KUMARAGURU COLLEGE OF TECHNOLOGY
COIMBATORE – 641 049

DEPARTMENT OF MECHANICAL ENGINEERING

B.E MECHANICAL ENGINEERING

CURRICULUM & SYLLABUS

R18 I-II SEMESTER

Semester I										Pre-requisite
S.No	**Course code**	**Course Title**	**Course Mode**	**CT**	**L**	**T**	**P**	**J**	**C**	
1.	U18ENI1201	Fundamentals of Communication -I	Embedded - Theory & Lab	HS	2	0	2	0	3	Nil
2.	U18MAI1201	Linear Algebra and Calculus	Embedded - Theory & Lab	BS	3	0	2	0	4	Nil
3.	U18CHT1201	Engineering Chemistry	Embedded - Theory & Lab	BS	3	0	2	0	4	Nil
4.	U18MEI1201	Engineering Graphics	Embedded - Theory & Lab	ES	2	0	2	0	3	Nil
5.	U18CSI1201	Problem Solving and Programming using C	Embedded - Theory & Lab	ES	3	0	2	0	4	Nil
6.	U18INI1300	Engineering Clinic 1	Project based course	ES	1	0	0	4	3	Nil
7.	U18MEP1502	Engineering Practices Laboratory	Lab	ES	0	0	2	0	1	Nil
Total Credits									22	
Total Contact Hours/week									26	

Semester II										Pre-requisite
S.No	**Course code**	**Course Title**	**Course Mode**	**CT**	**L**	**T**	**P**	**J**	**C**	
1.	U18ENI2201	Fundamentals of Communication-II	Embedded - Theory & Lab	HS	2	0	2	0	3	U18ENI1201
2.	U18MAI2201	Advanced Calculus and Laplace Transform	Embedded - Theory & Lab	BS	3	0	2	0	4	U18MAI1101
3.	U18PHT2001	Engineering Physics	Embedded - Theory & Lab	BS	3	0	2	0	4	Nil
4.	U18CSI2201	Problem Solving and Programming using Python	Embedded - Theory & Lab	ES	3	0	2	0	4	U18CSI1201
5.	U18MET2001	Manufacturing Technology	Theory	PC	3	0	0	0	3	NIL
6.	U18MEP2502	Manufacturing and Metallurgy Laboratory	Lab	PC	0	0	2	0	1	NIL
7.	U18INI2300	Engineering Clinic 2	Project based course	ES	1	0	0	4	3	Nil
Total Credits									22	
Total Contact Hours/week									25	

U18ENI1201 FUNDAMENTALS OF COMMUNICATION -I

L	T	P	PJ	C
2	0	2	0	3

(Common to all branches of Engineering and Technology)

Course outcomes:

At the end of this course, the student will be able to:

CO1: Understand and use Grammar and Vocabulary with accuracy and clarity.
CO2: Communicate effectively in various situations.
CO3: Read and Comprehend language.
CO4: Develop Writing skills.
CO5: Disseminate professional information through appropriate means of communication.

Pre-requisites: Nil

CO/PO MAPPING
(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	PROGRAMME OUTCOMES (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M										
CO2	S	M										
CO3	S	L			L				L	L		
CO4	M	L			L				L	L		M
CO5	M	L			L				L	L		M
CO6	L	L										

COURSE ASSESSMENT METHODS

DIRECT

Assessments (5Hours)

1. Listening Comprehension - A Film
2. Speaking
3. Conversation among few people
4. Grammar Presentations
5. Written Exercises
6. Class room tests

INDIRECT

1. Course-end survey

Applied Grammar and Vocabulary **14 Hours**

1.1 Verb and Adverb 2Hours
1.2 Subject Verb Agreement 2Hours
1.3 Adjectives and its types 2Hours
1.4 Articles, Gerunds, Infinitives and Prepositions 2Hours
1.5 Tenses 2Hours
1.6 Clauses 3Hours

1.7 Question tags 1hours

READING **3 Hours**

2.1 Skimming and Scanning using newspapers
2.2 Reading Comprehension and Cloze test
2.3 Summarizing and note-taking.

LISTENING COMPREHENSION **3 hours**

6 audios

SPEAKING **10 Hours**

4.1 Speak up
4.2 Narration
4.3 Presentations (Grammar)
4.4 Reading aloud

PRINCIPLES OF WRITING **10 Hours**

5.1 Be Forms
5.2 Sentence Patterns
5.3 Kinds of Sentences
5.4 Writing a Paragraph
5.5 Writing an Essay – Open Essay

Theory: 0	**Tutorial: 0**	**Practical: 40**	**Project: 0**	**Total: 40 Hours**

U18MAI1201 LINEAR ALGEBRA AND CALCULUS (Common to AE, AUE, CE, MCE, ME, ECE, EEE)

L	T	P	PJ	C
3	0	2	0	4

COURSE OUTCOMES

After successful completion of this course, the students should be able to:

CO1: Identify eigenvalues and eigenvectors and apply Cayley Hamilton theorem.

CO2: Apply orthogonal diagonalisation to convert quadratic form to canonical form.

CO3: Solve first order ordinary differential equations and apply them to certain physical situations.

CO4: Solve higher order ordinary differential equations.

CO5: Evaluate the total derivative of a function, expand the given function as series and locate the maximum and minimum for multivariate function.

CO6: Determine Rank, Inverse, Eigenvalues, Eigenvectors of the given matrix, Maxima-Minima of the function and Solving Differential equations using MATLAB

Pre-requisite: Basics of Matrices, Differentiation and Integration

CO/PO Mapping
S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S			M				M	M		M
CO2	S	S			M				M	M		M
CO3	S	S			M				M	M		M
CO4	S	S			M				M	M		M
CO5	S	S			M				M	M		M
CO6	S	S			M				M	M		M

Course Assessment methods:

DIRECT

1. Continuous Assessment Test I, II (Theory component)
2. Open Book Test; Cooperative Learning Report, Assignment; Journal Paper Review, Group Presentation, Project Report, Poster Preparation, Prototype or Product
3. Demonstration etc (as applicable) (Theory component)
4. Pre/Post - Experiment Test/Viva; Experimental Report for each Experiment (lab Component)
5. Model Examination (lab component)
6. End Semester Examination (Theory and lab components)

INDIRECT

1. Course-end survey

MATRICES **6 Hours**

Rank of a matrix – Consistency of a system of linear equations - Rouche's theorem - Solution of a system of linear equations - Linearly dependent and independent vectors– Eigenvalues and Eigenvectors of a real matrix – Properties of eigenvalues and eigenvectors – Cayley Hamilton theorem (excluding proof)

DIAGONALISATION OF A REAL SYMMETRIC MATRIX **6 Hours**

Orthogonal matrices – Orthogonal transformation of a symmetric matrix to diagonal form – Reduction of quadratic form to canonical form by orthogonal transformation.

