DEPARTMENT OF MECHANICAL ENGINEERING
KAKATIYA INSTITUTE OF TECHNOLOGY & SCIENCE, WARANGAL – 15
(An Autonomous Institute under Kakatiya University, Warangal)

SCHEME OF INSTRUCTION AND EVALUATION
I-SEMESTER OF 4-YEAR B.TECH DEGREE PROGRAMME

[5Th+4P+2MC]

Sl. No	Category	Course Code	Course Title	Hours per week			Credits	Evaluation Scheme				
								CIE			ESE	Total Marks
				L	T	P	C	TA	MSE	Total		
1	BSC	U18MH101	Engineering Mathematics – I	3	1	-	4	10	30	40	60	100
2	ESC	U18CS102	Programming for Problem Solving using C	3	-	-	3	10	30	40	60	100
3	BSC	U18PH103	Engineering Physics	3	1	-	4	10	30	40	60	100
4	HSMC	U18MH104	English for Communication	2	-	2	3	10	30	40	60	100
5	ESC	U18EE105	Basic Electrical Engineering	3	1	-	4	10	30	40	60	100
6	ESC	U18EE106	Basic Electrical Engineering Lab	-	-	2	1	40	-	40	60	100
7	ESC	U18CS107	Programming for Problem Solving using C Lab	-	-	2	1	40	-	40	60	100
8	BSC	U18PH108	Engineering Physics Lab	-	-	2	1	40	-	40	60	100
9	ESC	U18ME109	Workshop Practice	-	-	2	1	40	-	40	60	100
10	MC	U18EA110	EAA: Sports/Yoga/NSS*	-	-	2	-	100	-	100	-	100
11	MC	U18MH111	Universal Human Values-I *(Induction Programme)*	-	-	-	-	-	-	-	-	-
			Total:	**14**	**3**	**12**	**22**	**280**	**180**	**460**	**540**	**1000**

L= Lecture, T = Tutorials, P = Practicals & C = Credits
EAA: Extra Academic Activity
*** indicates mandatory non-credit course**

Contact hours per week : 29
Total Credits : 22

U18MH101 ENGINEERING MATHEMATICS- I

Class: B.Tech. I-Semester **Branch:** Common to all branches

Teaching Scheme :

L	T	P	C
3	1	-	4

Examination Scheme :

Continuous Internal Evaluation	40 marks
End Semester Exam	60 marks

Course Learning Objectives (LOs):

This course will develop students' knowledge in /on

LO1**:** *basic concepts such as convergence and divergence of series, tests for convergence of series; limit, continuity, differentiability of a function, mean value theorems, expansion of a function in series*

LO2 **:** *partial differentiation and total differentiation , and maxima & minima of functions of two/several variables*

LO3 **:** *differential equations of first order along with certain applications.*

LO4 **:** *the methods of solving higher order linear differential equations and introduce few applications to engineering problems.*

UNIT-I (9+3)

Infinite Series: Sequences & Series, General properties of series, Series of positive terms, Comparison test, Limit comparison test, Integral test, D'Alembert's Ratio test, Cauchy's n^{th} root test, Alternating series- absolute convergence.

Differential Calculus (Functions of One Variable): Limits, Continuity, Differentiability, Rolle's theorem (Physical and algebraic interpretations), Lagrange's mean value theorem (Geometrical interpretation), Cauchy's mean value theorem. Taylor's theorem and Power series representation of functions, Maclaurin's series, Asymptotes and Tracing of Simple Curves.

UNIT-II (9+3)

Differential Calculus (Functions of Several Variables): Partial differentiation, Total differentiation, Change of variables, Application to find Tangent plane and Normal to a surface, Jacobians. Taylor's theorem for function of two variables (without proof), Maximum and minimum values of functions of two variables. Langrage's method of undetermined multipliers. Differentiation under integral sign.

UNIT-III (9+3)

Differential Equations of First Order: Practical approach to differential equations. Formation and solution of differential equation. Solution of first order and first degree differential equation, variables separable form, homogeneous form, reducible to homogeneous form, First order linear equations, Equations reducible to linear equation (Bernoulli's equation), Exact differential equations, Equations reducible to exact form.

Applications of First Order Differential Equations: Simple examples of Physical applications (Orthogonal trajectories, RL series circuit problem).

UNIT-IV (9+3)

Higher Order Linear Differential Equations with Constant Coefficients: Linear differential Equations of higher order with constant coefficients, General solution, Complementary function, Particular Integral. Methods of evaluation of particular Integrals. Wronskian, Linear

dependence of solutions, Method of Variation of parameters. Cauchy's homogenous linear equation. Applications: Simple examples of RLC series circuit problem.

Text Books

1. Grewal, B.S., "Higher Engineering Mathematics", *Khanna Publishers,* Delhi, 43rd edition, 2014.

Reference Books

1. Kreyszig E., "Advanced Engineering Mathematics", *John Wiley & Sons, Inc.,* U.K 9th edition, 2013.
2. Shanti Narayan, "Differential Calculus", *S. Chand & Co.*, New Delhi.
3. S.S.Sastry, "Engineering Mathematics", Vol.II ,*Prentice Hall of India*, 3rd edition, 2014.

Course Learning Outcomes (COs):

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

CO1 : *test the convergence/divergence of a given series t ; understand the basic concepts of limit, continuity, differentiability of a function, and will be able to expand a given function in series .*

CO2 : *apply the technique of differentiation under integral sign to solve an integral and find maxima & minima of functions of two/several variables.*

CO3 : *solve a given differential equations of first order with boundary conditions and understand the application of differential equations of first order.*

CO4 : *solve a given higher order linear differential equation with constant coefficients and Understand few engineering applications.*

Mapping of the Course Learning Outcomes with Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	-	-	-	-	-	-	-	-	1
CO2	3	3	2	-	-	-	-	-	-	-	-	1
CO3	3	2	2	-	-	-	-	-	-	-	-	1
CO4	3	3	2	-	-	-	-	-	-	-	-	1
Avg.	**3**	**2.5**	**1.75**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**

U18CS102 PROGRAMMING FOR PROBLEM SOLVING USING C

Class: B.Tech. I -Semester **Branch:** Common to all branches

Teaching Scheme :

L	T	P	C
3	-	-	3

Examination Scheme :

Continuous Internal Evaluation	40 marks
End Semester Examination	60 marks

Course Learning Objectives (LOs):

This course will develop students' knowledge in /on

LO1*: computer fundamentals and concepts of problem solving using structured programming paradigm*
LO2*: control structures and array operations*
LO3*: string functions and modular programming concepts*
LO4*: structures, unions, pointers and files in C programming*

UNIT-I (9)

Introduction to Computers: Block diagram of computer, types of computers, computer languages, problem solving and program development steps, algorithm, flowchart

Overview of C: History, basic structure of C program

Constants, Variables and Data Types: Character set, C tokens, declaration of variables, symbolic constants and macros

Operators and Expressions: Arithmetic, relational, increment, decrement, conditional, logical, bit-wise, special operators, arithmetic expressions, precedence of operators and associativity

Managing Input and Output Operations: Reading a character, writing a character**,** formatted input, formatted output

UNIT-II (9)

Decision Making and Branching: Simple if, if-else, nested–if, else-if ladder, switch, conditional operator, goto statement

Decision Making and **Looping:** While, do-while, for statements, nested loops, break and continue statements

Arrays: One dimensional array, declaration of one dimensional arrays, initialization of one dimensional arrays, two dimensional arrays, initializing two dimensional arrays, linear search

UNIT-III (9)

Character Arrays and Strings: Reading strings, writing strings, string handling functions, table of strings

User Defined Functions: Need of user defined functions, definition of function, return values and their types, function calls, function declaration, category of function, no arguments and no return values, arguments but no return values, arguments with return values, no arguments but returns a value, recursion, storage classes

UNIT-IV (9)

Structures and Unions: Declaring structure variables, accessing structure members, array of structures, structures within structures, unions

Pointers: Understanding **pointers**, declaring and initializing pointer variables, pointer expressions, pointers and arrays, pointers and character strings, array of pointers, pointers as function arguments, pointers and structures

File Management in C: Defining and opening a file, input and output operations on sequential text files

Text Books:

1. E.Balagurusamy, "Programming in ANSIC", *Tata McGraw Hill*, 6th Edn, ISBN-13: 978-1- 25 - 90046 -2, 2012

Reference Books:

1. Kerninghan and Ritchie, "The C Programming Language", *Prentice Hall of India*, 2nd Edn., ISBN-13:007-6092003106, 1988
2. A.K.Sharma, "Computer Fundamentals and programming in C", *Universities Press, II edition,* ISBN-9789386235299, 2018.
3. Peter Norton, "Introduction to Computers", *Tata McGraw-Hill*, 6th Edn.,ISBN-978-0-07-0593-74-9. 2008
4. Herbert Schildt, "Complete Reference with C", *Tata McGraw Hill,* 4th Edn., ISBN-13: 9780070411838, 2000
5. Yaswanth Khanetkar, "Let Us C", *BPB Publications*, 13th Edn., ISBN-13: 9788183331630, 2012

Course Learning Outcomes (COs):

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

CO1*: draw the block diagram of a computer, enumerate programming development steps, design an algorithm and flow chart for a given application*

CO2*: apply logical skills for problem solving using control structures and arrays*

CO3*: develop string programs and modular programming with functions*

CO4*: implement structures, unions, pointers and files in C programming*

Mapping of the Course Learning Outcomes with Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	-	-	-	-	-	2	2	1	2	1
CO2	2	2	2	1	-	1	-	2	2	1	3	1
CO3	3	3	3	2	1	1	-	2	2	1	3	1
CO4	3	3	3	3	3	1	1	2	2	1	3	1
Avg.	**2.5**	**2.25**	**2.66**	**2**	**2**	**1**	**1**	**2**	**2**	**1**	**2.75**	**1**

U18PH103 ENGINEERING PHYSICS

Class: B.Tech. I-Semester

Branch: Common to all branches

Teaching Scheme:

L	T	P	C
3	1	-	4

Examination Scheme:

Continuous Internal Evaluation	40 Marks
End Semester Exam	60 Marks

Course Learning Objectives (LOs):

This course will develop students' knowledge in/on

LO1*: different types of oscillations with illustrations by mechanical and electrical examples, high frequency sound waves and their applications in various fields*

LO2*: concepts of interference, diffraction and polarization of light waves and their applications*

LO3*: concepts and working principles of lasers, fiber optics and their applications in various fields*

LO4*: basic concepts of quantum mechanics, modern materials and their applications*

UNIT-I (9+3)

Oscillations: Introduction, physical examples of simple harmonic motion- torsional pendulum, physical pendulum, spring-mass systems, loaded beams, two body oscillations; qualitative treatment of free, damped and forced oscillations- resonance, applications to series and parallel resonant circuits, Q-factor.

Ultrasonics: Introduction, properties of ultrasonics, production of ultrasonic waves- magnetostriction method and piezo-electric method; detection of ultrasonics, acoustic grating- determination of wavelength of ultrasonics; applications of ultrasonic waves- pulse echo NDT technique (reflection mode).

UNIT-II (9+3)

Interference & Diffraction: Superposition principle, coherence, phase change on reflection, interference of reflected light from uniform thin films- anti reflection coating, Newton's rings in reflected light; applications- determination of wavelength of a monochromatic light and refractive index of a liquid; Michelson's Interferometer, applications- determination of wavelength of a monochromatic light, thickness and refractive index of a thin transparent sheet;

distinction between Fresnel and Fraunhofer class of diffraction, Fraunhofer diffraction at a single slit (phasor method) and a circular aperture, Rayleigh's criterion for resolution; diffraction grating (qualitative)- dispersive power and resolving power of a diffraction grating, determination of wavelength of a monochromatic light using diffraction grating.

Polarisation: Polarised light, double refraction, geometry of calcite crystal, Nicol prism, Huygen's explanation (positive and negative crystals)- quarter and half wave plates; production and detection of plane, circularly and elliptically polarized light; applications- optical activity, LCDs.

UNIT-III (9+3)

Lasers(Qualitative): Introduction- difference between conventional and laser light; absorption, spontaneous and stimulated emission, relation among Einstein coefficients; basic principles- population inversion, pumping methods, optical resonator; types of lasers- Ruby, Nd-YAG, He-Ne and CO_2 Laser; applications of lasers, holography- introduction, formation and reconstruction of a hologram, applications of holography.

Fiber Optics(Qualitative): Introduction, total internal reflection, fiber construction, numerical aperture and acceptance angle; types of optical fibers- step index and graded index, V-number; Fiber drawing- double crucible technique; splicing- fusion & mechanical; power losses in optical fibers- attenuation, dispersion, bending; fiber optic communication system, applications of optical fibers- endoscope, fiber optic sensors (temperature and displacement).

UNIT-IV (9+3)

Elements of Quantum Mechanics: de-Broglie concept of matter waves- de-Broglie wavelength, properties of matter waves; Schrodinger time-independent wave equation (one dimension)- physical significance of wave function (Max Born interpretation); particle in a box (one dimension)- energy quantization; uncertainty principle- illustration and application to the non- existence of free electron in the nucleus.

Modern Materials (Qualitative):

Magnetic Materials: Introduction- origin of magnetic moment, Bohr magneton, permeability, magnetization, susceptibility; classification of magnetic materials, applications of magnetic materials- magnetic recording and magnetic memories.

Superconducting Materials: Superconductivity- Meissner effect, transition temperature, isotope effect, London's penetration depth; types of superconductors- type-I and type-II superconductors; high T_c superconductors; applications of superconductors.

Nanomaterials: Introduction, classification of nanomaterials, surface area to volume ratio, quantum confinement; properties of nanomaterials- physical, chemical, electrical, optical, magnetic and mechanical properties; applications of nanomaterials (in brief); synthesis of nanomaterials- bottom up approach (sol-gel method) and top down approach (ball milling method).

Textbooks:

1. Bhattacharya and Bhaskaran, "Engineering Physics", *Oxford University Press*, 1/e, ISBN-13: 978-0-19-806542-5, 2013.
2. V. Rajendran, "Engineering Physics", *Mc Graw Hill,* ISBN-13:978-9-35-134295-3, 2013.

Reference Books:

1. David Halliday, Robert Resnick and Krane, "Physics Volume I & II", *Wiley India Limited,* 5/e, *ISBN: 978-81-265-1089-4,2014.*
2. R.K. Gaur and S.L.Gupta, "Engineering Physics", *Dhanpath Rai and Sons,* ISBN13-9788189928223, 2013.
3. P.K. Palanisamy,"Engineering Physics", *Scitech Publishers*, 3/e, ISBN: 978 81 83714 487 7, 2013.
4. M. Avadhanulu and Kshirsagar, "A Text Book of Engineering Physics", *S. Chand & Company Ltd,* 10/e, ISBN: 81-219-0817-5, 2013.

Course Learning Outcomes (COs):

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

CO1*: determine the time period and frequency of SHM oscillatory system and know the principles and applications of ultrasonics in different fields*

CO2*: analyse and apply the concepts of interference, diffraction and polarization phenomena in accurate determination of wavelengths, thicknesses, narrow slit widths, optical activity, etc*

CO3*: describe the characteristics and working of lasers, optical fibers and their applications in various fields*

CO4*: classify and enumerate the properties of magnetic, superconducting and nanomaterials and know their engineering applications*

Mapping of the Course Learning Outcomes with Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	-	-	1	1	-	-	1	-	-	-
CO2	2	1	1	1	-	1	1	-	1	-	-	-
CO3	3	1	1	1	2	1	1	-	1	-		-
CO4	3	-	1	1	1	2	1	-	1	-	-	-
Avg.	**2.5**	**1**	**1**	**1**	**1.33**	**1.25**	**1**	**-**	**1**	**-**	**-**	**-**

U18MH104 ENGISH FOR COMMUNICATION

Class: B.Tech. I - Semester **Branch:** Common to all branches

Teaching Scheme :

L	T	P	C
2	-	2	3

Examination Scheme :

Continuous Internal Evaluation	:	40 marks
End Semester Exam	:	60 marks

Course Learning Objectives (LOs):

This course will develop students' knowledge in /on

LO1 **:** *To strengthen grammar and improve language ability to write effectively*

LO2 **:** *To enrich vocabulary and use it appropriately to describe situations*

LO3 **:** *To master reading skill and sub skills to comprehend the text*

LO4 **:** *To acquire listening, speaking and life skills using language laboratory*

UNIT-I (6)

Grammar:

Clause Analysis-Types of Clauses-Noun Clause-Relative Clause-Adverb Clause-Transformation –Simple, Complex, Compound Sentences

Errors-Nouns-Pronouns-Adjectives-Adverbs-Prepositions-Tenses-Articles-Subject-Verb Agreement

"In Banaras"- from the Stories of My Experiments with Truth-An Autobiography of Mahathma Gandhi

UNIT-II (6)

Vocabulary:

Vocabulary-Antonyms-Synonyms-Prefixes-Suffixes-Phrasal Verbs-One Word Substitutes- Word Pairs

"Education Provides a Solid Foundation"- from Wings of Fire –An Autobiography of APJ Abdul Kalam

UNIT-III (6)

Reading Skills:

"An Astrologer's Day" by R.K.Narayan

"On Saying Please" by A. G. Gardiner

UNIT-IV (6)

Writing Skills:

Precis Writing

Essay Writing

Report Writing

REFERENCE BOOKS:

1. Harper Collins, "Cobuild English Grammar" Third Edition, *Harper Collins Publishers Ltd.*
2. Sanjay Kumar & Pushp Lata, "Communication Skills" Second Revised Edition,2015, *Oxford University Press Ltd.*
3. R.K. Narayan," Malgudi Days" Indian Thought Publications,1943
4. APJ Abdul Kalam, "Wings of Fire" An Autobiography, Universities Press,1999
5. Mahatma Gandhi," The Story of My Experiments with Truth" An Autobiography, Global Vision Press,2013

ENGLISH LANGUAGE LAB

Listening Skills (3×2):

Listening to Sounds, Stress and Intonation
Listening for Information

Life Skills (3×2)

Etiquette
Goal Setting
Body Language

Speaking Skills (6×2)

a. ***Presentation Techniques:***
   Self Introduction
   JAM (Just A Minute)
   Group Discussion
   Debate
   Description
   Interview Skills
b. ***Assignment:***
   Students have to present PPT on the topics given in the English Laboratory

Course Learning Outcomes (COs):

After completion of this course, students' will be able to

CO1 : *acquire grammar awareness and use error-free language in speech and writing*

CO2 : *use appropriate vocabulary to describe various situations*

CO3 : *implement a particular reading strategy to comprehend the text*

CO4 : *communicate impressively and effectively*

Mapping of the Course Learning Outcomes with Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	1	-	1	1	1	1	1	1	3	2	1
CO2	1	1	-	-	-	-	1	-	3	2	-	3
CO3	-	1	-	-	-	-	-	-	2	2	2	3
CO4	-	1	1	1	-	-	1	-	3	2	1	3
Avg.	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**2.25**	**2.25**	**1.7**	**2.5**

U18EE105 BASIC ELECTRICAL ENGINEERING

Class: B.Tech. I-Semester **Branch:** Common to all branches

Teaching Scheme:

L	T	P	C
3	1	-	4

Examination Scheme:

Continuous Internal Evaluation	**:**	40 marks
End Semester Exam	**:**	60 marks

Course Learning Objectives (LOs):

This course will develop students' knowledge in/on

LO1*: network elements and analysis of simple electrical DC circuits*

LO2*: DC network theorems*

LO3*: fundamentals of 1-ϕ and 3-ϕ AC circuits*

LO4*: working principles and applications of DC & AC machines, concepts of earthing, fuses, lighting sources, MCB & batteries*

UNIT – I (9+3)

DC circuits: Introduction, network elements, Ohm's law, electric power, electrical energy, Kirchhoff's laws, resistances in series-voltage divider rule; resistances in parallel-current divider rule; series & parallel circuits, mesh analysis, nodal analysis (T & π networks only).

UNIT – II (9+3)

DC network theorems (Independent sources only): Introduction, superposition theorem, Thevenin's theorem, Norton's theorem, maximum power transfer theorem (T and π networks only).

UNIT – III (9+3)

1-ϕ AC circuits: Phasor representation of sinusoidal quantities, average and R.M.S values of sinusoidal wave form, AC through resistor, inductor, capacitor and series R-L-C circuit.

3-ϕ AC circuits: Production of 3-ϕ voltages, voltage & current relationships of line and phase values for balanced star and delta connections.

UNIT – IV (9+3)

Introduction to electrical machines (Qualitative treatment): Construction, principle of operation & applications of 1-ϕ transformer, 3-ϕ induction motor, 1-ϕ induction motor and DC motor.

Electrical earthing, fuses & lighting sources: Basic concepts of earthing, fuses and lighting sources-incandescent, fluorescent, CFL & LED lamps, Miniature Circuit Breaker(MCB), types of batteries.

Text Books:

1. K. Uma Rao, "Basic Electrical Engineering", *Pearson Education,* edn ,2011.

Reference Books:

1. B.L.Thereja, A.K.Thereja, "Electrical Technology Vol. I & II", *S.Chand & Company Ltd,* edn , 2005.
2. Edward Hughes, "Electrical & Electronics Technology", *Pearson Education,* 10/e., 2010.
3. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", *Tata McGraw Hill*, edn , 2010.
4. Chakravarthy A, Sudhipanath and Chandan Kumar, "Basic Electrical Engineering", *Tata McGraw Hill Ltd*, edn, 2009.

Course Outcomes (COs):

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

CO1*: determine voltage, current & power in electrical circuits using mesh & nodal analysis*

CO2*: apply suitable DC network theorems to analyze T & π networks*

CO3*: find current, voltage & power in 1-ϕ & 3 -ϕ AC circuits*

CO4*: explain construction, working principle & applications of electrical machines; electrical earthing, fuses, lighting sources, MCB & batteries.*

Mapping of the Course Learning Outcomes with Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	-	-	-	-	-	-	-	-	**-**	**-**
CO2	2	2	-	-	-	-	-	-	-	-	**-**	**-**
CO3	3	3	1	1	1		1			1	**-**	**-**
CO4	3	3	1	1	1	1	1	1		1	**-**	**-**
Avg.	**3**	**3**	**1**	**1**	**1**	**1**	**1**	**1**		**1**	**-**	**-**

U18EE106 BASIC ELECTRICAL ENGINEERING LABORATORY

Class: B.Tech. I-Semester **Branch:** Common to all branches

Teaching Scheme:

L	T	P	C
-	-	2	2

Examination Scheme:

Continuous Internal Evaluation	**:**	40 marks
End Semester Exam	**:**	60 marks

Course Learning Objectives (LOs):
This course will develop students' knowledge in/on
LO1*: domestic wiring & basic electrical installations*
LO2*: network elements and analysis of electrical circuits*
LO3*: 1-phase and 3-phase AC circuits*
LO4*: measurement of illumination*

List of Experiments

1. Verification of Kirchhoff's Laws
2. Verification of voltage divider rule and current divider rule
3. Verification of Thevenin's theorem
4. Verification of Norton's theorem
5. Verification of Superposition theorem
6. Verification of Maximum power transfer theorem
7. Determination of internal parameters of a choke coil
8. Impedance calculations and phasor representation of R-L series circuit
9. Impedance calculations and phasor representation of R-C series circuit
10. Load test on 1-phase transformer
11. Voltage and current relationships between line & phase quantities for balanced 3-phase star & delta connections
12. Measurement of illumination for various lighting sources

** DEMONSTRATION OF ELECTRICAL INSTALLATIONS **

[Wires, Cables, Fuse, MSB, Batteries, Earthing]

Text Books:
1. User manual prepared by the department of Electrical & Electronics Engineering, KITSW.

Course Outcomes (COs):
After completion of the course, the students will be able to
CO1*: handle basic electrical equipments*
CO2*: understand the concepts of network elements and theorems*
CO3*: understand fundamental concepts of 1-phase and 3-phase AC circuits*
CO4*: determine illumination of various lighting sources*

Mapping of the Course Learning Outcomes with Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	1	1	1	1	-	-	2	2	1	2
CO2	2	1	-	1	-	1	-	-	2	1	1	1
CO3	2	2	2	2	1	1	1	-	2	1	2	1
CO4	2	1	1	2	1	1	1	-	2	1	1	1
Avg.	**2**	**1.5**	**1.3**	**1.5**	**1**	**1**	**1**	**-**	**2**	**1.2**	**1.2**	**1.2**

U18CS107 PROGRAMMING FOR PROBLEM SOLVING USING C LAB

Class: B.Tech. I- Semester **Branch:** Common to all branches

Teaching Scheme :

L	T	P	C
-	-	2	1

Examination Scheme :

Continuous Internal Evaluation	40 marks
End Semester Examination	60 marks

Course Learning Objectives (LOs):

This course will develop students' knowledge in /on

LO1 *: the operators and decision making statements*
LO2 *: loop techniques and array operations for problem solving*
LO3 *: string functions and modular programming approach for problem solving*
LO4 *: structures, unions, pointers and files*

LIST OF EXPERIMENTS

1. Programs using input output functions, operators (arithmetic, relational and conditional)
2. Programs using operators (bit-wise, logical, increment and decrement)
3. Programs using conditional control structures: if, if-else, nested if
4. Programs using else if ladder, switch and goto
5. Programs using loop control structures: while
6. Programs using loop control structures: do-while and for
7. Programs on one dimensional array and two dimensional arrays
8. Programs on string handling functions
9. Programs on different types of functions, parameter passing using call-by-value, call-by-reference, recursion and storage classes
10. Programs using structures, unions, pointers to arrays and pointers to strings
11. Programs using array of pointers and pointers to structures
12. File operations and file handling functions for sequential file

Laboratory Manual:

1. Programming in C Lab Manual, prepared by faculty of Computer Science & Engineering, KITSW

Reference Books:

1. E.Balagurusamy, "Programming in ANSIC", *Tata McGraw Hill*, 6th Edn, ISBN-13: 978-1- 25 - 90046 -2, 2012
2. Kerninghan and Ritchie, "The C Programming Language", *Prentice Hall of India*, 2nd Edn., ISBN-13:007-6092003106, 1988
3. Herbert Schildt, "Complete Reference with C", *Tata McGraw Hill,* 4th Edn., ISBN-13: 9780070411838, 2000
4. Yaswanth Kkanetkar, "Let Us C", *BPB Publications*, 13th Edn., ISBN-13: 9788183331630, 2012

Course Learning Outcomes (COs):

After completion of the course, the students will be able to
CO1 *: write programs using operators and decision making statements*
CO2 *: use the loops and array operations for a given application*
CO3 *: implement string programs and apply modular programming techniques*
CO4 *: develop programs using structures, unions, pointers and files*

Mapping of the Course Learning Outcomes with Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	-	1	-	-	-	1	2	1	2	1
CO2	2	2	2	1	-	1	-	1	2	1	3	1
CO3	3	3	3	2	1	1	-	1	2	1	3	1
CO4	3	3	3	3	3	1	1	1	2	1	3	1
Avg.	**2.5**	**2.25**	**2.66**	**1.75**	**2**	**1**	**1**	**1**	**2**	**1**	**2.75**	**1**

U18PH108 ENGINEERING PHYSICS LABORATORY

Class: B.Tech. I-Semester **Branch:** Common to all branches

Teaching Scheme:

L	T	P	C
-	-	2	1

Examination Scheme:

Continuous Internal Evaluation	40 Marks
End Semester Exam	60 Marks

Course Learning Objectives (LOs):

This laboratory course will develop students' knowledge in/on

LO1: *determination of various properties like rigidity modulus, moment of inertia, acceleration due to gravity and other elastic properties from SHMs*

LO2: *determination of the wavelengths, diameters of thin wires, limit of resolution and optical activity with high degree of accuracy from interference, diffraction and polarization phenomena using conventional light*

LO3: *determination of the wavelengths, slit widths with high degree of accuracy from diffraction phenomena using laser light*

LO4: *determination of optical fiber characteristics*

LIST OF EXPERIMENTS

1. Determination of (a) rigidity modulus of a given wire and (b) moment of inertia of a ring using torsional pendulum
2. Acceleration due to gravity (g) by compound pendulum
3. Determination of force constant of a spiral spring using static method
4. Determination of wavelengths in mercury light using diffraction Grating- Normal incidence method
5. Determination of wavelength of He-Ne laser using reflection grating
6. Resolving power of a telescope
7. Determination of slit width using He-Ne laser
8. Dispersive power of a prism using spectrometer
9. Determination of wavelength of a monochromatic light using Newton's rings
10. Determination of thickness of thin wire using wedge method
11. Determination of specific rotation of sugar solution using Polarimeter (Saccharimeter)
12. Numerical Aperture of an Optical fiber

Laboratory Manual:

1. Manual for "Engineering Physics Laboratory" *prepared by the Department of Physical Sciences/Physics,* KITSW

Reference Book:

1. C.V.Madhusudhana Rao and V. Vasanth Kumar, "Engineering Lab Manual", *Scitech publications India Pvt. Ltd,* 3/e, 2012.

Course Learning Outcomes (COs):

After completion of this course, students will be able to

CO1*: measure precisely the values of elastic properties, moments of inertia, acceleration due to gravity, etc*

CO2*: make precise measurements of wavelengths, diameter of thin wires, limit of resolution and optical rotation from light phenomena (Interference, diffraction and polarization)*

CO3*: measure wavelengths, slit widths from diffraction patterns using laser light*

CO4*: measure numerical aperture, acceptance angle and fiber losses of optical fibers*

Mapping of the Course Learning Outcomes with Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	-	-	3	-	-	2	-	2	-	-	-
CO2	1	-	-	3	-	-	2	-	2	-	-	-
CO3	1	-	-	3	-	-	2	-	2	-	-	-
CO4	2	-	1	3	-	-	2	-	2	-	-	-
Avg.	**1.25**	**-**	**1**	**3**	**-**	**-**	**2**	**-**	**2**	**-**	**-**	**-**

U18ME109 WORKSHOP PRACTICE

Class: B. Tech. I-Semester **Branch:** Common to all branches

Teaching Scheme :

L	T	P	C
-	-	2	1

Examination Scheme :

Continuous Internal Evaluation :	40 marks
End Semester Exam :	60 marks

Course Learning Objectives (LOs):
This course will develop students' knowledge in/on
LO1: *preparation of various joints in carpentry*
LO2: *preparation of mould cavity using single and two piece pattern*
LO3: *preparation of joints using fitting and plumbing*
LO4: *operation of arc welding, gas welding and soldering*

LIST OF EXPERIMENTS

Carpentry:
1. Prepare a cross half lap joint
2. Prepare a half lap dovetail joint
3. Prepare mortise and tenon joint

Foundry:
1. Prepare a sand mould using single piece pattern-bracket
2. Prepare a sand mould using two piece pattern-dumbbell

Fitting:
1. Prepare a square fit.
2. Prepare a half round fit.

Plumbing:
1. Prepare a PVC Pipe joint using elbows & tee
2. Prepare a PVC Pipe joint using union & coupling

Welding:
1. Prepare a single V – Butt Joint using Arc welding
2. Preparation of pipe joint using gas welding
3. Soldering and de-soldering of Resistor in PCB.

Text Books:
1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy., "Elements of Workshop Technology, Vol-I-2008 &Vol-II-2010", *Media Promoters and publishers Pvt. Ltd,* India.

Reference:
1. Engineering Workshop Practice manual, Department of Mechanical Engineering, KITSW, 2018.

Course Learning Outcomes (COs):
After completion of the course, the student will be able to,
LO1: *prepare various joints in carpentry trade*
LO2: *prepare a mould cavity using single and two piece pattern*
LO3: *perform various joints in fitting and plumbing trade*
LO4: *weld metals using arc welding, gas welding and soldering*

Mapping of the Course Learning Outcomes with Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	3	1	1	1	-	-	-	-	1
CO2	3	2	1	3	1	1	1	-	-	-	-	1
CO3	3	2	1	3	1	1	1	-	-	-	-	1
CO4	3	2	1	3	1	1	1	-	-	-	-	1
Avg.	**3**	**2**	**1**	**3**	**1**	**1**	**1**	**-**	**-**	**-**	**-**	**1**

U18EA110 EAA: SPORTS/YOGA/NSS

Class: B.Tech. I -Semester **Branch:** Common to all branches

Teaching Scheme :

L	T	P	C
-	-	-	-

Examination Scheme :

Continuous Internal Evaluation :	100 marks
End Semester Exam :	-

I. SPORTS

Course Learning objectives (LOs):

LO1: *to perform and engage in a variety of physical activities*

LO2 : *to develop and maintain physical health and fitness through regular participation in physical activities*

LO3 : *to demonstrate positive self esteem, mental health and physiological balance through body awareness and control*

LO4 : *to exhibit the spirit of fair play, team work and sportsmenship*

Activities related to:

1. Physical Fitness
2. Games & Sports

II. NATIONAL SERVICE SCHEME (NSS)

Course Learning objectives (LOs):

The objectives of the NSS is to

LO1: *arouse the social consciousness of the students*

LO2 : *provide them with opportunity to work with people in villages and slums*

LO3 : *expose them to the reality of life*

LO4 : *bring about a change in their social perceptions*

LO5 : *develop competence required for responsibility sharing and team work*

List of Activities:

1. Shramadanam
2. Tree Plantation
3. General Medical camps in Villages
4. Awareness on Eye Donation
5. Awareness on "Child Labour and Child Marriages"
6. Awareness programs on "Literacy, Good Health Practices, etc."
7. Safe Riding Program
8. Awareness program on "RTI Act"
9. Awareness on Blood Donation

Course Learning Outcomes (COs):

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

CO1: *develop his/her personally through community service rendered*

CO2: *apply their education to find solutions to individual and community problems*

CO3: *acquire capacity to meet emergencies and natural disasters*

CO4: *acquire a democratic attitude, leadership qualities and practice national integration*

DEPARTMENT OF MECHANICAL ENGINEERING
KAKATIYA INSTITUTE OF TECHNOLOGY & SCIENCE, WARANGAL – 15
(An Autonomous Institute under Kakatiya University, Warangal)

SCHEME OF INSTRUCTION AND EVALUATION
II-SEMESTER OF 4-YEAR B.TECH DEGREE PROGRAMME

[5Th+2P+2MC]

Sl. No	Category	Course Code	Course Title	Hours per week			Credits	Evaluation Scheme				
								CIE			ESE	Total Marks
				L	T	P	C	TA	MSE	Total		
1	BSC	U18MH201	Engineering Mathematics – II	3	1	-	4	10	30	40	60	100
2	ESC	U18CS202	Data Structures through C	3	-	-	3	10	30	40	60	100
3	BSC	U18CH203	Engineering Chemistry	3	1	-	4	10	30	40	60	100
4	ESC	U18ME204	Engineering Drawing	2	-	4	4	10	30	40	60	100
5	ESC	U18CE205	Engineering Mechanics	3	1	-	4	10	30	40	60	100
6	ESC	U18CS207	Data Structures through C Lab	-	-	2	1	40	-	40	60	100
7	BSC	U18CH208	Engineering Chemistry Lab	-	-	2	1	40	-	40	60	100
8	MC	U18CH209	Environmental Studies*	2	-	-	-	10	30	40	60	100
9	MC	U18EA210	EAA: Sports/Yoga/NSS*	-	-	2	-	100	-	100	-	100
			Total:	**16**	**3**	**10**	**21**	**270**	**150**	**420**	**480**	**900**

L= Lecture, T = Tutorials, P = Practicals & C = Credits
EAA: Extra Academic Activity
*** indicates mandatory non-credit course**

Contact hours per week : 29
Total Credits : 21

U18MH201 ENGINEERING MATHEMATICS- II

Class: B.Tech. II-Semester **Branch:** Common to all branches

Teaching Scheme :

L	T	P	C
3	1	-	4

Examination Scheme :

Continuous Internal Evaluation	40 marks
End Semester Exam	60 marks

Course Learning Objectives (LOs):
This course will develop students' knowledge in/on
***LO1* :** *various methods of solving system of linear equations and eigen value problem.*
***LO2* :** *double integral , triple integral and their applications.*
***LO3* :** *vector point function and vector differential calculus with few engineering applications.*
***LO4* :** *integration of vector valued functions with few engineering applications.*

UNIT-I (9+3)

Matrices: Elementary transformations on a matrix. To find inverse of a matrix using elementary transformations- Rank of matrix, Normal form of a matrix, Solution of system of homogenous and non homogeneous linear equations, Linear dependence and independence of vectors.

Eigen values and Eigen vectors of a matrix- Cayley Hamilton's theorem, Reduction of a matrix to diagonal form, Reduction of a quadratic form to canonical form.

UNIT-II (9+3)

Multiple Integrals and Applications: Double integral, Change of order of integration, Double integration in polar coordinates, Triple integrals, Applications: Area enclosed by plane curves, Volumes of solids, Calculation of mass, Center of gravity, Moment of Inertia of plane lamina.

Beta and Gama functions and their relations. Evaluation of improper integrals in terms of Beta and Gamma functions.

UNIT-III (9+3)

Vector Differential Calculus: Vector functions - Derivative of a vector function of a scalar variable, Velocity and acceleration, Curves in Space, Tangent, Principal normal, Binormal, Curvature, Torsion of a given curve and Frenet -Serret Formulae.

Scalar and vector point functions, Vector operators – Gradient of a scalar field, Directional derivative, angle between two surfaces.

Divergence of a vector field, Curl of a vector field and their physical interpretations. Irrotational fields & Solenoidal fields.To find scalar potential of a conservative vector field.

UNIT-IV (9+3)

Vector Integration: Integration of vector valued functions of a scalar variable, Application to find velocity and displacement of a particle. Line integral of scalar point and vector point functions, Applications: Work done by a force, Circulation; Surface Integral & Volume integral. Green's theorem in plane, and area of a plane region using Green's theorem. Stokes theorem & Gauss divergence theorems (without proof).

