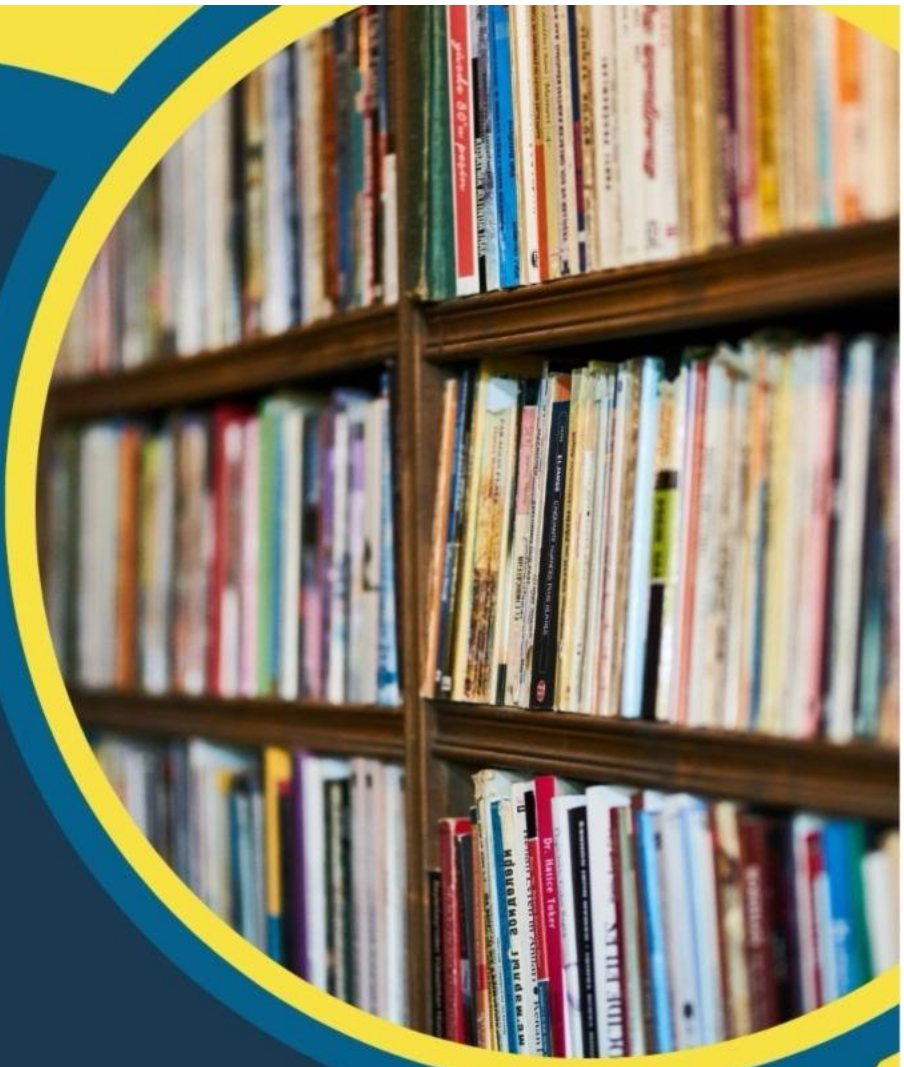

M.TECH.
ENGINEERING EDUCATION

Curriculum

Regulations 2024

National Institute of Technical Teachers Training and Research
Deemed to be University under Distinct Category – A Centrally Funded Technical Institute
CSIR Road, Taramani, Chennai - 600 113
(Ministry of Education, Government of India)
https://www.nitttrc.ac.in/

NITTTR CHENNAI

NATIONAL INSTITUTE OF TECHNICAL TEACHERS TRAINING AND RESEARCH CHENNAI

Deemed to be University under Distinct Category – A Centrally Funded Technical Institute

M. Tech. ENGINEERING EDUCATION - REGULATIONS 2024

CURRICULUM & SYLLABUS

The M.Tech. Engineering Education programme is designed to equip educators with the skills and knowledge necessary to excel in their field. By combining technical expertise with pedagogical excellence, learners can transform traditional teaching methods into engaging and effective learning experiences. The programme emphasizes experiential learning, hands-on activities, and real-world applications to ensure students are prepared for the challenges of modern education. Additionally, a focus on ongoing professional development will keep educators up-to-date with the latest advancements in technology and innovative teaching methodologies.

Programme Educational Objectives (PEOs)

PEO 1: To upskill educators to be capable of effectively teaching engineering principles and applying innovative pedagogical methods to foster student learning and development.

PEO 2: To enable learners to demonstrate a strong commitment to professional ethics, sustainability, and social responsibility in their educational practices, contributing to the advancement of engineering education and society at large.

PEO 3: To enhance verbal and written communication skills and effectively disseminate knowledge and engage with diverse audiences through various modes of instruction, including technology-enabled learning.

PEO 4: To equip them to design and implement effective instructional plans, assess student learning outcomes, and continuously evaluate and improve their teaching practices to enhance student success and engagement.

Programme Outcomes (POs)

Our graduates by the time of graduation will be able to

PO1: Demonstrate a deep understanding of engineering principles, concepts, and methodologies relevant to their area of specialization.

PO2: Apply advanced technical knowledge and problem-solving skills to address complex engineering challenges and develop innovative solutions.

PO3: Design, implement, and evaluate effective teaching and learning strategies, incorporating both traditional and modern pedagogical approaches.

PO4: Communicate effectively, both verbally and in writing, with diverse audiences, including students, colleagues, and the broader community.

PO5: Demonstrate a strong commitment to professional ethics, sustainability, and social responsibility in their educational practices.

PO6: Engage in lifelong learning and professional development to stay updated with advancements in engineering education, technology, and pedagogical practices.

Programme Credit Requirement

		PG Certificate	PG Diploma	PG Degree
PCC (Theory)	Credit	6	12	12
	Course	2	4	4
PCC (Lab)	Credit	4	8	8
	Course	2	4	4
PEC / OEC	Credit	9	9	18
	Course	3	3	6
FC	Credit		3	3
	Course		1	1
MC	Credit	3	3	3
	Course	1	1	1
Audit Course	Credit	0	0	0
	Course	2	2	2
IIC/ PRACTICUM	Credit	0	0	8
	Course	0	0	2
PD	Credit	0	5	28
	Course	0	1	2

Minimum Credit Requirement to obtain

PG Certificate – 20 Credits; PG Diploma – 40 Credits; PG Degree – 80 Credits

PCC	Professional Core Courses
PEC	Professional Elective Courses
OEC	Open Elective
FC	Foundation Course
MC	Mandatory Course
AC	Audit Course
IIC	Industrial Integrated Courses
PD	Project Dissertation

Course Structure and Details

PROFESSIONAL CORE COURSES (Theory)			
S.No	Course Code	Course Title	Credits
1	ED24P11	Instructional Planning and Delivery	3
2	ED24P12	Orientation towards Technical Education and Curriculum Aspects	3
3	ED24P13	Student Assessment and Evaluation	3
4	ED24P14	Technology Enabled Learning and Life-long Self-learning	3
PROFESSIONAL CORE COURSES (Laboratory)			
1	ED24P21	AI for Pedagogy Laboratory	2
2	ED24P22	Communication Skills Laboratory	2
3	ED24P23	Principles of Psychology Laboratory	2
4	ED24P24	Technology Enabled Learning Laboratory	2
FOUNDATION COURSE			
1	MA24M14	Statistics and Probability for Engineers	3
MANDATORY COURSE			
1	RM24K11	Research Methodology and IPR	3
PRACTICUM			
1	ED24G11	Engineering Project Management	4
2	ED24G12	Teaching Engineering Concepts	4
AUDIT COURSE			
1	AC24H11	English for Research Paper Writing	0
2	AC24H12	Indian Knowledge System	0
PROJECT DISSERTATION			
1	ED24T21	Project Phase 1	12
2	ED24T22	Project Phase II	16
PROFESSIONAL ELECTIVE COURSE – COMMUNICATION SKILLS, MODES AND KNOWLEDGE DISSEMINATION			
1	ED24A11	Communication Skills for Classroom Transactions	3
2	ED24A12	Digital Communication at the Workplace	3
3	ED24A13	Modes of Knowledge Dissemination	3
PROFESSIONAL ELECTIVE COURSE – EDUCATIONAL ADMINISTRATION			
1	ED24B11	Institutional Management Process	3
2	ED24B12	Professional Values and Human Realities	3
3	ED24B13	Strategic Planning for Growth and Development	3

PROFESSIONAL ELECTIVE COURSE – CREATIVE PROBLEM SOLVING AND RESEARCH			
1	ED24C11	Designing and Conducting Research	3
2	ED24C12	Problem Solving using Computational Thinking	3
3	ED24C13	Research in Technical Education	3
PROFESSIONAL ELECTIVE - QUALITY ASSURANCE AND ACCREDITATION			
1	ED24D11	Accreditation Systems for Technical Education	3
2	ED24D12	Outcome-Based Education and Continuous Improvement in Technical Programs	3
3	ED24D13	Quality Assurance in Technical Education	3
PROFESSIONAL ELECTIVE - SUSTAINABILITY IN EDUCATION			
1	ED24E11	Innovative Pedagogies for ESD	3
2	ED24E12	Sustainability Assessment and Reporting in Education	3
3	ED24E13	Sustainable Engineering Practices in Curriculum	3
PROFESSIONAL ELECTIVE – GUIDANCE AND COUNSELLING			
1	ED24F11	Fundamentals of Human Behaviour	3
2	ED24F12	Introduction to Guidance and Counselling	3
3	ED24F13	Mental Health Development	3
OPEN ELECTIVE			
1	OE24W11	Design Thinking for Educators	3
2	OE24W12	Blue Economy and Entrepreneurship	3
3	OE24W12	Swachhata Campus: Clean, Green and Sustainable Energy	3
4	OE24W13	Integration of AI Educational Practices	3
5	OE24W14	Extended Reality Technologies	3

Theory: 1 Credit = 15 hours; Practical: 1 Credit = 30 hours; Experiential learning including relevant experience and proficiency/ professional levels acquired 1 Credit – 40 -45 hours. The guidelines for attendance and assessment as stipulated in the PG regulations.

PROFESSIONAL CORE COURSES (Theory)

ED24P11	INSTRUCTIONAL PLANNING AND DELIVERY	3 CREDITS

Course Description:

This course equips educators with the skills to design and deliver effective instruction. It focuses on curriculum development, instructional planning, and the selection and use of teaching methods. Students will master curriculum analysis, mapping, and instructional strategies aligned with learning principles. The course emphasizes the integration of various instructional methods, media, and assessment techniques. By the end, students will be able to create engaging and impactful classroom experiences that meet the needs of diverse learners.

Course Outcomes:

On completion of the course, the student is expected to be able to

1. Analyze and map curricula, aligning objectives with programme outcomes.
2. Implement varied strategies for different knowledge types.
3. Apply teacher-centered, student-centered, and mixed methods.
4. Use media effectively, considering design principles and formats.
5. Develop comprehensive session plans with feedback mechanisms and industry-based instruction.