FIRST ORDER ORDINARY DIFFERENTIAL EQUATIONS **11 Hours**

Leibnitz's equation – Bernoulli's equation – Equations of first order and higher degree - Clairauts form – Applications: Orthogonal trajectories.

HIGHER ORDER LINEAR DIFFERENTIAL EQUATIONS **11 Hours**

Linear equations of second and higher order with constant coefficients – Euler's and Legendre's linear equations – Method of variation of parameters – First order Simultaneous linear equations with constant coefficients – Applications.

FUNCTIONS OF SEVERAL VARIABLES **11 Hours**

Total derivative – Taylor's series expansion – Maxima and minima of functions of two variables – Constrained maxima and minima: Lagrange's multiplier method with single constraints – Jacobians.

Theory: 45	**Tutorial: 0**	**Practical: 0**	**Project: 0**	**Total : 45 Hours**

REFERENCES

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 41st Edition, 2011.
2. Ramana B.V., "Higher Engineering Mathematics", Tata McGraw Hill Co. Ltd., New Delhi, 11th Reprint, 2010.
3. Kreyzig E., "Advanced Engineering Mathematics", Tenth Edition, John Wiley and sons, 2011.
4. Veerarajan T., Engineering Mathematics (for First Year), Tata McGraw Hill Pub. Co. Ltd., New Delhi, Revised Edition, 2007
5. Kandasamy P., Thilagavathy K., and Gunavathy K., "Engineering Mathematics", S. Chand & Co., New Delhi, (Reprint) 2008
6. Venkataraman M.K., "Engineering Mathematics", The National Pub. Co., Chennai,2003
7. Weir, MD, Hass J, Giordano FR: Thomas' Calculus, Pearson education 12th Edition, 2015
8. P.Bali., Dr. Manish Goyal., Transforms and partial Differential equations, University Science Press, New Delhi, 2010

9. G.B.Thomas and R.L.Finney, Calculus and analytical geometry, 11th Edition, PearsonEducation, (2006)

LAB COMPONENT **30 Hours**

List of MATLAB Programmes:

1. Introduction to MATLAB.
2. Matrix Operations - Addition, Multiplication, Transpose, Inverse
3. Rank of a matrix and solution of a system of linear equations
4. Characteristic equation of a Matrix and Cayley-Hamilton Theorem.
5. Eigenvalues and Eigenvectors of Higher Order Matrices
6. Curve tracing
7. Solving first order ordinary differential equations.
8. Solving second order ordinary differential equations.
9. Determining Maxima and Minima of a function of one variable.
10. Determining Maxima and Minima of a function of two variables.

Theory: 0	Tutorial: 0	Practical: 30	Project: 0	Total : 30 Hours

U18CHT1201 ENGINEERING CHEMISTRY
(Common to AE, AUE, CE, MCE, ME, ECE, EEE)

L	T	P	PJ	C
3	0	2	0	4

Course Outcomes

After successful completion of this course, the students should be able to

CO1: Apply the basic principles of chemistry at the atomic and molecular level.

CO2: Analyze the impact of engineering solutions from the point of view of chemical principles

CO3: Apply the chemical properties to categorize the engineering materials and their uses

CO4: Integrate the chemical principles in the projects undertaken in field of engineering and technology

CO5: Develop analytical proficiency through lab skill sets to demonstrate in professional practice.

Pre-requisites: Nil

CO/PO Mapping
(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M											
CO2	S		M		M							
CO3	S	M										
CO4	S			M					S		W	
CO5	S					M			S	W		

Course assessment methods

DIRECT
1. Continuous Assessment Test I, II 2. Open book test; Cooperative learning report, Assignment; Journal paper review, Group 3. Presentation, Project report, Poster preparation, Prototype or Product Demonstration etc. (as applicable) **4.** End Semester Examination
INDIRECT
1. Course-end survey

CHEMICAL BONDING **7 Hours**

Bonding: Introduction – Ionic bonding - Van der Waal's forces (dipole - dipole, dipole - induced dipole, induced dipole - induced dipole interactions) - hydrophobic interaction.

Bonding in organic molecules: covalent and co-ordinate bonds (overview only) - hybridization (sp, sp2, sp3) - hydrogen bonding and its consequences.

THERMODYNAMICS **7 Hours**

Introduction - Thermodynamic process – Internal energy – Enthalpy – limitations of First law of thermodynamics – Second law of thermodynamics - Entropy - Third law of thermodynamics – Free Energy and Work Function – Clausius-Clapeyron equation – Maxwell's relations – Kirchhoff's equation.

ELECTROCHEMISTRY AND CORROSION **7 Hours**

Electrodes - Electrode Potential – Nernst equation and problems - Galvanic cell - Electrochemical Series.

Corrosion: Classification and mechanism of chemical and electrochemical corrosion - Factors influencing corrosion

Corrosion control: Inhibitors – Cathodic protection (Sacrificial anodic protection, Impressed current cathodic protection) – Protective coating: Electroplating (Au) and Electroless plating (Ni).

WATER TECHNOLOGY **7 Hours**

Introduction - soft/hard water - Disadvantages of hard water in industries– scale, sludge, priming and foaming, caustic embrittlement.

Treatment of hard water: External treatment (Ion exchange method) - Internal treatment (colloidal, carbonate, phosphate and calgon conditioning) - Desalination (Reverse osmosis, Electrodialysis)

ENGINEERING MATERIALS **7 Hours**

Polymer: Introduction – Preparation, Properties and Applications of PMMA, PET, PVC.

Composites: Constituents of Composites – Polymer Composites - Metal Matrix Composites - Ceramic Matrix Composites – Applications

Lubricants: Classification - Functions - Properties (viscosity index, flash and fire point, oiliness, carbon residue, aniline point, cloud point and pour point) - Semi solid lubricant (greases with calcium based, sodium based, lithium based) - Solid lubricants (graphite, molybdenum disulphide)

SURFACE CHEMISTRY AND CATALYSIS **7 Hours**

Adsorption: Types of adsorption – Adsorption isotherms: Freundlich's adsorption isotherm – Langmuir's adsorption isotherm – Applications of adsorption on pollution abatement.