Text Books

1. Grewal, B.S., "Higher Engineering Mathematics", *Khanna Publishers,* Delhi, 43rd edition, 2014.

Reference Books

1. Kreyszig E., "Advanced Engineering Mathematics", *John Wiley & Sons, Inc.,* U.K 9th edition, 2013.
2. Spiegel M., "*Vector Analysis -Schaum Series*", McGraw Hill
3. S.S.Sastry, "Engineering Mathematics", Vol.II ,*Prentice Hall of India*, 3rd edition, 2014.

Course Learning Outcomes (COs):

After completion of this course, students' will be able to,

CO1: *compute inverse of a matrix using elementary transformations, compute rank of a matrix, and to solve a system of linear algebraic equations, to compute characteristic values, characteristic vectors of a given square matrix and reduce a given quadratic form to canonical form*

CO2 : *find double integral and triple integral and apply them to find moment of inertia, centre of gravity of plane lamina ; understand Beta and Gama functions and their relations and evaluate an improper integral in terms of Beta and Gamma functions*

CO3 : *understand the concept of a vector function and vector differentiation and will be able to find the characteristics of a space curve such as tangent, normal, binormal, curvature and torsion ; understand the concept of gradient , divergence and curl of a vector point function and will be able to apply them to find angle between two surfaces, and scalar potential*

CO4 : *find line, surface and volume integrals of vector valued functions and understand Green's theorem, Stokes theorem and Gauss theorem.*

Mapping of the Course Learning Outcomes with Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	-	-	-	-	-	-	-	-	1
CO2	3	3	2	-	-	-	-	-	-	-	-	-
CO3	3	2	2	-	-	-	-	-	-	-	-	-
CO4	3	2	2	-	-	-	-	-	-	-	-	1
Avg.	**3**	**2.5**	**1.75**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**0.5**

U18CS202 DATA STRUCTURES THROUGH C

Class: B. Tech II-Semester **Branch:** All Branches

Teaching Scheme :			
L	T	P	C
3	-	-	3

Examination Scheme:	
Continuous Internal Evaluation	40 marks
End Semester Examination	60 marks

Course Learning Objectives(LOs):

This course will develop students' knowledge in/on

LO1*: fundamental data structures and their usage with arrays*
LO2*: representing the linear data structures with stacks and queues*
LO3*: arranging the data using various sorting techniques and representing the data using linked lists*
LO4*: representing non-linear data structures with trees and graphs*

UNIT – I (9)

Introduction to Data Structures: Basic terminology, classification of data structures, operations on data structures

Arrays: Operations on arrays-traversing an array, inserting an element in an array, deleting an element from an array, searching an element using binary search

Dynamic Memory Allocation: Memory allocation functions, dynamic memory allocation for single and two dimensional arrays

UNIT – II (9)

Stacks: Introduction to stacks, array representation of stacks, operations on a stack–push and pop; applications of stacks- recursion, evaluation of expressions (infix to postfix conversion, evaluation of postfix expression)

Queues: Introduction to queues, array representation of queues, circular queues

UNIT - III (9)

Linked Lists: Basic terminologies, linked list versus arrays, memory allocation and deallocation for a linked list, singly linked list operations- traversing, searching, inserting, deleting, reversing; representing stack and queue using linked list

Sorting Techniques: bubble sort, selection sort, quick sort

UNIT – IV (9)

(Concepts and algorithms only)

Trees: Introduction, types of trees. **Binary Tree:** Creating a binary tree, traversing a binary tree-preorder, inorder, postorder recursive traversals.

Binary Search Tree: Operations- searching for a node in binary search tree, inserting an element into binary search tree.

Graphs: Introduction, graph terminology, representation of graphs, graphs traversal methods-breadth first search, depth first search

Text Book:

1. Reema Thareja, "Data Structures Using C", *Oxford University Press*, 2nd Edn., ISBN-13: 978-0-19-809930-7, 2014.

Reference Books:

1. E.Balagurusamy, "Programming in ANSI-C", *Tata McGraw Hill*, 6th Edn., ISBN-13: 978-1-25-90046-2, 2012.
2. Debasis Samanta, "Classic Data Structures", *Prentice Hall India*, 2nd Edn., ISBN-13: 978-81-203-3731-2, 2009.
3. E Balagurusamy, "Data Structure Using C", *McGraw Hill Education*, 1st Edn., ISBN-13: 978-125-902-9547, 2017.
4. Richard F. Gilberg and Behrouz A. Forouzan, "Data Structures: A Pseudocode Approach with C", *Cengage Learning*, 2nd Edn., ISBN-13: 9788131503140, 2007.

Course Learning Outcomes(COs):

After completion of this course, students' will be able to,

CO1*: implement programs using static & dynamic arrays*
CO2*: apply the linear data structures with stacks and queues*
CO3*: arrange the data with the help of various sorting techniques and linked lists*
CO4*: organize the data using non-linear data structures with trees and graphs*

Mapping of the Course Learning Outcomes with Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	-	-	-	-	-	1	2	1	2	-
CO2	2	2	2	1	-	1	-	1	2	1	3	-
CO3	3	3	3	2	1	1	-	1	2	1	3	1
CO4	3	3	3	3	3	1	1	1	2	1	3	1
Avg.	**2.5**	**2.25**	**2.66**	**2**	**2**	**1**	**1**	**1**	**2**	**1**	**2.75**	**1**

U18CH203 ENGINEERING CHEMISTRY

Class: B.Tech. II–Semester

Branch: Common to all branches

Teaching Scheme:

L	T	P	C
3	1	-	4

Examination Scheme:

Continuous Internal Evaluation	40 Marks
End Semester Exam	60 Marks

Course Learning objectives(LOs):

This course will develop students' knowledge in/on

LO1*: fundamental concepts of electrochemistry, electrochemical cells*

LO2 *: corrosion science; phase rule application to various equilibria; I/C engine fuels.*

LO3 *: basic spectroscopic techniques of chemical analysis; water analysis, treatment*

LO4*: basic concepts of organic chemistry; polymerization reactions, versatile applications of polymers*

UNIT-I (9+3)

Electrochemistry: Specific conductance ,equivalent conductance, effect of dilution ; conductometric titrations -acid base titrations, their advantages over conventional methods; electrode potential, Nernst equation, electrochemical series and its applications; calomel electrode , determination of pH using quinhydrone electrode, hydrogen electrode, potentiometric titrations (acid base titrations), commercial cells;lead-acid storage cell ,fuel cells:hydrogen-oxygen fuel cell.

UNIT-II (9+3)

Corrosion: Introduction-corrosion by pure chemical reaction(dry corrosion), electrochemical corrosion(wet corrosion), factors influencing corrosion, prevention methods of corrosion - cathodic protection, hot dipping methods(galvanising,tinning), cladding, electroplating.

Phase rule: Description of the terms-'phase', 'component' and 'degrees of freedom'; Gibbs phase rule equation; application of the phase rule to one-component system (water system), two-component system (silver-lead system), Pattinson's process for desilverisation of lead.

Fuels: characteristics of fuels for internal combustion engines, knocking , octane number, cetane number, compressed natural gas(CNG), power alcohol.

UNIT-III (9+3)

Introduction to Methods of Chemical Analysis: Introduction to spectroscopy- microwave spectra- theory, application of microwave spectra in the determination of bond length of a diatomic molecule; infra-red spectra, theory, applications- calculation of force constant and identification of functional groups in organic compounds, Lambert-Beer's law and its applications.

Water Analysis and Treatment: Hardness of water, determination of hardness of water by using EDTA, determination of alkalinity,determination of fluoride by spectrophotometry, determination of dissolved oxygen, biochemical oxygen demand, chemical oxygen demand, softening of water by ion-exchange process, desalination of brackish water- reverse osmosis, electrodialysis.

UNIT-IV (9+3)

Organic Chemistry: Fission of a covalent bond,types of electronic effects- inductive effect, mesomeric effect , reaction intermediates, their stabilities,types of reagents- electrophilic, nucleophilic reagents, mechanisms of nucleophilic substitution($SN^1$and SN^2) ; addition (electrophilic, nucleophilic and free radical) reactions .

Polymers: Introduction -types of polymerization reactions -addition ,condensation ; mechanism of free radical, cationic and anionic addition polymerization; thermo-setting and thermo plastic resins; conducting polymers and their applications.

Text Books:

1. Jain and Jain, "Engineering Chemistry *(16th edn.)*", *Dhanpat Rai Publishing Company,* 2012.

Reference Books:

1. J C Kuriacose and J.Rajaram, "Chemistry in Engineering and Technology (vol.I & vol.II)", *Tata Mc.Graw-Hills education private limited*, 2010.
2. Shashi Chawla, "Text book of Engineering Chemistry (3rd edn.)", *Dhanpat Rai Publishers*, 2003.
3. S.S.Dara, S S. Umare, "A Text book of Engineering Chemistry (12th edn.)", *S.Chand & Company Ltd.*, 2010.

Course Learning Outcomes(COs):

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

CO1*: Predict the feasibility of redox reactions , calculate electrode potentials, determine pH of a solution by various potentiometric methods,compare the principles and applications of batteries*

CO2*: make judicious selection of materials in the field of engineering; apply phase rule in the study of material science; select suitable fuels for internal combustion engines*

CO3*: calculate molecular parameters using spectroscopic techniques; calculate various quality parameters of water sample, describe softening methods of hard water*

CO4*: apply the fundamental concepts of organic chemistry; distinguish polymerization reactions and their mechanisms; describe versatile applications of polymers*

Mapping of the Course Learning Outcomes with Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	1	1	1	-	1	-	1	-	-	-
CO2	2	1	2	2	-	1	1	-	2	-	-	-
CO3	2	1	1	2	-	1	1	-	2	-	-	-
CO4	1	-	1	2	-	1	-	-	2	-	-	-
Avg.	**1.75**	**1.33**	**1.25**	**1.75**	**1.00**	**1**	**1**	**-**	**1.75**	**-**	**-**	**-**

U18ME204 ENGINEERING DRAWING

Class: B. Tech. II-Semester **Branch:** Common to all branches

Teaching Scheme :

L	T	P	C
2	4	-	4

Examination Scheme :

Continuous Internal Evaluation	:	40 marks
End Semester Exam	:	60 marks

Course Learning Objectives (LOs):
This course will develop students' knowledge in/on
LO1*: projections of points and straight lines-I*
LO2*: projections of straight lines-II and planes.*
LO3*: projections of solids and sections of solids*
LO4*: isometric and orthographic projections.*

UNIT – I (6+12)

Introduction: Importance of Engineering Drawing, instruments- uses; Layout of drawing sheets, Types of Lines, Lettering and dimensioning, Construction of regular polygons.

Projection of Points: Introduction to orthographic projections-Vertical Plane, Horizontal plane; Views-Front view, Top view and Side view; Projection of Points-different quadrants.

Projection of Straight lines - I: Line parallel to both the planes, Line parallel to one plane and perpendicular to the other reference plane, Line parallel to one plane and inclined to the other reference plane.

UNIT – II (6+12)

Projection of Straight Lines – II: Line- inclined to both the planes and Traces.

Projection of Planes: Planes - Perpendicular and Oblique planes; Projections of planes - parallel to one of the reference planes, inclined to one of the reference plane and perpendicular to the other; Projections of oblique planes.

UNIT – III (6+12)

Projection of Solids: Types-prisms, pyramids, cylinder and cone; Simple Positions-axis parallel to a reference plane and perpendicular to the other plane, axis parallel to one plane and inclined to other reference plane; axis inclined to both the reference planes.

Sections of Solids: Types-prisms and pyramids; Section planes, Sectional views and true shape of a section.

UNIT – IV (6+12)

Orthographic projections: Conversion of isometric views into orthographic views.

Isometric Projections: Isometric axis, Isometric Planes, Isometric View, Isometric projection, Construction of isometric view from orthographic views

AutoCAD: Introduction to AutoCAD, DRAW tools, MODIFY tools, TEXT, DIMENSION, PROPERTIES tool bar, Standard tool bars, LAYERS; drawing of orthographic and isometric projections in AutoCAD.

Text Books:

1. Bhatt N.D., "Elementary Engineering Drawing", *Charotar Publishing House,* Anand, India, 2017.

Reference Books:

1. Dhananjay A Jolhe, "Engineering Drawing", *Tata Mc Graw- hill,* 2008.
2. Venugopal K. "Engineering Graphics with Auto CAD", *New Age International Publishers Ltd.*, Hyderabad, 2012.
3. W J Luzadder and J M Duff, "Fundamentals of Engineering Drawing", *Prentice-Hall of India*, 1995.

Course Outcomes (COs):

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

CO1*: draw projections of points and straight lines-I.*

CO2*: draw projections straight lines-II and planes.*

CO3*: draw solids and sections of solids*

CO4*: draw projections of solids, orthographic and isometric views using AutoCAD.*

Mapping of the Course Learning Outcomes with Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	3	1	-	-	-	-	-	-	1
CO2	3	2	1	3	1	-	-	-	-	-	-	1
CO3	3	2	1	3	1	-	-	-	-	-	-	1
CO4	3	2	1	3	1	-	-	-	-	-	-	1
Avg.	**3**	**2**	**1**	**3**	**1**	-	-	-	-	-	-	**1**

U18CE205 ENGINEERING MECHANICS

Class: B.Tech. II-Semester

Branch: Common to all branches

Teaching Scheme :

L	T	P	C
3	1	-	4

Examination Scheme :

Continuous Internal Evaluation	:	40 marks
End Semester Exam	:	60 marks

Course Learning Objectives (LOs):

This course will develop students' knowledge in/on

LO1*: concept of force, principles of force and their application on engineering structures and machines*

LO2*: various kinds of statically determinate pin jointed structures and methods of analysing the trusses*

LO3*: importance of geometric centre, cross sectional areas of plane lamina through centroid and moment of inertia*

LO4*: dynamic behavior of particles in motion subjected to force system.*

UNIT – I (9+3)

Laws of Mechanics: Parallelogram law of forces, triangle law of forces, *Newton's law of gravitation,* law of superposition and transmissibility of forces.

Force Systems: Types of forces, co-planar, concurrent and parallel forces, moment and couple, free body diagram, resultant of force systems, resolution of forces, composition of forces, equilibrium equations of forces, Lami's theorem, Varignon's theorem, moment equilibrium equations, types of supports, beams and loadings, statically determinate structures, resultant and equilibrium of general force system.

UNIT –II (9+3)

Friction: Introduction, classification, laws of friction, coefficient of friction, angle of friction, ladder friction and wedge friction.

Plane Trusses: Rigid truss, stability and determinacy conditions, basic assumptions for a perfect truss, analysis of trusses by method of joints and method of sections of a cantilever and simply supported statically determinate pin-jointed trusses.

UNIT– III (9+3)

Centroid: Centroid of one dimensional figures, centroid of simple figures from first principles, centroid of composite sections.

Moment of Inertia: Moment of inertia of plane sections from first principles, theorems of moment of inertia – parallel axis theorem and perpendicular axis theorem, moment of inertia of standard sections and composite sections.

UNIT - IV (9+3)

Kinematics: Introduction to dynamics, rectilinear motion of a particle – displacement, velocity and acceleration, motion with uniform acceleration and motion with variable acceleration, curvilinear motion- rectangular components, components, acceleration of normal and tangential acceleration, projectile motion.

Kinetics: Rectilinear motion-equations of rectilinear motion, equations of dynamic equilibrium, D'Alembert's principle, curvilinear motion-equations of motion in rectangular components, tangential and normal components, equations of dynamic equilibrium, applications of work-energy, impulse –momentum principles of rectilinear motion and curvilinear motion.

Text Books:

1. Tayal A.K., "Engineering Mechanics: Statics and Dynamics", *Umesh Publishers,* New Delhi, 14th edn., 2014.

Reference Books:

1. Timoshenko S., Young D.H., Rao J.V., and Sukumar Pati, "Engineering Mechanics in SI units", *McGraw Hill Education Pvt. Ltd.,* New Delhi, 5th edn., 2013.
2. Vijaya Kumar Reddy K., Suresh Kumar J. "Singer's Engineering Mechanics Statics and Dynamics" *BS Publications / BSP Books*, 3rd edn. (SI Units), 8th Reprint, 2014.
3. Bhavikatti S.S., "Engineering Mechanics", *New Age International,* New Delhi, 4th edn., 2013 (reprint).
4. Basudeb Bhattacharyya, "Engineering Mechanics", *Oxford University Press*, 9th edn., 2013.

Course Learning Outcomes (COs):

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

CO1*: understand the physical action of forces on the bodies through free body diagrams and analyse the forces using principles of force*

CO2*: determine the axial forces in members of pin jointed structures subjected to various types of loadings*

CO3*: understand the technical importance of geometrical shapes using centroid and moment of inertia concepts*

CO4*: understand equilibrium condition of particles in dynamic condition and can analyse the problems using various applications such as impulse-momentum principle and work energy.*

Mapping of the Course Learning Outcomes with Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	3	2	--	1	--	--	--	--	--	--
CO2	3	2	3	1	--	1	--	--	--	--	--	--
CO3	3	1	2	2	--	1	--	--	--	--	--	1
CO4	3	2	3	1	--	1	--	--	--	--	--	1
Avg.	**3**	**1.5**	**2.7**	**1.5**	**--**	**1**	**--**	**--**	**--**	**--**	**--**	**1**

U18CS207 DATA STRUCTURES THROUGH C LABORATORY

Class: B. Tech II-Semester

Branch: All Branches

Teaching Scheme:

L	T	P	C
-	-	2	1

Examination Scheme:

Continuous Internal Evaluation	40 marks
End Semester Examination	60 marks

Course Learning Objectives(LOs):

This course will develop student's knowledge in/on

LO1*: implementing array operations*
LO2*: organizing the data using stacks and queues*
LO3*: different types of sorting techniques*
LO4*: memory and data management using linked list*

List of Experiments

Experiment-I

1. Program to implement initialization of array and traversal operation
2. Program to implement insertion operation on array

Experiment-II

3. Program to implement searching operations on array
4. Program to implement deletion operations on array

Experiment-III

5. Program to display the count of occurrences of every number in an array
6. Program to represent and display the sparse matrix

Experiment-IV

7. Program to implement initialization of arrays and traversal operation with DMA
8. Program to implement matrix addition and subtraction with DMA

Experiment-V

9. Program to implement matrix multiplication with DMA
10. Program to implement stack operations

Experiment-VI

11. Program to convert infix expression into postfix
12. Program to evaluate given postfix expression

Experiment-VII

13. Program to implement queue operations using arrays

Experiment-VIII

14. Program to create single linked list and implement its operations
    i) insert ii) traversal iii) search

Experiment-IX

15. Program to create single linked list and implement its operations
    i) delete ii) reversal

Experiment-X

16. Program to implement stack operations using linked list
17. Program to implement queue operations using linked list

Experiment-XI

18. Program to implement bubble sort
19. Program to implement selection sort

Experiment-XII

20. Program to implement quick sort

Laboratory Manual:

1. 'Data Structures Using C' laboratory manual, *prepared by faculty of Dept. of Computer Science &Engineering.*

Reference Books:

1. Reema Thareja, "Data Structures Using C", *Oxford University Press*, 2nd Edn., ISBN-13: 978-0-19-809930-7, 2014.
2. E.Balagurusamy, "Programming in ANSI-C", *Tata McGraw Hill*, 6th Edn., ISBN-13: 978-1-25-90046-2, 2012.
3. E Balagurusamy, "Data Structure Using C", *McGraw Hill Education*, 1st Edn., ISBN-13: 978-125-902-9547, 2017.

Course Learning Outcomes(COs):

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

CO1*: implement the fundamental data structures using C-language*
CO2*: develop programs using liner data structures (stacks, queues)*
CO3*: develop programs arranging the data using various sorting techniques*
CO4*: develop program using linked representation*

Mapping of the Course Learning Outcomes with Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	-	-	-	-	-	1	2	1	2	1
CO2	2	2	2	1	-	1	-	1	2	1	3	1
CO3	3	3	3	2	1	1	-	1	2	1	3	1
CO4	3	3	3	3	3	1	1	1	2	1	3	1
Avg.	**2.5**	**2.25**	**2.66**	**2**	**2**	**1**	**1**	**1**	**2**	**1**	**2.75**	**1**

U18CH208 ENGINEERING CHEMISTRY LABORATORY

Class: B.Tech. II-Semester **Branch:** Common to all branches

Teaching Scheme:

L	T	P	C
-	-	2	1

Examination Scheme:

Continuous Internal Evaluation	40 Marks
End Semester Exam	60 Marks

Course Learning Objectives(LOs):

This course will develop students knowledge in /on

LO1*: water analysis techniques*

LO2*: estimation of metals from their ores; concepts of adsorption*

LO3*: instrumentation methods of chemical analysis*

LO4*: saponification/acid value of an oil*

LIST OF EXPERMENTS:

1. Determination of alkalinity of test sample of water
2. Estimation of available chlorine in test sample of bleaching powder
3. Determination of hardness of water by using complexometric method
4. Determination of calcium in lime stone / dolomite
5. Estimation of cupric ions in the test solution
6. Adsorption of an acid on charcoal -applicability of adsorption isotherm
7. Synthesis of a polymer
8. Conductometric titrations
9. Potentiometric titrations
10. Colorimetric analysis-verification of Lambert-Beer's law
11. Estimation of metal ion using ion-exchange resin
12. Determination of saponification / acid value of an oil

Course Learning Outcomes (COs):

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

CO1: determine water quality parameters - alkalinity, hardness

CO2: estimate metals from their ores

CO3: handle analytical instruments for chemical analysis

CO4: measure saponification / acid value of an oil

Mapping of the Course Learning Outcomes with Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	1	3	-	1	2	-	2	-	-	-
CO2	2	-	1	3	-	-	2	-	2	-	-	-
CO3	2	-	1	3	-	-	3	-	2	-	-	-
CO4	2	-	1	3	-	-	1	-	2	-	-	-
Avg.	**2**	**-**	**1**	**3**	**-**	**1**	**2**	**-**	**2**	**-**	**-**	**-**

U18CH209 ENVIRONMENTAL STUDIES

Class: B.Tech. II-Semester **Branch:** Common to all branches

Teaching Scheme :

L	T	P	C
2	-	-	2

Examination Scheme :

Continuous Internal Evaluation :	40 marks
End Semester Exam :	60 marks

Course Learning objectives (LOs):
This course will develop students' knowledge in/on
LO1: *necessity to use natural resources more equitably*
LO2 : *concepts of ecosystem and the importance of biodiversity conservation*
LO3 : *causes, effects and control measures of various environmental issues*
LO4 : *issues involved in enforcement of environmental legislation*

UNIT-I (6)

Introduction - The multidisciplinary nature of environmental studies - definition, scope and importance.
Natural Resources: Forest Resources - Use and over–exploitation of forests, deforestation, timber extraction, mining, dams - their effects on forests and tribal people; **Water Resources -** Use and over-utilization of surface and ground water, floods, drought, conflicts over water; **Mineral Resources -** Environmental effects of extracting and using mineral resources; **Agricultural Land -** Land as a resource, land degradation, soil erosion and desertification; **Food Resources** - World food problems, effects of modern agriculture, fertilizer-pesticide problems, water logging and salinity; **Energy Resources -** Renewable and non-renewable energy sources, use of alternate energy sources.

UNIT-II (6)

Ecosystem and Biodiversity: Ecosystem - Concepts of an ecosystem, food chain, food webs, ecological pyramids, energy flow in the ecosystem and ecological succession;
Biodiversity and its Conservation – Introduction, definition, genetic, species and ecosystem diversity, value of biodiversity, biodiversity in India, hot spots of biodiversity, man-wildlife conflicts, endangered and endemic species of India, in-situ and ex-situ conservation.

UNIT-III (6)

Environmental Pollution: Global climatic change, green house gases, effects of global warming, ozone layer depletion; International conventions/protocols - Earth summit, Kyoto protocol and Montreal protocol; causes and effects of air, water, soil, marine and noise pollution with case studies; solid and hazardous waste management, effects of urban industrial and nuclear waste; natural disaster management - flood, earthquake, cyclone and landslides.

UNIT-IV (6)

Social Issues and the Environment: **Role of Individual and Society** - Role of individual in prevention of pollution, water conservation, Rain water harvesting and watershed management; **Environmental Protection / Control Acts** - Air (Prevention and control of Pollution) Act- 1981, water (Prevention and Control of Pollution) Act-1974, water Pollution Cess Act-1977, Forest conservation Act (1980 and 1992), wildlife Protection Act 1972 and environment protection Act 1986, issues involved in enforcement of environmental legislations; **Human Population and Environment** - Population growth, family welfare

programmes, women and child welfare programmes, role of information technology in environment and human health.

TEXT BOOKS:

1.Erach Bharucha, "Text Book of Environmental Studies for Under Graduate Courses (2nd edn.)", *Universities Press (India) Private Limited,* 2013.

REFERENCE BOOKS:

1. Y. Anjaneyulu, "Introduction to Environmental Science", *B.S. Publications*, 2004.
2. Gilbert M. Masters, "Introduction to Environmental Engineering & Science ", *Prentice Hall of India,*Third Edition,1991.
3. Anubha Kaushik, C.P. Kaushik, "Environmental Studies", 4/e, *New Age International Publishers,* 2014.
4. R.Rajagopalan, "Environmental Studies from crisis to cure", *Oxford University Press*, Second Edition, 2011.

Course Learning Outcomes(COs):

After completion of this Course, the student will be able to…

CO1 : *investigate any environmental issue using an interdisciplinary framework*

CO2 : *formulate an action plan for sustainable alternatives and conserving biodiversity that integrates science, humanist, social and economic perspective*

CO3 : *identify and explain the complexity of issues and processes which contribute to an environmental problem*

CO4 : *participate effectively in analysis and problem-solving through knowledge in environmental legislations*

Mapping of the Course Learning Outcomes with Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	2	1	-	2	1	-	1	-	-	-
CO2	-	-	2	-	-	1	2	-	1	-	-	-
CO3	1	2	1	-	-	1	2	1	1	-	-	-
CO4	-	-	1	-	-	1	2	-	1	-	-	-
Avg.	**1.5**	**1.5**	**1.5**	**1**	**-**	**1.25**	**1.75**	**1**	**1**	**-**	**-**	**-**

U18EA110 / U18EA210 EAA: SPORTS/YOGA/NSS

Class: B.Tech, I / II-Semester **Branch:** Common to all branches

Teaching Scheme :

L	T	P	C
-	-	-	-

Examination Scheme :

Continuous Internal Evaluation :	100 marks
End Semester Exam :	-

I. SPORTS

Course Learning objectives (LOs):

LO1: *to perform and engage in a variety of physical activities*
LO2 : *to develop and maintain physical health and fitness through regular participation in physical activities*
LO3 : *to demonstrate positive self esteem, mental health and physiological balance through body awareness and control*
LO4 : *to exhibit the spirit of fair play, team work and sportsmenship*

Activities related to:

1. Physical Fitness
2. Games & Sports

II. NATIONAL SERVICE SCHEME (NSS)

Course Learning objectives (LOs):

The objectives of the NSS is to
LO1: *arouse the social consciousness of the students*
LO2 : *provide them with opportunity to work with people in villages and slums*
LO3 : *expose them to the reality of life*
LO4 : *bring about a change in their social perceptions*
LO5 : *develop competence required for responsibility sharing and team work*

List of Activities:

1. Shramadanam
2. Tree Plantation
3. General Medical camps in Villages
4. Awareness on Eye Donation
5. Awareness on "Child Labour and Child Marriages"
6. Awareness programs on "Literacy, Good Health Practices, etc."
7. Safe Riding Program
8. Awareness program on "RTI Act"
9. Awareness on Blood Donation

Course Learning Outcomes (COs):

After completion of the course, the student will be able to
CO1: *develop his/her personally through community service rendered*
CO2: *apply their education to find solutions to individual and community problems*
CO3: *acquire capacity to meet emergencies and natural disasters*
CO4: *acquire a democratic attitude, leadership qualities and practice national integration*

DEPARTMENT OF MECHANICAL ENGINEERING
KAKATIYA INSTITUTE OF TECHNOLOGY & SCIENCE, WARANGAL – 15
(An Autonomous Institute under Kakatiya University, Warangal)

SCHEME OF INSTRUCTION AND EVALUATION
III-SEMESTER OF 4-YEAR B.TECH DEGREE PROGRAMME

[6Th+3P+1MC]

Sl. No	Category	Course Code	Course Title	Hours per week			Credits	Evaluation Scheme				
								CIE			ESE	Total Marks
				L	T	P	C	TA	MSE	Total		
1	BSC	U18MH301	Engineering Mathematics - III	3	1	-	4	10	30	40	60	100
2	HSMC	U18MH302	Professional English	-	-	2	1	10	30	40	60	100
3	ESC	U18ME303	Mechanics of Solids	3	_	_	3	10	30	40	60	100
4	PCC	U18ME304	Material Science and Metallurgy	3	-	-	3	10	30	40	60	100
5	PCC	U18ME305	Engineering Thermodynamics	3	1	-	4	10	30	40	60	100
6	PCC	U18ME306	Machine Drawing	2	-	4	4	10	30	40	60	100
7	PCC	U18ME307	Material Science and Metallurgy Lab	-	-	2	1	40	-	40	60	100
8	ESC	U18ME308	Mechanics of Solids Lab	-	-	2	1	40	-	40	60	100
9	PCC	U18ME309	Modeling Lab	-	-	2	1	40	-	40	60	100
10	MC	U18MH315	Essence of Indian Traditional Knowledge	2	-	-	-	10	30	40	60	100
			Total:	**14**	**2**	**12**	**22**	**190**	**210**	**400**	**600**	**1000**

L= Lecture, T = Tutorials, P = Practicals & C = Credits

Contact hours per week : 28
Total Credits : 22

U18MH301 ENGINEERING MATHEMATICS- III

Class: B. Tech. III-Semester **Branch:** Common to all branches

Teaching Scheme:

L	T	P	C
3	1	-	4

Examination Scheme:

Continuous Internal Evaluation	40 marks
End Semester Exam	60 marks

Course Learning Objectives (LOs):

This course will develop students' knowledge in/on…

LO1: laplace transform and its use to find the solutions of certain initial and boundary value problems in engineering

LO2: fourier series and its application to solve engineering problems

LO3: functions of complex variables, the property of analyticity of a function of complex variable and their applications

LO4: integration of a function of complex variable, evaluation of certain real integrals using complex analysis

UNIT-I (9+3)

Laplace Transforms: Integral transforms, Kernel of a transform, Laplace transform of a function, Inverse Transform-Existence and uniqueness of Laplace Transforms, S- plane and region of convergence (ROC), Laplace Transform of some commonly used signals- Dirac-delta (impulse) function $[\delta(t)]$,step $[u(t)]$,ramp $[tu(t)]$,parabolic $\left[t^2u(t)\right]$,real exponential $\left[e^{at}u(t)\right]$, complex exponential $\left[e^{j\Omega t}u(t)\right]$, sine and cosine functions, damped sine and cosine functions, hyperbolic sine and cosine functions, damped hyperbolic sine and cosine functions, rectangular pulse and triangle. Properties of Laplace Transforms- Linearity, First shifting theorem (Frequency shift property), Laplace transforms of derivatives and integrals, time scaling property, time reversal property, Laplace Transform of Heaviside unit step function, Second shifting theorem (time shift property), Initial value and final value theorems, Laplace transform of periodic functions- Convolution theorem

Operational Calculus: Transfer functions, Solution of ordinary differential equations with constant coefficients and system of ordinary differential equations with constant coefficients using Laplace Transforms. Application of Laplace transforms to the first order and second order system subjected to impulse, step, periodic, rectangular, square, ramp, triangular and sinusoidal functions

UNIT-II (9+3)

Fourier Series: Periodic functions, orthogonal and orthonormal functions and systems of orthogonal functions, representation of a function as Trigonometric Fourier series (FS) in a range of length 2π, Euler formulae, Conditions for the existence of Fourier series (Dirichlet's conditions), FS for typical wave forms-square wave, pulse train, impulse train(comb function), periodic rectangular wave, triangle, saw tooth, half wave rectified signal, full wave rectified signal, plotting FS coefficients - line spectrum (magnitude and Phase spectra), Fourier series on an arbitrary period, effects of symmetry of function on FS coefficients, half range series – half range cosine and sine series expansions, exponential FS

UNIT-III (9+3)

Complex Variables: Functions of complex variables, Limit, Continuity, Differentiability, Analytic Functions, Cauchy-Riemann Equations in Cartesian and Polar coordinates. Elementary functions, Harmonic Functions, Construction of Analytic functions. Applications to find velocity potential and stream function of a flow, conformal mapping and bilinear transformation

UNIT-IV (9+3)

Complex Integration: Line integration in complex plane, integral of a non analytic function, dependence on path of integration, *ML*-Inequality, Cauchy's integral theorem, Cauchy's integral formula, series expansion of complex functions: Taylor's series and Laurent's series, zeros and singularities, residues, Residue Theorem- Applications of Residue theorem to the properly chosen integrals around a unit circle and semi circle

Textbook:

[1] Grewal, B.S., *Higher Engineering Mathematics*, 43rd ed. New Delhi: Khanna Publishers, 2014.

Reference Books:

[1] Kreyszig E., *Advanced Engineering Mathematics*, 9th ed. U.K: John Wiley & Sons, Inc., 2013.

[2] Churchill R.V., *Complex Variable and its Applications*, 9th ed. New York: McGraw Hill, 2013.

Course Learning Outcomes (COs):

On completion of this course, students will be able to…

CO1: apply Laplace transform to solve certain differential equations whose solutions cannot be computed using classical methods

CO2: describe a given function as Fourier series in an interval

CO3: construct analytic function; find velocity potential and stream function of a fluid flow using complex analytical methods

CO4: represent a given function in Taylor's and Laurent's series, evaluate certain real integrals using integral theorems

Course Articulation Matrix (CAM): U18 MH301 Engineering Mathematics- III

CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO	**U18MH301.1**	2	2	-	-	-	-	-	-	-	-	-	1	2	-
CO	**U18MH301.2**	2	2	-	-	-	-	-	-	-	-	-	1	2	-
CO	**U18MH301.3**	2	2	-	-	-	-	-	-	-	-	-	1	2	-
CO	**U18MH301.4**	2	1	-	-	-	-	-	-	-	-	-	1	2	-
U18MH301		**2**	**1.75**	-	-	-	-	-	-	-	-	-	1	**2**	-

U14MH302 PROFESSIONAL ENGLISH

Class: B. Tech. III Semester **Branch:** Common to all branches

Teaching Scheme:

L	T	P	C
-	-	2	1

Examination Scheme:

Continuous Internal Evaluation:	100 marks
End Semester Exam :	-

Course Learning Objectives (LOs):
This course will develop the student's knowledge in/on…
LO1: reading skill and sub skills to comprehend the text
LO2: vocabulary and using it appropriately to describe situations
LO3: using phrasal verbs in speech and writing
LO4: grammar and improve language ability to write effectively

Week	Topic Name
I	**I. Reading Comprehension-** Significance of Reading Skimming **II. Verbal Ability-** Synonyms **III. Grammar-** Articles
II	**I. Reading Comprehension-** Scanning **II. Verbal Ability-** Antonyms **III. Grammar-** Articles
III	**I. Reading Comprehension-** Critical Reading **II. Verbal Ability-** Sentence completion with correct alternative word/group **III. Grammar-** Prepositions
IV	**I. Reading Comprehension-** Intensive Reading **II. Verbal Ability-** Sentence completion with correct alternative word/group **III. Grammar-** Reported Speech
V	**I. Reading Comprehension-** Intensive Reading **II. Verbal Ability-** Jumbled Sentences **III. Grammar-** Error Detection
VI	**I. Reading Comprehension-** Inferential Reading **II. Verbal Ability-** Jumbled Sentences **III. Grammar-** Error Detection
VII	**I. Reading Comprehension-** Lexical Reading **II. Verbal Ability-** Phrasal Verbs **III. Grammar-** Tenses, Structures
VIII	**I. Reading Comprehension-** Read to Interpret **II. Verbal Ability-** Single Word Substitutes **III. Grammar-** Tenses, Uses
IX	**I. Reading Comprehension-** Read to Analyze **II. Verbal Ability-** Collocations **III. Grammar-** Tenses, Uses
X	**I. Reading Comprehension-** Read to Summarize **II. Verbal Ability-** Spellings **III. Grammar,** Agreement between Subject & verb (concord)

Textbooks:

[1] Professional English manual prepared by the faculty of English, *KITSW*

[2] Arun Sharma and Meenakshi Upadhyay, *Verbal Ability and Reading Comprehension for CAT & Other Management Examinations*, 8th ed. Chennai: *McGraw Hill Education (India) Private Ltd*, 2018.

Reference Books:

[1] Nishit K. Sinha, *Verbal Ability and Reading Comprehension for the CAT*, 3rd ed. Chennai: Pearson India Education Services Pvt. Ltd.,

[2] Harper Collins, *Collins COBUILD English Grammar*, 3rd ed. Harper Collins Publishers Ltd.