Unit 1	**CURRICULUM ANALYSIS**	**09**
	Curriculum Analysis for Session Planning - Curriculum Analysis - Mapping for Curriculum Analysis - Strategies for Teaching Elements of Content Analysis - Aims, Goals and Objectives V/S PEOs, POs And COs - Curriculum Analysis of a Course - Instructional Planning - Course Planning - Session Planning - Session Learning Outcomes and its Analysis	
Unit 2	**TEACHING METHODS AND STRATEGIES**	**09**
	Strategies for Teaching Different Types of Subject Matter - Strategies for Teaching Factual, Conceptual, Procedural, Metacognitive Knowledge - Teaching Psychomotor Skills -Teaching Strategies for Affective Skills - Learning Principles and Events of Instruction - Gagne's Nine Events of Instruction - Maxims of Teaching	
Unit 3	**INSTRUCTIONAL METHODS AND STRATEGIES**	**09**
	Basic Teaching Model - Classification of Instructional Strategies - Basic Instructional Methods - Need for Variety - Types of Learning Outcomes - Availability of Resources - Teacher-Centered - Student-Centered - Mixed Strategy - Instructional Methods Continuum – Lecture, Demonstration, Tutorial - Laboratories - Blended and Flipped Learning Approach	
Unit 4	**INSTRUCTIONAL MEDIA**	**09**
	Need of Instructional Media - Classification of Media - Design of Handouts, Assignments, Laboratory Worksheets - Media Design Principles and Effective Board Work - Projected and Non-Projected Media - Mediating and Criterion Media - Audio, Visual and Audio-Visual Media - Print and Non-Print Media - Media Hardware and Software - Static and Dynamic Media - Exposition and Inquisition Media	
Unit 5	**CLASSROOM SESSION**	**09**
	Classroom Session Plan Preparation - Feedback Mechanism for Improvement - Planning for Laboratory and Industry-Based Instruction - Instructional Delivery - Organising for Effective Delivery in Classroom and Laboratory - Assessment Tools for Classroom - Aspects of Classroom Management: Students, Resources and Time - Practicum in Classroom	

Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	3	2	2	1	2
CO2	1	2	1	2	2	2
CO3	3	3	3	2	2	1
CO4	1	2	2	1	1	2
CO5	2	2	2	2	1	1

References:

1. Wilson B.(1987). *Methods of Training: Individualised Instruction*. Parthenon Publishing: Lancashire
2. Banthiya N.K., Joshua E., Mathew Susan S. et al.-*Devise Teaching Strategies and Select Teaching Methods- Competency Based Self-Learning Module;* TTTI Bhopal, 1999
3. Bozic, C., and Hartman, N. (2014). *Case-based instruction for innovation education in engineering and technology*. American Society for Engineering Education Annual Conference and Exposition, Indianapolis, IN.
4. Das, S. (2006). *Implementing a multi-media case study in traditional laboratory class*. American Society for Engineering Education Annual Conference and Exposition, Chicago, IL.
5. Fuchs, H. O. (1974). *On kindling flames with cases*. Engineering Education, 64(6), 412–415.
6. Garg, K. and Varma, V. (2007). *A study of the effectiveness of case study approach in software engineering education*. Conference on Software Engineering Education and Training, Dublin, Ireland.
7. Gupta, B. L. (2010). *Developing, using and analysing a Case study, Readings in Education Management*. Mahamaya Publishing House, New Delhi.
8. John Hattie and Helen Timperley (*March 2007*). *'The Power of Feedback'. Review* of Educational Research, Vol. 77, No. 1, pp. 81-112, DOI: 10.3102/003465430298487
9. Gagne, Robert M. and Briggs, Leslie, J. (1979, 2nd Ed.). *Principles of Instructional Design*. Holt, Rinehart and Winston, New York.

ED24P12	ORIENTATION TOWARDS TECHNICAL EDUCATION AND CURRICULUM ASPECTS	3 CREDITS

Course Description:

This course explores the foundations of quality education. Students will delve into quality assurance models, learning theories, and instructional design principles. The course emphasizes the development of skills in crafting clear learning objectives, understanding the teaching-learning process, and differentiating curriculum from syllabus. By the end, students will possess a comprehensive understanding of the elements critical to effective education.

Course Outcomes:

On completion of the course, the student is expected to be able to

1. Evaluate the concept of quality in higher education, examining models of quality assurance and the orientation towards technical education.
2. Grasp the three domains of learning and apply taxonomies such as Bloom's for cognitive, Krathwohl's for affective, and Dave's for psychomotor domains.
3. Define and justify instructional objectives, aligning them with Revised Bloom's Taxonomy.
4. Analyze the teaching-learning process, including factors influencing learning, and
5. Comprehend curriculum aspects, differentiating between curriculum and syllabus.

Unit 1	**ROLE OF TECHNICAL EDUCATION IN THE SOCIETY**	**09**
	Structure of Technical Education in India - Types of Technical Institutes - Apprenticeship Training Scheme - National Agencies - Orientation towards Technical Education - Quality Assurance in Higher Education - Concept of Quality - Models of Quality Assurance	
Unit 2	**THREE DOMAINS OF LEARNING**	**09**
	Introduction to Three Domains of Learning- Bloom's Taxonomy of Cognitive Domain - Revised Bloom's Taxonomy of Cognitive Domain - Krathwohl's Taxonomy for Affective Domain - Dave Taxonomy for Psychomotor Domain	
Unit 3	**INSTRUCTIONAL OBJECTIVES AND LEARNING OUTCOMES**	**09**
	Curriculum Aims, Goals and Objectives - Definition of Instructional Objectives - Reasons for Stating Instructional Objectives - Writing Instructional Objectives - Instructional Objectives and Revised Bloom's Taxonomy- Learning Outcomes References	
Unit 4	**LEARNING AND INSTRUCTION**	**09**
	Teaching-Learning Process - Factors Influencing Learning - Principles of Teaching and Learning - Learner Characteristics and Motivation - Student Types - Student Difficulties - Student Motivation - Causes of Demotivation in Students - Strategies of Motivation	
Unit 5	**ASPECTS OF CURRICULUM**	**09**
	Definition, Types and Components of Curriculum - Difference between a Curriculum and Syllabus - Curriculum Implementation, Monitoring and Evaluation - Curriculum Development Process Criteria of Utility, Variety and Flexibility for Curriculum Development -Difference Between Monitoring and Evaluation References	

Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	3	2	2	1	2
CO2	1	2	1	2	2	1
CO3	3	3	3	2	2	1
CO4	1	2	2	1	1	1
CO5	2	2	2	2	1	1

References:

1. Anderson, L. W. and Krathwohl, D. R., et al (Eds..) (2001) A Taxonomy for Learning, Teaching, and Assessing: A Revision of Bloom's Taxonomy of Educational Objectives. Allyn and Bacon. Boston, MA (Pearson Education Group)
2. Eugene E. Haddan, (1970) Evolving Instruction, London: The Macmillan Co.
3. Gagne R.M (1970) The Condition of Learning, (Revised Edition). New York: Holt, Rinehart and Winston Inc.
4. Robert M. Gagne and Leslie L. Briggs (1974) Principles of Instructional Design, New York: Holt, Rinehart and Winston Inc.
5. Walkin. L (1982), Instructional Techniques and Practice, (ELBS Edition). Avon, Great Britain: Stanley Thornes (Publishers) Ltd.
6. Learning outcomes resources from DePaul's Office for Teaching, Learning and Assessment.
7. Aggarwal, J.C. (2014). Essentials of Educational Psychology. New Delhi : Vikas Publishing House
8. "E Learning: The Key concepts" – Robin Mason and Frank Rennie; Routledge, 2007
9. Sharma, R.A. (2007). Psychology of Teaching-Learning Process. Meerut : Surya Publications
10. Mukhopadhyay, B. (1994). Motivation in Educational Management: Issues and Strategies. New Delhi: Sterling publishers
11. De Cecco(1973). Psychology of Learning and Instruction. Englewood Cliffs, NJ : Prentice-Hall
12. Railph W. Tyler (1949) Basic principles of Curriculum and Instruction, Chicago: University Press Chicago
13. Ben-Peretz, M. (1990). The Teacher-Curriculum Encounter. Buffalo: State University of New York Press.

ED24P13	STUDENT ASSESSMENT AND EVALUATION	3 CREDITS

Course Description:

This course provides a comprehensive understanding of educational assessment principles and practices. Students will learn to design and construct effective assessment tools, including various question types and formats. The course explores different cognitive levels of assessment and the importance of reliability and validity. By the end, students will be equipped with the skills to create assessments that accurately measure student learning and inform instructional decisions.

Course Outcomes:

On completion of the course, the student is expected to be able to

1. Understand the fundamental roles and purposes of educational assessments.
2. Construct effective questions, including closed-end and open-ended styles.
3. Classify knowledge dimensions and explore various cognitive processes.
4. Develop the ability to construct structured essay questions and design effective question papers.
5. Evaluate and analyze assessments, focusing on reliability and performance components.

Unit 1	**CONCEPTS OF EDUCATIONAL TESTING**	**09**
	Roles, Purposes of Assessment - The Languages of Assessment – Different Forms of Assessment - Questioning Skill - Different Questioning Types in the Classroom - Closed-end questions – Open-ended – Probing, Leading, Loaded - General Principles for Evaluation Process	
Unit 2	**CATEGORIES OF THE KNOWLEDGE DIMENSION**	**09**
	Knowledge of theories, models, and structures - Meta-Cognitive Knowledge – Self-knowledge - Categories of the Cognitive Process Dimension - Assessment Procedures - Standardized Examination - Quiz – Simulations – Demonstrations - Portfolios - Oral Exams	
Unit 3	**GUIDELINES FOR CONSTRUCTING STRUCTURED ESSAY QUESTIONS**	**09**
	Suggested terms and situations for essay tests - Numerical problems Solving - Pre-validation of Items - Design of Question Paper - Designing a Table of Specifications	
Unit 4	**PERFORMANCE ASSESSMENT**	**09**
	Parts of a rubric - Analytic Rubric - Characteristics of Assessment – Validity and Reliability – Characteristics of a good question paper - Analysis of a Question Paper – Criterion-referenced test versus Norm-referenced Test	
Unit 5	**ITEM ANALYSIS**	**09**
	Item Analysis for Constructed – Response Items - Item Difficulty Index - Reliability: Practical Strategies for Teachers - Scoring System – Absolute vs. Relative - Self-Assessment - Pre-validation of Items - Discrimination Index Selecting Appropriate Performance Tasks	

Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	3	2	2	1	2
CO2	3	2	1	2	2	3
CO3	3	3	3	2	2	3
CO4	1	3	2	3	3	3
CO5	2	2	3	2	1	3

References:

1. Popham, W. James. (2018). "Classroom Assessment: What Teachers Need to Know." Pearson.
2. Nitko, Anthony J., and Brookhart, Susan M. (2018). "Educational Assessment of Students." Pearson.
3. Gronlund, Norman E., and Waugh, Charles K. (2009). "Assessment of Student Achievement." Pearson.
4. Stiggins, Richard J. (2008). "An Introduction to Student-Involved Assessment FOR Learning." Pearson.
5. Cizek, Gregory J. (2016). "Handbook of Formative Assessment." Routledge.
6. Brookhart, Susan M. (2017). "How to Create and Use Rubrics for Formative Assessment and Grading." ASCD.
7. McMillan, James H. (2018). "Assessment Essentials for Standards-Based Education." Teachers College Press.
8. Pellegrino, James W., Chudowsky, Naomi, and Glaser, Robert. (2001). "Knowing What Students Know: The Science and Design of Educational Assessment." National Academies Press.

ED24P14	TECHNOLOGY-ENABLED LEARNING AND LIFELONG SELF-LEARNING	3 CREDITS

Course Description:

This course explores the integration of technology into education. It examines the role of teachers in creating effective technology-enhanced learning environments. Students will compare traditional and digital learning modalities, evaluate popular online platforms, and master digital tools for teaching and assessment. By understanding national technology policies and exploring practical applications, participants will develop the skills to leverage technology for improved student outcomes.

Course Outcomes:

On completion of the course, the student is expected to be able to

1. Describe and discuss some of the key skills that are needed in a technology-enabled teaching-learning
2. Identify the contributions of different factors to integrate technology into classroom instruction at all levels
3. Implement the appropriate technology tools for developing assessments
4. Differentiate traditional and digital learning environments
5. Master assessment fundamentals using ICT tools like Google Form and Socrative.