Catalysis: Catalyst – catalytic poisoning and catalytic promoters - autocatalysis –- acid base catalysis – enzyme catalysis – Michaelis-Menten equation – applications.

Chemical kinetics: Introduction – first order, pseudo first order, second order, zero order equations – parallel reactions – opposing reactions.

Theory: 45	**Tutorial: 0**	**Practical: 0**	**Project: 0**	**Total : 45 Hours**

REFERENCES

1. Jain P.C. and Jain. M., Engineering Chemistry, 16th Edition, Dhanpat Rai Publishing Company, New Delhi, Reprint 2017.

2. Puri B.R., Sharma L.R., Pathania, M.S. Principles of physical chemistry, Vishal Publishing Co., 2017
3. Atkins, P. and de Paula, J., Atkin's Physical Chemistry, 9th ed., Oxford Univ. Press, 2009.
4. Glasstone S., An introduction to Electrochemistry, 10th Edition, Affiliated to East West Press Private Limited, 2007.
5. Samir Sarkar., Fuels and Combustion, 3rd Edition, Orient Longman, India, 2009.
6. Dara S.S. and Umare S.S., A text book of Engineering Chemistry, S.Chand and Company Limited, New Delhi, 2014.
7. Engineering Chemistry, Wiley India Editorial Team, Wiley, 2018.

LABORATORY COMPONENT

LIST OF EXPERIMENTS

1. Preparation of Standard solutions
2. Conductometric estimation of mixture of acids vs strong base
3. Estimation of extent of corrosion of Iron pieces by Potentiometry
4. Estimation of the extent of dissolution of Copper / Ferrous ions by spectrophotometry.
5. Estimation of acids by pH metry.
6. Determination of total, temporary and permanent hardness by EDTA method.
7. Estimation of DO by Winkler's method
8. Estimation of Alkalinity by Indicator method.
9. Estimation of Chloride by Argentometric method
10. Estimation of Sodium and Potassium in water by Flame photometry.
11. Determination of Flash and Fire point of lubricating oil
12. Determination of Cloud and Pour point of lubricating oil
13. Determination of relative and kinematic viscosities of lubricating oil at different temperatures
14. Determination of corrosion rate on mild steel by Weight loss method
15. Morphological studies of corrosion on mild steel by microscopic techniques

Theory: 0	**Tutorial: 0**	**Practical:30**	**Project: 0**	**Total : 30 Hours**

REFERENCES

1. Jeffery G.H., Bassett J., Mendham J. and Denny R.C., Vogel's Text Book of Quantitative Chemical Analysis, Oxford, ELBS, London,2012.
2. Shoemaker D.P. and C.W. Garland., Experiments in Physical Chemistry, Tata McGraw-Hill Pub. Co., Ltd., London,2003.

U18MEI1201 ENGINEERING GRAPHICS
(Common to AE, AUE, CE, MCE, ME, ECE, EEE)

L	T	P	PJ	C
2	0	2	0	3

Course outcome

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

CO1: Construct various plane curves.

C02: Construct projection of points and projection of lines.

CO3: Develop projection of surfaces and solids.

CO4: Solve problems in sections of solids and development of surfaces.

CO5: Apply free hand sketching and concepts of isometric in engineering practice.

CO6: Draw engineering drawing in AutoCAD with dimensions.

Pre-requisites: Nil

CO/PO Mapping
(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M										
CO2	S	S									W	
CO3	S	S									M	
CO4	S	S										
CO5	S	S										
C06	S											

DIRECT
1. Continuous Assessment Test I, II (Theory component) 2. Open Book Test, Assignment, Group Presentation 3. Viva, Experimental Report for each Experiment (lab Component) 4. Model Examination (lab component) 5. End Semester Examination (Theory and lab components)
INDIRECT
2. Course-end survey

PLANE CURVES, PROJECTION OF POINTS, LINES AND PLANES 9Hours

Importance of graphics in design process, visualization, communication, documentation and drafting tools, Construction of curves - ellipse, parabola, and hyperbola by eccentricity method only. Orthographic projection of points.

Projections of straight lines located in first quadrant - determination of true length and true inclinations.

Projections of plane surfaces - polygonal lamina and circular lamina, located in first quadrant and inclined to one reference plane.

PROJECTION AND SECTION OF SOLIDS 9Hours

Projection of simple solids - prism, pyramid, cylinder and cone. Drawing views when the axis of the solid is inclined to one reference plane.

Sectioning of simple solids - prisms, pyramids, cylinder and cone. Obtaining sectional views and true shape when the axis of the solid is vertical and cutting plane inclined to one reference plane.

DEVELOPMENT OF SURFACES, ISOMETRIC PROJECTIONS AND FREE-HAND SKETCHING 9Hours

Development of lateral surfaces of truncated prisms, pyramids, cylinders and cones.

Isometric projection, Isometric scale, Isometric views of simple solids, truncated prisms, pyramids, cylinders and cones.

Free hand sketching techniques, sketching of orthographic views from given pictorial views of objects, including free-hand dimensioning.

INTRODUCTION TO AUTOCAD 9Hours

Introduction to Drafting Software (AutoCAD) & its Basic Commands. Introduction to coordinate systems, object selection methods, selection of units and precession. sketching – line, circle, arc, polygon, rectangle and ellipse. Working with object snaps, layers and object properties. Editing the objects – copy, move, trim, extend, working with arrays, mirror, scale, hatch, fillet and chamfer.

ISOMETRIC VIEWS WITH AUTOCAD 9Hours

Building drawings – Single and double bed room house (sectional Top view only). Introduction to Motion path animation. Isometric views of simple solid blocks.

Theory: 30	**Tutorial: 0**	**Practical:15**	**Project: 0**	**Total : 45 Hours**

REFERENCES

1. Basant Agrawal and CM Agrawal, Engineering Drawing, McGraw-Hill, New Delhi, First Edition, 2008.
2. Venugopal K. and Prabhu Raja V., Engineering Graphics, New Age International (P) Limited, New Delhi, 2008.
3. Nataraajan K.V., Engineering Drawing and Graphics, Dhanalakshmi Publisher, Chennai, 2005.
4. Warren J. Luzadder and Jon. M. Duff, Fundamentals of Engineering Drawing, Prentice Hall of India Pvt. Ltd., New Delhi, Eleventh Edition, 2005.
5. Gopalakirishna K.R., Engineering Drawing (Vol. I & II), Subhas Publications, 2001.
6. James Leach, AutoCAD 2017 Instructor, SDC Publications, 2016.

