



Department of New Media Technology

Detailed Syllabus

for

Bachelor of Technology (Printing and Packaging)

(Four Years Full-Time Undergraduate Degree Programme) Effective from July 2026



Department of New Media Technology

**MAKHANLAL CHATURVEDI NATIONAL UNIVERSITY OF
JOURNALISM**

& COMMUNICATION, BHOPAL

**Campus Address: Makhanpuram, Opposite M.P. State Shooting Academy,
Bishankhedi – 462044**

Bachelor of Technology (Printing and Packaging): B.Tech.(PP)

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1. ABOUT THE PROGRAMME:

B.Tech.(PP) is a Four year (Eight Semesters) Undergraduate programme, that prepares a Student to work for the Printing Packaging industry. The space of digital media is widening day-by-day where Printing is overlapped by Packaging. An increased focus in digital packaging, has led to digitally printed packaging opportunities and commercial digital printers looking to establish packaging operations. But lack of trained manpower is one of the biggest issues to be addressed. Keeping this in view, the University offers B. Tech. (Printing and Packaging) in response to a growing demand for trained Printing and Packaging professionals. The programme provides a comprehensive practical exposure in all aspects of printing and packaging processes. Focus on both existing and new technology skills and knowledge used throughout the production will prepare the learners for the exciting, diverse and technically advancing Printing and Packaging industry.

The programme content includes Printing and Packaging Technologies, Screen printing, Sheetfed offset printing, Flexography, Gravure, Weboffset, Multimedia Technology, Graphics design for Printing and Packaging, and more. State of art facilities are created in the department to provide complete practical exposure to the students along with working opportunity in University Press. This industry relevant programme is highly recommended for students who are creative and focused to upgrade their skill set for Printing and Packaging.

2. ELIGIBILITY:

First Year Admission: Passed 10+2 examination with Physics and Chemistry as mandatory subjects, along with a third subject selected from the AICTE-approved subjects (including Mathematics, Biology, Biotechnology, Computer Science, Information Technology, or Technical Vocational subjects).

Must have obtained at least **45% marks** (40% marks in case of candidates belonging to reserved categories) in the above subjects taken together.

Mandatory Bridge Course : Students admitted with a non-Mathematics background (such as Biology or Biotechnology streams) must successfully complete and pass the non-credit **Bridge Mathematics Courses (1AUD-1 in Semester I and 2AUD-2 in Semester II)** during their first year of study to prepare a level playing field.

Duration: 4 years

Lateral entry to Second Year: Passed 3 years Diploma in Any Engineering and Technology from a recognized institution.

Duration: 3 years

3. CAREER AVERUES:

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The programme empowers the students with ample job opportunities like Chief Production Officer, Assistant Director (Production), Technical Officer, Printing Officer, Manager Printing, Supervisor, Publication Officer in the field of printing and packaging industry. Also, they can work for Designing and Digital printing, Security printing, Software solution for print industry, Electronic publishing, Color management solution, Packaging, Print finishing and converting, and so on. The programme also trains young people to become entrepreneurs, to establish printing & packaging units and generate lot of employment.

4. PROGRAMME OBJECTIVES (PO):

The B.Tech.(PP) programme is designed with the following educational objectives:

- i. To inculcate Art, Aesthetics and Technology of Printing and Packaging elements in Students.
- ii. To equip the students with skills for Digital Electronic Circuits, Digital Prepress and Industrial Training.
- iii. To make the students understand the theoretical aspects of Printing and Packaging Process and Techniques.
- iv. To develop the practical ability to work with Printing and Packaging machines and empower the students to work as trained professional for Printing and Packaging industry.
- v. To prepare the students to become, Entrepreneur creating Employability, Professional with Industry Ethics and Researcher questing for New Dimensions of Societal issues.

5. PROGRAMME EDUCATIONAL OUTCOMES (PEO):

On successful completion of B.Tech.(PP), Students shall be able to

- i. Understand and identify the requirements of various Printing and Packaging elements for a given task.
- ii. Demonstrate Skills in Designing, and Publishing Print Content.
- iii. Develop competence in understanding the theoretical aspects and choose appropriate process and technique for implementing any given task.
- iv. Analytically explore the relevant substrate and machine to be used for various job contexts.
- v. Demonstrate Skills to distinguish between work responsibility and accountability in Print Packaging, as an entrepreneur and as an Individual.

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B. Tech. (Printing and Packaging)

	Course	Core Course (Compulsory) (CCC)	Credits	Ability Enhancement Compulsory Course (AECC) 2 Credits	Non-Credit Bridge (Audit) Course	Open Elective (3 Credits)	Total Credits
SEM I	1CCC-1	Engineering Chemistry	04	1AECC-1 Communicative English	1AUD-1: Bridge Mathematics Course	Introduction to Python Programming	22
	1CCC-2	Engineering Mathematics-1	05				
	1CCC-3	Basics of Electrical and Electronics Engineering	04				
	1CCC-4	Basic Mechanical Engineering	4				
SEM II	2CCC-5	Engineering Physics	04	2AECC-2 Environmental Studies	2AUD-2: Bridge Mathematics Course	Advanced Manufacturing Processes	22
	2CCC-6	Engineering Graphics	4				



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	2CCC-7	Electronics For AI and Robotics	4				
	2CCC-8	Engineering Mathematics-2	5				

Open Elective Papers Offered by Department of New Media Technology		Abbreviations
OE-1	Introduction to Python Programming	CCC - Core Course Compulsory-(4 Credits Each)
		AECC - Ability Enhancement Compulsory Course-(2 Credits Each)
OE-2	Advanced Manufacturing Processes	AUD - Audit Course/ Bridge course -(00 Credit applicable only for Non-Math Students)
		OE - Open Elective (3 Credits Each)
		L-Lecture T-Tutorial P-Practical • 1 hour of Lecture (L) per week = 1 credit • 1 hour of Tutorial (T) per week = 1 credit • 2 hours of Practical (P) per week = 1 credit (or 0.5 credits per 1 hour of practical)

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Programme Graduate Aptitude (PO)

PO	Attribute
PO1	Disciplinary Knowledge
PO2	Communication Skills
PO3	Critical Thinking
PO4	Problem Solving
PO5	Analytical Reasoning
PO6	Research Skills
PO7	Teamwork
PO8	Scientific Reasoning
PO9	Reflective Thinking
PO10	Digital Literacy
PO11	Self-Directed Learning
PO12	Multicultural Competence
PO13	Moral & Ethical Awareness
PO14	Leadership Readiness
PO15	Lifelong Learning

Mapping Value: 3-Strong 2- Moderate 1-Weak

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1. Disciplinary Knowledge: Capable of demonstrating comprehensive knowledge and understanding of one or more disciplines that form a part of an undergraduate programme of study.

2. Communication Skills: Ability to express thoughts and ideas effectively in writing and orally; Communicate with others using appropriate media; confidently share one's views and express herself/himself; demonstrate the ability to listen carefully, read and write analytically, and present complex information in a clear and concise manner to different groups.

3. Critical Thinking: Capability to apply analytic thought to a body of knowledge; analyse and evaluate evidence, arguments, claims, beliefs on the basis of empirical evidence; identify relevant assumptions or implications; formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach to knowledge development.

4. Problem Solving: Capacity to extrapolate from what one has learned and apply their competencies to solve different kinds of non-familiar problems, rather than replicate curriculum content knowledge; and apply one's learning to real life situations.

5. Analytical Reasoning: Ability to evaluate the reliability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyse and synthesise data from a variety of sources; draw valid conclusions and support them with evidence and examples, and addressing opposing viewpoints.

6. Research-related Skills: A sense of inquiry and capability for asking relevant/appropriate questions, problematising, synthesising and articulating; Ability to recognise cause-and-effect relationships, define problems, formulate hypotheses, test hypotheses, analyse, interpret and draw conclusions from data, establish hypotheses, predict cause-and-effect relationships; ability to plan, execute and report the results of an experiment or investigation.

7. Cooperation/Team Work: Ability to work effectively and respectfully with diverse teams; facilitate cooperative or coordinated effort on the part of a group, and act together as a group or a team in the interests of a common cause and work efficiently as a member of a team.

8. Scientific Reasoning: Ability to analyse, interpret and draw conclusions from quantitative/qualitative data; and critically evaluate ideas, evidence and experiences LOCF 4 from an open-minded and reasoned perspective.



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9.Reflective Thinking: Critical sensibility to lived experiences, with self-awareness and reflexivity of both self and society.

10.Information/Digital Literacy: Capability to use ICT in a variety of learning situations, demonstrate ability to access, evaluate, and use a variety of relevant information sources; and use appropriate software for analysis of data.

11.Self-directed Learning: Ability to work independently, identify appropriate resources required for a project, and manage a project through to completion.

12.Multicultural Competence: Possess knowledge of the values and beliefs of multiple cultures and a global perspective; and capability to effectively engage in a multicultural society and interact respectfully with diverse groups.

13.Moral and Ethical Awareness/Reasoning: Ability to embrace moral/ethical values in conducting one's life, formulates a position/argument about an ethical issue from multiple perspectives, and use ethical practices in all work. Capable of demonstrating the ability to identify ethical issues related to one's work, avoid unethical behavior such as fabrication, falsification or misrepresentation of data or committing plagiarism, not adhering to intellectual property rights; appreciating environmental and sustainability issues; and adopting objective, unbiased and truthful actions in all aspects of work.

14.Leadership Readiness/Qualities: Capability for mapping out the tasks of a team or an organization, and setting direction, formulating an inspiring vision, building a team who can help achieve the vision, motivating and inspiring team members to engage with that vision, and using management skills to guide people to the right destination, in a smooth and efficient way.

15.Lifelong Learning: Ability to acquire knowledge and skills, including "learning how to learn", that are necessary for participating in learning activities throughout life, through self-paced and self-directed learning aimed at personal development, meeting economic, social and cultural objectives, and adapting to changing trades and demands of work place through knowledge/skill development/reskilling.

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Course: 1B.Tech.(PP) 1 1CCCC-1: Engineering Chemistry				
Credit Details	Theory	Practical	Internal	Credits
Hours/Weightage	50	30	20	04

COURSE OBJECTIVES

1. Understand the properties of water, water treatment methods, and their industrial applications.
2. Learn the mechanisms of corrosion and methods for its prevention and control.
3. Understand the properties, testing, and applications of lubricants and photochemistry.
4. Study the classification, synthesis, properties, and applications of polymers.
5. Understand the principles and applications of modern chemical analytical techniques.

COURSE OUTCOMES

1. Explain water quality parameters, water treatment methods, and their industrial significance.
2. Analyze different types of corrosion and recommend suitable protection techniques.
3. Evaluate the properties and selection of lubricants and explain the basic concepts of photochemistry.
4. Classify polymers and relate their properties to engineering and industrial applications.
5. Explain the principles and applications of spectroscopic, chromatographic, and thermal analytical techniques.

