Hill.

D. S. Prakash Rao : Strength of Material : A Practical Approach, University Press, Hydrabad

Second Year (Third Semester)	**Academic Year: 2021-22**	
Course/Subject: Mechanics of Material	**Course Code: (3ME08)**	
On the completion of subject/course the student shall be able to		
S.N.	Outcomes	Bloom's Taxonomy Levels
3ME08.1	Determine the stress & strain in the member subjected to axial, bending & torsional load	L2
3ME08.2	To observe different types of material behavior such as elastic, plastic, ductile and brittle	L2
3ME08.3	Apply SF and BM diagrams to analyse resistance offered by the beam and able to solve practical problemsin real world	L3
3ME08.4	Apply deflection criteria to check the stability of beam	L3

Practicals:

Minimum Six to Eight out of the following:

1. Tension test on metals.
2. Compression test on materials.
3. Shear test on metals.
4. Impact test on metals.
5. Hardness test on metals.
6. Torsion test on metals.
7. Deflection of beams.
8. Modulus of rupture test.
9. Deflection of springs.

	transportation model.	
8ME08.4	Proficient to use sequencing, queuing for decision making in real life situation.	L3
8ME08.5	Proficient to use replacement and simulation for decision making in real life situation.	L3
8ME08.6	To formulate and solve multistaging dynamic programming problem.	L4

List of Practicals:-

At least 6 practical from above list should be done.

1. Formulation of LPP from real life situation.
2. Solution of LPP by using MS Excel.
3. Case study of transportation problems.
4. Case study of assignment problems
5. Case study on project network.
6. Case study on sequencing problems
7. Constructing and solving the simulation model from real life situations
8. Study of Replacement model through different problems.
9. Case study on dynamic programming problems.

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Course Outcomes

Department of Electrical Engineering

P. R. Pote (Patil) Education & Welfare Trust's Group of Institutions College of Engineering & Department of Electrical Engineering

Third Semester

Second Year (Third Semester)	Academic Year: 2021-22	
Course/Subject: Engineering Mathematics-III	Course Code: 3EP01	
On completion of this Subject/Course the student shall be able to		
SN	Outcomes	Bloom's Taxonomy Levels
3EP1.1	Demonstrate the knowledge of differential equations and partial differential equations, applied to electrical	L3
3EP1.2	Apply Laplace transform to solve differential equations	L3
3EP1.3	Demonstrate the use of Fourier Transform to connect the time domain and frequency domain.	L3
3EP1.4	Apply Z Transform to solve of various Linear Difference equations with constant coefficients.	L3
3EP1.5	Apply the knowledge of vector calculus to solve physical problems.	L3
3EP1.6	Perform vector differentiation and integration to analyze the vector fields and apply to compute line, surface and volume integrals.	L3

syllabus SECTION-A

Ordinary differential equations:- Completer solution, Operator D,Rules for finding complementary function, the inverse oprator, Rules for finding the particular integral, Method of variations of parameters, Cauchy's and Legendre's linear differential equations. Simultaneous linear differential equations with constant co-efficient, Applications to electrical circuits.

UNIT-II : Laplace transforms: definition, standard forms, properties of Laplace transform, inverse Laplace transform, initial and final value theorem, Convolution theorem, Laplace transform of impulse function, Unit step function, Laplace transforms of periodic function.

UNIT-III : a) Application of L.T. to linear differential equations with constant coefficients & Simultaneous linear differential equations.

b) Fourier transforms- Definition, standard forms, inverse Fourier transform, Properties of Fourier transforms, Convolution theorem. Fourier sine and Fourier cosine transforms and integrals.

SECTION-B

UNIT-IV : a) Difference equation:- solution of difference equations of first order, Solution of difference equations of higher order with constant co-efficients.

b) Z-transform: Definition, standard forms, Z-transform of impulse function, Unit step functions, Properties of Ztransforms (Linearity, shifting, multiplication by k, change of scale), initial and final values, inverse Z-transforms

SECTION-B

UNIT-IV : a) Difference equation:- solution of difference equations of first order, Solution of difference equations of higher order with constant co-efficients.

b) Z-transform: Definition, standard forms, Z-transform of impulse function, Unit step functions, Properties of Ztransforms (Linearity, shifting, multiplication by k, change of scale), initial and final values, inverse Z-transforms (by direct division and partial fraction), Solution of difference equation by Z-transforms.

UNIT-V : Vector calculus: Scalar and vector point functions, Differentiation of vectors, Curves in space,Gradient of a scalar point function, and their physical meaning, expansion formulae (without proof).

UNIT-VI : Line,surface,volume integrals, irrotational and solenoidal vector fields, Stoke's and Divergence theorem (without proof).

BOOKS RECOMMENDED:-

1) Advanced Engineering Mathematics, 3 edi – Potter, Oxford University Press, 2008

2) Mathematical Techniques – Jordan and Smith 4/e – Oxford University Press, 2008

3) A Mathematical Companion for Science and Engineering Students – Brettenbach, Oxford University Press, 2008

4) Elements of Applied Mathematics by P.N.Wartikar and J.N.Wartikar

5) Advancing Engg. Mathematics by E.K.Kreyzig.

Second Year (Third Semester)	Academic Year: 2021-22	
Course/Subject: Electrical Circuit Analysis	Course Code: 3EP02	
On completion of this Subject/Course the student shall be able to		
SN	Outcomes	Bloom's Taxonomy Levels
3EP2.1	Analyze electric and magnetic circuits using basic circuital laws	L4
3EP2.2	Analyze the circuit using Network simplification theorems.	L4
3EP2.3	Solve circuit problems using concepts of electric network topology.	L3
3EP2.4	Evaluate transient response of different circuits using Laplace transform	L5
3EP2.5	Evaluate two-port network parameters and network functions	L5

Syllabus

Unit I:

[a] Terminal Element Relationships: V-I relationship for Dependent &Independent , Voltage and Current Sources.,

Source Transformations. Source Functions: unit impulse, unit step, unit ramp and interrelationship, sinusoidal input,

generalized exponential input.

Magnetic Circuits: concept of self and mutual inductance, dot convention, coefficient of coupling, composite magnetic circuit, Analysis of series and parallel magnetic circuits.

[b] Basic Nodal and mesh Analysis: Introduction, Nodal analysis, super node analysis, mesh analysis, super mesh analysis.

Unit II:

Network Theorems: Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, Reciprocity theorem, Millman's theorem, Substitution theorem, Compensation theorem, Tellegen's theorem

Unit III :

Graph Theory and Network Equation:-Graph of a network, Trees and loops, Tie-set and cut set matrix of a network, Network equilibrium equations, duality-network transformation.

Unit IV:

a] Transformation of a Circuit into s-domain: Laplace Transformed equivalent of inductance, capacitance and mutual inductance, Impedance and admittance in the transform domain, Node Analysis and Mesh Analysis of the transformed circuit. Complete Solution of Linear Differential Equations for Series RC, Parallel RC, Series RL, Parallel RL, Series RLC, Parallel RLC and Coupled Circuits-for step Inputs. Natural Response, Transient Response, Determination of initial conditions.

Unit V :

Two Port Networks: Two port networks: Open circuit impedance parameters, Short circuit admittance parameters, Transmission parameters, Hybrid parameters, Condition for reciprocity and symmetry of a two port network, Interrelationship between parameters, Interconnection of two port networks , Input impedance in terms of two port network parameters, Output impedance, Image impedance.

Unit VI :

Network functions: Ports and terminal pairs, Network functions, poles and zeros, Necessary conditions for driving point function, Necessary conditions for transfer function. Applications of network analysis in driving network functions, positive real functions, driving point and transfer impedance function.

Text Book: Network Analysis, M.E. Van Valkenburg, PHI, 2005.

Reference Books:

1. Circuits & Networks – Analysis, Design & Synthesis by M.S.Sukhija, T.K.Nagasarkar, OxfordUniversity Press, 2010.
2. Circuit and Network Analysis, Sudhakar Shyammohan, Tata Mc Graw Hill, 2005.
3. Network Analysis, P. Ramesh babu, SciTech Publications, Chennai, 2009.

H.O.D. (Elect. Dept.)

Second Year (Third Semester)	Academic Year:	
Course/Subject: Electrical Machine-I	Course Code: 3EP03	
On completion of this Subject/Course the student shall be able to		
SN	Outcomes	Bloom's Taxonomy Levels
3EP03.1	Explain the construction and working of DC Machines.	L2
3EP03.2	Illustrate the different Characteristics, types, their applications and parallel Operation of D.C. Generator	L3
3EP03.3	Demonstrate the various characteristics, starting, speed control and braking operation on DC motor.	L2
3EP03.4	Analyze the performance of DC machines by conducting the various tests on it.	L4
3EP03.5	Determine the parameters of equivalent circuits, performance parameters of single phase transformer and merits & demerits of autotransformer	L6
3EP03.6	Explain the construction, working, different connections, applications and testing of three phase transformer.	L2

Unit I :
D.C. Machines: Construction, Principle of Operation, EMF Equation, Torque Equation. Armature winding – Lap, wave, single layer, double layer. Armature Reaction and commutation, method of improving commutation.
Unit II :
D.C. Generators:Types, Characteristics and Applications of D. C. Generators, Parallel Operation of D.C. Generators, Introduction to testing of D. C. Generators as per Indian standard.
Unit III :
D.C. Motors:Types, Characteristics & Modified Characteristics, Applications of D.C. Motors. Starting, Electric Braking, Speed Control of DC Motors. Losses, efficiency and testing of DC Motors.
Unit IV :
Single phase Transformer:Working Operation, EMF Equation, and separation of core losses in to its component. Equivalent Circuit, Parallel Operation. Open Circuit, Short Circuit & Sumpner's test on transformer as per Indian standard.
Single phase Autotransformer: - construction, working, merits, demerits and its application.
Unit V :
Three Phase Transformer: Construction, Working, Types, connections, vector group connections, open delta Connection, OC, SC, Heat run test, load test, magnetic balance, vector group test on three phase transformer.
Unit VI :

Three Phase Transformer: Three-winding transformer, On load & Off load tap changers, Scott Connection, Power transformer and Distribution transformer. Waveforms of no load current & inrush current phenomenon.

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(Second Semester)	Academic Year:2021-22
Course/Subject: Power Quality Improvement Techniques	Course Code: EP2203

On completion of this Subject/Course the student shall be able to

SN	Outcomes	Bloom's Taxonomy Levels
EP2203.1	To introduce to students the term and Definition of power quality, disturbances, and their causes.	L2
EP2203.2	Understand the Fundamentals of Harmonics .	L2
EP2203.3	To Understand the Causes of Harmonics	L2
EP2203.4	To interpret the Effect of Harmonics	L3
EP2203.5	Acquire knowledge on Suppression of Harmonics .	L4
EP2203.6	To recognise the harmonic sources, passive filters, active filters.	L2

syllabus... Unit I:

Concept of Power Quality: Frequency variations, voltage variations- sag and swell, waveform distortion –dc offset, harmonics, inter-harmonics, notching and noise.

Unit II:

Fundamentals of Harmonics: Representation of harmonics, waveform, harmonic power, measures of harmonic distortion; Current and voltage limits of harmonic distortions: IEEE, IEC, EN,NORSOK .

Unit III:

Causes of Harmonics: 2-pulse, 6-pulse and 12-pulse converter configurations, input current waveforms and their harmonic spectrum; Input supply harmonics of AC regulator, integral cycle control, cycloconverter, transformer, rotating machines, ARC furnace.

Unit IV:

Effect of Harmonics: Parallel and series resonance, effect of harmonics on static power plant – transmission lines, transformers, capacitor banks, rotating machines, harmonic interference with ripple control systems, power system protection, consumer equipments and communication systems, power measurement.

Unit V:

Elimination/ Suppression of Harmonics: High power factor converter, multi-pulse converters using transformer connections (delta, polygon) Passive Filters: Types of passive filters, single tuned and high pass filters, filter design criteria, double tuned filters, damped filters.

Unit VI:

Active Power Filters: Compensation principle, classification of active filters by objective, system configuration, power circuit and control strategy. PWM Inverter: Voltage sourced active filter, current sourced active filter, constant frequency control, constant tolerance band control, variable tolerance band control.

"

(Second Semester) Academic Year: 2019-20

Course/Subject: Application of Power Electronics to Power System Course Code:EP2205

On completion of this Subject/Course the student shall be able to

SN Outcomes Bloom's Taxonomy Levels

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(Second Semester)	Academic Year: 2021-22
Course/Subject: HVDC Transmission	Course Code:EP2204

On completion of this Subject/Course the student shall be able to

SN	Outcomes	Bloom's Taxonomy Levels
2EP2204.1	Understand the need for HVDC, Compare of AC and DC high voltage systems, and Applications of AC and DC high voltage systems, EHVAC Transmission System: Sequence impedance calculation	L2,L4
2EP2204.2	Calculate transmission line parameters and sequence impedances for lines with ground returns, sequence networks for various three-phase transformer connections	L3
2EP2204.3	Understand Converters and their characteristics. Control of the converters (CC and CEA),and characteristics. Equivalence of a dc system in an ac system. Per unit systems	L2,L3
2EP2204.4	demonstrate Parallel and series operation of converters. Load flow analysis of Alternating Current and direct Current	L3
2EP2204.5	Understand Corona: Basic phenomenon and calculate voltage gradient of conductors, power loss, audible noise and radio interference due to corona, electrostatic field of EHV lines	L2,L3
2EP2204.6	Understand Lightning Phenomenon: Charge formation in clouds: Wilson's theory, Simpson's theory; Mechanism of lightning: stepped leader, return stroke, multiple strokes	L2

syllabus...Unit I:
Need for HVDC, Comparative analysis of AC and DC high voltage systems, Applications of AC and DC high

voltage systems. EHVAC Transmission System: Sequence impedance calculation,

Unit II:
Calculation of transmission line parameters and sequence impedances for lines with ground returns, lines with bundle conductors and ground returns, sequence networks for various three phase transformer connections
Unit III:
Converters and their characteristics. Control of the converters (CC and CEA),and characteristics. Equivalence of a dc system in an ac system. Per unit systems.
Unit IV:
Parallel and series operation of converters. Load flow analysis of Alternating Current and direct Current..
Unit V:
Corona: Basic phenomenon and calculation of voltage gradient of conductors, power loss, audible noise and radio interference due to corona, electrostatic field of EHV lines
Unit VI:
Lightning Phenomenon: Charge formation in clouds: Wilson's theory, Simpson's theory; Mechanism of lightning: stepped leader, return stroke, multiple strokes.

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Course Outcomes

Department of Civil Engineering

Third Semester

Second Year (Third Semester)	Academic Year: 2021-22
Course/Subject: Engineering Mathematics-III	Course Code: 3CE01

On completion of this Subject/Course the student shall be able to

SN	Outcomes	Bloom's Taxonomy Levels
3CE01.1	Demonstrate the knowledge of differential equations and partial differential equations, applied to Civil Engineering systems.	L3
3CE01.2	Apply Laplace transform to solve differential equations.	L3
3CE01.3	Demonstrate the use of Partial Differential Equations.	L2
3CE01.4	Compute different Numerical Methods.	L4
3CE01.5	Apply the knowledge of Complex Analysis.	L3
3CE01.6	Demonstrate the basic concepts of probability and statistics.	L2

Syllabus

Unit I:

Ordinary Differential Equations: Complete solution, Operator D, rules for finding the complementry function, the inverseoperator, Rules for finding particular integral. Method of variation of parameters, Cauchy's and Legendre's Linear Differential equations. Simultaneous linear differential equations with constant coefficients Applications to civil engineering.

Unit II:

Laplace transforms: Definition and elementry properties, Inverse L.T. by various methods, Convolution theorem, Solution of ordinary differential equation using Laplace transform of periodic functions. Application to problems of beams and fluids.

Unit III :

Partial Differential Equations :P.D.E. of first order and first degree of types i) f(p,q) = O ii) f(p,q,z)=0, iii) f(p,q,x,y)=O iv) f(p,q,x,y,z)=O i.e. (a) Lagrange's form Pp + Qq = R (b) Clairtut's form z=px+qy+f(p,q) v) Equations reducible to above standard types linear Homogeneous P.D.E. of nth order with constant coefficients..

Unit IV:

Numerical Methods: (i) Solution of Algebraic and transcendal Equations by Newton Raphson method and by method of False Position. (ii) Solution of system of linear equations by Grout's method, Gauss Seidal method and Relaxation Method. Numerical solution of differential equations by Picard's method, Taylor's series method, Euler's method, modified Euler's method and Rungekutta forth order method.

Unit V :

Complex variable: Analytic functions, C. R. conditions, Harmonic functions. harmonic conjugate functions, Milne's method, conformal mappings (translation, rotation, magnification, inversion, bilinear transformation)

Unit VI :

Statistics: Probability: Axioms, conditional probability, Baye's theorem, Mathematical Expectation and Probability distributions (Binomial, Poisson and Normal). Curve fitting by method of least square Only for line and parabola, Correlation, regression.

Text Book:

1. Elements of Applied Mathematics by P. N. Wartikar and J. N. Wartikar. Poona Vidhyarthi Publisher
2. Higher Engineering Mathematics by B.S.Grewal. Khanna Publishers
3. Introduction to method of Numerical Analysis- S. S. Shastry, 2ND Edition, PHI Pvt. Ltd., New Delhi

Reference:

1. A Mathematical Companion for Science and Engineering Students – Brettenbach, Oxford University Press, 2008
2. Advancing Engg. Mathematics, E.K.Kreyzig, John Wiley
3. Numerical Method for Mathematics Science and Engineering, John H. Mathew, PHI
4. Numerical Methods - Principles, Analysis & Algorithms Pal, Oxford.

Second Year (Third Semester)	Academic Year: 2021-22
Course/Subject: Strength of Materials	Course Code: 3CE02

On completion of this Subject/Course the student shall be able to

SN	Outcomes	Bloom's Taxonomy Levels
3CE02.1	To understand the basics of material properties, stress and strain.	L2
3CE02.2	To apply knowledge of mathematics, science, for engineering applications	L3
3CE02.3	To identify, formulate, and solve engineering & real life problems	L4
3CE02.4	To design and conduct experiments, as well as to analyze and interpret action and reaction data.	L4
3CE02.5	To understand specific requirement from the component to meet desired needs within realistic constraints of safety.	L2

Syllabus

Unit I:
Mechanical properties: Concept of direct and shear stresses and strains, stress-strain relations, Biaxial and triaxial loading, elastic constants and their relationship, stress-strain diagrams and their characteristics for mild steel, tor steel, Generalized Hook's law, factor of safety. Uniaxial stresses and strains: Stresses and strains in compound bars in uniaxial tension and compression, temperature stresses in simple restrained bars and compound bars of two metals only.

Unit II:
Axial force, shear force & bending moment diagrams: Beams, loading and support conditions, bending Moment, shear force and axial load diagrams for all types of loadings for simply supported beams, cantilevers and beams with overhangs, relation between shear forces, bending moment and loading intensity.

Unit III :
Stresses in beams (Bending, Shear), i) Bending: Theory of simple bending, section modulus, moment of Resistance, bending stresses in solid, hollow and built up section. ii) Shear: Distribution of shear stresses on beam cross sections, impact loads and instantaneous stresses.

Unit IV:
Numerical Methods: Torsion: Theory of torsion & assumptions, derivation of torsion equation, polar modulus, stresses in solid & hollow circular shaft, power transmitted by shaft, closed coiled helical spring with axial load. Thin cylinders subjected to internal pressures.

Unit V :
Principal stresses: Biaxial stress system, principal stresses, principal planes, Mohr's circle of stresses, Principal strains. Combined direct & bending stresses.

Unit VI :
Statistics: Slope & deflection of beams: Slope & deflection in statically determinate beams subjected to point loads, uniformly distributed loads, moments by Macauley's method. Theory of long columns, Euler, Rankin's formula.

Text Book:

1. E. P. Popov, "Mechanics of Materials", Prentice Hall of India, New Delhi.

Second Year (Third Semester)	Academic Year: 2021-22
Course/Subject: Concrete Technology & R.C.C	Course Code: 3CE05

On completion of this Subject/Course the student shall be able to

SN	Outcomes	Bloom's Taxonomy Levels
3CE05.1	To know need and composition of binding material, cement.	L1
3CE05.2	To recognize concrete and RCC and will be able to perform desired test for suitability,	L3
3CE05.3	To analyze RCC Components like slab and lintels.	L4
3CE05.4	To decide and utilize the admixtures as per the need of Concrete.	L5
3CE05.5	To understand importance of mix design.	L2

Syllabus

Unit I:
Cement: Physical properties of Portland cement, laboratory tests on cement, types of cements. Aggregate: Classification of aggregate, physical properties, bulking and moisture content, specific gravity, bulk density.