[3] Rosemary and Courtney, *Longman-English-Chinese Dictionary of Phrasal Verbs*

Course Learning Outcomes (COs):

On completion of this course, students will be able to…

CO1: analyze the passage using skill and sub skill to solve different types of questions related to reading comprehension

CO2: identify grammatical errors in the given sentences and correct them

CO3: select correct synonyms/antonyms/phrasal verbs and complete sentences with suitable words or phrases

CO4: keep the given jumbled sentences in proper sequence to make a coherent paragraph

Course Articulation Matrix (CAM): U18MH302 Professional English														
CO		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	**U18MH302.1**	-	-	-	-	-	-	-	-	1	2	-	1	-	1
CO2	**U18MH302.2**	-	-	-	-	-	-	-	-	1	2	-	1	-	1
CO3	**U18MH302.3**	-	-	-	-	-	-	-	-	1	2	-	1	-	1
CO4	**U18MH302.4**	-	-	-	-	-	-	-	-	1	2	-	1	-	1
U18MH302		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**2**	**-**	**1**	**-**	**1**

U18ME303 MECHANICS OF SOLIDS

Class: B. Tech. III-Semester **Branch:** Mechanical Engineering (ME)

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation	40 marks
End Semester Exam	60 marks

Course Learning Objectives (LOs):
This course will develop students' knowledge in/on…

LO1: fundamental concepts of stress, strain and Elastic Constants
LO2: development of shear force & bending moment diagrams and determine bending stress in beams
LO3: determination of slope & deflections of beams; determination of shear stress in beams
LO4: theory of pure torsion, analysis of columns and thin cylinders

UNIT – I (9)

Simple Stress and Strain: Types of Loads, Stress, Shear Stress, Strain, Poisson's ratio, Modulus of Elasticity, Modulus of Rigidity, Volumetric strain, Bulk modulus , Relation between Elastic Constants, Principle of superposition, Bars of Varying Sections, Bars of Uniform Strength, Compound Bars, Thermal Stresses, Factor of safety

UNIT – II (9)

Shear Force and Bending Moment: Types of supports and beams, Shear Force, Bending Moment, Relation between Intensity of Loading, Shear Force and Bending Moment, Shear force and Bending Moment Diagrams for Cantilever and Simply Supported beams, over hanging beams

Theory of Simple Bending: Assumptions, Derivation of basic equation, Flexure formula, Modulus of section, Moment of resistance, Determination of Bending Stresses in beams of various cross sections-rectangular, solid circular, hollow circular, I - sections

UNIT – III (9)

Deflections of Beams: Slope and Deflection of Cantilever and Simply Supported beams for Point Loads and Uniformly Distributed Loads by Double Integration method and Macaulay's method

Shear Stresses in Beams: Equation of Shear Stress, Shear Stress Distribution across Rectangular, Circular and I - cross-sections

UNIT – IV (9)

Torsion of Circular Shafts: Theory of Pure Torsion, Derivation of Basic Equation, Solid and Hollow Circular Shafts, Torsional Shear Stresses and Angle of Twist, Power Transmission

Columns: Euler's crippling load of columns

Thin Cylinder: Hoop stress and longitudinal stress in Thin Cylinders

Textbooks:

[1] S.S.Rattan, *Strength of Materials,* 1st ed. New Delhi: Tata McGraw-Hill, 2008.

[2] B.C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, *Strength of Materials*, 10th ed. Laxmi Publications, 2013.

Reference Books:

[1] T.D.Gunneswara Rao and M. Andal, *Strength of Materials*, Cambridge University press, 2018

[2] Egor P.Popov, *Engineering Mechanics of Solids,* 12th ed. *USA:* Prentice Hall, 2016.

[3] James M.Gere and S.P.Timoshenko, *Mechanics of Materials,* 8th ed. CBS Publishers, 2014.
[4] F.P.Beer and E.R.Johnston, Jr., *Mechanics of Materials,* 2nd ed. McGraw-Hill, 1992.
[5] I.H.Shames and J.M.Pitarrew, *Introduction to Solid Mechanics,* 3rd ed. New Delhi: Prentice-Hall of India, 2000.
[6] S.Ramamrutham, *Strength of Materials,* 14th ed. New Delhi: Dhanpat Rai Publications, 2011.

Course Learning Outcomes (COs):
On completion of this course, students will be able to…

CO1: apply elastic constants to determine stress and strain
CO2: construct shear force and bending moment diagrams, find bending stresses in beams
CO3: determine slope, deflections of beams and the shear stress distribution in beams
CO4: apply torsion equation for design of shafts analyze columns and thin cylinders

Course Articulation Matrix (CAM): U18ME303 Mechanics of Solids

CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	**U18ME303.1**	2	2	1	1	-	-	-	-	-	-	-	-	2	1
CO2	**U18ME303.2**	2	2	1	1	-	-	-	-	-	-	-	-	2	1
CO3	**U18ME303.3**	2	2	1	1	-	-	-	-	-	-	-	-	2	1
CO4	**U18ME303.4**	2	2	1	1	-	-	-	-	-	-	-	-	2	1
U18ME303		**2**	**2**	**1**	**1**	-	-	-	-	-	-	-	-	**2**	**1**

U18ME304 MATERIAL SCIENCE AND METALLURGY

Class: B. Tech. III-Semester **Branch:** Mechanical Engineering (ME)

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation	40 marks
End Semester Exam	60 marks

Pre- requisites: U18PE103 Engineering Physics

Course Learning Objectives (LOs):

This course will develop students' knowledge in/on…

LO1: crystal structure, imperfections in solids and mechanical properties
LO2: solidification process and phase diagrams
LO3: types of heat treatment process and effect of alloying elements on steel and cast iron
LO4: principle and processes of powder metallurgy, types of furnaces and NDT

UNIT – I (9)

Crystallography: Space Lattices, Unit cells, Crystal Structure, Crystal Systems- Atomic packing factors; Crystal planes and directions - Miller indices - Miller Bravais indices; Crystal Imperfections- Point defects, Line defects, Surface defects; Mechanisms of Plastic Deformation- Slip and Twinning; Mechanical Properties of Materials, Destructive testing methods - Hardness, Tensile, Fracture, Fatigue and creep tests

UNIT – II (9)

Constitution of alloys: Solid Solution, types of solid solution- Substitutional solid solutions- Ordered and Disordered, Interstitial solid solution; Hume Rothery's rule, Gibb's phase rule.
Phase Diagrams: Binary phase diagrams – Phase rule two component system, Isomorphous, eutectic and eutectoid systems, Fe-Fe_3C equilibrium diagram

UNIT – III (9)

Heat Treatment: Time Temperature Transformation (TTT) diagram for eutectoid steels.
Heat Treatment Processes: Annealing, Normalizing, Hardening, Tempering, Case Hardening - flame Hardening, Induction Hardening & Chemical hardening techniques
Ferrous metals: Types of steels; Types of cast irons; Effect of common alloying elements on plain carbon steels

UNIT – IV (9)

Non Ferrous metals and alloys: Composition, Properties and Applications of Aluminum and its alloys, Copper and its alloys; Titanium
Powder Metallurgy: Preparation and characteristics of metal powders, Powder metallurgy process, Applications of Powder Metallurgy
Furnaces: Principle and operation of Blast furnace and Cupola furnace
Non-Destructive Testing: Classification, application, principle and operation of Fluorescent penetrant test, Magnetic particle inspection, X-ray and Ultrasonic

Textbook:

[1] V.D. Kodgire, *Material Science & Metallurgy*, 42nd ed. Pune: Everest Publishing House, 2018.

Reference Books:

[1] George E. Dieter, *Mechanical Metallurgy*, 3rd ed. New York: McGraw-Hill, 1988.

[2] V. Raghavan, *Material Science and Engineering*, 6th ed. Prentice-Hall of India Pvt. Ltd., 2015.
[3] Sydney, H. Avener, *Introduction to Physical Metallurgy*, 26th ed. New York: McGraw-Hill, 2009.
[4] William D. Callister, *Material Science and Engineering an Introduction*, 4th ed. John wiley & sons, Inc., 1997.

Course Learning Outcomes (COs):
On completion of this course, students will be able to…

CO1: explain crystal structures, imperfections in solids and mechanical properties
CO2: discuss solidification and phase diagrams
CO3: select suitable heat treatment processes and explain effect of alloying elements on steel and cast iron
CO4: describe processes of powder metallurgy, types of furnaces and NDT

Course Articulation Matrix (CAM): U18ME304 Material Science and Metallurgy

CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	**U18ME304.1**	2	-	-	-	-	-	-	-	-	-	-	-	1	-
CO2	**U18ME304.2**	2	1	-	-	-	-	-	-	-	-	-	-	1	-
CO3	**U18ME304.3**	2	-	-	-	-	-	-	-	-	-	-	-	1	-
CO4	**U18ME304.4**	2	1	-	-	-	-	-	-	-	-	-	-	1	-
U18ME304		**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**-**

U18ME305 ENGINEERING THERMODYNAMICS

Class: B. Tech. III-Semester **Branch:** Mechanical Engineering (ME)

Teaching Scheme:

L	T	P	C
3	1	-	4

Examination Scheme:

Continuous Internal Evaluation	40 marks
End Semester Exam	60 marks

Course Learning Objectives (LOs):

This course will develop students' knowledge in /on…

LO1: concept of heat and work, and first law of thermodynamics applied to closed systems
LO2: steady flow energy equation, its applications and second law of thermodynamics
LO3: entropy for various processes, availability, irreversibility and second law efficiencies
LO4: thermodynamic relations, principle and performance of various gas power cycles

UNIT - I (9+3)

Fundamental Concepts: Introduction, units, types of systems, control volume, control mass, continuum, macroscopic and microscopic point of view thermodynamics, Thermodynamic state, property, process, cycle, Intensive and extensive properties. Heat and Work, Thermodynamic Equilibrium, point and path functions, cyclic process, reversibility, quasi static process, irreversible process, Zeroth law of Thermodynamics and its applications **(3+1)**

First Law of Thermodynamics to closed system: Statement of First law, applications to closed systems- internal energy, enthalpy and specific heats; Processes of closed system-constant volume, constant pressure, isothermal, adiabatic and polytrophic; P-V-T relations, Perfect and real gases, Joule-Thomson coefficient, inversion curve, Vander walls equation of state **(6+2)**

UNIT -II (9+3)

First law applied to open system: Steady flow energy equation (SFEE); applications to thermodynamic devices- boiler, turbine, nozzle, compressor, pump, heat exchangers **(3+1)**

Second Law of Thermodynamics: Limitations of first law of thermodynamics , Kelvin Planck Statement, Clausius statement, Equivalence of Kelvin and Clausius Statements, Heat engine, Heat pump, Refrigerator, relation between COP of Heat pump and Refrigerator, Reversibility, Irreversibility, Causes of irreversibility, Conditions for reversibility, Carnot cycle, Carnot theorem, Thermodynamic temperature scales **(6+2)**

UNIT -III (9+3)

Entropy: Concept of Entropy, Clausius inequality, Entropy principle and its applications, property of entropy, entropy change in various processes, entropy change mechanism, entropy generation in open and closed system, Entropy and Disorder, Third law of Thermodynamics **(3+1)**

Availability: Available energy, unavailable energy, Available energy referred to a cycle, useful work, dead state, availability in steady flow, availability equation for a flow and non flow process, irreversibility, second law efficiencies, Helmholtz and Gibb's functions (**6+2)**

UNIT - IV (9+3)

Thermodynamic Relations: Max-well relations, coefficient of volume expansion, isothermal compressibility factor, T-ds Equations, difference in heat capacities, ratio of heat capacities, change in internal energy, entropy and enthalpy equations **(3+1)**

Gas Power Cycles: Otto cycle, Diesel cycle, Dual cycles-Calculation of air standard efficiency and mean effective pressure, Comparison of Otto cycle, Diesel cycle, Dual cycle for same compression ratio, heat rejection and same maximum Temperature, Representation of Stirling, Ericsson and Atkinson cycles on P-V and T-S diagrams **(6+2)**

Textbook:

[1] Nag. P.K., *Engineering Thermodynamics,* 6th ed. New Delhi: Tata McGraw-Hill, 2017.

Reference Books:

[1] Van Wylen., *Fundamentals of classical Thermodynamics*, 4th ed. New York: John Wiley, 1994.
[2] P. Chattopadhyay, *Engineering Thermodynamics*, 2nd ed. New Delhi: Oxford University press, 2016.
[3] Mahesh M Rathore, *Thermal Engineering*, New Delhi: Tata McGraw Hill, 2010.
[4] Mathur M.L and Mehta F.S, *Thermal Engineering*, 4th ed. New Delhi: Jain Brothers, 2016.
[5] R.S Khurmi and Gupta, *A Text book of Thermal Engineering SI Units*, 5th ed. New Delhi: S. Chand & Co, 2015.

Course Learning Outcomes (COs):

On completion of this course, students will be able to…

CO1: explain the concepts of heat and work and apply first law of thermodynamics for a closed system
CO2: derive and apply steady flow energy equation (SFEE) for various thermodynamic devices, and state second law of thermodynamics
CO3: evaluate entropy for various processes, availability, irreversibility and second law efficiencies
CO4: derive thermodynamic relationships and evaluate the performance of various gas power cycles

Course Articulation Matrix (CAM): U18ME305 ENGINEERING THERMODYNAMICS

CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	**U18ME305.1**	2	2	1	-	-	-	-	-	-	-	-	-	2	1
CO2	**U18ME305.2**	2	2	1	-	-	-	-	-	-	-	-	-	2	1
CO3	**U18ME305.3**	2	2	1	-	-	-	-	-	-	-	-	-	2	1
CO4	**U18ME305.4**	2	2	1	-	-	-	-	-	-	-	-	-	2	1
U18ME305		2	2	1	-	-	-	-	-	-	-	-	-	2	1

U18ME306 MACHINE DRAWING

Class: B. Tech. III-Semester **Branch:** Mechanical Engineering (ME)

Teaching Scheme:

L	T	P	C
2	4	-	4

Examination Scheme:

Continuous Internal Evaluation	40 marks
End Semester Exam	60 marks

Pre-requisite: (U18ME204) Engineering Drawing

Course Learning Objectives(LOs):

This course will develop students' knowledge in/on…

LO1: conventions, limits, fits & tolerances used in machine drawing

LO2: drawing of sectional views of various machine components

LO3: part drawings of fast and loose pulley, drill jig, revolving center, steam stop valve, milling machine tail stock

LO4: assembly drawings of stuffing box, eccentric, screw jack, swivel bearing, Petrol engine connecting rod

UNIT – I (6+12)

Introduction: Classification of machine drawings, Conventional representation- Materials, Springs, Welded joints, Gears, Machine components and Surface roughness; Limits, Fits and Tolerances- Introduction, representation of fits, hole and shaft basis systems

Machine Elements: Screw fastening - Screw thread nomenclature, Types of thread profiles; Bolted joints- Hexagonal headed bolt with nut and washer, studded joint; Nuts- Lock nut, castle nut, wile's lock nut; Foundation bolts- Grooved bolt, eye foundation bolt; Keys- Representation of saddle key, sunk keys

UNIT – II (6+12)

Cotter joints- Cotter joints with sleeve, cotter joint with socket and spigot joint, Cotter joint with a gib, knuckle joint; **Couplings**- Butt muff coupling, half lap muff coupling; Flexible couplings- types of flanged couplings; **Non-aligned couplings**-Universal coupling, Oldham's coupling; **Riveted joint**-Types of riveted joints and rivet heads; **Bearings**- Solid journal bearing, bushed journal bearing, Plummer block, collar thrust bearing, foot step bearing, Anti-friction bearings

UNIT – III (6+12)

Part Drawings:

Part drawing of

- Fast and Loose Pulley
- Revolving Center
- Milling machine tail stock
- Drill Jig
- Steam stop valve

UNIT – IV (6+12)

Assembly drawings:

Assembly drawing of

- Stuffing Box
- Screw Jack
- Petrol engine connecting rod
- Eccentric
- Swivel Bearing

Textbook:

[1] Siddheshwar, Kannaiah and Sastry, *Machine Drawing,* 48th reprint ed. New Delhi: McGraw-Hill Education Pvt. Ltd., 2014.

Reference Books:

[1] Narayana, Venkat Reddy and Kannaiah, *Machine Drawing*, 3rd ed. New Age International, 2009.

[2] N. D. Bhatt and V. M. Panchal, *Machine Drawing*, 46th ed. Charotar Publishing House, 2011.

Course Learning Outcomes (COs):

On completion of this course, students will be able to…

CO1: apply the conventions, limits, fits & tolerances in machine drawing

CO2: draw sectional views of machine components cotter joints, couplings, riveted joints & bearings

CO3: draw part drawings with appropriate fits and tolerances on fast and loose pulley, drill jig, revolving centre, steam stop valve, milling machine tail stock

CO4: assemble the given parts of stuffing box, eccentric, screw jack, swivel bearing, petrol engine connecting rod and draw the different views

Course Articulation Matrix (CAM): U18ME306 Machine Drawing

CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	**U18ME306.1**	2	1	2	-	-	-	-	1	-	1	-	1	1	1
CO2	**U18ME306.2**	2	1	2	-	-	-	-	-	-	1	-	1	1	1
CO3	**U18ME306.3**	2	1	2	-	-	-	-	-	-	1	-	1	1	1
CO4	**U18ME306.4**	2	1	2	-	-	-	-	-	-	1	-	1	1	1
U18ME306		2	1	2	-	-	-	-	1	-	1	-	1	1	1

U18ME307 MATERIAL SCIENCE AND METALLURGY LABORATORY

Class: B. Tech. III-Semester **Branch:** Mechanical Engineering (ME)

Teaching Scheme :

L	T	P	C
-	-	2	1

Examination Scheme :

Continuous Internal Evaluation	40 marks
End Semester Exam	60 marks

Course Learning Objectives(LOS):
This Laboratory course will develop students' knowledge in/on…
LO1: preparation of specimen for metallography and various types of crystal models
LO2: microstructures of metals and non-metals
LO3: heat treatment and its applications
LO4: measurement of hardness

LIST OF EXPERIMENTS

1. Preparation of specimen for metallography- Mounting
2. Preparation and study of crystal models.
3. Observation and Study of microstructure of mild steel and brass specimen.
4. Observation of microstructure of bearing metals - Tin Babbitt and Lead Babbitt.
5. Observation and Study of microstructure of pure metals-Pure Copper, Pure Aluminium, Armco Iron.
6. Observation and Study of microstructure of Steels.
7. Observation of microstructure of Cast Irons.
8. Observation of microstructure of heat treated steels under heat treated process- Annealing, Normalizing and Hardening.
9. Measurement of grain size and phase volume fraction of ferrous and nonferrous alloys using optical microscope with image analyzer system.
10. Observation of micro-hardness using Vickers hardness test.
11. Measurement of hardness of ferrous and nonferrous metals using universal hardness tester.
12. Demonstration of liquid penetration and magnetic particle test for welding.

Laboratory Manual:

[1] Material Science and Metallurgy Laboratory Manual, Dept. of ME, KITSW.

Reference Books:

[1] V.D. Kodgire, *Material Science and Metallurgy,* 42nd ed. Pune: Everest Publication, *2018.*
[2] E.C. Subba Rao, *Testing and Inspection of Engineering Materials,* New Delhi: Tata McGraw-Hill, 1998.

Course Learning Outcomes (COs):
On completion of this course, students will be able to…

CO1: prepare specimen for metallography and recognize crystal models based on arrangement of atoms
CO2: read the microstructure and infer the metals and non-metals
CO3: distinguish the microstructures of metals under heat treatment process
CO4: find the hardness number on a given material

Course Articulation Matrix (CAM): U18ME307 Material Science and Metallurgy														
CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	U18ME307.1	2	2	-	-	-	-	-	-	-	-	-	-	2	-
CO2	U18ME307.2	2	2	-	1	-	-	-	-	-	-	-	-	2	-
CO3	U18ME307.3	2	2	-	1	-	-	-	-	-	-	-	-	2	-
CO4	U18ME307.4	2	2	-	-	-	-	-	-	-	-	-	-	2	-
U18ME307		**2**	**2**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**

U18ME308 MECHANICS OF SOLIDS LABORATORY

Class: B. Tech. III-Semester **Branch:** Mechanical Engineering (ME)

Teaching Scheme :

L	T	P	C
-	-	2	1

Examination Scheme :

Continuous Internal Evaluation	40 marks
End Semester Exam	60 marks

Course Learning Objectives(LO):
This Laboratory course will develop students' knowledge in/on
LO1: testing of engineering materials
LO2: the hardness of materials by conducting the hardness tests
LO3: the stiffness and rigidity modulus by conducting compression test on spring, torsion test on shaft
LO4: mechanical properties of engineering materials

LIST OF EXPERIMENTS

1 Stress – strain characteristics of Mild steel.
2 Determination of the Brinell"s hardness numbers for Steel, Brass and Aluminum.
3 Determination of the compressive strength of wood and punching shear strength.
4 Determination of the stiffness and modulus of rigidity by conducting compression test on spring.
5 Determination of the modulus of rigidity by conducting Torsion test on Solid shaft or Hollow shaft.
6 Determination of the Young"s modulus of the given material by measuring deflection for a given Simply Supported Beam.
7 Determination of the Young"s modulus of the given material by measuring deflection for a given propped cantilever beam.
8 Impact test- Determination of impact properties of materials- Izod Impact test.
9 Impact test- Determination of impact properties of materials-Charpy Impact test.
10 Ductility test for steel.
11 Shear test for Mild steel specimen.
12 Bend and Rebend test on plates and bars.

Laboratory Manual:

[1] Mechanics of Solids Laboratory Manual, Dept. of ME, KITSW.

Reference Books:

[1] V.D. Kodgire, *Material Science and Metallurgy*, 36th ed. Pune: Everest Publication, 2015.
[2] E.C. Subba Rao, *Testing and Inspection of Engineering Materials*, New Delhi: Tata McGraw-Hill, *1998.*
[3] E. Harmer Davis and George Earl Troxell, *Testing and Inspection of Engineering Materials*, 2nd ed. McGraw-Hill book company, inc, 1955.
[4] A. V. K. Suryanarayana, *Testing of Metallic Materials*, 2nd ed. Prentice-Hall of India, 2007.

Course Learning Outcomes (COs):
On completion of this course, students will be able to…

CO1: draw stress – strain characteristics of Mild steel
CO2: find the hardness of materials by conducting hardness tests
CO3: estimate the stiffness and rigidity modulus by conducting compression test on spring & , torsion test on shaft
CO4: the behaviour/limitations on various materials by conducting experiments

Course Articulation Matrix (CAM): U18ME308 MECHANICS OF SOLIDS LABORATORY														
CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	U18ME308.1	1	1	1	2	-	-	1	-	1	-	-	1	2	1
CO2	U18ME308.2	1	1	1	2	-	-	1	-	1	-	-	1	2	1
CO3	U18ME308.3	1	1	1	2	-	-	1	-	1	-	-	1	2	1
CO4	U18ME308.4	1	1	1	2	-	-	1	-	1	-	-	1	2	1
	U18ME308	**1**	**1**	**1**	**2**	-	-	**1**	-	**1**	-	-	**1**	**2**	**1**

U18ME309 MODELING LAB

Class: B. Tech. III- Semester **Branch:** Mechanical Engineering (ME)

Teaching Scheme :

L	T	P	C
-	-	2	1

Examination Scheme :

Continuous Internal Evaluation	:	40 marks
End Semester Examination	:	60 marks

Course Learning Objectives (LOs):

This course will develop students' knowledge in /on…

LO1*: skills required to use software for modeling of machine components*
LO2*: part modeling environment, tools and basic techniques for part creation*
LO3*: assembly modeling*
LO4*: principle and operation of 3D printing*

LIST OF EXPERIMENTS

1. Introduction to 2-D sketches, Basic Tools, Constrain, Dimensions.
2. Sketching of simple geometric shapes.
    a. Special S – Wrench
    b. Racket Pawl
    c. Cork Gasket
    d. Adjustable Sector
3. Problems on Part Modeling
    a. Gears
    b. Piston
    c. Blade Impeller
4. Problems on Assembly Modeling
    a. Universal Coupling
    b. Knuckle Joint
5. 3D Printing of a Spur Gear.

Laboratory Manual:

[1] Modeling Laboratory Manual, Dept. of ME, KITSW.

Reference Books:

[1] Prof. Sham Tickoo, *AutoCAD 2017 for Engineers and Designers*, 23rd ed. Dreamtech Press, Wiley Publisher, 2016.

[2] Prof. Sham Tickoo, *Pro / Engineer PTC Creo Parametric 3.0 for Engineers and Designers*, Dreamtech Press, 2015.

[3] Prof. Sham Tickoo, *CATIA V5 – 6R 2017 for Designers*, 15th ed. BPB Publications, 2017.

Course Learning Outcomes (COs):
On completion of this course, students will be able to…

CO1: sketch section geometry, configure a sketch, create references to dimension and constrain the sketch geometry
CO2: build a 3D parametric part model of gears, piston and blade impeller, from a 2D sketch by combining basic and advanced features of modelling software
CO3: apply assembly modeling features of modeling software, to create a product assembly of universal coupling and knuckle joint
CO4: demonstrate and perform 3D printing of spur gear on 3D printer

Course Articulation Matrix (CAM): U18ME309 MODELING LAB

CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	**U18ME309.1**	2	2	-	-	2	-	-	-	-	-	-	1	1	2
CO2	**U18ME309.2**	2	2	-	-	2	-	-	-	-	-	-	1	1	2
CO3	**U18ME309.3**	2	2	-	-	2	-	-	-	-	-	-	1	1	2
CO4	**U18ME309.4**	2	2	2	-	2	-	-	-	-	-	-	1	1	2
U18ME309		**2**	**2**	**2**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**1**	**2**

U18MH315 ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE

Class: B. Tech. III - Semester

Branch: Common to all branches

Teaching Scheme:

L	T	P	C
2	-	-	-

Examination Scheme:

Continuous Internal Evaluation	40 marks
End Semester Exam	60 marks

Course Learning Objectives (LOs):

This course will develop the student's knowledge in/on..

LO1: basic structure of Indian knowledge system

LO2: Indian perspective of modern science

LO3: basic principles of yoga and holistic health care

LO4: benefits of yoga practice

Unit – I (6)

Basic Structure of Indian Knowledge System: Introduction, Vedas – Origin, Classification, Structure, Rig Veda, Sama Veda, Yajur Veda, Atharva Veda; Upavedas – Dhanurveda, Sthapatveda, Gandharvaveda, Ayurveda; Vedang – Shiksha, Chanda, Vyakarna, Nirukta, Kalpa, Jyothisha; Upanga – Dharmashastra, Mimamsa, Tarkashastra, Purvana

Unit – II (6)

Modern Science and Indian Knowledge System: Introduction – Vedas as Basis for Modern Science – Architectural Developments – Medicine and its relevance – Mathematical Sciences in Vedas – Space and Military related developments – Chemical Sciences

Unit – III (6)

Yoga and Holistic Health Care: Healthy mind in healthy body – Yoga: Definition, types; Yoga to keep fit: Diet, Yoga Asanas – Fundamentals; Breathing techniques in Patanjali Yoga tradition – Pranayama; chakras; meditation; Benefits of Yoga – Physical Health, Emotional Health, Prevention of Disease, Reducing or Alleviating Symptoms of Problems

Unit – IV (6)

Case studies – Yoga Practice: Yoga as an effective tool for management of human crisis – Depression, Self – Concept & Mental health, Yoga for stress management; Yoga : A way to cure for Insomnia

Requisite:

Yoga practice sessions are to be conducted for all the students taking this course by the time they complete Unit 1 and Unit 2

Textbooks:

[1] Sathish Chandra Chaterjee and Dhirendramohan Datta, *An Introduction to Indian Philosophy,* New Delhi: Rupa Publications Pvt. Ltd. (Chapter 2, 3)

[2] Priyadaranjan Ray and S.N. Sen, *The Cultural Heritage of India, Vol. 6, Science and Technology*, Calcutta: The Ramakrishna Mission Institute of Culture.

[3] *Yoga Sutra of Patanjali*, Kolkatta: Ramakrishna Mission.

[4] RN Jha, *Science of Consciousness Psychotherapy and Yoga Practices*, New Delhi: Vidyanidhi Prakasham, 2016 (Chapter 4, 5, 6, 7, 8)

Reference Books:

[1] Swami Jitatmananda, *Holistic Science and Vedanta*, Bombay: Bharatiya Vidya Bhavan. (Chapter 2, 3)

Course Learning Outcomes (COs):
On completion of this course, students will be able to…

CO1: summarize the basic structure of Vedas, Upavedas, Vedanga, Upanga
CO2: explain Vedas as principal source of knowledge for scientific inventions
CO3: describe different yogasanas, breathing techniques, chakras, meditation and their benefits
CO4: discuss the benefits of yoga as an effective tool for management of human crisis

Course Articulation Matrix (CAM): U18MH315 ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE															
CO Code		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	**U18MH315.1**	-	-	-	-	-	1	-	2	1	1	-	-	-	-
CO2	**U18MH315.2**	-	-	-	-	-	1	1	2	1	1	-	-	-	1
Co3	**U18MH315.3**	-	-	-	-	-	1	-	2	2	1	-	2	-	-
Co4	**U18MH315.4**	-	-	-	-	-	1	1	2	2	1	-	2	-	-
U18MH315		**-**	**-**	**-**	**-**	**-**	**1**	**1**	**2**	**1.5**	**1**	**-**	**2**	**-**	**1**

DEPARTMENT OF MECHANICAL ENGINEERING
KAKATIYA INSTITUTE OF TECHNOLOGY & SCIENCE, WARANGAL – 15
(An Autonomous Institute under Kakatiya University, Warangal)
SCHEME OF INSTRUCTION AND EVALUATION
IV-SEMESTER OF 4-YEAR B.TECH DEGREE PROGRAMME

[7Th+2P+1MC]

Sl. No	Category	Course Code	Course Title	Hours per week			Credits	Evaluation Scheme				
								CIE			ESE	Total Marks
				L	T	P	C	TA	MSE	Total		
1	BSC	U18OE401	Open Elective-II	3	1	-	4	10	30	40	60	100
2	HSMC	U18TP402	Soft and Inter Personal Skills	-	-	2	1	100	-	100	-	100
3	PCC	U18OE403	Open Elective-I	3	-	-	3	10	30	40	60	100
4	PCC	U18ME404	Design of Machine Elements	3	-	-	3	10	30	40	60	100
5	PCC	U18ME405	Kinematics of Machinery	3	1	-	4	10	30	40	60	100
6	PCC	U18ME406	Manufacturing Processes	3	-	-	3	10	30	40	60	100
7	PCC	U18ME407	Applied Thermodynamics	3	-	-	3	10	30	40	60	100
8	PCC	U18ME408	Manufacturing Processes Lab	-	-	2	1	40	-	40	60	100
9	PCC	U18OE411	Open Elective-I based Lab	-	-	2	1	40	-	40	60	100
10	MC	U18CH416	Environmental Studies*	2	-	-	-	10	30	40	60	100
Total:				**18/20***	**2**	**6**	**23**	**240/250***	**180/210***	**420/460***	**480/540***	**900/1000***

L= Lecture, T = Tutorials, P = Practicals & C = Credits
*** indicates mandatory non-credit course for Lateral Entry Students only**

Contact hours per week : 26/28* **Total Credits : 23**

Open Elective-I:	**Open Elective-II:**	**Open Elective-I based Lab:**
U18OE403A: Object Oriented Programming (CSE)	U18OE401A: Applicable Mathematics (MH)	U18OE411A: Object Oriented Programming Lab (CSE)
U18OE403B: Fluid Mechanics & Hydraulic Machines (CE)	U18OE401B: Basic Electronics Engineering (ECE)	U18OE411B: Fluid Mechanics & Hydraulic Machines Lab (CE)
U18OE403D: Web Programming (IT)	U18OE401D: Measurements & Instrumentation (EIE)	U18OE411D: Web Programming Lab (IT)
U18OE403E: Microprocessors (ECE)	U18OE401E: Fundamentals of Computer Networks (IT)	U18OE411E: Microprocessors Lab (ECE)
U18OE403F: Strength of Materials (CE)	U18OE401F: Renewable Energy Sources (EEE)	U18OE411F: Strength of Materials Lab(CE)

U18OE401A APPLICABLE MATHEMATICS

Class: B. Tech. IV-Semester **Branch:** Common to all branches

Teaching Scheme:

L	T	P	C
3	1	-	4

Examination Scheme:

Continuous Internal Evaluation	40 marks
End Semester Exam	60 marks

Course Learning Objectives (LOs):
This course will develop students' knowledge in/on…

LO1: application of Fourier series to solve wave equation, heat conduction equation and Laplace equation
LO2: the methods of fitting curves by the method of least squares, statistical methods and probability distributions with applications to engineering disciplines
LO3: finite difference operators; the concept of interpolation and numerical integration
LO4: numerical methods and application to find numerical solutions of differential equations

UNIT-I (9+3)

Applications of Partial Differential Equations: Basic concepts of partial differential equations, classification of second order partial differential equations, solution of a partial differential equation, solution through the method of separation of variables

Vibrating String: Wave equation and its solution by the method of separation of variables, D'Alembert's solution of wave equation, solutions of various boundary value problems based on vibrating string

One Dimensional Heat Flow: Transient heat flow equation, heat flow through a bar of finite length with homogeneous and non homogeneous boundary conditions, heat flow through a bar with insulated ends

Two Dimensional Heat Flow: Equation of two dimensional heat flow (Laplace's equation) under steady state / the electrostatic potential of electrical charges in any region that is free of these charges (problems based on Trigonometric FS only),solution of Laplace's equation in Cartesian and polar form, heat flow through infinite rectangular plates, finite square plate and semi circular and circular plates

UNIT-II (9+3)

Statistics: Statistical data: Review of measures of central tendency and measures of dispersion, correlation coefficient, rank correlation, regression – Linear regression equations

Curve Fitting: Method of least squares –fitting of (i) Straight line (ii) Second degree parabola (iii) Exponential curves, most plausible solution of a system of linear algebraic equations

Probability: Review of the concepts of probability, random variables, Discrete and continuous probability distributions, mean and variance of a distribution, Binomial distribution, Poisson distribution, and Normal distribution, fitting of these probability distributions to the given data

UNIT-III (9+3)

Numerical Analysis: Finite differences and difference operators

Interpolation: Newton's forward and backward interpolation formulae. Lagrange interpolation

Numerical Differentiation: First and second derivatives using forward and backward interpolation polynomials at the tabulated points

Numerical Integration: Gaussian quadrature formula, Trapezoidal rule, Simpson's $1/3^{rd}$ rule and Simpson's $3/8^{th}$ rule

UNIT-IV (9+3)

Solution to System of Linear Equations: Gaussian elimination method, Jacobi Method and Guass-Siedel Iteration Method

Numerical Solution of Algebraic and Transcendental Equations: Bisection method, Regula-Falsi method and Newton Raphson's method

Numerical Solution of Ordinary Differential Equations: Taylor's method, Picard's method, Euler's method and Runge - Kutta methods of second and fourth order

Textbook:

[1] Grewal, B.S., *Higher Engineering Mathematics*, 43rd ed. New Delhi: Khanna Publishers, 2014.

Reference Books:

[1] Gupta and Kapoor, *Fundamentals of Mathematical Statistics*, 11th ed. New Delhi: Sulthan Chand and & sons, 2010.

[2] Kreyszig E., *Advanced Engineering Mathematics*, 9th ed. U.K: John wiely & sons, Inc., 2013.

[3] Sastry S.S, *Introduction to numerical Analysis*, 4th ed. New Delhi: Prentice Hall of India Private Limited, 2005.

Course Learning Outcomes (COs):

On completion of this course, students will be able to…

CO1: solve wave equation, heat conduction equation and Laplace equation using Fourier series

CO2: find correlation regression coefficients, fit curves using method of least squares for given data and apply theoretical probability distributions in decision making

CO3: estimate value of a function by applying interpolation formulae

CO4: apply numerical methods to solve simultaneous algebraic equations, differential equations, find roots of algebraic and transcendental equations

Course Articulation Matrix (CAM): U18OE401A APPLICABLE MATHEMATICS

CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	**U18OE401A.1**	2	2	-	-	-	-	-	-	-	-	-	1	1	-
CO2	**U18OE401A.2**	2	2	-	-	-	-	-	-	-	-	-	1	1	-
CO3	**U18OE401A.3**	2	2	-	-	-	-	-	-	-	-	-	1	1	-
CO4	**U18OE401A.4**	2	2	-	-	-	-	-	-	-	-	-	1	1	-
U18OE401A		**2**	**2**	-	-	-	-	-	-	-	-	-	1	**1**	-

U18OE401B BASIC ELECTRONICS ENGINEERING

Class: B. Tech. IV Semester

Branch: Common to all branches

Teaching Scheme:

L	T	P	C
3	1	-	4

Examination Scheme:

Continuous Internal Evaluation	40 Marks
End Semester Exam	60 Marks

Course Learning Objectives (LOs):
This course will develop student's knowledge on/in…

LO1: to introduce the basic concepts of semiconductors and conductivity in semiconductors
LO2: to impart the knowledge on working of semiconductor diode as Rectifier
LO3: to make the students to understand the basic concepts of BJT &DC biasing concepts
LO4: to introduce the fundamental concepts and basic principles of special semiconductor devices

UNIT-I (9+3)

Introduction to Electronics: Analog Signals (DC & AC), Sources (DC & AC), Digital Signals
Semiconductors: Energy bands in solids, Concept of forbidden gap, Insulator, Metals and Semiconductors, Transport phenomenon in semiconductors: Mobility and conductivity, intrinsic semiconductor, Donor and Acceptor impurities, Fermi level, Drift currents and Diffusion currents, Temperature dependence of conductivity, Hall Effect

UNIT-II (9+3)

Semiconductor Diode: P-N Junction, Band diagram, Depletion layer, V-I characteristics of P-N Diode, Diode resistance and capacitance, Avalanche and Zener breakdown mechanisms

Diode Circuits: Rectifier circuits – Half wave, Full wave & Bridge rectifiers, Ripple factor with and without filters, Voltage regulation using Zener diode, Block diagram of DC adapter.

UNIT-III (9+3)

Bipolar Junction Transistor: Physical structure, Transistor current components, CE, CB & CC configurations and their Input & Output characteristics

DC Analysis of BJT Circuits: DC load line, Need for biasing, Transistor biasing techniques for CE configuration, Basic transistor applications: Switch and Amplifier.

UNIT-IV (9+3)

Field Effect Transistor: Physical **s**tructure, Operation and Characteristics of a Junction Field Effect Transistor (JFET), MOSFET, DMOSFET, EMOSFET

Special Semiconductor Devices: Operation and Characteristics- Tunnel Diode, Schottky diode, Photo Diode, Photo Transistor, PIN Diode, LED, LASER, UJT

Textbooks:

[1] Bhargava and Kulashresta, *Basic Electronics and Linear Circuits*, TTTI, TMH*, India*.
[2] S. Salivahanan and N. Suresh Kumar, *Electronic Devices and Circuits*, 2nd ed.Tata McGraw Hill Education (India) Private Ltd, 2009.