U18CSI1201 PROBLEM SOLVING AND PROGRAMMING USING C

L	T	P	PJ	C
3	0	2	0	4

Course outcomes

AFTER SUCCESSFUL COMPLETION OF THIS COURSE, THE STUDENTS SHOULD BE ABLE TO

CO1: Develop simple Python program in interactive and script mode.

CO2: Solve problems using control statements in Python

CO3: Construct Python programs using functions and strings.

CO4: Make use of Python lists, set, tuples, dictionaries to represent compound data.

CO5: Build Python Programs to read and write data from/to files.

CO6: Develop python programs to handle exceptions.

Pre-requisites: Nil

CO/PO MAPPING

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	PROGRAMME OUTCOMES (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	M		M				M	M		M
CO2	S	S	M		M				M	M		M
CO3	S	S	M		M				M	M		M
CO4	S	S	M		M				M	M		M
CO5	S	S	M		M				M	M		M
CO6	S	S	M		M				M	M		M

COURSE ASSESSMENT METHODS

DIRECT

1. Continuous Assessment Test I, II (Theory component)
2. Open Book Test, Assignment, Group Presentation
3. Viva, Experimental Report for each Experiment (lab Component)
4. Model Examination (lab component)
5. End Semester Examination (Theory and lab components)

INDIRECT

1. Course-end survey

THEORY COMPONENT CONTENTS

BASICS OF PYTHON PROGRAMMING **9 Hours**

Introduction-Python interpreter- interactive and script mode; values and types, operators, expressions, statements, precedence of operators, Multiple assignments, comments, Boolean values and operators.

CONTROL STATEMENTS AND FUNCTIONS IN PYTHON 9 Hours

Conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Functions: Introduction, inbuilt functions,function definition and use, flow of execution, parameters and arguments,return values, parameters, scope: local and global, composition, recursion.

DATA STRUCTURES: STRINGS, LSTS, SET 9 Hours

Strings: string slices, immutability, string methods and operations; Lists: creating lists, list operations, list methods, mutability, aliasing, cloning lists, list and strings, list and functions ; list processing : list comprehension, searching and sorting, Sets: creating sets, set operations.

DATA STRUCTURES: TUPLES, DICTIONARIES 9 Hours

Tuples: Tuple assignment, Operations on Tuples, lists and tuples, Tuple as return value; Dictionaries: operations and methods, Nested Dictionaries, Traversing Nested Dictionaries.

FILES, MODULES, PACKAGES 9 Hours

Files and exception: text files, reading and writing files, format operator; errors and exceptions, handling exceptions, modules, packages.

Theory: 30	Tutorial: 0	Practical: 0	Project: 0	Total: 30 Hours

REFERENCES

1. Ashok NamdevKamthane,Amit Ashok Kamthane, Programming and Problem Solving with Python , Mc-Graw Hill Education,2018.
2. Allen B. Downey, Think Python: How to Think Like a Computer Scientist, Second edition, Updated for Python 3, Shroff / O'Reilly Publishers, 2016John V Guttag, Introduction to Computation and Programming Using Python, Revised and expanded Edition, MIT Press , 2013.
3. Robert Sedgewick, Kevin Wayne, Robert Dondero, Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.
4. Timothy A. Budd, Exploring Python, Mc-Graw Hill Education (India) Private Ltd., 2015.
5. Kenneth A. Lambert, Fundamentals of Python: First Programs, CENGAGE Learning, 2012.
6. Charles Dierbach, Introduction to Computer Science using Python: A Computational Problem Solving Focus, Wiley India Edition, 2013.

E BOOKS AND ONLINE LEARNING MATERIALS

1. www.mhhe.com/kamthane/python
2. Allen B. Downey, Think Python: How to Think Like a Computer Scientist, Second edition, Updated for Python 3, Shroff / O'Reilly Publishers, 2016 (http://greenteapress.com/wp/thinkpython/)

LAB COMPONENT CONTENTS 30 Hours

LIST OF EXPERIMENTS

1. Programs using expressions and input and output statements.

2. Programs using operators and built in functions.
3. Programs using conditional statements.
4. Program to exchange the values of two variables.
5. Program to test whether a given year is a leap year or not
6. Programs performing all string operations.
7. Programs using functions
8. Programs to find square root, GCD, exponentiation, sum an array of numbers
9. Programs to perform linear search, binary search
10. Programs to perform operations on list
11. Programs using dictionary and set
12. Programs to work with Tuples.
13. Programs to sort elements (Selection, Insertion, Merge, Quick)
14. Programs to search element.
15. Program to perform word count in file.
16. Program to copy file
17. Program to read and write file
18. Programs using modules and packages

Theory: 0	**Tutorial: 0**	**Practical: 30**	**Project: 0**	**Total: 30 Hours**

ONLINE COURSES AND VIDEO LECTURES:
http://nptel.ac.in

U18MEP1502 ENGINEERING PRACTICES LABORATORY
(Common to all branches of Engineering and Technology (Except CSE and IT))

L	T	P	PJ	C
0	0	2	0	1

Course outcomes

At the end of this course, the student will be able to:

CO1: Understand the applications of simple tools used in the fabrication workshop.

CO2: Select the appropriate tools required for specific operation.

CO3: Make simple joints using Carpentry and Fitting tools also make simple components using sheet metal tools.

CO4: Understand the applications of different plumbing tools and fittings.

CO5: Demonstrate and evaluate the parameters of basic electronic components (wires, resistors, capacitors, diodes etc.) and test the components.

CO6: Estimate DC and AC Voltage and currents using appropriate measuring instruments.

Pre-requisites: Nil

CO/PO MAPPING
(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	PROGRAMME OUTCOMES (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1			W					M		M		
CO2			W					M		M		
CO3			W					M		M		
CO4			W					M		M		
CO5			W					M		M		
CO6			W					M		M		

COURSE ASSESSMENT METHODS

DIRECT
1. Continuous Assessment Test I, II (Theory component) 2. Open Book Test, Assignment, Group Presentation 3. Viva, Experimental Report for each Experiment (lab Component) 4. Model Examination (lab component) 5. End Semester Examination (Theory and lab components)
INDIRECT
1. Course-end survey

LIST OF EXPERIMENTS

GROUP – I

A. CIVIL ENGINEERING

1. Carpentry

- Study of carpentry tools
- Preparation of T joint
- Preparation of dovetail joint

2. Plumbing
   - Study of pipeline joints

B. MECHANICAL ENGINEERING

1. Fitting
   - Study of fitting tools
   - Preparation of L joint
2. Sheet Metal Working
   - Study of sheet metal working tools
   - Preparation of Tray
   - Preparation of Cone
3. Demonstration of mold preparation
4. Demonstration of smithy operations
5. Demonstration of SMA welding process

GROUP - II (ELECTRICAL & ELECTRONICS ENGINEERING)

C. ELECTRICAL ENGINEERING PRACTICE

1. Residential house wiring using switches, fuse, indicator, lamp and energy meter.
2. Fluorescent lamp wiring.
3. Stair-case wiring.
4. Measurement of electrical quantities–voltage, current, power & Power factor in RLC circuit.
5. Measurement of energy using single phase energy meter.