Unit II:
Properties of fresh concrete: Workability of concrete, methods of measuring workability, nominal mix, mixing, centering & formwork, placing, compaction and curing of concrete. Properties of hardened concrete: Grades of concrete, properties of concrete, compressive, tensile, and shear strength, modulus of elasticity, creep, shrinkage. Durability of concrete, laboratory tests on concrete.

Unit III :
Basic elastic theory and concept of reinforced concrete, types of reinforcement, Analysis of rectangular sections by working stress method, modes of failure, design of singly reinforced beams, one-way slabs (simply supported), lintels, and chajjas.

Unit IV:
Pozzolana and Admixtures: Plasticizer, retarders, accelerators, water proofing agents, mineral admixtures, IS code provisions. Construction chemicals: concrete curing compounds, polymer bonding agent, surface retarders, bond aid for plastering, protective and decorative coating.

Unit V :
Special concrete: Ready Mix Concrete Light weight concrete, fiber reinforced concrete, Roller compacted concrete, self-compacted concrete, high strength concrete, high performance concrete, high volume fly ash concrete. Special concreting techniques: Guniting, grouting and shotcrete concrete, introduction & application of Ferrocement.

Unit VI :
Introduction of mix design, factors governing mix design, IS Code method of mix design (IS: 10262 – 2019) and Ambuja method.

Text Book:

1. Lea, F. M. The Chemistry of Cement and Concrete, Edward Arnold (Publishers) ltd.
2. Neville, A. M.: Properties of Concrete, Pitman Publishing Company.
3. Neville, Brooks: Concrete Technology, ELBS
4. Gambhir, M. L. : Concrete Technology, Dhanpat Rai and Sons
5. Orchard D. F.: Concrete Technology, Applied Science Pub Ltd.
6. Shetty, M. S.: Concrete Technology, S. Chand
7. Varshney, R. S.: Concrete Technology, Oxford Pub. house.

8. IS: 456 – 2000,
9. IS: 10262 – 2019,
10. Krishna Raju: Design of Concrete Mixes, Mc – Graw Hill.
11. Ambuja Cement Concrete Mix Design- Ambuja Technical Literature series 79.

Second Year (Third Semester)	**Academic Year: 2021-22**
Course/Subject: Concrete Technology & R.C.C – Lab	**Course Code:** 3CE09

On completion of this Subject/Course the student shall be able to

SN	Outcomes	Bloom's Taxonomy Levels
3EP9.1	Demonstrate properties of cement	L2
3EP9.2	Demonstrate grading of aggregate	L2
3EP9.3	Demonstrate grading of sand	L2
3EP9.4	Demonstrate workability of concrete	L2

List of Experiment

1. Mix Design (Compulsory) by IS method.
2. Compulsory site visit and submission of site visit report.
3. Fineness of cement
4. Soundness of cement
5. Consistency and setting time of the cement
6. Compressive strength of cement
7. Sieve analysis of aggregate.
8. Bulking of sand (fine aggregate).
9. Silting of sand.
10. Workability by slump cone test compaction factor test
11. Admixture: Density, Compatibility Test
12. Workability by flow table method.
13. Compressive & Tensile strength of concrete.

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Second Year (Sixth Semester)		Academic Year: 2021-22
Course/Subject: Mini Project		Course Code: 6CE09
On completion of this Subject/Course the student shall be able to		
SN	Outcomes	Bloom's Taxonomy Levels
6CE09.1	To understand the practical applications of technical knowledge	L2
6CE09.2	To understand use of Total station and other Surveying Equipments.	L3
6CE09.3	To know how to Work in teams and learn time management, communication and presentation skills	L3

List of Experiment

Any one Group Project in details.
1) Irrigation Project
2) Rehabilitation of Village / Town
3) Water Supply Project
4) Sewerage System
5) Bridge on River
6) Flood Relief Structures

Students should conduct a detailed survey in a seven day camp.
Data Analysis, Design & Submit Report & Drawing sheets.

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D

Course Outcomes

Department of Science & Humanities

First & Second Semester

First Year (First & Second Semester)		Academic Year: 2017-18 2018-19
Course/Subject: Engineering Chemistry		**Course Code:** 1B2
On completion of this Subject/Course the student shall be able to		
SN	**Outcomes**	Bloom's Taxonomy Levels
1B2.1	Apply the fundamental knowledge in water softening and calculate the chemicals required for water softening.	L3
1B2.2	Explain the chemical reaction involved in corrosion, its preventing methods and latest applications of nanochemistry in various fields.	L4
1B2.3	Explain the manufacturing process of cement, its properties and nuclear reactions with its utilization.	L4
1B2.4	List the importance of fuels and lubricants.	L1
1B2.5	Compare the various examples of polymers and its uses.	L2
1B2.6	Describe the different segments of environment, various atmospheric effects and controlling methods to remove particulates from atmospheric gases.	L4

Syllabus
SECTION A

Unit I: Water Technology :
Hardness of water :- Temporary and permanent hardness, units and their inter-conversions. Experimental determination by EDTA method, softening of water by Lime-Soda, Ion exchange and Zeolite process. Numerical problems based on Lime Soda & Zeolite process. (9)

Unit II: Corrosion, Corrosion Control and Nano-Chemistry :
Corrosion & its control - : Dry & Wet corrosion and their mechanism. Types of corrosion-Pitting corrosion, waterlinecorrosion, inter-granular corrosion, galvanic and stress corrosion. Role of design and material selection in corrosion control. Anodic and Cathodic protection, hot dipping (Galvanizing and tinning) Introduction of Nano Chemistry, types of Nano materials. General methods of preparation of Nano materials, Applications of Nano materials. (7)

Unit III: Portland cement & Nuclear Fuels & Power generation :
A) Portland cement: Raw materials & manufacture of cement by wet process, setting and hardening, heat of hydration, soundness of cement.
B) Nuclear Fuels & Power generation: Nuclear binding energy, nuclear fission and fusion, critical mass. Components of nuclear power reactor and breeder reactors. (9)

SECTON-B

Unit IV: Fuels and Lubricants:
A) Fuels :- Definition of chemical fuel, classification, calorific value-gross and net, analysis of coal, Proximate and ultimate analysis and their significance, cracking of petroleum fractions. Use of gasoline and diesel in internal combustion engines, Knocking, Chemical constitution and knocking properties, octane number, cetane number.
B) Lubricants: - Classification of lubricants, mechanism of lubrication, testing of lubricants for viscosity and viscosity index, flash and fire point. (7)

Unit V: Polymers, Resins/ Plastics, Rubbers:
Classification of polymers on the basis of their structure, methods of polymerization, Cationic & Anionic mechanism of polymerization, Thermosetting and Thermoplastic Resin, Preparation, properties and uses of PVC, Teflon, Bakelite, Natural rubber : vulcanization, properties and uses of Synthetic rubbers styrene rubber, nitrile rubber & butyl rubber. (7)

Unit VI: Environmental Chemistry :
Segments of environment: lithosphere, hydrosphere, bio-sphere & atmosphere. Green House Effect, Acid rain, Ozone depletion. Methods and equipments for controlling of Particulate emissions: wet scrubber, fabric filters, cyclone separators and electrostatic precipitators.

TEXT BOOK :
(1) "A Text Book of Engineering Chemistry"-S. S. Dara. (S.Chand).

REFERENCE BOOKS :
1) "Engineering Chemistry"-Jain & Jain. (Dhanpat Rai &Sons).
2) "A Text book on Experiments & Calculations in Engineering Chemistry- S. S. Dara. (S.Chand).
3) "Text book of Engineering &Technology" vol I & II-Rajaram & Kuriacose.
4) "AText Book of Polymer Science &Tech"-V Gowarikar.
5) Nanotechnology Fundamentals and Applications : Manasi Karkare,I K International Pub.

First Year (First & Second Semester)		**Academic Year: 2017-18 2018-19**
Course/Subject: Engineering Chemistry Practical		**Course Code:** 1B6
On completion of this Subject/Course the student shall be able to		
SN	**Outcomes**	**Bloom's Taxonomy Levels**
1	Apply the knowledge of chemistry in softening processes involved in water technology.	L3
2	Identify various types of corrosion and methods to protect the metallic structures form corrosive environment	L2

3	Understanding of the energy storage system (battery) .	L2
4	Apply the knowledge of useful engineering materials such as cement, lubricants, ceramics, refractories and nano materials based on their properties.	L3
5	Develop the technique involved in the manufacturing process of cement	L3
6	Apply the knowledge about the properties of chemical fuels for the generation of power.	L3
7	Apply the knowledge of various polymeric material, their synthesis and applications.	L6
8	Identify various phases of material at different thermodynamics variables.	L2
9	Identification and analysis of materials by using advanced analytical techniques.	L2

List of Experiment

1. Determination of alkalinity of water sample in given alkali mixture.
(i) NaOH and Na_2CO_3 (ii) Na_2CO_3 and $NaHCO_3$
2. Determination of hardness of water by EDTA method.
3. Determination of chloride ions in water sample.(Mohr's Method)
4. Determination of chlorine in water sample. (Iodometry)
5. Determination of % CaO in given cement sample.
6. Preparation of phenol formaldehyde & Urea formaldehyde resin.
7. Determination of viscosity of lubricating oil by Redwood viscometer No. 1
8. Determination of viscosity of lubricating oil by Redwood viscometer No. 2
9. Determination of flash point of lubricating oil by Pensky Marten's Apparatus.
10. Determination of flash point of lubricating oil by Abel's apparatus.
11. To carry out proximate analysis of coal.
12. Determination of acid value of lubricating oil.
13. Determination of Fe^{2+} and Fe^{3+} in given solution.
14. Determination of Dissolved Oxygen in Water Sample.
15. Determination of conductivity of unknown sample by conductivity meter.
16. Determination of pH of unknown sample by pH meter.

(Note : Minimum 08 experiments shall be conducted.)

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First Year (First & Second Semester)	Academic Year: : 2017-18, 2018-19
Course/Subject: Computer Programming (Lab)	Course Code: 1B7

On completion of this Subject/Course the student shall be able to

SN	Outcomes	Bloom's Taxonomy Levels
1B7.1	Explain fundamental concept of computer and computing	L2
1B7.2	Test and execute the programs and correct syntax and logical errors.	L3
1B7.3	Implement conditional branching, iteration and recursion	L4
1B7.4	Decompose a problem into function and synthesize a complete program using divide and conquer approach.	L5
1B7.5	Use arrays, pointers and structures to formulate algorithms and programs	L4
1B7.6	Recognize and apply various problem solving techniques using programming concept and computer applications to solve real life problems.	L5

List of Experiment

1. Basic Interface of GUI based on OS
2. Introduction to MS-Office
3. Introduction About Networking and Internet
4. A simple C Program
5. A program on Decision Constructs
6. Program on Decision Making
7. Program on Looping Constructs
8. Program on Array, String & Structure
9. Program on Functions
10. Program on Pointer

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Construction and working of PMMC, MI, Electro-dynamometer & Induction type Measuring Instruments. Necessity of earthing and types of earthing (Plate earthing & Pipe earthing)

TEXT BOOKS :

1.Basic Electrical Engineering , First Ed., Kulshreshtha D.C., TMH
2. D. P. Kothari & I. J. Nagrath, "Basic Electrical Engineering", TMH Pub. Co. Ltd., New Delhi , 4th Edition
3. Basic Electrical Engineering, V. N. Mittle, TMH Publishing company Ltd
4. Basic Electrical Engineering, Fifth Edition, Fidzgerald A.E., TMH -2006.

REFERENCE BOOKS :

1.Basic Electrical Engineering, First ed., R. Anand Natarajan & P. Ramesh
2.. Principle of Electrical Engineering , 4th Edition, Del Toro V., PHI 2005
3.. Basic Electrical Engineering –First ed., T. K. Nagsarkar, OXFORD University Press, 2005
4. Electrical Technology – Volume - I, B. L. Theraja, S. Chand & Co. Publication

First Year (First & Second Semester)	**Academic Year: 2019-20, 2020-21,2021-22**
Course/Subject: Engineering Mechanics (Lab)	**Course Code: 1A7**

On completion of this Subject/Course the student shall be able to

SN	Outcomes	Bloom's Taxonomy Levels
1B7.1	verify network theorem.	L5
1B7.2	To analyze & study AC circuit	L4
1B7.3	study measuring instruments	L6

List of Experiment

1.To verify KCL and KVL .
2. To verify Superposition theorem.
3. To verify Thevenin's theorem
4. To verify the effect of temperature on conductor and temperature coefficient of resistance.
5. To analyze series RLC circuit
6. To analyze Star connected resistive circuit
7. To analyze Delta connected resistive circuit
8. To perform load test on a single phase transformer
9. To study D.C. Motors
10. To study measuring instruments

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Instruments. Necessity of earthing and types of earthing (Plate earthing & Pipe earthing)

TEXT BOOKS :

1.Basic Electrical Engineering , First Ed., Kulshreshtha D.C., TMH
2. D. P. Kothari & I. J. Nagrath, "Basic Electrical Engineering", TMH Pub. Co. Ltd., New Delhi , 4th Edition
3. Basic Electrical Engineering, V. N. Mittle, TMH Publishing company Ltd
4. Basic Electrical Engineering, Fifth Edition, Fidzgerald A.E., TMH -2006.

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1.Basic Electrical Engineering, First ed., R. Anand Natarajan & P. Ramesh
2.. Principle of Electrical Engineering , 4th Edition, Del Toro V., PHI 2005
3.. Basic Electrical Engineering –First ed., T. K. Nagsarkar, OXFORD University Press, 2005
4. Electrical Technology – Volume - I, B. L. Theraja, S. Chand & Co. Publication

First Year (First & Second Semester)	**Academic Year: 2017-18, 2018-19**
Course/Subject: Engineering Mechanics (Lab)	**Course Code:** 1A7

On completion of this Subject/Course the student shall be able to

SN	Outcomes	Bloom's Taxonomy Levels
1B8.1	verify network theorem.	L5
1B8.2	To analyze & study AC circuit	L4
1B8.3	study measuring instruments	L6

List of Experiment

1.To verify KCL and KVL .
2. To verify Superposition theorem.
3. To verify Thevenin's theorem
4. To verify the effect of temperature on conductor and temperature coefficient of resistance.
5. To analyze series RLC circuit
6. To analyze Star connected resistive circuit
7. To analyze Delta connected resistive circuit
8. To perform load test on a single phase transformer
9. To study D.C. Motors
10. To study measuring instruments

trajectories and Electrical engineering. (8)

Unit VI :Sequences and Series

Convergence of Sequence and Series, Test for Convergence, Comparison Test, Ratio Test, Root Test, Raabe's Test, Range of Convergence. (8)

Text / Reference Books :

i) Wartikar P.N . , Wartikar J.N. – A text of applied Mathematics, Volume I, II, Pune V.G. Prakashan , Pune.
ii) Grewal B. S. – Higher Engineering Mathematics, (latest Edition), Khanna Publishers .
iii) Kreyszig E.K. – Advanced engineering Mathematics, John Wiley.
iv) Ramana B. V. - Higher Engineering Mathematics, (TMH).
v) Singh R.R. And Bhatt M. - Higher Engineering Mathematics, (TMH).
vi) N.P.Bali and Manish Goyal – A text book of Engineering Mathematics, Laxmi Publications.
vii) Veerarajan T. Engineering mathematics for first year,(TMH).

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substitution. (10)

Unit VI :
Solution of differential equation of first order and higher degree by various methods application of differential equations of first order and first degree to the problems on orthogonal trajectories and electrical engineering. (10)

TEXT BOOK :-
(1) Wartikar P.N. & Wartikar J.N.- A Text Book of Applied Mathematics, Vol.-I, & II, Pune V.G. Prakashan, Pune.

REFERENCE BOOKS :-
1) Grewal B.S. - Higher Engineering Mathematics, 40/e, Khanna Publishers.
2) Kreyszig E.K. - Advanced Engineering Mathematics, John Wiley.
3) Ramana B.V. - Higher Engineering Mathematics, (TMH)
4) Singh R.R. & Bhatt M. - Engineering Mathematics, (TMH)

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Unit VI: Multivariable Integral Calculus II :
Triple integrals, Cartesian, transformation to spherical polar coordinates, Volume by Triple Integration, Mean and RMS Value Theorem. (8)

Text / Reference Books :

i) Wartikar P.N . , Wartikar J.N – A text of applied Mathematics, Volume I, II Pune V.G. Prakashan, Pune.
ii) Grewal B. S. – Higher Engineering Mathematics, (latest Edition), Khanna Publishers .
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iv) Ramana B. V. - Higher Engineering Mathematics, (TMH).
v) Singh R.R. And Bhatt M. - Higher Engineering Mathematics, (TMH).
vi) N.P.Bali and Manish Goyal – A text book of Engineering Mathematics, Laxmi Publications.
vii) Veerarajan T. - Engineering mathematics for first year, (TMH)

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First & Second Semester

First Year (First & Second Semester)	Academic Year: 2017-18, 2018-19
Course/Subject: Engineering Mathematics-II	Course Code: 1B1

On completion of this Subject/Course the student shall be able to

SN	Outcomes	Bloom's Taxonomy Levels
1B1.1	The essential tool of matrices and linear Algebra in a comprehensive Manner.	L3
1B1.2	Evaluation of Integrals by Reduction Formulae, Gamma and Beta Function	L5
1B1.3	Use the tool of Fourier series for learning advanced engineering mathematics.	L3
1B1.4	Use new techniques DUIS to evaluate Integrals and Tracing of Curves	L3
1B1.5	The Mathematical tools needed in evaluating Multiple Integrals and their usage.	L5

Syllabus

SECTION - A

Unit I : Matrices :
Inverse by Partitioning, Rank of a matrix, Rank-nullity theorem(without proof), System of linear equations; Eigen values and Eigen Vectors, Cayley-Hamilton Theorem . (8)

Unit II : Fourier series:
Periodic function, Fourier expansion of periodic function in (C, C+2L), half range Fourier series, Parseval's Theorem, Harmonic Analysis. (8)

Unit III: Integral Calculus :
(a) Scalar Triple Product, vector triple product and their properties, multiple products.
(b) Rule of differentiation under integral sign.
(c) Tracing of curves in Cartesian, polar and parametric forms. (10)

SECTION – B

Unit IV:
Reduction formulae, Beta and Gamma function, Rectification.(10)

Unit V: Multivariable Integral Calculus I :
Double Integrals, Cartesian, Change of Order of Integration, Change of Variables (Cartesian to polar coordinates), Evaluation of area by Double Integration.. (8)

Unit VI: Multivariable Integral Calculus II :
Triple integrals, Cartesian, transformation to spherical polar coordinates, Volume by Triple Integration, Mean and RMS Value Theorem. (8)

TEXT BOOK :-

(1) Wartikar P.N. & Wartikar J.N.- A Text Book of Applied Mathematics, Vol.-I, & II, Pune V.G. Prakashan, Pune.

REFERENCE BOOKS :-

1) Grewal B.S. - Higher Engineering Mathematics, 40/e, Khanna Publishers.
2) Kreyszig E.K. - Advanced Engineering Mathematics, John Wiley.
3) Ramana B.V. - Higher Engineering Mathematics, (TMH)
4) Singh R.R. & Bhatt M. - Engineering Mathematics, (TMH)

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Course Outcomes

Department of MBA

MBA First Semester

First Year (First Semester)		Academic Year: 2021-22
Course/Subject: Principle and Practice of Management		Course Code: MBA/101
On completion of this Subject/Course the student shall be able to		
SN	Outcomes	Bloom's Taxonomy Levels
C101.1	Understand the basic knowledge of Principles of Management and the contributions of Management theory and also explain current developments in management practices.	L2
C101.2	Relate the basic concepts of planning: the importance of planning, strategic Planning and the types of objectives and plans developed by organizations.	L3
C101.3	Describe the various forms of structure available to an organization also explain effective strategies for recruiting and selecting qualified job applicants.	L4
C101.4	Demonstrate the ability to directing ,leadership and communicate effectively	L5
C101.5	Describe the control process including: the importance of control, tools for Measuring organizational performance, and managerial actions.	L4

Syllabus

Unit-I: The Concept of Management: Development of management thought-various approaches to and of management philosophy: Mathematical, Behavioural, Scholastic schools of management and systems, contingency approaches. Contribution of Taylor, Fayol & Elton Mayo

Unit-II: Planning: The Nature and Purpose of Planning, Objectives of Planning, Planning Premises, Policies, Procedures and Methods; Forecasting and Planning, Planning Process, The Process of Decision Making.