Unit 1	Water And its Industrial Applications	L	T	P
1.1	Sources, Impurities, Hardness & Its Units, Disadvantage of Hard Water – Scale and Sludge in Boiler	1	0	0



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1.2	Preventive Methods, Caustic Embrittlement	1	0	0
1.3	Boiler Corrosion, Priming and Foaming. Water Softening Methods – Soda-Lime	1	0	0
1.4	Zeolite And Demineralization, Chemical Analysis of Water- Alkalinity	1	0	2
1.5	Complex Metric Titration for Hardness- Numerical Problems Based on Softening Methods	1	1	2

Unit 2	Corrosion	L	T	P
2.1	Dry and wet corrosion – oxidation, electrochemical corrosion, Galvanic corrosion, pitting corrosion, water-line corrosion, differential aeration corrosion, stress corrosion	2	0	0
2.2	Factors influencing corrosion, Protection against corrosion. Protective coatings – Electroplating	1	0	0
2.3	cleaning articles, Electroplating methods, Electroless plating	1	0	2
2.4	Other metallic coatings, Organic coatings – Paints, pigments	1	0	0
2.5	vehicles, thinner, driers, extenders, varnish and lacquers.	1	0	0

Unit 3	Lubricants	L	T	P
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3.1	Introduction, mechanism, classification,	1	0	0
3.2	Properties and Testing of lubricating oils-Viscosity	1	0	2
3.3	Flash and fire point, Cloud and pour point etc	1	0	2
3.4	Selection of Lubricants. Basics of Photochemistry	1	0	0
3.5	Classification, characteristics, Laws of Photochemistry, Photosensitization 2application in photography	1	0	0

Unit 4	High- Polymer	L	T	P
4.1	Nomenclature, types and classification of polymers, Polymerization reaction mechanism, Preparation,	1	0	0
4.2	Properties & uses of – Thermoplastic resins-Polyethylene	1	0	0
4.3	Properties & uses of , PVC, PVA, Polystyrene, PMA, PMMA, Teflon	1	0	0
4.4	Properties & uses of acrylonitrile, Polyamides- Nylon 6, Nylon 6:6. Terylene. Thermo set resins- Phenol formaldehyde	1	0	0
4.5	Properties & uses of Urea - Formaldehyde Resin, Glyptal. Silicone Resin, Polyurethanes.	1	0	2

Unit 5	Analysis & Techniques	L	T	P
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5.1	Instrumental Techniques in Chemical Analysis: Spectroscopy- Introduction, Principle	1	0	0
5.2	Instrumentation and applications of IR, UV, Visible, Atomic emission spectroscopy Flame Photometry and Gas Chromatography.	2	0	2
5.3	Thermal Analysis Techniques: Thermogravimetric (T.G)	1	0	0
5.4	Differential Thermal Analysis (DTA)	1	0	0
5.5	Differential scanning Colorimetry	1	0	0

Practical/Projects/Assignments: -

1. Analyze water samples to determine hardness, alkalinity, and evaluate suitable water treatment methods for industrial applications.
2. Conduct lubricant testing by determining viscosity, flash point, fire point, cloud point, and pour point, and interpret the results.
3. Study corrosion mechanisms and prepare a report on corrosion prevention methods used in engineering industries.
4. Prepare a comparative study on engineering polymers, resins, and their applications in printing, packaging, automotive, and consumer products.
5. Perform case studies or seminars on modern analytical techniques such as UV-Visible spectroscopy, IR spectroscopy, flame photometry, gas chromatography, and thermal analysis, highlighting their industrial applications.

Suggested Readings:

1. Jain, P. C., & Jain, M. (2021). *Engineering Chemistry* (17th ed.). Dhanpat Rai Publishing Company.
2. Dara, S. S., & Umare, S. S. (2020). *A Textbook of Engineering Chemistry* (20th ed.). S. Chand Publishing.
3. Dara, S. S., & Umare, S. S. (2004). *A Text Book of Engineering Chemistry*. S. Chand Publication.
4. Viramani, O. P., & Narula, A. K. (1995). *Applied Chemistry - Theory and Practice*. New Age Pub.
5. Ghosh, P. (2010). *Polymer Science & Technology* (3rd ed.). Tata McGraw Hill.
6. Sivasankar, B. (2008). *Engineering Chemistry*. Tata McGraw-Hill Education.
7. Panda, H. (2011). *Technology of Synthetic Resins and Emulsion Polymers*. Engineers India Research Institute.
8. Sharma, B. K. (2011). *Spectroscopy*. Krishna Prakashan Media.



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9. Jain, P. C., & Jain, M. (2021). Engineering Chemistry (17th ed.). Dhanpat Rai Publishing Company.
10. * Dara, S. S., & Umare, S. S. (2020). A Textbook of Engineering Chemistry (20th ed.). S. Chand
11. Dara, S. S., & Umare, S. S. (2020). A textbook of engineering chemistry (20th ed.). S. Chand Publishing.
12. Devi, B. R., Aparna, P., & Rath, P. (2022). Engineering chemistry. Cengage Learning.
13. Jain, P. C., & Jain, M. (2021). Engineering chemistry (17th ed.). Dhanpat Rai Publishing Company.
14. Rath, P., Chuadhury, A. K., & Das, B. (2021). Engineering chemistry: Fundamental and applications. Cengage Learning India.
15. Vairam, S. (2020). Engineering chemistry (2nd ed.). Wiley India.

E-Resources:

1. NPTEL – Engineering Chemistry [NPTEL Engineering Chemistry Course](#)
2. ACS Educational Resources ACS Education – American Chemical Society ([acs.org in](#)) ACS Chemistry Education Resources ([acs.org in](#))
3. SWAYAM Online Courses SWAYAM Central – Explore Courses
4. MIT OpenCourseWare – Chemistry MIT OCW – Principles of Chemical Science ([ocw.mit.edu in](#)) [MIT OCW Chemistry Courses Overview](#)

CO-PO Mapping

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	3	-	2	-	-	-	-	3	-	-	-	-	2	-	2

Mapping Value: 3-Strong, 2-Moderate, 1-Weak



Course: 1B.Tech.(PP) 2 1CCC-2: Engineering Mathematics-1				
Credit Details	Theory	Practical	Internal	Credits
Hours/Weightage	80	00	20	05

COURSE OBJECTIVES

1. Understand the concepts and applications of differential calculus.
2. Apply integral calculus to solve engineering and geometrical problems.
3. Develop analytical skills for solving ordinary differential equations.
4. Understand matrix operations and their applications in engineering.
5. Learn the fundamentals of Boolean algebra, graph theory, and fuzzy logic.

COURSE OUTCOMES

1. Apply differential calculus techniques to solve optimization and curve analysis problems.
2. Solve engineering problems using definite integrals, multiple integrals, and special functions.
3. Solve ordinary differential equations using appropriate analytical methods.
4. Analyze systems of linear equations using matrices, eigenvalues, and eigenvectors.
5. Apply Boolean algebra, graph theory, and fuzzy logic concepts to engineering applications.

Unit 1	Differential Calculus	L	T	P
1.1	Expansion of functions by Maclaurin's and Taylor's theorem.	2	1	0
1.2	differentiation, Euler's theorem and its application in approximation and errors	2	1	0



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1.3	Maxima and Minima of function of two variables	2	1	0
1.4	Curvature: Radius of curvature	1	1	0
1.5	Centre of curvature.	1	0	0

Unit 2	Integral Calculus	L	T	P
2.1	Definite Integrals: Definite Integrals as a limit of a sum	1	1	0
2.2	its application in Summation of series, Beta and Gamma Functions	2	1	0
2.3	Double and Triple Integrals	2	1	0
2.4	Change of Order of Integration, Area, Volume and Surfaces using double and triple Integral	2	1	0
2.5	Curve tracing	1	1	0

Unit 3	Differential Equations	L	T	P
3.1	Solution of Ordinary Differential Equation of first order and first degree for Exact differential Equations	2	1	0
3.2	Solution of Ordinary Differential Equation of first order and higher degree (solvable for p, x and y, Clairauts Equation)	2	1	0



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3.3	Linear Differential Equations with Constant Coefficients	2	1	0
3.4	Cauchy's Homogeneous differential Equation	1	1	0
3.5	Simultaneous differential Equations, Method of Variation of Parameters	2	1	0

Unit 4	Matrices	L	T	P
4.1	Rank, Solution of Simultaneous equation by elementary transformation.	2	1	0
4.2	Consistency of System of Simultaneous Linear Equation	1	1	0
4.3	Eigenvalues and Eigenvectors,	2	1	0
4.4	Cayley-Hamilton Theorem	1	1	0
4.5	Application to find the inverse	1	1	0

Unit 5	Algebra of Logic	L	T	P
5.1	Boolean Algebra, Principle of Duality	1	1	0
5.2	Basic Theorems, Boolean Expressions and Functions.	2	1	0
5.3	Elementary Concept of Fuzzy Logic Graph Theory	1	0	0
5.4	Graphs, Sub graphs, Degree and Distance	2	1	0



5.5	Tree, cycles and Network,	2	1	0
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Practical/Projects/Assignments: -

1. Solve engineering case studies involving applications of differential calculus, including optimization, approximation, and curvature.
2. Analyze engineering problems using definite, double, and triple integrals for area, volume, and surface calculations.
3. Model and solve real-world engineering problems using ordinary differential equations.
4. Use matrix methods to solve systems of linear equations and determine eigenvalues, eigenvectors, and matrix inverses.
5. Apply Boolean algebra and graph theory to solve logic design, network, and connectivity problems using suitable software or analytical methods.

Suggested Readings: -

1. Ramana, B. V. (2006). *Higher engineering mathematics*. Tata McGraw-Hill. ISBN-10 007063419X
2. Grewal, B. S. (2014). *Higher engineering mathematics* (43rd ed.). Khanna Publication. ISBN-10 8174091955
3. Duffy, D. G. (2010). *Advanced engineering mathematics with MATLAB* (3rd ed.). CRC Press. III Edition ISBN-10 1439816247
4. Sastri, S. S. (2004). *Engineering mathematics*. Prentice-Hall of India. ISBN 8120308042
5. Arumugham, S. (2011). *Mathematics for engineers*. Scitech Publication. ISBN-10: 8183711359
6. Kreyszig, E. (2011). *Advanced engineering mathematics* (10th ed.). Wiley India ISBN-10 8126531355
7. Boyce, W. E., DiPrima, R. C., & Meade, D. B. (2021). *Elementary differential equations and boundary value problems* (12th ed.). John Wiley & Sons,
8. 2. Grewal, B. S. (2021). *Higher engineering mathematics* (44th ed.). Khanna Publishers.
9. 3. Kreyszig, E. (2020). *Advanced engineering mathematics* (10th ed., Wiley Precise Student ed.). John Wiley & Sons.
10. 4. Ramana, B. V. (2021). *Higher engineering mathematics* (11th ed.). McGraw-Hill Education.
11. 5. Thomas, G. B., Hass, J., Heil, C., & Weir, M. D. (2020). *Thomas' calculus* (14th ed.). Pearson.

E-Resources:

1. NPTEL – Mathematics I (Engineering Mathematics I)  [NPTEL Engineering Mathematics I – IIT Bombay](#)



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2. MIT OpenCourseWare – Single Variable Calculus MIT OCW – Single Variable Calculus (18.01) (ocw.mit.edu in) MIT OCW – Calculus I: Single Variable Calculus (2020) (ocw.mit.edu in)
3. Paul's Online Math Notes Paul's Online Math Notes – Lamar University (tutorial.math.lamar.edu in)
4. Khan Academy – Calculus Khan Academy – Calculus 1 Khan Academy – Calculus 2
5. Wolfram MathWorld Wolfram MathWorld – Comprehensive Math Encyclopedia

CO-PO Mapping

Course Outcome s	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13	PO 14	PO 15
CO1	3	-	2	-	-	-	-	3	-	-	-	-	2	-	2

Mapping Value: 3-Strong, 2-Moderate, 1-Weak



Course: 1B.Tech.(PP) 3				
ICCC-3: Basics of Electricals and Electronics Engineering				
Credit Details	Theory	Practical	Internal	Credits
Hours/Weightage	50	30	20	04

COURSE OBJECTIVES

1. Understand the fundamentals of electrical and electronic engineering.
2. Explain the operation of electrical circuits, transformers, and electrical machines.
3. Learn the basics of digital electronics and logic circuits.
4. Understand semiconductor devices and transistor applications.
5. Apply electrical and electronic concepts to engineering problems.

COURSE OUTCOMES

1. Analyze basic DC and AC electrical circuits.
2. Explain the operation and performance of transformers and electrical machines.
3. Apply digital electronics concepts using logic gates and flip-flops.
4. Analyze the characteristics of semiconductor devices and transistor circuits.
5. Perform basic testing and analysis of electrical and electronic circuits.

Unit 1	Electrical circuit analysis	L	T	P
1.1	Voltage and current sources, dependent and independent sources, source conversion	1	0	0
1.2	DC circuits analysis using mesh & nodal method, Thevenin's & superposition theorem	3	1	2



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1.3	star-delta transformation. 1-phase AC circuits under sinusoidal steady state, active, reactive and apparent power	2	1	0
1.4	physical meaning of reactive power, power factor	1	0	0
1.5	3-phase balanced and unbalanced supply, star and delta connections.	1	0	2
Unit 2	Transformers	L	T	P
2.1	Review of laws of electromagnetism, emf, flux, and their relation	1	0	0
2.2	Analysis of magnetic circuits	1	1	0
2.3	Single-phase transformer, basic concepts	1	0	0
2.4	Construction features, voltage, current	1	0	0
2.5	Impedance transformation, equivalent circuits, phasor diagram, voltage regulation, losses and efficiency, OC and SC test.	3	1	4
Unit 3	Rotating Electric machines	L	T	P
3.1	Constructional details of DC machine, induction machine and synchronous machine.	2	0	0
3.2	Working principle of 3-Phase induction motor	2	0	0
3.3	Emf equation of 3-Phase induction motor, Concept of slip in 3-Phase induction motor	1	1	0
3.4	Explanation of Torque-slip characteristics of 3-Phase induction motor	1	0	2
3.5	Classification of self-excited DC motor and generator.	2	0	2

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Unit 4	Binary Electronics	L	T	P
4.1	Number systems used in digital electronics, decimal, binary, octal, hexadecimal, their complements.	2	1	0
4.2	Operation and Conversion	1	0	0
4.3	floating point and signed numbers, Demorgan's theorem	2	1	0
4.4	AND, OR, NOT, NOR, NAND, EX-NOR, EX-OR gates and their representation	1	0	2
4.5	Truth table, half and full adder circuits, R-S flip flop, J-K flip flop.	2	0	2
Unit 5	Electronic Components and Circuits	L	T	P
5.1	Introduction to Semiconductors, Diodes, V-I characteristics.	2	0	2
5.2	Bipolar junction transistors (BJT) and their working, introduction to CC	2	0	0
5.3	CB & CE transistor configurations	2	0	2
5.4	Different configurations and modes of operation of BJT	1	0	0
5.5	DC biasing of BJT	1	1	0

Practical/Projects/Assignments: -

1. Verify basic electrical circuit theorems and measure AC/DC circuit parameters.
2. Perform transformer tests and determine efficiency and voltage regulation.
3. Study the characteristics of DC machines and three-phase induction motors.
4. Design and test basic digital logic circuits using logic gates and flip-flops.
5. Analyze semiconductor devices and simple rectifier, amplifier, and switching circuits.