Unit 1	**INTRODUCTION TO TEACHING INTO TECHNOLOGY**	**09**
	Technology in Education: National Educational Policy (Draft) Overview - The Crucial Role of the Teacher in TEL - Learning Space: Teaching Environment - Teaching Learning Principles - ICT Perspective Learning Theories - The potential benefits of adopting TEL - Digital age and the necessary skills - National Education Policy - Digital Natives and Digital Immigrants	
Unit 2	**INTRODUCTION TO DIGITAL LEARNING ECOSYSTEM**	**09**
	Traditional vs Digital Learning Environment – SAMR Model – Online Lecture delivery platform – Zoom; Google Meet; Webex - ICT Tools for creating learning environment - Google Classroom; Flip Grid; Ed Puzzle; PADLET; Poll – Demonstration and Activities for effective implementation (Poll Everywhere, Mentimeter and Slido) – Overview of Learning Management System.	
Unit 3	**INTERACTIVE E-LEARNING MODULES**	**09**
	Design and development of engaging and interactive digital learning modules - Blended Learning Models - Understanding the integration of traditional and digital learning approaches for an effective blend - Mobile Learning (M-Learning) - The role of mobile devices in supporting lifelong learning - On-the-go access to educational resources.	
Unit 4	**FUNDAMENTALS OF ASSESSMENT**	**09**
	Preparation of digital assessment – ICT Tools for preparing assessments - Purpose of Assessment - Selection of right technological tools for assessment - types of question format - Google Form, Hot Potatoes, Answer Garden, Socrative, Class kick, Edpuzzle, Plickers, Rubistar, Poll Everywhere, Quizizz, Formative, TED-Ed, Audio Feedback, e-portfolio	
Unit 5	**ADAPTIVE LEARNING TECHNOLOGIES**	**09**
	Exploration of technologies that personalize learning experiences based on individual progress and needs - Microlearning Approaches - Implementing short, focused learning sessions to support continuous and easily digestible self-learning - Data Analytics for Personalized Learning	

Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	3	2	2	1	2
CO2	1	2	1	2	2	1
CO3	3	3	3	2	2	2
CO4	1	2	2	1	3	2
CO5	2	2	2	2	3	2

References:

1. Goodson, C. E., and Miertschin, S. L., and Stewart, B. L. (2018, June), Digital Learning Preferences: What Do Students Want? Paper presented at 2018 ASEE Annual Conference and Exposition, Salt Lake City, Utah. https://peer.asee.org/30335
2. Roger G. Hadgraft and Anette Kolmos (2020) Emerging learning environments in engineering education, Australasian Journal of Engineering Education
3. Smith, John. Technology in Education: A Comprehensive Guide. Publisher, Year.
4. Johnson, Mary A. Digital Learning Theories: Insights for Educators. Publisher, Year.
5. Brown, Karen R. Creating Effective Online Learning Environments. Publisher, Year.
6. Williams, David S. Assessment Strategies in the Digital Age. Publisher, Year.
7. Taylor, Laura M. Teaching with Technology: Tools and Strategies for the Classroom. Publisher, Year.
8. Davis, Robert P. ICT Tools for Educators: A Practical Guide. Publisher, Year.
9. Miller, Emma L. Innovative Approaches to Assessment in Online Education. Publisher, Year.

PROFESSIONAL CORE COURSES (Laboratory)

ED24P21	AI FOR PEDAGOGY LABORATORY	2 CREDITS

Course Description:

This course introduces the use of artificial intelligence in education, focusing on how AI tools can enhance teaching, learning, and assessment. Students will explore real-world AI applications, experiment with AI-based tutoring and evaluation systems, and learn to design personalized and accessible learning experiences. Ethical considerations and emerging trends in AI for education are also examined, enabling participants to apply AI responsibly and effectively in engineering classrooms.

Course Outcomes:

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

CO1: Understand and help become more efficient in using artificial intelligence

CO2: Identify the various applications of AI in pedagogy

CO3: Implement AI tools for effective engineering education practices

Experiments/Exercises:

Implement the following exercises and use cases

1. Identify examples of AI in everyday life (e.g., virtual assistants, recommendation systems) and discuss how they could be applied to education.
2. Experiment with pre-built AI tutoring platforms and identify their key features and benefits.
3. Use online tools with AI to create interactive quizzes or assessments.
4. Explore how AI can be used to create personalized learning paths based on student data (e.g., grades, interests).
5. Discuss the ethical implications of using AI in education, such as privacy concerns, bias, and accountability.
6. Explore how AI can be used to provide personalized feedback to students and automate grading.
7. Learn about how AI can be used to make education more accessible for students with disabilities.
8. Research emerging trends in AI for education and discuss their potential impact on teaching and learning.

Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	1	2	2	1	2
CO2	3	2	2	2	2	2
CO3	2	1	1	2	1	3

ED24P22	COMMUNICATION SKILLS LABORATORY	2 CREDITS

Course Description:

This course focuses on developing essential communication skills required in technical and teaching contexts. Students will practise effective oral and written communication, apply instructional strategies to improve classroom interactions, and engage in activities that strengthen questioning, feedback, presentations, and group facilitation. Through hands-on exercises, learners will also develop competencies in technical documentation and professional communication relevant to engineering education.

Course Outcomes:

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

CO1: Communicate effectively in technical contexts, both orally and in writing

CO2: Apply instructional strategies to enhance discussions, presentations, and classroom interactions

CO3: Develop the communication skills necessary for success in technical fields

Experiments/Exercises:

1. Maintain a positive and productive learning environment through positive communication
2. Practise Questioning strategies to promote critical thinking and engagement.
3. Provide constructive feedback and assessing student learning.
4. Facilitate productive group discussions and debates.
5. Interpret and use nonverbal cues in communication.
6. Deliver effective technical presentations, including using visuals and handling questions.
7. Create user manuals, troubleshooting guides, and other technical documentation.
8. Conduct technical interviews (e.g., job interviews, research interviews).

Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	1	2	2	1	2
CO2	3	2	2	2	2	2
CO3	2	1	1	2	1	3

ED24P23	PRINCIPLES OF PSYCHOLOGY LABORATORY	2 CREDITS

Course Description:

This course introduces key psychological principles through hands-on experiments that explore cognition, attention, memory, perception, and problem-solving. Students will apply psychological concepts to real-life contexts, develop skills in experimental design and analysis, and build a scientific understanding of human behaviour related to learning, habit formation, resilience, and well-being.

Course Outcomes:

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

CO1: Apply psychological concepts to real-world situations, such as habit formation, resilience, and well-being

CO2: Develop critical thinking and research skills by designing, conducting, and analysing psychological experiments

CO3: Foster a scientific approach to understanding human behaviour towards learning.

Experiments/Exercises:

1. Personality Analysis
2. Attention and Memory
3. Performance intelligence
4. Rate of learning and hand-eye coordination
5. Division of Attention
6. Cognitive functions
7. Habit formation
8. Resilience and Well-Being

Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	1	2	2	1	2
CO2	3	2	2	2	2	2
CO3	2	1	1	2	1	3

ED24P14	TECHNOLOGY ENABLED LEARNING LABORATORY	2 CREDITS

Course Description:

This course introduces learners to technology-enabled teaching practices through hands-on creation of digital learning materials. Students will design multimedia content, explore gamification strategies to enhance engagement, and work with adaptive tools to support personalised learning. By experimenting with various online platforms and assessment technologies, participants gain practical skills in developing interactive and learner-centered digital experiences.

Course Outcomes:

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

CO1: Demonstrate the usability and effectiveness of different online learning platforms

CO2: Identify the various gamification elements

CO3: Apply the technology for assessment

Experiments/Exercises:

1. Create a mini course on platform and assess user experience and features
2. Design a simple quiz using platforms and test it with peers
3. Create an AR experience using tools to explain the concept
4. Create a short podcast discussing a relevant educational topic
5. Create and publish an OER on a chosen topic with videos and images
6. Prepare a lecture video for a lesson and facilitate the discussion or activity
7. Use an adaptive learning tool to tailor a lesson for different learning style and analyse the outcomes.

Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	1	2	2	1	2
CO2	3	2	2	2	2	2
CO3	3	1	1	2	1	3

FOUNDATION COURSE

MA24M14	STATISTICS AND PROBABILITY FOR ENGINEERS	3 CREDITS

Course Description:

This course introduces essential concepts in linear algebra, probability, and statistics that form the foundation of engineering analysis. Students will learn vector spaces, transformations, and matrix methods alongside core ideas in probability, random variables, and common distributions. The course also covers two-dimensional random variables, sampling distributions, and hypothesis testing, with an introduction to multivariate techniques such as the multivariate normal distribution and principal component analysis. Through these topics, learners develop the analytical and critical thinking skills needed to model, interpret, and solve real-world engineering problems.

Course Outcomes:

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

CO1: Apply the concepts of Linear Algebra to solve practical problems**.**

CO2: Use the ideas of probability and random variables in solving engineering problems.

CO3: Explain the commonly encountered two dimensional random variables and be equipped for a possible extension to multivariate analysis.

CO4: Use statistical tests in testing hypotheses on data.

CO5: Develop critical thinking based on empirical evidence and the scientific approach to knowledge development.

Unit 1	**LINEAR ALGEBRA:**	**09**
	Vector spaces – norms – Inner Products – Eigenvalues using QR transformations – QR factorization – generalized eigenvectors – Canonical forms – singular value decomposition and applications – pseudo inverse – least square approximations.	
Unit 2	**PROBABILITY AND RANDOM VARIABLES:**	**09**
	Probability – Axioms of probability – Conditional probability – Baye's theorem – Random variables – Probability function – Moments – Moment generating functions and their properties – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions – Function of a random variable.	
Unit 3	**TWO DIMENSIONAL RANDOM VARIABLES:**	**09**
	Joint distributions – Marginal and conditional distributions – Functions of two-dimensional random variables – Regression curve – Correlation.	
Unit 4	**SAMPLING DISTRIBUTIONS:**	**09**
	Type I and Type II errors – Small and Large samples – **TESTING OF HYPOTHESIS:** Tests based on Normal, t, Chi square and F distributions for testing of mean, variance and proportions – Tests for independence of attributes and goodness of fit.	
Unit 5	**MULTIVARIATE ANALYSIS:**	**09**
	Random vectors and matrices – Mean vectors and covariance matrices – Multivariate normal density and its properties – Principal components – Population principal components – Principal components from standardized variables.	

Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	3	2	3	3
CO2	3	2	2	2	3	2
CO3	3	2	3	3	3	2
CO4	3	2	3	3	2	3
CO5	2	3	3	2	3	2

References:

1. Jin Ho Kwak and Snngpyo Hong, Linear Algebra, Second Edition, Springer (2004).
2. Gilbert Strang, Introduction to linear algebra, 4th Edition, Academic Press.
3. Introduction of Probability Models, S. M. Ross, Academic Press, N.Y.
4. Fundamentals of Statistics, vol. I & II, A. Goon, M. Gupta and B. Dasgupta, World Press.
5. Higher Engineering Mathematics, B. S. Grewal, Khanna Publication, Delhi.
6. Probability and Statistics for Engineers, (Fourth Edition), I. R. Miller, J.E. Freund and R. Johnson, PHI.

MANDATORY COURSE

RM24K11 - Research Methodology and IPR – 3 Credits

Refer to the syllabus of the MOOC course

PRACTICUM

ED24G11	ENGINEERING PROJECT MANAGEMENT	4 CREDITS

Course Description:

"Engineering Project Management Practicum" is designed to equip students with practical skills essential for managing engineering projects from inception to completion. This course emphasizes project planning, execution, and evaluation through hands-on, project-based learning, enabling students to apply theoretical concepts in real-world scenarios.

Course Outcomes:

Upon completion of the course, students are expected to be able to:

1. Develop a comprehensive project charter that outlines goals, deliverables, timelines, and resources.
2. Conduct thorough risk assessments to identify potential issues and formulate effective mitigation strategies.
3. Collaborate effectively in team settings, enhancing teamwork, communication, and problem-solving skills.
4. Implement project plans, monitor progress, and adapt strategies as necessary using project management tools.
5. Evaluate project outcomes and prepare comprehensive reports based on post-project evaluations.

Course Overview:

Duration: One semester.

Structure:

Project-based learning with individual or team projects, focusing on real-world engineering scenarios.

Key Components:

1. **Project Planning:** Covers the development of project charters, including goals, deliverables, timelines, and resource allocation.
2. **Risk Management:** Focuses on conducting risk assessments and creating strategies to mitigate identified risks.
3. **Team Collaboration:** Engages students in group activities that enhance teamwork and communication.
4. **Project Execution and Monitoring:** Teaches students how to implement project plans, monitor progress, and adjust as needed using project management tools.
5. **Project Evaluation and Reporting:** Involves assessing project outcomes and preparing detailed reports based on evaluations.

Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	1	1	1	1
CO2	2	3	1	1	2	1
CO3	1	1	3	2	1	1
CO4	1	1	2	3	1	1
CO5	1	1	1	2	3	1

References:

1. Turner, J. R., & Cochrane, R. (1993). Goals and Methodologies in Project Management. *International Journal of Project Management*, 11(2), 92-101.
2. Kerzner, H. (2017). Project Management: A Systems Approach to Planning, Scheduling, and Controlling (12th ed.). Hoboken, NJ: John Wiley & Sons.
3. PMI. (2017). *A Guide to the Project Management Body of Knowledge (PMBOK® Guide)* (6th ed.). Newtown Square, PA: Project Management Institute.
4. Meredith, J. R., & Mantel, S. J. (2017). Project Management: A Managerial Approach (9th ed.). Hoboken, NJ: John Wiley & Sons.
5. Schwalbe, K. (2018). Information Technology Project Management (8th ed.). Boston, MA: Cengage Learning.
6. Rao, P. S., & Bansal, S. (2015). *Project Management: A Systems Approach*. New Delhi: New Age International Publishers.
7. Gopalakrishnan, P., & Sundararajan, V. (2013). *Project Management: A Managerial Approach*. New Delhi: McGraw-Hill Education.

ED24G12	TEACHING ENGINEERING CONCEPTS	4 CREDITS

Course Description:

"Teaching Engineering Concepts Practicum" is designed to equip future educators with the skills needed to effectively teach engineering concepts and methodologies. This course blends theoretical knowledge with hands-on teaching practice, allowing students to apply learning theories, instructional design, and curriculum development techniques specifically tailored to engineering education. Through microteaching, field experience, and reflective practice, students will hone their ability to engage diverse learners, manage classrooms, and assess student progress.

Course Outcomes:

On completion of the course, the student is expected to be able to

1. Apply learning theories to create effective lesson plans and teaching strategies in engineering education.
2. Design and implement instructional materials for engineering concepts that align with curriculum goals and cater to diverse learning styles.
3. Demonstrate effective teaching techniques through microteaching sessions, incorporating clear communication and classroom management strategies.
4. Evaluate student learning using a variety of assessment methods and feedback mechanisms tailored to technical education.
5. Reflect on teaching practices through continuous self-assessment and refinement, enhancing teaching effectiveness in both classroom and field settings.

Course Overview

Duration: One semester

Structure:

A blend of classroom instruction, microteaching sessions, and field experience, providing both theoretical and practical skills in teaching engineering.

Key Components:

1. **Educational Theory:** Introduces educational psychology, learning theories, and instructional design, focusing on how these principles apply to engineering education.
2. **Curriculum Development:** Teaches students to design lesson plans and activities for engineering topics, aligning content with learning objectives and catering to diverse learning styles.
3. **Microteaching:** Students conduct short teaching demonstrations in peer groups, refining their methods through practice and peer feedback.
4. **Field Experience:** Offers opportunities to observe and assist in real classrooms at technical institutes, applying course knowledge in a practical setting.
5. **Reflective Practice:** Students maintain a reflective journal, assessing their teaching experiences, identifying areas for improvement, and fostering ongoing professional growth.

Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	1	3	2	1	1
CO2	1	2	3	2	1	1
CO3	1	1	3	3	1	1
CO4	1	1	2	3	1	1
CO5	1	1	1	2	3	1

References:

1. Biggs, J., & Tang, C. (2011). *Teaching for Quality Learning at University* (4th ed.). New York: Open University Press.
2. Aggarwal, J. C. (2010). *Essentials of Educational Technology: Innovations in Teaching-Learning*. New Delhi: Vikas Publishing House.
3. Merrill, M. D. (2002). *First Principles of Instruction*. Educational Technology Research and Development, 50(3), 43-59.
4. Sharma, R. A. (2007). *Fundamentals of Educational Technology*. Meerut: R. Lall Book Depot.
5. Kolb, D. A. (1984). *Experiential Learning: Experience as the Source of Learning and Development*. Englewood Cliffs, NJ: Prentice-Hall.

Cluster – A. COMMUNICATION SKILLS, MODES AND KNOWLEDGE DISSEMINATION

ED24A11	COMMUNICATION SKILLS FOR CLASSROOM TRANSACTIONS	3 CREDITS

Course Description:

This course is designed to equip learners with the essential communication skills necessary for effective classroom transactions. Through a combination of theoretical knowledge and practical exercises, students will develop their ability to communicate effectively with students, colleagues, and administrators. The course will cover topics such as active listening, questioning techniques, feedback strategies, cultural sensitivity, and the use of technology in education. By the end of the course, students will be able to communicate clearly, concisely, and persuasively in a variety of educational settings.

Course Outcomes:

Upon completion of the course, students are expected to:

1. Demonstrate effective active listening skills and provide appropriate feedback.
2. Utilize effective questioning techniques to stimulate critical thinking and engage students.
3. Communicate effectively in diverse classroom settings accommodate the needs of students with special needs.
4. Integrate technology into classroom communication to engage students, and create inclusive learning environments.
5. Develop strong professional writing (e.g., syllabi, assignments) and presentation skills.

Unit 1	**COMMUNICATION IN EDUCATION**	**09**
	The role of communication in teaching and learning - Importance of effective communication in the classroom - Communication as a two-way process - Barriers to effective communication - Verbal communication - Non-verbal cues	
Unit 2	**EFFECTIVE CLASSROOM COMMUNICATION STRATEGIES**	**09**
	Active listening in the classroom - Techniques for active listening - Providing feedback and clarification - Questioning Techniques - Types (e.g., open-ended, closed-ended, probing) - Using questions to stimulate critical thinking - Giving Feedback	
Unit 3	**COMMUNICATION IN DIVERSE CLASSROOMS**	**09**
	Cultural Sensitivity in Communication - communication strategies to different cultures - Avoiding cultural misunderstandings - Assistive technologies to enhance communication - Creating inclusive learning environments.	
Unit 4	**COMMUNICATION TECHNOLOGIES IN EDUCATION**	**09**
	Technology into classroom communication (e.g., online forums, video conferencing) - Enhancing student engagement - Technical challenges in online communication - Online Teaching and Communication	
Unit 5	**COMMUNICATION FOR PROFESSIONAL DEVELOPMENT**	**09**
	Effective Presentations - Visual aids to enhance presentations - Handling questions and feedback - Professional Writing - Writing effective course materials - Communicating with colleagues and administrators - Professional writing style and conventions	

Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	1	2	1	1	1
CO2	1	2	3	1	1	1
CO3	1	2	3	2	1	1
CO4	1	2	3	3	2	1
CO5	2	1	2	2	3	3

References:

1. Wong, Harry K., and Rosemary T. Wong. *Classroom Management: A Guide for Teachers*. HarperCollins, 1991.
2. Fay, Jim, and Foster W. Cline. *Teaching with Love and Logic*. HarperCollins, 1990.
3. Spearman, Charles E. *The Teacher's Handbook: A Comprehensive Guide to Effective Teaching*. Pearson, 2017.
4. Lang, James M. *Teaching Online: A Practical Guide*. Routledge, 2018.
5. Gee, James P., and James R. Paul (eds.).*The Handbook of Research on Educational Communications and Technology*. Routledge, 2018.
6. Strunk Jr., William, and E.B. White. *The Elements of Style*. Fourth edition. Allyn and Bacon, 1999.
7. King, Stephen. *On Writing: A Memoir of the Craft*. Scribner, 2000.

ED24A12	DIGITAL COMMUNICATION AT THE WORKPLACE	3 CREDITS

Course Description:

This course is designed to equip M.Tech students in engineering education with the essential digital communication skills necessary for effective workplace interactions. Learners will develop their ability to communicate effectively using digital tools and platforms. The course will cover topics such as email etiquette, instant messaging, social media, collaboration tools, and cross-cultural communication.

Course Outcomes:

Upon completion of the course, students are expected to:

1. Demonstrate effective digital communication skills through digital tools and platforms.
2. Understand the ethical implications of digital communication including privacy, confidentiality, and online professionalism.
3. Communicate effectively in a global context and work effectively in virtual teams.
4. Utilize digital tools for collaboration and teamwork, share information, and manage tasks.
5. Stay updated on emerging trends in digital communication and their impact on the workplace.

Unit 1	**EVOLUTION OF DIGITAL COMMUNICATION**	**09**
	Technology and workplace communication - Key Concepts - Synchronous vs. asynchronous communication - Digital literacy and its importance - Ethical considerations in digital communication	
Unit 2	**EFFECTIVE DIGITAL COMMUNICATION STRATEGIES**	**09**
	Email Etiquette - Formatting and structure - Responding to emails promptly and professionally - Instant Messaging and Chat Tools - Nuances of online communication - Social Media in the Workplace - Professional use of social media platforms	
Unit 3	**DIGITAL TOOLS AND PLATFORMS**	**09**
	Collaboration Tools - (e.g., Google Workspace, Microsoft 365) - Effective teamwork and collaboration online - Communication Apps - Using communication apps (e.g., Zoom, Teams) for meetings and presentations - Best practices	
Unit 4	**DIGITAL COMMUNICATION IN A GLOBAL CONTEXT**	**09**
	Cross-Cultural Communication - Cultural differences in digital communication - Remote Work and Virtual Teams - Effective communication in remote work environments - Building and maintaining relationships in virtual teams	
Unit 5	**FUTURE TRENDS IN DIGITAL COMMUNICATION**	**09**
	Understanding emerging technologies (e.g., AI, AR, VR) - Impact of these technologies on workplace communication - Future Trends in Digital Communication - Predicting future trends in digital communication	

Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	1	2	1	1	3
CO2	1	2	3	1	1	1
CO3	1	2	3	2	1	1
CO4	1	2	3	3	1	1
CO5	3	1	2	2	3	2

References:

1. *Newman, David. (2013)*. Digital Etiquette: A Guide to Good Manners in the Digital Age. *HarperCollins*.
2. *Wachter, Ben. (2018)*. The Digital Workplace: How Technology is Reshaping the Way We Work. *Harvard Business Review Press*.
3. *Gallagher, Michael. (2018)*. The Future of Work: How Technology Is Transforming Our Jobs and Lives. *HarperCollins*.
4. *Sharma, R. (2019)*. Digital Transformation in India: Strategies and Innovations. *New Delhi: Sage Publications*.
5. *Kumar, S., & Singh, A. (2020)*. Workplace Culture and Digital Transformation in India. *New Delhi: Atlantic Publishers & Distributors*.

ED24A13	MODES OF KNOWLEDGE DISSEMINATION	3 CREDITS

Course Description:

This course explores the various modes of knowledge dissemination in engineering education. Students will gain a comprehensive understanding of traditional and modern methods, including lectures, textbooks, online learning, social media, and emerging technologies like AI and VR. The course will delve into theoretical foundations, practical applications, and evaluation strategies. By the end, students will be equipped to effectively select and implement appropriate knowledge dissemination methods to enhance their teaching and learning experiences.

Course Outcomes:

Upon completion of the course, students are expected to:

1. Understand the theoretical foundations of knowledge dissemination.
2. Evaluate the effectiveness of various modes of knowledge dissemination.
3. Design and implement effective knowledge dissemination strategies.
4. Utilize emerging technologies for knowledge dissemination.
5. Evaluate the impact of knowledge dissemination on student learning.

Unit 1	**THEORETICAL FOUNDATIONS OF KNOWLEDGE DISSEMINATION**	**09**
	Constructivism, behaviourism, and cognitive theories - Implications for knowledge dissemination strategies - Communication Theories - Shannon-Weaver model, transactional model, and interpersonal communication theory	
Unit 2	**TRADITIONAL MODES OF KNOWLEDGE DISSEMINATION**	**09**
	Lectures and Presentations - Effective lecture techniques - Using visual aids and multimedia - Engaging students in presentations - Designing effective textbooks and course materials - Evaluating the quality of educational resources - Copyright and intellectual property issues - Workshops and Seminars	
Unit 3	**MODERN MODES OF KNOWLEDGE DISSEMINATION**	**09**
	Online Learning and E-Learning - Types of online learning (e.g., MOOCs, blended learning) - Designing effective online courses - Challenges and opportunities in online learning - Social Media and Online Communities - OER	
Unit 4	**EVALUATING AND ASSESSING KNOWLEDGE DISSEMINATION**	**09**
	Traditional and alternative assessment methods - Evaluating the Effectiveness of Knowledge Dissemination - Measuring student learning outcomes - Gathering feedback from students and stakeholders - Improving knowledge dissemination strategies	
Unit 5	**EMERGING TRENDS IN KNOWLEDGE DISSEMINATION**	**09**
	Artificial Intelligence and Education - AI-powered personalized learning - AI-assisted assessment - Ethical implications of AI in education - Virtual and Augmented Reality in Education	

Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	1	2	1	1	2
CO2	1	2	2	1	1	1
CO3	1	2	3	2	1	2
CO4	1	2	2	3	1	3
CO5	3	1	2	2	3	1

References:

1. *McKeachie, Wilbert J. (2014)*. Teaching and Learning: A Psychological Perspective. *Cengage Learning*.
2. *Schroeder, Richard G. (2018)*. The Effective Teacher: A Guide to Teaching and Learning. *Cengage Learning*.
3. *Siemens, George. (2012)*. Learning Technologies: A Handbook. *Routledge*.
4. *Dhanapal, R., & Iyer, A. (2016)*. Educational Technology: A Practical Guide for Teachers. *New Delhi: Sage Publications*.
5. *Singh, L., & Gupta, R. (2017)*. Innovative Teaching Strategies in Higher Education. *New Delhi: Atlantic Publishers & Distributors*.