Unit-III: Organizing: Nature and Purpose of Internal Organization of Business Enterprise, Principles of Organizing; Span of Management; Departmentation Line and Staff Authority relationship; Service departments, Centralization vs. Decentralization of authority; Delegation of Authority; Committees, Staffing.

Unit IV: Directing, Nature of Directing, Leadership Concept and Styles, Motivation Concept, Theory: Maslow, Hertzberg, Supervision, Concept of Communication, Coordination; Need & Principles.

Unit-V: Control; Process of Control; Techniques and Tools; Management by objectives, Participative Management. Management by exception

Suggested Reading:

1. Koontz, H and Wechrich,H Management. 10th ed. New York McGraw Hill, 1995.

2. Luthans F. Organizational Behavior. 7th ed. New York,McGraw Hill, 1995

3. Robbins S.P. Management 5th ed. New Jersey, Englewood Clifts. Prentice Hall Inc. 1996.

4. Robbins S.P. Organizational Behavior. 7th ed., New Delhi, Prentice Hall of India, 1996.

5. Singh, Dalip Emotional Intelligence at Work, Response Books, Sage Publications, Delhi 2001.

6. Staw, B.M. Psychological Dimensions of Organizational Behaviour 2nd ed. Englowed Cliffs. New Jersey Prentice Hall Inc., 1995.

7. Stoner, J. etc. Management 6th ed., New Delhi, Prentice Hall of India 1996..

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First Year (First Semester)	Academic Year: 2021-22
Course/Subject: Managerial Economics	Course Code: MBA/102

On completion of this Subject/Course the student shall be able to

SN	Outcomes	Bloom's Taxonomy Levels
C102.1	The student will understand the Concept, Techniques and Applications of Managerial Economics	L2
C102.2	The student will learn the concept of Utility Analysis, Demand Analysis, Law of Demand, Elasticity of Demand, Law of Supply and Supply Analysis	L2
C102.3	The student will learn the concept of Production & Cost function.	L2
C102.4	The student will understand different Theories of firm.	L2
C102.5	The student will understand different Market Structure, short term pricing in these market structure	L4

Syllabus

Unit I:
Concept, Need, Scope, Techniques and Applications of Managerial Economics

Unit II:
Utility Analysis, Marshal Approach, Demand Analysis, Demand Function, Law of Demand, Elasticity of Demand and demand forecasting. Law of Supply and Supply Analysis.

Unit III :
Production & Cost function, Production ISO-quant, ISO-cost, Expansion path, Economies and Diseconomies of scale, short run and long run cost behaviour.

Unit IV:
Theories of firm, Profit Maximization, Sales Maximization, Managerial Utility Model, Simon Satisfying Behavior Model.

Unit V :
Market Structure-Perfect Competition, Monopoly, Oligopoly, Monopolistic Competition, short term pricing in these market structure

Text Book: Maheshwari, Managerial Economics SultanChand & Sons

Reference Books:

1. Adhikary, M. Business Economics. New Delhi, Excel Books, 2000
2. Baumol, W.J. Economics Theory and Operations Analysis 3rd ed., New Delhi, Prentice Hall Inc. 1996.
3. Chopra, O.P. Managerial Economics. New Delhi, Tata McGraw Hill 1985
4. Keat, Paul G & Philips K.Y.Young, Managerial Economics, Prentice Hall New Jersey 1996.
5. Koutsoyiannis, a Modern Micro Economics. New York, Macmillan, 1991
6. Milgrom, P and Roberts J. Economics Organization and Management Englewood Clitts, New Jersey Prentice Hall Inc. 1992.
7. Maheshwari, Yogesh. Managerial Economics. P.H.I.
8. Mehta, P.L Managerial Economics SultanChand & Sons

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MBA First Semester

First Year (First Semester)	Academic Year: 2021-22
Course/Subject: Managerial Skill Development	Course Code: MBA/107

On completion of this Subject/Course the student shall be able to

SN	Outcomes	Bloom's Taxonomy Levels
C107.1	The student will learn the different Managerial Skills like Employability Skills, Soft Skills etc	L2
C107.2	The student will learn the basic concept of Communication, Principles of effective communication, Process of communication	L3
C107.3	The student will acquire the knowledge of Business correspondence	L4
C107.4	The student will understand different Listening Skills, Body Language and Public Speaking, Negotiation Skill, etc	L5
C107.5	The student will understand different Interview Techniques, Brain Storming, Paper Writing and Presentation.	L4

Syllabus

Unit-I: Managerial Skills- Nature & Concepts, objectives, significance, Managerial Skills, Employability Skills, Soft Skills and Technical Skills.

Unit-II: Importance & Nature of communication, Verbal and Non Verbal, Talking and Speaking, Communication, Principles of effective communication, Process of communication, Barriers of Communication, Types of Communication.

Unit-III: Do's and Don'ts of Business Writing, Business correspondence, Report Writing, e-communication, Resume Writing, C.V, Writing,

Unit IV: Listening Skills, Body Language and Public Speaking, Negotiation Skill.

Unit-V: Interview Techniques, Group Discussions, Presentation skills, Meetings, Case Analysis, Brain Storming, Paper Writing and Presentation.

Suggested Reading:

1. Bowman, Joel P and Branchaw, Bemadine "Business Communications from Process to Product. 1987 Dryden Press, Chicago

2. Hatch Richard "Communicating in Business. 1977 Science Research Associates, Chicago

3. Murphy, Herta A and Peck, Charries E "Effective Business Communications". 2nd ed. 1976. Tata McGraw Hill, New Delhi.

4. Pearce. C. Glenn etc. "Business Communications: Principles and Applications.2nd" ed. 1988. John Wiley., New York.

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Suggested Reading:

1. Budnik, Frank S. Dennis, Mcleavey, Richard Mojena Principles of Operations Research 2nd ed. Richard, Irwin, Illinois-All India Traveller Bookseller, New Delhi, 1995

2. Gould,F.J. etc. introduction to Management Science Englewood Cliffs, New Jersey, Prentice Hall Inc. 1994.

3. Mathur K and Solow, D. Management Science Englewood Cliffs, New Jersey, Prentice Hall inc., 1994.

4. Narag A.S. Linear Programming and Decision Making, New Delhi,Sultan Chand, 1995.

5. Sharma J.K. Operations Research: Theory and Applications New Delhi, Macmillan India Ltd. 1997

6. Taha, H.A. Operations Research, An introduction, New York, Mc- Millan, 1989.

7. Theirouf, R J and Klekmp, R.C. Decision Making Through Operations Research, NewYork, John Wiley 1989

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MBA Fourth Semester

Second Year (Fourth Semester)		Academic Year: 2021-22
Course/Subject: Marketing for Non-Profit Organisations and Social Services		Course Code: MBA/4203/SM
On completion of this Subject/Course the student shall be able to		
SN	Outcomes	Bloom's Taxonomy Levels
C4203.1	Students will understand about Scope and application of Marketing in the field of Non Profit Organisations.	L2
C4203.2	Student will able to understand how to set Marketing Objective by analyzing internal and external environmental factors of NPO's	L3
C4203.3	Students will learn how to use Marketing Mix strategies for marketing of NPO's Services .	L2
C4203.4	Students will understand and the Role of CRM , Advertisement and product distribution strategy for NPO's products .	L3
C4203.5	Students will learn about the marketing strategy for CSR program and monitoring the marketing strategy for NPO's .	L4

Syllabus

Unit-I: Scope and application of Marketing in the context of NPO: Hospitals, Police, Public Services, etc. & social services, e.g. health and family welfare, adult literacy Programme, environment protection, social forestry, etc.

Unit-II: Setting Marketing Objective: Analyzing internal & external Environment influencing NPO's and Social Services.

Unit-III: Market Segmentation, customer targeting, marketing mix strategies, product-service life cycle for NPO's and social services.

Unit IV: Beneficiary contact programme, use of print and electronic media in mass communication, diffusion of innovative ideas, marketing tools, Distribution & Delivery Strategy for NPOs and Social Services.

Unit-V: Marketing Strategies for social services & NPOs and Relevance of CST (Corporate Social Responsibility), review and monitoring of marketing strategies of socially relevant programmes.

Suggested Reading:

1. Jena, B and Pati R, *Health and Family Welfare Services in India*, Ashish, New Delhi, 1986.

2. Kotler, Philip and Roberto Eduardo L., *Social Marketing : Strategies for changing Public Behaviour*, Free Press, New York, 1989.

3. Maitra, T, *Public Services in India*, Mittal, New Delhi, 1985.

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MBA Fourth Semester

First Year (Fourth Semester)		Academic Year: 2021-22
Course/Subject: Retail Marketing		Course Code: MBA/4204/SM
On completion of this Subject/Course the student shall be able to		
SN	Outcomes	Bloom's Taxonomy Levels
C4204.1	The student will understand the concept of Retail: Meaning, importance and types.	L2
C4204.2	The student will get to learn marketing of retail business, organizational structure of retail business and careers in retail.	L3
C4204.3	The student will get the knowledge of different aspects of retail location and will study different retail layouts.	L4
C4204.4	The student will acquire the knowledge of retail communication mix.	L4
C4204.5	The student will study different retailing strategies and understand role of Information Technology in retail.	L4

Syllabus

Unit I: Retailing – Definition & Importance – Indian Vs Global Scenario – Types of Retailing – Store Retailing – Non Store Retailing – Types of retail formats – Franchising in retailing.

Unit II: Retail Marketing Mix – Retail consumer buying behavior – types – factors influencing – buying behavior –
Segmentation – Positioning, Retail Organization Structure – Major Functional Areas – Careers in retailing.

Unit III: Retail Location – Factors affecting retail location decision – Site Selection – Factors affecting site selection – Steps in selecting site – Location based retail strategies, Store design – Interiors & Exterior – Store layout – Types of layouts – Factors affecting store layout – Retailing image mix – Store façade.

Unit IV: Retail Communication Mix – Sales Promotion – Advertising – Public Relation – Personal Selling – Steps in planning retail communication.

Unit V: Retail Strategies – Differentiation Strategies – Growth Strategies – Expansion Strategies – Pricing Strategies, Role of IT in retailing – Electronic Data Exchange – Bar Coding – RFID – Electronic Payment Systems.

Suggested Reading:

1. Retailing Management – Swapna Pradhan

2. Retail Marketing Management – Swapna Pradhan

3. Retail Management – Gibson Vedamani
4. Retail Management – Levy &Weitz
5. Channel Management & Retail Management – MeenalDhotre
6. Retail Marketing Management – David Gilbert
7. Retail Management – Ron Hasty & James Reardon
8. The Art of Retailing – A.J. Lamba
9. Retail Management – W. Steward
10. Retail Management – Analysis Planning & Control – David Walters

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Course Outcomes

Department of MCA

P R Pote Patil College of Engg and Management, Amravati
Department of MCA
CO with Syllabus and Blooms' Taxonomy

First Semester

First Year(First Semester)	**Academic Year: 2020-21**
Course/Subject: Advance Computer Architechture	**Course Code:** MCA20101

On completion of this Subject/Course the student shall be able to

SN	Outcomes	Bloom's Taxonomy Levels
C20101.1	CO1: Introduces the computer system and its architecture and their knowledge	L2
C20101.2	CO2: Explain fundamentals of parallel processing and pipeline Processing	L2
C20101.3	CO3: Analyze and classify different pipelined processors	L4
C20101.4	CO4: Explains the function of virtual memory organization	L2
C20101.5	CO5: Will describe various types of Architectures	L2
C20101.6	CO6: Learn different multithreaded processors architecture	L3
Units	**Contents**	**Total Hrs**
I	Amdahl's law, Von Neumann machine architecture, Program development tools, Operating systems. Design of ALU, Bit slice processors. Concept of instruction formats and instruction set, instruction set types, types of operands and operations, Generation of memory addresses and addressing modes, Subroutine nesting using stacks to implement subroutine calls and calling conventions, Processor organizations, Register organization, Stack based organizations, Encoding of machine instructions, General features of RISC and CISC instruction sets, modern processors convergence of RISK with CISC, Processor microarchitecture-I - Fundamental concepts for data path implementation, Processor microarchitecture-II - Data path implementation, microprogrammed execution, recent innovations in execution unit design.	
II	Overview of Parallel Processing and Pipelining Processing, study and comparison of uni-processors and parallel processors. Conventional and EPIC architecture. Evolution of parallel processors, future trends and there architecture. Overview of Parallel Processing and Pipelining Processing Necessity of high performance, Constraints of conventional architecture, Parallelism in uniprocessor system, Evolution of parallel processors, future trends, Architectural Classification, Applications of parallel processing, Instruction level Parallelism and Thread Level Parallelism, Explicitly Parallel Instruction Computing (EPIC) Architecture. Principles of scalable performance: Performance Metrics and Measures, Speedup Performance Laws.	10

III	- Instruction pipeline, instruction pipeline hazards, overcoming hazards using a pipeline with forwarding paths, instruction set design influence on pipelining, example of pipelined CISC processor, example of pipelined RISC processor, VLIW (Very Long Instruction Word) processors, Vector processors, Multithreaded processors, Compilation techniques support to instruction level parallelism, Extracting parallelism.	10
IV	Virtual memory organization, mapping functions for translating the program pages in virtual to physical addresses space, partitioning, segmentation (superpages or page blocks) partitioning of virtual address space in to segment and page address, demand paging and swapping, cache and virtual swapping, cache and virtual memory, inverted page tables concept, protection between programs running on the same system, accessing I/O devices, programmed I/O, interrupts, direct memory access DMA, bus arbitration, interface circuits, I/O interfaces, I/O processors, external I/O devices.	10
V	Multiprocessor Architectures – Objectives, Introduction, Multiprocessor Architectures, Performance Charateristics of Multiprocessors, Multicore Architectures – Single Chip Multiprocessors, Flynn Classification, Interconnection Structures, Interconnection Networks – Dynamic and Static Multiprocessor System Interconnects, Banyan and Delta Networks (Banyan Multistage Networks), Interprocess Arbitration, Interprocess Communication, Memory Organization in Multiprocessors, Shared-memory Multiprocessor Systems, Synchronization – Memory Organization, Contention and Arbitration, Cache Coherence and Synchronization Mechanisms, Cache Coherence, Message Passing Systems, Issues in Cluster Computing	10
VI	Study of Architecture of Multithreaded processors, Latency hiding techniques, Principles of multithreading, Issues and solutions. Parallel Programming Techniques: Message passing program development, Synchronous and asynchronous message passing, Message passing parallel programming, Shared Memory Programming, Data Parallel Programming. Implementation issues of a multithreaded program.	10

Textbook :

1. Computer Architecture and Organization by Nicholus Carter &Rajkamal, Schaum Series Pub.
2. Kai Hwang, Faye A. Briggs, "Computer Architecture and Parallel Processing" McGraw-Hill International Edition
3. Kai Hwang, "Advanced Computer Architecture", Tata McGraw-Hill

Reference Books :

1. V.Rajaraman, L Sivaram Murthy, "Parallel Computers", PHI.
2. William Stallings, "Computer Organization and Architecture, Designing for performance" Prentice Hall, Sixth edition.
3. Kai Hwang, Scalable Parallel Computing.
4. Harrold Stone, High performance computer Architecture.
5. Richard Y. Kain, Advanced Computer Architecture
6. http://www.intel.com/products/processor (for Intel Itanium Processor)

First Year(First Semester)	Academic Year: 2020-21
Course/Subject: Data structure and Algorithms	Course Code: MCA20102

On completion of this Subject/Course the student shall be able to

SN	Outcomes	Bloom's Taxonomy Levels
C20102.1	CO1 Explain and identify fundamental concepts of data structures	L2
C20102.2	CO2: Understand various data searching and sorting methods with its complexity	L2
C20102.3	CO3: Demonstrate operations such as insertion, deletion, searching and traversing on data structures.	L3
C20102.4	CO4: Design algorithms for solving problems with the help of fundamental data structures	L5

Units	Contents	Total Hrs
I	Data structures basics, Mathematical /algorithmic notations & functions, Complexity of algorithms, Sub-algorithms. String processing: storing strings, character data type,string operations, word processing, and pattern matching algorithms.	10
II	Linear arrays and their representation in memory, traversing linear arrays, inserting & deleting operations, Bubble sort, Linear search and Binary search algorithms. Multidimensional arrays, Pointer arrays. Record structures and their memory representation. Matrices and sparse matrices.	10
III	Linked lists and their representation in memory, traversing a linked list, searching a linked list.Memoryallocation & garbage collection.Insertion deletion operations on linked lists.Header linked lists, Two- way linked lists.	10
IV	Stacks and their array representation. Arithmetic expressions: Polish notation. Quick sort, application of stacks. Implementation of recursive procedures by stacks, Queues. Deques. Priority queues.	10
V	Trees, Binary trees & and their representation in memory,Traversing binary trees. Traversal algorithms using stacks, Header nodes : threads. Heap and heapsort.Path length & Huffman's algorithm.Generaltrees.	10
VI	Graph theory, sequential representations of graphs, Warshalls' algorithm, Linked representation, operations & traversing the graphs. Posets& Topological sorting. Insertion Sort, Selection Sort. Radix sort.	10

Textbook :	
	Seymour Lipschutz: "Data Structures with C", Schaum's Outline Series.

Reference Books :

1. Forouzan, Gilberg: Data Structures and Algorithms, CENGAGELearning.
2. ReemaThareja: Data Structures using C, Oxford University Press,2011.
3. Arpita Gopal: Magnifying Data structures, PHI (EEE),2010.
4. Ellis Horowitz, SartajSahni: Fundamentals of Data Structures,CBS Publications.

First Year(First Semester)	Academic Year: 2020-21
Course/Subject: Oprating System	**Course Code:** MCA20103

On completion of this Subject/Course the student shall be able to

SN	Outcomes	Bloom's Taxonomy Levels
C20103.1	CO1: Understand the concept of programs & processes along with the need of scheduling in operating systems	L2
C20103.2	CO2: Recognize different states of process and schedulers to apply scheduling algorithms to meet the scheduling objectives and acquire the knowledge of dealing with deadlocks.	L4
C20103.3	CO3: Apply memory management techniques & virtual memory concepts to avoid page faults and computing page replacement strategies	L3
C20103.4	CO4: Analyze and apply various protection and security mechanisms	L4
C20103.5	CO5: Compare different operating system	L4

Units	Contents	Total Hrs
I	Introduction: OperatingSystem (OS) definition, OS Evolution, OS Components and Services. Process Concept, Process Scheduling, Operations on Processes, Cooperating Processes, Interprocess Communication, Threads Overview, Multi-threading Models, Threading Issues, Java Threads.	10
II	CPU Scheduling Concepts, Scheduling Criteria and Algorithms. Process Synchronization: The Critical-Section Problem, Synchronization Hardware,Semaphores,Monitors. Deadlocks: Definition & Characterization, Deadlocks Prevention,Avoidance,Detection and Recovery from Deadlock.	10
III	Memory Management Background, Swapping, Contiguous Memory Allocation Schemes, Paging, Segmentation. Virtual Memory Management: Background, Demand Paging scheme, Process Creation, Page Replacement Policies, Allocation of Frames, Thrashing.	10
IV	File-System Interface; Directory structure, File-System Mounting, File Sharing & Protection. File-System Structure, File-System Implementation. Directory Implementation, Allocation Methods, Free- Space Management. File Recovery	10
V	I/O Systems: Overview, I/O Hardware, Application I/O Interface, and Kernel I/O Subsystem. Transforming I/O to Hardware Operations. Disk Scheduling, Disk Management,Swap – Space Management, RAID Structure.	10
VI	File protection & security: Goals of Protection, Principles of Protection, Revocation of Access Rights, Security Problem, Program Threats, Classifications, User Authentication, Implementing Security Defenses, Firewalling to Protect Systems	10

Textbook :	
	Text Books :AviSilberschatz , P.B.Galvin, G. Gagne : "Operating System Concept" (Sixth Edition) John Wiley & Sons Publication.

Reference Books :	
	1. A .S.Tanenbaum,"Modern Operating Systems" Pearson education. 2. William Stallings,"Operating Systems"Prentice-Hall. 3. D.M.Dhamdhere ,"Operating Systems "Tata McGraw-Hill. 4. M.Milankovic,"Operating Systems"McGraw-Hill. 5. Achutt Godbole, "Operating Systems" TataMcGraw-Hill.