D. ELECTRONIC ENGINEERING PRACTICE

1. Assembling simple electronic component on a small PCB and Testing.
2. Soldering simple electronic circuits and checking continuity.
3. Measurements using digital multimeter.
   - DC and AC voltage measurement
   - DC and AC current measurements.
   - Resistance Measurement.
   - Continuity measurement.

1. Testing of Electronic components
   - Resistors
   - Inductors and capacitors
   - Diodes (resistance in forward bias and reverse bias)
   - Transistors
2. Study of CRO and Function generator
   - Study of Panel Controls
   - Measurement of Amplitude, Frequency, phase difference

Theory: 0	**Tutorial: 0**	**Practical: 45**	**Project: 0**	**Total: 45 Hours**

SEMESTER II

U18ENI2201 FUNDAMENTALS OF COMMUNICATION II

(Common to all branches of Engineering and Technology)

L	T	P	PJ	C
2	0	2	0	3

Course outcomes

At the end of this course, the student will be able to:

CO1: Make formal presentations in technical and business scenarios.
CO2: Hone skills required to face corporate interviews.
CO3: Comprehend and write reviews for products, articles and films.
CO4: Gain competence in Business and Technical Writing

Pre-requisites: Nil

CO/PO MAPPING

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	PROGRAMME OUTCOMES (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												
CO6												

COURSE ASSESSMENT METHODS

DIRECT
Assessments (5 hrs) 1. Spoken Practice tests 2. Presentations 3. Assignments 4. Class room tests
INDIRECT
Course-end survey

FORMAL PRESENTATIONS AND MOCK INTERVIEW **10 Hours**

1.1 Formal Presentations to an Audience

1.2 Mock Interview

- Corporate Round
- Technical Round
- Current Affairs

WRITING REVIEWS **10 Hours**

2.1 Writing a story for the Newspaper
2.2 Product Review
2.3 Article Review
2.4 Film Review

BUSINESS WRITING **10 Hours**

3.1 Letters, Memo
3.2 Emails
3.3 Agenda and Minutes
3.4 Writing an organizational chart
3.5 Profile Writing

TECHNICAL WRITING **10 Hours**

4.1 Technical Letters
4.2 Technical Report
4.3 Writing a Research Proposal
4.4 Data Interpretation

Theory: 0	**Tutorial: 0**	**Practical: 45**	**Project: 0**	**Total: 45 Hours**

U18MAI2201 ADVANCED CALCULUS AND LAPLACE TRANSFORMS

L	T	P	PJ	C
3	1	0	0	4

(Common to all branches of Engineering and Technology)

Course Outcomes

After successful completion of this course, the students should be able to:

CO1: Evaluate multiple integrals and apply them to find area, moment of inertia, centre of mass and volume.

CO2: Apply various vector differential operators and integral theorems for solving Engineering problems involving cubes and rectangular parallelepipeds.

CO3: Construct analytic functions of complex variables and transform functions from z Plane and w-plane and vice-versa, using conformal mappings.

CO4: Use the fundamentals of residues, complex integration to evaluate real integrals.

CO5: Transform functions in time domain to frequency domain using Laplace transform.

CO6: Convert ordinary differential equations into algebraic equations using Laplace transform and solve them using inverse Laplace transform.

Pre-requisites : NIL

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S							M	M		M
CO2	S	S							M	M		M
CO3	S	S							M	M		M
CO4	S	S							M	M		M
CO5	S	S							M	M		M
CO6	S	S							M	M		M

Course Assessment methods

Direct
1. Continuous Assessment Test I, II 2. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation, Project report, Poster preparation, Prototype or Product Demonstration etc. (as applicable) 3. End Semester Examination
Indirect
1. Course-end survey

9 + 2 Hours

MULTIPLE INTEGRALS

Double integration – Cartesian and polar coordinates – Change of order of integration –Change of variables between Cartesian and polar coordinates – Triple integration in Cartesian coordinates – Application: Area as double integral – Moment of inertia - Centre of mass - Volume as triple integral.

VECTOR CALCULUS **9 + 3 Hours**

Gradient, divergence and curl – Directional derivative – Irrotational and Solenoidal vector fields - Green's theorem in a plane, Gauss divergence theorem and Stoke's theorem (excluding proofs) – Simple applications involving cubes and rectangular parallelepipeds.

ANALYTIC FUNCTIONS **9 + 3 Hours**

Functions of a complex variable – Analytic functions – Necessary conditions, Cauchy- Riemann equations in Cartesian coordinates and sufficient conditions (excluding proofs) – Properties of analytic function – Construction of analytic function by Milne Thomson method – Conformal mapping : $w = z + c$, cz , $1/z$ and bilinear transformation.

COMPLEX INTEGRATION **9 + 2 Hours**

Statement and applications of Cauchy's integral theorem and Cauchy's integral formula (excluding proofs) – Taylor's and Laurent's series expansions – Singularities – Residues – Cauchy's residue theorem (excluding proof) – Application of residue theorem to evaluate real integrals - Unit circle and semi-circular contours (excluding poles on real axis).

LAPLACE TRANSFORM **5 + 3 Hours**

Definition - Properties – Superposition - Shift in t - Shift in s - Time Derivatives – Time Integral – Initial and Final Value Theorems – Periodic functions: sine wave, saw-tooth, square and triangular waves.

INVERSE LAPLACE TRANSFORM **4 + 2 Hours**

Inverse Laplace Transform – Simple system dynamic models – Transfer Functions – Poles and Zeroes – Response of First-Order Systems – Solution of RC Free, Step and Sinusoidal Responses; Response of Second-Order Systems – Free Response, step Response – Convolution theorem.