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SUGGESTED READINGS

1. Alexander, C. K., & Sadiku, M. N. O. (2020). *Fundamentals of electric circuits* (7th ed.). McGraw Hill.
2. Bhattacharya, S. K. (2017). *Basic electrical and electronics engineering* (2nd ed.). Pearson Education.
3. Hughes, E., Hiley, J., Brown, K., & McKenzie, I. (2016). *Hughes electrical and electronic technology* (12th ed.). Pearson.
4. Kothari, D. P., & Nagrath, I. J. (2020). *Basic electrical and electronics engineering* (2nd ed.). McGraw Hill.
5. Muthusubramanian, R., & Salivahanan, S. (2025). *Basic electrical and electronics engineering* (2nd ed.). McGraw Hill.
6. Sahdev, S. K. (2017). *Basic electrical engineering*. Pearson Education.
7. Theraja, B. L., & Theraja, A. K. (2020). *A textbook of electrical technology: Volume I*. S. Chand Publishing.
8. Alexander, C. K., & Sadiku, M. N. O. (2020). *Fundamentals of electric circuits* (7th ed.). McGraw-Hill Education.
9. Kothari, D. P., & Nagrath, I. J. (2020). *Basic electrical and electronics engineering* (2nd ed.). McGraw-Hill Education.
10. Muthusubramanian, R., & Salivahanan, S. (2025). *Basic electrical and electronics engineering* (2nd ed.). McGraw-Hill Education.
11. Rizzoni, G., & Kearns, J. (2021). *Principles and applications of electrical engineering* (7th ed.). McGraw-Hill Education.
12. Theraja, B. L., & Theraja, A. K. (2020). *A textbook of electrical technology: Volume I* (Revised ed.). S. Chand Publishing.

E-Resources:

1. NPTEL – Basic Electrical Circuits [NPTEL Basic Electrical Circuits \(IIT Bombay\)](#)
2. All About Circuits Textbook [All About Circuits – Textbook](#)
3. Tinkercad Circuits Simulator [Tinkercad Circuits – Official Simulator](#)
4. CircuitLab Simulator [CircuitLab – Online Circuit Simulator](#)
5. Falstad Circuit Simulator [Falstad Circuit Simulator](#)

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	3	-	-	2	2	-	-	3	-	-	-	-	-	-	2

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C02	3	-	-	-	-	-	-	2	-	-	-	-	-	-	2
C03	3	-	2	2	2	-	-	2	-	-	-	-	-	-	2
C04	3	-	2	-	-	-	-	2	-	3	-	-	-	-	2
C05	3	-	-	-	-	-	-	2	-	-	-	-	-	-	2

Mapping Value: 3-Strong, 2-Moderate, 1-Weak

Authorized Signatory:
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Course: 1B.Tech.(PP) 4 1CCC-4: Basic Mechanical Engineering				
Credit Details	Theory	Practical	Internal	Credits
Hours/Weightage	50	30	20	04

COURSE OBJECTIVES

1. Understand the properties and applications of engineering materials.
2. Learn the principles of engineering measurements and manufacturing systems.
3. Understand the fundamentals of fluid mechanics and hydraulic machines.
4. Apply the basic principles of thermodynamics, boilers, and refrigeration systems.
5. Understand the working principles and performance of reciprocating machines and internal combustion engines.

COURSE OUTCOMES

1. Explain the properties, testing methods, and applications of engineering materials.
2. Use measuring instruments and describe basic manufacturing and automation systems.
3. Apply the principles of fluid mechanics to analyze fluid flow and hydraulic systems.
4. Explain thermodynamic laws and evaluate the performance of boilers and refrigeration systems.
5. Describe the working and performance characteristics of steam engines and internal combustion engines.

Unit 1	Engineering Materials	L	T	P
1.1	Engineering materials and their classification	1	0	0
1.2	Iron-Carbon Diagram, Properties of Engineering Material	1	0	0
1.3	Alloy steel and their applications	1	0	0



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1.4	Stress-strain diagram, hooks law and modulus of elasticity	1	1	0
1.5	Tensile, shear, hardness and fatigue testing of materials	1	0	2
Unit 2	Measurement	L	T	P
2.1	Temperature, pressure, velocity, flow, strain, force and torque measurement.	1	0	0
2.2	Concept of measurement error & uncertainly analysis	1	1	0
2.3	Measurement by Vernier caliper, micrometer, dial gauges, slip gauges, sine-bar and combination set	1	0	2
2.4	Introduction to lath, drilling, milling, and shaping machine	1	0	2
2.5	Introduction to NC/CNC/DNC, FMS, CAD/CAM, CIM and factory of future.	1	0	0

Unit 3	Fluid Mechanics	L	T	P
3.1	Importance of Fluid Mechanics, Fluid, Properties of fluids, density, specific weight, specific gravity, viscosity, vapor pressure, compressibility, static and kinetic energy,	1	0	0
3.2	Pressure at a point, pascal's law, and pressure variation with temperature, depth and altitude,	1	0	0
3.3	Classification of flows- steady and unsteady, uniform and non-uniform, laminar and turbulent, rotational and irrotational flows,	1	0	0

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3.4	Euler's equation, Continuity equation, Bernoulli's equation for incompressible fluids, Reynolds number and its significance, Working principle of fluid coupling, pumps, compressors, turbines, positive displacement machines and pneumatic machines	2	1	2
3.5	Hydraulic power & pumped storage plants for peak load management as compared to base load plants.	1	0	0

Unit 4	Thermodynamics	L	T	P
4.1	Basic concepts, Heat transfer basics, zeroth law of thermodynamics, first and second law of thermodynamics;	1	1	0
4.2	Steam properties, steam processes at constant pressure, volume,	1	1	0
4.3	Enthalpy & entropy, classification and working of boilers,	1	0	2
4.4	Refrigeration, vapor absorption & compression cycles,	1	0	2
4.5	Coefficient of performance (COP), refrigerant properties & ecofriendly refrigerants	1	1	0

Unit 5	Reciprocating Machines	L	T	P
5.1	Carnot cycle and ideal efficiency	1	0	0
5.2	Otto and diesel cycles	1	1	0
5.3	Working of two stroke & four stroke engines	1	1	0
5.4	Petrol & diesel IC engines	1	0	2
5.5	Air pollution due to I C Engines.	1	0	0

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Practical/Projects/Assignments

1. Perform material testing to determine tensile strength, hardness, and other mechanical properties of engineering materials.
2. Practice precision measurements using Vernier caliper, micrometer, dial gauge, slip gauge, and sine bar, and prepare a measurement report.
3. Conduct fluid mechanics experiments such as Bernoulli's theorem and flow measurement using Venturi and Orifice meters.
4. Study the operation and performance of boilers, refrigeration systems, and determine the Coefficient of Performance (COP) of a refrigeration unit.
5. Analyze the performance of internal combustion engines by measuring brake horsepower and evaluating exhaust gas emissions using suitable instruments.

Suggested Readings

1. Narula, G., Narula, K., & Gupta, V. (2001). *Material science* (1st ed.). Tata McGraw-Hill.
2. Agrawal, B. (2008). *Basic mechanical engineering*. Wiley India.
3. Nag, P. K., & Tripathi, S. (2016). *Basic mechanical engineering*. Tata McGraw-Hill.
4. Rajput, R. K. (2007). *Basic mechanical engineering* (4th ed.). Laxmi Publications.
5. Sawhney, G. S. (2015). *Fundamentals of mechanical engineering* (3rd ed.). PHI Learning.
6. Nakra, B. C., & Chaudhry, K. K. (2016). *Instrumentation, measurement & analysis* (4th ed.). Tata McGraw-Hill.
7. Nag, P. K. (2013). *Engineering thermodynamics* (5th ed.). Tata McGraw-Hill.
8. Ganesan, V. (2012). *Internal combustion engines* (4th ed.). Tata McGraw-Hill.
9. Rao, P. N. (2013). *Manufacturing technology* (3rd ed.). Tata McGraw-Hill.
10. John, K. C. (2013). *Mechanical workshop practice* (2nd ed.). PHI Learning.
11. Cengel, Y. A., & Cimbala, J. M. (2025). *Fluid mechanics: Fundamentals and applications* (5th ed.). McGraw-Hill Education.
12. Nag, P. K., & Tripathi, S. (2021). *Basic mechanical engineering* (3rd ed.). McGraw-Hill Education.
13. Rajput, R. K. (2020). *Basic mechanical engineering* (5th ed.). Laxmi Publications.
14. Sawhney, G. S. (2021). *Fundamentals of mechanical engineering* (4th ed.). PHI Learning.
15. Shigley, J. E., Budynas, R. G., & Nisbett, J. K. (2020). *Mechanical engineering design* (11th ed.). McGraw-Hill Education.



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E-Resources:

1. NPTEL – Basic Mechanical Engineering  [NPTEL Basic Mechanical Engineering \(IIT Bombay\)](#)
2. Coursera – Introduction to Thermodynamics  Coursera – Introduction to Thermodynamics: Transferring Energy from Here to There (University of Michigan) ([coursera.org in](#))
3. Engineering Toolbox  [Engineering Toolbox – Mechanical & Thermodynamics Resources](#)
4. MIT OpenCourseWare – Thermodynamics  MIT OCW – Thermodynamics & Kinetics (5.60) ([ocw.mit.edu in](#))  MIT OCW – Thermodynamics & Propulsion (16.06) ([ocw.mit.edu in](#))
5. SimScale – Engineering Simulations  [SimScale – Cloud-Based Engineering Simulation Platform](#)

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	3	1	2	1	1	2	1	3	1	1	1	1	2	1	2
CO2	3	2	1	2	3	1	1	1	1	3	2	1	1	1	2
CO3	3	1	3	2	2	1	2	2	1	1	1	1	1	1	2
CO4	3	1	2	3	2	1	1	3	1	1	1	1	1	1	2
CO5	3	1	1	2	2	2	2	2	2	1	1	1	1	1	3

Mapping Value: 3-Strong, 2-Moderate, 1-Weak

Authorized Signatory:

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Course: 1B.Tech.(PP) 5 1AECC-1: Communicative English				
Credit Details	Theory	Practical	Internal	Credits
Hours/Weightage	40	00	10	02

COURSE OBJECTIVES

1. To improve basic Grammar and essential of language skill.
2. To train to identify the nuances of Phonetics, intonation and enhance pronunciation skills.
3. To enable students to practice modern usage of English as it is spoken and written today with speech practice, reading passages and comprehension.
4. To enhance with English vocabulary and Language Proficiency.
5. To enable students to acquire a basic knowledge of phonetics required for effective communication.

COURSE OUTCOMES

1. Use Grammatical English and essentials of language skills and identify the numbers of phonetic s, intonation and flawless pronunciation.
2. Implement English Vocabulary at command and Language Proficiency.
3. Identify common error in Spoken and Written Communication
4. Understand and Improve the Nonverbal Communication and Kinesics.
5. Perform well in campus recruitment, engineering and all other general competitive examination.