Cluster – B. EDUCATINAL ADMINISTRATION

ED24B11	INSTITUTIONAL MANAGEMENT PROCESS	3 CREDITS

Course Description:

This course focuses on the key processes that drive effective institutional management, such as planning, organizing, leading, and controlling. Students will learn about decision-making, resource management, performance evaluation, leadership, and change management, with an emphasis on creating sustainable and high-performing institutions.

Course Outcomes:

On completion of the course, the student is expected to be able to

1. Design and implement effective management processes in institutions.
2. Develop and execute strategic plans to achieve institutional goals.
3. Lead teams with a focus on performance, innovation, and ethical practices.
4. Manage institutional resources efficiently and ensure sustainability.
5. Adapt to changes and drive positive organizational transformation
6. Understand the core professional values

Unit 1	**INSTITUTIONAL MANAGEMENT**	**09**
	Concept of an institution – Institution Vs Organisation – Types of Institutions – Characteristics of an Institution – Components of Institutional management – objectives of Institutional management – Aspects of Institutional management – Concept of Administration	
Unit 2	**INSTITUTIONAL PLANNING**	**09**
	Introduction to Institutional planning – The Institutional Planning process – Types of Institutional Plans – Leadership and Stakeholder Involvement in Institutional Planning - Developing an Institutional Plan – Essentials of Planning – Strategic and operational planning	
Unit 3	**ORGANIZING FOR OPTIMIZATION**	**09**
	IMAP Organizing Concept and Importance - IMAP Principles of Organizing - Organisation Design & Structure - Authority, Responsibility and Delegation - Components of Organizational Structure - Workflow and Process Optimization	
Unit 4	**DIRECTING THROUGH THE ACADEMIC LEADERSHIP**	**09**
	Concepts and importance of Academic Leadership – Qualities of a good academic leader – Importance and challenges – Theories of Leadership – Styles of Leadership – Qualities of Effective Leaders – Strategies for Academic Leadership	
Unit 5	**MONITORING AND CONTROLLING FOR HIGHER PERFORMANCE**	**09**
	Concepts and process – Design effective institutional control system – Tools for Monitoring performance – The controlling process and corrective actions – KPIs and their role in Higher performance – The role of feedback in continuous improvement	

Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	2	2	1	2	2
CO2	1	2	1	2	3	1
CO3	3	2	3	2	1	1
CO4	1	1	2	1	2	1
CO5	2	2	2	1	1	1

References:

1. Anyamele, S.C., 2004. Institutional management in higher education: A study of leadership approaches to quality improvement in university management-Nigerian and Finnish Cases.
2. Kumar, S. and Dash, M.K., 2011. Management education in India: trends, issues and implications. Research Journal of International Studies, 18(1), pp.16-26.
3. Dey, N., 2011. Higher Education Institutions in India and Its Management. International Journal of Academic Research in Business and Social Sciences, 1(1), pp.20-28.
4. Pareek, Udai & T. V. Rao (1981). Designing and Managing Human Resources System. New Delhi: Oxford & IDH.

ED24B12	PROFESSIONAL VALUES AND HUMAN REALITIES	3 CREDITS

Course Description:

This course aims to bridge the gap between technical knowledge and the ethical, emotional, and social dimensions of professional life. The course outcomes are often designed to help students develop both the intellectual and emotional intelligence necessary to thrive in the workplace while maintaining a sense of ethical responsibility. Since the professionals are at the top of their professions, they are expected to self-regulate themselves, for which the role of professional societies is also highlighted in this module.

Course Outcomes:

On completion of the course, the student is expected to be able to

1. Understand the core professional values
2. Analyze the situation and will develop the ability to make ethical decisions
3. Demonstrate a strong commitment to maintain professionalism in their work
4. Understand the importance of trust and credibility in professional relationships
5. Suggest with justification, ways and means for ensuring ethical behaviour by teachers

Unit 1	**UNDERSTANDING OF VALUES, ATTITUDES AND ETHICS**	**09**
	Definition and types of values – The role of values in Decision-making – Formation of values – Aligning values with actions – Impact of attitude on behaviour – Developing Positive attitude – Ethical Decision – making process – Workplace ethics – Building ethical culture	
Unit 2	**ROLE OF PROFESSIONAL SOCIETIES**	**09**
	Introduction to Professional societies – Types of Professional societies – Development of code of ethics – Continuing Education and certifications – Access to Research and knowledge resources – Fostering professional integrity and accountability	
Unit 3	**SOCIAL RESPONSIBILITY**	**09**
	Introduction to Social Responsibility - Benefits to Society and the Environment - Ethical Considerations - CSR Strategies and Initiatives - Corporate Environmental Responsibility - Diversity, Equity, and Inclusion (DEI)	
Unit 4	**ORGANISATION CULTURE FOR SUSTAINABLE DEVELOPMENT**	**09**
	Introduction to Organizational Culture - Understanding Sustainable Development - Relevance to Organizations - Organizational Culture's Impact on Sustainability - Strategies for Building a Culture of Sustainability - Setting Measurable Goals and Accountability	
Unit 5	**ETHICAL CONFLICT**	**09**
	Definition of Ethical Conflict - Common Causes of Ethical Conflict - Frameworks for Ethical Decision-Making - Strategies to Prevent Ethical Conflicts - Resolving Ethical Conflicts – Code of conduct and Ethical conflict	

Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	3	2	2	1	2
CO2	1	2	1	2	2	1
CO3	3	3	3	2	2	1
CO4	1	2	2	1	1	1
CO5	2	2	2	2	1	1

References:

1. Gaur R. R., Sangal R. and Bagaria G.P., A Foundation Course in Human Values and Professional Ethics: presenting universal approach to value education - through self exploration. Bangalore: Excel Books,2016.
2. Govindarajan M., Natarajan S. and Senthilkumar V. S., Engineering Ethics includes Human Values. Delhi: PHI Learning Private Limited, 2016
3. Martin M. W. and Schinzinger R., Ethics in Engineering, Chennai: McGraw Hill Education (India) Pvt. Ltd., 2017
4. Heasly B. T., Towards an Architecture for the teaching of virtues, values and ethics, Peter Lang AG, 2015

ED24B13	STRATEGIC PLANNING FOR GROWTH & DEVELOPMENT	3 CREDITS

Course Description:

This course provides a comprehensive guide to the principles and practices of strategic planning with a focus on long-term growth and development. It equips participants with the knowledge and tools to set organizational goals, anticipate future challenges, and create actionable plans that promote sustainable growth. The course emphasizes critical thinking, adaptability, and the alignment of organizational vision with emerging trends and opportunities.

Course Outcomes:

On completion of the course, the student is expected to be able to

1. Understand the strategic planning process and its importance for future growth.
2. Identify and analyze internal and external factors that influence organizational development.
3. Develop long-term goals and objectives aligned with future opportunities and challenges.
4. Formulate and implement strategies that ensure sustainable growth.
5. Monitor progress and adjust strategic plans to respond to changing circumstances.

Unit 1	**STRATEGIC PLANNING PROCESS**	**09**
	Introduction to Strategic Planning - Stages of the Strategic Planning Process - Tools and Techniques in Strategic Planning - Strategy Formulation and Goal Setting - Implementation and Monitoring	
Unit 2	**ESSENTIALS OF PLANNING**	**09**
	Planning and its importance – Key components of the planning process – Types of plans – Barriers to Effective plans - Planning Tools and Techniques - Application of Planning – Objective and its characteristics	
Unit 3	**STRATEGIC AND OPERATIONAL PLANNING**	**09**
	Introduction to Strategic and Operational Planning - Strategic Planning Process - Strategy Formulation - Operational Planning - Implementation of Strategic and Operational Plans - Monitoring and Control - Strategic Planning for Development	
Unit 4	**STRATEGY FORMULATION**	**09**
	Understanding Strategy - Overview of the Strategy Formulation Process – External and Internal Environment Analysis - Setting Strategic Objectives - Strategic Analysis Tools - Identifying and Evaluating Strategic Alternatives - Functional Strategies	
Unit 5	**IMPLEMENTATION OF STRTEGIC PLANS**	**09**
	Introduction to Strategic Implementation - The Role of Leadership in Implementation - Translating Strategy into Actionable Plans - Resource Allocation - Building an Implementation Roadmap- Organizational Structure and Strategy Alignment - Change Management in Strategic Implementation	

Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	2	2	3	1	2
CO2	1	2	1	2	2	1
CO3	3	2	3	3	2	1

CO4	1	2	2	2	1	1
CO5	2	1	2	2	1	1

References:

1. Pearce, J.A., Robinson, R.B. and Subramanian, R., 2000. Strategic management: Formulation, implementation, and control. Columbus, OH: Irwin/McGraw-Hill.
2. Gupta, A.K. and Singhal, A., 1993. Managing human resources for innovation and creativity. Research-Technology Management, 36(3), pp.41-48.
3. Dawson, P. and Andriopoulos, C., 2014. Managing change, creativity and innovation. Sage.

Cluster-C. CREATIVE PROBLEM SOLVING AND RESEARCH

EE24C11	PROBLEM SOLVING USING COMPUTATIONAL THINKING	3 CREDITS

Course Description:

This course introduces students to the principles of computational thinking and its application in problem-solving across various domains. Students will learn to decompose complex problems, identify patterns, design algorithms, and develop solutions using computational tools and techniques. The course aims to foster critical thinking and analytical skills through hands-on projects and real-world applications.

Course Outcomes:

Upon completion of the course, students are expected to:

1. Define computational thinking and explain its significance in problem-solving.
2. Decompose complex problems into manageable components.
3. Develop algorithms and pseudo-code to solve specific problems.
4. Utilize computational tools and programming languages to implement solutions.
5. Evaluate and optimize solutions and effectively communicate results.

Unit 1	INTRODUCTION TO COMPUTATIONAL THINKING	09
	Definition and Importance - Overview of computational thinking (CT) and its relevance in various fields - Differences between traditional problem-solving and computational thinking - Core Concepts of CT - Decomposition: Breaking down problems into smaller parts - Pattern recognition: Identifying trends and similarities - Abstraction: Focusing on relevant details while ignoring irrelevant information - Algorithms: Creating step-by-step instructions for solving problems - Applications of Computational Thinking - Use of CT in everyday life, science, engineering, and business - Case studies highlighting successful applications of computational thinking.	
Unit 2	**PROBLEM DECOMPOSITION AND ALGORITHM DESIGN**	**09**
	Problem Decomposition Techniques - Strategies for effectively breaking down complex problems - Practice exercises in decomposing real-world problems - Algorithm Design - Introduction to algorithms: Definitions and characteristics. - Creating algorithms using flowcharts and pseudo-code - Examples of algorithms in various contexts - Hands-on Activities - Group exercises to design algorithms for specific problems - Peer reviews of algorithm designs.	
Unit 3	**PROGRAMMING FUNDAMENTALS**	**09**
	Introduction to Programming Languages - Overview of popular programming languages (Python, Java, Scratch) - Importance of selecting the right language for problem-solving - Basic Programming Concepts - Variables, data types, and control structures (if statements, loops) - Functions and modular programming. -Practical Coding Sessions - Writing and debugging simple programs to implement algorithms - Interactive coding exercises using an integrated development environment (IDE).	
Unit 4	**ADVANCED PROBLEM-SOLVING TECHNIQUES**	**09**
	Data Structures and Their Applications - Overview of data structures (arrays, lists, dictionaries) - Choosing appropriate data structures for specific problems - Searching and Sorting Algorithms - Introduction to common algorithms (binary	

	search, quicksort) - Analyzing the efficiency of algorithms using Big O notation - Real-World Problem-Solving Projects - Group projects that require advanced problem-solving techniques - Presentations on project findings and solutions.	
Unit 5	**EVALUATION AND OPTIMIZATION**	**09**
	Testing and Debugging Techniques - Strategies for testing algorithms and programs. - Common debugging practices and tools - Evaluating Solutions - Criteria for evaluating the effectiveness of solutions - Peer evaluation of group projects and solutions - Communicating Solutions - Best practices for presenting technical solutions to non-technical audiences - Preparing documentation and reports for problem-solving projects.	

Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	1	1	1	1	1
CO2	2	1	2	1	1	1
CO3	1	2	3	2	1	1
CO4	1	2	3	3	1	1
CO5	1	1	2	2	3	1

References:

1. Wing, J. M. (2011). *Computational Thinking.* ACM Queue. ACM Queue Article
2. Grover, S., & Pea, R. (2013). *Computational Thinking in K–12: A Review of the State of the Field.* Educational Researcher. Educational Researcher
3. Kumar, A., & Saini, R. (2018). *Introduction to Computational Thinking and Programming Using Python.* New Delhi: Wiley India.
4. Singh, A. K., & Shukla, R. (2020). *Programming in Python: A Comprehensive Guide.* New Delhi: Cengage Learning India.
5. Sedgewick, R., & Wayne, K. (2011). *Algorithms (4th Edition).* Boston: Addison-Wesley.

EE24C12	RESEARCH IN TECHNICAL EDUCATION	3 CREDITS

Course Description:

This course provides an in-depth understanding of research methodologies and practices in the field of technical education. It covers various research designs, data collection techniques, statistical analysis, and the ethical considerations in conducting research. Students will engage in critical evaluation of existing research, develop their research proposals, and conduct small-scale research projects relevant to technical education.

Course Outcomes:

Upon completion of the course, students are expected to:

1. Understand and articulate the significance of research in technical education.
2. Identify and apply appropriate research methodologies for various educational inquiries.
3. Design and develop a research proposal addressing a relevant issue in technical education.
4. Analyze quantitative and qualitative data using appropriate statistical tools.
5. Evaluate existing research literature and contribute to the field of technical education

Unit 1	INTRODUCTION TO RESEARCH IN TECHNICAL EDUCATION	09
	Definition and Importance of Research - Understanding research and its relevance in technical education - Types of research: Basic vs. Applied, Qualitative vs. Quantitative - Research Process - Steps in the research process: Identifying a problem, literature review, research design, data collection, and analysis - Formulating research questions and hypotheses - Critical Evaluation of Research - Evaluating the quality of research studies in technical education - Understanding peer review and publication processes.	
Unit 2	**RESEARCH METHODOLOGIES**	**09**
	Quantitative Research Methods - Experimental, quasi-experimental, and descriptive research designs - Sampling techniques and selection of participants - Qualitative Research Methods - Ethnography, case studies, grounded theory, and phenomenology - Data collection methods: Interviews, focus groups, and observations - Mixed Methods Research - Combining quantitative and qualitative approaches - Advantages and challenges of mixed methods.	
Unit 3	**DATA COLLECTION AND ANALYSIS**	**09**
	Data Collection Techniques - Surveys, questionnaires, and structured interviews - Observational methods and field notes - Statistical Analysis - Descriptive statistics: Measures of central tendency and variability - Inferential statistics: T-tests, ANOVA, regression analysis - Qualitative Data Analysis - Coding and thematic analysis - Using software tools for qualitative analysis (e.g., NVivo, Atlas.ti)	
Unit 4	**RESEARCH PROPOSAL DEVELOPMENT**	**09**
	Components of a Research Proposal - Title, introduction, literature review, methodology, and expected outcomes - Importance of a well-defined research question. Writing the Proposal - Formatting and structuring the proposal according to academic standards - Tips for effective writing and presentation - Presentation and Defense of Proposals - Strategies for presenting research proposals to peers and faculty - Constructive feedback and revisions.	
Unit 5	**ETHICAL CONSIDERATIONS AND TRENDS IN EDUCATIONAL RESEARCH**	**09**
	Ethics in Research - Understanding informed consent, confidentiality, and ethical treatment of participants - Institutional Review Boards (IRB) and ethical approval processes - Current Trends in Technical Education Research - Emerging topics and	

	technologies in technical education - The role of policy, globalization, and societal changes on technical education - Future Directions in Research - Identifying gaps in existing research and potential areas for further inquiry - The impact of research on policy and practice in technical education.

Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	1	1	1	1	1
CO2	2	2	2	1	1	1
CO3	1	2	3	1	1	1
CO4	1	1	2	3	2	1
CO5	1	1	2	2	3	1

References:

1. Research Design: Qualitative, Quantitative, and Mixed Methods Approaches – 2018 (5th Edition) - Creswell, J. W - Sage Publications
2. Introduction to Research in Education – 2019 (9th Edition) - Ary, D., Jacobs, L. C., & Sorensen, C - Cengage Learning
3. The Challenge of Problem-Based Learning – 2019 (3rd Edition) - Boud, D., & Feletti, G.- Routledge
4. Qualitative Research: A Guide to Design and Implementation – 2015 (4th Edition) - Merriam, S. B., & Tisdell, E. J. - Jossey-Bass.

EE24C13	DESIGNING AND CONDUCTING RESEARCH	3 CREDITS

Course Description:

This course offers a comprehensive exploration of the principles and practices of research design and execution. Students will learn to formulate research questions, select appropriate methodologies, collect and analyze data, and present their findings effectively. The course emphasizes both qualitative and quantitative research methods, preparing students for rigorous academic research.

Course Outcomes:

Upon completion of the course, students are expected to:

1. Develop clear and focused research questions relevant to their field of study.
2. Differentiate between qualitative and quantitative research methodologies.
3. Design a comprehensive research proposal that includes a literature review, methodology, and data analysis plan.
4. Execute a research project, demonstrating proficiency in data collection and analysis.
5. Critically evaluate research studies and articulate findings in a professional format.

Unit 1	INTRODUCTION TO RESEARCH DESIGN	09
	Understanding Research - Definition and importance of research in academia and industry - Types of research: Basic vs. Applied, Qualitative vs. Quantitative. - Research Process - Steps in the research process: Identifying a problem, conducting a literature review, formulating research questions and hypotheses - Ethical considerations in research: Informed consent, confidentiality, and institutional review boards (IRBs) - Formulating Research Questions - Characteristics of good research questions - Techniques for generating and refining research questions.	
Unit 2	**QUALITATIVE RESEARCH METHODOLOGIES**	**09**
	Qualitative Research Design - Overview of qualitative research: Characteristics and applications - Common qualitative methods: Interviews, focus groups, observations, and ethnography - Data Collection Techniques - Designing interview questions and conducting effective interviews - Recording and transcribing qualitative data - Data Analysis in Qualitative Research - Coding and thematic analysis - Using qualitative data analysis software (e.g., NVivo, Atlas.ti).	
Unit 3	**QUANTITATIVE RESEARCH METHODOLOGIES**	**09**
	Quantitative Research Design - Overview of quantitative research: Characteristics and applications - Experimental, quasi-experimental, and correlational research designs - Sampling Techniques - Probability and non-probability sampling methods - Determining sample size and selection criteria - Data Collection in Quantitative Research - Designing surveys and questionnaires - Validity and reliability of measurement instruments.	
Unit 4	**DATA ANALYSIS AND INTERPRETATION**	**09**
	Statistical Analysis - Introduction to descriptive and inferential statistics - Common statistical tests: T-tests, ANOVA, regression analysis - Interpreting Results - Presenting quantitative findings using tables and graphs. Understanding p-values and confidence intervals - Writing Up Research Findings - Structuring a research report: Introduction, methods, results, and discussion - Adhering to academic writing conventions and citation styles.	
Unit 5	**RESEARCH PROPOSAL DEVELOPMENT AND PRESENTATION**	**09**
	Components of a Research Proposal - Title, introduction, literature review, methodology, and budget - Importance of a well-defined research question and	

	objectives. Writing the Proposal - Formatting and structuring the proposal according to academic standards - Tips for effective writing and clarity. Presentation Skills - Techniques for presenting research findings to diverse audiences - Preparing for questions and feedback during presentations.

Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	1	1	1	1	1
CO2	1	2	2	2	1	1
CO3	1	2	3	2	1	1
CO4	1	2	2	3	1	1
CO5	1	1	2	2	3	1

References:

1. Research Design: Qualitative, Quantitative, and Mixed Methods Approaches - 2018 (5th Edition) - Creswell, J. W – Sage Publications
2. Qualitative Research: A Guide to Design and Implementation - 2015 (4th Edition) - Merriam, S. B., & Tisdell, E. J. - Jossey-Bass
3. How to Conduct Surveys: A Step-by-Step Guide – 2017 (5th Edition) - Fink, A.- Sage Publications
4. Research in Education - 2016 (10th Edition) - Best, J. W., & Kahn, J. V - Pearson

Cluster-D. QUALITY ASSURANCE AND ACCREDITATION

ED24D11	ACCREDITATION SYSTEMS FOR TECHNICAL EDUCATION	3 CREDITS

Course Description:

This course explores the various accreditation systems applicable to technical education, focusing on national and international frameworks. Students will gain insights into the accreditation process, criteria, and standards essential for ensuring quality in technical programs. The course prepares educators to navigate the complexities of accreditation while enhancing institutional effectiveness.

Course Outcomes:

Upon completion of the course, students are expected to:

1. Understand the significance and purpose of accreditation in technical education.
2. Differentiate between national and international accreditation systems.
3. Prepare and organize documentation for accreditation processes.
4. Identify best practices for sustaining accreditation and fostering a culture of quality.
5. Analyze the impact of accreditation on student outcomes and institutional reputation.

Unit 1	**INTRODUCTION TO ACCREDITATION**	**09**
	Overview of accreditation and its purpose in technical education - Differences between institutional and programmatic accreditation - The role of accreditation in quality assurance - Comparison between national and international accreditation systems - Introduction to key accrediting bodies (NBA, ABET).	
Unit 2	**NATIONAL ACCREDITATION FRAMEWORKS**	**09**
	Focus on National Board of Accreditation (NBA) and National Assessment and Accreditation Council (NAAC) frameworks - Criteria for accrediting technical programs: student performance, curriculum, faculty quality - Accreditation process: self-assessment reports and external evaluations - Compliance with AICTE regulations.	
Unit 3	**INTERNATIONAL ACCREDITATION SYSTEMS FOR TECHNICAL EDUCATION**	**09**
	Examination of international accreditation systems (ABET, EUR-ACE) - Criteria for accrediting technical programs - Role of international agreements (Washington Accord) in global recognition - Comparative analysis of NBA, ABET, and EUR-ACE standards.	
Unit 4	**PREPARING FOR ACCREDITATION IN TECHNICAL EDUCATION**	**09**
	Process of preparing for accreditation: developing self-study reports - Required documentation and best practices for accreditation visits - Engaging faculty, industry partners, students, and alumni in accreditation - Common challenges in accreditation and strategies for addressing them.	
Unit 5	**POST-ACCREDITATION AND CONTINUOUS IMPROVEMENT**	**09**
	Exploration of post-accreditation responsibilities for institutions - Maintaining accreditation and continuous quality improvement - Reaccreditation process and integrating feedback into practices - Case studies of institutions sustaining accreditation and the impact on global recognition and student mobility.	

Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	2	2	3	2	3
CO2	1	2	3	3	3	2
CO3	1	3	3	3	3	3
CO4	1	2	3	2	1	3
CO5	2	2	3	3	2	3

References:

1. Kumar, D. N. V., & Prasad, A. N. (2017). Accreditation: A Tool for Quality Improvement in Higher Education. *New Delhi: Excel Books*.
2. Kumar, K. V. (2015). Quality Assurance and Accreditation in Technical Education. *Hyderabad: University Press*.
3. Stukel, J. W. (2013). *Higher Education Accreditation: A Comprehensive Guide*. New York: Routledge.
4. Johnson, J. L., & Cottam, L. J. (2018). *Guide to Accreditation in Higher Education*. London: Springer.