Theory: 45	**Tutorial: 15**	**Practical: 0**	**Project: 0**	**Total : 60 Hours**

REFERENCES

1. Kreyzig E., Advanced Engineering Mathematics, John Wiley & Sons (Asia), Pvt, Ltd., Singapore, 10th Edition, 2010
2. Grewal B.S., Higher Engineering Mathematics, Khanna Publishers, Delhi, 42nd Edition, 2012.
3. Philip D. Cha, James J. Rosenberg, Clive L. Dym, Fundamentals of Modelling and Analyzing Engineering Systems, Cambridge University Press, United Kingdom, 2000.

4 Veerarajan T., Engineering Mathematics (for First Year), Tata McGraw Hill, Pub. Co. Ltd., New Delhi, Revised Edition, 2007.
5 Venkataraman M.K., Engineering Mathematics, Volume - II, The National Pub. Co., Chennai, 2003.
6 Kandasamy P., Thilagavathy K. and Gunavathy K., Engineering Mathematics, S. Chand & Co., New Delhi, 2008.
7 Arunachalam T. and Sumathi K., Engineering Mathematics II, Sri Vignesh Publications, Coimbatore, Third Edition, 2011.
8 Weir .MD, Hass J, Giordano FR: Thomas Calculus Pearson education 12th Edition, 2015.
9 N.P.Bali., Dr. Manish Goyal., ―Transforms and partial differential equations, University science Press, New Delhi, 2010.

E books and online learning materials

1. Advanced Engineering Mathematics, P. V. O'Neil, 5th Indian reprint 2009, Cengage Learning India Pvt. Ltd.
2. Advanced Engineering Mathematics, Dennis Zill Warren S Wright Michael R. Cullen, 4th edition, 2011, Jones & Bartlett Learning.

Online Courses and Video Lectures:

1.http://nptel.ac.in/course.php?disciplineId=111

2.www.mathworld.wolfram.com

U18PHT2001 ENGINEERING PHYSICS

L	T	P	PJ	C
3	0	2	0	4

Course Outcomes

After successful completion of this course, the students should be able to

CO1: Understand the principles of motion and rotation of a rigid body in the plane.

CO2: Enhance the fundamental knowledge in properties of matter and its applications relevant to various streams of Engineering and Technology.

CO3: Recognise the nature and role of the thermodynamic parameters.

CO4: Compute electrostatic field and electric potential due to point and distributed charges.

CO5: Use electrostatic & magneto static boundary conditions to relate fields in adjacent media.

CO6: Introduce and provide a broad view of the smart materials and Nano science to undergraduates.

Pre-requisites : Nil

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M										M
CO2	S	M			S							M
CO3	S	M			S							M
CO4	S	M			S							M
CO5	S	M			S							M
CO6	S	M					M					M

Course Assessment methods

Direct
1. Continuous Assessment Test I, II (Theory component) 2. Cooperative learning report, Assignment; Group Presentation, Project report, Poster preparation, 3. Pre/Post - experiment Test/Viva; Experimental Report for each experiment (lab component) 4. Model examination (lab component) 5. End Semester Examination (Theory and lab component)
Indirect
1. Course-end survey

Theory Component contents

KINEMATICS & RIGID BODY MOTION **9 Hours**

Definition and motion of a rigid body in the plane; Rotation in the plane; Kinematics in a coordinate system rotating and translating in the plane; Angular momentum about a point of a rigid body in planar motion; Euler's laws of motion, their independence from Newton's laws, and their necessity in describing rigid body motion; Examples.

PROPERTIES OF MATTER AND MATERIALS TESTING **9 Hours**

Properties of matter: Hooke's Law Stress - Strain Diagram - Elastic moduli - Relation between elastic constants - Poisson's Ratio - Expression for bending moment and depression - Cantilever - Expression for Young's modulus by Non uniform bending and its experimental determination.

Materials testing: Mechanism of plastic deformation, slip and twinning – types of fracture – Vickers Hardness test - fatigue and creep test.

HEAT **9 Hours**

Specific heat capacity, thermal capacity. Temperature rise. Coefficient of linear thermal expansion. Methods of measurement of thermal expansion. Thermal stresses in composite structures due to non-homogeneous thermal expansion. Applications -The bimetallic strip. Expansion gaps and rollers in engineering structures. Thermal conductivity: differential equation of heat flow. Lee's disc apparatus for determination of thermal conductivity. Thermal Insulation. Convection and radiation. Applications to refrigeration and power electronic devices.

ELECTROSTATICS & MAGNETOSTATICS **10 Hours**

ELECTROSTATICS : Maxwell's equation for electrostatics – E due to straight conductors, circular loop, infinite sheet of current - electric field intensity (D) - Electric potential - dielectrics - dielectric polarization - internal field – Clasious - Mosotti equation - dielectric strength - applications.

MAGNETOSTATICS: Maxwell's equation for magnetostatics - B in straight conductors, circular loop, infinite sheet of current - Lorentz force, magnetic field intensity (H) – Biot–Savart's Law – Ampere's Circuit Law –Magnetic flux density (B) – magnetic materials – Magnetization – Applications.

NEW ENGINEERING MATERIALS AND NANO TECHNOLOGY **8 Hours**

New Engineering Materials: Metallic glasses – preparation, properties and applications – Shape memory alloys (SMA) – characteristics, properties of NiTi alloy applications - advantages and disadvantages of SMA.

Nano Materials: synthesis - Ball milling - Sol-gel - Electro deposition — properties of nano particles and applications. – Carbon Nano Tubes – fabrication by Chemical Vapour Deposition - structure, properties & applications.

Theory: 45	Tutorial: 0	Practical: 0	Project: 0	Total: 45 Hours

REFERENCES

1. Elements of Properties of Matter, Mathur D.S., Shyamlal Charitable Trust, New Delhi, 1993.
2. Essential University Physics, Vols. 1 and 2., Richard Wolfson, Pearson Education, Singapore, 2011.
3. Properties of matter, brijlal and Subharamaniam, S.Chand and Co, New Delhi, 2004.
4. Fundamentals of General Properties of Matter by Gulati H.R., R. Chand & Co., New Delhi, 1982.
5. Engineering Mechanics (2nd ed.), Harbola M. K., Cengage publications, New Delhi, 2009.
6. Introduction to Mechanics, Verma M. K. (CRC Press), University Press, 2000.
7. Thermodynamics: An Engineering Approach (SI Units), yunus a. cengel & michael a. boles 7^{th} edition, mcgraw-hill companies 2014.
8. Concepts in Thermal Physics, Stephen Blundell, Oxford University Press, 2 nd Edition 2010.
9. Concepts of Physics, H.C.Verma vol 1 and 2, Bharati Bhawan Publishers & Distributors; First edition (2017).
10. Engineering Electromagnetics, W. H. Hayt and John A. Buck, 6th Edition, Tata McGraw Hill, New Delhi, 2014.
11. Fundamentals of Applied Electromagnetics (7th Edition), Fawwaz T. Ulaby, Umberto Ravaioli Pearson, 2010
12. Electromagnetic Field Theory, 5th Edition, Gangadhar K.A. and Ramanathan P.M., Khanna Publishers, New Delhi, 2013.
13. Problems and Solutions in Electromagnetics, 1st Edition, J.A. Buck and W. H. Hayt, Tata McGraw Hill, New Delhi, 2010.
14. Electromagnetic with Applications, 5th Edition, John D. Kraus and Daniel A. Fleisch, Tata McGraw Hill, New Delhi, 2010.
15. Theory and Problems of Electromagnetic Schaum's Outline Series, 5th Edition, Joseph A. Edminister, Tata McGraw Hill Inc., New Delhi, 2010.
16. Engineering Physics, Rajendran V., Tata McGraw-Hill Education Pvt. Ltd., 2010
17. Nano – the Essentials, Pradeep T., McGraw-Hill Education, Pvt. Ltd., 2007.