Reference Books:

[1] Jacob Millman, Christos C Halkias, *Electronic Devices and Circuits*, 3rd ed. *TMH,* India.
[2] David. A. Bell, *Electronic Devices and Circuits*, New Delhi: Oxford University Press.
[3] Neil storey, *Electronics: A systems Approach*, 4th ed. Pearson Education Publishing Company Pvt. Ltd, India

Course Learning Outcomes (COs):

On completion of this course, students will be able to…

CO1: *Analyze the behavior of semiconductor devices*
CO2: *Design half wave and full wave rectifier circuits with filters*
CO3: *Characterize BJT configurations with input output characteristics and biasing techniques*
CO4: *Acquire knowledge of new emerging areas of science and technology in differentiating semiconductor devices*

Course Articulation Matrix (CAM): U18EC401B BASIC ELECTRONICS ENGINEERING														
CO		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	**U18EC401B.1**	2	2	1	2	-	-	-	-	-	-	-	-	1	-
CO2	**U18EC401B.2**	2	2	2	2	-	-	-	-	-	-	-	-	1	-
CO3	**U18EC401B.3**	2	2	2	2	-	-	-	-	-	-	-	-	1	-
CO4	**U18EC401B.4**	2	2	1	2	-	-	-	-	-	-	-	2	1	-
U18EC401B		**2**	**2**	**1.5**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**1**	**-**

U18OE401D FUNDAMENTALS OF MEASUREMENTS & INSTRUMENTATION

Class: B. Tech. IV – Semester

Branch: Common to all Branches

Teaching Scheme:

L	T	P	C
3	1	-	4

Examination Scheme:

Continuous Internal Evaluation	40 marks
End Semester Examination	60 marks

Course Learning Objectives (LOs):

This course will develop students' knowledge on /in…

LO1: working principle of DC measuring instruments; DC, AC bridge circuits and their applications

LO2: principle of operation of Q meter, DVM, DMM, CRO, DSO and display devices

LO3: working principle of various transducers and their applications

LO4: working principle of seismic transducers, piezoelectric accelerometer, sound level meter, level transducer, flow meter and data acquisition system

UNIT–I (9+3)

DC measuring instruments (principle of operation): Measurement system – block diagram and example; performance characteristics – accuracy, precision, resolution, threshold, span, % error and fidelity; DC meters (working principle) – PMMC mechanism, shunt type ammeter, series type voltmeter, shunt type ohmmeter; DC potentiometers - Crompton's DC potentiometer, calibration of meters (ammeter, voltmeter & wattmeter) using DC potentiometer

DC & AC bridges: General bridge balance equation, bridge calibration, applications of bridges, Wheatstone bridge, Maxwell bridge, Schering bridge, Wien's bridge

UNIT – II (9+3)

Electronic instruments (principle of operation): Q-meter – basic Q-meter circuit; digital meter – characteristics (resolution & count), DC & AC attenuators, block diagram of dual slope type digital voltmeter, block diagram of digital multimeter (DMM); oscilloscopes – working principle of cathode ray tube (CRT), block diagram of cathode ray oscilloscope (CRO) , block diagram of digital storage oscilloscope (DSO); display devices – working principle of LED & LCD types

UNIT – III (9+3)

Transducers (principle of operation): Transducer - classification, examples and ideal requirements; sensors – cantilever beam & proving ring types of load cells, bourdon tube & diaphragm type pressure sensors; resistive transducers – piezo-resistive effect of strain gauge (SG), gauge factor, SG type force transducer, SG type pressure transducer and RTD; thermocouple type temperature transducer, LVDT type inductive transducer, differential type capacitive transducer, piezoelectric type transducer; photoelectric type transducer

UNIT – IV (9+3)

Transducers (principle of operation): Seismic transducers – displacement transducer, velocity pickup and accelerometer, piezoelectric accelerometer, sound level meter (block diagram), capacitive microphone, capacitive type level transducer (double electrode type), ultrasonic flow meter and electromagnetic flow meter; introduction to data acquisition (DAQ) system

Textbooks:

[1] P. Pruthviraj, B. Bhudaditya, S. Das and K. Chiranjib, *Electrical and Electronic Measurement and Instrumentation*, 2nd ed. New Delhi: McGraw-Hill Education, 2013 (*Chapters 1 to 3, 8 to 10 and 13 to 15*)

[2] Arun K. Ghosh, *Introduction to Transducers,* 4th ed. New Delhi: PHI, 2015. (*Chapters 1 to 7*)

Reference Books:

[1] A.K. Sawhney, *Electrical and Electronics Measurements and Instrumentation,* New Delhi: Dhanpatrai & Co., 2015.

[2] Helfrick. A.D and Cooper W.D., *Modern Electronic Instrumentation and Measurement Techniques*, 2nd ed. New Delhi: Pearson India Edn., 2016.

[3] B.C. Nakra, K.K Choudhry, *Instrumentation Measurement and Analysis*, 4th ed. New Delhi: *TMH,* 2008.

[4] D.V.S. Murthy, *Transducers and Instrumentation*, 2nd ed. New Delhi: Prentice Hall of India, 2012.

Course Learning Outcomes (COs):

On completion of this course, students will be able to…

CO1: explain about working principle of measurement system, PMMC based meters and applications of DC & AC bridge circuits

CO2: describe the principle of operation of Q-meter, DVM, DMM, CRO, DSO and display devices

CO3: elaborate on the working principle of resistive, inductive, capacitive and piezoelectric transducers and their applications

CO4: explain about seismic transducers, sound level meter, level transducer, flow meters and block diagram of data acquisition system

Course Articulation Matrix (CAM): U18EI401D FUNDAMENTALS OF MEASUREMENTS & INSTRUMENTATION

CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	**U18EI401D.1**	2	1	1	1	-	-	1	-	-	-	-	1	1	1
CO2	**U18EI401D.2**	2	1	1	1	-	-	1	-	-	-	-	1	1	1
CO3	**U18EI401D.3**	2	1	1	1	-	-	1	-	-	-	-	1	1	1
CO4	**U18EI401D.4**	2	1	1	1	-	-	1	-	-	-	-	1	1	1
U18EI401D		**2**	**1**	**1**	**1**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**1**	**1**	**1**

U18OE401E FUNDAMENTALS OF COMPUTER NETWORKS

Class: B. Tech. IV- Semester **Branch:** Common to all branches

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation	40 marks
End Semester Exam	60 marks

Course Learning Objectives (LOs):

This course will develop students' knowledge in/on…

LO1: network topologies, network reference models, network architecture and data transmission

LO2: design issues and protocols of data link layer, error detection and correction, MAC protocols and ethernet standards

LO3: principles and design issues of network layer and internet protocols

LO4: transport layer design issues, protocols and application layer services

UNIT - I (9)

Introduction: History of Computer Networks and the Internet, Principles of Computer Network Design, Network Architecture, Network Types

Physical Layer: Factors Affecting Data Transmission, Data Transmission, data Transmission Codes: Non-return to Zero, Manchester Encoding, Digital modulation & Modems, Transmission Media

UNIT- II (9)

Data Link Layer: Functions of Data Link Layer, Framing Techniques, Error Detection and Correction, Elementary Data Link Layer Protocols for Flow Control

Local Area Networks: Medium Access Protocols, LAN Protocol Stack, Ethernet Protocols, IEEE 802.11 LAN Standard: IEEE 802.11 Protocol Stack, Wireless LAN Topologies, Frames in IEEE 802.11

UNIT - III (9)

The Network Layer: Network Layer Services, Packet Switching Networks, The Internet Protocol(IP): IP Header in IPv4, IP Addressing in IPv4, Subnet addressing and Classless Inter-Domain Routing (CIDR), Address Resolution Protocol, Dynamic Host Configuration Protocol, Internet Layer Protocols, Fragmentation and Reassembly, IP Version 6: Motivation for IPv6 Development, Features of IPv6, IPv6 Address Representation

Routing Protocols: Elements of Routing Protocol Performance, Flooding, Distance-Vector and Link State Routing Protocols, Hierarchical Routing

UNIT - IV (9)

The Transport Layer: User Datagram Protocol, Transmission Control Protocol, TCP State Transition Diagram, Other TCP Timers, TCP Congestion Control

The Application Layer: World Wide Web, Domain Name System, Electronic Mail.

Network Security: Threats and Vulnerabilities in Computer Networks, Cryptographic Algorithms, Data Encryption Standard

Textbooks:

[1] Mayank Dave, *Computer Networks*, 2nd ed. Cengage Learning, ISBN-13:978-81-315-0986-9, 2014.

Reference Books:

[1] Forouzan, *Data Communication and Networking*, 5th ed. ISBN978-0-07-296775-3, TMH, 2012.

[2] William Stallings, *Data and Computer Communications*, 9th ed. ISBN-81-203-1240-6, Prentice-Hall India, 2011.

[3] Andrew S. Tanenbaum and David J. Wetherall, *Computer Networks*, 5th ed. ISBN-13: 978-0-13-212695-3, Pearson Education, 2011.

Course Learning Outcomes (COs):

On completion of this course, students will be able to…

CO1: describe various network topologies, architecture and techniques for data transmission modes

CO2: outline various design issues in data link layer and develop protocols to handle data link layer operation

CO3: describe various design issues and develop protocols for network layer.

CO4: explain various design issues , protocols of transport layer & application layer services

Course Articulation Matrix (CAM): 18OE401E Fundamentals of Computer Networks														
CO		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	**U18OE401E.1**	2	1	-	1	-	1	-	-	-	-	-	1	-	1
CO2	**U18OE401E.2**	3	3	2	1	1	1	-	-	-	-	-	1	-	1
CO3	**U18OE401E.3**	3	3	2	2	1	1	-	-	-	-	-	1	-	1
CO4	**U18OE401E.4**	3	3	2	2	1	1	-	-	-	-	-	1	-	1
U18OE401E		**2.75**	**2.5**	**2**	**1.5**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**1**

U18OE401F RENEWABLE ENERGY SOURCES

Class: B. Tech. IV Semester **Branch:** Common to all branches

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation	40 marks
End Semester Examination	60 marks

Course Learning Objectives (LOs) :

This course will develop student's knowledge in/on…

LO1 different renewable energy sources and principle of solar energy systems
LO2 wind energy, geothermal energy and MHD power generation systems
LO3 harnessing energy from oceans and biomass
LO4 working of fuel cells and different energy storage systems

UNIT-I (9)

Introduction: Conventional and non-conventional sources of energy – Brief Description of different Renewable energy sources

Solar Energy: Introduction to prospects of solar photovoltaic (SPV) systems, principle of a PV cell, large scale SPV systems, economic considerations of SPV systems, PV cell technology, merits and limits of SPV systems, applications of SPV systems-street lighting, domestic lighting, Battery charging, SPV pumping systems

UNIT-II (9)

Wind Energy: Principles of wind power- Operation of a wind turbine- Site Characteristics

Geothermal Energy: Origin and types of geothermal energy- Operational Difficulties- Vapor dominated systems- Liquid dominated systems- Petro- thermal systems

Magneto-Hydro Dynamic (MHD) Power Generation: MHD system- Open and Closed systems- Advantages of MHD systems

UNIT-III (9)

Energy from Oceans: Ocean temperature differences, ocean waves-Wave motions and tides-Energy from the waves; Introduction of tidal power, basic principle of tidal power, components of tidal power plants, advantages and disadvantages

Bio-Energy: Introduction-bio-mass conversion, technologies-wet process, dry process, photo synthesis; Biogas generation- biogas from power plant wastes, methods of maintaining biogas production, utilization of biogas, biogas gasification, applications of gasifiers

UNIT-IV (9)

Chemical Energy Sources: Introduction of fuel cells, Principle of Operation of fuel cell, Classification of Fuel cells, Advantages and disadvantages of fuel cells

Types of Energy Storage Systems: Introduction, Different types of Batteries, Ultra Capacitors, Flywheels, Super Conducting Magnetic storage

Textbooks:

[1] Rai G.D, *Non-Conventional Energy Sources*, New Delhi: Khanna Publishers.

[2] Felix A. Farret and M. Godoy Simoes, *Integration of Alternative Sources of Energy*, John Wiley & Sons, 2006.

[3] Bansal N. K, Kaleeman and M.Miller, *Renewable Energy Sources and Conversion Technology*, New Delhi: TATA Mc Graw-Hill.

Reference Books:

[1] EL-Wakil M.M, *Power Plant Technology*, New York: Mc Graw-Hill.
[2] Duffie and Beckman, *Solar Energy Thermal Process*, New York: John Wiley & Sons.

Course Learning Outcomes (COs):

On completion of this course, students will be able to…

CO1: compare conventional and non-conventional energy resources; explain the working principle of solar energy harnessing and its applications
CO2: explain the working principles of wind energy, geothermal energy and MHD power generation systems
CO3: describe the harnessing of electric power from oceans and biomass
CO4: explain the principle of operation of fuel cells and different types of energy storage systems

Course Articulation Matrix (CAM): U18OE401F RENEWABLE ENERGY SOURCES

CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	**U18OE401F.1**	3	-	-	-	-	-	1	-	-	-	-	-	1	1
CO2	**U18OE401F.2**	3	-	-	-	-	-	1	-	-	-	-	-	1	1
CO3	**U18OE401F.3**	3	-	-	-	-	-	1	-	-	-	-	-	1	1
CO4	**U18OE401F.4**	3	-	-	-	-	-	1	-	-	-	-	-	1	1
U18OE401F		**3**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**1**	**1**

U18TP402 **SOFT AND INTERPERSONAL SKILLS**

Class: B. Tech IV semester **Branch:** Common to all branches

Teaching Scheme:

L	T	P	C
-	-	2	1

Examination Scheme:

Continuous Internal Evaluation	100 marks
End Semester Examination	-

Course Learning Objectives (LOs):
This course will develop students' knowledge in/on…

LO1: logical construction of speech appropriate for the occasion and exhibiting team work
LO2: acquiring spontaneity, presence of mind for effective communication
LO3: identifying, analyzing the theme of the topic and understanding presentation skills
LO4: communicating professionally and developing strategies in selecting career objectives in line with industry expectations

LIST OF ACTIVITIES

Introduction

Activity 1	Team interaction
Activity 2	SWOT analysis
Activity 3	Debate
Activity 4	Group Discussion

Activity 5	Presentations through PPTs
Activity 6	Video Synthesis
Activity 7	Resume Writing
Activity 8	Email Etiquette

Activity 9 : My interview Plan: Self Introduction & FAQs
Activity 10 : "My Career Plan" Oral presentation
} Comprehensive Presentation

Textbooks:

[1] Developing Communications Skills – Krishna Mohan & Meera Benerji
[2] Soft Skills - Alex.K
[3] Soft skills Cornerstone of Professional success – Raman & Meenakshi

References:

[1] https://onlinecourses.nptel.ac.in/noc19_hs20/preview
[2] https://onlinecourses.nptel.ac.in/noc18_hs30/preview

Course Learning Outcomes (COs):
On completion of this course, students will be able to…

CO1: *introspect to convert strengths into opportunities, identify weaknesses, bypass threats*
CO2: *present views on various issues confidently in a group*
CO3: *make effective PPT presentations, synthesize videos*
CO4: *prepare a professional resume, communicate effectively to attain better opportunities*

Course Articulation Matrix (CAM): U18TP402 SOFT AND INTERPERSONAL SKILLS															
CO		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	**U18TP402.1**	-	-	-	-	-	-	-	-	2	3	-	-	-	1
CO2	**U18TP402.2**	-	-	-	-	-	-	-	2	3	3	-	-	-	1
CO3	**U18TP402.3**	-	-	-	-	-	-	-	-	2	3	-	-	-	1
CO4	**U18TP402.4**	-	-	-	-	-	-	-	1	2	3	-	-	-	1
U18TP402		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1.5**	**2.25**	**3**	**-**	**-**	**-**	**1**

U18OE403A OBJECT ORIENTED PROGRAMMING

Class: B. Tech. IV-Semester **Branch:** Common to all branches

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation	40 marks
End Semester Examination	60 marks

Course Learning Objectives(LOs):

This course will develop students' knowledge in/on…

LO1: fundamentals of object oriented and java programming.

LO2: classes, objects and inheritance for implementing object oriented concepts.

LO3: polymorphism interfaces and packages for realizing object oriented programming.

LO4: manage Exceptional and I/O operations in application developments.

UNIT- I (9)

Fundamentals of Object Oriented Programming: Programming paradigms, basic concepts of object oriented paradigm (oop), benefits and applications of oop

Basics of Java Language: Java language features, java programming structure, java tokens, JVM, constants, variables, data types, scope of variable, type casting, operators and expressions, branching and looping statements, arrays

UNIT – II (9)

Classes and Objects: Defining a class, field declaration, method declaration, creating object, accessing class members, constructors, garbage collection, static members, nested and inner classes, command line arguments, wrapper classes

Inheritance: Extending a class, defining subclasses, subclass constructor, multilevel inheritance, hierarchical inheritance, access controls, this and super keywords

UNIT-III (9)

Polymorphism: Overloading methods, overloading constructors, overriding methods, dynamic method dispatch, abstract classes, final keyword

Interfaces: Defining an interface, implementing interfaces, nested interfaces, variables in interfaces, extending interfaces

Packages: Packages, java API packages, using system packages, naming conventions, creating packages, accessing packages, adding a class to package, hiding classes, static import

UNIT – IV (9)

Exception handling: Fundamentals, exception types, uncaught exceptions, using try and catch, multiple catch clauses, explicit exceptions with throw, throws and finally keywords

String Handling: String constructors, string length, string operations, character extraction, string comparison, searching string, modifying string, changing string cases, joining strings

Using I/O: I/O basics, reading console input, writing console output, reading and writing files

Textbooks:

[1] Herbert Schildt, *JAVA the Complete Reference*, 9th ed. ISBN: 9781259002465, McGraw-Hill Education India Pvt. Ltd., 2014.

[2] E. Balgurusamy, *Programming with JAVA a primer*, 5th ed., ISBN: 9351343200, McGraw-Hill Publication Ltd, 2014.

References Books:

[1] P Radha Krishna, *Object Oriented Programming through JAVA*, ISBN: 9788173715723, Universities Press, 2011.

[2] Herbert Schildt, *JAVA the Complete Reference*, 9th ed. ISBN: 9781259002465, McGraw-Hill Education India Pvt. Ltd, 2011.

[3] Kathy Sierra, Bert Bates, *Head First Java*, 2nd ed. ISBN-13: 978-0596009205, O'Reilly Publictions.

[4] Uttam K. Roy, *Advanced JAVA Programming*, ISBN-13: 978-0199455508, Oxford Publications.

Course Learning Outcomes (COs):

On completion of this course, students will be able to…

CO1: demonstrate object oriented concepts and java programming features.
CO2: solve computing problems using object orientation and inheritance concepts.
CO3: use polymorphism, interfaces and Packages for effective object oriented programming
CO4: handle Exceptions and I/O operations in application development.

Course Articulation Matrix (CAM): U18OE403A OBJECT ORIENTED PROGRAMMING

CO/PO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	**U18OE403A.1**	2	2	2	1	2	1	-	1	2	1	2	1	1	-
CO2	**U18OE403A.2**	2	2	2	1	2	1	-	-	2	1	2	1	1	-
CO3	**U18OE403A.3**	2	2	2	1	2	1	-	-	2	1	2	1	1	1
CO4	**U18OE403A.4**	2	2	2	1	2	1	1	1	2	1	2	1	1	1
U18OE403A		**2**	**2**	**2**	**1**	**2**	**1**	**1**	**1**	**2**	**1**	**2**	**1**	**1**	**1**

U18OE403B FLUID MECHANICS AND HYDRAULIC MACHINES

Class: B. Tech. IV -Semester **Branch:** Common to all branches

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation	40 marks
End Semester Examination	60 marks

Course Learning Objectives (LOs):

This course will develop students' knowledge in /on…

LO1: various Properties of fluids and fluid statics
LO2: application of Bernoulli's equation and dimensional analysis
LO3: flow through pipes and working principles of hydraulic turbines
LO4: performance of reciprocating and centrifugal pumps

UNIT-I (9)

Fluid fundamentals: Classification of fluids, fluid properties - density, specific weight, specific gravity, specific volume, viscosity, capillarity, vapor pressure, compressibility, surface tension, cohesion and adhesion

Fluid statics:Pascal's Law, hydrostatic Law, measurement of pressure, manometers, Piezometer, U-tube differential manometer, inverted differential manometer, hydrostatic forces on submerged plane and curved surfaces, buoyancy, metacenter, stability of floating and submerged bodies

UNIT-II (9)

Fluid dynamics: Classification of fluid flow, continuity equation in one, two and three dimensional flow, velocity potential and stream function, forces causing motion, Euler's equation of motion, Bernoulli's Equation, applications of Bernoulli's equation, venturi meter, orifice meter, pitot tube, linear momentum equation ,application of linear momentum equation to forces on pipe bend

Dimensional analysis: Dimensional analysis by Rayleigh's method and Buckingham π's theorem, dimensionless numbers and model laws, Reynolds law and Froude's law

UNIT-III (9)

Flow through pipes: Loss of head in pipes, expression for head loss due to major and minor losses in pipes, HGL and TEL lines, pipes in series and parallel, equivalent pipe

Hydraulic turbines: Concept of impact jets, classification, head, losses and various efficiencies, Pelton turbines, components, velocity triangles, power and efficiencies, reaction turbines, Francis and Kaplan turbines, efficiencies and characteristics, unit quantities, specific speed, draft tube theory

UNIT-IV (9)

Reciprocating pumps: Working of single and double acting pumps, work done and efficiencies, slip, negative slip, performance characteristics of pumps, air vessel

Centrifugal pumps: Principle, components, work done and efficiency, pumps in series and in parallel, multi stage pumps, characteristics, cavitation and priming

Textbook:

[1] P.N.Modi and S.M. Seth, *Hydraulics and Fluid Mechanics Including Hydraulic Machines*, 21st ed. Standard Book House, Rajsons Publications Private Limited, 2017.

Reference Books:

[1] R.K.Bansal, *Fluid Mechanics and Hydraulic Machines*, Periodicals Private Ltd., 2018
[2] Victor Streeter and E. Benjamin Wylie, *Fluid Mechanics*, 9th ed. Singapore: McGraw Hill, 2017.
[3] Frank M. White, *Fluid Mechanics*, Special Indian Edition, New Delhi: Tata McGraw Hill, 2011.
[4] A.K. Jain, *Fluid Mechanics Including Hydraulic Machines*, 12th ed. Khanna Publications, 2018.

Course Learning Outcomes (COs):

On completion of this course, students will be able to…

CO1: summarize fluid properties using fundamental laws of fluid statics.
CO2: analyze fluid flows using Bernoulli's equation and model laws.
CO3: estimate losses in pipes and characterize hydraulic turbines.
CO4: discuss the working principle and characteristics of pumps.

Course Articulation Matrix (CAM): U18OE303B FLUID MECHANICS AND HYDRAULIC MACHINES

CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	**U18CE403B.1**	2	1	-	-	-	-	-	-	1	1	-	1	2	1
CO2	**U18CE403B.2**	2	1	-	1	-	-	-	-	1	1	-	1	2	1
CO3	**U18CE403B.3**	2	1	-	1	-	-	-	-	1	1	-	1	2	1
CO4	**U18CE403B.4**	2	1	-	1	-	1	-	-	1	1	-	1	2	1
U18CE403B		**2**	**1**	**-**	**1**	**-**	**1**	**-**	**-**	**1**	**1**	**-**	**1**	**2**	**1**

U18OE403D WEB PROGRAMMING

Class: B. Tech. IV-Semester **Branch:** Common to all branches

Teaching Scheme:

L	T	P	C
3		-	3

Examination Scheme:

Continuous Internal Evaluation	40 marks
End Semester Exam	60 marks

Course Learning Objectives (LOs):

This course will develop students' knowledge in /on…

LO1: designing static webpage using HTML Tags, CSS properties, interactivity with JavaScript
LO2: creating dynamic webpage using JSP.
LO3: developing server-side scripts for web applications using PHP.
LO4: building databases applications using PHP, MYSQL and XML.

UNIT-I (9)

HTML: Document Structure, Basic Tags, Creating Headings, Working with Links, Creating Paragraph, Working with Images, Tables, Frames. Introduction to Forms and Controls: Creating HTML Form, Specifying Action URL and Method to Send the Form, Using HTML Controls

CSS: *CSS* (Cascading style sheet) rules and properties, Types: Inline, External and Internal Style Sheets, Style Classes, Multiple Styles

JAVASCRIPT: JavaScript syntax, Embedding JavaScript in HTML Page. Usage of variables, Working with Operators, Control-Flow Statements, Functions and Array, Creating Objects, Handling Events

UNIT-II (9)

JSP: Syntax and Semantics, JSP Development Model, Components of JSP page: Directives, Comments, Expressions, Scriptlets, Declarations, Implicit Objects, Standard Actions, Tag Extensions, A Complete JSP Example. Session and Thread Management: Session Tracking, Session API, Thread Management. Application Event Listeners

JDBC: Database access with JDBC, Overview, JDBC drivers, connecting to database with Driver Manager, Statement Interfaces: Statement, Prepared statement, Callable statement, Result Sets

UNIT-III (9)

Introduction to PHP: Overview of PHP, Advantages of PHP over scripting languages, Creating and running a PHP script, handling errors. Working with Variables and Constants: Variables, Data Types and Operators

Controlling Program Flow: Conditional Statements, Looping Statements, Break, Continue and Exit Statements. Working with Functions, Arrays, Files and Directories

Working with Forms: Web Forms and Form Elements, Processing a Web Form, Validating a Web Form

UNIT-IV (9)

Database using PHP: Exploring Relational Database Model, Records and Primary Keys; Working with SQL Statements using PHP and MySql; Checking Configuration, Connecting to Database, Selecting a Database, Adding and Altering a Table in a Database, Inserting and modifying Data in a Table, Retrieving Data from a Table

XML: Introduction to XML, XML Basics: Syntax, Declaration, Elements, Attributes, Valid XML Documents, Viewing XML, XML Parser, XML Technologies, Document Object Model (DOM)

Textbooks:

[1] Kogent, *Web Technologies HTML, CSS, JavaScript, ASP.NET, Servlets, JSP, PHP, ADO.NET, JDBC and XML,* ISBN-13:9789351192510, Dreamtech Press (Black Book), 2013.

[2] Phil Hanna, *JSP: The Complete Reference*, 2nd ed. ISBN: 007-212768-6, McGraw-Hill, 2001.

Reference Books:

[1] Ivan Bayross, *Web Enabled Commercial Application Development Using HTML, JavaScript, DHTML and PHP*, 4th ed. ISBN-13: 978-8183330084, BPB Publications, 009,

[2] UttamK.Roy, *Web Technologies*, 7th ed. ISBN-10: 0-19-806622-8, ISBN-13: 978-0-19-806622-4, Oxford Higher Education, 2010.

[3] Luke Welling, Laura Thomson, *PHP and MySQL Web Development*, 3rd ed. ISBN: 0-672-32672-8, Sams Publications, 2005

[4] Jayson Falkner and Kevin Jones, *Servlets and Java Server Pages*, ISBN: 0-321-13649-7, Pearson, 2003

Course Learning Outcomes (COs):

On completion of this course, students will be able to…

CO1: create static web pages using HTML Tags, CSS properties and Java scripts

CO2: create dynamic web pages using java server page concepts.

CO3: develop web server side applications using PHP concepts

CO4: develop enterprise databases for web-based applications using PHP and MySQL.

Course Articulation Matrix (CAM): U18OE403D WEB PROGRAMMING

CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	**U18OE403D.1**	2	2	2	1	2	1	-	1	2	1	2	1	-	1
CO2	**U18OE403D.2**	2	2	2	1	2	1	-	1	2	1	2	1	-	1
CO3	**U18OE403D.3**	2	2	2	1	2	1	-	1	2	1	2	1	-	1
CO4	**U18OE403D.4**	2	2	2	1	2	1	1	1	2	1	2	1	-	1
U18OE403D		2	2	2	1	2	1	1	1	2	1	2	1	-	1

U18OE403E MICROPROCESSORS

Class: B. Tech. IV-Semester **Branch:** Common to all branches

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation:	40 marks
End Semester Exam:	60 marks

Course Learning Objectives (LOs):
This course will develop students' knowledge in/on…

LO1: architectural issues of 8086 Microprocessor
LO2: programming concepts of 8086 Microprocessor
LO3: interfacing of 8086 microprocessor to various I/O subsystems.
LO4: serial data communication types and standards like RS232, IEEE 488 Bus.

UNIT – I (9)

Review of 8085 MPU Architecture
8086 Family Architecture: Organization of 8086 CPU, Concept of Memory Segmentation, Segment Registers, Physical and Logical Addressing, Addressing Modes and Instruction Formats, Instruction Set

UNIT – II (9)

Assembly Language Programming: Assembler Directives, Simple Programming of 8086, Arithmetic, Logical and Data Processing Programs; Implementation of Control Loops, Structures, Strings, Procedures, Macros
Pin Configuration, Minimum / Maximum Modes, Timing Diagrams, Delay Subroutines

UNIT – III (9)

Interfacing with 8086: 8086 Interrupts, Interrupt Service Routines, Programmable Interrupt Controller 8259, Programmable Peripheral Interface 8255, Interfacing of Switches, Keyboards, LEDs, Stepper Motor, ADCs and DACs

UNIT – IV (9)

DMA Controller 8257, Programmable Timer/Counter 8254
Serial Data Communication through 8086: Types of Serial Communication, Synchronous and Asynchronous Communication, Serial Data Communication through USART 8251, Serial Data Communication Standards, RS-232, IEEE 488 Bus (GPIB)

Textbooks:

[1] D.V.Hall, *Microprocessors and Interfacing: Programming & Hardware*, 2nd ed. New Delhi: Tata McGraw Hill, 1992. (Chapter 3 to 10)

[2] Yuchang Liu and Glen A. Gibson, *Microcomputer Systems. The 8086/8088 Family, Architecture, Programming and Design,* 2nd ed. New Delhi: PHI, 1995. (Chapter 2 to 11)

Reference Books:

[1] Kenneth J. Ayala and Ayala Kenneth, *The 8086 Microprocessor: Programming and Interfacing The PC*, *West Pub*., 1994.

[2] Barry B. Brey, *The Intel Microprocessors: Architecture, Programming and Interfacing*, 2nd ed. New Delhi: PHI, 1998.

Course Learning Outcomes (COs):

On completion of this course, students will be able to…

CO1: describe the architecture of 8086 microprocessor and explain instructions with suitable examples

CO2: write Assembly Language Programs (ALPs) to perform a given task

CO3: design 8086 microprocessor based system for given specifications with memory mapping

CO4: explain serial communication modes and discuss it standards

Course Articulation Matrix (CAM): U18OE 303E MICROPROCESSORS														
CO		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	**U18OE 403E.1**	3	3	2	1	--	--	--	--	--	--	--	--	-	1
CO2	**U18OE 403E.2**	3	2	2	1	--	--	--	--	--	--	--	--	-	1
CO3	**U18OE 403E.3**	3	3	2	1	--	--	--	--	--	--	--	--	-	1
CO4	**U18OE 403E.4**	3	3	2	1	--	--	--	--	--	--	--	1	-	1
U18OE 403E		3	2.75	2	1	--	--	--	--	--	--	--	1	-	1

U18OE403F STRENGTH OF MATERIALS

Class: B. Tech. IV -Semester **Branch:** Common to all branches

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation	40 marks
End Semester Examination	60 marks

Course Learning Objectives (LOs):

This course will develop students' knowledge in /on…

LO1: behavior of bodies subjected to various types of stresses and strains
LO2: shear force and bending moment for determinate beams
LO3: bending and shearing stresses for beams in flexure
LO4: behavior of circular shafts, springs and thin cylinders

UNIT-I(9)

Simple Stresses and Strains: Types of stresses, strains, stress–strain diagram, elastic limit, Hooke's law, bars of varying sections, uniformly tapering circular and rectangular sections, elongation of bars due to self weight, temperature stresses in uniform bars

Elastic Modulii: Elastic constants, longitudinal strain, lateral strain, Poisson's ratio, complimentary shear stress, state of simple shear, modulus of elasticity (E), modulus of rigidity (N), bulk modulus (K), relation between E, N & K, strain energy, resilience, impact loading

UNIT-II (9)

Principal Stresses: Definition, normal and shear stress, principal stresses, principal planes and their graphical representation by Mohr's circle

Shear Force and Bending Moment: Types of supports, classification of beams, concept of shear force and bending moment, shear force diagram and bending moment diagram for simply supported, cantilever and overhanging beams, loading from shear force and bending moment diagram, principle of superposition

UNIT-III (9)

Bending Stresses in Beams: Assumptions, theory of simple bending, application of bending equation and calculation of bending stresses in beams of homogeneous and flitched beam material, beams of uniform strength

Shearing Stresses in Beams: Shearing stress due to bending, variation of flexural shear stress distribution across rectangular, triangular, circular, flanged section, shear resilience

UNIT-IV (9)

Circular Shafts and springs: Theory of pure torsion in solid and hollow circular shafts, shear stresses, angle of twist, power transmitted by shaft, close-coiled and open-coiled helical spring subjected to axial load and axial twist, springs in series and parallel

Thin Cylinders: Analysis of thin walled pressure vessels, hoop stress, longitudinal stress

Textbooks:

[1] Rajput R.K., *Strength of Materials*, 7th ed. S Chand and Company.

[2] Gunneswara Rao T. D. and Mudimby Andal, *Strength of Materials,* Cambridge University Press, 2018.

Reference Books:

[1] Timoshenko and Gere, *Mechanics of Materials,* Mc Graw Hill International.

[2] Punmia B.C., Arun K. Jain and Ashok K. Jain, *Mechanics of Materials,* 2nd ed. New Delhi: Laxmi Publications.

[3] Subramanian R., *Strength of Materials*, 3rd ed. Oxford University Press.

[4] Ramamrutham S., *Strength of Materials,* 2nd ed. New Delhi: Dhanpat Rai & Sons.

Course Learning Outcomes (COs):

On completion of this course, students will be able to…

CO1: estimate various types of stresses and strains

CO2: construct Mohr's circle, shear force and bending moment diagrams for determinate beams

CO3: determine the bending and shearing stresses for beams subjected to pure bending

CO4: analyze stresses in thin cylinders, circular shafts and springs by theory of pure torsion

Course Articulation Matrix (CAM): U18OE403F STRENGTH OF MATERIALS

CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	**U18CE403F.1**	2	2	1	1	-	-	-	-	-	1	-	2	2	1
CO2	**U18CE403F.2**	2	2	1	-	-	-	-	-	-	1	-	1	2	1
CO3	**U18CE403F.3**	2	2	1	1	-	-	-	-	-	-	-	1	2	1
CO4	**U18CE403F.4**	2	2	1	2	-	-	-	-	-	1	-	1	2	1
U18CE403F		**2**	**2**	**1**	**1.33**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**1.25**	**2**	**1**

U18ME404 DESIGN OF MACHINE ELEMENTS

Class: B. Tech. IV-Semester **Branch:** Mechanical Engineering (ME)

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation	40 marks
End Semester Exam	60 marks

Course Learning Objectives (LOs):

This course will develop students' knowledge in/on…

LO1: design of machine elements using different theories of elastic failures.
LO2: design and analysis of shaft under various loading conditions.
LO3: design and analysis of temporary joints like keys, couplings cotter joints, knuckle joint and bolted joints with different geometrical features under various loading conditions.
LO4: design and analysis of permanent joints like riveted joints and welded joints under various loading conditions.

UNIT – I (9)

Introduction: Engineering Design, Basic Design procedure, Basic requirements of machine elements, Selection of material for engineering applications. Design Criterion

Design for Static Strength: Analysis of Biaxial state of stress at a point, Principal Stresses, Mohr's Circle Representation of stresses, Importance of failure theories in design: Maximum principal stress theory, Maximum shear stress theory, Maximum principal strain theory, Maximum total strain energy theory, Distortion energy theory and applications

UNIT – II (9)

Design for Fatigue Strength: Types of Fatigue loads, phenomenon of Fatigue failure, endurance limit, Stress concentration factor and its importance in design, notch sensitivity, Gerber's parabola, Goodman line, Soderberg equation, and fatigue design under Combined loading

Design of Shafts: Introduction, Materials and design Stresses, Design criterion for shafts, Design of solid and hollow shafts under combined loads

UNIT – III (9)

Design of Keys and Couplings: Types of Keys, Deign of Sunk Keys, and Effect of keyways in sunk keys; functions of Couplings, Rigid and flexible couplings, Design of Flange coupling and Bush - Pin type coupling

Cotter Joints: Design of socket & spigot type cotter joints and Knuckle joint

Bolted joints:-Stresses in screw fastenings, initial stresses, Stresses due to external forces, Stresses due to combined load, Bolts of uniform strength, eccentrically loaded bolted joints

UNIT – IV (9)

Riveted joints: Terminology, different types of riveted joints, failure modes, Design procedure, Boiler Joints – Longitudinal butt joint and circumferential lap joint, structural joints-lozenge joint, eccentrically loaded riveted joints

Welded joints: Conventional representation of welded joints, Butt and fillet welds under static and varying loads, welded joints under eccentric loading

Textbook:

[1] Bhandari, V B., *Design of Machine Elements*, 4th ed. New Delhi: Tata McGraw Hill Book Company, 2016.

Reference Books:

[1] Richard Budynas and Keith Nisbett Shigley's, *Mechanical Engineering Design* 10th ed. Tata McGraw Hill Book Company, 2015.

[2] R.S.Khurmi and J.K.Guptha, *A Text book of Machine Design*, 15th ed. New Delhi: S. Chand & Co., 2005.

[3] Robert L. Norton, *Machine Design, An Integrated Approach*, 5th ed. Pearson publishing, 2014.

[4] N. C. Pandya and C. S. Shah, *Elements of Machine Design*, 20th ed. Anand: Charotar Publishing House, 2015.