Unit 1	Introduction To Sentence and Grammar	L	T	P
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1.1	Sentences: Simple, Compound, Complex, Assertive, Interrogative, Imperative, And Exclamatory. (Lecture, Practical),	1	0	1
1.2	Clauses: Co-ordinate, Sub-ordinate, Relative, Adverb, Comparative (Adverb + Adjective) Articles: Usage of 'A', 'AN', 'THE' Preposition: (Lecture, Practical)	1	0	1
1.3	Position of Prepositions, Place Relations Time Relations and other relations. (Lecture, Practical)	1	0	1
1.4	Basic English Grammar and Part of Speech- Noun, Pronoun (Lecture, Practical),	1	0	1
1.5	Adjective, Verbs, Adverbs, Preposition, Articles, Conjunctions. (Lecture, Practical),	1	0	1

Unit 2	Tenses	L	T	P
2.1	The Sequence of Tenses, Tenses: Simple Present (Lecture, Practical)	1	0	1
2.2	Progressive Perfect (Lecture, Practical)	1	0	1
2.3	Present Perfect Progressive along-with Past Tense (Lecture, Practical)	1	0	1



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2.4	indications of futurity, Reported speech Modals (Will, Shall, Would and Other) (Lecture, Practical)	1	0	1
2.5	Voice: Active and Passive (Lecture, Practical)	1	0	1

Unit 3	Introduction to listening Skills and Phonetics	L	T	P
3.1	Introduction to Phonetics, Sound Mispronounced, Silent and non-silent letter (Lecture, Practical)	1	0	1
3.2	Homonyms, Aspiration, Pronunciation of The, word ending age, some Plural forms. (Lecture, Practical)	1	0	1
3.3	Articles: Use of articles-Indefinite a Definite Articles	1	0	0
3.4	Speech Sound: Vowels and Consonants: Exercises on it, Propositions Kind of Proposition and Prepositions often Confused. (Lecture, Practical)	1	0	1
3.5	Word Accent - Rules for Word Accent, Stress Shift, Question Tags, and Question Tags for Assertive Sentences and One-word Substitutes and Exercises. (Lecture, Practical)	1	0	1

Unit 4	Comprehension of Unseen Passage, Vocabulary and Speaking Skills	L	T	P
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4.1	Short answer type questions to test understanding of the passage. (Lecture, Practical)	1	0	1
4.2	Usage of Dictionary and Thesaurus, Diction - Words meaning and Usage (Lecture, Practical)	1	0	1
4.3	Spelling rules, Verb patterns, Idioms and Phrases, Common error in Spellings and Sentences (Lecture, Practical)	1	0	1
4.4	Words formation, Strong and Weak forms of words, Extempore and Public Speaking (Lecture, Practical)	1	0	1
4.5	Information Transfer, Listening Comprehension, Common Errors in Pronunciation (Lecture, Practical)	1	0	1

Unit 5	Paragraph Writing	L	T	P
5.1	Paragraph writing based on expansion of given ideas Note taking /Note making (Lecture, Practical)	1	0	1
5.2	Introducing one self and others, Letter Formats & writing (Lecture, Practical)	1	0	1
5.3	Dialogue speaking and writing in different situations (Lecture, Practical)	1	0	1

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5.4	Developing ability of questioning and answering in a discourse (Lecture, Practical)	1	0	1
5.5	Practice of Introducing to an Interview board, Emergence of new English's (Lecture, Practical)	1	0	1

Practical/Projects/Assignments: -

1. Grammar and Vocabulary Exercises: Practice sentence construction, error correction, synonyms, antonyms, idioms, and vocabulary-building activities.
2. Listening and Pronunciation Practice: Perform exercises on phonetics, stress, intonation, listening comprehension, and pronunciation using audio-visual resources.
3. Reading and Speaking Activities: Analyze unseen passages, participate in group discussions, extempore speeches, role plays, and oral presentations.
4. Professional Writing Tasks: Prepare paragraphs, letters, emails, resumes, cover letters, and dialogue-based communication for academic and professional purposes.
5. Communication Skills Project: Deliver an individual presentation and participate in a mock interview or group discussion demonstrating verbal, non-verbal, and interpersonal communication skills.

Suggested Readings

1. Sharma, R. C. (n.d.). Business correspondence and report writing. Tata McGraw-Hill.
2. Allen, W. S. (n.d.). Living English structure. Longmans.
3. Ehrlich, E. (n.d.). English grammar. McGraw-Hill Education.
4. Bansal, R. K., & Harrison, J. B. (n.d.). Spoken English for India. Orient Longman.
5. Jones, L., & Alexander, R. (n.d.). New international business English. Oxford University Press.
6. Rizvi, M. A. (n.d.). Effective technical communication. Tata McGraw-Hill.

E-Resources:

1. BBC Learning English  BBC Learning English – Official Site (bbc.co.uk/in)



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2. SWAYAM – Technical English for Engineers SWAYAM – Technical English for Engineers Course (swayam.gov.in)
3. Purdue Online Writing Lab (OWL) Purdue OWL – Writing Resources
4. British Council – English Online British Council English Online (englishonline.britishcouncil.org)
5. Cambridge English Learning Resources Cambridge English Learning Resources (cambridgeenglish.org)

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	3	2	2	1	1	2	1	2	3	2	2	1	2	1	2
CO2	2	3	1	1	2	1	2	1	2	3	2	2	1	2	3
CO3	2	2	3	2	2	1	1	1	2	2	3	1	2	2	2
CO4	1	2	2	2	2	3	2	2	1	2	1	3	2	1	2
CO5	2	2	1	2	2	1	3	2	2	2	3	2	1	3	3

Mapping Value: 3-Strong, 2-Moderate, 1-Weak

Authorized Signatory:

HOD NMT



Course: 1B.Tech.(PP) 6

1AUD-1: Bridge Mathematics Course

Credit Details	Theory	Practical	Internal	Credits
Hours	40	-	-	-

COURSE OBJECTIVES

1. Develop a strong foundation in algebra, functions, and differential calculus.
2. Understand trigonometric concepts and their engineering applications.
3. Apply coordinate geometry and vector algebra to solve engineering problems.
4. Learn the fundamentals of limits, differentiation, and integration for engineering applications.
5. Apply statistical methods and probability concepts for engineering data analysis and quality control.

COURSE OUTCOMES

1. Solve algebraic equations and apply differential calculus to basic engineering problems.
2. Apply trigonometric identities and formulas to solve engineering and geometrical problems.
3. Use coordinate geometry and vector operations for engineering calculations and graphical analysis.
4. Apply limits, differentiation, and integration techniques to solve engineering and scientific problems.
5. Analyze engineering data using statistical measures, probability concepts, and quality control techniques.

Unit 1	Fundamentals of Matrices & Determinants	L	T	P
1.1	Overview	1	0	0
1.2	Types of matrices, addition, subtraction, and scalar multiplication.	2	0	0



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Unit 1	Fundamentals of Matrices & Determinants	L	T	P
1.3	Matrix multiplication.	1	0	0
1.4	Determinants of order 2 and 3, properties of determinants.	1	0	0
1.5	Solving linear equations using Cramer's rule.	1	2	0

Unit 2	Set Theory & Basics of Logic	L	T	P
2.1	Overview	1	0	0
2.2	Sets, subsets, union, intersection difference	2	0	0
2.3	Venn diagrams.	1	0	0
2.4	Basic propositional logic: AND, OR, NOT operations	1	2	0
2.5	Truth tables	1	0	0

Unit 3	Basics of Differential Calculus	L	T	P
3.1	Overview	1	0	0
3.2	Concept of limits and continuity, standard limits.	1	0	0
3.3	Differentiation from first principles	1	0	0



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3.4	Basic rules of differentiation (sum, difference)	1	1	0
3.5	Basic rules of differentiation (product, quotient, and chain rule).	1	1	0

Unit 4	Basics of Integral Calculus	L	T	P
4.1	Integration as the inverse process of differentiation.	1	1	0
4.2	Standard integration formulas (algebraic).	1	1	0
4.3	Standard integration formulas (trigonometric).	1	0	0
4.4	introduction to definite integrals.	1	0	0
4.5	introduction to definite integrals and finding simple areas.	1	0	0

Unit 5	Introduction to Differential Equations	L	T	P
5.1	Overview	1	0	0
5.2	Definition of order and degree of a differential equation.	1	0	0
5.3	Formation of simple differential equations.	1	1	0
5.4	Solving basic first-order, first-degree differential equations by the variable separable method.	1	0	0

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5.5	Understanding the use in Printing and packaging Industry	1	1	0
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Practical/Projects/Assignments: -

1. Solve practice problems on linear equations, quadratic equations, functions, and graphs.
2. Practice trigonometric identities and solve simple engineering-related trigonometry problems.
3. Solve numerical problems on coordinate geometry, vectors, and basic calculus (limits, differentiation, and integration).
4. Perform simple statistical calculations such as mean, median, mode, standard deviation, and probability using sample data.
5. Complete assignment sheets on mathematical applications in Printing and Packaging Engineering, such as basic dimension calculations and data interpretation.

Suggested Readings: -

1. Grewal, B. S. (2017). *Higher engineering mathematics*. Khanna Publishers.
2. Kreyszig, E. (2011). *Advanced engineering mathematics*. Wiley.
3. Bali, N. P., & Goyal, M. (2011). *Engineering mathematics*. Laxmi Publications.
4. AICTE Prescribed Engineering Mathematics Textbooks.
5. Bali, N. P., & Goyal, M. (2020). A textbook of engineering mathematics (10th ed.). Laxmi Publications.
6. Grewal, B. S. (2021). *Higher engineering mathematics* (44th ed.). Khanna Publishers.
7. Larson, R., & Edwards, B. (2021). *Calculus: Early transcendental functions* (7th ed.). Cengage Learning.
8. Stewart, J. (2020). *Calculus: Early transcendentals* (9th ed.). Cengage Learning.
9. Thomas, G. B., Hass, J., Heil, C., & Weir, M. D. (2020). *Thomas' calculus* (14th ed.). Pearson.

E-Resources:

1. Paul's Online Math Notes ➡ Paul's Online Math Notes – Lamar University (tutorial.math.lamar.edu in)
2. Symbolab Math Solver ➡ Symbolab – Math Solver
3. MIT OpenCourseWare – Single Variable Calculus (18.01) ➡ MIT OCW – Calculus I (ocw.mit.edu in)
4. Desmos Graphing Calculator ➡ Desmos – Online Graphing Calculator

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CO-PO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	3	-	2	-	-	-	-	3	-	-	-	-	2	-	2
CO2	3	-	2	-	-	-	-	3	-	-	-	-	2	-	3
CO3	3	-	3	2	-	-	-	3	-	-	-	-	2	-	3
CO4	3	-	3	2	-	-	-	3	-	-	-	-	2	-	3
CO5	3	2	3	2	3	-	-	3	-	2	-	-	3	-	3

Mapping Value: 3-Strong, 2-Moderate, 1-Weak



Course: 1B.Tech.(PP) 7 OE-1: Introduction to Python Programming				
Credit Details	Theory	Practical	Internal	Credits
Hours/Weightage	40	00	10	03

COURSE OBJECTIVES

1. Explain Python fundamentals, syntax, variables, operators, and input/output operations.
2. Develop Python programs using decision-making statements and looping constructs.
3. Implement modular programming using functions, strings, lists, tuples, dictionaries, and sets.
4. Apply file handling, exception handling, and modules to develop reliable Python applications.
5. Design and implement simple real-world Python programs using object-oriented programming concepts.

COURSE OUTCOMES

1. Apply computational thinking to solve basic programming problems.
2. Develop logical and analytical skills through Python programming.
3. Design efficient, readable, and reusable Python programs.
4. Use modern programming tools and libraries for application development.
5. Demonstrate ethical programming practices, teamwork, and lifelong learning.