Lab component:

COURSE OUTCOMES

CO 1: Determine different physical properties of a material like band gap, magnetic field intensity, etc., for engineering and technological applications.
CO 2: Perform experiments involving the physical phenomena like light, heat and sound.
CO 3: Verify physics concepts through experiments.

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												
COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S											
CO2		M	S									
CO3		S		M								

LIST OF EXPERIMENTS

1. Lee's disc - determination of thermal conductivity of a bad conductor
2. Measurement of Moment of Inertia
3. Hysteresis curve
4. Determination of band gap of a semiconductor
5. Determination of specific resistance by Carry – Foster Bridge
6. Calibration of Ammeter, Voltmeter
7. Determination of thickness of thin sheet – Air wedge
8. Determination of frequency of an electrically maintained turning fork – Melde's string
9. Spectrometer - determination of wavelength of mercury source using grating
10. Determination of solar cell parameters

Experiments for Demonstration:

1. Hall effect
2. Hardness Test
3. Four probe experiment
4. Laser experiments - Determination of wavelength of light, Numerical aperture and acceptance of optical fibre

Theory: 0	**Tutorial: 0**	**Practical: 30**	**Project: 0**	**Total: 30 Hours**

U18CSI2201 PROBLEM SOLVING AND PROGRAMMING USING PYTHON

L	T	P	PJ	C
3	0	2	0	4

COURSE OUTCOMES

AFTER SUCCESSFUL COMPLETION OF THIS COURSE, THE STUDENTS SHOULD BE ABLE TO

CO1: Explain the basics of problem solving techniques.
CO2: Select appropriate data types and control structures for solving a given problem.
CO3: Illustrate the representation of arrays, strings and usage of string operations.
CO4: Illustrate the importance of pointers and functions.
CO5: Explain the fundamentals of structures and unions.
CO6: Explain the fundamentals of file handling .

Pre-requisites: U18CSI1201

CO/PO MAPPING
(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	PROGRAMME OUTCOMES (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M										
CO2	S	M										
CO3	S	L			L				L	L		
CO4	M	L			L				L	L		M
CO5	M	L			L				L	L		M
CO6	L	L										

COURSE ASSESSMENT METHODS

DIRECT

1. Continuous Assessment Test I, II (Theory Component)
2. Assignment (Theory Component)
3. Group Presentation (Theory Component)
4. Pre/Post - experiment Test/Viva; Experimental Report for each experiment (lab component)
5. Model examination (lab component)
6. End Semester Examination (Theory and lab component)

INDIRECT

2. Course-end survey

THEORY COMPONENT CONTENTS

STRUCTURED PROGRAMMING **9 Hours**

Algorithms, building blocks of algorithms (instructions/statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving.

ARRAYS AND STRINGS **9 Hours**

Introduction to C Programming – Operators and Expressions – Data Input and Output – Control Statements. Defining an array – Processing an array – Passing arrays to functions – Multidimensional Arrays Character Arithmetic – Defining a string – NULL character – Initialization of Strings – Reading and Writing Strings – Processing Strings –Searching and Sorting of Strings.

FUNCTIONS, STORAGE CLASSES **9 Hours**

Defining a function – Accessing a function – Function prototypes – Passing arguments to a function – Function with string - Recursion – Storage classes

POINTERS **9 Hours**

Pointer Fundamentals – Pointer Declaration – Passing Pointers to a Function – Pointers and one dimensional arrays – operations on pointers– Dynamic memory allocation

STRUCTURES, UNIONS AND FILES **9 Hours**

Structures and Unions: Defining a Structure – Processing a Structure – User defined data types (Typedef) – Unions

Files: Opening and Closing a Data File – Reading and writing a data file – Processing a data file – Unformatted data files – Concept of binary files – Accessing a file randomly using fseek

Theory: 45	**Tutorial: 0**	**Practical: 0**	**Project: 0**	**Total: 45 Hours**

REFERENCES

1. Byron S Gottfried and Jitendar Kumar Chhabra, “Programming with C”, Tata McGraw Hill Publishing Company, Third Edition, New Delhi, 2011.
2. PradipDey and ManasGhosh, “Programming in C”, Second Edition, Oxford University Press, 2011.
3. Kernighan,B.W and Ritchie,D.M, “The C Programming language”, Second Edition, Pearson Education, 2006
4. Ashok N. Kamthane, “Computer programming”, Pearson Education, 2007.
5. Byron S Gottfried and Jitendar Kumar Chhabra, “Programming with C”, Tata McGraw Hill Publishing Company, Third Edition, New Delhi, 2011.
6. PradipDey and ManasGhosh, “Programming in C”, Second Edition, Oxford University Press, 2011.
7. Kernighan,B.W and Ritchie,D.M, “The C Programming language”, Second Edition, Pearson Education, 2006
8. Ashok N. Kamthane, “Computer programming”, Pearson Education, 2007.