Course Learning Outcomes (COs):

On completion of this course, students will be able to…

CO1: design machine elements by using different theories of elastic failures.

CO2: design machine elements under fatigue loading conditions and design Shafts under various loading conditions

CO3: design and analyze temporary joints like keys, couplings cotter joints, knuckle joint and bolted joints with different geometrical features under various loading conditions

CO4: design different permanent joints like riveted joints and welded joints under different loading conditions.

Course Articulation Matrix (CAM): U18 ME404 DESIGN OF MACHINE ELEMENTS

CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	**U18ME404.1**	2	2	2	2	**-**	-	**-**	-	**-**	**-**	-	**-**	2	1
CO2	**U18ME404.2**	2	2	2	2	**-**	-	**-**	-	**-**	**-**	-	**-**	2	1
CO3	**U18ME404.3**	2	2	2	2	**-**	-	**-**	-	**-**	**-**	-	**-**	2	2
CO4	**U18ME404.4**	2	2	2	2	**-**	-	**-**	-	**-**	**-**	-	**-**	2	2
U18 ME404		**2**	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**1.5**

U18ME405 KINEMATICS OF MACHINERY

Class: B. Tech. IV-Semester **Branch:** Mechanical Engineering (ME)

Teaching Scheme:

L	T	P	C
3	1	-	4

Examination Scheme:

Continuous Internal Evaluation:	40 marks
End Semester Examination:	60 marks

Course Learning Objectives (LOs):
This course will develop students' knowledge in/on…

LO1: concept of machines, mechanisms, DOF, inversions of four bar and slider crank mechanisms; construction of the velocity polygon for planar mechanisms
LO2: construction of the acceleration polygon for planar mechanisms
LO3: draw Cam profile for various followers and follower motions
LO4: concept of gears, gear trains

UNIT-I (9+3)

Basic Concepts: Element, Link, kinematic pair, kinematic chain, mechanism, inversion, structure, machine, constrained motion, Grubbler's criterion, four bar chain, Grashoff's criterion, Inversions of four bar, single slider and double slider crank chains, steering gear mechanism

Velocity Analysis: Relative Velocity Method; Instantaneous center Method, Aronhold-Kennedy Theorem of Three centers; Velocity Diagrams

UNIT-II (9+3)

Acceleration Analysis: Radial and Transverse Components of Acceleration, Coriolis Component of Acceleration, Acceleration Diagrams and Klein's construction

UNIT-III (9+3)

Cams: Classification of cams and followers. Displacement, velocity and acceleration diagrams for specified follower motion: uniform velocity, SHM, uniform acceleration and retardation, cycloidal motion. Generation of cam profiles with different types of followers: knife-edge, roller, and flat faced. Reciprocating and oscillating types-radial and offset types. Analysis of motions the follower for cams with specified contours-Roller follower on tangent cam, roller follower on convex sided cam, flat-faced follower on convex sided cam

UNIT-IV (9+3)

Toothed Gearing: Law of gearing, velocity of sliding, involute profile, path of contact, arc of contact, interference, methods to avoid interference, minimum number of teeth on pinion to avoid interference, involute and cycloidal tooth profiles, comparison

Gear Trains: Simple, compound, reverted, epicyclic gear trains, Analysis of epicyclic gear train, torques in epicyclic gear trains, sun and planet gear, compound epicyclic gear trains, Bevel-epicyclic gear train, Wilson four speed gear box and differential gear box of an automobile

Textbook:

[1] S.S Rattan, *Theory of Machines,* 4th ed. New Delhi: McGraw-Hill, 2014.

Reference Books:

[1] R.L.Norton, *Design of Machinery-An Introduction to the Synthesis and Analysis of Mechanisms and Machines,* 4th ed. New York: McGraw-Hill, 2008.

[2] Ambekar, *Theory of Mechanisms and Machines,* New Delhi: Prentice Hall of India, 2007.

[3] J.S.Rao and R.V. Dukkipati, *Theory of Mechanisms and Machine Theory,* 2nd ed. New Delhi: New Age International, 2006.

[4] R.S.Kurmi and J.K.Guptha, *Theory of Machines*, 14th ed. New Delhi: S. Chand & Co., 2014

[5] Thomas Bevan, *The Theory of Machines,* 3rd ed. New Delhi: CBS Publishers, 2005

Course Learning Outcomes (COs):

On completion of this course, students will be able to…

CO1: identify degree of freedom of planar mechanisms; draw velocity polygons of planar mechanisms

CO2: draw and analyze acceleration polygons of planar mechanisms

CO3: draw the cam profiles for various follower motions and evaluate velocity, acceleration of the follower.

CO4: identify tooth profiles, interference of gear; simple, planetary gear trains and differential gear box of an automobile and determine speed ratios of gear trains.

Course Articulation Matrix (CAM): U18ME405 KINEMATICS OF MACHINERY

CO Code		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	**U18ME405.1**	2	2	2	1	-	-	-	-	-	-	-	-	2	2
CO2	**U18ME405.2**	2	2	2	2	-	-	-	-	-	-	-	-	2	2
CO3	**U18ME405.3**	2	2	1	1	-	-	-	-	-	-	-	-	2	2
CO4	**U18ME405.4**	2	2	2	2	-	-	-	-	-	-	-	-	2	2
U18ME405		2	2	1.75	1.5	-	-	-	-	-	-	-	-	2	2

U18ME406 **MANUFACTURING PROCESSES**

Class: B. Tech. IV-Semester **Branch:** Mechanical Engineering (ME)

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation	40 marks
End Semester Exam	60 marks

Course Learning Objectives (LOs):
This course will develop students' knowledge in/on…
LO1: fundamentals of metal casting processes
LO2: principles and operation of metal forming processes
LO3: principles and operation of sheet metal operations
LO4: methods of welding techniques.

UNIT – I (9)

Metal Casting: Introduction, Pattern-materials, types and allowances; Molding materials-sand composition, types and properties; Sand testing- Grain Fineness Number, Moisture content, Clay content and Permeability; Gating System- elements of a gating system, Design of gating system and Riser. Casting Processes-Sand casting, Centrifugal casting, Die casting and Investment casting, casting defects

UNIT – II (9)

Metal Forming Processes: Classification; Cold working and hot working; Rolling - principle and operation, Calculation of Rolling load & Roll pass design; Forging-principle and operations; Types-Drop and Upset Forging; Extrusion-principle and operation; Types-Wire drawing, Rod drawing and Tube drawing

UNIT – III (9)

Sheet Metal Operations: Shearing principle; Shearing operations-Blanking, Punching, Drawing, Bending, Stretch forming, Metal spinning, Embossing and Coining
Press Tools: Types-Simple die, Compound die and Progressive die; Design of Punch and Die. Strip layout

UNIT – IV (9)

Metal Fabrication Processes: Classification; Gas welding-principle of oxy-acetylene welding, types of flames; Electric Arc welding- Principle, Equipment; Types-AC and DC welding; TIG and MIG welding processes; Resistance welding- principle, Types- Butt welding, Spot welding and Seam welding; Solid state welding-principle, Types-Friction welding, Explosive welding; Brazing and Soldering; Electron Beam welding and laser beam welding, welding defects

Textbook:

[1] P. N. Rao, *Manufacturing Technology,* 5th ed. Volume-I, New Delhi: Tata McGraw-Hill, 2018.

Reference Books:

[1] Amitabha Ghosh and Asok Kumar Mallik, *Manufacturing Science*, 2nd ed. East-West Press Pvt. Ltd., 2010.
[2] Serope Kalpakjain and Steuen. R. Sechmid, Manufacturing *Technology*, SI ed. Pearson Education Asia, 2018.
[3] P.C. Sharma, *A Text Book of Manufacturing Technology–I*, S Chand & Co Ltd., 2011.
[4] R.K. Jain, *Production Technology*, New Delhi: Khanna publishers, 2018.

Course Learning Outcomes (COs):

On completion of this course, students will be able to…

CO1: explain various metal casting processes and design of gating/riser system for sound casting.

CO2: compare and contrast various metal forming processes and calculation of load in rolling, forging and extrusion.

CO3: recommend suitable sheet metal operation for a given application and design of press tools.

CO4: Classify and illustrate various welding techniques.

Course Articulation Matrix (CAM): U18ME406 MANUFACTURING PROCESSES														
CO		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	**U18ME406.1**	2	2	1	1	-	-	-	-	-	-	-	-	1	1
CO2	**U18ME406.2**	2	2	1	1	-	-	-	-	-	-	-	-	1	1
CO3	**U18ME406.3**	2	2	1	1	-	-	-	-	-	-	-	-	1	1
CO4	**U18ME406.4**	2	2	1	-	-	-	-	-	-	-	-	-	1	1
U18ME406		2	2	1	1	-	-	-	-	-	-	-	-	1	1

U18ME407 APPLIED THERMODYNAMICS

Class: B. Tech. IV-Semester

Branch: Mechanical Engineering (ME)

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation	40 marks
End Semester Examination	60 marks

Course Learning Objectives(LOs):

This course will develop students' knowledge in/on…

LO1: properties of steam and methods of improving the Rankine cycle efficiency
LO2: working of low and high pressure boilers, performance of boiler
LO3: steam nozzle design and applications of condensers in thermal power plants
LO4: steam turbines working principles and their performance

UNIT –I (9)

Properties of Steam: Steam properties, use of (Steam) property tables, Mollier diagram, various processes

Vapor Power Cycles: Components of Steam power cycle, Rankine Cycle, Modified Rankine Cycle, P-V, h-s and T-s diagrams, Rankine cycle with superheat, reheat and regeneration, Binary vapor cycle

UNIT –II (9)

Steam Generators: Introduction, Classification of boilers, Low pressure boilers–working principles of Lancashire, Babcock and Wilcox, Stirling boilers; High pressure boilers–Lamont and Benson boilers; Criteria for selection of a boiler, functions of Boiler Mountings and Accessories

Performance of Boilers: Equivalent evaporation, Boiler efficiency, boiler trial and heat balance

UNIT-III (9)

Steam Nozzles: Classification, flow through nozzles, velocity of steam, equation of continuity, condition for maximum discharge, expansion of steam considering friction, super saturated flow through nozzles–Wilson's line, degree of under cooling and degree of super saturation, area-velocity and pressure relationship

Steam Condensers: Elements of a condensing plant, types of condensers, working and comparison of jet and surface condensers, Condenser vacuum, sources of air leakage and its disadvantages, vacuum efficiency and condenser efficiency

UNIT –IV (9)

Steam Turbines: Classification, Compounding of Impulse and reaction turbine

Impulse turbine -Velocity diagrams, power output, axial thrust, maximum blade efficiency of a single stage and two stage impulse turbine

Reaction turbine -Velocity diagrams, degree of reaction, power output, maximum blade efficiency, Comparison of impulse and impulse-reaction turbines, losses in steam turbines

Textbook:

[1] Mahesh M. Rathore, *Thermal Engineering*, New Delhi: Tata Mc Graw-Hill publications, 2010.

Reference Books:

[1] M. L .Mathur and F.S. Mehta, *Thermal Engineering*, 3rd ed. New Delhi: Jain Brothers, 2009.

[2] P.K. Nag., *Basic and Applied Thermodynamics,* 2nd ed. Tata McGraw Hill, 2018.

[3] R. S. Khurmi and J.P. Guptha, *A Text Book of Thermal Engineering*, 15th ed. S. Chand Publishing, 2006.

[4] V. P. Vasandani and D. S. Kumar, *Heat Engineering,* 4th ed. Metropolitan Book Co Pvt. Ltd., 2008.

Course Learning Outcomes (COs):

On completion of this course, students will be able to…

CO1: *compute the properties of steam and efficiency of Rankine cycle with reheat and regeneration*

CO2: *categorize the boilers, and evaluate their performance using heat balance sheet*

CO3: *explain the need for nozzle and condensers in power plants*

CO4: *analyze the operation of steam turbines and compare their performance characteristics*

Course Articulation Matrix (CAM): U18ME407 APPLIED THERMODYNAMICS

CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	**U18ME407.1**	2	2	2	2	-	-	-	-	-	-	-	-	2	1
CO2	**U18ME407.2**	2	2	2	2	-	-	-	-	-	-	-	-	2	1
CO3	**U18ME407.3**	2	2	2	2	-	-	-	-	-	-	-	-	2	1
CO4	**U18ME407.4**	2	2	2	2	-	-	-	-	-	-	-	-	2	1
U18ME407		2	2	2	2	-	-	-	-	-	-	-	-	2	1

U18ME408 **MANUFACTURING PROCESSES LAB**

Class: B. Tech. IV-Semester **Branch:** Mechanical Engineering

Teaching Scheme :

L	T	P	C
-	-	2	1

Examination Scheme :

Continuous Internal Evaluation	40 marks
End Semester Exam	60 marks

Course Learning Objectives(LOs):
This laboratory course will develop students' knowledge in/on…

LO1: sand properties, testing and pouring
LO2: preparation of various welding joints
LO3: deep drawing and rolling operations
LO4: blanking and piercing operations

LIST OF EXPERIMENTS

1. Prepare sand specimen and conduct tests for determination of compression, shear and tensile strengths as per standards.
2. Prepare sand specimen and conduct tests for determination of Grain Fineness Number and Shatter Index as per standards.
3. Prepare sand specimen and conduct tests for determination of moisture content and clay content as per standards
4. Design a wooden pattern of rectangular block and produce aluminum casting.
5. Effect of heat input on weld bead geometry.
6. Prepare a Pipe joint using Oxy-Acetylene welding and Gas cutting.
7. Prepare a lap joint using Resistance Spot Welding.
8. Prepare a lap joint using TIG welding
9. Conduct bend test on a single V butt joint prepared by DC Arc welding
10. Rolling of aluminum sheet metal.
11. Prepare a mild steel washer using piercing and blanking operations.
12. Perform Deep drawing using mechanical press.

Laboratory Manual:

[1] Manufacturing Processes Laboratory Manual, Dept. of ME, KITSW.

Reference Books:

[1] P. N. Rao, Manufacturing Technology, 5th ed. Volume-I, New Delhi: Tata McGraw-Hill, 2018.

[2] Amitabha Ghosh and Asok Kumar Mallik, *Manufacturing Science*, 2nd ed. East-West Press Pvt. Ltd., 2010.

[3] Serope Kalpakjain and Steuen. R. Sechmid, Manufacturing *Technology*, SI ed. Pearson Education Asia, 2018.

[4] P.C. Sharma, *A Text Book of Manufacturing Technology–I*, S Chand & Co Ltd., 2011.

[5] R.K. Jain, *Production Technology*, New Delhi: Khanna publishers, 2018.

Course Learning Outcomes (COs):

On completion of this course, students will be able to…

CO1: prepare sand specimen and conduct standard tests as per Indian standards to calculate pre-requisite properties and demonstrate the sand casting for aluminium
CO2: demonstrate the welded joints using Arc welding, Oxy-Acetylene welding and resistance welding
CO3: Perform rolling and deep drawing operations on aluminium sheets
CO4: design and produce a washer on simple die

Course Articulation Matrix (CAM): U18ME408 MANUFACTURING PROCESSES LAB

CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	**U18ME408.1**	2	1	-	-	1	-	-	-	-	1	-	-	1	1
CO2	**U18ME408.2**	2	1	1	-	1	-	-	-	-	1	-	-	1	1
CO3	**U18ME408.3**	2	1	-	-	1	-	-	-	-	1	-	-	1	1
CO4	**U18ME408.4**	2	1	1	-	1	-	-	-	-	1	-	-	1	1
U18ME408		2	1	1	-	1	-	-	-	-	1	-	-	1	1

U18OE411A OBJECT ORIENTED PROGRAMMING LABORATORY

Class: B. Tech. IV-Semester **Branch:** Common to all branches

Teaching Scheme:

L	T	P	C
-	-	2	1

Examination Scheme:

Continuous Internal Evaluation	40 marks
End Semester Examination	60 marks

Course Learning Objectives(LOs):

This course will develop students' knowledge in/on…

LO1: implementing concepts of object oriented programming
LO2: debug and test java applications effectively
LO3: effective use of exception handling, interfaces and packages during applications development
LO4: I/O and applet programming in java

List of Experiments

Experiment-I

1. Write a program to demonstrate operators of java.
2. Write a program to demonstrate type casting and operator precedence.
3. Write a program to demonstrate different types of if-statements.
4. Write a program to demonstrate switch-case.

Experiment-II

1. Write a program to demonstrating loop control statements.
2. Write a program to demonstrate for-each control loop.
3. Implement programs using single dimensional arrays.
4. Write a program to define a two dimensional array where each row contains different number of columns.

Experiment -III

1. Write a program to demonstrate creating object to a class for accessing variables and methods.
2. Write a program to demonstrate creating multiple objects.
3. Write a program to demonstrate passing objects to methods.
4. Write a program to demonstrate constructors and garbage collector by invoking it explicitly.

Experiment -IV

1. Write a program to demonstrate static members.
2. Write a program to demonstrate command line argument.
3. Write a program to demonstrate variable length argument.
4. Write a program to demonstrate wrapper classes.

Experiment -V

1. Write a program to demonstrate inheritance using extends keyword.
2. Write a program to demonstrate multilevel inheritance.
3. Write a program to demonstrate hierarchical inheritance.
4. Write a program to demonstrate access controls.

Experiment -VI

1. Write program to demonstrate *this* and *supper* keywords.
2. Write program to demonstrate dynamic method dispatch.
3. Write a program to demonstrate final variable and methods.
4. Write a program to demonstrate use of abstract class.

Experiment -VII

1. Write a program to define an Interface and implement it into a class.
2. Write a program to implement multiple interfaces into single class.
3. Write a program to extend interfaces.
4. Write a program to implement nested interfaces.

Experiment -VIII

1. Write a program to create a package, and demonstrate to import a package to a class.
2. Write a program to demonstrate access protection of packages.
3. Write a program to demonstrate static import of package.

Experiment-IX

1. Write a program to demonstrate *try* and *catch* statement for exception handling
2. Handle *ArrayIndexOfBoundsException*, *NumberFormatException* and *DivideByZeroException* using multiple catch blocks.
3. Write a program to demonstrate user defined exception with *throw keyword*
4. Write a program to demonstrate *finally* block.

Experiment-X

1. Write a program to demonstrate string handling functions.
2. Write a program to demonstrate string searching functions.
3. Write a program to demonstrate string comparison functions.
4. Write a program to demonstrate string modification functions.

Experiment-XI

1. Write a program to demonstrate reading and writing input using byte stream classes
2. Write a program to demonstrate reading and writing input using character stream classes
3. Write a program to demonstrate data input and output streams
4. Write a program to demonstrate array input and output streams

Experiment-XII

1. Write a program to create a file using byte stream classes
2. Write a program to create a file using character stream classes
3. Write a program to open the specific file
4. Write a program to copy the content of one file to another.

Laboratory Manual:

[1] Java Programming Laboratory Manual, Dept. of CSE, KITSW.

Reference Books:

1. Herbert Schildt, *JAVA The Complete Reference*, 9th ed. McGraw-Hill Education India Pvt. Ltd., ISBN: 9781259002465, 2014.

Course Learning Outcomes (COs):
On completion of this course, students will be able to…

CO1: implement OOP concepts using Java
CO2: use the concepts like inheritance, polymorphism, packages and interfaces in application development
CO3: handle runtime exceptions in object oriented programming
CO4: build effective I/O interfaces for software applications

Course Articulation Matrix (CAM): U18OE411A OBJECT ORIENTED PROGRAMMING LABORATORY														
CO		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	**U18OE411A.1**	2	2	2	1	2	1	-	1	2	1	2	1	-	1
CO2	**U18OE411A.2**	2	2	2	1	2	1	1	-	2	1	2	1	-	1
CO3	**U18OE411A.3**	2	2	2	1	2	1	-	-	2	1	2	1	-	1
CO4	**U18OE411A.4**	2	2	2	1	2	1	1	1	2	1	2	1	-	1
U18OE411		**2**	**2**	**2**	**1**	**2**	**1**	**1**	**1**	**2**	**1**	**2**	**1**	**-**	**1**

U18OE411B FLUID MECHANICS AND HYDRAULIC MACHINES LABORATORY

Class: B. Tech. IV -Semester

Branch: Common to all branches

Teaching Scheme :

L	T	P	C
-	-	2	1

Examination Scheme :

Continuous Internal Evaluation	40 marks
End Semester Examination	60 marks

Course Learning Objectives (LOs):

This course will develop students' knowledge in /on…

LO1: determining the hydraulic coefficient for various flow measuring devices
LO2: implementing Bernoulli's equation and application of Bernoulli's theorem in estimating various losses in pipe
LO3: studying the various parameters which effects the impact of jet
LO4: studying the characteristics of hydraulic machines

LIST OF EXPERIMENTS

1. Determination of Coefficient of Discharge for given Orifice meter and Venturi meter.
1. Determination of Coefficient of Discharge for given notches (triangular/rectangular)
2. Determination of Coefficient of Discharge for given orifice and mouth piece.
3. Verification of Bernoulli's theorem.
4. Estimation of coefficients of various head losses in pipes due to major and minor losses (sudden enlargement, sudden contraction and bend).
5. Determineof Reynolds's number usingReynolds's apparatus.
6. Determination of coefficient of impact for a jet on given vane.
7. Determination of performance characteristics of Francis Turbine
8. Determination of performance characteristics of Pelton Wheel.
9. Determination of performance characteristics of Centrifugal Pump.
10. Determination of performance characteristics of Submersible Pump.
11. Determination of performance characteristics of Reciprocating Pump.

Laboratory Manual:

[1] Fluid Mechanics Laboratory Manual, Dept. of CE, KITSW.

Reference Books:

[1] N. Kumara Swamy, *Fluid Mechanics and Machinery Laboratory Manual,*Charotar Publishing House Pvt., Ltd., 2008.
[2] Sarbjit Singh, *Experiments in Fluid Mechanics*, New Delhi: PHI Learning Private Limited, 2009.

Course Learning Outcomes (COs):
On completion of this course, students will be able to…

CO1: determine the hydraulic coefficient for various flow measuring devices
CO2: apply Bernoulli's equation in estimating head lossin pipes
CO3: apply the principles of impact of jet on different vanes
CO4: demonstrate the characteristics of hydraulic machines.

Course Articulation Matrix (CAM): U18OE311B Fluid Mechanics And Hydraulic Machines Laboratory														
CO		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO	**U18OE311B.1**	2	1	-	1	-	-	-	-	1	-	-	1	1	1
CO	**U18OE411B.2**	2	1	-	1	-	-	-	-	1	-	-	1	1	1
CO	**U18OE411B.3**	2	1	-	1	-	-	-	-	1	-	-	1	1	1
CO	**U18OE411B.4**	2	1	-	1	-	-	-	-	1	1	-	1	1	1
U18OE311B		**2**	**1**	**-**	**1**	**-**	**-**	**-**	**-**	**1**	**1**	**-**	**1**	**1**	**1**

U18OE411D WEB P0ROGRAMMING LABORATORY

Class: B. Tech. IV Semester **Branch:** Common to all branches

Teaching Scheme :

L	T	P	C
-	-	3	2

Examination Scheme :

Continuous Internal Evaluation :	40 marks
End Semester Exam :	60 marks

Course Learning Objectives(LOs):
This course will develop students' knowledge in /on…

LO1: implementing HTML Tags, CSS and Java Scripts for creating static web pages.
LO2: usage of JSP in designing dynamic web pages.
LO3: usage of PHP in designing a web base application.
LO4: accessing different web data servers using JSP and PHP

Experiment-1

1. Design the following static web pages with the following attributes:
   a. Basic Tags.
   b. Heading Tags.
   c. List (Ordered and Un-Ordered).
   d. Textbox, Buttons.

Experiment-2

2. HTML

AIM: Design the following static web pages required for an online book store web site.

a. **HOME PAGE:**
b. **LOGIN PAGE**
c. **CATALOGE PAGE**

DESCRIPTION:

a. HOME PAGE

The static home page must contain three **frames**.

- ***Top frame*:** Logo and the college name and links to Home page, Login page, Registration page, Catalogue page and Cart page (the description of these pages will be given below).
- ***Left frame*:** At least four links for navigation, which will display the catalogue of respective links. For e.g.: When you click the link **"CSE"** the catalogue for **CSE** Books should be displayed in the Right frame.
- ***Right frame*:** The *pages to the links in the left frame must be loaded here*. Initially this page contains description of the web site.

Logo	Web Site Name			
Home	Login	Registration	Catalogue	Cart
CSE ECE EEE CIVIL	Description of the Web Site			

b. LOGIN PAGE: This page looks like below:

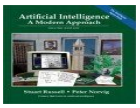
Logo	Web Site Name			
Home	Login	Registration	Catalogue	Cart
CSE ECE EEE CIVIL	Login : Password: Submi Reset			

Experiment-3

c. CATOLOGUE PAGE:

The catalogue page should contain the details of all the books available in the web site in a table. The details should contain the following:

- Snap shot of Cover Page.
- Author Name and Publisher.
- Price and Add to cart button.

Logo	Web Site Name			
Home	Login	Registration	Catalogue	Cart
CSE		Book : XML Bible Author : Winston Publication : Wiely	$ 40.5	Add to cart
ECE		Book : AI Author : S.Russel Publication : Princeton hall	$ 63	Add to cart
EEE		Book : Java 2 Author : Watson Publication : BPB publications	$ 35.5	Add to cart
CIVIL		Book : HTML in 24 hours Author : Sam Peter Publication : Sam publication	$ 50	Add to cart

Experiment-4

3. VALIDATION

AIM: To do validation for registration page using JavaScript.

DESCRIPTION: Write *JavaScript* to validate the following fields of the above registration page.

a. Name (Name should contains alphabets and the length should not be less than 6 characters).
b. Password (Password should not be less than 6 characters length).
c. E-mail id (should not contain any invalid and must follow the standard pattern ***(name@domain.com)***
d. Phone number (Phone number should contain 10 digits only).

Note: You can also validate the login page with these parameters.

4. CSS

AIM: Write a program illustrating various methods in cascading style sheets.

a. Use different font, styles and set a background image
b. Control the repetition of the image
c. Define styles for links
d. Work with layers and add a customized cursor

DESCRIPTION: Design a web page using **CSS (C**ascading **S**tyle **S**heets**)** which includes the following:

a. Use different font, styles: In the style definition you define how each selector should work (font, color etc.).Then, in the body of your pages, you refer to these selectors to activate the styles.
b. Set a background image for both the page and single elements on the page. You can define the background image for the page like this:
c. Control the repetition of the image with the background-repeat property. As background-repeat: repeat
d. Define styles for links
e. Work with layers:
f. Add a customized cursor:

Selector {cursor:value}
.xlink {cursor:crosshair}
.hlink{cursor:help}

5. Embedding JavaScript in HTML pages.
6. Design a registration form and validate its field by using JavaScript.

Experiment-5

7. To design the scientific calculator and make event for each button using JavaScript.
8. WAP to create popup boxes in JavaScript.
9. Program to create a class calculator that contains an overloaded method called "add" to calculate the sum of two integers, two float numbers and, one integer and one float.

Experiment-6

10. Print current date & time
11. JSP Program to auto refresh a page
12. JSP Program to count no. of visitors on website
13. JSP program for error handling
14. Demonstrate expression tag
15. Detect locale, language settings & local specific time
16. Demonstrate JSP implicit object
17. JSP Program to display given number in words

Experiment-7

18. Display the contents of Employee table in a neat format.
19. Insert ***N***, no. of records into Employee table using ***Prepared Statement.***
20. Enhance the salaries of Employee by 10% who are earning salary greater than 5000 using ***Callable Statement.***
21. Delete all students whose marks are below 50% and also display the count.

Experiment-8

22. Write a HTML file to create a simple form with 5 input fields ***(Name, Password, Email, Pin code, Phone No. and a Submit button)*** and demonstrate required field validations to validate that all input fields are required and display error messages if the above validations do not hold.

23. Create a JSP Page with and run in JSP Engines.
24. Demonstrate Session Tracking in JSP.
25. JSP Program to validate username and password

Experiment-9

26. Create Database Connectivity with JSP page with different JDBC Drivers.
27. JSP Program to Select record from database
28. JSP Program to Insert a record into the database
29. Create a CRUD operation for JSP Page using MySQL
30. JSP Program to upload file into server

Experiment-10

31. Create a form for your college library entering student details for each student in the college. Validate the form using PHP valuators and display error messages.
32. Write a PHP which does the following job:
Insert the details of the 3 or 4 users who register with the web site by using registration form. Authenticate the user when he submits the login form using the UserName and Password from the database (instead of cookies).

Experiment-11

33. Create tables in the database which contain the details of items (books in our case like Book name, Price, Quantity, Amount) of each category. Modify your catalogue page in such a way that you should connect to the database and extract data from the tables and display them in the catalogue page using PHP.
34. Create and delete MYSQL database using PHP.

Experiment-12

35. Create a PHP program to demonstrate opening and closing a file.
36. Create a PHP program to demonstrate reading a file and writing in a file.

Laboratory Manual:

[1] Web Programming Laboratory Manual, Dept. of IT, KITSW.

Course Learning Outcomes (COs):
On completion of this course, students will be able to…

CO1: create the static web pages using HTML Tags and CSS and JavaScripts
CO2: design dynamic web page for web applications using JSP
CO3: develop server side scripts for web base applications using PHP
CO4: design web applications for effective storage and retrieval of data in MySQL using PHP.

Course Articulation Matrix (CAM): U18OE411D WEB P0ROGRAMMING LABORATORY															
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12	PSO1	PSO2
CO1	U18OE411D.1	2	2	2	1	2	1	-	1	2	1	2	1	-	1
CO2	U18OE411D.2	2	2	2	1	2	1	-	1	2	1	2	1	-	1
CO3	U18OE411D.3	2	2	2	1	2	1	-	1	2	1	2	1	-	1
CO4	U18OE411D.4	2	2	2	1	2	1	1	1	2	1	2	1	-	1
U18OE411		2	2	2	1	2	1	1	1	2	1	2	1	-	1

U18OE411E MICROPROCESSORS LABORATORY

Class: B. Tech. IV-Semester **Branch:** Common to all branches

Teaching Scheme :

L	T	P	C
-	-	3	2

Examination Scheme :

Continuous Internal Evaluation :	40 marks
End Semester Exam :	60 marks

Course Learning Objectives (LOs):

This Course will develop student's knowledge on/in…

LO1: programming using 8086 Microprocessor kit
LO2: basic arithmetic programs and sorting using 8086 Microprocessor kit
LO3: string manipulation and code conversions using MASM
LO4: interfacing of subsystems to 8086 microprocessor kit

List of Experiments

(Based on theory course U18OE303E)

1. Study of 8086 Trainer Board
2. Simple Arithmetic Operations (Addition, Subtraction, Multiplication and Division)
3. Finding Sum, Average.
4. Largest/Smallest Number in a given array
5. Arranging in Ascending/ Descending order
6. Finding Factorial using recursive procedure
7. Transfer of bytes from DS to ES
8. ALPs for String Manipulation
9. ALPs for Code conversions
10. Wave form Generation using DAC modules
    i. Square wave ii. Saw tooth wave iii. Triangular wave
11. ADC interfacing
12. Stepper motor –interfacing

Laboratory Manual:

[1] Microprocessors Laboratory Manual, Dept. of ECE, KITSW.

Course Learning Outcomes (COs):

On completion of this course, students will be able to…

CO1: write and execute assembly language programs for given tasks on 8086 microprocessor kit
CO2: implement code conversions and bit manipulations programs in 8086 using MASM
CO3: write waveform generation code using DAC modules
CO4: interface stepper motor, keyboard, memory etc. with 8086 microprocessor

Course Articulation Matrix (CAM): U18OE411E MICROPROCESSORS LAB															
CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	U18OE411E.1	3	3	2	1	-	-	-	-	-	-	-	-	-	1
CO2	U18OE411E.2	3	2	2	1	-	-	-	-	-	-	-	-	-	1
CO3	U18OE411E.3	3	2	1	1	-	-	-	-	-	-	-	-	-	1
CO4	U18OE411E.4	3	3	2	1	-	-	-	-	-	-	-	-	-	1
U18OE411E		**3**	**2.5**	**1.75**	**1**	-	-	-	-	-	-	-	-	-	**1**

U18OE411F STRENGTH OF MATERIALS LABORATORY

Class: B. Tech. IV -Semester **Branch:** Common to all branches

Teaching Scheme:

L	T	P	C
-	-	2	1

Examination Scheme:

Continuous Internal Evaluation	40 marks
End Semester Examination	60 marks

Course Learning Objectives (LOs):

This course will develop students' knowledge in /on…

LO1: testing of civil engineering materials
LO2: mechanical properties of civil engineering materials
LO3: behavior of civil engineering materials when tested
LO4: codal specifications of various engineering materials

LIST OF EXPERIMENTS

1. Determination of Stress–Strain characteristics of (a) Mild steel and (b) TOR steel.
2. Determination of the compressive strength of wood and punching shear strength.
3. Determination of the Brinell's hardness numbers for steel, brass and aluminum.
4. Determination of the modulus of rigidity by conducting torsion test on solid shaft or hollow shaft.
5. Determination of the modulus of rigidity by conducting compression test on spring.
6. Determination of the Young's modulus of the given material by conducting flexural test on simply supported beam.
7. Determination of the Young's modulus of the given material by conducting flexural test on continuous beam.
8. Determination of the Young's modulus of the given material by measuring conducting flexural test on propped cantilever beam.
9. Bend and rebend test on steel specimen.
10. Shear test for Mild steel specimen.
11. Impact test on Metal Specimens using Izod test.
12. Impact test on Metal Specimens using Charpy test.
13. Demonstration of measuring strains using strain gauges, LVDTs

Laboratory Manual:

[1] Strength of Materials Laboratory Manual, Dept. of CE, KITSW.

Reference Books:

[1] Harmer E. Davis and George Earl Troxell, *Testing and Inspection of Engineering Materials,* 2nd ed. McGraw-Hill book company, inc, 1955.
[2] A.V.K. Suryanarayana, *Testing of Metallic Materials,* 2nd ed. Prentice-Hall of India, 2007.
[3] IS 1786:2008, *High strength deformed steel bars and wires for concrete reinforcement-specification,* New Delhi: Bureau of Indian standards, 2008.
[4] IS 432(Part-II):1982, *Specification for mild steel and medium tensile steel bars and Hard drawn steel wires for concrete reinforcement,* New Delhi: Bureau of Indian standards, 2004.
[5] IS 432(Part-I):1982, *Specification for mild steel and medium tensile steel bars and Hard drawn steel wires for concrete reinforcement,* New Delhi: Bureau of Indian standards, 1992 .

Course Learning Outcomes (COs):
On completion of this course, students will be able to…

CO1: correlate theory with the testing of engineering materials for quality assessment.
CO2: evaluate the mechanical properties of civil engineering materials.
CO3: appraise the behavior of civil engineering materials when tested under loads.
CO4: realize the specifications recommended by codes to civil engineering materials.

Course Articulation Matrix (CAM): U18OE311F STRENGTH OF MATERIALS LABORATORY														
CO		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	**U18OE411F.1**	1	-	-	1	-	1	-	-	2	1	1	1	1	1
CO2	**U18OE411F.2**	1	-	-	1	-	1	-	-	2	-	-	1	1	1
CO3	**U18OE411F.3**	1	-	-	1	-	1	-	-	2	-	-	1	1	1
CO4	**U18OE411F.4**	1	-	-	1	-	1	-	2	1	1	1	1	1	1
U18OE411F		**1**	**-**	**-**	**1**	**-**	**1**	**-**	**2**	**1.75**	**1**	**1**	**1**	**1**	**1**

U18CH416 ENVIRONMENTAL STUDIES

Class: B. Tech. IV -Semester **Branch:** Common to all branches

Teaching Scheme:

L	T	P	C
2	-	-	2

Examination Scheme:

Continuous Internal Evaluation :	40 marks
End Semester Exam :	60 marks

Course Learning objectives (LOs):
This course will develop students' knowledge in/on…

LO1: *necessity to use natural resources more equitably*
LO2 : *concepts of ecosystem and the importance of biodiversity conservation*
LO3 : *causes, effects and control measures of various environmental issues*
LO4 : *issues involved in enforcement of environmental legislation*

UNIT-I (6)

Introduction - The multidisciplinary nature of environmental studies - definition, scope and importance

Natural Resources: Forest Resources - Use and over–exploitation of forests, deforestation, timber extraction, mining, dams - their effects on forests and tribal people; **Water Resources -** Use and over-utilization of surface and ground water, floods, drought, conflicts over water; **Mineral Resources -** Environmental effects of extracting and using mineral resources; **Agricultural Land -** Land as a resource, land degradation, soil erosion and desertification; **Food Resources** - World food problems, effects of modern agriculture, fertilizer-pesticide problems, water logging and salinity; **Energy Resources -** Renewable and non-renewable energy sources, use of alternate energy sources

UNIT-II (6)

Ecosystem and Biodiversity: Ecosystem - Concepts of an ecosystem, food chain, food webs, ecological pyramids, energy flow in the ecosystem and ecological succession;

Biodiversity and its Conservation – Introduction, definition, genetic, species and ecosystem diversity, value of biodiversity, biodiversity in India, hot spots of biodiversity, man-wildlife conflicts, endangered and endemic species of India, in-situ and ex-situ conservation

UNIT-III (6)

Environmental Pollution: Global climatic change, green house gases, effects of global warming, ozone layer depletion; International conventions/protocols - Earth summit, Kyoto protocol and Montreal protocol; causes and effects of air, water, soil, marine and noise pollution with case studies; solid and hazardous waste management, effects of urban industrial and nuclear waste; natural disaster management - flood, earthquake, cyclone and landslides

UNIT-IV (6)

Social Issues and the Environment: **Role of Individual and Society** - Role of individual in prevention of pollution, water conservation, Rain water harvesting and watershed management; **Environmental Protection / Control Acts** - Air (Prevention and control of Pollution) Act- 1981, water (Prevention and Control of Pollution) Act-1974, water Pollution Cess Act-1977, Forest conservation Act (1980 and 1992), wildlife Protection Act 1972 and environment protection Act 1986, issues involved in enforcement of environmental legislations; **Human Population and Environment** - Population growth, family welfare programmes, women and child welfare programmes, role of information technology in environment and human health

Textbook:

[1] Erach Bharucha, *Text Book of Environmental Studies for Under Graduate Courses*, 2nd ed. Universities Press (India) Private Limited, 2013.