Unit 1	Introduction to Python Language	L	T	P
1.1	Introduction to Programming and Python (Class room lecture, Video Demonstration and PPT)	1	0	0



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1.2	Installing Python and IDEs (IDLE, VS Code) (Class room lecture, Video Demonstration and PPT)	1	0	1
1.3	Variables, Data Types and Type Conversion (Class room lecture and PPT)	1	0	1
1.4	Input/Output Statements and Operators (Class room lecture, Video Demonstration and PPT)	1	0	1
1.5	Expressions and Basic Programming Examples (Class room lecture, Video demonstration and PPT)	1	0	1

Unit 2	Control Structures	L	T	P
2.1	Conditional Statements (if, if-else, nested if) (Class room lecture and PPT)	1	0	1
2.2	Looping Statements (for, while) (Class room lecture, demonstration and PPT)	1	0	1
2.3	Break, Continue and Pass Statements (Class room lecture and demonstration)	1	0	1
2.4	Range Function (Class room lecture, demonstration and PPT)	1	0	0
2.5	Pattern Programs and Number-based Problems (Class room lecture, demonstration and PPT)	1	0	1

Unit 3	Functions and Data Structures	L	T	P
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3.1	User-defined Functions and Built-in Functions (Class room lecture, demonstration and PPT)	1	0	1
3.2	Strings and String Operations (Class room lecture, demonstration and PPT)	1	0	1
3.3	Lists and List Methods (Class room lecture, demonstration and PPT)	1	0	1
3.4	Tuples, Sets and Dictionaries (Class room lecture, demonstration and PPT)	1	0	1
3.5	Basic Searching and Sorting Techniques (Class room lecture, demonstration and PPT)	1	0	1

Unit 4	File Handling and Modules	L	T	P
4.1	File Handling (Read, Write, Append) (Class room lecture, demonstration and PPT)	1	0	1
4.2	Exception Handling (try, except, finally) (Class room lecture, demonstration and PPT)	1	0	1
4.3	Python Modules and Packages Tracks, Video Effects and their applications (Class room lecture, demonstration and PPT)	1	0	0
4.4	Date and Time Module (Class room lecture, demonstration and PPT)	1	0	1
4.5	Math and Random Modules (Class room lecture, demonstration and PPT)	1	0	1

Unit 5	Object-Oriented Programming	L	T	P
5.1	Classes and Objects (Class room lecture, PPT, demonstration and assignments)	1	0	1

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5.2	Constructors and Methods (Class room lecture, demonstration and assignments)	1	0	1
5.3	Inheritance (Class room lecture, PPT, demonstration and assignments)	1	0	1
5.4	Polymorphism (Class room lecture, PPT, demonstration and assignments)	1	0	1
5.5	Mini Python Application Development (Class room lecture, PPT, demonstration and assignments)	1	0	2

Practical/Projects/Assignments:

1. Develop Python programs using variables, operators, decision-making, and looping statements.
2. Implement programs using functions, strings, lists, tuples, dictionaries, and sets.
3. Create applications using file handling, exception handling, and Python modules.
4. Design object-oriented programs using classes, objects, inheritance, and polymorphism.
5. Develop a mini-Python application (e.g., Student Record System, Library Management System, Calculator, Inventory Management, or Printing & Packaging Utility).

Suggested Readings

1. Thareja, R. (2025). *Python programming using problem solving approach* (3rd ed.). Oxford University Press India.
2. Mehta, A., & Gurbani, K. (2025). *Python programming*. Himalaya Publishing House.
3. Jacob, J. E., & Viswam, B. S. (2024). *Python programming* (2nd ed.). S.K. Kataria & Sons.
4. Mehra, R. (2025). *Python programming*. Cengage India.
5. Rao, R. N. (2024). *Core Python programming* (Reprint ed.). Dreamtech Press.

E-Resources:

1. Python Official Documentation
<https://www.python.org/>

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2. NPTEL Online Courses

https://nptel.ac.in/?utm_source

3. SWAYAM Portal

https://swayam.gov.in/?utm_source

4. GeeksforGeeks Python Tutorials

<https://www.geeksforgeeks.org/python/python-programming-language-tutorial/>

5. TutorialsPoint Python Tutorial

https://www.tutorialspoint.com/python/index.htm?utm_source

CO-PO Mapping Matrix

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

Authorized Signatory:

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Course: 2B. Tech (PP) 1 2CCC-5: Engineering Physics				
Credit Details	Theory	Practical	Internal	Credits
Hours/Weightage	50	30	20	04

COURSE OBJECTIVES

1. Understand the fundamentals of quantum physics and wave mechanics.
2. Learn the principles of wave optics and optical phenomena.
3. Understand the basic concepts and applications of nuclear physics.
4. Explore the properties of solid-state materials and semiconductor devices.
5. Understand the principles, working, and applications of lasers and optical fibres.

COURSE OUTCOMES

1. Explain the principles of quantum physics and solve basic quantum mechanical problems.
2. Apply the concepts of interference, diffraction, and polarization in optical systems.
3. Describe nuclear models, radiation detection techniques, and particle accelerators.
4. Explain the properties of semiconductors, superconductors, and dielectric materials for engineering applications.
5. Describe the working principles and applications of lasers and optical fibre communication systems.

Unit 1	Quantum Physics	L	T	P
1.1	Group and particle velocities & their relationship.	1	0	0
1.2	Uncertainty principle with elementary proof and applications, determination of position of a particle by a microscope, nonexistence of electron in nucleus, diffraction of an electron beam by a single slit.	1	1	0



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1.3	Compton scattering, Wave function and its properties, energy and momentum operators	1	0	0
1.4	Time dependent and time independent Schrödinger wave equation	1	1	0
1.5	Application of time independent Schrödinger wave equation to particle trapped in a one-dimensional square potential well (derivation of energy eigenvalues and wave function)	1	1	0

Unit 2	Wave Optics	L	T	P
2.1	Interference: Fresnel's Biprism	1	0	2
2.2	Interference from a wedge-shaped thin film	1	0	0
2.3	Interference in thin films (due to reflected and transmitted light), Newton's rings and Michelson's interferometer experiments and their applications. Diffraction at single slit, double slit and n-slits (diffraction grating)	1	0	2
2.4	Resolving power of grating and prism. Concept of polarized light, Brewster's laws	1	0	0
2.5	Double refraction, Nicol prism, quarter & half wave plate.	1	0	2

Unit 3	Nuclear Physics	L	T	P
3.1	Nuclear liquid drop model (semi empirical mass formula), nuclear shell model.	1	0	0



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3.2	Linear Particle accelerators: Cyclotron, general description of Synchrotron	1	0	0
3.3	Synchrocyclotron and Betatron. Geiger- Muller Counter	1	0	0
3.4	Motion of charged particles in crossed electric and magnetic fields	1	1	0
3.5	Uses of Bainbridge and Auston mass Spectrographs.	1	0	0

Unit 4	Solid State Physics	L	T	P
4.1	Qualitative discussion of Kronig-Penny model (no derivation).	1	0	0
4.2	Effective mass, Fermi-Dirac statistical distribution function	2	0	0
4.3	Fermi level for Intrinsic and Extrinsic Semiconductors, Zener diode, tunnel diode	1	0	2
4.4	Photodiode, solar-cells, Hall effect. Superconductivity: Meissner effect, Type I and Type II superconductors	1	0	2
4.5	Di-electric polarization, Complex permittivity, dielectric losses	1	0	0

Unit 5	Laser and Fibre Optics	L	T	P
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5.1	Laser: Stimulated and spontaneous processes, Einstein's A & B Coefficients, transition probabilities, active medium.	1	0	0
5.2	population inversion, pumping, Optical resonators, and characteristics of laser beam	1	0	0
5.3	Coherence, directionality and divergence. Principles and working of Ruby, Nd-YAG, He-Ne & Carbon dioxide Lasers with energy level diagram	1	0	2
5.4	Fundamental idea about optical fibre, types of fibres, acceptance angle & cone, numerical aperture, V-number, propagation of light through step index fibre (Ray theory) pulse dispersion	1	1	2
5.5	Attenuation, losses & various uses. Applications of lasers and optical fibers.	1	0	0

Practical/Projects/Assignments: -

1. Perform optical experiments using Fresnel's biprism, Newton's rings, Michelson interferometer, and diffraction grating to study interference and diffraction phenomena.
2. Conduct experiments to determine the refractive index, wavelength of light, resolving power, Brewster's angle, and polarization characteristics of optical elements.
3. Study semiconductor devices by determining the energy band gap, Hall coefficient, solar cell characteristics, and the operation of diodes and transistors.
4. Perform laser and optical fibre experiments to determine numerical aperture, beam divergence, slit width, and fibre transmission characteristics.
5. Prepare a case study or seminar on modern applications of quantum physics, nuclear physics, lasers, optical fibres, or semiconductor materials in printing, packaging, communication, and industrial technologies.

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Suggested Readings: -

1. Ghatak, A. (2016). *Optics* (6th ed.). McGraw Hill Education.
2. Rajendran, V. (2010). *Engineering Physics*. Tata McGraw-Hill Education.
3. Subrahmaniyam, N., Lal, B., & Avadhanulu, M. N. (2006). *A textbook of optics* (23rd ed.). S. Chand Publishing.
4. Avadhanulu, M. N. (2010). *A textbook of engineering physics*. S. Chand Publishing.
5. Subrahmaniyam, N., Lal, B., & JivanSeshan, P. S. (2007). *Atomic and nuclear physics*. S. Chand Publishing.
6. Beiser, A., Mahajan, S., & Choudhury, S. R. (2015). *Concepts of modern physics* (7th ed.). McGraw Hill Education.
7. Kittel, C. (2012). *Introduction to solid state physics* (8th ed.). Wiley India.
8. Halliday, D., Resnick, R., & Walker, J. (2002). *Fundamentals of physics* (6th ed.). Wiley.
9. Avadhanulu, M. N., & Kshirsagar, P. G. (2022). *A textbook of engineering physics* (11th ed.). S. Chand Publishing.
10. Beiser, A., Mahajan, S., & Choudhury, S. R. (2020). *Concepts of modern physics* (7th ed.). McGraw-Hill Education.
11. Ghatak, A. (2020). *Optics* (7th ed.). McGraw-Hill Education.
12. Halliday, D., Resnick, R., & Walker, J. (2021). *Fundamentals of physics* (12th ed.). John Wiley & Sons.
13. Serway, R. A., & Jewett, J. W. (2020). *Physics for scientists and engineers with modern physics* (10th ed.). Cengage Learning.

E-Resources:

1. NPTEL – Engineering Physics  [NPTEL Engineering Physics \(IIT Bombay\)](#)
2. PhET Interactive Physics Simulations  PhET Interactive Simulations – University of Colorado Boulder (phet.colorado.edu in)
3. HyperPhysics (Georgia State University)  HyperPhysics – Concept Map Based Physics Resource (hyperphysics.phy-astr.gsu.edu in)
4. MIT OpenCourseWare – Physics  [MIT OCW Physics Courses Overview](#)  Example: MIT OCW – Physics I: Classical Mechanics (8.01) (ocw.mit.edu in)
5. LibreTexts Physics  [Physics LibreTexts – Open Access Textbooks](#)

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CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	3	-	2	-	-	-	-	3	-	-	-	-	2	-	2
CO2	3	-	2	2	-	-	-	2	-	2	-	-	-	-	2
CO3	3	-	3	-	-	2	-	2	-	-	-	-	-	-	2
CO4	3	-	2	3	2	-	-	2	-	2	-	-	-	-	2
CO5	3	2	2	-	-	-	-	2	-	2	-	-	-	-	3

Mapping Value: 3-Strong, 2-Moderate, 1-Weak



Course: 2B. Tech (PP) 2 2CCC-6: Engineering Graphics				
Credit Details	Theory	Practical	Internal	Credits
Hours/Weightage	50	30	20	04

COURSE OBJECTIVES

1. Understand the fundamentals of engineering drawing, scales, and engineering curves.
2. Learn the principles of orthographic projections of points, lines, and planes.
3. Develop the skills to draw projections of engineering solids.
4. Understand sectional views and surface development of engineering solids.
5. Create isometric drawings and computer-aided drafting (CAD) models.

COURSE OUTCOMES

1. Apply engineering drawing standards, scales, and geometric constructions to technical drawings.
2. Construct orthographic projections of points, lines, planes, and engineering components.
3. Draw projections of solids in different positions using standard projection methods.
4. Prepare sectional views and surface developments of engineering solids for manufacturing applications.
5. Create isometric drawings and basic CAD models using standard drafting and editing commands.