LAB COMPONENT CONTENTS

LIST OF EXPERIMENTS **30 Hours**

1. Writing algorithms, flowcharts and pseudo codes for simple problems.

2. Programs on expressions and conversions
3. Programs using if, if-else, switch and nested if statements
4. Programs using while, do-while, for loops
5. Programs on one dimensional arrays, passing arrays to functions and array operations
6. Programs using two dimensional arrays, passing 2D arrays to functions
7. Programs using String functions
8. Programs using function calls, recursion, call by value
9. Programs on pointer operators, call by reference, pointers with arrays
10. Programs using structures and unions.
11. Programs on file operations and modes.
12. Working with text files, random files and binary files

Theory: 0	**Tutorial: 0**	**Practical: 30**	**Project: 0**	**Total: 30 Hours**

REFERENCES

1. Byron S Gottfried and Jitendar Kumar Chhabra, "Programming with C", Tata McGraw Hill Publishing Company, Third Edition, New Delhi, 2011.
2. PradipDey and ManasGhosh, "Programming in C", Second Edition, Oxford University Press, 2011.
3. Kernighan,B.W and Ritchie,D.M, "The C Programming language", Second Edition, Pearson Education, 2006
4. Ashok N. Kamthane, "Computer programming", Pearson Education, 2007.

U18MET2001 MANUFACTURING TECHNOLOGY

L	T	P	PJ	C
3	0	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO 1: Apply the knowledge of various metal casting processes that are useful in designing system components or processes and create appropriate techniques and apply modern tools and research to model complex design and making processes of components.

CO 2: Discuss the various welding techniques with their equipment, process capabilities and principle of operations that match specific manufacturing needs with considerations for public health, safety and social issues.

CO 3: Apply the knowledge of metal working processes understanding and studying the physics behind it and focus on typical forging operations

CO 4: Identify various rolling, piercing and extrusion operations and study and make use of them in solving complex design needs through specific manufacturing tools and methods

CO 5: Understand the applications of heat treatment processes.

CO 6: Study the formability, characteristics, test methods and working principle of sheet metals by applying the knowledge of engineering and make use of sheet metal processing knowledge in practical engineering applications.

Pre-requisites: Nil

CO/PO MAPPING

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	PROGRAMME OUTCOMES (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1			S		S				W	M		
CO2			S	M	S	W			W	M		
CO3	M		S						W	M		
CO4	M		S						W	M		
CO5			S		M					M		
CO6	M		S							M		

Course Assessment methods

Direct
1. Continuous Assessment Test I, II 2. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation, Project report, Poster preparation, Prototype or Product Demonstration etc (as applicable) 3. End Semester Examination
Indirect
1. Course-end survey

METAL CASTING PROCESSES **12 Hours**

Sand casting – Sand moulds - Type of patterns – Pattern materials – Pattern allowances – Types of Moulding sand – Properties – Core making – Methods of Sand testing – Moulding machines – Types of moulding machines – Working principle of Special casting processes – Shell, investment casting – Ceramic mould – Pressure die casting – Centrifugal casting – Sand Casting defects – Inspection methods, Runner, Riser and Gating Design, Solidification.

FABRICATION PROCESSES **10 Hours**

Fusion welding processes – Types of Gas welding – Equipments used – Flame characteristics – Filler and Flux materials - Arc welding equipments - Electrodes – Coating and specifications – Principles of Resistance welding – Spot/butt, seam welding – Gas cutting opeartions – Flux cored – Submerged arc welding – TIG welding –Weld defects – Brazing and soldering process.

METAL FORMING AND HEAT TREATMENT PROCESSES **13 Hours**

FORGING

Hot working and cold working of metals – Forging processes – Open and close die forging – Characteristics of the process – Typical forging operations.

ROLLING

Rolling of metals – Flat strip rolling – Types of Rolling mills – Shape rolling operations – Tube piercing – Defects in rolled parts.

EXTRUSION

Principles of Extrusion – Types of Extrusion – Hot and Cold extrusion.

WIRE DRAWING

Principle of rod and wire drawing.

HEAT TREATMENT

Annealing – Normalizing – Hardening – Tempering – Surface hardening processes.

SHEET METAL FORMING PROCESSES **10 Hours**

Sheet metal characteristics - Typical shearing operations, bending and drawing operations – Stretch forming operations — Formability of sheet metal – Test methods – Working principle and application of special forming processes - Hydro forming – Rubber pad forming – Metal spinning – Explosive forming – Magnetic pulse forming – Super plastic forming – Process characteristics.

Theory: 45	**Tutorial: 0**	**Practical: 0**	**Project: 0**	**Total: 45 Hours**

REFERENCES

1. HajraChoudhury, “Elements of Workshop Technology”,MediaPromotorsPvt.Ltd., Mumbai, 2001.
2. SeropeKalpajian and Steven R.Schmid, “Manufacturing Engineering and Technology”, Pearson Education, 2002.

3. B.S. MagendranParashar and R.K. Mittal,“Elements of Manufacturing Processes”, Prentice Hall of India, New Delhi,2003.
4. P.N.Rao,“Manufacturing Technology”,Tata McGraw-Hill,2002.
5. P.C. Sharma, “Production Technology”, S. Chand,New Delhi,2007.

U18MEP2502 MANUFACTURING AND METALLURGY LABORATORY

L	T	P	PJ	C
0	0	2	0	1

Course Outcomes

After successful completion of this course, the students should be able to

CO 1: Practice making molds using different types of patterns and core and acquire practical knowledge involved in designing prototypes/components
CO 2: Learn how to make internal geometries in castings using core
CO 3: Know and practice the skill of smithy and learn to modify the shapes of hard metal rods physically.
CO 4: Know how to perform welding operations and how to join different metals.
CO 5: Analyze the procedure of microstructure studies of various materials.
CO 6: Execute the various heat treatment process for different stages.

Pre-requisites : Nil

CO/PO MAPPING
(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	PROGRAMME OUTCOMES (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1			S		S				S	W	M	
CO2			S						S	W	W	
CO3					S			S	S	W	W	
CO4					S			S	S	W	W	
CO5	M			M						M		M
CO6	M			M						M		M

Course Assessment methods

Direct
1. Pre-or Post-experiment Test/Viva; Experimental Report for each experiment; Model Examination 2. End Semester Examination
Indirect
1. Course-end survey

List of Experiments

LIST OF EXPERIMENTS: MANUFACTURING TECHNOLOGY LABORATORY

1. Mould with solid and split patterns
2. Mould with Core
3. Conversion of round rod in to hexagonal headed square rod
4. SMAW of different types of joints

LIST OF EXPERIMENTS: METALLURGY LABORATORY

1. Study the construction and working principle of metallurgical microscope.
2. Study the procedure of specimen preparation for metallographic studies.
3. Identification of microstructure of ferrous materials, EN8 and mild steel.
4. Heat treatment comparison of
   i) Unhardened specimen
   ii) Quenched specimen, annealed and normalized specimen

Theory: 30	**Tutorial: 0**	**Practical: 30**	**Project: 0**	**Total: 30 Hours**