H.O.D. Dept of MCA

P.R. Pote Pa... Welfare Trust
Group of Institu... Management
Kathora Road, Amravati

	Suggested Practical List
	The sample list of programs is given below. This list can be used as a guideline but the scope of the laboratory should not be limited to the same. Aim of the list is to inform about minimum expected outcomes. 1. Write, debug and execute simple JAVA programs that demonstrate programming logic by making use of various control statements . 2. Programs to Demonstrate the understanding and application of classes and objects to real world problems 3. Programs that Demonstrate the understanding and application of interfaces. 4. Programs to Demonstrate the understanding of built in and user defined packges 5. Programs that Demonstrate the understanding and application of Exception handling using real world problems 6. Programs that Demonstrate the understanding and application of Multi-threading using Thread Class/Runnable Interface 7. Programs that Demonstrate the understanding and application of synchronization using multi-threading. 8. Programs that Demonstrate use of streams for File handling, 9. Programs to Demonstrate the use and benefits of generic classes, generic methods, 10. Programs that Demonstrate the use of few Collection classes with real world problems 11. Programs that Demonstrate the use of Swing Control Classes & Methods in GUI application development 12. Programs that Demonstrate the use of Delegation Event model .

H.O.D. Dept. of BCA
P.R. Pote Patil Welfare Trust
Group of Institutions & Management
Kathora Road, Amravati

P. R. Pote (Patil) College of Engineering & Management, Amravati

Academic Program Assessment Handbook

(Guidelines Document)

IQAC Cell

Guidelines and Procedures

This handbook is designed to assist faculty and administrators with the process of developing and/or revising expected learning outcomes and methods for assessing those outcomes in their degree programs. This handbook begins by providing basic information related to

(1) Concept related to assessment
(2) Course-level outcomes.
(3) Program-level outcomes.
(4) Assessing course and program level outcome
(5) Ways assessment data can or should be used to make improvementsto degree programs.

Contents

DEPARTMENTOF

ENGINEERING

1. Institute Vision, Mission and Objectives

1.1 Vision of the Institution

To flourish as a centre of excellence for producing the skilled technocrats and committed human beings.

Mission of the Institution

M1	To create conducive environment for teaching & learning.
M2	To impart quality education through demanding academic programs.
M3	To enhance career opportunities by exposure to Industries & recent technologies.
M4	To develop professionals with strong ethics and human values for the betterment of Society.

1.1 OBJECTIVES:

1. To provide quality education to students and nurture them for a professional career.
2. To increase the number of students progressing in higher education and entrepreneurship.
3. To make the students engaged in lifelong learning for accepting socio-economic responsibilities.
4. To promote students for research and adopting recent trends in technology among all disciplines.
5. To enhance the proficiency and excellence of teachers

1.2 QUALITY POLICY

"We are committed to impart quality technical and management education as per need and expectations of the students."

1.3 PROGRAM OUTCOMES

PO 1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization for the solution of complex engineering problems.

PO 2: Problem analysis: Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO 3: Design/Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, and cultural, societal, and environmental considerations.

PO 4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO 5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations

PO 6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO 7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO 8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice

PO 9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO 10: Communication: Communicate effectively on complex engineering activities with the engineering community and with the society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions

PO 11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO 12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

2. Basic Terminology related to Assessment

2.1 BASIC TERMINOLOGY

a. **Assessment**-Assessment is the systematic and ongoing method of gathering, analyzing and using information from measured outcomes to improve student learning.
b. **Assessment Method** - this term refers to any technique or activity that is used to investigate what students are learning or how well they are learning.
c. **Assessment Plan** – the proposed methods and timeline for assessment-related activities in a given course (e.g., when are you going to check what/how well the students are learning and how are you going to do that?).
d. **Course-Level Assessment** – this type of assessment focuses on what students are learning in a certain course within a program. Course-level assessment can focus on either a single section of a course or all sections of the same course. Course-level assessment data can be used as one source of information for program level assessment.
e. **Program Assessment**-When developing and implementing assessment strategies, academic units should have at least one of three purposes in mind: to improve, to inform, and/or to prove. The results from an assessment process should provide information that can be used to determine whether or not program outcomes are being achieved and how the programs can be improved. An assessment process should also be designed to inform departmental faculty and other decision-makers about relevant issues that can impact the program and student learning.
f. **Learning Outcome** - what the program faculty intend students to be able to know, do, or think upon completion of a degree program (synonyms for "program outcome" include learning outcome, learning outcome statement, exemplary educational outcomes, and expected learning outcome).
g. **Direct Assessment Method** - direct measures of student learning requires students to display their actual knowledge and skills (rather than report what they think their knowledge and skills are). Examples of direct assessment methods include objective tests, Unit tests, presentations, and classroom assignments.
h. **Indirect Assessment Method** - indirect assessment asks students to reflect on their learning rather than to demonstrate it. Examples include external reviewers, course end survey, student exit surveys, exit interviews, alumni surveys, employer surveys, etc.
i. **Formative Assessment** – assessment that occurs during a learning experience. This type of assessment allows faculty and administrators to make adjustments to the learning experience to increase student learning. Examples include midterm exams in the middle of a course, focus groups at the midpoint in a degree program, etc.
j. **Summative Assessment** – assessment that occurs at the end of a course completion (e.g., a comprehensive exam at the end of a semester etc.).
k. **Rubric** - a scoring and instruction tool used to assess student performance using a task-specific range or set of criteria. To measure student performance against this pre-determined set of criteria, a rubric contains the essential criteria for the task and levels of performance (i.e., from poor to excellent) for each criterion.
l. **Target (criterion):** Desired level of student performance on a particular learning outcome, stated explicitly in an assessment report, and set before assessment of course or program learning outcomes is conducted.

2.2 WHY ASSESS?

Assessment can facilitate improvement through variety of venues. When faculty members are directly considering what worked well and what didn't, and involved in the development, implementation, and using those observations and impressions to make analysis of assessment activities, a number of specific changes in your curriculum.

2.1.1 Who is responsible for assessment?

Assessment is not the sole responsibility of any one faculty member or administrator. The best assessment plans include a variety of professionals from various walks of life. Assessment is the responsibility of the management, faculty, and department. Program-level assessment is the responsibility of all of the faculty, administrators, and university for any given degree program.

2.1.2 Purposes of program assessment

The four main purposes of program assessment are:

- **To improve** – the assessment process should provide feedback to determine how the program can be improved.
- **To inform** – the assessment process should inform faculty and other decision makersof the contributions and impact of the program.
- **To prove** – the assessment process should encapsulate and demonstrate to students, faculty, staff and outsiders what the program is accomplishing.
- **To support** – the assessment process should provide support for institute decision-making activities such as program review and strategic planning, as well as external accountability activities such as accreditation.

2.1.3 What are the steps to effective program assessment?

Ultimately, the purpose of program assessment approach to respond to departmental goals and timelines, taking into account internal expectations, external requirements, or both. In general, however, department will complete the following steps to develop an effective program assessment plan: Checklist to better learning:

- Agree on your mission
- Create goals for program outcomes and processes
- Identify related activities for each goal
- Brainstorm appropriate measures
- Evaluate and select measures
- Identify appropriate assessment methods
- Develop a plan for collecting data
- Prioritize goals
- Set timeline, milestones
- Implement assessment plan
- Use data to improve processes
- Communicate results

3. Administrative Setup for Assessment Implementation

3.1 The administrative system for implementation of Assessment consists of coordinators and committees. There are three committees responsible for effective implementation which helps in ensuring the achievements of the PEOs/POs/PSOs.

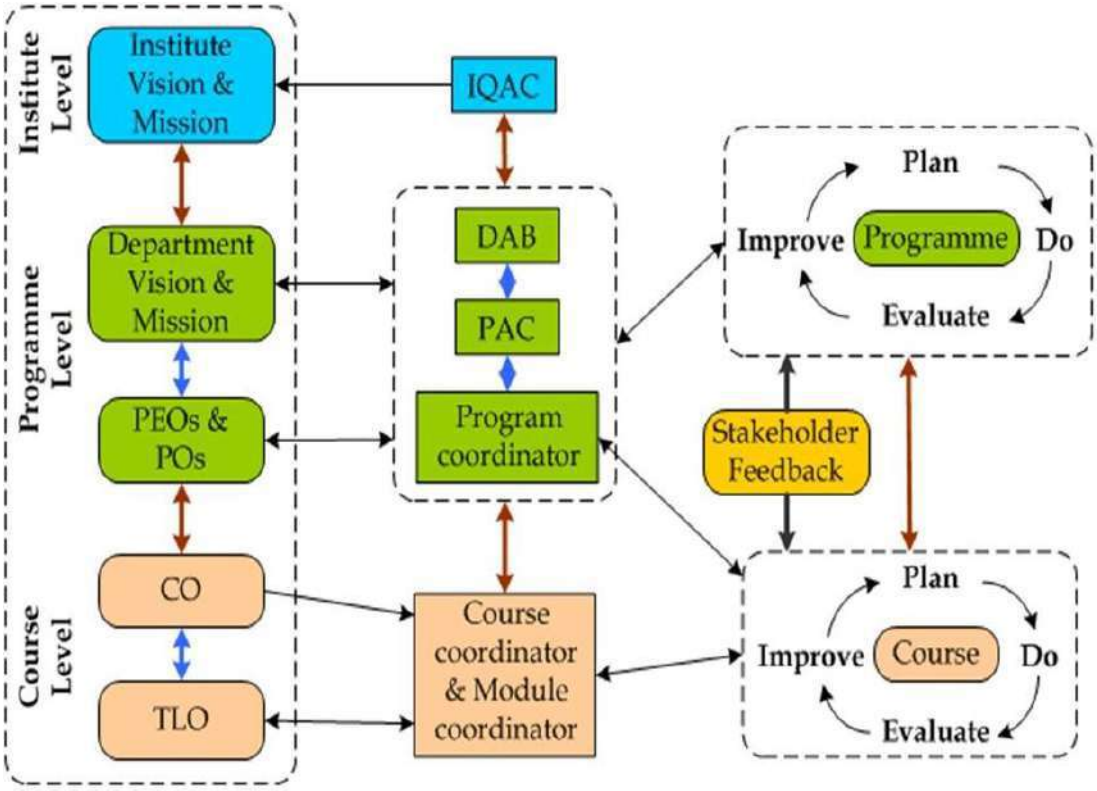


Fig 3.1 Administrative Setup

Internal Quality Assurance Cell (IQAC)

Chairman: - Principal

Members

1. Head of Departments
2. NAAC/NBA Coordinator
3. Management representative
4. Student representative

Functions of IQAC

a) Development and application of quality benchmarks/parameters for various academic and administrative activities of the institution.
b) Facilitating the creation of a learner-centric environment conducive to quality education and faculty maturation to adopt the required knowledge and technology for participatory teaching and learning process.
c) Arrangement for feedback response from students, parents, and other stakeholders on quality-related institutional processes.
d) Dissemination of information on various quality parameters of higher education.
e) Organization of inter and intra institutional workshops, seminars on quality related themes and promotion of quality circles.
f) Documentation of the various programmes/activities leading to quality improvement.
g) Acting as a nodal agency of the Institution for coordinating quality-related activities, including adoption and dissemination of best practices.
h) Development and maintenance of institutional database through MIS for the purpose of maintaining /enhancing the institutional quality.
i) Development of Quality Culture in the institution.
j) Periodical conduct of Academic and Administrative Audit (AAA) and its follow-up.
k) Preparation of the Annual Quality Assurance Report (AQAR) as per guidelines and parameters of NAAC, to be submitted to NAAC.
l) To facilitate in the preparation of Institutional Annual reports and policies.

3.2 Departmental Advisory Board (DAB)

DAB is basic constituent of the academic system

- The composition and of the DAB:

i. **Chairman:** Head of the concerned department

ii. **Members:**
   1. **Member secretary:** Programme NBA Coordinator:
   2. **Internal members:** Two senior faculty members of department.
   3. **Industry representative:** One representative from industry/corporate sector/allied area relating to placement.
   4. **Module coordinators**
   5. **Course coordinators**
   6. **One academician outside college.**
   7. **One meritorious alumnus.**
   8. **One parent.**
   9. **One student.**

The term of the nominated members shall be two years. Principal shall decide the schedule for meeting of the DAB for different departments. The meeting may be scheduled as and when necessary, but at least once a year.

- **Functions of DAB**
   1. Drafting of Vision, Mission of department
   2. Drafting of PEOs, Formulation of POs/PSOs
   3. Defines current and future issues related to programme.

4. Develop/recommends new or revised PEOs/PSOs
5. Recommends the proposals/requirements for effective implementation of OBE
6. Define various assessment tools for measuring outcomes
7. Evaluates the attainment of PEOs, POs/PSOs and proposes necessary improvements

3.3 Program Assessment Committee (PAC)

i. Chair: Programme Coordinator

ii. Members:

1. Module coordinators
2. Faculty representatives

❖ **Functions of PAC**

1. Evaluates and monitors the attainment of POs/PSOs
2. Proposes necessary changes for continuous improvements.
3. Preparation of periodic reports on programme related activities, status reportsfor management and key stakeholders.
4. Faculty motivation: Attend/organize workshop/seminar/FDP, paper publication, development of models/lab.
5. Student motivation: Attend/participate tech competitions, paper presentation,mini projects/models, social/cultural events, skill development programs.
6. Conduct surveys, interaction with faculty, coordinators and other stakeholders
7. Planning of co-curricular activities for attainment of POs/PSOs

3.4 Programme Coordinator:

The duties, responsibilities and regulations of coordinators are as follows:

i) Schedules programme work in accordance with PEOs and POs/PSOs.
ii) Oversees daily operations and coordinate activities of programme interrelated with activities of other programmes to ensure optimum efficiency and compliance with appropriate policies and specifications given by HOD.
iii) Monitor and reviews activities of each year in the programme independently with course coordinators.
iv) Interacts with key stake holders, students, faculty, HOD and employers.
v) Conduct and interprets various surveys require to assess PEOs and POs/PSOs.

3.5 Focus Group (FG)

Chair: Module

Coordinator**Members:**

1. Course coordinators.
2. Programme coordinator.
3. Student representative.
4. Industry representative.
5. Alumni representative

❖ **Functions of Focus Group (FG)**

1. Verification and approval of curriculum gaps and content beyond syllabi
2. Methodology and assessment tools to bridge the gaps
3. Approval to co-curricular activities
4. Evaluates the attainment of POs/PSOs and Cos

3.6 Module Committee (MC)

i. Chair: Module Coordinator

ii. Members: Course coordinators

❖ **Functions of Module Committee (MC)**

- Formation of COs and TLOs
- Formulation of curriculum gap and content beyond syllabi
- Semester planning for course delivery, design contest, workshop, expert lectures, site visits, mini projects
- Evaluates and monitors the attainment of COs, TLOs
- Proposes necessary changes for continuous improvements.
- Preparation of periodic reports on course related activities, status reports for management and key stakeholders.
- Student motivation: Attend/participate tech competitions, paper presentation,mini projects/models, social/cultural events, skill development programs.

3.6.1 Module Coordinator:

The duties, responsibilities and regulations of coordinators are as follows:

i) Coordinate and supervise the faculty teaching the courses in the module
ii) Assessment of COs.
iii) Recommend and facilitates workshop/guest lectures/seminar/FDP tomeet the COs.
iv) Analyse the attainment of COs of a particular course and recommends programme coordinator to take appropriate action for improvements.
v) Interact with students, faculty, Programme Coordinator and Head of Department to determine priorities and policies for improvements.

3.6.2 Course Coordinator:

The duties, responsibilities and regulations of coordinators are as follows:

i) Plan, implement, monitor and review Topic Learning Outcomes (TLOs)and Course Outcomes (COs).
ii) Evaluation of COs.
iii) Suggest improvements based on attainment of COs.

3.6.3. Course teacher

The functions and duties of course teacher are:

i. Conduct classes as per the timetable issued by the HoD and maintain all academic records (Attendance, Evaluation, Attainment) for that course.
ii. Prepare course delivery and evaluation plan for student performance and distribute to all the students within the first week of each semester.
iii. Display students' performance in attendance and evaluation as stipulated in the academic RRs.
iv. Report to the HOD on a periodic (monthly) basis, the potential cases of verypoor academic performance as well as those of low attendance.
v. Submit Class Test Marks / Assignment / Teamwork marks to PAC as per the schedule in academic calendar.
vi. Document all academic records in the course book in a format specified by Dean IQAC and submit it for academic audit.

4. Framing Course Outcomes

4.1 Course Outcomes (COs)

COs are statements indicating what a student can do after the successful completion of a course. Every Course leads to some Course Outcomes. The CO statements are defined by considering the course content covered in each unit of a course.

- It states both the substance of learning and how its attainment is to be demonstrated.
- It is a formal statement that articulate:
  - The knowledge, skills/abilities, and attributes we want our students to be able to demonstrate.

4.2 Before Writing course Outcomes

- Think about the 4-9 most important things that students should learn in the course.
- Focus on high-level, broad framing outcomes instead of specific, discreet things that students will learn.
- The COs should be the big-picture knowledge and skills that students should have when they successfully complete a course.

4.3 Writing effective learning outcome statements

Selection of Action Words for course Outcome Statements: When stating student learning outcomes, it is important to use verbs that describe exactly what the learner(s) will be able to know or do upon completion of the degree program.
Many degree programs want to incorporate words that reflect critical or higher order thinking into their learning outcome statements. Bloom (1956) developed a taxonomy outlining the different types of thinking skills people use in the learning process.

4.4 Bloom's Taxonomy

Benjamin Bloom was working along with a group of measurement specialists in early 1950s on the development of a taxonomy of learning.

- In 1956, the group produced "Taxonomy of Educational Objectives: The Classification of Educational Goals. Handbook I: Cognitive Domain." (Bloom, Engelhart, Furst, Hill, & Krathwohl,1956). This became quite popular and was generally called "The Handbook."
- After a similar process of discussions involving several experts, a major revision was proposed in 2001. Anderson, Krathwohl et. al. (Eds): "A Taxonomy for Learning, Teaching, and Assessing: A Revision of Bloom's Taxonomy of Educational Objectives"

A. Bloom's Taxonomy: Learning Domains

- Any given task tends to be generally dominant in one of the three psychological domains: cognitive, affective, or psychomotor.

- The cognitive domain deals with a person's ability to process and utilize information in a meaningful way.
- The affective domain relates to the attitudes and feelings that result from or influence the learning process.
- The psychomotor domain involves manipulative or physical skills.
- This classification is for focus and convenience; all the three dimensions are involved to varying degrees in all intended learning experiences and activities.

B. Blooms Level:

1. Remember – recalling relevant terminology, specific facts, or different procedures related to information and/or course topics. At this level, a student can remember something, but may not really understand it.

2. Understand – the ability to grasp the meaning of information (facts, definitions, concepts, etc.) that has been presented.

3. Apply – being able to use previously learned information in different situations or in problem solving.

4. Analyze – the ability to break information down into its component parts. Analysis also refers to the process of examining information in order to make conclusions regarding cause and effect, interpreting motives, making inferences, or finding evidence to support statements/arguments.

5. Evaluate – being able to judge the value of information and/or sources of information based on personal values or opinions.

6. Create – the ability to creatively or uniquely apply prior knowledge and/or skills to produce new and original thoughts, ideas, processes, etc. At this level, studentsare involved in creating their own thoughts and ideas.