Reference Books:

[1] Y. Anjaneyulu, *Introduction to Environmental Science*, B.S. Publications, 2004.
[2] Gilbert M. Masters, *Introduction to Environmental Engineering & Science*, 3rd ed. Prentice Hall of India, 1991.
[3] Anubha Kaushik and C.P. Kaushik, *Environmental Studies*, 4th ed. New Age International Publishers, 2014.
[4] R. Rajagopalan, *Environmental Studies from crisis to cure*, 2nd ed. Oxford University Press, 2011.

Course Learning Outcomes (COs):

On completion of this course, students will be able to…

CO1: investigate any environmental issue using an interdisciplinary framework
CO2: formulate an action plan for sustainable alternatives and conserving biodiversity that integrates science, humanist, social and economic perspective
CO3: identify and explain the complexity of issues and processes which contribute to an environmental problem
CO4: participate effectively in analysis and problem-solving through knowledge in environmental legislations

Course Articulation Matrix (CAM): U18CH416 ENVIRONMENTAL STUDIES														
CO		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	**U18CH416.1**	2	1	2	1	-	2	1	-	1	-	-	-	1	-
CO2	**U18CH416.2**	-	-	2	-	-	1	2	-	1	-	-	-	1	-
CO3	**U18CH416.3**	1	2	1	-	-	1	2	1	1	-	-	-	1	-
CO4	**U18CH416.4**	-	-	1	-	-	1	2	-	1	-	-	-	1	-
U18CH416		**1.5**	**1.5**	**1.5**	**1**	**-**	**1.25**	**1.75**	**1**	**1**	**-**	**-**	**-**	**1**	**-**

DEPARTMENT OF MECHANICAL ENGINEERING
KAKATIYA INSTITUTE OF TECHNOLOGY & SCIENCE, WARANGAL – 15
(An Autonomous Institute under Kakatiya University, Warangal)

SCHEME OF INSTRUCTION AND EVALUATION
V-SEMESTER OF 4-YEAR B.TECH DEGREE PROGRAMME

[6Th+3P+1Seminar]

Sl. No	Category	Course Code	Course Title	Hours per week			Credits	Evaluation Scheme				
								CIE			ESE	Total Marks
				L	T	P	C	TA	MSE	Total		
1	HSMC	U18TP501	Quantitative Aptitude & Logical Reasoning	2	-	-	1	10	30	40	60	100
2	PE	U18ME502	Professional Elective - I / MOOC-I	3	-	-	3	10	30	40	60	100
3	PCC	U18ME503	Dynamics of Machinery	3	-	-	3	10	30	40	60	100
4	PCC	U18ME504	Machine Tools and Metrology	3	-	-	3	10	30	40	60	100
5	PCC	U18ME505	Production and Operations Management	3	-	-	3	10	30	40	60	100
6	ESC	U18IT511	Object Oriented Programming through JAVA	3	-	-	3	10	30	40	60	100
7	PCC	U18ME506	Dynamics of Machinery Lab	-	-	2	1	40	-	40	60	100
8	PCC	U18ME507	Production Engineering Lab-I	-	-	2	1	40	-	40	60	100
9	ESC	U18IT512	JAVA Programming Lab	-	-	2	1	40	-	40	60	100
10	PROJ	U18ME508	Seminar	-	-	2	1	100	-	100	-	100
Total:				**17**	**-**	**8**	**20**	**280**	**180**	**460**	**540**	**1000**
Additional Learning*:			*Maximum credits allowed for Honours/Minor*	-	-	-	7	-	-	-	-	-
			Total credits for Honours/Minor students:	**-**	**-**	**-**	***20+7***	**-**	**-**	**-**	**-**	**-**

** List of courses for additional learning through **MOOCs** towards Honours/Minor in Engineering shall be prescribed by the department under Honours/ Minor Curricula*

L= Lecture, T = Tutorials, P = Practicals & C = Credits; Contact hours per week: 25

Professional Elective-I / MOOC-I:
U18ME502A: Design of Transmission Systems
U18ME502B: Robotics
U18ME502C: Computer Aided Design
U18ME502M: MOOCs Course

U18TP501/U18TP601 QUANTITATIVE APTITUDE AND LOGICAL REASONING

Class: B. Tech. V-Semester
B. Tech. VI-Semester

Branch(s): ME, CSE, IT, CSN
CE, EIE, EEE, ECE, ECI

Teaching Scheme:

L	T	P	C
2	-	-	1

Examination Scheme :

Continuous Internal Evaluation :	40 marks
End Semester Exam :	60 marks

Course Learning Objectives (LOs):

This course will develop students' knowledge on /in…

LO1: quantitative aptitude & problem solving skills

LO2: computing abstract quantitative information

LO3: application of basic mathematics skills and critical thinking and to draw conclusions

LO4: evaluating the validity and possible biases in arguments presented in authentic contexts

UNIT - I (6)

Quantitative Aptitude-I: Number system, Averages, Percentages, Ratios and Proportions, Time, Speed & Distance, Time and work, Data Interpretation

UNIT - II (6)

Quantitative Aptitude-II: Simple Interest & Compound Interest, Profit & Loss, Ages, Permutations and combinations, Probability

UNIT - III (6)

Logical Reasoning-I: Series completion, Analogy, Coding and Decoding, Blood Relations, Number, Ranking & Time Sequence Test, Linear & Circular arrangements

UNIT - IV (6)

Logical Reasoning-II: Data Sufficiency, Logical Venn diagram, Syllogisms, Statement and Arguments, Statement and Assumptions, Direction Sense test

Textbooks:

[1] R S Agarwal, *Quantitative Aptitude for Competitive Examinations*, 3rd ed, 2019, S.Chand Publications.
(chapters 1,6,7,8,10,11,12,15,17,21,22,30,31)

[2] R S Agarwal, A *Modern Approach to Verbal and Non-Verbal reasoning,* 3rd ed, 2019, S.Chand Publications.
(chapters Section I: 1,3,4,5,6,8,16, Section II: 2,3)

Reference Books:

[1] Dinesh Khattar, *Quantitative Aptitude for Competitive Examinations*, 2019, PEARSON INDIA.

[2] Nishit K Sinha, *Reasoning for Competitive Examinations*, 2019 PEARSON INDIA.

[3] R.N.Thakur, *General Intelligence and Reasoning*, 2017, Mc Graw Hill Education

Course Learning Outcomes (COs):

On completion of this course, students will be able to…

CO1: solve arithmetic relationships and interpret data using mathematical models

CO2: compute abstract quantitative information

CO3: apply basic mathematics skills and think critically to draw conclusions, and solve problems

CO4: evaluate the validity and possible biases in arguments presented in authentic contexts logically and sensibly

Course Articulation Matrix (CAM): U18TP501/U18TP601 QUANTITATIVE APTITUDE AND LOGICAL REASONING

CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	**U18TP501.1/ U18TP601.1**	1	2	-	1	-	-	-	-	-	-	-	1	-	-
CO2	**U18TP501.2/ U18TP601.2**	1	2	-	1	-	-	-	-	-	-	-	1	-	-
CO3	**U18TP501.3/ U18TP601.3**	-	1	-	2	-	2	-	-	-	-	-	1	-	-
CO4	**U18TP501.4/ U18TP601.4**	-	1	-	2	-	2	-	-	-	-	-	1	-	-
U18TP501/ U18TP601		**1**	**1.5**	**-**	**1.5**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**-**

U18ME502A DESIGN OF TRANSMISSION SYSTEMS

Class: B. Tech. V-Semester **Branch:** Mechanical Engineering (ME)

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation	40 marks
End Semester Examination	60 marks

Course Learning Objectives(LOs):
This course will develop students' knowledge in/on…
LO1: flywheels and springs
LO2: belt drives and gears
LO3: sliding contact and rolling element bearings
LO4: clutches and brakes

UNIT-I (9)

Flywheels: Principle of flywheel, Design of flywheel rim, Stresses in flywheel rim, Design of hub, arms and Pulley design

Springs: Closed coiled helical springs subjected to axial loading, deflection and stresses in helical springs and springs under variable loads

UNIT-II (9)

Belts: Classification, Geometrical relationship for the length and tensions of open and crossed flat belt drives, Design of flat belt drives and V-belt drives

Gears: Design of spur, helical gears, Lewis strength equation, Buckingham dynamic load equation, Wear Strength equation; Design of gear wheels

UNIT-III (9)

Sliding Contact Bearings: Hydrodynamic and Hydrostatic lubrication; friction circle; Bearing Characteristic number; McKee's equation, Somerfield number, torque and power losses in journal bearings and design of journal and thrust bearings

Rolling Element Bearings: Types of rolling element bearings, basic dynamic load rating, Nominal life, Average life, Basic static load rating, combined radial and thrust loads, equivalent load, selection of bearings

UNIT-IV (9)

Clutches: Necessity of a clutch in an automobile; design procedure for disc clutch and cone clutch

Brakes: Introduction, design procedure for block brakes, band brakes, internal expanding shoe brakes, band and block brake

Textbook:

[1] V.B. Bhandari, *Design of Machine Elements*, 4th ed. New Delhi: Tata McGraw Hill Book Company, 2016. *(Chapters 10,11,12,13,15,16,17,18 and 21)*

Reference Books:

[1] J.E.Shigley and C.R.Mischke *Mechanical Engineering Design*, 6th ed., New Delhi: Tata McGraw Hill, 2014.

[2] N.C.Pandya and C. S. Shah, *Machine Design*, 20th ed. Anand: Charotar Publishing House, 2015.

[3] R.L.Norton, *Machine Design: An Integrated Approach,* 3rd ed. Noida: Pearson Education India, 2013.
[4] R.S.Kurmi & Guptha, *A Text Book of Machine Design*, 34th ed. New Delhi: S.Chand & Co., 2018.
[5] P. Kannaiah, *Machine Design*, 15th ed. Chennai: Scitech Publication Pvt. Ltd., 2009.
[6] *PSG Design Data book for engineers*, 3rd ed. Coimbature: Kalaikathir Achagam, 2014.

Note: Design Data book for Machine Elements is permitted in the Examination

Course Learning Outcomes (COs):
On completion of this course, students will be able to…

CO1: determine types, shape, size of flywheels and springs for different functions & applications
CO2: design belts & gears for different applications
CO3: recommend and justify the suitable bearing for the given loading conditions
CO4: design clutches & brakes for different applications

Course Articulation Matrix (CAM): U18ME502A DESIGN OF TRANSMISSION SYSTEMS														
CO		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	**U18ME502A.1**	1	2	2	-	-	-	-	-	-	-	-	1	2	1
CO2	**U18ME502A.2**	1	2	2	-	-	-	-	-	-	-	-	1	2	1
CO3	**U18ME502A.3**	1	2	2	-	-	-	-	-	-	-	-	1	2	1
CO4	**U18ME502A.4**	1	2	2	-	-	-	-	-	-	-	-	1	2	1
U18ME502A		**1**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**2**	**1**

U18ME502B ROBOTICS

Class: B. Tech. V-Semester **Branch:** Mechanical Engineering (ME)

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation	40 marks
End Semester Examination	60 marks

Course Learning Objectives(LOs):

This course will develop students' knowledge in/on

LO1: types of joints, components, drives and control systems for robots
LO2: direct kinematics and D-H representation in robot arm kinematics
LO3: trajectory planning and control of robot manipulators
LO4: working principle of different sensors and vision systems for robot

UNIT-I (9)

Basic Concepts in Robotics: Classification, advantages and applications of robots; different joints in a manipulator, degrees of freedom of a manipulator for positioning and orientation; work space- dexterous and reachable; basic components of a robotic system, factors affecting accuracy and repeatability of a manipulator, controller resolution, dexterity and compactness; drives and control systems for robots

UNIT-II (9)

Robot Arm Kinematics: Direct kinematics, position and orientation of a manipulator, representation of orientation in terms of unit vectors, successive rotations, rotations about two distinct moving axes, rotations about three distinct moving axes, transformation matrix for rotations, combined rotations, transformation between co-ordinate systems, Denavit - Hartenberg representation

UNIT-III (9)

Trajectory Planning: General considerations in trajectory planning, joint interpolated trajectories, planning of Cartesian path trajectories

Control of Robot Manipulators: Control of robot arm-computed torque technique, feedback control, resolved motion control and adaptive control

UNIT-IV (9)

Robot Vision and Sensing: Different types of sensors- proximity, touch, force and torque sensors; low level, high level vision and vision systems

Textbook:

[1] K.S. Fu, R.C. Gonzalez, C.S.G. Lee, *Robotics*, New Delhi: McGraw Hill Education, 2008. *(Chapters 1 to 5)*

Reference Books:

[1] J.J. Craig, *Robotics,* 3rd ed. New Jersey: Pearson Education Inc., 2005.
[2] Y. Koren, *Robotics for Engineers,* New York: McGraw Hill Inc., 1985.
[3] Robert J. Schilling, *Fundamentals for Robotics: Analysis and Control,* New Delhi: Prentice-Hall of India Pvt. Ltd., 1996.
[4] R.K. Mittal and I.J. Nagrath, *Robotics and Control*, New Delhi: Tata McGraw-Hill Education, 2003.
[5] S.K. Saha, *Introduction to Robotics*, 2nd ed. New Delhi: Tata McGraw-Hill Education, 2015.
[6] Saeed B. Niku, *Introduction to Robotics: Analysis, Control, Applications*, 2nd ed. Wiley India, 2011.

Course Learning Outcomes (COs):

On completion of this course, students will be able to…

CO1: categorize various drives & control systems for robots
CO2: analyze motion of the manipulator using direct kinematics & D-H representation
CO3: design a trajectory and apply different techniques to control the robot manipulators
CO4: analyze the sensing & vision systems of robot

Course Articulation Matrix (CAM):U18ME502B ROBOTICS															
CO		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	**U18ME502B.1**	2	1	1	1	-	-	-	-	-	-	-	1	2	1
CO2	**U18ME502B.2**	2	1	1	1	-	-	-	-	-	-	-	1	2	1
CO3	**U18ME502B.3**	2	1	1	1	-	-	-	-	-	-	-	1	2	1
CO4	**U18ME502B.4**	2	1	1	1	-	-	-	-	-	-	-	1	2	1
U18ME502B		**2**	**1**	**1**	**1**	**-**	-	**-**	**-**	**-**	**-**	**-**	**1**	**2**	**1**

U18ME502C COMPUTER AIDED DESIGN

Class: B. Tech. V-Semester **Branch:** Mechanical Engineering (ME)

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation	40 marks
End Semester Exam	60 marks

Course Learning Objectives(LOs):
This course will develop students' knowledge in/on…
LO1: CAD/CAM tools and various algorithms for generation of line and circle
LO2: 2D and 3D transformations
LO3: geometric modeling of curves
LO4: geometric modeling of surfaces , solids and CAD/ CAM data exchange

UNIT – I (9)

Introduction: Introduction to CAD/CAM, Types of system and CAD/CAM system evaluation criteria
Graphics Primitives: Monitor pixels and frame buffers; Generation of line and circle algorithms

UNIT – II (9)

Transformations: 2D and 3D transformations – translation, scaling, shearing, rotation, reflection, homogeneous transformation, matrix operations, concatenation, isometric, orthographic and perspective projections

UNIT – III (9)

Geometric Modeling of Curves: Wire frame models, wire frame entities; parametric representation of synthetic curves - Hermite cubic splines, Bezier curves, B-spline curves and rational curves

UNIT – IV (9)

Geometric Modeling of Surfaces: parametric representation of synthetic Surfaces - Hermite Bicubic surface, Bezier surface, B-spline surface, Coons surface, blending surface and sculptured surface
Geometric Modelling of Solids: Solid entities, Boolean operations; boundary representation (B-rep) and constructive solid geometry (CSG) approach of solid modeling; CAD/CAM Data Exchange -IGES and PDES

Textbook:

[1] Ibrahim Zeid, *CAD/CAM theory and practice*, 2nd ed. New Delhi: McGraw-Hill, 2009. *(Chapters 1 to 7)*

Reference Books:

[1] David F. Rogers and J. Alan Adams, *Mathematical Elements for Computer Graphics*, 2nd ed. New York*: McGraw-Hill*, 2002.

[2] Donald Hearn and M. Pauline Baker, *Computer Graphics*, 2nd ed. New Delhi: Prentice-Hall of India, 2007

[3] James D. Foley, Andries Van Dam, et. al., *Computer Graphics: Principles and Practice*, 2nd ed. New Delhi: Pearson Education, 2005.

[4] Apurva A. Desai, *Computer Graphics,* New Delhi: Prentice-Hall of India, 2008

Course Learning Outcomes (COs):

On completion of this course, students will be able to…

CO1: analyze basic Bresenham's line & circle generation algorithm
CO2: analyze surfaces & solids using various geometric transformation techniques
CO3: evaluate mathematical models to represent curves
CO4: evaluate mathematical models to represent surfaces & solids

Course Articulation Matrix (CAM): U18ME502C COMPUTER AIDED DESIGN														
CO		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	**U18ME502C.1**	1	2	1	1	1	-	-	-	-	-	-	1	2	1
CO2	**U18ME502C .2**	1	2	1	1	1	-	-	-	-	-	-	1	2	1
CO3	**U18ME502C.3**	1	2	1	1	1	-	-	-	-	-	-	1	2	1
CO4	**U18ME502C.4**	1	-	1	1	1	-	-	-	-	-	-	1	2	1
U18ME502C		**1**	**2**	**1**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**2**	**1**

U18ME503 DYNAMICS OF MACHINERY

Class: B. Tech. V-Semester **Branch: Mechanical Engineering (ME)**

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation:	40 marks
End Semester Examination:	60 marks

Course Learning Objectives(LOs):
This course will develop students' knowledge in/on…
LO1: gyroscopic couple, force analysis in mechanisms and flywheel
LO2: governors and their characteristics
LO3: static and dynamic balancing of rotary and reciprocating masses
LO4: free and forced damped vibration of single degree freedom systems

UNIT-I (9)

Static and Dynamic Force Analysis in Mechanisms: Approximate analytical method for velocity and acceleration of the piston, angular velocity and acceleration of the connecting rod; engine force analysis-piston effort, crank effort, turning moment on crank shaft, inertia forces in reciprocating engines; Turning moment diagrams, fluctuation of speed and energy- principle of flywheel

Gyroscope: Gyroscopic couple, gyroscopic effect-aeroplanes, ships; stability of two and four wheel vehicles

UNIT-II (9)

Governors: Types -Watt, Porter, Proell, Hartnell, Wilson-Hartnell governor; sensitiveness, hunting, isochronism, stability, effort and power of a governor, controlling force, coefficient of insensitiveness

UNIT-III (9)

Balancing: static and dynamic balancing, transfer of force to a reference plane, balancing of rotating masses in several planes; balancing of reciprocating mass -partial balancing of reciprocating mass, balancing of multi-cylinder inline engines, analysis of primary and secondary forces and couples, balancing of radial engines by direct crank and reverse crank method; working principle of balancing machines

UNIT-IV (9)

Vibrations: Free longitudinal vibrations, damped vibrations, logarithmic decrement; forced damped vibration of spring mass system, magnification factor, vibration isolation and transmissibility; transverse vibrations of shafts- point load, UDL and several point loads-Dunkerley's method and energy method; whirling of shafts; torsional vibrations of rotating shafts-two rotor system

Textbook:

[1] S. S. Rattan, *Theroy of Machines,* 5th ed. New Delhi: Tata McGraw-Hill, 2019 (*Chapters 12, 13,14,16,17 and 18)*

Reference Books:

[1] Amitabha Ghosh and Ashok Kumar Mallik, *Theory of Mechanisms and Machines*, 3rd ed. New Delhi: East West Press Pvt. Ltd., 2006.

[2] J. E. Shigley and John Joseph Uicker, *Theory of Machines and Mechanisms*, 2nd ed. New Delhi: McGraw-Hill international edition, 2003.

[3] A. G. Ambekar, *Theory of Mechanisms and Machines,* New Delhi: Jain Brothers, 2009.

[4] Thomas Bevan, *Theory of Machines,* 3rd ed. New Delhi: Pearson-India, 2009.

[5] R. S. Khurmi and J. K. Guptha, *Theory of Machines*, 14th ed. New Delhi: S. Chand & Co., 2005.

[6] J. S. Rao and R. V. Dukkipati, *Mechanisms and Machine Theory,* 2nd ed. New Delhi: New Age International, 1992.

Course Learning Outcomes (COs):

On completion of this course, students will be able to…

CO1: estimate the effect of gyroscopic couple on stability of different vehicles and analyze inertia forces of slider crank mechanism & flywheel

CO2: formulate the equilibrium speed for different types of centrifugal governors and distinguish their characteristics

CO3: analyze static & dynamic balance of rotary & reciprocating masses

CO4: evaluate natural frequency of vibration in single degree freedom systems

Course Articulation Matrix (CAM): U18ME503 DYNAMICS OF MACHINERY

CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	U18ME503.1	2	2	2	1	-	-	-	-	-	-	-	1	2	1
CO2	U18ME503.2	2	2	2	1	-	-	-	-	-	-	-	1	2	1
CO3	U18ME503.3	2	2	2	1	-	-	-	-	-	-	-	1	2	1
CO4	U18ME503.4	2	2	2	1	-	-	-	-	-	-	-	1	2	1
U18ME503		**2**	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	1	**2**	**1**

U18ME504 MACHINE TOOLS AND METROLOGY

Class: B. Tech. V-Semester **Branch:** Mechanical Engineering (ME)

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation	40 marks
End Semester Exam	60 marks

Course Learning Objectives(LOs):

This course will develop students' knowledge in/on...

LO1: lathe, shaper, planer and drilling machines
LO2: milling & grinding machines, jigs & fixtures
LO3: line & end standards, limits, fits & tolerances and alignment testing
LO4: comparators, surface finish and screw threads

UNIT – I (9)

Machine Tools: Classification and applications

Lathe Machine: Types, description, speed& feed mechanisms and lathe operations

Shaper and Planer: Types, description and operations

Drilling Machine: Types, description and operations

UNIT – II (9)

Milling Machine: Types, principal parts, types of milling cutters and operations

Grinding Machine: Classification and operations; Grinding wheels-specification of a grinding wheel; selection of grinding wheels

Jigs and Fixtures: Principles of jigs and fixtures design, principles of location, methods of location; Clamping- types and functions; Types of jigs and fixtures

UNIT – III (9)

Line and end standards: Linear measurements – vernier caliper, micrometer and slip gauges; angular measurement-sine bar, angle gauges, clinometers and angle dekkor

Limits, fits and tolerances: Terminology; types of fits; hole and shaft basis systems; design of gauges-Taylor's principles for limit gauges; limit gauges -plug, ring and snap gauges**;** alignment tests for lathe

UNIT – IV (9)

Comparators: Classification; Mechanical comparators-Johanson Mikrokater, Sigma Comparator, optical comparator- autocollimator; interferometry-profile projector; pneumatic comparator-differential back pressure type comparator

Metrology of Surface roughness: Terminology; methods of measurement of surface roughness; principle and operation of Tomlinson surface meter and Taylor-Hobson Talysurf

Metrology of screw threads: measurement of effective diameter using 2-wire and 3-wire method

Textbooks:

[1] S.K. Hajra Chowdary, S. K. Bose and A.K. Hajra Chowdary, *Elements of Workshop Technology,* Vol. II, 15th ed. New Delhi: Media Promoter and Publishers Pvt. Ltd., India, 2019. *(Chapters 3,5,7,8.10,11 and 14*)

[2] I. C. Gupta, *A Text book of Engineering Metrology,* 7th ed., New Delhi: Dhanpat Rai and Sons, 2018. *(Chapters 1 to 6,9,11 and 13)*

Reference Books:

[1] R. K. Jain, *Engineering Metrology,* 25th ed. New Delhi: Khanna publishers, 2005.
[2] Henrich Gerling, *All about Machine Tools*, revised ed., New Delhi: New Age International, 2007.
[3] Kalpakjian, S. and Steven R. Schmid, *Manufacturing, Engineering & Technology,* 4th ed. New Delhi: Pearson, 2001.
[4] M. Mahajan, *A text book of Metrology,* New Delhi: Dhanpat Rai & Co., 2016.

Course Learning Outcomes (COs):

On completion of this course, students will be able to…

CO1: categorize various machine tools and distinguish working principles, operations & applications of lathe, shaper & drilling machines
CO2: distinguish working principles, operations & applications of milling & grinding machines and jigs & fixtures
CO3: determine linear & angular dimensions, design limit gauges using Taylor's principle and explain alignment test for lathe
CO4: recommend suitable comparator for a given application and determine surface finish & effective diameter of screw threads

Course Articulation Matrix (CAM): U18ME504 MACHINE TOOLS AND METROLOGY

CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	**U18ME504.1**	2	-	-	-	-	-	-	-	-	-	-	1	2	1
CO2	**U18ME504.2**	2	-	-	-	-	-	-	-	-	-	-	1	2	1
CO3	**U18ME504.3**	2	2	2	-	-	-	-	-	-	-	-	1	2	1
CO4	**U18ME504.4**	2	2	-	-	-	-	-	-	-	-	-	1	2	1
U18ME504		**2**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**2**	**1**

U18ME505 PRODUCTION AND OPERATIONS MANAGEMENT

Class: B. Tech. V-Semester **Branch:** Mechanical Engineering (ME)

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation	40 marks
End Semester Examination	60 marks

Course Learning Objectives(LOs):

This course will develop students' knowledge in/on…

LO1: forecasting techniques and inventory control

LO2: production planning & control, material requirement planning and aggregate planning

LO3: sequencing, scheduling and network models

LO4: work study and work measurement

UNIT-I (9)

Production and Operations Management: Introduction, objectives and areas

Forecasting: Qualitative techniques-market survey, Delphi method and life cycle analogy; Quantitative techniques-time series methods, moving average, simple exponential smoothing and regression analysis; Forecasting errors

Inventory Control: Quantitative inventory- Economic Order Quantity (EOQ) for purchase model, manufacturing model and discount model; Qualitative inventory-classification and ABC analysis

UNIT-II (9)

Production Planning and Control: Objectives, components and functions

Material Requirement Planning: Terminology; system inputs and outputs, MRP logic

Aggregate Planning: Characteristics, decision options- modification of demand and supply

UNIT-III (9)

Sequencing and Scheduling: sequencing of 'n' jobs on 1, 2 and 3 machine problems

Network Models: CPM & PERT**;** Transportation models and Assignment models

UNIT-IV (9)

Work Study: Techniques of Work Study; method study-tools and techniques, process charts

Work Measurement: Elements of time study, time study procedure, standard time calculation

Textbook:

[1] Shailendra Kale, *Production and Operations Management*, New Delhi: McGraw-*Hill*, 2017 (*Chapters 1,2,4,7,11,13,14 and 17*)

Reference Books:

[1] Panneerselvam, *Production and Operation Management*, New Delhi: PHI, 2017.

[2] Joseph G. Monks *Operations Management: Theory and Problems,* 2nd ed. New York: McGraw-Hill, 1982.

[3] Elwoods. Buffa, *Modern Production and Operations Management*, 8th ed. New Delhi: Wiley Eastern, 2009.

[4] Hajra Chowdary, *Production Management-Integrated with Industrial Engineering Approach,* 2nd ed. Bombay: Media Promoters and Publishers, 1993.

Course Learning Outcomes (COs):

On completion of this course, students will be able to…

CO1: categorize forecasting techniques and derive EOQ for inventory models

CO2: assess the components and functions of production planning & control for material requirement & aggregate planning

CO3: solve problems on CPM, PERT, transportation & assignment models

CO4: apply tools & techniques for work study & work measurement

Course Articulation Matrix (CAM): U18ME505 PRODUCTION AND OPERATIONS MANAGEMENT														
CO		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	**U18ME505.1**	2	2	2	-	-	-	-	-	-	1	-	1	2	-
CO2	**U18ME505.2**	2	-	-	-	-	-	-	-	-	1	-	1	2	-
CO3	**U18ME505.3**	2	2	2	-	-	-	-	-	-	1	2	1	2	-
CO4	**U18ME505.4**	2	2	-	-	-	-	-	-	-	1	-	1	2	-
U18ME505		**2**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**2**	**1**	**2**	**-**

U18IT511 OBJECT ORIENTED PROGRAMMING THROUGH JAVA

Class: B. Tech. V – Semester

Branch: Mechanical Engineering (ME)

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation	40 marks
End Semester Examination	60 marks

Course Learning Objectives(LOs):

This course will develop students' knowledge in/on…

LO1: fundamentals of object oriented & Java programming

LO2: classes, objects & inheritance for implementing object oriented concepts

LO3: concepts of polymorphism, interfaces & packages

LO4: exception handling, string handling, input & output operations

UNIT-I (9)

Fundamentals of Object Oriented Programming: Programming paradigms, Basic concepts of Object Oriented paradigm (OOP), benefits and applications of OOP

Basics of Java Language: Java language Features, Java Programming Structure, Java Tokens, JVM, Constants, Variables, Data types, Scope of variables, Type Casting, Operators and Expressions, Branching and looping statements, Arrays

UNIT – II (9)

Classes and Objects: Defining a class, Field declaration, Method declaration, Creating object, Accessing Class Members, Constructors, garbage collection, Static members, Nested and inner classes, Command line arguments, Wrapper classes

Inheritance: Extending a class, Defining subclasses, Subclass constructor, Multilevel inheritance, Hierarchical inheritance, Access controls, *this* and *super* keywords

UNIT-III (9)

Polymorphism: Overloading methods, Overloading constructors, Overriding Methods, Dynamic method dispatch, Abstract classes, Final Keyword

Interfaces: Defining an interface, Implementing interfaces, Nested Interfaces, Variables in interfaces, Extending interfaces

Packages: Packages, java API packages, Using System Packages, Naming Conventions, Creating Packages, Accessing Packages, Adding a class to package, Hiding classes, Static Import

UNIT–IV (9)

Exception handling: Fundamentals, Exception types, uncaught exceptions, Using try and catch, Multiple catch clauses, Explicit exceptions with *throw, throws* and *finally* keywords

String Handling: String constructors, string length, String operations, Character extraction, String comparison, Searching strings, modifying a string, changing string cases, Joining strings

I/O: I/O Basics, reading console Input, writing console output, Reading and writing files

Textbooks:

[1] Herbert Schildt, *Java The Complete Reference*, 9th ed. New Delhi : McGraw Hill Education (India) Pvt.Ltd , 2014.

[2] E. Balagurusamy, *Programming with Java: A Primer*, 5th ed. New Delhi : McGraw Hill Education (India) Pvt.Ltd, 2014.

References Books:

[1] P. Radha Krishna, *Object Oriented Programming through Java*, Hyderabad: Universities Press (India) Limited, 2011.

[2] Kathy Sierra and Bert Bates, *Head First Java*, 2nd ed. USA: O'Reilly Media, Inc., 2005.

[3] Uttam Kumar Roy, *Advanced Java Programming*, New Delhi: Oxford University Press India, 2015.

Course Learning Outcomes(COs):

On completion of this course, students will be able to…

CO1: illustrate object oriented concepts & Java programming features

CO2: solve computing problems using classes, objects & inheritance concepts

CO3: use polymorphism, interfaces & packages for developing objected oriented programs

CO4: develop applications using exception handling, string handling, input & output operations

Course Articulation Matrix (CAM): **U18IT511 OBJECT ORIENTED PROGRAMMING THROUGH JAVA**

CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	**U18IT511.1**	1	-	-	-	-	-	-	-	-	-	-	1	1	-
CO2	**U18IT511.2**	2	2	1	1	-	-	-	-	-	-	-	1	1	-
CO3	**U18IT511.3**	2	2	1	1	-	-	-	-	-	-	-	1	1	-
CO4	**U18IT511.4**	2	2	1	1	-	-	-	-	-	-	-	1	1	-
U18IT511		**1.75**	**2**	**1**	**1**	**-**	-	-	-	-	-	-	**1**	**1**	**-**

U18ME506 DYNAMICS OF MACHINERY LABORATORY

Class: B. Tech. V-Semester **Branch:** Mechanical Engineering (ME)

Teaching Scheme:

L	T	P	C
-	-	2	1

Examination Scheme:

Continuous Internal Evaluation:	40 marks
End Semester Examination:	60 marks

Course Learning Objectives(LOs):

This course will develop students'knowledge in/on...

LO1: cam and follower mechanism and governors

LO2: gyroscope, perform unbalance masses and balancing of masses

LO3: whirling phenomenon and critical speeds and concept of radius of gyration on bi-filar suspension

LO4: Dunkerley's rule and programming concepts for vibratory models using C++/Matlab

LIST OF EXPERIMENTS

1. To draw the curves for displacement, velocity and acceleration vs angle of rotation for a given cam-follower combination.
2. To draw the controlling force diagrams of Hartnel governors.
3. To verify the relations of gyroscopic effect.
4. To perform Static and dynamic balancing of rotating mass system.
5. To study the whirling phenomenon in shafts.
6. To determine the radius of gyration of given bar by using Bi-Filar suspension.
7. To study the undamped free vibrations of equivalent spring mass system.
8. To verify Dunkerly's rule.
9. Study of damped Torsional vibrations of single Rotor shaft system.
10. To Plot the resulting motions of a mass subjected to two harmonic motions & identify the Beat Frequency.
11. To Plot the time variations of the displacement, velocity & acceleration of the mass in a given spring mass system.
12. To plot the impulse response of a single degree of freedom structure due to
    a) a single impact and b) double impact

Note: Exercises from 10 to 12 will be solved using MATLAB or C++

Laboratory Manual:

[1] Dynamics of Machinery Laboratory Manual, Dept. of ME, KITSW.

Reference Books:

[1] S. S. Rattan, *Theroy of Machines,* 5th ed. New Delhi: Tata McGraw-Hill, 2019

[2] Amitabha Ghosh and Ashok Kumar Mallik, *Theory of Mechanisms and Machines*, 3rd ed. New Delhi: East West Press Pvt. Ltd., 2006.

[3] J. E. Shigley and John Joseph Uicker, *Theory of Machines and Mechanisms*, 2nd ed. New Delhi: McGraw-Hill international edition, 2003.

[4] A. G. Ambekar, *Theory of Mechanisms and Machines,* New Delhi: Jain Brothers, 2009.

[5] Thomas Bevan, *Theory of Machines,* 3rd ed. New Delhi: Pearson-India, 2009.

[6] R. S. Khurmi and J. K. Guptha, *Theory of Machines*, 14th ed. New Delhi: S. Chand & Co., 2005.

[7] J. S. Rao and R. V. Dukkipati, *Mechanisms and Machine Theory,* 2nd ed. New Delhi: New Age International, 1992.

Course Learning Outcomes (COs):

On completion of this course, students will be able to…

CO1: analyze the relation between displacements, velocity & acceleration w.r.t angle of rotation for tangent cam-flat follower mechanism & condition of Hartnell governor under different speeds

CO2: evaluate gyroscopic couple, balanced mass & its angular displacement using static & dynamic balancing

CO3: estimate the critical speeds during the various loops formed in the shaft at different speeds and determine the restoring torque and compare the experimental & theoretical radius of gyration

CO4: analyze natural frequencies of beam at different conditions and develop C++/Matlab programs for vibratory models using Dunkeley's rule

Course Articulation Matrix (CAM): U18ME506 DYNAMICS OF MACHINERY LABORATORY														
CO		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	**U18ME506.1**	2	2	1	1	-	-	-	-	1	1	-	1	1	1
CO2	**U18ME506.2**	2	2	1	1	-	-	-	-	1	1	-	1	1	1
CO3	**U18ME506.3**	2	2	1	1	-	-	-	-	1	1	-	1	1	1
CO4	**U18ME506.4**	2	2	1	1	1	-	-	-	1	1	-	1	1	1
U18ME506		**2**	**2**	**1**	**1**	**1**	**-**	**-**	**-**	**1**	**1**	**-**	**1**	**1**	**1**

U18ME507 PRODUCTION ENGINEERING LABORATORY-I

Class: B. Tech. V-Semester **Branch:** Mechanical Engineering (ME)

Teaching Scheme:

L	T	P	C
-	-	2	1

Examination Scheme:

Continuous Internal Evaluation	40 marks
End Semester Exam	60 marks

Course Learning Objectives(LOs):

This course will develop students' knowledge in/on….

LO1: machining operations on lathe, slotter and shaper
LO2: machining operations on drilling and milling machine
LO3: measurement of linear and angular dimensions
LO4: statistical quality control

LIST OF EXPERIMENTS

1. Perform step, taper and thread cutting on lathe machine.
2. Perform eccentric turning on lathe machine.
3. Perform a key way slot on rectangular block using slotter machine.
4. Perform V-groove on cylindrical bar using shaper machine.
5. Perform a contour cut on rectangular block using milling machine.
6. Perform drilling and tapping on MS rod using drilling machine
7. Measurement of external taper angle of a component using sine bar.
8. Measurement of bore diameter, taperness and ovality using bore gauge.
9. Measurement of screw thread characteristics using profile projector
10. Measurement of screw thread effective diameter using screw thread micrometer and 3-wire set.
11. Construction of X-bar and R-bar variable charts (SQC) of a given sample.
12. Alignment tests for machine tools
    (a) Roundness of head stock spindle (b) Flatness of lathe bed.

Laboratory Manual:

[1] Production Engineering Laboratory-I Manual, Dept. of ME, KITSW.

Reference Books:

[1] S.K. Hajra Chowdary, S. K. Bose and A.K. Hajra Chowdary, *Elements of Workshop Technology,* Vol. II, 15th ed. New Delhi: Media Promoter and Publishers Pvt. Ltd., India, 2019.