Unit 1	Fundamentals of Engineering Drawing, Scales and Curves	L	T	P
1.1	Introduction to engineering drawing: Drawing instruments and accessories,	1	0	1
1.2	Types of line, lettering, practice and rules of dimensioning, geometrical constructions, basic geometrical shapes;	1	0	1



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1.3	Scales: Types of scales, units of length and their conversion, construction of scales, plain scale, diagonal scale	1	0	2
1.4	Curves used in engineering practice and their constructions; Conic sections, construction of ellipse, parabola and hyperbola	1	0	2
1.5	Special curves, construction of cycloid, epicycloids, hypocycloid and involutes	1	0	2

Unit 2	Orthographic Projections, Projection of Points, Lines and Planes	L	T	P
2.1	Orthographic projection: Principles of orthographic projections, conventions, first and third angle projections,	1	0	1
2.2	Projection of points, projection of lines, lines inclined to single plane	1	0	2
2.3	Lines inclined to both the planes, true lengths and traces;	1	1	2
2.4	Projection of planes: Projection of regular planes, planes inclined to one plane,	1	0	2
2.5	Planes inclined to both planes, projection of planes by auxiliary plane projection method.	1	1	2



Unit 3	Projections of Solids	L	T	P
3.1	Projection of solids: Projections of regular solid,	1	0	1
3.2	Prisms, cylinders, pyramids, cones.	1	0	2
3.3	Solids inclined to one plane,	1	0	2
3.4	Solids inclined to both planes	1	1	2
3.5	Projection of solid by auxiliary plane projection method	1	0	2

Unit 4	Sections of Solids & Development of Surfaces	L	T	P
4.1	Sectional Views of Right Regular Solids,	1	0	2
4.2	Prisms, cylinders, pyramids and cones;	1	0	2
4.3	Solids inclined to one plane, solids inclined to both planes, projection of solid by auxiliary plane projection method (Lecture, Discussion)	1	1	2
4.4	Development of surfaces: Development of lateral surface of right regular solids, (Lecture, Discussion)	1	0	2
4.5	Prisms, cylinders, pyramids and cones; (Lecture, Discussion)	1	0	2

Unit 5	Isometric Projections & CAD	L	T	P
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5.1	Isometric projections: Principle of isometric projection, isometric scale and isometric views,	1	0	2
5.2	Isometric projections of planes, prisms, cylinders, pyramids, and cones.	1	0	2
5.3	Computer Aided Drafting (CAD): Introduction, benefit,	1	0	1
5.4	Software's basic commands of drafting entities like line, circle, polygon, polyhedron, cylinders	1	0	2
5.5	Transformations and editing commands like move, rotate, mirror, array; solution of projection problems on CAD.	1	0	2

Practical/Projects/Assignments: -

1. Prepare engineering drawing sheets on geometric constructions, scales, conic sections, and engineering curves using standard drawing instruments.
2. Draw orthographic projections of points, lines, planes, and solids in different orientations using first-angle projection.
3. Develop sectional views and surface developments of prisms, pyramids, cylinders, and cones through manual drafting.
4. Create isometric views of engineering objects and convert orthographic drawings into isometric projections.
5. Develop CAD drawings using AutoCAD or equivalent software by applying basic drawing, editing, transformation, dimensioning, and plotting commands.

Suggested Readings: -

1. VTU. (2007). Computer Aided Engg drawing (3rd ed.). I K International Publishing House.
2. Bhatt, N. D. (2014). Engineering Drawing (53rd ed.). Charotar Publishing House.
3. Venugopal, K. (2015). Engineering Graphics. New Age International Publishers.
4. John, K. C. (2009). Engg. Graphics for Degree (1st ed.). PHI.
5. Gill, P. S. (2013). Engineering Drawing. S.K. Kataria & Sons.
6. Jeyapoovan, T. (2010). Engineering drawing & Graphics Using AutoCAD (3rd ed.). Vikas Publishing House.
7. Agrawal, B., & Agrawal, C. M. (2013). Engineering Drawing (2nd ed.). TMH.
8. Shah, M. B., & Rana, B. C. (2009). Engg. drawing (2nd ed.). Pearson Education.

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9. Luzadder, W. J., & Duff, J. M. Fundamental of Engg Drawing. PHI.
10. Jolhe, D. (2007). Engg. Drawing with an Introduction to AutoCAD. TMH.
11. Narayana, K. L. (2013). Engineering Drawing. Scitech Publications (India).
12. Agrawal, B., & Agrawal, C. M. (2020). Engineering drawing (3rd ed.). McGraw-Hill Education.
13. Bhatt, N. D. (2023). Engineering drawing (54th ed.). Charotar Publishing House.
14. Gill, P. S. (2021). Engineering drawing (Revised ed.). S. K. Kataria & Sons.
15. Jeyapooan, T. (2020). Engineering graphics using AutoCAD (4th ed.). Vikas Publishing House.
16. Venugopal, K. (2020). Engineering graphics (Revised ed.). New Age International Publishers.

E-Resources

1. NPTEL – Engineering Graphics and Drawing [NPTEL Engineering Graphics and Drawing \(IIT Bombay\)](#)
2. Autodesk Student Portal & Tutorials Autodesk Education Community – Free Student Software ([autodesk.com in](#)) [Autodesk Tutorials & Learning Resources](#)
3. CADTutor Web Resources [CADTutor – AutoCAD Tutorials, Tips & Forums](#)
4. Onshape Free CAD for Education [Onshape Education – Free CAD Platform](#)
5. GrabCAD Community Tutorials [GrabCAD Tutorials & Resources](#)

CO-PO Mapping

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	3	-	2	-	-	-	-	3	-	-	-	-	2	-	2
CO2	3	-	3	2	-	-	-	3	-	-	-	-	1	-	2
CO3	3	-	3	3	2	-	-	3	-	-	-	-	1	-	2
CO4	3	-	3	3	2	2	-	3	-	-	-	-	2	-	2
CO5	3	-	3	3	2	-	-	3	-	3	2	-	2	-	3

Mapping Value: 3-Strong, 2-Moderate, 1-Weak

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Course: 2B. Tech (PP) 3
2CCC-7: Electronics for AI and Robotics

Credit Details	Theory	Practical	Internal	Credits
Hours/Weightage	50	30	20	04

COURSE OBJECTIVES

1. Understand the fundamentals of electronics, AI, and robotics systems.
2. Learn the working principles of analog and digital electronic circuits.
3. Understand the operation of sensors, actuators, and embedded systems used in intelligent devices.
4. Develop simple AI and robotics applications using Arduino, ESP32, and IoT technologies.
5. Apply electronics and AI concepts to solve basic engineering and automation problems.

COURSE OUTCOMES

1. Explain the fundamentals of electronics, AI, and robotic systems.
2. Analyze basic analog and digital electronic circuits used in automation.
3. Interface sensors and actuators with embedded platforms for intelligent applications.
4. Develop simple IoT and AI-enabled robotic systems using Arduino or ESP32.
5. Apply AI, robotics, and smart electronics concepts to engineering and industrial applications.

Unit 1	Introduction to AI, Electronics and Passive Components	L	T	P
1.1	Introduction to AI and its Engineering Applications	1	0	0
1.2	Predictive, Generative, Agentic and Multimodal AI	1	1	0
1.3	Robotics and Intelligent Systems	1	0	2



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1.4	Electronic components, Resistors, Capacitors, Inductors, Diodes LEDs, Transistors, Power supply, Battery basics, Breadboard and PCB	1	0	1
1.5	Electronic measuring instruments, Digital Multimeter, Oscilloscope (Introduction), Applications in AI Hardware	1	0	1

Unit 2	Analog and Digital Electronics	L	T	P
2.1	Analog Electronics, Voltage and Current	1	0	0
2.2	Ohm's Law, Kirchhoff's Laws, RC Circuits	1	1	1
2.3	Operational Amplifier (Introduction), Digital Electronics, Binary Number System	1	0	0
2.4	Logic Gates, Boolean Algebra (Introduction)	1	0	2
2.5	Application of various introductory concept in Robotics	1	0	0

Unit 3	Sensors and Actuators	L	T	P
3.1	Sensors-IR Sensor, Ultrasonic Sensor, Motion Sensor (PIR), Temperature Sensor, Light Sensor (LDR), Gas Sensor, Humidity Sensor, Color Sensor	1	0	2
3.2	Accelerometer and Gyroscope (Introduction)	1	0	1
3.3	Actuators, Stepper Motor, Relay, Servo Motor, Solenoid	1	0	2
3.4	Applications in Mobile Robots, Smart Vehicles	1	0	1

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3.5	Industrial Automation	1	0	0
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Unit 4	Embedded Systems and Microcontrollers	L	T	P
4.1	Introduction to Embedded Systems, Arduino and ESP32 Mini Applications	1	0	2
4.2	Industrial Robots	1	0	0
4.3	Autonomous Mobile Robots	1	0	1
4.4	Drones	1	0	1
4.5	Case Studies and Mini Projects	1	0	0

Unit 5	Smart Systems and Future Technologies			
5.1	Internet of Things (IoT)& Devices	1	0	1
5.2	Wireless Communication Basics: Wi-Fi, Bluetooth, Cloud-connected Devices(Introduction)	1	0	2
5.3	Smart Manufacturing& Sustainable Electronics	1	0	0
5.4	Introduction to Printed Electronics and Related Components	1	0	0
5.5	Future Trends in AI Hardware	1	0	0



Practical/Projects/Assignments: -

Suggested Software Tools	Arduino IDE, Tinkercad Circuits, Wokwi Simulator, Proteus (optional), MIT App Inventor (optional), FlutterFlow (optional)
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1. Identify basic electronic components (resistors, capacitors, diodes, LEDs, transistors, breadboard, and power supply) and study their functions.
2. Measure voltage, current, and resistance using a Digital Multimeter (DMM) and verify Ohm's Law.
3. Construct simple circuits on a breadboard such as an LED blinking circuit, push-button switch, and basic logic gate circuits.
4. Interface simple sensors (LDR, IR, Ultrasonic, or Temperature Sensor) with Arduino/ESP32 and observe their outputs.
5. Develop a simple mini-project using a sensor and an actuator (e.g., automatic light controller, obstacle detector, smart dustbin, or automatic street light) and demonstrate its working.

Alternative Mini Projects (Optional)

1. Automatic Night Lamp
2. Smart Dustbin
3. Obstacle Detection System
4. Temperature Monitoring System
5. Water Level Indicator
6. Automatic Street Light
7. Simple Line Following Robot (Basic)
8. Smart Parking Indicator

Suggested Readings & References

1. Floyd, T. L. (2017). *Electronic devices* (10th ed.). Pearson.



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2. Boylestad, R. L., & Nashelsky, L. (2012). *Electronic devices and circuit theory* (11th ed.). Pearson.
3. Monk, S. (2016). *Programming Arduino: Getting started with sketches* (2nd ed.). McGraw-Hill Education.
4. Margolis, M., & Jeannie, J. (2020). *Arduino cookbook: Recipes to begin, expand, and enhance your projects* (3rd ed.). O'Reilly Media.
5. Valvano, J. W. (2012). *Embedded systems: Introduction to Arm Cortex-M microcontrollers*. Jonathan Valvano.
6. Boxall, J. (2013). *Arduino workshop: A hands-on introduction with 65 projects*. No Starch Press.
7. Mano, M. M. (2017). *Digital design: With an introduction to the Verilog HDL, VHDL, and SystemVerilog* (6th ed.). Pearson.
8. Siegwart, R., Nourbakhsh, I. R., & Scaramuzza, D. (2011). *Introduction to autonomous mobile robots* (2nd ed.). MIT Press.
9. Siciliano, B., & Khatib, O. (Eds.). (2016). *Springer handbook of robotics*. Springer.
10. Russell, S., & Norvig, P. (2020). *Artificial intelligence: A modern approach* (4th ed.). Pearson.
11. Boxall, J. (2021). *Arduino workshop: A hands-on introduction with 65 projects* (2nd ed.). No Starch Press.
12. Margolis, M., & Jeannie, J. (2020). *Arduino cookbook: Recipes to begin, expand, and enhance your projects* (3rd ed.). O'Reilly Media.
13. Monk, S. (2021). *Programming Arduino: Getting started with sketches* (3rd ed.). McGraw-Hill Education.
14. Russell, S., & Norvig, P. (2020). *Artificial intelligence: A modern approach* (4th ed.). Pearson.
15. Siciliano, B., & Khatib, O. (Eds.). (2020). *Springer handbook of robotics* (2nd ed., Softcover reprint). Springer.

E-Resources:

1. Tinkercad Circuits Simulator  [Tinkercad Circuits – Official Simulator](#)
2. Wokwi Online Arduino Simulator  [Wokwi Arduino Simulator](#)
3. Arduino Official Project Hub  [Arduino Project Hub – Official](#)

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4. ROS (Robot Operating System) Documentation [ROS Documentation – Official](#)

5. MIT OpenCourseWare – Autonomous Robotics [MIT OpenCourseWare | Free Online Course Materials](#)

CO-PO Mapping

CO	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15
CO1	3	1	2	1	1	2	-	3	1	2	2	-	-	-	2
CO2	3	1	3	2	2	2	-	3	1	1	1	-	-	-	2
CO3	2	2	2	3	3	3	2	2	2	3	2	1	1	2	3
CO4	2	2	3	3	3	2	2	2	2	3	2	1	2	3	3
CO5	2	3	3	3	3	3	3	2	3	3	3	3	3	3	3

Mapping Value: 3-Strong, 2-Moderate, 1-Weak

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Course: 2B. Tech (PP) 8 2CCC-8: Engineering Mathematics-2				
Credit Details	Theory	Practical	Internal	Credits
Hours/Weightage	80	00	20	05

COURSE OBJECTIVES

1. Understand the methods for solving ordinary differential equations.
2. Learn advanced techniques for higher-order differential equations and series solutions.
3. Develop the ability to formulate and solve partial differential equations.
4. Understand the concepts and applications of complex variables.
5. Apply vector calculus techniques to solve engineering and scientific problems.