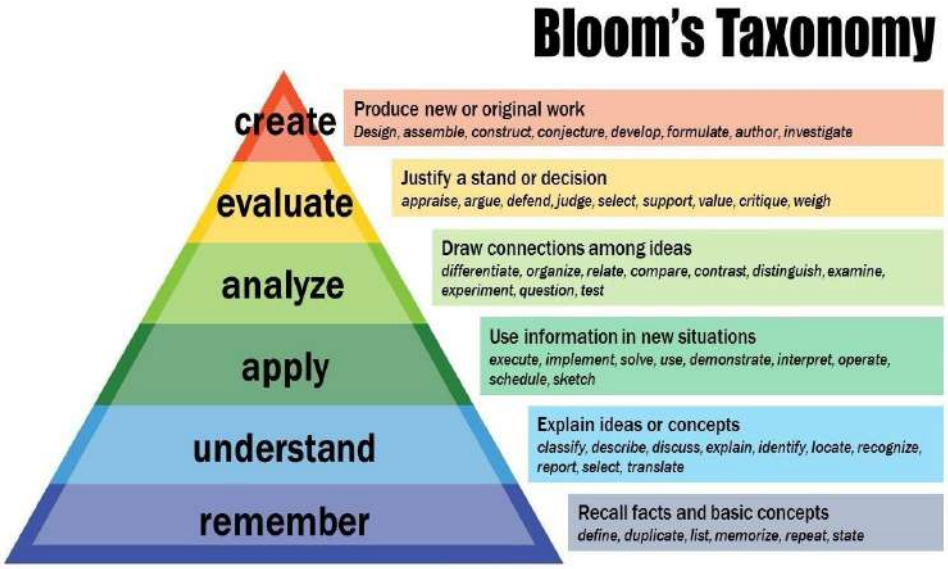


Fig 4.1 Bloom's Taxonomy

c. List of action words related to critical thinking skills

Definitions	I. Remembering	II. Understanding	III. Applying	IV. Analyzing	V. Evaluating	VI. Creating
Bloom's Definition	Exhibit memory of previously learned material by recalling facts, terms, basic concepts, and answers.	Demonstrate understanding of facts and ideas by organizing, comparing, translating, interpreting, giving descriptions, and stating main ideas.	Solve problems tonew situations by applying acquired knowledge, facts, techniques and rules in a differentway.	Examine and breakinformation into parts by identifying motives or causes. Make inferences and find evidence to support generalizations.	Present and defend opinions by making judgments about information, validity of ideas, or quality of workbased on a set of criteria.	Compile information together in a different way bycombining elements in a new pattern or proposing alternative solutions.
Verbs	• Choose • Define • Find • How • Label • List • Match • Name • Omit • Recall • Relate • Select • Show • Spell • Tell • What • When • Where • Which • Who • Why	• Classify • Compare • Contrast • Demonstrate • Explain • Extend • Illustrate • Infer • Interpret • Outline • Relate • Rephrase • Show • Summarize • Translate	• Apply • Build • Choose • Construct • Develop • Experiment with • Identify • Interview • Make use of • Model • Organize • Plan • Select • Solve • Utilize	• Analyze • Assume • Categorize • Classify • Compare • Conclusion • Contrast • Discover • Dissect • Distinguish • Divide • Examine • Function • Inference • Inspect • List • Motive • Relationships • Simplify • Survey • Take part in • Test for • Theme	• Agree • Appraise • Assess • Award • Choose • Compare • Conclude • Criteria • Criticize • Decide • Deduct • Defend • Determine • Disprove • Estimate • Evaluate • Explain • Importance • Influence • Interpret • Judge • Justify • Mark • Measure • Opinion • Perceive • Prioritize • Prove • Rate • Recommend • Rule on • Select • Support • Value	• Adapt • Build • Change • Choose • Combine • Compile • Compose • Construct • Create • Delete • Design • Develop • Discuss • Elaborate • Estimate • Formulate • Happen • Imagine • Improve • Invent • Make up • Maximize • Minimize • Modify • Original • Originate • Plan • Predict • Propose • Solution • Solve • Suppose • Test • Theory

4.5 Structure of a CO statement

- **Action:** Represents a cognitive/ affective/ psychomotor activity the learner should perform. Action is indicated by an action verb, occasionally two, representing the concerned cognitive process (es).
- **Knowledge**: Represents the specific knowledge from any one or more of the eight knowledge Categories
- **Condition**: Represents the process the learner is expected to follow or the condition under which to perform the action (This is an optional element of CO)
- **Criteria:** Represent the parameters that characterize the acceptability levels of performing the action (This is an optional element of CO)

4.6 How to write course outcome statements

- **Write in the future tense** – 'by the end of this course, students will be able to…'
- Don't try to use outcomes to replace your syllabus – identify the most important things you want the students to learn, and try keep the **number of outcomes to between 4 and 6.**
- Make sure that your **outcomes are achievable and assessable** – think about how you might assess the outcomes as you write them and excise any which are vague, unclear, or un-assessable. (Avoid verbs such as ''understand,'' ''appreciate,''and ''value,'' which are not observable or measurable.)
- Try to use language that students will understand – try to avoid jargon and abbreviations. It should be limited to one verb.
- **Include process as well as product** – try not to make the outcome match the product, rather use the outcome to show what process you expect students to undertake.
- Write at the **appropriate cognitive level** for the course
- Have a balance of **different types of outcomes.**

Sample COs **Course: Software Modeling and Design**

After the completion of the course, students will be able to

CO312.1	Choose between available technologies and devices for stated IoT challenge
CO312.2	Design an application using UML Static modeling as fundamental tool.
CO312.3	Design an application using UML Dynamic modeling as fundamental tool.
CO312.4	Evaluate appropriate modern tool for designing and modeling
CO312.5	Apply design patterns to understand reusability in OO design.
CO312.6	Apply appropriate modern testing tool for testing web-based/desktop application

5.Mapping of CO with PO and PSO

5.1 Correlation of CO with PO, PEO

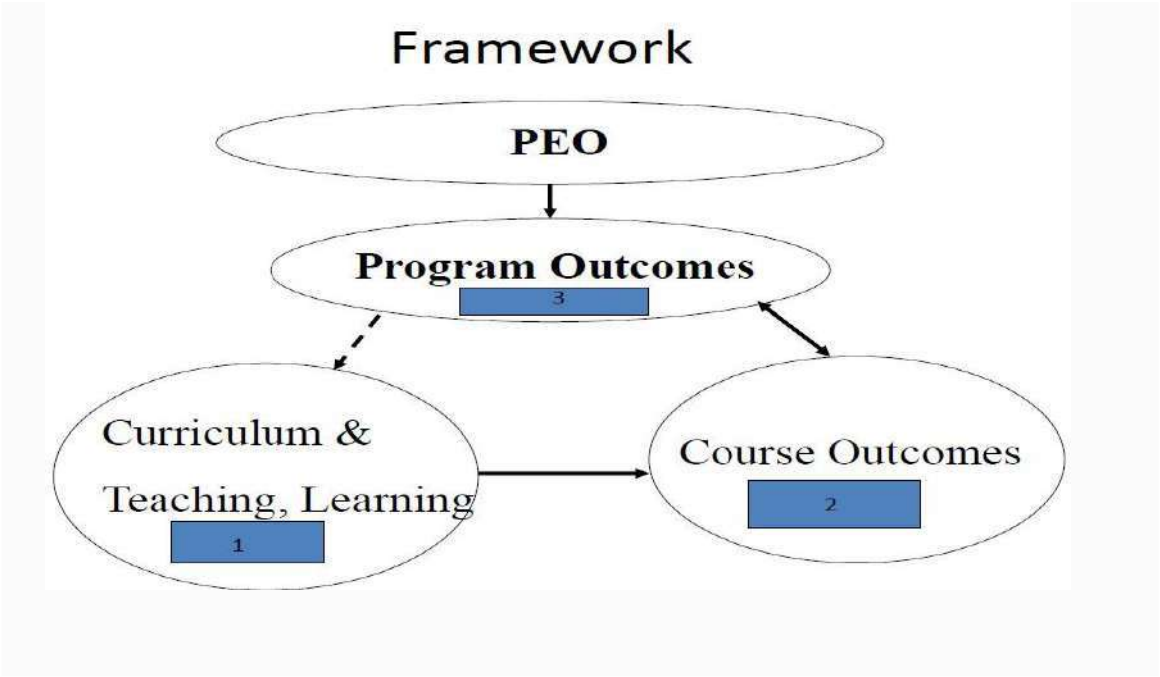


FIG 5.1 Correlation of CO with PO, PEO

5.2. Steps involved in CO-PO Mapping.

1. CO Formulation process: For each course, subject teacher formulate the course outcome and assign appropriate blooms level. The CO statements are defined by considering the course content covered in each module of a course. For every course there may be 5 or 6 COs.

2. CO mapping with PO and PSO: All the courses together must cover all the POs (and PSOs). For a course, map the COs to POs through the CO-PO matrix and to PSOs through the CO-PSO matrix as shown below. The various correlation levels are:

- **"1"** – Slight (Low) Correlation
- **"2"** – Moderate (Medium) Correlation
- **"3"** – Substantial (High) Correlation
- **"-"** indicates there is no correlation.

3. A sample CO-PO Course Articulation matrix

Table 5.1 CO-PO matrix

CLASS	COURSE/ SUBJECT	COURSE OUTCOMES	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
			M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
TE	XYZ	CO1	2	1	1	-	1	2	-	-	1	1	-	2	1	-	-
		CO2	3	2	2	-	1	1	-	-	1	1	-	1	1	-	-
		CO3	2	2	2	-	-	2	-	-	2	2	-	2	1	-	-
		CO4	3	2	2	1	1	1	-	-	1	2	-	2	1	-	-
		CO5	2	1	1	-	-	1	-	-	1	1	-	1	1	-	-
		CO6	2	2	2	-	1	1	-	-	-	-	-	1	1	-	-
		AVG	2.33	1.67	1.67	1.00	1.00	1.33	-	-	1.20	1.40	-	1.50	1.00	-	-

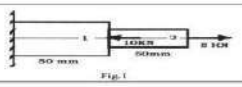
- It is necessary to determine the level (mapping strength) at which a particular PO/PSO is addressed by the course.
- Subject teacher can estimate the mapping strengths between specific COs and POs/PSOs based on subjective perception, taking into account the expected cognitive level, as well as the nature of the course content. Such estimated values can be entered into the matrix.

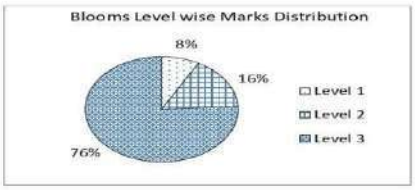
4. Mapping of assessment with CO, PO and PSO

The course teacher prepare list of test paper ,assignments .All questions are mapped with appropriate Blooms level, CO, PO,PSO. The analysis of distribution of cognitive level is done. The assessment purpose is to measure the stated course outcome of student; hence assessment tool is selected properly and aligned with CO.

JSPM's Jayawantrao Sawant College of Engineering Hadapsar, Pune
Department of Mechanical Engineering
MID TERM TEST
[BE-MECH], Sem-I (AY: 2019-20)
(Sub: CAD/CAM AND AUTOMATION)

Date: 12/08/2019 [Duration: 2 hours]
Time: 8:30 to 10:30 am Maximum Marks: 50

Q. No.	Description	Marks	Attainment of			
			CO	PO	PSO	BL
1 a)	An object is to be rotated about point A (-10,-10) by 90° in counterclockwise direction. Calculate concatenated (CT) transformation matrix.	4	1	1,2	1	3
1b)	A triangle ABC having coordinate point A (10, 10), B (40, 10) and C (40, 30). Perform following operation in sequence: 1) Mirrored about line y=x and 2) Rotate by 30^0 about point A. Write concatenated transformation matrix and new coordinates of the rectangle.	8	1	1,2	1	3
1 c)	Explain in detail Orthographic Transformations and Isometric Transformations from the perspectives of Computer aided Design	4	1	1,2	1	2
2 a)	Given two lines L_1 and L_2, end point for L_1 are P_1 (1, 2, 7) and P_2 (5, 6, 1) end points for L_2 are P_3 (7, 3, 4) and P_4 (3, 9, 10). Determine: 1) Parametric equations of lines. 2) Unit vectors in the directions of lines. 3) Are the two lines parallel/ perpendicular ?	6	2	1,2	1	3
2 b)	Find the points on the Hermite Cubic Spline curve at the value of u = 0, 0.2, 0.4, 0.6, 0.8 and 1 having the end points P_0 (1, 1) and P_1 (7, 4). The tangent vector for end P_0 (5, 6) and P_1 (10, 7).	6	2	1,2	1	3
2 c)	Draw neat sketch a constructive solid geometry (CSG) technique of modeling. State its two main advantages.	4	2	1,2	1	1
3 a)	Find stresses in step bar due to forces 10KN and 5 KN. Modulus of elasticity: E_1 = 200 GPa & E_2=70 GPa, Area: A_1 = 150mm^2 & A_2=100 mm^2 	10	3	1,2	1	3
3 b)	Explain linear shape functions in FEM.	4	3	1	1	2
3 c)	Derive Element Stiffness Matrix for 1-D by any method.	4	3	1,2	1	3



CO – Course Outcomes
PO – Program Outcomes
PSO – Program Specific Outcomes
BL – Bloom's Taxonomy Levels
(1- Remembering, 2- Understanding, 3 – Applying, 4 – Analyzing, 5 – Evaluating, 6 - Creating)

Fig 5.2 Sample Question Paper

6. Assessment Tools and Evaluation Process

6.1 Assessment methods

- Assessment methods are tools and techniques used to determine the extent to which the stated learning outcomes are achieved. A variety of methods, qualitative and quantitative, direct and indirect, should be used.

6.2 Assessment tools

Tools used for course assessment are Direct Assessment Tools and Indirect Assessment Tools.

Examples of Direct Assessment Methods:	**Examples of Indirect Assessment Methods:**
• Comprehensive exams • Performance assessment • Writing proficiency exams • Field Achievement Tests • GRE subject exams • Certification exams, • Internal tests • Mini project • Portfolio evaluation • Internship evaluations • Grading with scoring rubrics*	• Peer institutions comparison • Job placement • Employer surveys • Performance in institute • Student graduation/retention rates Exit interviews • Focus group discussions • Alumni surveys Tracking of alumni awards, achievements (national, state, international, etc.) • Curriculum/syllabus analysis

6.3 Sample Assessment Methods used at department

1. Written surveys and questionnaires - Asking individuals to share their perceptions about a particular area of interest—e.g., their own or others' skills/attitudes/behavior, or program/course qualities and attributes.

2. Exit and other interviews - Asking individuals to share their perceptions about a particular area, of interest—e.g., their own skills/attitudes, skills and attitudes of others, or program qualities— in a face-to-face dialog with an interviewer.

3. Commercial, norm-referenced, standardized examinations - Commercially developed examinations, generally group administered, mostly multiple choices, "objective" tests, usually purchased from a private vendor.

4. Locally developed assessments - Objective or subjective designed by local staff/faculty.

5. Focus groups - Guided discussion of a group of people who share certain characteristics related to the research or evaluation question, conducted by trained moderator.

6. Portfolios (collections of work samples usually compiled over time and rated using scoring rubrics).

7. Performance Appraisals - Systematic measurement of overt demonstration of acquired skills, generally, through direct observation in a "real world" situation—e.g., while student is working on internship or on project for client.

8. External Examiner - Using an expert in the field from outside your program — usually from a similar program at another institution — to conduct, evaluate, or supplement the assessment of students.

9. Oral examinations - Evaluation of student knowledge levels through a face-to-face dialogue between the student and the examiner—usually faculty**.**

6.4 Setting Course Outcome Targets

There are several ways to set target level. Course coordinator can decide target in consultation with module coordinator. Following are few ways to set target.

a. To set the target level average mark criteria is used. Average marks of last three exams can be taken into consideration and it should be kept as target average marks.
b. If average marks of last exams are not available then current average marks can also be considered as target level.
c. Target level can be different for each assessment method (e.g. Internal assessment: assignment1, assignment2, class test1, class test2 etc. External assessment: End Semester exam/university exam, Practical external exam)
d. Same target can be identified for all the COs of a course.

6.5 Definition of Attainment

Attainment can be defined as what percentage of students has above set target marks .There are many ways to set attainment level. Course coordinator can select the attainment criterion for a given course. E.g.

- **Attainment Level 3**: 60% of students score more than 60% marks out of the maximum relevant marks.
- **Attainment Level 2**: 50% of students score more than 60% marks out of the maximum relevant marks.
- **Attainment Level 1**: 40% of students score more than 60% marks out of the maximum relevant marks.

6.6 Continuous Evaluation

To ensure effective academic progress and to decide corrective actions, continuous internal evaluation is essential. Internal assessment broadly includes theory/objective exam and student activity

1. Theory exam includes test, assignments and MCQs. Each of the questions is mapped with CO and Bloom's level. The proper attention is given to ensure the weightage for each CO
2. Performance assessment in lab, projects and students' activities are done through well-defined performance rubric.
3.

Sr no.	Method	Tools for Assessment	Type of assessment	Assessment Cycle
1	Direct	Internal class Tests	internal	Two class tests per semester
2	Direct	Assignments/Tutorial	internal	Assignments (as applicable)
3	Direct	Practical evaluation	internal	Every practical batch per practical per student
4	Direct	Seminar/project evaluation	internal	Once per semester
5	Direct	University Exams	External	Once per semester
6	Indirect	Course Exit Survey	internal	At the end of Semester

A. **Continuous assessment in the laboratory**

Performance based internal assessment of students is carried out on each assignment during the regular Practical Session, lab reports are also written and evaluated onregular basis.

Continuous Assessment of Experiment:

- Mapping of each experiment with one or more CO's, POs and PSOs
- Elaboration of aim and scope of each Lab assignment.
- Building of performance parameter along with rubrics.
- Implementation / conduction of assignment along with write-ups and accordingly grading of performance parameter for individual students.
- The assessed marks are included in CO attainment calculation for respective lab in respective theory subject

Fig 6.1 describes the process adopted for internal evaluation and articulated as below :

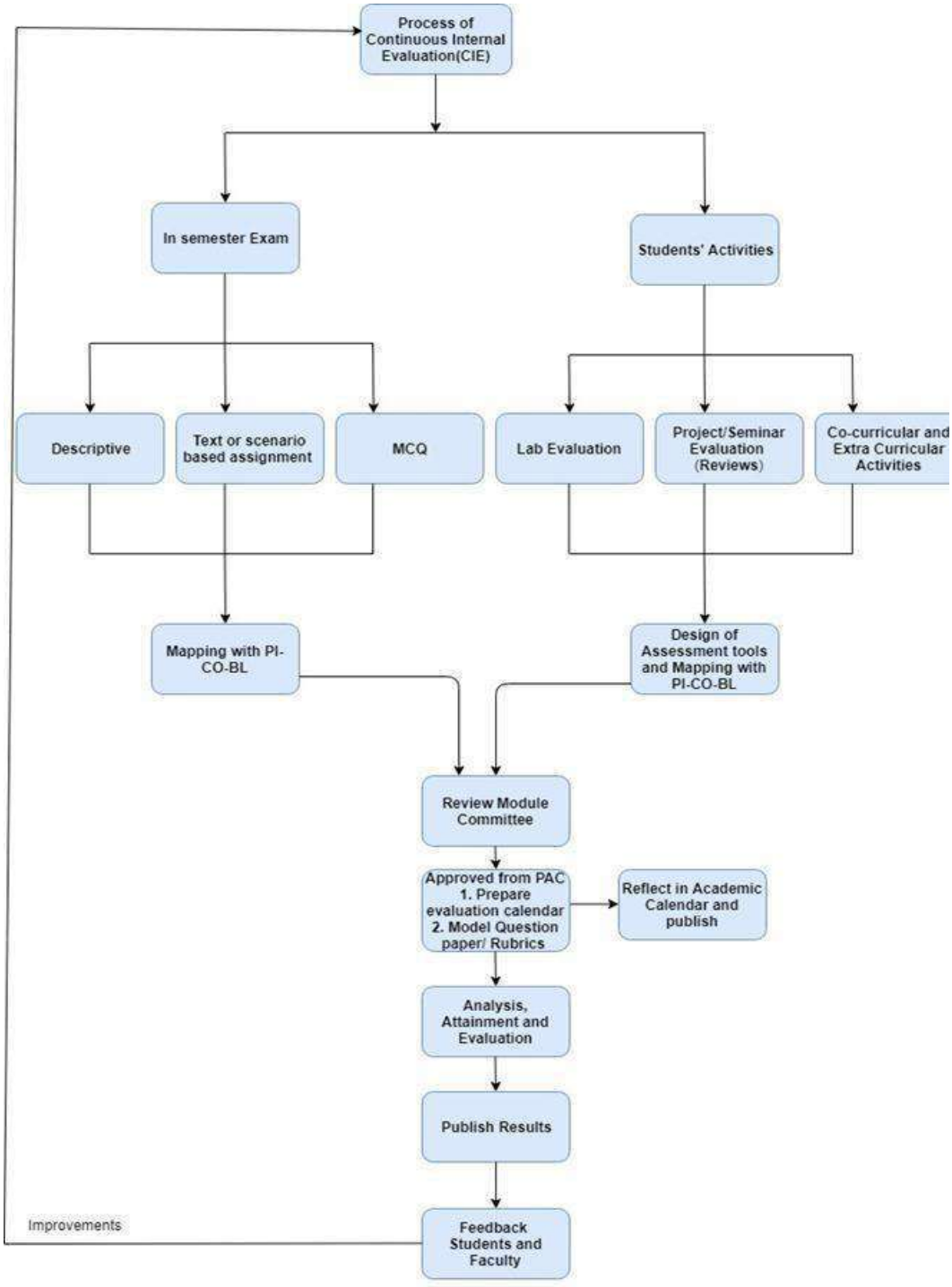


Fig 6.1 Process for Internal Evaluation

6.7 Sample of Assessment Tools used to assess course outcomeswith target and weightage

Course Outcome	Assessment Tools	Set Target	Weight age	Attainment levels
C202.1 C202.2	Test	60%	30%	No of students actively target =y =42 Total No of students =N=47CO attainment = (y/N) * 100=42/47*100=89.36 Then attainment levels are 0<AL0<40 40<=AL1 <50 50<=AL2<60 60<=AL3<=100
	Practical Experiment	60%	Rubric score 30%	
C202.3 C202.4	Assignment	60%	30%	
C202.5 C202.6	Course end survey	60%	10%	