[2] I. C. Gupta, *A Text book of Engineering Metrology,* 7th ed., New Delhi: Dhanpat Rai and Sons, 2018.

[3] R. K. Jain, *Engineering Metrology,* 25th ed. Khanna publishers, 2005.

[4] Henrich Gerling, *All about Machine Tools*, revised ed., New Delhi: New Age International, 2007.

[5] Kalpakjian, S. and Steven R. Schmid, *Manufacturing, Engineering & Technology,* 4th ed. New Delhi: Pearson, 2001.

[6] M. Mahajan, *A text book of Metrology,* New Delhi: Dhanpat Rai & Co., 2016.

Course Learning Outcomes (COs):

On completion of this course, students will be able to…

CO1: recommend suitable machining operations on lathe, slotter & shaper machines for a given component

CO2: recommend suitable machining operations on drilling & milling machines for a given component

CO3: determine thread characteristics & taper angles using appropriate instrument(s)/gauge(s)

CO4: analyze X-bar & R-bar control charts for a given sample

Course Articulation Matrix (CAM): U18ME507 PRODUCTION ENGINEERING LABORATORY-I														
CO		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	**U18ME507.1**	2	1	-	-	-	-	-	-	1	1	-	1	1	-
CO2	**U18ME507.2**	2	1	-	-	-	-	-	-	1	1	-	1	1	-
CO3	**U18ME507.3**	2	1	-	-	-	-	-	-	1	1	-	1	1	-
CO4	**U18ME507.4**	2	1	1	-	-	-	-	-	1	1	-	1	1	1
U18ME507		**2**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**1**	**1**	**-**	**1**	**1**	**1**

U18IT512 JAVA PROGRAMMING LABORATORY

Class: B. Tech. V – Semester **Branch:** Mechanical Engineering (ME)

Teaching Scheme:

L	T	P	C
-	-	2	1

Examination Scheme:

Continuous Internal Evaluation	40 marks
End Semester Examination	60 marks

Course Learning Objectives(LOs):

This course will develop students' knowledge in/on…

LO1: basic concepts of object oriented programming
LO2: classes, objects & inheritance features
LO3: concepts of polymorphism, interfaces & packages
LO4: exception handling, string handling, input & output operations

List of Experiments

Experiment-I

1. Write a program to demonstrate operators of java
2. Write a program to demonstrate type casting and operator precedence
3. Write a program to demonstrate different types of if-statements
4. Write a program to demonstrate switch-case

Experiment-II

5. Write a program to demonstrate loop control statements
6. Write a program to demonstrate for-each control loop
7. Implement programs using single dimensional arrays
8. Write a program to define a two dimensional array where each row contains different number of columns

Experiment -III

9. Write a program to demonstrate creating object to a class for accessing variables and methods
10. Write a program to demonstrate creating multiple objects
11. Write a program to demonstrate passing objects to methods
12. Write a program to demonstrate constructors and garbage collector by invoking it explicitly

Experiment -IV

13. Write a program to demonstrate static members
14. Write a program to demonstrate command line arguments
15. Write a program to demonstrate variable length arguments
16. Write a program to demonstrate wrapper classes

Experiment -V

17. Write a program to demonstrate inheritance using extends keyword
18. Write a program to demonstrate multilevel inheritance
19. Write a program to demonstrate hierarchical inheritance
20. Write a program to demonstrate access controls

Experiment -VI

21. Write a program to demonstrate *this* and *super* keywords

22. Write a program to demonstrate dynamic method dispatch
23. Write a program to demonstrate *final* variables and methods
24. Write a program to demonstrate use of abstract class

Experiment -VII

25. Write a program to define an interface and implement it into a class
26. Write a program to implement multiple interfaces into a single class
27. Write a program to extend interfaces
28. Write a program to implement nested interfaces

Experiment-VIII

29. Write a program to create a package and demonstrate to import a package into a class
30. Write a program to demonstrate access protection of packages
31. Write a program to demonstrate static import of package

Experiment-IX

32. Write a program to demonstrate *try* and *catch* statements for exception handling
33. Write a program to handle ArrayIndexOutOfBoundsException, NumberFormatException and DivideByZeroException using multiple catch blocks
34. Write a program to demonstrate user defined exception with *throw* keyword
35. Write a program to demonstrate finally block

Experiment-X

36. Write a program to demonstrate string searching functions
37. Write a program to demonstrate string comparison functions
38. Write a program to demonstrate string modification functions

Experiment-XI

39. Write a program to demonstrate reading and writing input using byte stream classes
40. Write a program to demonstrate reading and writing input using character stream classes
41. Write a program to demonstrate data input and output streams
42. Write a program to demonstrate array input and output streams

Experiment-XII

43. Write a program to create a file using byte stream classes
44. Write a program to create a file using character stream classes
45. Write a program to copy the content of one file to another

Laboratory Manual:

[1] Java Programming laboratory Manual, Dept. of IT, KITSW.

Reference Books:

[1] Herbert Schildt, *Java the Complete Reference*, 9th ed. New Delhi: McGraw Hill Education (India) Pvt.Ltd , 2014.

[2] E. Balagurusamy, *Programming with Java: A Primer*, 5th ed. New Delhi: McGraw Hill Education (India) Pvt.Ltd, 2014.

Course Learning Outcomes(COs):

On completion of this course, students will be able to…

CO1: develop programs to implement object oriented programming concepts using Java
CO2: develop programs using classes, objects & inheritance concepts
CO3: experiment with the polymorphism, interfaces & packages
CO4: build applications using exception handling, string handling, input & output operations

Course Articulation Matrix (CAM): U18IT512 JAVA PROGRAMMING LABORATORY														
CO		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	**U18IT512.1**	2	-	-	-	-	-	-	-	-	-	-	1	1	-
CO2	**U18IT512.2**	2	2	1	1	-	-	-	-	-	-	-	1	1	-
CO3	**U18IT512.3**	2	2	1	1	-	-	-	-	-	-	-	1	1	-
CO4	**U18IT512.4**	2	2	1	1	-	-	-	-	-	-	-	1	1	-
U18IT512		**2**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**1**	**-**

U18ME508 SEMINAR

Class: B. Tech. V - Semester **Branch:** Mechanical Engineering (ME)

Teaching Scheme:

L	T	P	C
-	-	-	1

Examination Scheme:

Continuous Internal Evaluation	100 marks
End Semester Examination	-

Course Learning Objectives (LOs):

This course will develop students' knowledge on /in…

LO1: selecting topic, referring to peer reviewed journals / technical magazines / conference proceedings
LO2: literature review and well-documented report writing
LO3: creating PPTs and effective technical presentation
LO4: preparing a technical paper in scientific journal style & format

Student has to give independent seminar on the state-of-the-art technical topics relevant to their program of study, which would supplement and complement the program assigned to each student.

Guidelines:

1. The HoD shall constitute a Department Seminar Evaluation Committee (DSEC)
2. DSEC shall allot a faculty supervisor to each student for guiding on (i) selection of topic (ii) literature survey and work to be carried out (iii) preparing a report in proper format and (iv) effective seminar presentation
3. There shall be only Continuous Internal Evaluation (CIE) for seminar
4. The CIE for seminar is as follows:

Assessment	Weightage
Seminar Supervisor Assessment	20%
Seminar Report	30%
Seminar Paper	20%
DSEC Assessment: *Oral presentation with PPT and viva-voce*	30%
Total Weightage:	100%

Note: It is mandatory for the student to appear for oral presentation and viva-voce to qualify for course evaluation

(a) **Seminar Topic**: The topic should be interesting and conducive to discussion. Topics may be found by looking through recent issues of peer reviewed Journals / Technical Magazines on the topics of potential interest

(b) **Report:** Each student is required to submit a well-documented report on the chosen seminar topic as per the format specified by *DSEC.*

(c) **Anti-Plagiarism Check:** The seminar report should clear plagiarism check as per the Anti-Plagiarism policy of the institute.

(d) **Presentation:** Each student should prepare PPT with informative slides and make an effective oral presentation before the *DSEC* as per the schedule notified by the department

(e) The student has to register for the Seminar as supplementary examination in the following cases:
   i) he/she is absent for oral presentation and viva-voce
   ii) he/she fails to submit the report in prescribed format
   iii) he/she fails to fulfill the requirements of seminar evaluation as per specified guidelines

(f) i) The CoE shall send a list of students registered for supplementary to the HoD concerned

ii) The DSEC, duly constituted by the HoD, shall conduct seminar evaluation and send the award list to the CoE within the stipulated time

Course Learning Outcomes (COs):

On completion of this course, students will be able to…

CO1: select current topics in their engineering discipline & allied areas from peer reviewed journals / technical magazines/ conference proceedings

CO2: demonstrate the skills for performing literature survey, identify gaps, analyze the technical content and prepare a well-documented seminar report

CO3: create informative PPT and demonstrate communication skills through effective oral presentation showing knowledge on the subject & sensitivity towards social impact of the seminar topic

CO4: write a "seminar paper" in scientific journal style & format from the prepared seminar report

Course Articulation Matrix (CAM): U18ME508 SEMINAR

CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	U18ME508.1	1	1	-	1	1	-	1	2	2	2	1	2	1	1
CO2	U18ME508.2	1	1	-	-	-	-	-	2	2	2	-	2	1	1
CO3	U18ME508.3	-	-	-	-	-	-	1	2	2	2	-	2	1	1
CO4	U18ME508.4	-	-	-	-	-	-	-	2	2	2	-	2	1	1
U18ME508		**1**	**1**	**-**	**1**	**1**	**-**	**1**	**2**	**2**	**2**	**1**	**2**	**1**	**1**

DEPARTMENT OF MECHANICAL ENGINEERING
KAKATIYA INSTITUTE OF TECHNOLOGY & SCIENCE, WARANGAL – 15
(An Autonomous Institute under Kakatiya University, Warangal)

SCHEME OF INSTRUCTION AND EVALUATION
VI-SEMESTER OF 4-YEAR B.TECH DEGREE PROGRAMME

[5Th+3P+1MC+1Mini Project]

Sl. No	Category	Course Code	Course Title	Hours per week			Credits	Evaluation Scheme				
								CIE			ESE	Total Marks
				L	T	P	C	TA	MSE	Total		
1	MC	U18MH601	Universal Human Values-II	2	-	-	-	10	30	40	60	100
2	OE	U18OE602	Open Elective - III	3	-	-	3	10	30	40	60	100
3	PE	U18ME603	Professional Elective - II / MOOC-II	3	-	-	3	10	30	40	60	100
4	PCC	U18ME604	Heat Transfer	3	-	-	3	10	30	40	60	100
5	PCC	U18ME605	IC Engines and Gas Turbines	3	-	-	3	10	30	40	60	100
6	PCC	U18ME606	Theory of Metal Cutting	3	-	-	3	10	30	40	60	100
7	PCC	U18ME607	Heat Transfer Lab	-	-	2	1	40	-	40	60	100
8	PCC	U18ME608	Computer Aided Analysis Lab	-	-	2	1	40	-	40	60	100
9	PCC	U18ME609	Fuels and IC Engines Lab	-	-	2	1	40	-	40	60	100
10	PROJ	U18ME610	Mini Project	-	-	2	1	100	-	100	-	100
Total:				**17**	**1**	**8**	**19**	**280**	**180**	**460**	**540**	**1000**
Additional Learning*:			*Maximum credits allowed for Honours/Minor*	-	-	-	*7*	-	-	-	-	-
Total credits for Honours/Minor students:				**-**	**-**	**-**	***19+7***	**-**	**-**	**-**	**-**	**-**

** List of courses for additional learning through **MOOCs** towards Honours/Minor in Engineering shall be prescribed by the department under Honours/ Minor Curricula*

L= Lecture, T = Tutorials, P = Practicals & C = Credits; Contact hours per week: 26

Professional Elective-II / MOOC-II:	**Open Elective-III:**
U18ME603A: Finite Element Methods	U18OE602A: Disaster Management
U18ME603B: Mechanical Vibrations & Condition monitoring	U18OE602B: Project Management
U18ME603C: Composite Materials	U18OE602C: Professional Ethics in Engineering
U18ME603M: MOOCs course	U18OE602D: Rural Technology and Community Development

U18MH501 / U18MH601 UNIVERSAL HUMAN VALUES - II

Class: B. Tech. V – Semester
B. Tech. VI – Semester

Branch(s): CE, **EIE**, EEE, ECE & ECI
ME, CSE, IT & CSN

Teaching Scheme:

L	T	P	C
2	-	-	-

Examination Scheme:

Continuous Internal Evaluation	40 marks
End Semester Examination	60 marks

* Pre-requisite: U18MH111 Universal Human Values - I (*Induction Programme)*

Course Learning Objectives (LOs):
This course will develop students' knowledge on/in…

LO1: self-exploration, happiness and prosperity as the process of value education
LO2: harmony in the human being - self & family
LO3: co-existence of human being with society & nature
LO4: professional ethics, commitment and courage to act

UNIT – I (6)

Introduction - Need, Basic Guidelines, Content and Process for Value Education:
Purpose and motivation for the course, Recapitulation from Universal Human Values - I (*Induction programme*)

Self-Exploration: Its content and process, Natural acceptance and experiential validation – As the process for self-exploration

Continuous Happiness and Prosperity: A look at basic human aspirations, Right understanding, Relationship and physical facility - The basic requirement for fulfillment of aspirations of every human being with their correct priority

Understanding Happiness and Prosperity correctly: A critical appraisal of the current scenario, Method to fulfill the above human aspirations - Understanding and living in harmony at various levels

UNIT – II (6)

Understanding Harmony in the Human Being- Harmony in Myself & Family:

Harmony in Myself: Understanding human being as a co-existence of the sentient 'I' and the material 'Body', Understanding the needs of Self ('I') and 'Body' - Happiness and physical facility; Understanding the 'Body' as an instrument of 'I' (I being the doer, seer and enjoyer), Understanding the characteristics and activities of 'I' and harmony in 'I', Understanding the harmony of 'I' with the 'Body' - Sanyam and Health; Correct appraisal of physical needs, Meaning of prosperity in detail, Programs to ensure Sanyam and Health

Harmony in Family: Understanding values in human - Human relationship; Meaning of justice (Nine universal values in relationships), Program for its fulfillment to ensure mutual happiness, Trust and respect as the foundational values of relationship, Understanding the meaning of trust, Difference between intention and competence; Understanding the meaning of respect, Difference between respect and differentiation, The other salient values in relationship

UNIT – III (6)

Understanding Harmony with Society, Nature & Existence:

Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, Fearlessness (trust) and Co-existence as comprehensive human goals, visualizing a universal harmonious order in society – Undivided society; Universal order - From family to world family

Understanding the harmony in the nature: Interconnectedness and mutual fulfillment among the four orders of nature - Recyclability and self-regulation in nature

Whole Existence as Co-existence: Understanding existence as co-existence of mutually interacting units in all-pervasive space, Holistic perception of harmony at all levels of existence

UNIT – IV (6)

Implications of Holistic Understanding of Harmony on Professional Ethics:

Natural acceptance of human values, Definitiveness of ethical human conduct, Basis for Humanistic education, Humanistic constitution and Humanistic universal order

Competence in professional ethics: a) Ability to utilize the professional competence for augmenting universal human order b) Ability to identify the scope and characteristics of people friendly and eco-friendly production systems and c) Ability to identify and develop appropriate technologies and management patterns for above production systems

Case studies: Case studies of typical holistic technologies, Management models and production systems, Strategy for transition from the present state to Universal human order – a) At the level of individual: As socially and ecologically responsible engineers, technologists and managers b) At the level of society: As mutually enriching institutions and organizations

Textbook:

[1] R .R. Gaur, R. Sangal and G. P. Bagaria, *Human Values and Professional Ethics*, New Delhi: Excel Books, 2010.

Reference Books:

[1] A. Nagaraj, *JeevanVidya: Ek Parichaya*, Raipur: Jeevan Vidya Prakashan, Amarkantak, 2018.
[2] A.N. Tripathi, *Human Values*, 3rd ed. New Delhi: New Age International Publisher, 2019.
[3] M. Govindrajran, S. Natrajan & V.S. Senthil Kumar, *Engineering Ethics (includes Human Values)*, 12th ed. Haryana: PHI Learning Pvt. Ltd., 2011.
[4] Jayshree Suresh, B. S. Raghavan, *Human Values & Professional Ethics*, 4th ed. New Delhi: S. Chand & Co. Ltd., 2012.

Additional Resources:

[1] R.R Gaur, R Sangal, G P Bagaria, *A foundation course in Human Values and professional Ethics (Teacher's Manual)*, New Delhi: Excel books, 2010.
[2] A set of DVDs containing - Video of Teachers' Orientation Program - PPTs of Lectures and Practice Sessions (*Audio-visual material for use in the practice sessions*)

Course Learning Outcomes (COs):

On completion of this course, students will be able to…

CO1: interpret the importance of continuous happiness & prosperity through self exploration and imbibe skills to examine harmony

CO2: appraise the concept of sentience, distinguish between intention & competence and prioritize human values in relationships

CO3: build fearlessness & co-existence as comprehensive human goal and agree upon interconnectedness & mutual fulfillment

CO4: assess the understanding of harmony, adapt professional ethics and take part in augmenting universal human order

Course Articulation Matrix (CAM): U18MH501 / U18MH601 UNIVERSAL HUMAN VALUES - II															
CO		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	**U18MH501.1/ U18MH601.1**	-	-	-	-	-	1	-	2	1	1	-	2	**-**	**-**
CO2	**U18MH501.2/ U18MH601.2**	-	-	-	-	-	1	-	2	1	1	-	2	**-**	**-**
CO3	**U18MH501.3/ U18MH601.3**	-	-	-	-	-	1	-	2	1	1	-	2	**-**	**-**
CO4	**U18MH501.4/ U18MH601.4**	-	-	-	-	-	1	-	2	1	1	-	2	**-**	**-**
U18MH501/ U18MH601		-	**-**	-	**-**	-	**1**	-	**2**	**1**	**1**	**-**	**2**	-	**-**

U18OE602A/ U18OE701A DISASTER MANAGEMENT

Class: B. Tech. VI – Semester
B. Tech. VII – Semester

Branch(s): ME, CSE, IT & CSN
CE, EIE, EEE, ECE & ECI

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation	40
End Semester Examination	60

Course Learning Objectives (LOs):
This course will develop students' knowledge in/on

LO1: disaster types, its impacts & national policy on disaster management
LO2: prevention, preparedness and mitigation measures for different disasters, emergency support functions and relief camps
LO3: different types of vulnerability, macroeconomic, financial management of disaster and its related losses
LO4: disaster management for infrastructure, treatment of plants, geo spatial information in agriculture, multimedia technology in disaster risk management and training

UNIT – I (9)

Introduction & Principles of Disaster Management: Nature - Development, Hazards and disasters; Natural disasters - Earth quakes, Floods, Fire, Landslides, Cyclones, Tsunamis, Nuclear; Chemical dimensions and Typology of disasters - Public health disasters, National policy on disaster management

UNIT –II (9)

Prevention Preparedness and Mitigation Measures: Prevention, Preparedness & mitigation measures for various disasters, Post disaster reliefs and logistics management, Emergency support functions and their coordination mechanism, Resources and material management, Management of relief camp

UNIT– III (9)

Risk and Vulnerability: Building codes and land use planning, Social vulnerability, Environmental vulnerability, Macroeconomic management and sustainable development, Climate change, Risk rendition, Financial management of disaster and related losses

UNIT - IV (9)

Role of Technology in Disaster Management: Disaster Management for infrastructures, Taxonomy of infrastructure, Treatment plants and process facilities, Electrical sub stations, Roads and Bridges, Geo spatial information in agriculture, Drought assessment, Multimedia technology in disaster risk management and training

Textbook:

[1] Rajib shah and R.R Krishnamurthy, *Disaster management – Global Challenges and local solutions,* Hyderabad: Universities Press (India) Pvt. Ltd., 2009.

Reference Books:

[1] Satish Modh, *Introduction to Disaster management,* Bengaluru: Macmillan India Ltd., 2010.

Course Learning Outcomes (COs):

On completion of this course, students will be able to ...

CO1: classify the disasters and discuss natural & non-natural disasters, their implications, the institutional & legal framework for national policy on disaster management in India

CO2: identify mitigation strategies, preparedness & prevention measures and prioritizes the rescue & relief operations to reduce the impact of a disaster

CO3: list the vulnerable groups in disaster; examine the concepts of macroeconomic & sustainability & impact of disaster on development

CO4: discuss disaster management for infrastructure, utilize geospatial information in agriculture and apply multimedia technology for disaster risk management & training

Course Articulation Matrix (CAM): U18OE602A/ U18OE701A DISASTER MANAGEMENT															
CO		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS O1**	**PSO 2**
CO1	**U18OE602A/ U18OE701A.1**	-	-	-	-	-	2	2	1	-	-	1	1	-	-
CO2	**U18OE602A/ U18OE701A.2**	-	-	-	-	-	2	2	1	-	-	1	1	1	1
CO3	**U18OE602A/ U18OE701A.3**	-	-	-	-	-	2	2	1	-	-	1	1	-	-
CO4	**U18OE602A/ U18OE701A.4**	-	-	-	-	-	2	2	1	-	-	1	1	1	1
U18OE602A/ U18OE701A		**-**	**-**	-	-	-	**2**	**2**	**1**	**-**	**-**	**1**	**1**	**1**	1

U18OE602B/ U18OE701B PROJECT MANAGEMENT

Class: B. Tech. VI – Semester
B. Tech. VII – Semester

Branch(s): ME, CSE, IT & CSN
CE, EIE, EEE, ECE & ECI

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation	40
End Semester Examination	60

Course Learning Objectives (LOs):
This course will develop student's knowledge in/on…

LO1: role of project manager, organization and management functions
LO2: effective time &conflict management, ethics & professional responsibilities
LO3: project planning, scheduling and budgeting
LO4: *cost control, risk management and quality control techniques*

UNIT – I (9)

Project Management: Understanding project management, Role of project manager, Classification of projects, Project management growth, Definitions and Concepts, Organizational structures - Organizing and staffing the project management office and team; Management functions

UNIT – II (9)

Time and Conflict Management: Understanding time management, Time management forms, Effective time management, Stress and burnout, Conflict environment, Conflict resolution, Management of conflicts, Performance measurement, Financial compensation and rewards, Morality, ethics, Corporate culture, Professional responsibilities, Success variables, Working with executives

UNIT – III (9)

Project planning: General planning, Life-cycle phases, Proposal preparation, Project planning, The statement of work, Project specifications, Milestone schedules, Work breakdown structure, Executive role in planning, The planning cycle, Handling project phase outs and transfers, Stopping projects, Scheduling techniques - CPM and PERT, Pricing and estimating

UNIT – IV (9)

Cost and quality control: Understanding cost control, Earned Value Measurement System, Cost control problems, Methodology for trade-off analysis, Risk management process, Risk analysis, Risk responses, Monitoring and control of risks, Contract management, Quality management concepts, Cost of quality, Quality control techniques

Textbook:

[1] Harold Kerzner, *Project Management: A Systems Approach to Planning, Scheduling and Controlling*, 10th ed. Hoboken, NJ: John Wiley & Sons Inc., 2009.

Reference Books:

[1] Jack R Meredith & Samuel J mantel Jr., *Project Management: A Managerial Approach*, 8th ed. Hoboken, NJ: John Wiley & Sons Inc., 2012.
[2] John M Nicholas & Herman Steyn, *Project Management for Business, Engineering and Technology*, 4th ed. Abingdon, UK: Taylor & Francis, 2012.

[3] Adedeji B. Badiru, *Project Management: Systems, Principles and Applications*, Florida, USA: CRC Press, 2012.

Course Learning Outcomes (COs):
On completion of the course, the student will be able to…

CO1: evaluate the desirable characteristics of effective project managers
CO2: plan to resolve issues in conflicting environments
CO3: apply appropriate approaches to plan a new project in-line with project schedule & suitable budget
CO4: estimate the risks to be encountered in a new project and apply appropriate techniques to assess & improve ongoing project performance

Course Articulation Matrix (CAM): U18OE602B/ U18OE701B PROJECT MANAGEMENT															
CO		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS O1**	**PSO 2**
CO1	**U18OE602B/ U18OE701B.1**	-	-	-	-	-	1	-	-	-	1	1	-	1	1
CO2	**U18OE602B/ U18OE701B.2**	-	-	-	-	-	1	-	2	-	1	1	-	1	1
CO3	**U18OE602B/ U18OE701B.3**	1	1	-	-	-	1	-	-	-	1	1	-	1	1
CO4	**U18OE602B/ U18OE701B.4**	1	1	-	-	-	1	-	-	-	1	1	-	1	1
U18OE602B/ U18OE701B		**1**	**1**	**-**	**-**	**-**	**1**	**-**	**2**	**-**	**1**	**1**	**-**	**1**	**1**

U18OE602C/ U18OE701C PROFESSIONAL ETHICS IN ENGINEERING

Class: B. Tech. VI – Semester
B. Tech. VII – Semester

Branch(s): ME, CSE, IT & CSN
CE, EIE, EEE, ECE & ECI

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation	40
End Semester Examination	60

Course Learning Objectives (LOs):

This course will develop students' knowledge in/on …

LO1: human values and engineering ethics
LO2: professionalism, theory of virtues and code of ethics
LO3: safety & risk benefit analysis, professional and intellectual property rights
LO4: environmental & computer ethics and various roles of engineers in a company

UNIT – I (9)

Human Values: Morals, Values & ethics, Integrity, Work ethic, Service learning, Civic virtue, Respect for others, Living peacefully, Caring, Sharing, Honesty, Courage, Valuing time, Co-operation, Commitment, Empathy, Self-confidence, Character, Spirituality

Engineering Ethics: Senses of "Engineering Ethics", Variety of moral issues, Types of inquiry, Moral dilemmas, Moral autonomy, Kohlberg's theory, Gilligan's theory - Consensus and controversy

UNIT – II (9)

Profession and professionalism: Profession and its attributes, Models of professional roles

Theory of Virtues: Definition of virtue and theories of virtues, Self-respect, Responsibility and senses, Modern theories of virtues, Uses of ethical theories

Engineering as social experimentation: Engineering as experimentation, Engineers as responsible experimenters, Codes of ethics, A balanced outlook on law, The challenger case study

UNIT –III (9)

Safety, Responsibilities and Rights: Safety and risk, Assessment of safety and risk, Risk benefit analysis and reducing risk - Three Mile Island and Chernobyl case studies; Collegiality and loyalty, Respect for authority, Collective bargaining, Confidentiality, Conflicts of interest, Professional rights, Employee rights, Intellectual Property Rights (IPR), Discrimination

UNIT – IV (9)

Global Issues: Multinational corporations - Environmental ethics, Computer ethics, Engineers as managers, Consulting engineers, Engineers as expert witnesses and advisors, Moral leadership, Sample code of ethics (*Specific to a particular engineering discipline*)

Textbook:

[1] D.R. Kiran, *Professional Ethics and Human Values*, New York: McGraw Hill, 2013.

Reference Books:

[1] Govindarajan. M, Natarajan. S, Senthil Kumar. V.S, *Professional Ethics and Human Values,* New Delhi: Prentice Hall of India, 2013.

[2] Mike Martin and Roland Schinzinger, *Ethics in Engineering*, 4th ed. New York: McGraw Hill, 2014.

[3] Charles D. Fleddermann, *Engineering Ethics*, 4th ed. New Delhi: Prentice Hall, 2004.

Course Learning Outcomes (COs):

On completion of this course, students will be able to…

CO1: identify the need for human values, morals & ethics and apply Gilligan's & Kohlberg's theories for morale development

CO2: identify the desired characteristics of a professional & the need for code of ethics & balanced outlook on law

CO3: estimate the safety margin & threshold level and describe the procedure for obtaining a patent

CO4: analyze the role of engineer in multinational companies as an advisor, consultant & manager

Course Articulation Matrix (CAM): U18OE602C/ U18OE701C PROFESSIONAL ETHICS IN ENGINEERING

CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO 2
CO1	**U18OE602C/ U18OE701C.1**	-	-	-	-	-	1	-	2	1	-	-	1	-	-
CO2	**U18OE602C/ U18OE701C.2**	-	-	-	-	-	1	-	2	1	-	-	1	-	-
CO3	**U18OE602C/ U18OE701C.3**	-	-	-	-	-	1	-	2	1	-	-	1	1	1
CO4	**U18OE602C/ U18OE701C.4**	-	-	-	-	-	1	-	2	1	-	-	1	1	1
U18OE602C/ U18OE701C		**-**	**-**	**-**	**-**	**-**	**1**	**-**	**2**	**1**	**-**	**-**	**1**	**1**	**1**

U18OE602D/ U18OE701D RURAL TECHNOLOGY AND COMMUNITY DEVELOPMENT

Class: B. Tech. VI – Semester
B. Tech. VII – Semester

Branch(s): ME, CSE, IT & CSN
CE, EIE, EEE, ECE & ECI

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation	40
End Semester Examination	60

Course Learning Objectives (LOs):

This course will develop students' knowledge in/on...

LO1: building technologies, modern agricultural implements and food processing methods
LO2: medicinal & aromatic plants to fulfill the needs of pharmaceutical industries and rural energy for eradication of drudgery
LO3: purification of drinking water, rain water harvesting and employment generating technologies in rural areas
LO4: objectives & characteristics of community development, need for community mobilization and approaches for community organization

UNIT – I (9)

Technologies and Process: Building materials and components - Micro concrete roofing tiles, Water & fire proof mud walls and thatch, Red mud/rice husk cement, Types of bricks, Ferro-cement water tanks and other products, Cement blocks, Preservation of mud walls, Agricultural implements - Naveen sickle, Animal drawn digger, Grubber weeder, Self propelled reaper, Seed drill, Improved bakhar

Food Processing: Fruit and vegetable preservation - Process flow sheet, Scale of operation, Economic feasibility, Source of technology; Soya milk - Process, Economics; Dehydration of fruits and vegetables, Cultivation of oyster mushroom - Preparation of beds, Spawning, Removal of bags for production of mushrooms, Harvesting and marketing, Economics, Process flow sheet, Source of technology

UNIT – II (9)

Medicinal and Aromatic plants: Plants and its use, Aromatic plants, Cymbopogons, Geranium, Manufacturing of juice, Gel and powder, Rural energy - Cultivation ofjatrophacurcus and production of biodiesel, Low cost briquetted fuel, Solar cookers and oven, Solar drier, Bio-mass gasifier

Bio-fertilizers: Introduction, Vermicompost, Improvement over traditional technology/process, Techno economics, Cost of production, Utilization of fly ash for wasteland development and agriculture

UNIT – III (9)

Purification of Drinking water: Slow sand filtration unit, Iron removal plant connected to hand pump, Chlorine tablets, Pot chlorination of wells, Solar still, Fluoride removal, Rain water harvesting through roof top, Rain water harvesting through percolation tank, Check dams, Recharging of dug wells

Employment Generating Technologies: Detergent powder and cake - Process, Process for liquid detergent, Carcass utilization - Improvement over traditional technology, Flow chart, Process, Capital investment; Indigo blue - Dye, Organic plant production, Dye extraction

techniques, Aspects of indigo market, Economics; Modernization of bamboo based industries - Process for bamboo mat making, Machinery, Products, Agarbatti manufacturing; Vegetable tanning of leathers - Raw material, Soaking, Liming, Reliming, Deliming, Pretanning, Malani, Setting, Yield

UNIT – IV (9)

Community Development: Community organization - Definition, Need, Functions, Principles, Stages; Community development - Definition, Need, Objectives, Characteristics, Elements, Indicators; Differences between community organization and community development

Community Mobilization: Need, Benefits, Preparing, Initial contact with community, Coordinating, Functions of the community, Challenges, Techniques for mobilizing community, Community contributions, Leadership and capacity building, Community participation, Role of community worker in community mobilization, Models of community organization practice - Local development model, Social planning model, Social action model, Approaches to community organization

Textbooks:

[1] M.S. Virdi, *Sustainable Rural Technology*, New Delhi: Daya Publishing House, 2009.
[2] Asha Ramagonda Patil, *Community Organization and Development: An Indian Perspective*, New Delhi: Prentice Hall of India, 2013.

Reference Books:

[1] Punia Rd Roy, *Rural Technology*, New Delhi: Satya Prakashan Publishers, 2009.
[2] S.B. Verma, S.K. Jiloka, Kannaki Das, *Rural Education and Technology*, New Delhi: Deep & Deep Publications Pvt. Ltd., 2006.
[3] Edwards, Allen David and Dorothy G.Jones, *Community and Community Development*, The Hague, Netherlands: Mouton, 1976.
[4] Lean, Mary, *Bread, Bricks and Belief: Communities in Charge of Their Future*, West Hartford, US: Kumarian Press, 1995.
[5] Heskin, Allen David, *The Struggle for Community*, Colorado, US: West View Press, 1991
[6] Clinard, Marshall Barron, *Slums and Community Development: Experiments in Self- Help*, Mumbai: Free Press, 1970.

Course Learning Outcomes (COs):

On completion of this course, students will be able to…

CO1: discuss various building technologies, modern agricultural implements and food processing methods which can be implemented in rural areas
CO2: identify major medicinal plants that are required for pharmaceutical companies & alternative fuel that meets substantial oil need in the country and the need and usage of bio- fertilizers
CO3: analyze several cost effective technologies for purification of water, rain water harvesting techniques for collection & storage of rain water and examine the employment generating technologies in tribal/ rural areas
CO4: distinguish between community organization and community development and identify techniques for community mobilization & approaches to community organization for social change

Course Articulation Matrix (CAM): U18OE602D/U18OE701D RURAL TECHNOLOGY AND COMMUNITY DEVELOPMENT															
CO		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	**U18OE602D/ U18OE701D.1**	**-**	**-**	1	**-**	**-**	1	2	**-**	**-**	**-**	**-**	1	1	1
CO2	**U18OE602D/ U18OE701D.2**	**-**	**-**	1	**-**	**-**	1	2	**-**	**-**	**-**	**-**	1	1	1
CO3	**U18OE602D/ U18OE701D.3**	**-**	**-**	1	**-**	**-**	1	2	**-**	**-**	**-**	**-**	1	1	1
CO4	**U18OE602D/ U18OE701D.4**	**-**	**-**	-	**-**	**-**	1	2	**-**	**-**	**-**	**-**	-	-	-
U18OE602D/ U18OE701D		**-**	**-**	**1**	**-**	**-**	**1**	**2**	**-**	**-**	**-**	**-**	**1**	1	1

U18ME 603A **FINITE ELEMENT METHODS**

Class: B. Tech. VI-Semester **Branch:** Mechanical Engineering (ME)

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation	40 marks
End Semester Exam	60 marks

Course Learning Objectives(LOs):

This course will develop students' knowledge in/on…

LO1: fundamentals of finite element method, convergence criteria; interpolation function and isoparametric formulation

LO2: finite element formulation of one dimensional bar elements and truss elements

LO3: finite element formulation of beam elements and computer implementation of finite element method

LO4: applications of finite element method in heat transfer and structural dynamic analysis

UNIT-I (9)

Introduction: Finite Element Method-basic concept and general description, comparison with other methods of analysis, engineering applications, advantages and limitations; discretization of the domain, element stiffness matrix and properties, assembly of global stiffness matrix and load vector, formulation of finite element equations, types and treatment of boundary conditions, convergence of finite element solutions

Interpolation Functions and Isoparametric Formulation: Interpolation function – definition and characteristics, polynomial form of interpolation functions, selection of the order of the polynomial, derivation of finite element equations using principle of virtual work & Rayleigh-Ritz method; Isoparametric formulation–definition and concept, sub parametric, super parametric elements, natural coordinate system, mapping of elements

UNIT-II (9)

One-Dimensional Problems: Bar elements – element stiffness matrix, assembly of global stiffness matrix and load vector; application of boundary conditions, solution for displacements, reactions, stresses, temperature effects and interpolation functions

Truss Elements: Plane truss, local and global coordinate systems, element stiffness matrix, stress calculations and temperature effects

UNIT-III (9)

Beam Elements: Derivation of element stiffness matrix, finite element formulation, load vector, boundary considerations; slope, deflection, reactions, and stresses for cantilever and simply supported beams with point load and UDL, interpolation functions

Computer Implementation of Finite Element Method: Pre processing – model definition, element type and material property definitions, types of analysis, loading and boundary conditions; meshing techniques – free and mapped meshing, quality checks; processing, post processing – interpretation and validation of results, data interpretation

UNIT-IV (9)

Applications in Heat Transfer: Steady state heat transfer, one-dimensional conduction and convection, one-dimensional heat transfer in fins

Structural Dynamics: Dynamic equations of motion, element mass matrices, evaluation of Eigen values and Eigen vectors

Textbook:

[1] Chandrupatla T. R. and Belegundu A. D., *Introduction to Finite Elements in Engineering*, 4th ed. New Delhi: Pearson Education India, 2015. *(Chapters 1 to 5, 7 and 8)*

Reference Books:

[1] Singiresu S. Rao, *The Finite Element Method in Engineering*, 6th ed. Massachusetts: Elsevier Butterworth–Heinemann, 2017.
[2] David V. Hutton, *Fundamentals of Finite Element Analysis*, New Delhi: Tata McGraw-Hill India, 2017.
[3] Robert D. Cook, *Concepts and Applications of Finite Element Analysis*, 4th ed. New Delhi: Wiley India, 2007.
[4] J.N. Reddy, *Introduction to the Finite Element Method,* 4th ed. New Delhi: McGraw-Hill, 2018.
[5] Bathe K. J., *Finite Element Procedures*, 2nd ed. New Jersey: Prentice-Hall Inc., 2016.
[6] P. Seshu, *Finite Element Analysis,* 10th ed. New Delhi: Prentice Hall of India, 2012.
[7] S. Moaveni, *Finite element analysis, Theory and Application with ANSYS*, 4th ed. New Jersey: Prentice Hall, 2014.