COURSE OUTCOMES

1. Solve ordinary differential equations using appropriate analytical methods.
2. Apply advanced methods such as power series, Legendre polynomials, and Bessel functions to solve engineering problems.
3. Formulate and solve partial differential equations arising in engineering applications.
4. Apply complex variable theory and residue techniques to evaluate engineering and mathematical problems.
5. Analyze engineering problems using vector differentiation, integration, and integral theorems.

Unit 1	Ordinary Differential Equations I	L	T	P
1.1	Differential Equations of First Order and First Degree (Leibnitz linear, Bernoulli's, Exact)	2	1	0
1.2	Differential Equations of First Order and Higher Degree	2	1	0



1.3	Higher order differential equations with constants coefficients	2	1	0
1.4	Homogeneous Linear Differential equations	1	1	0
1.5	Simultaneous Differential Equations.	2	1	0

Unit 2	Ordinary differential Equations II	L	T	P
2.1	Second order linear differential equations with variable coefficients,	2	1	0
2.2	Method of variation of parameters,	2	1	0
2.3	Power series solutions;	2	1	0
2.4	Legendre polynomials,	1	1	0
2.5	Bessel functions of the first kind and their properties	2	1	0

Unit 3	Partial Differential Equations	L	T	P
3.1	Formulation of Partial Differential equations,	1	1	0
3.2	Linear	2	1	0
3.3	Non-Linear Partial Differential Equations	2	1	0
3.4	Homogeneous Linear	2	1	0



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3.5	Partial Differential Equations with Constants Coefficients	2	1	0
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Unit 4	Complex Variables	L	T	P
4.1	Functions of Complex Variables: Analytic Functions, Harmonic Conjugate,	2	1	0
4.2	Cauchy-Riemann Equations (without proof), Line Integral,	2	1	0
4.3	Cauchy-Goursat theorem (without proof), Cauchy Integral formula (without proof),	2	1	0
4.4	Singular Points, Poles & Residues, Residue Theorem,	2	1	0
4.5	Application of Residues theorem for Evaluation of Real Integral (Unit Circle).	1	1	0

Unit 5	Vector Calculus	L	T	P
5.1	Differentiation of Vectors	1	1	0
5.2	Scalar and vector point function,	1	0	0
5.3	Gradient	1	1	0
5.4	Geometrical meaning of gradient,	1	1	0

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5.5	Directional Derivative, Divergence and Curl, Line Integral, Surface Integral and Volume Integral, Gauss Divergence, Stokes and Green theorems.	3	2	0
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Practical/Projects/Assignments: -

1. Solve application-based problems on first-order and higher-order ordinary differential equations using analytical methods.
2. Prepare tutorial assignments on power series solutions, Legendre polynomials, and Bessel functions with engineering applications.
3. Model engineering systems using partial differential equations and solve them using appropriate techniques.
4. Evaluate complex integrals using Cauchy's theorems and the residue theorem, and present their engineering applications.
5. Apply vector calculus to solve problems involving gradient, divergence, curl, and Gauss, Green, and Stokes theorems using analytical methods or mathematical software (e.g., MATLAB, Scilab, or Python).

Suggested Readings: -

1. Thomas, G. B., & Finney, R. L. (2002). *Calculus and analytic geometry* (9th ed.). Pearson.
2. Kreyszig, E. (2006). *Advanced engineering mathematics* (9th ed.). John Wiley & Sons.
3. Boyce, W. E., & DiPrima, R. C. (2009). *Elementary differential equations and boundary value problems* (9th ed.). Wiley India.
4. Ross, S. L. (1984). *Differential equations* (3rd ed.). Wiley India.
5. Coddington, E. A. (1995). *An introduction to ordinary differential equations*. Prentice Hall India.
6. Ince, E. L. (1958). *Ordinary differential equations*. Dover Publications.
7. Brown, J. W., & Churchill, R. V. (2004). *Complex variables and applications* (7th ed.). McGraw Hill.
8. Bali, N. P., & Goyal, M. (2008). *A text book of engineering mathematics*. Laxmi Publications.
9. Grewal, B. S. (2010). *Higher engineering mathematics* (36th ed.). Khanna Publishers.
10. Boyce, W. E., DiPrima, R. C., & Meade, D. B. (2021). *Elementary differential equations and boundary value problems* (12th ed.). John Wiley & Sons.
11. Brown, J. W., & Churchill, R. V. (2021). *Complex variables and applications* (9th ed.). McGraw-Hill Education.
12. Grewal, B. S. (2021). *Higher engineering mathematics* (44th ed.). Khanna Publishers.
13. Kreyszig, E. (2020). *Advanced engineering mathematics* (10th ed., Wiley Precise Student ed.). John Wiley & Sons.
14. Zill, D. G. (2021). *A first course in differential equations with modeling applications* (12th ed.). Cengage Learning.



E-Resources

1. NPTEL – Differential Equations  [NPTEL Differential Equations \(IIT Bombay\)](#)
2. MIT OpenCourseWare – Differential Equations  MIT OCW – Differential Equations (18.03) (ocw.mit.edu in)
3. Paul's Online Math Notes – Differential Equations  Paul's Online Math Notes – Differential Equations (tutorial.math.lamar.edu in)
4. Wolfram Alpha – Computational Engine  Wolfram Alpha – Solve Differential Equations (wolframalpha.com in)
5. Khan Academy – Differential Equations  Khan Academy – Differential Equations (khanacademy.org in)

CO-PO Mapping

CO/PO	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15
CO1	3	2	3	1	2	1	1	3	2	1	3	2	2	1	3
CO2	3	1	2	3	2	1	1	2	2	1	2	1	1	1	3
CO3	3	1	3	2	3	1	1	2	1	1	1	1	1	1	2
CO4	3	1	2	2	3	2	1	3	1	2	1	3	2	2	3
CO5	3	2	3	3	3	2	1	3	1	2	1	2	1	2	3

Mapping Value: 3-Strong, 2-Moderate, 1-Weak



Course: 2B. Tech (PP) 5 2AECC-2: Environmental Studies				
Credit Details	Theory	Practical	Internal	Credits
Hours/Weightage	40	00	10	02

COURSE OBJECTIVES

1. Understand the importance of environmental studies, natural resources, and sustainable development.
2. Learn the structure, functions, and conservation of ecosystems and biodiversity.
3. Understand the causes, effects, and control of environmental pollution and waste management.
4. Develop awareness of environmental laws, policies, and sustainable environmental practices.
5. Understand the relationship between human population, environment, health, and social responsibility.

COURSE OUTCOMES

1. Explain the significance of natural resources and sustainable resource management.
2. Describe ecosystem functions and biodiversity conservation strategies.
3. Analyze environmental pollution, waste management practices, and disaster management measures.
4. Explain environmental legislation, ethics, and sustainable development practices.
5. Evaluate the impact of population growth and environmental issues on human health and society.

Unit 1	Multidisciplinary Nature of Environmental Studies	L	T	P
1.1	Definition; Scope and importance	1	0	0
1.2	Natural resources, Forest resources, Water resources, Mineral resources, Food resources,	1	0	0



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1.3	World food problems	1	0	0
1.4	Energy resources, renewable and non-renewable energy sources	1	0	0
1.5	use of alternate energy sources, Land resources, Equitable use of resources for sustainable lifestyles	1	0	1

Unit 2	Ecosystems, Biodiversity and its Conservation	L	T	P
2.1	Concept, structure and function of an ecosystem, food chains, Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.	1	0	0
2.2	Food webs and ecological pyramids. Types of ecosystem: - Forest ecosystem, Grassland ecosystem, Desert ecosystem	1	0	0
2.3	Aquatic ecosystems Biodiversity: Definition, Bio-geographical classification of India	1	0	1
2.4	Value of biodiversity, biodiversity at global, national and local levels	1	0	0
2.5	India as a mega-diversity nation, Hot-spots of biodiversity	1	0	0

Unit 3	Environmental Pollution	L	T	P
3.1	Definitions. Causes, effects and control measures of Air, Water	1	0	0
3.2	Soil, Marine, Noise, Thermal, Nuclear pollution & hazards.	1	0	0
3.3	Solid waste management: Causes, effects and control measures of urban industrial wastes.	1	0	1

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3.4	Disaster management: floods, earthquake	1	0	0
3.5	cyclone and landslides	1	0	0

Unit 4	Social Issues and the Environment	L	T	P
4.1	Unsustainable to Sustainable development, Water conservation	1	0	0
4.2	Environmental ethics: Issues and possible solutions, Environment Protection Act-Air (Prevention and Control of Pollution)	1	0	0
4.3	Act, Water (Prevention and Control of Pollution)	1	0	0
4.4	Act, Wildlife Protection Act, Forest Conservation	1	0	0
4.5	Act, Issues involved in enforcement of environmental legislation, Public awareness.	1	0	1

Unit 5	Human Population and the Environment	L	T	P
5.1	Population growth, variation among nations.	1	0	0
5.2	Population explosion-Family welfare Program	1	0	0
5.3	Environment and human health	1	0	0
5.4	Human Rights	1	0	0
5.5	Value Education	1	0	0



Practical/Projects/Assignments: -

1. Conduct a field visit to a local ecosystem (river, forest, wetland, grassland, or hill) and prepare a report on its biodiversity, natural resources, and conservation practices.
2. Carry out an environmental survey of a polluted urban, rural, industrial, or agricultural area to identify pollution sources and recommend suitable control measures.
3. Prepare a biodiversity documentation project by identifying common plant, bird, and insect species in the local area and discussing their ecological significance.
4. Develop a case study on environmental issues such as waste management, renewable energy, biodiversity conservation, climate change, or sustainable development practices.
5. Prepare a seminar or presentation on environmental laws, population growth, public health, value education, gender equality, or environmental ethics with reference to current environmental challenges.

Suggested Readings: -

1. Harris, C. E., Pritchard, M. S., & Rabins, M. J. (2013). *Engineering ethics* (5th ed.). Cengage Learning.
2. Rana, S. V. S. (2013). *Essentials of ecology and environmental science* (5th ed.). PHI Learning.
3. Reynolds, G. W. (2012). *Ethics in information technology* (4th ed.). Cengage Learning.
4. Sivakumar, R. (n.d.). *Energy, environment & ethics in society*. Tata McGraw-Hill.
5. Sharma, B. K. (2014). *Environmental chemistry*. Krishna Prakashan Media.
6. Krishnamoorthy, B. (2008). *Environmental management: Text and cases* (2nd ed.). PHI Learning.
7. Kiely, G. (2006). *Environmental engineering* (1st ed.). Tata McGraw-Hill.
8. Bharucha, E. (2021). *Textbook of environmental studies for undergraduate courses* (3rd ed.). Orient BlackSwan.
9. Harris, C. E., Pritchard, M. S., & Rabins, M. J. (2020). *Engineering ethics: Concepts and cases* (6th ed.). Cengage Learning.
10. Rajagopalan, R. (2020). *Environmental studies: From crisis to cure* (4th ed.). Oxford University Press.
11. Rana, S. V. S. (2020). *Essentials of ecology and environmental science* (6th ed.). PHI Learning.
12. Sharma, B. K. (2020). *Environmental chemistry* (15th ed.). Krishna Prakashan Media.



E-Resources

1. UNEP – United Nations Environment Programme Resources ➔ UNEP Official Website
2. SWAYAM – Environmental Studies ➔ SWAYAM – Environmental Studies Course (swayam.gov.in)
3. EPA – US Environmental Protection Agency Science & Resources ➔ EPA Science & Environmental Resources
4. World Bank – Climate Change Knowledge Portal ➔ World Bank Climate Change Knowledge Portal (climateknowledgeportal.worldbank.org)
5. National Geographic – Environment Section ➔ National Geographic – Environment (nationalgeographic.com)

CO-PO Mapping

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	3	-	2	-	-	-	-	3	-	-	-	-	2	-	2
CO2	3	-	2	-	-	2	-	3	-	-	-	-	2	-	2
CO3	3	2	2	3	2	2	-	3	-	2	-	-	2	-	2
CO4	3	2	2	2	-	-	-	3	2	2	-	2	3	-	2
CO5	3	2	2	2	2	-	2	3	2	-	2	2	3	2	3

Mapping Value: 3-Strong, 2-Moderate, 1-Weak



Course: 2B. Tech (PP)6 2AUD-2: Bridge Mathematics Course				
Credit Details	Theory	Practical	Internal	Credits
Hours	40	00	-	00

COURSE OBJECTIVES

1. Develop a strong foundation in basic mathematical concepts required for engineering studies.
2. Understand the fundamentals of algebra, trigonometry, calculus, and coordinate geometry.
3. Apply mathematical techniques to solve simple engineering and scientific problems.
4. Develop analytical and logical problem-solving skills using mathematics.
5. Prepare students for Engineering Mathematics and engineering applications in Printing & Packaging.