6.8 Targets and attainment levels

Assessment Tool type	Outcome attainment
Internal Assessment Tools	Target: 60% of max allotted marks. Authority: Course Coordinator
External Assessment Tools	Target: University exam -60 % of max allotted Marks Authority: Program Assessment Committee
Attainment levels	AL = % age no of students achieving target • AL0 = 0-39% AL1=40-50% • AL2=51 -60% AL3=61-100%

6.9 Overall Process of Internal Assessment is as shown in flowchart:

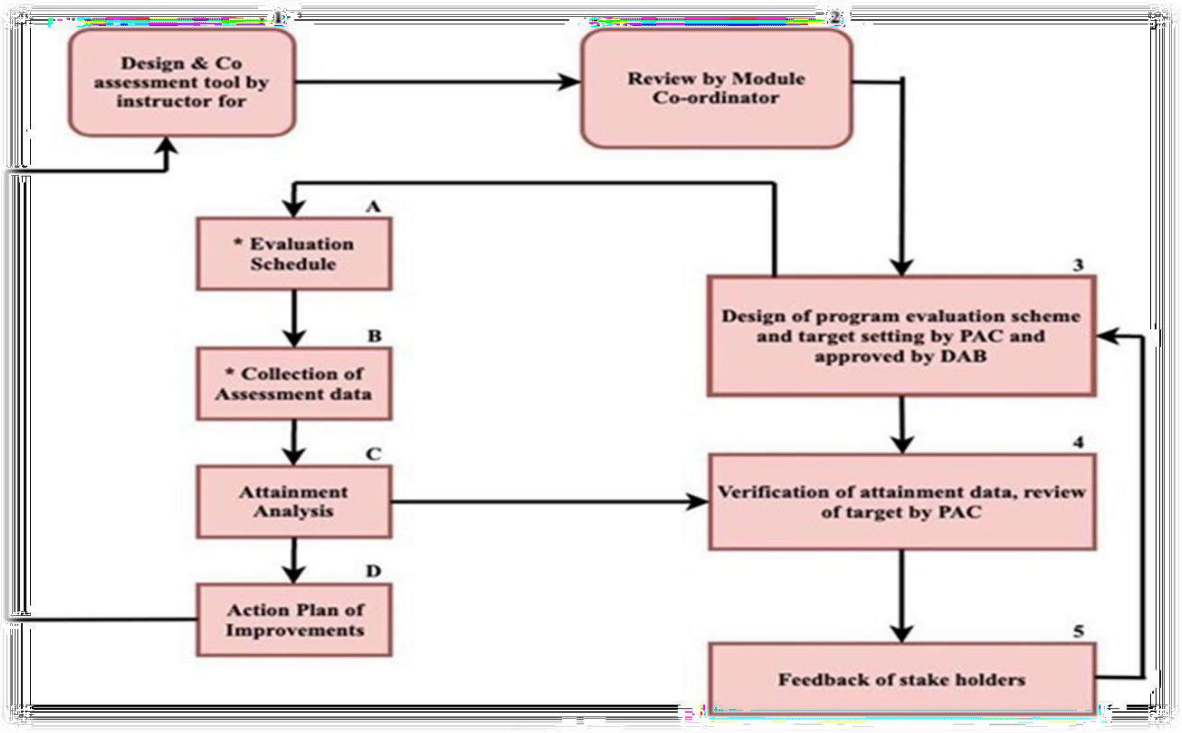


Fig 6.2 Steps involved in Internal Assessment

7. CO Attainment Process

7.1 CO Assessment Plan (Direct-Internal Assessment):

For each course, assessment plan is prepared which includes mark distribution, assessment tool for each course outcome.

Sample Assessment Plan

CO Assessment Process: Direct tools-Graded and Performance Rubrics (Internal)																
CO	Un	Marks allocation	Direct Graded								Direct Non graded				Share of Each CO	
			Internal Test		Objective Tests						Lab-Work (Experiments) and Student Activities (Assesses by Performance Rubrics)					
			IT 1 (25)	IT 2 (25)	OT 1 (25)	OT 2 (50)	OT 3	OT 4	OT 5	OT 6	EXPT	Poster Presentation	Survey	Programming	Marks	Percentage
C308.1	I	18	18		15						60				93	23.25
C308.2	II	16	16			15					30				61	15.25
C308.3	III	16	16				15				30				61	15.25
C308.4	IV	16		16				15				30			61	15.25
C308.5	V	16		16					15				30		61	15.25
C308.6	VI	18		18						15				30	63	15.75
Total			**50**	**50**	**15**	**15**	**15**	**15**	**15**	**15**	**120**	**30**	**30**	**30**	**400**	**100**

IT= Internal Test OT=Objective Test

7.2 Overall process to measure CO attainment

- Attainment of COs can be measured **directly** and **indirectly**
- Direct attainment of COs can be determined from the performances of students in all the relevant assessment.
- Indirect attainment of COs can be determined from the course exit survey.
- The exit survey form should permit receiving feedback from students on all the COs.
- Computation of indirect attainment of COs is based on the student refection. Hence, the percentage weightage to indirect attainment kept at a low value, say 10%.

7.3 Stepwise CO attainment

7.3.1 Direct CO Attainment

Direct attainment of COs is determined from the performances of students inContinuous Internal Evaluation (CIE) and University Exam(UE)

- The proportional weightages Internal assessment contributes 30% anduniversity assessment contributes 70%.
- Direct attainment of a specific COs is determined from the performances of students to all the assessment items related to that particular CO. Hence, everyassessment item needs to be tagged with the relevant CO.
- Also, we need data about performance of students in all assessment.

.

7.3.2 **Direct CO attainment from CIE**

- Continuous Internal Evaluation (CIE) is conducted and evaluated by the Department itself
- Course teacher has access to question-wise marks in all assessment in CIE.
- As all questions are tagged with relevant COs, the performances of students withrespect to each CO can be recorded.

The process of CO attainment is articulated in figure

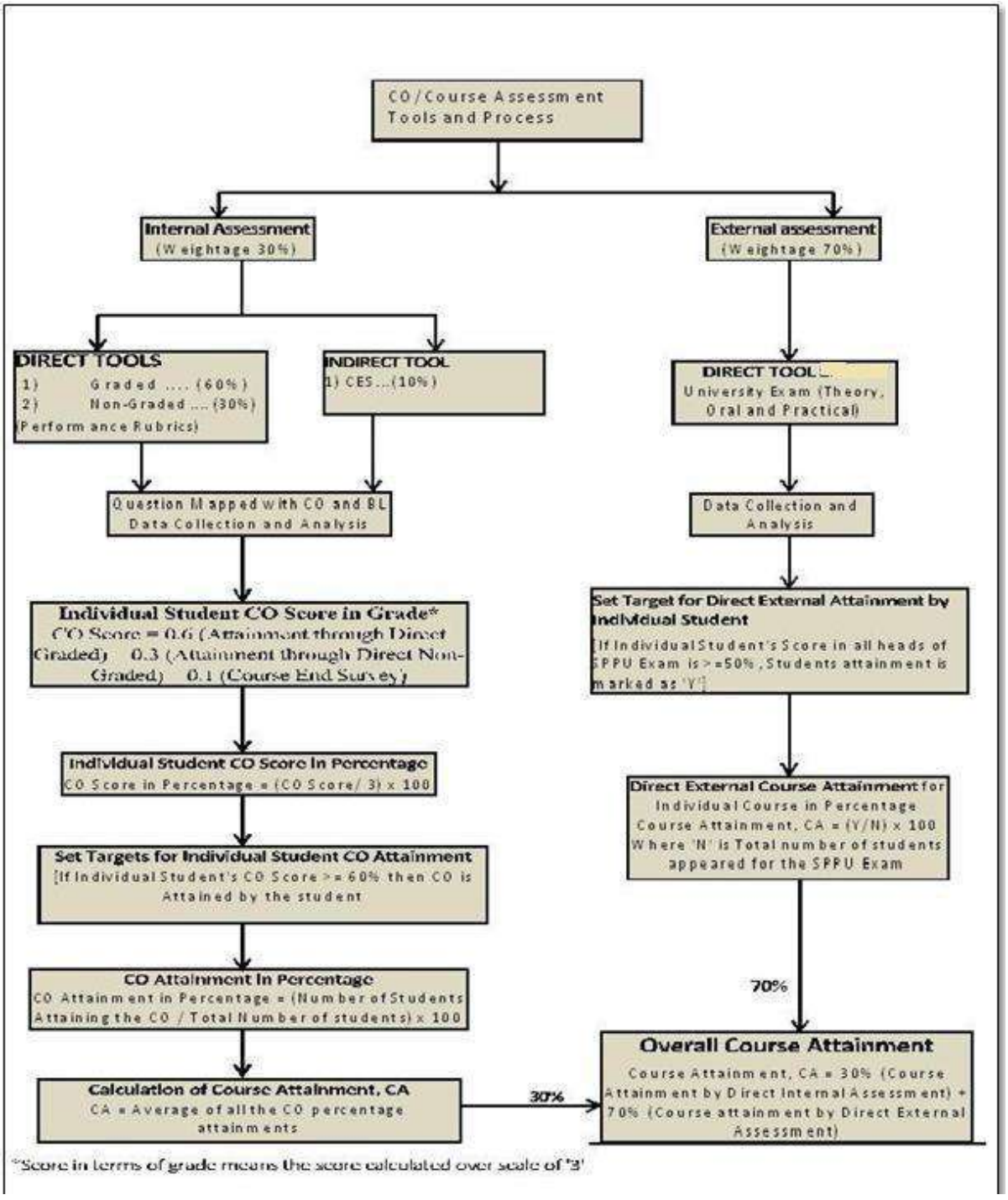


Fig 7.1 CO Attainment Flowchart

Table7.1 : Attainment of CO by Direct-Internal Assessment Method

Course:- Design Of Machine Elements-II (DME-II) (C308) [Semester-II AY 2018-19]												
C308.1 Attainment												
Overall Score Of The Student Over Scale Of '3', (D) = 0.6 X (A) + 0.3 X (B) + 0.1 X (C) & % Score Of The Student, (E) = (D)/3 X 100												
	Direct-Graded					Direct Non-Graded			CES	Attainment		
Max Marks	18	15	**33**	**Percentage Direct-Graded Marks Obtained By The Student (%)**	**Total Direct- Graded Marks Converted To Scale Of '3'**	**(Assessed By Performance Rubrics)**		**Average Of Direct Non-Graded Marks (Scale Of 3)**	**Course End Survey**	**Total Score Of The Student**		**Student's Percent Score Cross The Threshold* Value**
Name Of The Student	MT (Q1)	OT Q1	**Total Marks Obtained**			**Lab-Work / Experiment**	**Student Activity**			**Over The Scale Of '3'**	**% Score Of The Student**	
					(A)			(B)	(C)	(D)	(E)	
	4	11	15	45%	1.36	1.60	Na	1.60	3.00	1.60	53.27	No
	12	12	24	73%	2.18	2.20	Na	2.20	3.00	2.27	75.64	Yes
	14	10	24	73%	2.18	2.20	Na	2.20	3.00	2.27	75.64	Yes
:	:	:	:	:	:	:	:	:	:	:	:	:
:	:	:	:	:	:	:	:	:	:	:	:	:
	14	4	18	55%	1.64	2.40	Na	2.40	3.00	2.00	66.73	Yes
	00	00	00	00%	0.00	1.00	Na	1.00	0.00	0.30	10.00	No
	14	8	22	67%	2.00	2.20	Na	2.20	3.00	2.16	72.00	Yes

MT= Midterm test, OT= Online Test, AS= Assignment, PR=Practical (Lab experiment) CES=Course end survey

7.3.4 Attainment of all Cos

COURSE OUTCOMES	Percentage	Attainment
C308.1	54.79	2
C308.2	49.32	1
C308.3	53.42	2
C308.4	57.53	2
C308.5	45.21	1
C308.6	50.68	2
Average	51.83	1.67

7.3.5 Direct CO attainment from University exam

- External exam is conducted and evaluated by the University, so Departments get only total marks scored in exam.
- Departments have no access of individual CO performance. So average marks in university exam is considered as common attainment for all Cos.

Course Attainment by Direct [External] Assessment Process

Percentage attainment of the course will be calculated as,

$$\% \text{ attainment} = \frac{\text{(Number of Students Securing} \geq 50\%)}{\text{(Total number of students appearing for exam)}} * 100$$

Roll No	Name of Student	SEM V									
		C308 DME-II [302048] TE MECH SEM-II AY 2018-19								Percentage marks of the student	Student's % Marks Cross the Threshold* (YES / NO)
		Insem Exam		Theory Exam		Oral Exam		Total Marks (Out of 125)			
		Marks Obtained	Maximum Marks	Marks Obtained	Maximum Marks	Marks Obtained	Maximum Marks	Marks Obtained	Maximum Marks		
3101		28	30	56	70	22	25	106	125	84.80	YES
3102		15	30	46	70	20	25	81	125	64.80	YES
3103		22	30	29	70	18	25	69	125	55.20	YES
:	:	:	:	:	:	:	:	:	:	:	:
3372		1	30	28	70	AA	25	29	125	23.20	NO
3373		10	30	21	70	AA	25	31	125	24.80	NO
3374		18	30	42	70	13	25	73	125	58.40	YES
3375		0	30	AA	70	AA	25	0	125	0.00	NO
3376		12	30	45	70	3	25	60	125	48.00	NO

Total number of YES	Y=134
Total number of students	N= 172
% Attainment = (134/172)*100	77.90

Total marks as scored by each student for each course is calculated. Then percentage marks as scored by each student for a particular course is calculated and the students securing more than 50%* mark for that course (subject) are assumed to have attained that course (YES). The number of "YES" i.e. the number of students attained the course is counted and total number of students appearing for that exam is also counted and based on these two values, percentage attainment for that particular course(subject) is calculated. This percentage is treated as the attainment by direct-external

assessment process. The same is depicted in table (50% is assumed as threshold value of direct-external assessment for each course/subject)

YEAR	COURSE	COURSE OUTCOMES	Co Attainment (Internal)	SPPU Attainment (External)	Total Attainment	Attainment Level
TE	DME-II	C308.1	54.79	77.90	66.345	3
		C308.2	49.32	77.90	63.61	3
		C308.3	53.42	77.90	65.66	3
		C308.4	57.53	77.90	67.715	3
		C308.5	45.21	77.90	61.555	3
		C308.6	50.68	77.90	64.29	3
		AVERAGE	51.82	77.90	64.86	3

7.3.6 Direct Attainment Computation of CO

(Weighted summation of direct-internal and direct-external percentage for calculating overall attainment percentage)

Once direct-internal and direct-external percentage attainment is known for all the courses of a particular semester of a particular academic year, assigning 30% weightage for direct-internal and 70% weightage for direct-external attainment percentage a weighted sum is calculated as overall percentage attainment for a particular course.

Overall direct attainment of a course/subject = 30% of Direct Internal PercentageAttainment + 70% of Direct External Percentage Attainment

YEAR	**COURSE NAME**	**COURSE CODE**	**Internal**		**External**		**Total Attainment = (0.2*internal attainment) + (0.8*external attainment)**	**Attainmentlevel**
			Weightage 20%		**Weightage 80%**			
			Actual % of internal CO Attainment	**Weight**	**Students scored morethan average marks in SPPU exam**	**Weight**		
TE	**DME-II**	**XYZ**	**51.82**	**0.3**	**77.90**	**0.7**	**70.07**	3

7.3.7 Total CO Attainment:

Computation of Attainment of CO = 0.9 * Direct CO Attainment + 0.1 * Indirect CO Attainment.

CO	Direct CO Attainment %	Indirect CO Attainment (Obtained from	Total CO attainment
CO1	66.35	90.00	78.17
CO2	63.61	85.00	74.31
CO 3	65.66	87.00	76.33
CO 4	67.72	90.00	78.86
CO 5	61.56	85.00	73.28
CO 6	64.29	89.00	76.65

If set target is not attained, then improvements must be planned to bridge the gap next time. In case, target attained or exceeded, attainment target may be enhanced next time.

7.4 Action Plans for Improving the CO Attainments

- Action plans need to be as specific as possible.
- Indicate if any additional resources (Physical resources, Learning resources) are required to implement the improvement plans.
- Indicate if any changes in the Lesson Plan are required.
- Avoid vague statements like ‘‘Motivate the students’’, ‘‘Work harder’’.
- If possible, have the action plans reviewed by peers.

8. PO and PSO attainment

8.1 POs and PSOs:

A. **POs and PSOs are/can be addressed through**:

- Core courses
- Projects (Major and Mini)
- Seminars / Presentations
- Internships
- Co-curricular and Extra-Curricular Activities
- For any activity to be considered for computing the attainment of POs/PSOs, all students of a program are required to participate in that activity.
- For activities to be included for computing attainment, the related student performances should be measurable.

B. **Strength of CO-PO/PSO Mapping**
Attainment of a PO/PSO depends both on the attainment levels of associated COs and the strengths to which it is mapped

8.2 List of PO, PSO assessment tools and processes

Broadly the data collection to measure the attainment of POs and PSOs is done through direct and indirect methods. The list of assessment tools is as stated in table

a. **PO Assessment tools based on learning domain**

Table 8.1 PO Assessment tools based on learning domain

Learning Domain	POs	Tool	Data Collection theme
Knowledge	PO1	i) Test/Assignment ii) SGBAU Exam	Each question is mapped withCO, PO,BL & analysis of matrixobtained against set target
Problem SolvingSkill	PO2,3,4,5	i)Assignment ii)Mini/Major ProjectLab Assessment iv) Co-Curricular activities	A rubric is designed with performance indicators & analysis of rubric score obtained against set target.
Supportive skill	PO9,10,11	i)Lab Assessments ii)Project iii) Co-curricular activities	A rubric is designed with performance indicators & analysis of rubricscore obtained against set target
Attitude	PO6,7,8,12	i)Lab Assessments ii) Project iii) Co-curricular activities	A rubric is designed with performance indicators & analysis of rubric score obtained against set target

8.3 Relevancy of Assessment tools detail:

Table 8.2 Relevancy of Assessment tools

Tool	Frequency	Type	PO/PSO	Data Collected
Test (Internal)	After completion of each unit	Direct	PO 1-3 PSO 1-3	Actual CO Attainment of each course based on Percentage of students scoring the set targets.
Assignment (Internal)	After completion of each unit	Direct	PO 1-5 PSO 1-3	
Lab Assessment(Internal)	After completion of each practical	Direct	PO 4-10 PSO 1-3	
Project Assessment(Internal)	4 reviews per semester	Direct	PO 1-12 PSO 1-3	
Student Activity(Internal)	Once based on course requirement	Direct	PO 1-12 PSO 1-3	
SGBAU Exam(External)	At the end of each semester	Direct	PO 1-5,9,10 PSO 1-3	
Exit Survey	At the time of Graduation	Indirect	All PO/PSO	Indirect attainment level of each PO/PSO based on survey/feedback analysis.
Employer feedback	Once every year	Indirect	All PO/PSO	