ED24D12	OUTCOME-BASED EDUCATION AND CONTINUOUS IMPROVEMENT	3 CREDITS

Course Description:

This course focuses on the principles of Outcome-Based Education (OBE) and its implementation in technical programs. Students will learn how to develop learning outcomes, assess student performance, and implement continuous improvement strategies. The course prepares educators to enhance educational effectiveness through data-driven practices and stakeholder engagement.

Course Outcomes:

Upon completion of the course, students are expected to:

1. Understand the principles and significance of Outcome-Based Education (OBE).
2. Design and develop effective learning outcomes for technical programs.
3. Implement assessment strategies that align with OBE principles.
4. Apply continuous improvement models to enhance educational quality.
5. Analyze case studies of successful OBE implementation in technical education.

Unit 1	**INTRODUCTION TO OUTCOME-BASED EDUCATION (OBE)**	**09**
	Principles of outcome-based education (OBE) and its significance - Shift from input-based to outcome-focused learning - Key components of OBE: learning outcomes, assessment strategies, and curriculum alignment – Programme outcomes (POs), course outcomes (COs), and student outcomes (SOs) - Role of accreditation bodies in promoting OBE.	
Unit 2	**DESIGNING LEARNING OUTCOMES IN TECHNICAL EDUCATION**	**09**
	Development of programme and course outcomes using Bloom's Taxonomy - Curriculum mapping to ensure alignment between course content and outcomes - Involvement of stakeholders (industry and faculty) in the design process - Effective strategies for writing and implementing outcomes in technical programs.	
Unit 3	**ASSESSMENT STRATEGIES FOR OUTCOME-BASED EDUCATION**	**09**
	Exploration of assessment methods: formative and summative assessments - Use of rubrics and grading scales for evaluating skills - Direct and indirect assessment techniques - Role of learning analytics in improving student outcomes - Feedback mechanisms for continuous improvement.	
Unit 4	**CONTINUOUS IMPROVEMENT MODELS IN TECHNICAL PROGRAMS**	**09**
	Continuous improvement models for outcome-based education (e.g., PDCA cycle) - Data-driven decision-making to revise curricula and teaching strategies - Importance of feedback loops in closing assessment gaps - Curriculum revision and faculty engagement strategies.	
Unit 5	**CASE STUDIES AND BEST PRACTICES IN OBE AND CONTINUOUS IMPROVEMENT**	**09**
	Case studies of successful OBE implementations in technical programs - Lessons learned from industry-academia collaborations - Innovative approaches to OBE and continuous improvement - Global perspective on adapting OBE principles to local contexts.	

Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	1	3	3	3	3
CO2	1	2	3	3	2	2
CO3	1	2	3	3	3	3
CO4	2	3	3	2	1	3
CO5	1	1	3	2	3	3

References:

1. Sharma, S. K., & Sharma, R. C. (2016).Outcome-Based Education: A Model for the Future. *New Delhi: PHI Learning Pvt Ltd*.
2. Ghosh, S., & Bhatia, N. (2020).Designing and Assessing Learning Outcomes in Technical Education. *New Delhi: Sage Publications*.
3. Rao, M. K. (2018).Implementing OBE in Technical Institutions: A Step-by-Step Guide. *Bangalore: I.K. International Publishing*.
4. Brown, R. A. B. (2015). Outcome-Based Education: Principles and Practices. *New York: Springer*.
5. Callahan, J. C. (2014). Implementing Outcome-Based Education: Strategies for the Classroom. *New York: Routledge*.

ED24D13	QUALITY ASSURANCE IN TECHNICAL EDUCATION	3 CREDITS

Course Description:

This course provides an in-depth understanding of quality assurance mechanisms necessary for maintaining high standards in technical education. Students will learn how to implement quality assurance frameworks, develop key performance indicators (KPIs), and utilize continuous improvement strategies to enhance academic and administrative processes. The course emphasizes hands-on learning through case studies, preparing educators to improve student outcomes and institutional quality in technical education settings.

Course Outcomes:

Upon completion of the course, students are expected to:

1. Understand the principles of quality assurance and their application in technical education.
2. Develop and apply key performance indicators (KPIs) for monitoring and improving the quality of technical education.
3. Implement continuous improvement models for institutional and academic processes in technical education.
4. Conduct quality audits and prepare reports for internal and external quality assurance in technical institutions.
5. Analyze and apply quality assurance case studies in technical education institutions.

Unit 1	OVERVIEW OF QUALITY ASSURANCE IN TECHNICAL EDUCATION	09
	Introduction to quality assurance and its role in higher education - Key elements of quality assurance: objectives, standards, and performance metrics - Role of governing bodies in ensuring education quality - Key performance indicators (KPIs) for engineering institutions - Continuous improvement processes in education (Plan-Do-Check-Act Cycle) - Monitoring student outcomes and faculty performance.	
Unit 2	**QUALITY ASSURANCE TOOLS AND FRAMEWORKS**	**09**
	Quality assurance frameworks for higher education - ISO standards and their application in educational institutions - Tools for assessing educational quality: rubrics, benchmarks, and feedback systems - Role of learning analytics in quality improvement - Developing quality manuals and policies for institutional governance - Internal vs. external quality assurance mechanisms.	
Unit 3	**CONTINUOUS IMPROVEMENT MODELS**	**09**
	Concept of Total Quality Management (TQM) in education - The Six Sigma approach to improving educational processes - Curriculum and instructional design improvements based on student feedback - Data-driven decision-making in the context of continuous improvement - Strategies for engaging faculty, staff, and students in quality enhancement - Monitoring and revising quality assurance practices for ongoing improvement.	
Unit 4	**QUALITY AUDITS AND ACCREDITATION PREPARATION**	**09**
	Purpose and types of quality audits: internal and external - Preparing for a quality audit: documentation, processes, and reporting-Self-assessment tools for institutional quality improvement - Best practices for organizing and conducting accreditation visits - Developing a quality culture within educational institutions - Post-accreditation follow-up: sustaining improvements and addressing gaps.	

Unit 5	CASE STUDIES IN QUALITY ASSURANCE	09
	Case studies of successful quality assurance models in engineering education - Lessons learned from leading institutions in maintaining high educational standards - Addressing common challenges in implementing quality assurance systems - Innovative approaches to quality management in technical education - Adapting global quality assurance best practices to local contexts - Role of leadership in fostering a culture of quality in institutions.	

Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	1	3	3	3	3
CO2	1	2	3	3	3	2
CO3	1	2	3	3	3	3
CO4	1	2	2	3	1	3
CO5	1	1	3	2	3	3

References:

1. Naagarazan, R. S. (2014).Quality Assurance in Education: A Comprehensive Guide. *New Delhi: New Age International*.
2. Kumar, D. N. V., & Prasad, A. N. (2017).Accreditation: A Tool for Quality Improvement in Higher Education. *Hyderabad: Universities Press*.
3. Sharma, S. K. (2015).Quality Management in Technical Education. *New Delhi: Sage Publications*.
4. Oakland, J. S. (2011).Total Quality Management and Operational Excellence. *London: Routledge*.
5. Goetsch, D. L., & Davis, S. B. (2016).Quality Management for Organizational Excellence. *Boston: Pearson*.

Cluster- E. SUSTAINABILITY IN EDUCATION

ED24E11	INNOVATIVE PEDAGOGIES FOR ESD	3 CREDITS

Course Description:

This course focuses on contemporary teaching methods that promote sustainability across diverse learning environments. The course explores creative approaches to engage learners in critical thinking, problem-solving and collaboration for sustainable development. It emphasizes the integration of Education for Sustainable Development (ESD) into curriculum design, active learning and transformative pedagogies. Students will examine case studies and strategies for fostering global citizenship, environmental stewardship, and social equity. The course aims to equip educators with the tools to inspire sustainable behavior change in their learners.

Course Outcomes:

Upon completion of the course, students are expected to:

1. Understand the foundational principles of assessment in engineering education.
2. Design assessments that are aligned with learning objectives and outcomes.
3. Develop a variety of assessment types suitable for engineering curricula.
4. Utilize technology effectively in assessment design and implementation.
5. Analyze and interpret assessment data to improve instructional practices and student learning.

Unit 1	**Introduction to Education for Sustainable Development**	**09**
	Definition and goals of ESD - UNESCO's role, SDGs - The importance of sustainability in education - Role of educators in promoting ESD.	
Unit 2	**Theoretical Foundations of Innovative Pedagogies**	**09**
	Constructivism, experiential learning, transformative learning theory - Student-centered approaches: inquiry-based, problem-based learning, collaborative learning - Critical thinking and systems thinking in ESD.	
Unit 3	**Innovative Pedagogical Approaches for ESD**	**09**
	Project-based learning (PBL) for sustainability - Place-based education - Gamification and the use of technology in ESD.	
Unit 4	**Integrating ESD Across Disciplines**	**09**
	Infusing sustainability into STEM education - Social sciences and sustainability (cultural, political, economic perspectives) - Arts-based approaches to sustainability education.	
Unit 5	**Assessment and Reflection in ESD**	**09**
	Formative and summative assessment in ESD - Reflective practices for continuous improvement - Assessing critical thinking, creativity, and problem-solving skills in sustainability education.	

Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	1	1	1	3	1
CO2	1	2	2	2	3	1
CO3	1	2	3	2	3	1
CO4	1	2	2	3	1	1

CO5	1	1	2	2	3	1

References:

1. Tilbury, D. (2011). Assessing ESD in Educational Institutions.
2. Wals, A. E. (2015). Sustainability in Higher Education: From Double to Triple Loop Learning.
3. Sterling, S. (2010). Transformative Learning and Sustainability.

ED24E12	SUSTAINABILITY ASSESSMENT AND REPORTING IN EDUCATION	3 CREDITS

Course Description:

This course explores key principles and methods for evaluating sustainability performance in educational institutions. It covers frameworks for sustainability assessment, reporting standards, and the role of education in promoting sustainable development. Students will learn how to analyze sustainability data, prepare reports, and implement strategies for continuous improvement. The course also emphasizes stakeholder engagement and the ethical implications of sustainability reporting in education.

Course Outcomes:

Upon completion of the course, students are expected to:

- Apply key sustainability assessment frameworks in educational settings, such as ESG and SDG models.
- Analyse sustainability data and evaluate the performance of educational institutions in terms of environmental, social, and governance metrics.
- Develop comprehensive sustainability reports aligned with global standards and reporting guidelines.
- Propose and implement strategies for continuous sustainability improvement in educational institutions.
- Engage in sustainability initiatives and be able to address ethical considerations in sustainability reporting.

Unit 1	**Introduction to Sustainability in education**	**09**
	Definition and importance of sustainability - Overview of the Sustainable Development Goals (SDGs) - Role of education in promoting sustainable development - Key sustainability challenges in the education sector	
Unit 2	**Frameworks for Sustainability Assessment**	**09**
	Environmental, Social, and Governance (ESG) criteria - Tools and methodologies for sustainability assessment - Life Cycle Assessment (LCA) and Carbon foot printing in education - Case studies: Best practices in sustainability assessments	
Unit 3	**Sustainability Reporting Standards**	**09**
	Global reporting frameworks: GRI, SASB, and SDG reporting - Principles of transparent and accurate sustainability reporting - Writing sustainability reports for educational institutions - Integrating sustainability into institutional strategic planning	
Unit 4	**Data Collection and Analysis for Sustainability**	**09**
	Key performance indicators (KPIs) for sustainability in education - Methods for collecting and analyzing sustainability data - Benchmarking and measuring progress - Software tools for sustainability tracking and reporting	
Unit 5	**Stakeholder Engagement and Ethical Considerations**	**09**
	Importance of stakeholder engagement in sustainability reporting - Communicating sustainability efforts to diverse audiences - Ethical implications of sustainability assessment and reporting - Continuous improvement strategies and feedback mechanisms	

Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	1	2	1	2	1
CO2	1	2	3	2	2	1
CO3	1	2	3	2	2	1
CO4	1	2	3	3	2	1
CO5	1	1	2	2	3	1

References:

1. Lucretia D. Baltrunaite, Sustainability Reporting for Sustainability Performance
2. William R. Blackburn, The Sustainability Handbook: The Complete Management Guide to Achieving Social, Economic, and Environmental Responsibility
3. Peggy F. Barlett and Geoffrey W. Chase, Sustainability in Higher Education: Stories and Strategies for Transformation

ED24E13	SUSTAINABLE ENGINEERING PRACTICES IN CURRICULUM	3 CREDITS

Course Description:

This course provides a comprehensive understanding of principles, tools, and methodologies required to design and implement engineering solutions that prioritize sustainability. This course emphasizes the integration of environmental, economic, and social dimensions into engineering decision-making. By the end of the course, students will be equipped to explore key topics such as life cycle assessment (LCA), sustainable materials, renewable energy technologies, waste minimization, green building design, and climate change mitigation strategies.