COURSE OUTCOMES

1. Solve basic algebraic, trigonometric, and calculus problems.
2. Apply coordinate geometry and vector concepts to simple engineering applications.
3. Use differentiation and integration techniques to solve basic mathematical problems.
4. Analyze data using elementary statistical methods.
5. Apply mathematical concepts in Engineering Mathematics and Printing & Packaging applications.

Unit 1	Differential Calculus	L	T	P
1.1	Linear Equations	1	0	0
1.2	Quadratic Equations	2	0	0
1.3	Functions and Graphs	1	2	0
1.4	Polynomial Functions	1	0	0
1.5	Maxima and Minima of function of one variables	1	0	0



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Unit 2	Trigonometry	L	T	P
2.1	Trigonometric Ratios of allied angles	1	0	0
2.2	Trigonometric Identities	1	0	0
2.3	Sum difference formula and their application, product formula.	1	2	0
2.4	T- Ratio of multiple angles	1	0	0
2.5	Applications in Engineering	2	0	0

Unit 3	Coordinate Geometry & Vectors	L	T	P
3.1	Cartesian Coordinate System, slope of Straight Line, Angle between two Straight Line	1	0	0
3.2	Distance Formula, Division Formula	2	0	0
3.3	Concept of vector and scalar quantities	1	0	0
3.4	Types of vectors	1	2	0
3.5	Dot & Cross Product	1	0	0

Unit 4	Calculus	L	T	P
4.1	Limits	1	0	0
4.2	Derivatives of a Sum, Difference, product	1	0	0
4.3	Integration by substitution	1	0	0
4.4	Integral of $\tan x$, $\sec x$, $\operatorname{cosec} x$	2	0	0
4.5	Integration of parts	1	2	0

Unit 5	Statistics & Engineering Applications	L	T	P
5.1	Frequency distribution	1	0	0
5.2	Measure of central tendency Mean Median Mode	1	0	0
5.3	Measure of Applied dispersion: mean deviation, variance, Standard Deviation	1	0	0
5.4	Permutation and Combination	2	0	0
5.5	Data Analysis in Packagingng Industry	1	2	0

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Practical/Projects/Assignments: -

1. Solve practice problems on algebra, trigonometry, and coordinate geometry.
2. Perform differentiation and integration exercises with simple engineering applications.
3. Prepare graphs and solve basic vector and geometry problems.
4. Analyze sample production data using mean, median, mode, and standard deviation.
5. Solve simple mathematical problems related to printing, packaging dimensions, and material calculations.

Suggested Readings

1. Grewal, B. S. (2017). *Higher engineering mathematics* (44th ed.). Khanna Publishers.
2. Kreyszig, E. (2011). *Advanced engineering mathematics* (10th ed.). Wiley.
3. Bali, N. P., & Goyal, M. (2016). *A textbook of engineering mathematics*. Laxmi Publications.
4. AICTE. (2018). *Prescribed engineering mathematics textbooks*. AICTE Publishing.
1. Anton, H., Bivens, I., & Davis, S. (2021).
5. Calculus: Early transcendentals (12th ed.). John Wiley & Sons.
6. Bali, N. P., & Goyal, M. (2020). *A textbook of engineering mathematics* (10th ed.). Laxmi Publications.
7. Grewal, B. S. (2021). *Higher engineering mathematics* (44th ed.). Khanna Publishers.
8. Kreyszig, E. (2020). *Advanced engineering mathematics* (10th ed., Wiley Precise Student ed.). John Wiley & Sons.
9. Strang, G. (2020). *Linear algebra and its applications* (5th ed.). Cengage Learning.

E-Resources

1. MIT OpenCourseWare – Linear Algebra (18.06) ➞ MIT OCW Linear Algebra ([ocw.mit.edu in](https://ocw.mit.edu/in))
2. Linear Algebra Toolkit (University of Arkansas) ➞ Linear Algebra Toolkit ([math.odu.edu in](https://math.odu.edu/in))
3. Essence of Linear Algebra – 3Blue1Brown (YouTube) ➞ 3Blue1Brown Linear Algebra Playlist (youtube.com).
4. OpenStax – Linear Algebra Textbook ➞ OpenStax Linear Algebra ([openstax.org in](https://openstax.org/in))
5. Paul's Online Math Notes – Linear Algebra Section ➞ Paul's Notes – Linear Algebra ([tutorial.math.lamar.edu in](https://tutorial.math.lamar.edu/in))
6. Desmos Graphing Tool ➞ [Desmos Graphing Calculator](https://www.desmos.com/calculator)



CO-PO Mapping

Outcomes	PO1	PO2	PO3	PO4	PO5	PO8	PO9	PO10	PO11	PO13	PO14	PO15
CO1	3	-	2	-	2	3	-	-	2	-	2	3
CO2	3	-	3	2	2	2	-	-	2	-	-	2
CO3	2	-	2	3	3	1	-	-	3	-	-	2
CO4	2	2	1	2	2	2	1	2	2	1	1	2
CO5	1	3	2	3	3	2	1	2	1	2	2	3

Mapping Value: 3-Strong, 2-Moderate, 1-Weak

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Course: 2B. Tech (PP) 7				
OE2: Advanced Manufacturing Processes				
Credit Details	Theory	Practical	Internal	Credits
Hours/Weightage	40	00	10	03

COURSE OBJECTIVES

1. Understand the fundamentals of metal forming processes and plastic deformation.
2. Explain the principles of welding and rolling processes used in manufacturing.
3. Understand extrusion and drawing processes for manufacturing metal products.
4. Learn sheet metal forming techniques and die design concepts.
5. Understand the principles, processing, and applications of powder metallurgy.

COURSE OUTCOMES

1. Explain the fundamentals of metal forming and deformation mechanisms.
2. Describe welding and rolling processes, defects, and industrial applications.
3. Analyze extrusion and drawing processes for manufacturing engineering applications.
4. Apply sheet metal forming techniques and die design concepts in manufacturing.
5. Explain powder metallurgy processes and identify suitable industrial applications.

Unit 1	Fundamentals of Manufacturing Processes	L	T	P
1.1	Introduction to Manufacturing processes and Production systems	1	0	0
1.2	Metal forming processes – Hot working and Cold working	1	0	0
1.3	Basic plastic deformation	1	1	0

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1.4	Classification and selection of manufacturing processes for engineering products	1	0	0
1.5	Introduction to Additive manufacturing processes (3D printing), Rapid prototyping & related components	0	1	0

Unit 2	Joining and Rolling Processes	L	T	P
2.1	Introduction to Joining processes – Welding, Brazing, Soldering and Adhesive bonding	1	0	1
2.2	Welding processes – Arc, Resistance (spot, seam, projection) Laser welding and Friction stir welding	1	0	1
2.3	Rolling processes – Principles, Types of rolling mills and industrial applications	1	0	0
2.4	Form rolling, Rolling defects, Quality inspection and Process control	1	1	0
2.5	Introduction to Smart manufacturing, Industry 4.0 and Automation in manufacturing	1	0	0

Unit 3	Extrusion and Material Processing	L	T	P
3.1	Extrusion processes – Principle, Types, Equipment and Industrial applications	1	0	0
3.2	Plastic extrusion processes – Film, Sheet and Profile extrusion	1	0	0
3.3	Wire, Tube and Profile drawing processes – Principle and Applications	1	0	1
3.4	Defects in extrusion and drawing processes, Quality control and Process improvement	1	0	0
3.5	Introduction to Lean manufacturing and Waste reduction techniques	1	0	0

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Unit 4	Sheet Material Forming and Converting Processes	L	T	P
4.1	Sheet material forming processes – Classification, Press types, Formability and Selection of presses	1	0	0
4.2	Forming processes – Deep drawing, Bending, Stretch forming and Thermoforming	1	0	1
4.3	Press working operations – Blanking, Punching, Piercing, Bending and Forming	1	0	0
4.4	Die cutting, Embossing, Creasing and Basic die design	1	0	0
4.5	Introduction to Sustainable manufacturing, Green manufacturing and Material recycling	1	0	1

Unit 5	Powder Metallurgy and Advanced Material Processing	L	T	P
5.1	Powder metallurgy – Introduction, Powder production methods and Material characteristics	1	0	0
5.2	Powder compaction, Binders and Green compacts	1	0	0
5.3	Sintering process, Sintering equipment and Product characteristics	1	0	1
5.4	Applications of powder metallurgy, Metal injection moulding (MIM) and Functional components	1	0	0
5.5	Advanced materials, Sustainable material processing and Emerging manufacturing trends	1	0	0

Practical/Projects/Assignments: -

1. Prepare a comparative study of conventional manufacturing processes and additive manufacturing (3D Printing).



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2. Study and present the working principles, applications, and quality aspects of joining, rolling, and extrusion processes.
3. Prepare a report on sheet material processing operations such as blanking, punching, bending, die cutting, embossing, and thermoforming.
4. Develop a case study or seminar on Lean Manufacturing, Smart Manufacturing, Industry 4.0, or Green Manufacturing.
5. Prepare a presentation on powder metallurgy, metal injection moulding (MIM), advanced materials, or emerging manufacturing technologies with suitable industrial applications.

Suggested Readings: -

1. Rao, P. N. (2018). *Manufacturing technology* (5th ed., Vols. 1-2). McGraw Hill Education.
2. Kalpakjian, S., & Schmid, S. R. (2018). *Manufacturing engineering and technology* (7th ed., SI edition). Pearson Education.
3. Rajput, R. K. (2017). *A textbook of manufacturing technology* (2nd ed.). Laxmi Publications.
4. Khurmi, R. S., & Gupta, J. K. (2010). *A textbook of workshop technology: Manufacturing processes*. S. Chand & Company.
5. Choudhury, H. S. K. (2008). *Elements of workshop technology* (Vols. 1-2). Media Promoters and Publishers.
6. Groover, M. P. (2021). *Fundamentals of modern manufacturing: Materials, processes, and systems* (7th ed.). John Wiley & Sons.
7. Kalpakjian, S., & Schmid, S. R. (2020). *Manufacturing engineering and technology* (8th ed., SI Units). Pearson Education.
8. Khurmi, R. S., & Gupta, J. K. (2020). *A textbook of workshop technology: Manufacturing processes* (16th ed.). S. Chand Publishing.
9. Rajput, R. K. (2020). *A textbook of manufacturing technology* (3rd ed.). Laxmi Publications.
10. Rao, P. N. (2020). *Manufacturing technology: Metal cutting and machine tools* (4th ed., Vol. 2). McGraw-Hill Education.
11. Arunkrishnan, P. R., & Ghosh, P. (2025). *3D printing: A practical and hands-on textbook for mastering 3D printing technology*. BPB Publications.

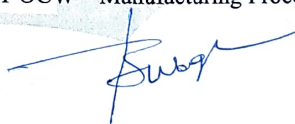
E-Resources

1. NPTEL – Advanced Manufacturing Processes ➡ NPTEL Advanced Manufacturing Processes (IIT Kanpur)
2. ScienceDirect – Journal of Materials Processing Technology ➡ Journal of Materials Processing Technology – ScienceDirect (sciencedirect.com)
3. SME – Society of Manufacturing Engineers Resources ➡ SME Manufacturing Knowledge Center (sme.org in)
4. MIT OpenCourseWare – Manufacturing Processes ➡ MIT OCW – Manufacturing Processes I (ocw.mit.edu in) ➡ MIT OCW Mechanical Engineering Courses (ocw.mit.edu)

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5. Make: Community – Manufacturing Guides ➡ Make: Community – Manufacturing & DIY Guides

CO-PO Mapping

CO	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15
CO1	3	1	2	1	2	1	1	3	1	1	2	1	2	1	2
CO2	3	2	2	2	2	2	2	2	1	1	2	1	1	2	2
CO3	2	1	3	3	3	2	1	2	2	2	2	1	1	1	2
CO4	2	1	3	3	2	1	1	2	2	1	3	1	1	1	2
CO5	3	1	1	1	2	2	1	3	2	1	2	2	1	1	3

Mapping Value: 3-Strong, 2-Moderate, 1-Weak

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