8.3 Process for Attainment of PO and PSO

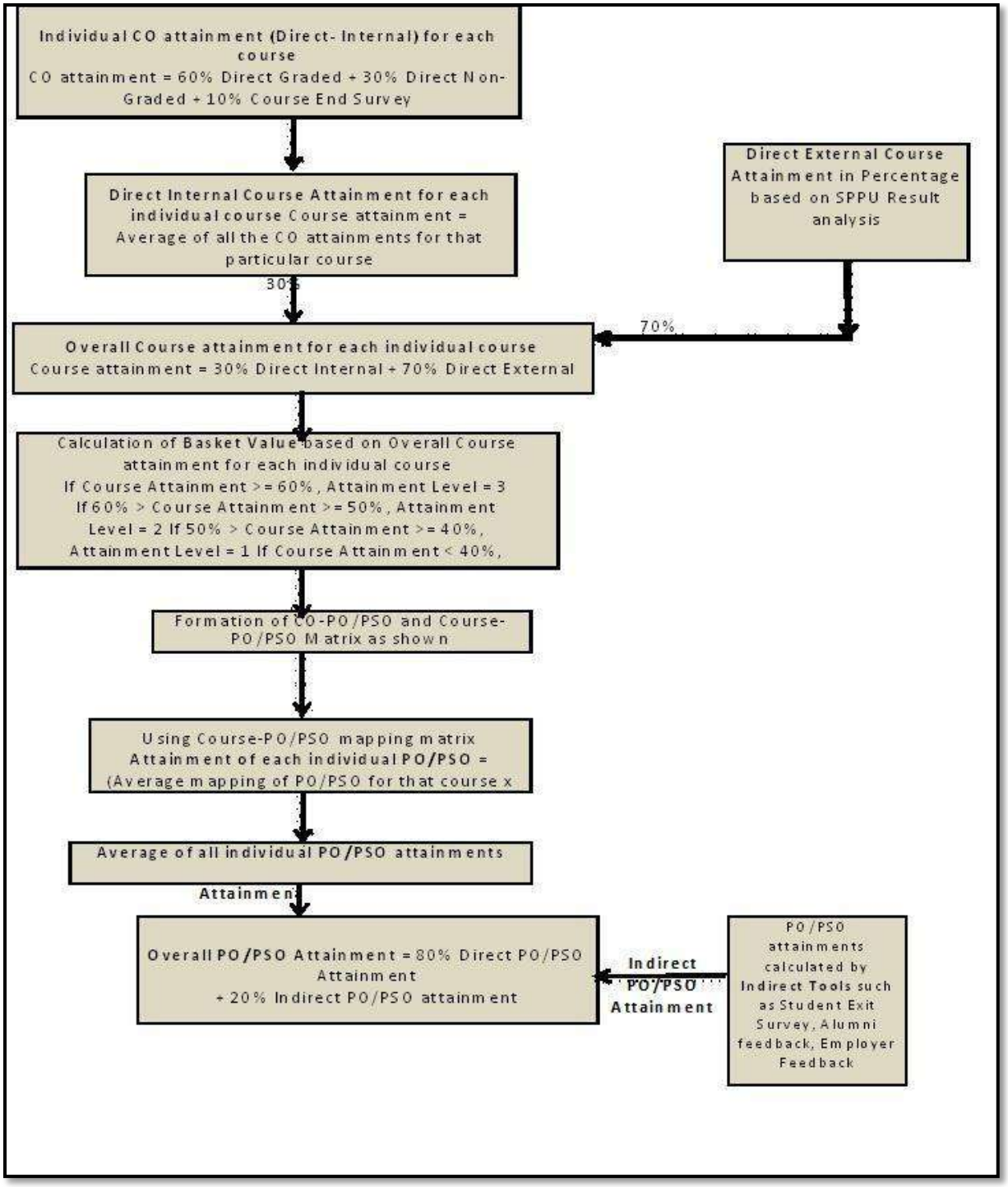


Fig 8.1 Process For Attainment Of PO and PSO

1.Mapping of CO with PO and PSO

CLASS	COURSE / SUBJECT	COURSE OUTCOMES	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
			M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
TE	XYZ	CO 1	2	1	1	0	1	2	0	0	1	1	0	2	1	0	0
		CO 2	3	2	2	0	1	1	0	0	1	1	0	1	1	0	0
		CO 3	2	2	2	0	0	2	0	0	2	2	0	2	1	0	0
		CO 4	3	2	2	1	1	1	0	0	1	2	0	2	1	0	0
		CO 5	2	1	1	0	0	1	0	0	1	1	0	1	1	0	0
		CO 6	2	2	2	0	1	1	0	0	0	0	0	1	1	0	0

2. Average mapping calculation

CLASS	COURSE/ SUBJECT		PO1	PO2	PO3	PO4	PO5	PO6	PO 7	PO 8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
			M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
TE		AVG	2.33	1.67	1.67	1.00	1.00	1.33	-	-	1.20	1.40	-	1.50	1.00	-	-

3. Total CO Attainment

CO	Total CO attainment
CO1	66.345
CO2	63.61
CO 3	65.66
CO 4	67.715
CO 5	61.555
CO6	64.29

4. **PO/PSO Attainment**

Attainment of PO/PSO = (Average of attainments of relevant COs) x Scale Factor

Scale Factor = (Actual Mapping Strength / Maximum Possible Mapping Strength)

= Actual Mapping Strength / 3

PO	**COs**	**Mapping Strength**	**PO/PSO Attainment**
PO1	CO1,CO2,CO3,CO4,CO5,CO6	2.33	50.37
PO2	CO1,CO2,CO3,CO4,CO5,CO6	1.67	36.10
PO3	CO1,CO2,CO3,CO4,CO5,CO6	1.67	36.10
PO4	CO4	1.00	22.57
PO5	CO4, CO6	1.00	22.00
PO6	CO1,CO2,CO3,CO4,CO5,CO6	1.33	28.75
PO9	CO1,CO2,CO3,CO4,CO5	1.20	25.99
PO10	CO1,CO2,CO3,CO4,CO5	1.40	30.32
PO12	CO1,CO2,CO3,CO4,CO5,CO6	1.50	32.43
PSO1	CO1,CO2,CO3,CO4,CO5,CO6	1.00	21.62

8.4 Total Attainment of a PO / PSO

Combine the Direct Attainment with the Indirect Attainment using suitable weights. Typical values are 0.8 and 0.2.
Determine the Indirect Attainment based on all the relevant Surveys. (Graduate Exit Survey, Alumni Survey, Employer Survey)
To calculate final PO and PSO attainment all courses attainment is recorded and average of each PO attainment is calculated.

Total Attainment =0.8 * Direct Attainment + 0.2 * Indirect Attainment

Sr. No.	Subject Code	Subject Name	PO1	PO2	PO3	….	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	C101	EM-I	1.00			…							1.00	
11	C111	FPL-I	1.00	1.00		…					1.00			
23	C211	AT	2.00	2.00	2.00	…		2.00	2.00		1.00			1.00
27	C302	HT	2.00	2.00	1.00	…	1.67	1.83	1.83	1.00	1.83			2.00
32	C307	NMO	3.00	3.00	3.00	…		1.40	2.00		3.00	2.00		
33	C308	DME-II	2.00	1.83	1.50	…		1.00	1.60		1.00	1.00		
Average Direct Attainment			1.66	1.62	1.57	…	1.19	…	1.62	1.06	1.40	1.51	1.59	1.64
80% of Average Direct Attainment			1.33	1.29	1.25	…	0.95	…	1.30	0.85	1.12	1.21	1.27	1.31
Indirect Attainment			2.39	2.25	2.33	…	2.65	…	2.57	2.44	2.11	2.20	2.25	2.08
20% of Indirect Attainment			0.48	0.45	0.47	…	0.53	0.55	0.51	0.49	0.42	0.44	0.45	0.42
Ovarall attainment of PO/PSO			1.81	1.75	1.72	…	1.48	1.81	1.81	1.34	1.54	1.65	1.72	1.73

8.5 Closing the Quality Loop at the Program Level

For each PO and PSO:

Attainment target is set by PAC, the attainment evaluation is performed byPAC
Total attainment value for each PO and PSO is computed and checked it againsttarget.
The areas of weaknesses are identified in the program based on the analysis of evaluation of POs & PSOs attainment levels. Measures identified and implemented to improve POs & PSOs attainment levels for the next assessment years.

Definitions

- **Lectures** The traditional class where the teacher speaks; students listen and take notes. These days lectures can be very interactive, allowing students to ask questions, providing time for students to discuss ideas with each other and so on. It is good practice to alternate delivery of content with more active student participation every 20 minutes or so.
- **Tutorials** A smaller class (usually no more than 20 students) which provides an opportunity for discussion and feedback. The tutor will normally ask questions to check that students have understood the material and to encourage debate. Students may also be required to use this time to work in groups on set tasks and then feedback to the whole class.
- **Seminars** Similar to a tutorial. A smaller class (usually no more than 20 students) built around discussion and exploration of the module content. Sometimesstudents will be asked to prepare a short paper or presentation.
- **Laboratory Sessions** in which students are guided to undertake practical experiments
- **Practicals /workshops** These are sessions in which students practice their practical / skills
- **IT workshops** These take place in a classroom with computers and are dedicated to teaching students how to use the software they need. They may also be used to engage students with electronic resources that help them learn more about their subject, such as through simulations, online quizzes and so on.
- **Directed reading** This is where students are set tasks and asked to read materialin between classes, in their own time.
- **Self-directed learning** This refers to time that students study either by themselves, in pairs or in groups. They will usually be set a task, but they will need their own initiative to give shape to the task, for example by selecting and assessingjournal articles, or by profiling contemporary or topical issues in their field.
- **Problem-based learning** A method of teaching whereby students are set a problem and work in groups to research and solve it.

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Department of Electrical Engineering

ALUMNI SURVEY FORMAT
(Indirect Assessment)

PRPCOEM is following outcome-based education. The assessment of outcome has to be through a survey (such as graduate exit survey, Alumni survey, employer survey and parent feedback etc.). The following questionnaire need your valued considerations. Please find time and send your response. This report will be kept confidential.

Name of the Alumni: Ajinkya Anil Bharde	**PRN No:** 88054
Degree: B.E./M.E. in Electrical	
Year of Graduation: 2019	
Name of the Organization where you are working: –	
Designation: –	

Sr. No.	Graduate Attributes	Program Outcomes (POs)	Excellent 5	Very Good 4	Good 3	Satisfactory 2	Poor 1
1	Extent of usefulness of Basic and Engineering science courses in understanding problems you solved so far in your career.	PO1	✓	✓	✓		
2	Publication of research papers, findings, and promotion in the organization.	PO2 PO4	✓			✓	
3	Ability to design and develop system components and processes	PO3 PSO1, PSO2					
4	New tools learnt and used during job and its applications	PO8 PSO2					
5	Ability to factor in sustainability, ethical, health, public safety, and environmental issues in the solutions developed and or participated by you.	PO6 PO7 PO8 PSO3	✓	✓	✓		
6	Level of comfort in working in groups – initially and at present	PO9					
7	Communication skills (level of acquisition during the program, usefulness in the job, additional acquisitions during work etc.)	PO10	✓				
8	Extent of project management, investigation of various problems of electrical and electronic circuits and/or power systems.	PO11 PSO1		✓			
9	Enhancement of qualifications, knowledge gain and technical and managerial skills developed by you.	PO12 PSO2	✓				

10	Solved ethically and professionally various Electrical Engineering problems in societal and environmental context and communicate effectively	PSO3					

Relevance of curriculum in your job-

Yes it is relevent

Please suggest any changes in curriculum and Syllabi -

Basic Subject Syllabus is good.

Please suggest any improvement in teaching learning process-

No Improvement needed.

Have you learned the basic concepts through your project? Yes / No

Any other suggestions / Comments-

Not sufficient

Signature

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Name	Sagar Ashok Keswani	PRN Number	8813 3
Mailing Address			
Email:	Sagarkeswani@gmail.com	Year of Passing	2018-2019

Sr. No.	Questions	Excellent	Very Good	Good	Satisfactory	Poor
		5	4	3	2	1
1	**Engineering knowledge:** Where you able to apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	✓				
2	**Problem analysis:** Where you comfortable inIdentifying, formulating, reviewing research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.					
3	**Design/development of solutions:** Where you able to design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	✓	✓			
4	**Conduct investigations of complex problems:** Was it easy to use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.			✓		
5	**Modern tool usage:** Where you able to create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the	✓				

	limitations.				
6	**The engineer and society:** Did you apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues, and the consequent responsibilities relevant to the professional engineering practice.		✓		
7	**Environment and sustainability:** Did youunderstand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	✓			
8	**Ethics:** Where youapply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice		✓		
9	**Individual and teamwork:** Did youfunction effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings	✓			
10	**Communication:** Did you communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions				
11	**Project management and finance:** Did you demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	✓		✓	
12	**Life-long learning**: How far you recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.		✓		
13	Did you apply fundamental knowledge to identify, formulate, design and investigate various problems of electrical and electronic circuits and power systems.	✓			
14	Where you apply software tools for design, simulation and analysis of electrical systems, skill based technical training and to engage in life- long learning and to successfully adapt in multi-disciplinary environments.				
15	Where you Solve ethically and professionally various Electrical Engineering problems in societal and environmental context and communicate effectively.	✓		✓	

Your detailed comments for improvement

Signature

Attainment Procedure of Pos and Cos with Sample data

Marks allocation of university: The division of marks given by the university, and weightages in arriving at at the attainment of cos are as given below.

Sr.No.	Types of course	Internal Marks	External Marks	Total Marks	Net Co attainment level as per weighttage
1	Theory	20	80	100	0.2* CIA level +0.8 *SEE Level
2	Laboratory	25	25	50	0.5* CIA level +0.5 *SEE Level
3	Seminar	50	-		CIA Level
4	Project	75	75	150	0.5* CIA level +0.5 *SEE Level

Direct assessment tools and indirect assessment tools tomeasure attainment of the COs.

- Direct attainment displays the student's knowledge and skills from their performance. It can be determined from the performance of the students in all the relevant assessment instruments – like internal assessments, unit test, assignments, quiz and final university examination. These methods provide a sampling of what students know and/or can do and provide strong evidence of student learning.
- Indirect methods such as surveys and interviews ask the stakeholders to reflect on student's learning. They assess opinions or thoughts about the graduate's knowledge or skills.
- Indirect measures can provide information about graduate's perception of students learning and how different stakeholders has valued this learning.

Table shows type of assessment with Courseassessment, evaluation method, process and frequency of assessment

Type of assessment	Assessment tool	Process	Frequency
		Department will conduct two internal tests and assignment, scheduled in accordance with the university and college calendar of events.	Twice a semester

Direct assessment	Theory Internal Assessment (IA) tests and assignment	The faculties will prepare the Question papers and assignment for the respective subject and will be submitted to UT coordinator well in advance.	Once in semester
		The faculties will follow scheme and solutions for each test and assignment to evaluate the performance of students as per the assessment rubrics. The Internal assessment marks are based on average of two tests and one assignment conducted.	
	Laboratory Assessment	Laboratory in-charge faculties will follow the rubrics, which is set by the department for evaluation of laboratory experiments/programs.	Continuous practical wise assessment and internal exam once in semester
		There shall be maximum of 25 Marks IA in each practical.	
	Seminars	The Department selects a senior faculty member as a Seminar coordinator.	Once in semester
		Seminar Coordinator has to sit with other faculty to assess the Technical seminar presentations by students.	
		He/She would ensure that the students choose advanced concepts in electrical engineering field.	
		One seminar presentation per student in the VIII semester would be conducted as per the schedule mentioned prior in Time Table.	
		Seminar coordinators follow rubrics, which is set by the department for evaluation of seminar.	
		Project batches are formed as per the instruction given by project coordinators.	
		Synopsis will be submitted to the project coordinators for scrutinizing.	

	Project	Project Batches are allotted to the internal guides based on the specialization and competency skills of the faculties.	Once in semester
		Each internal guide will continuously monitor their students on a weekly basis to observe the progress of the work.	
		The project guide along with project coordinator conduct 2 project reviews as per the rubrics, which is set by the Department and the submit the Internal Assessment marks to the Head Of Department.	
	Term end exam	At end of each semester, term end examination is conducted by university for all theory and laboratory courses. The questions for this examination covers entire syllabus of the courses. The questions are mapped with the COs. Attainment of COs depends on percentage of students getting target marks.	Once in semester
Indirect assessment	Alumni Feedback	Alumni feedback is obtained every year during alumni meetings and also during visit of alumni to college for placement activities, guest lectures and other occasions.	Once in Year
	Employer Survey	Feedback forms are circulated among the employers for our departmental students to understand their views regarding POs.	Once in Year
	Course Exit Survey	On completion of every semester, a feedback is obtained from the students for the courses which they have learnt.	Once in Year

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		5	4	3	2	1
1	**Engineering knowledge:** Where you able to apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	✓				
2	**Problem analysis:** Where you comfortable inIdentifying, formulating, reviewing research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.					
3	**Design/development of solutions:** Where you able to design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	✓	✓			
4	**Conduct investigations of complex problems:** Was it easy to use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.			✓		
5	**Modern tool usage:** Where you able to create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the	✓				

	limitations.				
6	**The engineer and society:** Did you apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues, and the consequent responsibilities relevant to the professional engineering practice.		✓		
7	**Environment and sustainability:** Did youunderstand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	✓			
8	**Ethics:** Where youapply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice		✓		
9	**Individual and teamwork:** Did youfunction effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings	✓			
10	**Communication:** Did you communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions				
11	**Project management and finance:** Did you demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	✓		✓	
12	**Life-long learning**: How far you recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.		✓		
13	Did you apply fundamental knowledge to identify, formulate, design and investigate various problems of electrical and electronic circuits and power systems.	✓			
14	Where you apply software tools for design, simulation and analysis of electrical systems, skill based technical training and to engage in life- long learning and to successfully adapt in multi-disciplinary environments.				
15	Where you Solve ethically and professionally various Electrical Engineering problems in societal and environmental context and communicate effectively.	✓		✓	

Your detailed comments for improvement

Signature

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Name of the Alumni: Ajinkya Anil Bharde	**PRN No:** 88054
Degree: B.E./M.E. in Electrical	
Year of Graduation: 2019	
Name of the Organization where you are working: –	
Designation: –	

Sr. No.	Graduate Attributes	Program Outcomes (POs)	Excellent 5	Very Good 4	Good 3	Satisfactory 2	Poor 1
1	Extent of usefulness of Basic and Engineering science courses in understanding problems you solved so far in your career.	PO1	✓	✓	✓		
2	Publication of research papers, findings, and promotion in the organization.	PO2 PO4	✓			✓	
3	Ability to design and develop system components and processes	PO3 PSO1, PSO2					
4	New tools learnt and used during job and its applications	PO8 PSO2					
5	Ability to factor in sustainability, ethical, health, public safety, and environmental issues in the solutions developed and or participated by you.	PO6 PO7 PO8 PSO3	✓	✓	✓		
6	Level of comfort in working in groups – initially and at present	PO9					
7	Communication skills (level of acquisition during the program, usefulness in the job, additional acquisitions during work etc.)	PO10	✓				
8	Extent of project management, investigation of various problems of electrical and electronic circuits and/or power systems.	PO11 PSO1		✓			
9	Enhancement of qualifications, knowledge gain and technical and managerial skills developed by you.	PO12 PSO2	✓				

10	Solved ethically and professionally various Electrical Engineering problems in societal and environmental context and communicate effectively	PSO3					

Relevance of curriculum in your job-

Yes it is relevent

Please suggest any changes in curriculum and Syllabi -

Basic Subject Syllabus is good.

Please suggest any improvement in teaching learning process-

No Improvement needed.