Course Outcomes:

Upon completion of the course, students are expected to:

- Conduct life cycle assessments to evaluate the environmental impact of products and systems.
- Identify and select sustainable materials and energy sources for engineering projects.
- Design engineering solutions that minimize waste and reduce carbon footprints.
- Analyze the role of policy, regulations, and ethics in promoting sustainable engineering.
- Collaborate effectively to propose innovative solutions to sustainability challenges.

Unit 1	INTRODUCTION TO SUSTAINABLE ENGINEERING AND LCA	09
	Key Concepts - Environmental Challenges - Sustainable Development Goals (SDGs - Sustainability Metrics - Ethical Implications -Life Cycle Thinking - Definition and importance of LCA in sustainable engineering - Life cycle stages: raw material extraction, manufacturing, use, disposal/recycling - LCA Methodology - Inventory analysis: collecting data on material and energy flows.	
Unit 2	**SUSTAINABLE ENERGY SYSTEMS**	**09**
	Renewable Energy Sources - Energy Efficiency - Green Buildings - LEED certification, building energy management, sustainable building materials - Energy Storage & Smart Grids: Technologies for storage (batteries, hydrogen fuel cells), role of smart grids in efficient energy distribution - Environmental Impacts: Analysis of energy sources on the environment.	
Unit 3	**SUSTAINABLE WATER AND WASTE MANAGEMENT**	**09**
	Water Resources Management - Efficient water use, water recycling, and desalination technologies -Sustainable Wastewater Treatment: Biological treatments, constructed wetlands, decentralized systems - Solid Waste Management: 3Rs (Reduce, Reuse, Recycle), waste-to-energy technologies, composting -E-Waste: Managing electronic waste sustainably, recovery of materials from e-waste- Circular Economy.	
Unit 4	**SUSTAINABLE TRANSPORTATION SYSTEMS**	**09**
	Green Mobility - Public Transportation Systems - Promoting mass transit, reducing emissions in public transport - Sustainable Urban Planning: Designing cities for lower environmental impact, promoting non-motorized transport (biking, walking) -	

	Alternative Fuels: Biofuels, synthetic fuels, their advantages and challenges -Case Studies: Successful implementation of sustainable transport systems in different cities.	
Unit 5	**WASTE MINIMIZATION AND CIRCULAR ECONOMY**	**09**
	Waste Management in Engineering - Circular Economy - Principles of circular economy and its relevance to sustainable engineering - Designing products and systems for reuse and recyclability - Case studies in circular economy applications - Sustainable Supply Chains - Concepts of sustainable supply chain management - Sustainable procurement and Resource management - Best practices in green logistics and product lifecycle management.	

Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	1	2	1	3	2
CO2	2	2	3	1	3	2
CO3	2	2	3	2	1	2
CO4	2	2	3	3	3	2
CO5	2	1	2	2	3	2

References:

1. David T. Allen and David R. Shonnard, Sustainable Engineering: Concepts, Design and Case Studies, Pearson Education (2nd Edition, 2011)
2. Waste to Wealth: The Circular Economy Advantage**,** Peter Lacy and Jakob Rutqvist, Palgrave Macmillan (1st Edition, 2016)
3. Michael Z. Hauschild, Ralph K. Rosenbaum, and Stig Irving Olsen, Life Cycle Assessment: Theory and Practice, Springer (1st Edition, 2017)

Cluster - F. GUIDANCE AND COUNSELLING

ED24F11	Fundamentals of Human Behaviour	3 CREDITS

Course Description:

This course provides a comprehensive introduction to the study of human behaviour. It explores the biological, psychological, and social factors that influence how individuals think, feel, and act. Students will learn about key concepts in psychology, including perception, learning, motivation, emotion, personality, and social interaction. The course also examines the interplay between individuals and their environment, considering the impact of culture, society, and situational factors on behaviour.

Course Outcomes:

Upon completion of the course, students are expected to:

- Analyze the biological and psychological foundations of behaviour.
- Explain the role of cognitive processes in shaping human actions.
- Evaluate the influence of social and cultural factors on behaviour.
- Apply knowledge of human behaviour to real-world situations.
- Develop an understanding of individual differences and diversity.

Unit 1	**INTRODUCTION TO SUSTAINABLE ENGINEERING AND LCA**	**09**
	Definition and scope of human behaviour - Approaches to studying human behaviour (biological, psychological, social) - The scientific method in behavioural research - Ethical considerations in studying human behaviour - Historical perspectives on the study of human behaviour.	
Unit 2	**BIOLOGICAL FOUNDATIONS OF BEHAVIOUR**	**09**
	The nervous system: Structure and function of the brain and spinal cord - The endocrine system and its influence on behaviour - Genetics and behaviour: The role of heredity in shaping behaviour - Evolutionary psychology: The evolutionary basis of human behaviour - The impact of biological factors on behaviour (e.g., sleep, nutrition, stress).	
Unit 3	**COGNITIVE PROCESSES AND BEHAVIOUR**	**09**
	Perception: How we perceive the world around us - Attention: The selective focus on certain stimuli - Learning: Classical and operant conditioning, cognitive learning - Memory: Encoding, storage, and retrieval of information - Language and thought: The relationship between language and cognitive processes.	
Unit 4	**SOCIAL AND CULTURAL INFLUENCES ON BEHAVIOUR**	**09**
	Social psychology: Attitudes, persuasion, and social influence - Group dynamics: Conformity, obedience, and group behaviour - Cultural influences: The impact of culture on behaviour and values - Interpersonal relationships: Communication, attraction, and conflict - Diversity and individual differences: Understanding and appreciating human diversity.	
Unit 5	**MOTIVATION, EMOTION, AND PERSONALITY**	**09**
	Motivation: Theories of motivation, needs, and drives - Emotion: The nature of emotions, emotional expression, and emotional regulation - Personality: Theories of personality, personality assessment, and individual differences - Stress and coping:	

	The impact of stress on behaviour and strategies for coping - Positive psychology: The study of happiness, well-being, and human strengths.

Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	1	2	2	2
CO2	2	3	2	2	3	3
CO3	2	2	3	3	2	3
CO4	2	3	3	3	3	3
CO5	2	2	2	2	3	3

References:

1. Breedlove, S. M., & Rosenzweig, M. R. (2020). *Principles of Behavioural Neuroscience* (3rd ed.). Sinauer Associates.
2. Buss, D. M., & Larsen, R. J. (2018).[1]*Personality Psychology: Domains of Knowledge About Human Nature* (7th ed.). McGraw-Hill Education.
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ED24F12	INTRODUCTION TO GUIDANCE AND COUNSELLING	3 CREDITS

Course Description:

This course introduces students to the fundamental concepts, theories, and practices in guidance and counselling. It covers the role of a counsellor, the skills needed for effective counselling, the various types of guidance programs, and the ethical considerations involved in the practice. The course also highlights the importance of understanding human development and behavior in the context of counselling and guidance services.

Course Outcomes:

On completion of the course, the student is expected to be able to

1. Understand the principles, importance, and barriers in guidance and counselling.
2. Evaluate historical development and movements in guidance and counselling.
3. Recognize organizational needs and services in the guidance and counselling domain.
4. Explore various fields and institutions contributing to guidance and counselling.
5. Develop essential counselling skills and foster collaboration with other professionals.

Unit 1	**INTRODUCTION TO GUIDANCE AND COUNSELLING**	09
	Basic assumptions and principles of guidance - Importance of understanding the individual - Barriers to understanding - Aids in understanding - Measurement and application of self-understanding - Guidance movement in India.	
Unit 2	**TYPES OF GUIDANCE AND COUNSELLING SERVICES**	**09**
	Meaning and factors - Types of counselling - Emergence and growth of counselling psychology - Counselling movement in India - Present status of counselling - Qualities of a Counsellor	
Unit 3	**COUNSELLING SERVICES I**	**09**
	Requirements of School Guidance Services - Counselling Services - Remedial Services - Follow-up Services - Research Services - Organisation of Child Guidance Clinic - Concept of Self-help Group - Human rights & Child rights	
Unit 4	**COUNSELLING SERVICES II**	**09**
	The Youth Employment Services - The National Foundation for Research - The National Institutes in Industrial Psychology - Child Guidance Clinics and the School Psychological Services - The Educational Welfare Services - The National Institutes of Handicapped - The University Employment Information and Guidance Bureaus and Student Advisor - The Rehabilitation Council of India (RCI)	
Unit 5	**COUSELLING PROCESS AND TECHNIQUES**	**09**
	Basic counselling skills - Observation, Questioning, Communication skills - Making notes and reflection - Case history, collecting and documenting information - Working with other professionals	

Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	2	2	1	2	2
CO2	3	2	1	2	3	1
CO3	2	2	3	2	1	1
CO4	1	1	2	1	2	1
CO5	1	2	2	1	1	1

References:

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2. Barki, B.G. and Mukhopadhyay, B .(1989). Guidance and Counselling – A Manual; New Delhi: Sterling Publishers Pvt Ltd
3. Aggarwal, J.C. (1989). Educational and Vocational Guidance and Counselling, Doaba House; Delhi
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ED24F13	MENTAL HEALTH DEVELOPMENT	3 CREDITS

Course Description:

This course explores the concepts, theories, and practices related to mental health development. It emphasizes understanding how mental health is shaped across the lifespan, the factors that influence it, and the strategies for promoting resilience and well-being. Students will also learn about mental health disorders, the stigma surrounding mental illness, and the role of community and public health interventions in mental health promotion.

Course Outcomes:

On completion of the course, the student is expected to be able to

1. Understand normality, abnormality, and principles of good mental health.
2. Apply mental hygiene to promote positive mental health and adjustment.
3. Utilize the Wellness Counselling Model and solution-focused therapy effectively.
4. Apply a personal contextual approach to wellness counselling.
5. Develop coping skills for health-related problems and stress management.
6. Implement strategies for promoting health-enhancing behaviours and adjustments

Unit 1	**Mental Health and Mental Hygiene**	**09**
	Normality and Abnormality and Mental Health - Characteristics of Good Mental Health - Concept, Nature and Principles of Mental Hygiene - Mental Health in Adjustment - Maintaining positive Mental Health.	
Unit 2	**Promoting Wellness**	**09**
	The Wellness Counselling Model- Essential Self, Coping self, Social self, Creative self, Physical self - Personal contextual approach to wellness counselling - Solution focused therapy and wellness counselling.	
Unit 3	**Developing Coping Skills for Health-Related Problems**	**09**
	Concept of Stress, Sources, Causes, Consequences of Stress, Coping with Stress - Counselling for health-related problems: Diabetes, Cancer, and AIDS - Health Enhancing Behavior: Exercise, Yoga, Relaxation, Accident Prevention, Maintaining Healthy Diet, Weight Control - Intervention for Health Compromising Behavior (Smoking, Drugs, Alcoholism).	
Unit 4	**Adjustments**	**09**
	Concept and Nature of Adjustment, Social, Emotional, Health and Educational Adjustment. Factor Affecting Adjustment: Biological, Psychological, Social and Cultural. Adjustment Mechanism - Aggression, Escape. Approaches to adjustment: Psychoanalytic and Humanistic- Self- Management Techniques: Self Recording, Self- Evaluation, Self-Cueing, Self-Reinforcement.	
Unit 5	**Stress Management**	**09**
	Stress management: definition, concept, scope - Controlling emotion, controlling stress and meditation - Intellectual and emotional basis of stress. Effects of stress on the body - Reduction of stress through relaxation techniques, cognitive techniques, and physical activity - Stress in adulthood and old age.	

Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	2	2	3	1	2
CO2	3	2	1	2	2	1
CO3	2	2	3	3	2	1
CO4	1	2	2	2	1	1
CO5	2	1	2	2	1	1

References:

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2. Arkoff, A. (1968). Adjustment and mental health. New York, McGraw-Hill.
3. Carroll, A. (1964). Herbert Mental Hygiene (4thed). Prentice Hall Inc. EnglewodCliffs, New Jersey
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