Have you learned the basic concepts through your project? Yes / No

Any other suggestions / Comments-

Not sufficient

Signature

Sample Rubrics Developed:

P. R. Pote (Patil) College of Engineering & Management, Amravati

Department of Electrical Engineering

Name of the Program: B. E. (Electrical & Electronics) Engineering	**Academic Year:**
Class: VII Sem-Section-A	**Section:** A
Course/Subject: SwitchGear & Protection Lab	**Course Code:**
Course Owner: Dr. S. B. Warkad	**Designation:** Professor

SN	List of Experiment
1	To study different equipment used in electrical power system/switchgear and protection laboratory
2	To study the Arc extinguish phenomenon using MATLAB tool.
3	To plot the characteristics of Fuses and Miniature Circuit Breaker
4	To Study Transformer Differential Protection using Numerical Relay
5	To plot the characteristics of Electromagnetic IDMT Relay.
6	To plot the characteristics of Directional Over Current Relay.
7	To study the operation of Numerical Overvoltage and Undervoltage Relay.
8	To study the operation of Numerical Overcurrent Relay.
9	To study the earth fault and phase protection in power system.
10	To simulate Protection of Three phase line against different types of faults using MATLAB

Lab Course Outcomes

After Successful completion of Laboratory course, the students will able to

SN	Outcomes
1	understand and list various equipment used in electrical power system/switchgear and protection laboratory.
2	explain and demonstrate Arc extinguish phenomenon using MATLAB tool.
3	explain or illustrate the characteristics of Fuses and Miniature Circuit Breaker used for protection.
4	understand and demonstrate working of Transformer Differential Protection, Overvoltage, Undervoltage, Overcurrent, earth fault and phase protections using Numerical Relays.
5	explain or illustrate the characteristics of IDMT, and directional overcurrentelectromagnetic Relays.
6	simulate Protection of Three phase line against different types of faults using modern tools i.e. MATLAB

Assessment Strategy: Rubrics for continuous evaluation in lab session

Parameters	Allocated Marks	High	Medium	Low
Prelab test	**2**	Student answered all the prelab questions and Objective of the experiment.	Student answered only few prelab questions and partial know objective of the experiment.	Student did not answer any prelab question and not aware about objective of the experiment
		2	1	0
In-Lab performance	**5**	Student performed or executed experiment, obtained results, and drawn conclusion fully as per expectation.	Student performed or executed experiment, obtained results, and drawn conclusion partially as per expectation.	Student performed or executed experiment, obtained results, and drawn conclusion below the expectation.
		5	4-3	2-1
Post lab test	**3**	Student answered the Post lab Viva voce questions and fully confirms the understanding of the experiments.	Student partially answered the Post lab Viva voce questions and partially confirms the understanding of the experiments.	Student did not answer the Post lab Viva voce questions and not confirms the understanding of the experiments.
		3	2-1	0
Lab Record	**5**	Records submitted by the Student found highly satisfactory after evaluation.	Records submitted by the Student found moderately satisfactory after evaluation.	Records submitted by the Student found highly dissatisfactory after evaluation.
		5	4-3	2-1
Total Marks	**15 Marks** (Continuous Assessment)			

Assessment Strategy:Rubrics usefor Internal Examination

Parameters	Allocated Marks	High	Medium	Low
Performance	5	Students able to conduct the given experiment with desired output.	Student partially able to conduct the given experiment with desired output.	Student not able to conduct given experiment with desired output.
		5-4	3-1	0
Viva Voce	5	Student answered theQuestions satisfactorily.	Student answered theQuestions moderately satisfactorily.	Student did not answer the Questions.
		5-4	3-1	0
Total marks		**10 Marks (Internal Examination)**		
Grand Total Marks		Continues Assessment (15)+Internal Examination (10) =25 Marks		

Mapping Relation Between Rubrics and Course Outcomes for Overall Assessment

SN	Rubrics Parameters	Course Outcome
A): **Continuous evaluation in lab session**		
1	**Prelab test**	CO1, CO2, CO3, CO4, CO5, CO6
2	**In-Lab performance**	CO2, CO3, CO4, CO5, CO6
3	**Post lab test**	CO1, CO2, CO3, CO4, CO5, CO6
4	**Lab Record**	CO1, CO2, CO3, CO4, CO5, CO6
B): **Internal Examination**		
1	**Performance**	CO2, CO3, CO4, CO5, CO6
2	**Viva Voce**	CO1, CO2, CO3, CO4, CO5, CO6
	Total Mapping	Take sum of average of each CO for attending respective PO **Set Target attainment:** • **High:** 70% students scoring ≥ 60% average marks in Internal Lab Assessment • **Medium:** 60% students scoring ≥ 60% average marks in Internal Lab Assessment • **Low:** 50% students scoring ≥ 60% average marks in Internal Lab Assessment

Seminar Assessment Rubrics

RUBRICS	Max Marks:50
Topic selection	10
Presentation	10
Communication skill	10
Report Writing	10
Question & Answer	10

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Project Assessment Rubrics

Review #	Agenda	Assessment	Review Assessment Weightage	Over all Weightage
Review 1	Project Defining Seminar Format	Rubric R1	50	(R1+R2+R3)/2
Review 2	Project Review Seminar	Rubric R2	50	
Review 3	Project Presubmission Seminar	Rubric R3	50	
External Evaluation (100)				**75**
Total				150

Rubric 1 (R1): Phase -1 Evaluation (25 Marks)

Parameters	**Low** (0-35%)	**Medium** (36% - 65%)	**High** (66% – 100%)	**Max Marks**
Knowledge and information about proposed work including literature survey	Less Knowledge and information about proposed work including inadequate literature survey	Need more knowledge about topic with need of more paper to review.	Overall good knowledge with proper survey.	30
Presentation	Poor Presentation	Average Presentation	Good presentation	10
Project report & Contents	Unorganized project report and short with contents	Unorganized project report and all contents	Well organized Project report & all contents	10

Rubric 2 (R2): Phase -2 Evaluation (25 Marks)

Parameters	**Low** (0-35%)	**Medium** (36% - 65%)	**High** (66% – 100%)	**Max Marks**
Progress of proposed project work since last seminar	Less than 40% of work done	Less than 60%of work	60% of work done	30
Presentation	Poor Presentation	Average Presentation	Good presentation	10
Project report & Contents	Unorganized project report and short with contents	Unorganized project report and all contents	Well organized Project report & all contents	10

Rubric 3 (R3): Phase -3 Evaluation (25 Marks)

Parameters	**Low** (0-35%)	**Medium** (36% - 65%)	**High** (66% 100%)	**Max Marks**
Completion(Final results/observations/publications if any) of proposed project work	Less than 60% work	Less than 100% work and incomplete report	100 % work completed with project report	30
Presentation	Poor Presentation	Average Presentation	Good presentation	10
Project report & Contents	Unorganized project report and short with contents	Unorganized project report and all contents	Well organized Project report & all contents	10

Direct attainment by CIA sample calculation

Power Electronics (6EP03) 6th – Semester

Table-I Unit Test-1 internal exam attainment

Roll number	1a (7M)	1b (8M)	CO1 Q.1 (15M)	Target Level >=60% Marks	2a (7M)	2b (8M)	CO1 Q.2 (15 M)	Target Level >=60% Marks	3a (7M)	3b (8M)	CO2 Q.3 (15 M)	Target Level >=60% Marks	4a (7M)	4b (8M)	CO2 Q.4 (15M)	Target Level >=60% Marks
A301	7	7	14	Y					7	6	13	Y				
A302					7	7	14	Y					6	4	10	Y
A303	5	2	7	N									6	6	12	Y
A304	7	6	13	Y									7	5	12	Y
A305					6	8	14	Y	4	8	12	Y				
A306					6	4	10	Y					2	6	8	N
A307	7	7	14	Y					7	7	14	Y				
A308	6	7	13	Y					7	0	7	N				
A309					7	7	14	Y					7	7	14	Y
A310					2	5	7	N					7	6	13	Y
Target achived			Y	26			Y	21			Y	24			Y	21
Target not achived			N	3			N	3			N	4			N	4
Not appeard			NA	0			NA	0			NA				NA	

CO1 Attainment	**0.89**	**CO1 Attainment**	**0.87**	**CO2 Attainment**	**0.85**	**CO2 Attainment**	**0.84**	
Avg Attaintment CO1	**(0.89+0.87)/2=0.88**			**Avg Attaintment CO2**	**(0.85+0.84)/2=0.845**			
Attainment Level	**3**			**Attainment Level**	**3**			

Attainment level Value	Target
1	50% students scoring>=60% marks out of relevant maximum marks
2	60% students scoring>=60% marks out of relevant maximum marks
3	70% students scoring>=60% marks out of relevant maximum marks

Similarly, for unit test-II and assignment co attainment level are obtained is obtained

Direct attainment by SEE sample calculation

Power electronics(6EP03) Sixth Semester					
Table-II Semester End exam attainment					
S.N.	ENROLLMENT NO.	UNIVERSITY ROLL NO.	NAME OF STUDENT	University Marks	Target Level >=30%
1	16644506	168179130199	ABHIJEET DHONDIBA BHANGE	40	Y
2	16669237	168179130199	ADITYA SUNIL SARODE	44	Y
3	16644508	168179130199	AJINKYA ANIL BHARDE	6	N
4	16644510	168179130199	AKSHAY BALKRUSHANA DHOKE	27	Y
5	16644511	168179130199	AMOL RAMESHRAO IRAPACHI	22	N
6	16644514	168179130199	BHAVESH RAJENDRARAO BELSARE	19	N
7	16644516	168179130199	BHUSHAN GANESH KHUPSE	51	Y
8	16644517	168179130199	CHAITANYA VINOD TADE	25	Y
9	16644447	168179130199	Ku.CHANCHAL ATMARAM PATIL	33	Y
10	16644526	168179130199	KAUSTUBH MANOJ WANKHADE	29	Y
11	16644456	168179130199	Ku.KETKI PRAFULRAO BHUYAR	24	Y
12	16644446	168179130199	Ku.CHAITALI SUNIL LIPNE	12	N
13	16644457	168179130199	Ku.KIRTI RAVINDRA KALSKAR	24	Y
14	16644458	168179130199	Ku.LAXMI MANOJ DHOTE	35	Y
15	16644461	168179130199	Ku.MEENA GAJANAN DHOTE	54	Y
		Target Achived		Y	35
		Target not Achived		N	18
		Not Appeared		NA	0
COs Attainment				0.66	
Attainment Level				3	

Sr.No.	Attainment Level	Attainment Level Values	Target
1	Low	1	40% students scoring>=30% marks out of relevant maximum marks
2	Medium	2	50% students scoring>=30% marks out of relevant maximum marks
3	High	3	60% students scoring>=30% marks out of relevant maximum marks

Table-III Overall direct attainment of power electronics(6EP03)

Internal/External/Overall attainment

	INTERNAL ASSESSMENTS (COLLEGE EXAMS)												Overall internal attainment
	Attainment Percentage of Cos						Attainment Level of Cos						
Course	CO1	CO2	CO3	CO4	CO5	CO6	CO1	CO2	CO3	CO4	CO5	CO6	
6EP03	89	85	63	69	90	90	3	3	2	2	3	3	2.67

	EXTERNAL ASSESSMENTS												Overall External attainment
	Attainment Percentage of Cos						Attainment Level of Cos						
Course	CO1	CO2	CO3	CO4	CO5	CO6	CO1	CO2	CO3	CO4	CO5	CO6	
6EP03	66	66	66	66	66	66	3	3	3	3	3	3	3.00

	Overall attainment			
Theory Course	0.2*Overall internal attainment	0.8*Overall External attainment	Overall attainment	Target
6EP03	0.53	2.4	2.93	2.4

Indirect Attainment Process

For indirect attainment graduate exit survey, alumni survey and employer survey are carried out once in a year for different attributes to be addressed by survey and depending on attributes weightages are decided

Weightages															
Assessment Tools	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Graduate Exit Survey	40%	50%	40%	40%	50%	40%	50%	30%	40%	30%	50%	30%	50%	50%	50%
Alumni Survey	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%
Employer Survey	30%	20%	30%	30%	20%	30%	20%	40%	30%	40%	20%	40%	20%	20%	20%

Assuming 80% weightage to University examination and 20% weightage to Internal assessment, the attainment calculations will be (80% of University level) + (20% of Internal level)

In overall attainment 80% weightage is given to direct assessment and 20% toindirect assessment.

Sample calculation for Network analysis (3EP02)

Cell number 3EP02-PO1: PO attainment value = (Corresponding cell value from CO-POs mapping Table x Overall CO attainment value for course (3EP02)/3 =(3x2.9)/3

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Sample Overall CO-PO attainment of an Academic Year (2017-21)												
Department of Electrical Engineering												
Program Outcome attainment levels for all POs												
Course	Course PO correlation Matrix											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
	Semester-1											
I A 1(M1)	2.3	2.8	2.0	2.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I A 2(Phy)	2.5	2.5	0.0	1.3	2.0	0.0	2.0	0.0	2.0	2.0	1.0	1.5
I A 3(EM)	2.5	2.5	2.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I A 4(ED)	2.3	2.5	2.5	2.5	2.0	2.0	0.0	0.0	0.0	2.0	0.0	1.0
I A 5(WS01)	2.1	2.5	2.0	2.0	2.0	2.0	0.0	0.0	0.0	0.7	0.0	0.7
I A 6(PhyLab)	2.5	2.0	2.0	2.0	2.0	0.0	2.0	2.5	2.0	2.5	2.5	2.5
I A 7(EM Lab)	3.0	2.3	2.1	0.0	2.0	0.0	0.0	0.0	0.0	2.0	0.0	2.5
I A 8(EDLab)	2.1	2.0	2.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I B 1(M2)	2.5	2.0	2.0	2.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I B 2(Chem)	3.0	2.0	2.3	2.0	2.7	0.0	0.0	0.0	0.0	0.0	2.0	0.0
I B 3(CP)	2.3	2.0	2.2	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	2.3
I B 4(EE)	2.2	2.1	1.5	2.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I B 5(W.S02)	2.0	2.0	2.0	2.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	2.0
I B 6(Chem Lab)	3.0	2.0	0.0	2.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	2.0
I B 7(CP Lab)	2.0	2.0	2.0	3.0	3.0	0.0	2.8	0.0	0.0	0.0	0.0	3.0
I B 8(EE Lab)	3.0	2.0	2.3	2.0	2.7	0.0	0.0	0.0	0.0	0.0	2.0	0.0
3EP01(M III)	2.0	2.3	1.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3EP02(NA)	2.9	2.0	2.0	0.0	3.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0
3EP03(ERG)	2.3	2.3	2.3	2.0	0.0	0.0	3.5	0.0	0.0	0.0	0.0	2.0
3EP04(EDC)	2.1	2.0	2.7	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3EP05(EMI)	2.1	2.5	2.5	2.5	0	0	0	0	0	0	0	0
3EP06(NA Lab)	2.0	2.0	3.0	0.0	3.0	0.0	2.8	0	0	0	0	3.0
3EP07(EDC Lab)	2.1	1.0	2.7	1.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3EP08(EMI Lab)	2	2	2	3	3	0	0	0	0	0	0	0
4EP01(EM01)	2.83	2.5	2	2	2	0	0	0	0	1.6	0	2
4EP02(ET)	2.0	1.9	0.0	0.0	3.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
4EP03(ADC)	1.5	1.8	2.2	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4EP04(M IV)	1.4	2.5	2.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4EP05(NMCP)	**3.0**	**2.0**	**2.0**	**2.0**	**3.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**2.0**	0.0
4EP06(EM1 Lab)	2	2	2	3	1.5	2	0	0	1.9	3	1.9	2
4EP07(ADC Lab)	3.0	2.0	2.3	2.0	1.7	0.0	0.0	0.0	0.0	0.0	2.0	0.0
4EP08(NMCPLab)	3.0	2.0	2.3	2.0	1.7	0.0	0.0	0.0	0.0	0.0	2.0	0.0
5EP01(CS01)	2.5	2.5	2.0	2.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5EP02(MPMC)	1.9	2.0	2.0	2.5	1.9	0.0	0.0	0.0	1.9	2.4	2.4	0.7
5EP03(EM02)	3.0	2.0	2.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5EP04(SS)	3.0	2.0	3.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5FEPP05(EQ)	2.3	2.0	2.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5EP06(Com.S)	0.0	0.0	0.0	0.0	0.0	2.7	2.7	0.0	2.7	0.0	2.5	2.0
5EP07(CS01 Lab)	2.0	2.2	2.0	2.0	2.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0
5EP08(MP Lab)	2.33	2.33	2.5	2.5	0	0	0	0	2	2	2	0.0
5EP09(EM02Lab)	**2.8**	**1**	**0**	**0**	**0**	**2**	**0**	0	**2**	**2.8**	**0**	**2**
5EP010(Com Lab)	0	0	0	0	0	2.33	1	0	1.5	0	1.8	1.66
6EP01(EP01)	2.6	2.2	1.8	2.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6EP02(OT)	**3.0**	**2.0**	**2.0**	**2.0**	3.0	0.0	0.0	0.0	2.0	0.0	2.0	0.0
6EP03(PE)	2.3	2.0	2.2	0.0	0.0	2.0	2.0	0.0	0.0	0.0	0.0	0.0
6EP04(CAMD)	3.0	2.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6FEEP05(NCS)	2.0	2.0	2.0	2.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	2.0

6EP06(EEU)	3.0	2.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6EP07(PE Lab)	**2.0**	**2.0**	**3.0**	0.0	**3.0**	0.0	**2.8**	0.0	0.0	0.0	0.0	**3.0**
6EP08(CD Lab)	3.0	2.0	0.0	2.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6EP09(EU Lab)	3.0	2.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7EP01(CS02)	2.3	2.8	2.0	2.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7EP02(PSOC)	2.5	2.0	0.0	2.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0
7EP03(EP02)	**2.5**	1.8	2.5	1.7	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7EP04(SGP)	2.3	1.8	2.5	2.2	1.0	2.0	0.0	0.0	0.0	1.5	0.0	1.0
7EP05(CMPSA)	**3.0**	**2.2**	**2.0**	**2.0**	**2.0**	**2.0**	0.0	**0.0**	**2.0**	**0.0**	2.0	**0.0**
7EP06(P&S)	1.0	1.0	2.3	2.0	1.6	2.7	1.0	2.1	2.8	2.0	2.2	1.5
7EP07 (EP02Lab)	3.0	2.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7EP08(SGP Lab)	2.5	1.6	2.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8EP01(PSS)	2.2	2.1	0.0	0.0	0.0	**2.0**	0.0	0.0	0.0	0.0	0.0	2.5
8EP02(HVE)	3.0	2.0	2.2	2.0	2.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8EP03(DSP)	3.0	2.0	2.3	2.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8EP04(PQ)	2.0	2.0	2.0	2.0	1.0	0.0	0.0	2.0	0.0	0.0	0.0	2.0
8EP05(P&S)	1.3	2.0	2.0	2.0	2.0	2.5	1.0	2.5	2.6	2.4	2.5	1.5
8EP06(DSP Lab)	2.0	2.0	2.0	2.0	3.0	2.0	0.0	0.0	2.0	0.0	2.0	0.0

Program overall attainment levels for all POs Session(2017-21)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Target	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1
Direct Attainment	2.37	2.02	2.12	2.01	2.15	2.14	2.13	2.14	2.10	2.07	2.05	1.89
Indirect Attainment	2.53	2.51	2.53	2.53	2.51	2.53	2.51	2.55	2.53	2.55	2.51	2.55
Total Attainment	2.40	2.12	2.20	2.12	2.22	2.22	2.20	2.22	2.18	2.17	2.14	2.02
Result	Attained	Attained	Attained	Attained	Attained	Attained	Attained	Attained	Attained	Attained	Attained	Attained

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Sample CO-PSO attainment of an Academic Year (2017-21)

Course	Course PSO correlation Matrix		
	PSO1	PSO2	PSO3
3EP01(M III)	0.0	2	0
3EP02(NA)	2	3	2
3EP03(ERG)	0	0	2.33
3EP04(EDC)	2	0	0
3EP05(EMI)	1.9	2	0
3EP06(NA Lab)	3	2.5	2
3EP07(EDC Lab)	2.33	0	0
3EP08(EMI Lab)	2	2	0
4EP01(EM01)	2	2	2
4EP02(ET)	2	2	0
4EP03(ADC)	2.33	1.25	1
4EP04(M IV)	3	2.67	1.67
4EP05(NMCP)	**2.25**	**0**	**2.5**
4EP06(EM1 Lab)	2	2	0
4EP07(ADC Lab)	2.33	1.25	1
4EP08(NMCPLab)	0.0	0.0	2
5EP01(CS01)	2	2	0
5EP02(MPMC)	2.4	2.4	2
5EP03(EM02)	2.0	0.0	0.0
5EP04(SS)	3	2	0
5FEPP05(EQ)	2.66	2	0
5EP06(Com.S)	2	2	2.5
5EP07(CS01 Lab)	2	3	0
5EP08(MP Lab)	2.33	2.33	0
5EP09(EM02Lab)	**2**	**0**	**2**
5EP010(Com Lab)	2	0	2.5
6EP01(EP01)	2.5	2	2.5
6EP02(OT)	**2.5**	**2**	**2.6**
6EP03(PE)	2	3	2
6EP04(CAMD)	3	0	0
6FEEP05(NCS)	0	0	2
6EP06(EEU)	2	0	2
6EP07(PE Lab)	**3**	**2.5**	**2**
6EP08(CD Lab)	2	0	2
6EP09(EU Lab)	2	0	2
7EP01(CS02)	**2.5**	0	**2**
7EP02(PSOC)	2	2	2
7EP03(EP02)	0.0	0.0	2
7EP04(SGP)	1	0	2
7EP05(CMPSA)	**2.5**	**2**	**2**
7EP06(P&S)	1.7	2.5	2.5
7EP07 (EP02Lab)	0.0	2	0
7EP08(SGP Lab)	1	1	2
8EP01(PSS)	**2.1**	0	**2**

8EP02(HVE)	3	1	2
8EP03(DSP)	3	0	0
8EP04(PQ)	0	2	0
8EP05(P&S)	0	2	0
8EP06(DSP Lab)	2	2	2

Program overall attainment levels for all PSOs

	PSO1	**PSO2**	**PSO3**
Target	2.1	2.1	2.1
Direct Attainment	2.28	2.08	2.04
Indirect Attainment	2.53	2.51	2.55
Total Attainment	2.33	2.16	2.14
Result	Attained	Attained	Attained

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