Course Learning Outcomes (COs):

On completion of this course, students will be able to…

CO1: justify the sequential procedure for solving boundary value field problems in engineering
CO2: analyze one-dimensional bar element & plane truss problems to determine displacements, reactions & stresses
CO3: determine slope, deflections & stresses of statically determinate beam problems and assess the different stages in computer implementation of finite element method.
CO4: analyze conduction & convection in slabs, fins & un-damped free vibrations of structures

Course Articulation Matrix (CAM):U18ME605A FINITE ELEMENT METHODS

CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	P O	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	**U18ME603A.1**	2	2	2	1	-	-	-	-	-	1	-	1	2	1
CO2	**U18ME603A.2**	2	2	2	1	-	-	-	-	-	1	-	1	2	1
CO3	**U18ME603A.3**	2	2	2	1	1	-	-	-	-	1	-	1	2	1
CO4	**U18ME603A.4**	2	2	2	1	-	-	-	-	-	1	-	1	2	1
U18ME603A		**2**	**2**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**1**	**-**	**1**	**2**	**1**

U18ME603B MECHANICAL VIBRATIONS AND CONDITION MONITORING

Class: B.Tech. VI-Semester **Branch:** Mechanical Engineering (ME)

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation	40 marks
End Semester Examination	60 marks

Course Learning Objectives (LOs):
This course will develop student's knowledge in/on…
LO1: causes and effects of vibration in mechanical systems, Fourier series analysis
LO2: vibration measuring instruments, critical speed
LO3: two degrees of freedom systems and vibration absorber
LO4: condition monitoring and methods

UNIT-I (9)

Single Degree of Freedom Systems: Introduction, causes and effects of vibration; characteristics of vibration-displacement, velocity, acceleration and phase; beats phenomenon; coulomb damping, rate of decay from energy considerations, comparison between viscous and coulomb damping; Fourier series analysis-evaluation of coefficients

UNIT-II (9)

Vibration Measuring Instruments: Seismic instruments-mechanical arrangement, electrical arrangement, vibrometers, velocity meters & accelerometers, phase distortion.

Critical speed: Critical speed-light vertical shaft with single disc without damping, light flexible shaft carrying single rotor with damping, shaft carrying multiple discs without damping, secondary critical speed.

UNIT-III (9)

Two Degree Freedom Systems: Differential equations of motion of 2dof system, stiffness and flexibility, influence coefficients, static and dynamic coupling, Eigen values and Eigen vectors, principal modes, vibration absorber- undamped, centrifugal pendulum.

UNIT-IV (9)

Condition Monitoring: Various methods of maintenance, need and importance of condition monitoring, commonly measured operating characteristics, typical vibration sources; monitoring methods- spectroscopic oil analysis programme (SOAP), ferrography, time domain, frequency domain, FFT analyzers, Fourier analysis, vibration signature, vibration severity criteria.

Textbooks:

[1] R.Venkata Chalam, *Mechanical Vibrations*, New Delhi: PHI, 2014. *(Chapters 1,2,6,10,11 and 13)*

[2] Collacott, R.A., *Mechanical Fault Diagnosis and Condition Monitoring*, London: Chapman and Hall, 2012. *(Chapters 4,5,6 and 9)*

Reference Books:

[1] Groover, *Mechanical Vibrations*, 6th ed. New Delhi: Nemchand and Bros., 1996.

[2] John S. Mitchell, *Introduction to Machinery Analysis and Monitoring*, 2nd ed. New Delhi: Pennwell books, 1993.

[3] S. Graham Kelly, *Fundamentals of Mechanical Vibrations*, 2nd ed. New Delhi: McGraw-Hill, Singapore, 1993.

[4] A. G. Ambekar, *Mechanical Vibrations and Noise Engineering*, New Delhi: Prentice Hall of India, 2006.

Course Learning Outcomes (COs):

On completion of this course, students will be able to…

CO1: analyze vibration using Fourier series, beats phenomenon & rate of decay.
CO2: categorize vibration measuring instruments and determine critical speeds.
CO3: determine influence coefficients & draw principal modes.
CO4: apply condition monitoring methods for recognition and identify the defects in machinery

Course Articulation Matrix (CAM): U18ME603B MECHANICAL VIBRATIONS AND CONDITION MONITORING

CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	**U18ME603B.1**	2	2	2	-	-	-	-	-	-	-	-	1	2	1
CO2	**U18ME603B.2**	2	2	2	-	-	-	-	-	-	-	-	1	2	1
CO3	**U18ME603B.3**	2	2	2	-	-	-	-	-	-	-	-	1	2	1
CO4	**U18ME603B.4**	2	2	-	1	-	-	-	-	-	-	-	1	2	1
U18ME603B		**2**	**2**	**2**	1	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	2	1

U18ME603C COMPOSITE MATERIALS

Class: B. Tech. VI -Semester **Branch:** Mechanical Engineering (ME)

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation	40 marks
End Semester Examination	60 marks

Course Learning Objectives(LOs):
This course will develop students'knowledge in/on…

LO1: composite material properties and applications
LO2: polymer matrix composites, manufacturing and applications
LO3: metal matrix composites, manufacturing and applications
LO4: ceramic matrix composites, manufacturing and applications

UNIT- I (9)

Introduction to Composites: Fundamentals, need, Enhancement of properties, classification– Polymer Matrix Composites (PMC), Metal Matrix Composites (MMC), Ceramic Matrix Composites (CMC); Reinforcement – Particle reinforced composites, fibre reinforced composites; applications of various types of composites

UNIT-II (9)

Polymer Matrix Composites: Polymer matrix resins-thermosetting resins, thermoplastic Resins; reinforcement fibres – rovings, woven fabrics, non woven random mats – different types of fibres; PMC manufacturing processes - hand layup processes, spray up processes, compression moulding, reinforced reaction injection moulding, resin transfer moulding, pultrusion, filament winding, injection moulding; Fibre Reinforced Plastics (FRP), Glass Fibre Reinforced Plastics (GRP)

UNIT-III (9)

Metal Matrix Composites: Characteristics, types, alloy vs. MMC, advantages, limitations, metal matrix reinforcements – particles, fibres; effect of reinforcement - volume fraction, rule of mixtures; processing– powder metallurgy process, diffusion bonding, stir casting, squeeze casting

UNIT-IV (9)

Ceramic Matrix Composites: Engineering ceramic materials – properties, advantages, limitations; monolithic ceramics –need for CMC, ceramic matrix – types, oxide ceramics, non oxide ceramics, aluminum oxide, silicon nitride; reinforcements – particles, fibres and whiskers

Carbon / Carbon Composites: Advantages, limitations; Carbon fibre – chemical vapour deposition of carbon on carbon fibre preform, SOL gel technique; applications

Textbook:

[1] Chawla K.K., Composite *Materials*, 4th ed. Springer – Verlag, 2019. (*Chapters1,2,3,5,6,7&8*)

Reference Books:

[1] Agarwal B. D. and Broutman L. J., *Analysis and Performance of Fiber Composites*, 4th ed. John Wiley & Sons, 2017
[2] Strong A.B., *Fundamentals of Composite Manufacturing*, 2nd ed. SME, 2007.

[3] Sharma S.C., *Composite materials*, Narosa Publications, 2000.
[4] Mathews F.L. and Rawlings R.D., *Composite materials: Engineering and Science*‖, London: Chapman and Hall, 1994.
[5] Krishnan K., Chawla *Composite Materials Science and Engineering*, Springer (India) Pvt. Ltd., 2009
[6] P. K. Mallick, *Fiber Reinforced Composite materials, Manufacturing and Design*, Newyork: CRC Press, Taylor and Francis Group, 2010.

Course Learning Outcomes (COs):
On completion of this course, students will be able to…

CO1: categorize composite materials and explain their applications for different fields
CO2: distinguish different manufacturing methods of polymer matrix composites
CO3: distinguish metal matrix composite material properties and recommend a suitable composite material for the particular application
CO4: analyze ceramic matrix composites, carbon/carbon composite material & their properties.

Course Articulation Matrix (CAM):U18ME603C COMPOSITE MATERIALS															
CO		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	**U18ME603C**.1	2	2	2	1	-	-	1	-	-	-	-	1	2	1
CO2	**U18ME603C** 2	2	2	2	1	-	-	1	-	-	-	-	1	2	1
CO3	**U18ME603C**.3	2	2	2	1	-	-	1	-	-	-	-	1	2	1
CO4	**U18ME603C**.4	2	2	2	1	-	-	1	-	-	-	-	1	2	1
U18ME603C		**2**	**2**	**2**	**1**	**-**	**-**	**1**	**-**	**-**	-	**-**	1	**2**	**1**

U18ME604 HEAT TRANSFER

Class: B. Tech. VI-Semester **Branch:** Mechanical Engineering (ME)

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation	40 marks
End Semester Exam	60 marks

Course Learning Objectives (LOs):

This course will develop students' knowledge in/on…

LO1: modes of heat transfer, conduction and extended surfaces

LO2: lumped systems and forced convection heat transfer

LO3: free convection, boiling, condensation and heat exchangers

LO4: thermal radiation and radiative heat exchange between two bodies

UNIT – I (9)

Introduction: Basic modes of heat transfer; Fourier's law of heat conduction, Newton's law of cooling, Stefan-Boltzmann's law of thermal radiation; thermal conductivity and thermal resistance

Conduction: General heat conduction equation in cartesian, cylindrical and spherical coordinate systems; thermal diffusivity; boundary and initial conditions; one-dimensional steady state heat conduction without heat generation in plane walls, cylinders and spheres; composite systems; critical thickness of insulation; one-dimensional steady state heat conduction with internal heat generation in plane walls, cylinders and spheres

Extended Surfaces: Types and applications; one-dimensional heat conduction equation for uniform cross-sectional area - infinitely long fin and fin of finite length with insulated tip; efficiency and effectiveness

UNIT – II (9)

Transient Heat Conduction: Definition of lumped system; governing differential equation for lumped system; significance of Biot and Fourier number; time constant and response of thermocouple

Convection: Mechanisms of free and forced convective heat transfer; physical significance of dimensionless parameters - Reynolds, Prandtl, Nusselt, Stanton, Peclet, Grashof and Rayleigh's number; dimensional analysis - Buckingham's π theorem for forced and free convection

Forced Convection:

External Flow - Concepts of hydrodynamic and thermal boundary layers; use of empirical correlations for convective heat transfer - flat plate and cylinders

Internal Flow - Concepts of hydrodynamic and thermal boundary layers; use of empirical correlations for convective heat transfer - horizontal pipe

UNIT – III (9)

Free Convection: Development of hydrodynamic and thermal boundary layers along a vertical plate; use of empirical correlations for convective heat transfer – vertical plate

Boiling and Condensation: Heat transfer accompanied by phase change; regimes of pool boiling and flow boiling; film and drop wise condensation

Heat Exchangers: Classification - parallel flow, counter flow and cross flow heat exchangers, condensers and evaporators; logarithmic mean temperature difference; NTU-effectiveness

UNIT – IV (9)

Thermal Radiation: Definitions and concepts - monochromatic and total emissive powers; absorptivity, reflectivity and transmissivity; black and gray surfaces; emissivity; Kirchhoff's law, Planck's distribution law, Wein's displacement law, Lambert's cosine law

Radiative Heat Exchange Between Two Bodies: configuration factor; large parallel plates, equal parallel and opposite squares, rectangular plates perpendicular to each other; heat exchange between large parallel plates of different emissivity; gray body radiation - large parallel plates, concentric cylinders and spheres, small body in a large enclosure, concept of shape and surface resistances, re-radiating surfaces, radiation shields

Textbook:

[1] R. C. Sachdeva, *Fundamentals of Engineering Heat and Mass Transfer,* 5th ed. New Delhi: New Age International Pvt. Ltd., 2015. *(Chapters 1, 2, 3, 5, 6, 7, 8, 9, 10,11,12)*

Reference Books:

[1] J. P. Holman and Souvik Bhattacharyya, *Heat Transfer*, 10th ed. New Delhi: McGraw Hill Education (India) Pvt. Ltd., 2011.

[2] Frank P. Incropera, David P. Dewitt, Theodore L. Bergman and Adrienne S. Lavine, *Incropera's Principles of Heat and Mass Transfer*, New Delhi: Wiley India Pvt. Ltd., 2018.

[3] Yunus A Cengel and Afshin J Ghajar, *Heat and Mass Transfer-Fundamentals and Applications*, 5th ed. New Delhi: McGraw Hill, 2015.

[4] P.K. Nag, *Heat and Mass Transfer,* 3rd ed. New Delhi: Tata McGraw Hill Education Pvt. Ltd., 2011.

[5] P.S. Ghoshdastidar, *Heat Transfer*, 2nd ed., New Delhi*:* Oxford University Press, 2012.

[6] S. K. Som, *Introduction to Heat Transfer*, New Delhi: PHI Learning Pvt. Ltd., 2008.

[7] Sarit K. Das, *Fundamentals of Heat and Mass Transfer,* New Delhi: Narosa Publishing House Pvt. Ltd., 2010.

Data Book:

[1] C. P. Kothandaraman and S. Subramanian, *Heat and Mass Transfer Data Book*, 9th ed. New Delhi: New Age International Pvt. Ltd., 2018.

Note: Heat and Mass Transfer Data Books are permitted into the exam hall.

Course Learning Outcomes (COs):

On completion of this course, students will be able to…

CO1: analyze heat conduction problems for various geometries
CO2: analyze transient problems using the lumped capacitance method & forced convection problems
CO3: analyze free convection problems, boiling, condensation and design heat exchangers
CO4: estimate the radiation heat transfer between surfaces

Course Articulation Matrix (CAM): U18ME604 HEAT TRANSFER

CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	**U18ME604.1**	2	2	2	1	-	-	-	-	-	1	-	1	1	1
CO2	**U18ME604.2**	2	2	2	1	-	-	-	-	-	1	-	1	1	1
CO3	**U18ME604.3**	2	2	2	1	-	-	-	-	-	1	-	1	1	1
CO4	**U18ME604.4**	2	2	2	1	-	-	-	-	-	1	-	1	1	1
U18ME604		2	2	2	1	-	-	-	-	-	1	-	1	1	1

U18ME605 INTERNAL COMBUSTION ENGINES AND GAS TURBINES

Class: B. Tech. VI-Semester **Branch**: Mechanical Engineering (ME)

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation	40 marks
End Semester Exam	60 marks

Course Learning Objectives (LOs):

This course will develop students' knowledge in /on…

LO1: classification of engines and their performance parameters
LO2: fuel supply and ignition systems, developments in IC engines
LO3: rotary, centrifugal and axial flow compressors
LO4: classification and performance of gas turbines

UNIT-I [9]

Introduction: Basic engine components and nomenclature; classification of engines; Working principle of two and four stroke SI & CI engines; valve and port timing diagrams

Testing of IC Engines: Measurement of brake power, friction power and indicated power; indicator diagram, fuel and air consumption; performance parameters–mean effective pressure, specific fuel consumption, air-fuel ratio, mechanical, volumetric and thermal efficiencies; heat balance sheet; effect of clearance volume on volumetric efficiency

UNIT-II [9]

Fuel Supply Systems: SI Engines - carburetion, mixture requirements; calculation of air fuel ratio; types of carburetors; CI Engines - functional requirements of an injection system, injection pump and injector nozzle

Ignition: Requirements of an ignition system; types of ignition systems-battery ignition system, magneto ignition system, transistorized coil ignition system and capacitance discharge ignition system

Supercharging & Scavenging: Effect of supercharging on thermal efficiency; methods of supercharging and scavenging

Developments in IC Engines: Working principles of EGR, MPFI, CRDI and HCCI

UNIT-III [9]

Rotary Compressors: Classification; comparison between reciprocating and rotary compressors; Roots blower, Vane type and Screw compressors

Centrifugal Compressors: Working principle; velocity diagram; degree of reaction; losses and efficiency of centrifugal compressor; slip and slip factor; work factor and pressure coefficient; effect of impeller blade shape on compressor performance; choking and surging

Axial Flow Compressors: Working principle; velocity triangles; degree of reaction; polytropic work input and efficiency; flow and work coefficient, pressure coefficient; losses in axial flow compressor; surging, choking and stalling; comparison between centrifugal and axial flow compressors

UNIT-IV [9]

Gas Turbines: Classification; comparison between open and closed cycle gas turbine; deviation of actual gas turbine cycle from Brayton cycle-Isentropic efficiencies of compressor and gas turbine; methods of improving thermal efficiencies of gas turbine power plant - reheating, regeneration and inter cooling; applications

Textbooks:

[1] V. Ganesan, *Internal Combustion Engines*, 4th ed. New Delhi: Tata McGraw-Hill, 2013. *(Chapters 1, 2, 7 to 10,15,16,18 and 19)*

[2] Mahesh M Rathore, *Thermal Engineering*, New Delhi: Mc Graw Hill, 2010. *(Chapters 24 ,25,26 and 27)*

Reference Books:

[1] J.B. Heywood, *Internal Combustion Engine Fundamentals*, revised ed., New Delhi: McGraw-Hill, 1988.

[2] R.Colin. Ferguson, T. Allan. Kirkpatrick, *Internal Combustion Engines: Applied Thermo sciences*, 2nd ed. New Delhi: Wiley, 2001.

[3] H.N. Gupta, *Fundamentals of Internal Combustion Engines*, 2nd ed. New Delhi*: PHI Pvt. Ltd*., 2012.

[4] R.K. Rajputh, *Text book on Internal Combustion Engines*, New Delhi: Laxmi publication Pvt. Ltd., 2013

Course Learning Outcomes (COs):

On completion of this course, students will be able to…

CO1: analyze IC engines working & their performance parameters
CO2: distinguish the fuel supply, ignition systems & developments in IC engines
CO3: determine the performance parameters of rotary, centrifugal & axial flow compressors
CO4: elaborate various methods to improve efficiency of gas turbine

Course Articulation Matrix (CAM): U18ME605 INTERNAL COMBUSTION ENGINES & GAS TURBINES

CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	U18ME605.1	2	2	1	1	-	-	1	-	-	-	-	1	2	1
CO2	U18ME605.2	2	2	1	1	-	-	1	-	-	-	-	1	2	1
CO3	U19ME605.3	2	2	1	1	-	-	1	-	-	-	-	1	2	1
CO4	U18ME605.4	2	2	1	1	-	-	1	-	-	-	-	1	2	1
U18ME605		**2**	**2**	**1**	**1**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**1**	**2**	**1**

U18ME606 THEORY OF METAL CUTTING

Class: B. Tech. VI- Semester

Branch: Mechanical Engineering (ME)

Teaching Scheme:

L	T	P	C
3	--	-	3

Examination Scheme:

Continuous Internal Evaluation	40 marks
End Semester Examination	60 marks

Course Learning Objectives(LOs):

This course will develop students' knowledge in/on…

LO1: tool materials, tool geometry and mechanism of chip formation
LO2: mechanics of metal cutting, measurement of cutting forces and temperature
LO3: tool wear, tool life, machinability and economics of machining
LO4: principles and applications of modern machining processes.

UNIT-I (9)

Tool Materials: Types, properties and applications.

Tool Geometry: Geometry of single point cutting tool; Geometry of multi point cutting tools-plain milling cutter and twist drill; Types of reference system–ASA, ORS & NRS and their relationships

Mechanism of Chip Formation: Orthogonal and Oblique cutting; Chip formation-types of chips; factors affecting the chip formation; Chip geometry-shear plane model, determination of shear angle, strain and strain rate; velocity relationships

UNIT-II (9)

Mechanics of Metal Cutting: Forces in chip formation; Merchant's analysis of metal cutting processes – various forces, power and specific energy; Ernst and Merchant analysis, theory of Lee and Shaffer

Measurement of Cutting Forces and Temperature: Dynamometer-principle and construction of two component lathe tool dynamometer; Source of heat in metal cutting- temperature zones, estimation of average cutting temperature, measurement of cutting temperature- tool work thermocouple

UNIT-III (9)

Tool Wear and Tool Life: Types of tool Wear; Mechanisms of tool wear; Tool life – tool life criteria, relation between cutting speed and tool life; variables effecting tool life

Machinability: Criterion for machinability; variables effecting machinability

Economics of Machining: Types of costs; determination of optimum cutting speed for maximum production rate and minimum cost criteria

Cutting Fluids: Functions, properties, types and selection

UNIT-IV (9)

Modern Machining Processes: Classification; principle and application of Ultra Sonic Machining, Abrasive Jet Machining, Electric Discharge Machining, Electro Chemical Machining, Electron Beam Machining, Laser Beam Machining and Plasma Arc Machining

Textbooks:

[1] G. K. Lal, *Introduction to Machining Science*, 3rd ed. New Delhi: New Age International Publishers, 2007. *(Chapters 2 to 8)*

[2] P.C.Sharma, A *Text Book Production Engineering*, 8th revised ed. New Delhi: S Chand & Company, 2009. *(Chapters 6, 7 and 9)*

Reference Books:

[1] A. Bhattacharya, *Metal Cutting Theory and Practice*, Calcutta: Central Book Publishers, 1984.
[2] Amitabha Ghosh and A K Mallik, *Manufacturing Science*, 2nd ed. New Delhi: Associated East West Press Pvt. Ltd., 2010.
[3] Geoffrey Boothroyd and Winston A. Knight, *Fundamentals of Machining & Machine Tools*, 3rd ed. Newyork: CRC press, 2005.
[4] V K Jain, *Advanced Machining Processes*, Mumbai: Allied Publishers, 2010.

Course Learning Outcomes (COs):
On completion of this course, students will be able to…

CO1: categorize tool materials, draw tool geometry in various reference systems and interpret chip formation process
CO2: analyze Merchant's circle and measure various cutting forces & temperature
CO3: determine tool wear, tool life, machinability & optimum cutting speed for maximum production rate & minimum cost criteria
CO4: distinguish principles & applications of various modern machining processes

Course Articulation Matrix (CAM): U18ME606 THEORY OF METAL CUTTING														
CO		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	**U18ME606.1**	2	2	-	-	-	-	-	-	-	-	-	1	2	1
CO2	**U18ME606.2**	2	2	2	-	-	-	-	-	-	-	-	1	2	1
CO3	**U18ME606.3**	2	2	2	-	-	-	-	-	-	-	-	1	2	1
CO4	**U18ME606.4**	2	-	-	-	-	-	-	-	-	-	-	1	2	1
U18ME606		**2**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**2**	**1**

U18ME607 HEAT TRANSFER LABORATORY

Class: B. Tech. VI-Semester **Branch:** Mechanical Engineering (ME)

Teaching Scheme:

L	T	P	C
-	-	2	1

Examination Scheme:

Continuous Internal Evaluation	40 marks
End Semester Examination	60 marks

Course Learning Objectives(LOs):

This course will develop students' knowledge in/on…

LO1: thermal conductivity of conductors and insulators

LO2: local and average convective heat transfer coefficient in free and forced convection

LO3: emissivities of gray bodies

LO4: analysis of heat exchangers

LIST OF EXPERIMENTS

1. Thermal conductivity of metal rod.
2. Thermal conductivity of insulating material.
3. Heat transfer through composite walls.
4. Heat transfer coefficient by forced convection for fluid flow through conduit.
5. Heat Transfer coefficient by free convection over a vertical surface
6. Emissivity of non black surfaces.
7. Estimation of Stefan-Boltzman's constant.
8. Heat transfer through pin fin by natural convection.
9. Heat transfer through pin fin by forced convection.
10. Estimation of critical heat flux in saturated pool boiling.
11. Parallel and counter flow Heat exchangers.
12. Calibration of Thermocouple.

Laboratory Manual:

[1] Heat Transfer Laboratory Manual, Dept. of ME, KITSW.

Reference Books:

[1] R. C. Sachdeva, *Fundamentals of Engineering Heat and Mass Transfer,* 5th ed. New Delhi: New Age International Pvt. Ltd., 2015.

Data Book:

[1] C. P. Kothandaraman and S. Subramanian, *Heat and Mass Transfer Data Book*, 9th ed. New Delhi: New Age International Pvt. Ltd., 2018.

Note: Heat and Mass Transfer Data Books are permitted into the exam hall.

Course Learning Outcomes (COs):

On completion of this course, students will be able to…

CO1: determine the thermal conductivity of conductors & insulators

CO2: analyze the local & average convective heat transfer coefficient in free & forced convection

CO3: determine the emissivity of gray bodies

CO4: analyze the performance of heat exchangers

Course Articulation Matrix (CAM): U18ME607 HEAT TRANSFER LABORATORY

CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	**U14ME607.1**	3	2	1	1	-	-	-	-	1	1	-	1	1	1
CO2	**U14ME607.2**	3	2	1	1	-	-	-	-	1	1	-	1	1	1
CO3	**U14ME607.3**	3	2	1	1	-	-	-	-	1	1	-	1	1	1
CO4	**U14ME607.4**	3	2	1	1	-	-	-	-	1	1	-	1	1	1
U14ME607		**3**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**1**	**1**	**-**	**1**	**1**	**1**

U18ME608 COMPUTER AIDED ANALYSIS LABORATORY

Class: B. Tech. VI Semester **Branch:** Mechanical Engineering (ME)

Teaching Scheme:

L	T	P	C
-	-	2	1

Examination Scheme:

Continuous Internal Evaluation:	40 marks
End Semester Examination:	60 marks

Course Learning Objectives (LOs):

This course will develop students' knowledge in/on…

LO1: static analysis of one-dimensional problems using a FEA software
LO2: modeling and stress analysis of plane stress and axi-symmetric problems
LO3: thermal, dynamic and fluid flow analysis of 1-Dand 2-Dproblems
LO4: developing FEM1D program for a two-point boundary value problem

LIST OF EXPERMENTS

1. Static Analysis of Bars of constant cross section area.
2. Static Analysis of Bars of tapered cross section area and Stepped bar.
3. Static Analysis of Plane Truss member.
4. Shear Force and Bending Moment diagrams of Simply supported beams with point load, UDL, varying load.
5. Modeling and Stress Analysis of Rectangular plate with a circular hole (Plane stress).
6. Modeling and Stress Analysis of circular pipe (Axi-symmetric).
7. Thermal Analysis –One Dimensional problem with conduction and convection boundary conditions for a fin.
8. Thermal Analysis - One Dimensional problem with conduction and convection boundary conditions for a composite slab.
9. Dynamic Analysis – Determination of Natural frequency for cantilever beam.
10. Dynamic Analysis - Modal and Harmonic analysis for cantilever beam.
11. Fluid flow Analysis - Potential distribution in the two-dimensional bodies.
12. Develop a **FEM1D** program which applies the finite element method (FEM) to a linear two-point boundary value problem (BVP) in one spatial dimension.

Exercises will be solved using ANSYS package during regular class work in each week.

Laboratory Manual:

[1] Computer Aided Analysis Laboratory Manual, Dept. of ME, KITSW.

Reference Books:

[1] N. Nakasone, T. A. Stolarski and S. Yoshimoto, *Engineering Analysis with ANSYS Software*, Massachusetts: Elsevier Butterworth-Heinemann, 2006.
[2] Chennakesava R. Alavala, *Finite Element Methods: Basic Concepts and Applications,* New Delhi: PHI Learning Pvt. Ltd., 2009.
[3] David. V. Hutton, *Fundamentals of Finite Element Analysis*, New York: McGraw Hill, 2004.
[4] S. Moaveni, *Finite element analysis, Theory and Application with ANSYS*, 4th ed. New Jersey: Prentice Hall, 2014.
[5] Chandrupatla T.R. and Belegundu A.D., *Introduction to finite Elements in Engineering,* 2nd ed. New Delhi: Pearson Education, 2003.

Course Learning Outcomes (COs):
On completion of this course, students will be able to…

CO1: analyze bar of constant area, stepped bar, tapered bar & plane truss problems using computer aided analysis techniques
CO2: analyze plane stress & axi-symmetric problems
CO3: analyze 1-D thermal, dynamic & 2-D fluid flow problems
CO4: evaluate two-point boundary value problem using a FEM1D program

Course Articulation Matrix (CAM): U18ME608 COMPUTER AIDED ANALYSIS LAB															
CO		**PO**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO7**	**PO 8**	**PO 9**	**PO**	**PO**	**PO 12**	**PSO 1**	**PSO 2**
CO1	**U18ME608.1**	1	1	1	1	2	-	-	-	1	1	-	1	2	1
CO2	**U18ME608.2**	1	1	1	1	2	-	-	-	1	1	-	1	2	1
CO3	**U18ME608.3**	1	1	1	1	2	-	-	-	1	1	-	1	2	1
CO4	**U18ME608.4**	1	1	1	1	2	-	-	-	1	1	-	1	2	1
U18ME608		**1**	**1**	**1**	**1**	**2**	**-**	**-**	-	**1**	**1**	-	**1**	**2**	**1**

U18ME609 FUELS AND INTERNAL COMBUSTION ENGINES LABORATORY

Class: B. Tech. VI-Semester **Branch:** Mechanical Engineering (ME)

Teaching Scheme:

L	T	P	C
-	-	2	1

Examination Scheme:

Continuous Internal Evaluation	40 marks
End Semester Exam	60 marks

Course Learning Objectives(LOs):
This laboratory course will develop students' knowledge in/on…

LO1: flash, fire points and carbon residue of a fuel
LO2: kinematic and dynamic viscosity of a fuel
LO3: various components of IC engine
LO4: testing methods used to measure the performance parameters of an IC engine

LIST OF EXPERIMENTS:

1. Flash and fire points of a given fuel using Cleveland's apparatus.
2. Fire point of a given fuel by using Abel's apparatus.
3. Kinematic and dynamic viscosity measurement of a given fuel/lubricating oil using Redwood viscometer apparatus.
4. Carbon residue of a given fuel using Rams bottom apparatus.
5. Performance test and heat balance test on conventional single cylinder four stroke, Compression Ignition Engine with Brake Drum Dynamometer.
6. Performance test on and heat balance test conventional twin cylinder, four stroke, Compression Ignition engine with hydraulic dynamometer
7. Performance test and heat balance test on four cylinder, four stroke, Spark Ignition engine with eddy current dynamometer
8. Performance test on single cylinder, four stroke, Compression Ignition engine with eddy current dynamometer with Variable Compression Ratio.
9. Valve Timing Diagram of a single cylinder four stroke, Compression Ignition Engine.
10. Morse test on four stroke, four cylinder Spark Ignition Engine.
11. Performance test and heat balance test on computer aided single cylinder four stroke, Compression Ignition Engine with eddy current Dynamometer.
12. Assembly and Disassembly of an IC engine.

Laboratory Manual:

[1] Fuels and Internal Combustion Engines Laboratory Manual, Dept. of ME, KITSW.

Reference Books:

[1] V. Ganesan, *Internal Combustion Engines*, 4th ed. New Delhi: Tata McGraw-Hill, 2013.
[2] Mahesh M Rathore, *Thermal Engineering*, New Delhi: Mc Graw Hill, 2010.
[3] J.B. Heywood, *Internal Combustion Engine Fundamentals*, revised ed. New Delhi: McGraw-Hill, 1988.
[4] R. Colin. Ferguson, T. Allan. Kirkpatrick, *Internal Combustion Engines: Applied Thermo sciences*, 2nd ed. New Delhi: Wiley, 2001.
[5] H.N. Gupta, *Fundamentals of Internal Combustion Engines*, 2nd ed. New Delhi: PHI Pvt. Ltd., 2012.

[6] R.K. Rajputh, *Text book on Internal Combustion Engines*, New Delhi: Laxmi publication Pvt. Ltd., 2013

Course Learning Outcomes (COs):
On completion of this course, students will be able to…

CO1: estimate flash, fire points & carbon residue of different fuels
CO2: determine the absolute & kinematic viscosity of different fuels
CO3: inspect different components of IC engine
CO4: evaluate performance parameters at constant & variable speeds

Course Articulation Matrix (CAM): U18ME609 FUELS AND INTERNAL COMBUSTION ENGINES LABORATORY

CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	**U18ME609.1**	2	2	1	1	-	-	1	-	-	1		1	2	1
CO2	**U18ME609.2**	2	2	1	1	-	-	1	-	-	1	-	1	2	1
CO3	**U19ME609.3**	2	2	1	1	-	-	1	-	-	1	-	1	2	1
CO4	**U18ME609.4**	2	2	1	1	-	-	1	-	-	1	-	1	2	1
U18ME609		**2**	**2**	**1**	**1**	**-**	**-**	**1**	**-**	**-**	**1**	**-**	**1**	**2**	**1**

U18ME610 MINI PROJECT

Class: B. Tech. VI - Semester **Branch:** Mechanical Engineering (ME)

Teaching Scheme:

L	T	P	C
-	-	-	2

Examination Scheme:

Continuous Internal Evaluation	100 marks
End Semester Examination	-

Course Learning Objectives (LOs):

This course will develop students' knowledge on /in…

LO5: implementing a project independently by applying knowledge to practice
LO6: literature review and well-documented report writing
LO7: creating PPTs and effective technical presentation skills
LO8: writing technical paper in scientific journal style & format and creating video pitch

Student has to take up independent mini project on innovative ideas, innovative solutions to common problems using their knowledge relevant to courses offered in their program of study, which would supplement and complement the program assigned to each student.

Guidelines:

5. The HoD shall constitute a *Department Mini Project Evaluation Committee (DMPEC)*
6. DMPEC shall allot a faculty supervisor to each student for guiding on (i) selection of topic (ii) literature survey and work to be carried out (iii) preparing a report in proper format and (iv) effective mini project oral presentation
7. There shall be only Continuous Internal Evaluation (CIE) for mini project
8. The CIE for seminar is as follows:

Assessment	Weightage
Mini Project Supervisor Assessment	20%
Working model / process / software package / system developed	20%
Mini Project report	20%
Mini Project paper	10%
Video pitch	10%
DMPEC Assessment: *Oral presentation with PPT and viva-voce*	20%
Total Weightage:	100%

Note: It is mandatory for the student to appear for oral presentation and viva-voce to qualify for course evaluation

(g) **Mini Project Topic**: The topic should be interesting and conducive to discussion. Topics may be found by looking through recent issues of peer reviewed Journals / Technical Magazines on the topics of potential interest

(h) **Working Model**: Each student is requested to develop a working model / process / system on the chosen work and demonstrate before the *DMPEC* as per the dates specified by *DMPEC*

(i) **Report:** Each student is required to submit a well-documented report on the chosen seminar topic as per the format specified by *DMPEC*

(j) **Anti-Plagiarism Check:** The seminar report should clear plagiarism check as per the Anti-Plagiarism policy of the institute

(k) **Presentation:** Each student should prepare PPT with informative slides and make an effective oral presentation before the *DMPEC* as per the schedule notified by the department

(l) **Video Pitch:** Each student should create a pitch video, which is a video presentation on his / her mini project. Video pitch should be no longer than 5 minutes by keeping the pitch concise and to the point, which shall also include key points about his / her business idea / plan (*if any*) and social impact

(m) The student has to register for the Mini project as supplementary examination in the following cases:
   iv) he/she is absent for oral presentation and viva-voce
   v) he/she fails to submit the report in prescribed format
   vi) he/she fails to fulfill the requirements of Mini project evaluation as per specified guidelines

(n) i) The CoE shall send a list of students registered for supplementary to the HoD concerned
   ii) The DSEC, duly constituted by the HoD, shall conduct Mini project evaluation and send the award list to the CoE within the stipulated time

Course Learning Outcomes (COs):
On completion of this course, students will be able to…

CO5: apply knowledge to practice to design & conduct experiments and utilize modern tools for developing working models / process / system leading to innovation & entrepreneurship

CO6: demonstrate the competencies to perform literature survey, identify gaps, analyze the problem and prepare a well-documented Mini project report

CO7: make an effective oral presentation through informative PPTs, showing knowledge on the subject & sensitivity towards social impact of the Mini project

CO8: write a "Mini project paper" in scientific journal style & format from the prepared Mini project report and create a video pitch on Mini project

Course Articulation Matrix (CAM): U18ME610 MINI PROJECT

CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	**U18ME610.1**	1	1	2	2	1	1	1	2	2	2	1	2	2	1
CO2	**U18ME610.2**	1	1	-	2	-	-	-	2	2	2	-	2	2	1
CO3	**U18ME610.3**	-	-	-	-	-	-	1	2	2	2	-	2	2	1
CO4	**U18ME610.4**	-	-	-	-	-	-	-	2	2	2	-	2	2	1
U18CE609		**1**	**1**	**2**	**2**	**1**	**1**	**1**	**2**	**2**	**2**	**1**	**2**	**2**	**1**

DEPARTMENT OF MECHANICAL ENGINEERING
KAKATIYA INSTITUTE OF TECHNOLOGY & SCIENCE, WARANGAL – 15
(An Autonomous Institute under Kakatiya University, Warangal)

SCHEME OF INSTRUCTION AND EVALUATION
VII-SEMESTER OF 4-YEAR B.TECH DEGREE PROGRAMME

[4Th+2P+1MC+1Mini Project]

Sl. No	Category	Course Code	Course Title	Hours per week			Credits	Evaluation Scheme				
								CIE			ESE	Total Marks
				L	T	P	C	TA	MSE	Total		
1	HSMC	U18MH701	Management Economics & Accountancy	3	-	-	3	10	30	40	60	100
2	PE	U18ME702	Professional Elective - III / MOOC-III	3	-	-	3	10	30	40	60	100
3	PE	U18ME703	Professional Elective - IV / MOOC-IV	3	-	-	3	10	30	40	60	100
4	PCC	U18ME704	Refrigeration & Air Conditioning	3	-	-	3	10	30	40	60	100
5	PCC	U18ME705	Thermal Engineering Lab	-	-	2	1	40	-	40	60	100
6	PCC	U18ME706	Production Engineering Lab-II	-	-	2	1	40	-	40	60	100
7	PROJ	U18ME707	Major Project - Phase – I	-	-	6	3	100	-	100	-	100
8	MC	U18ME708	Internship Evaluation	-	-	2	-	100	-	100	-	100
Total:				**12**	**-**	**12**	**17**	**320**	**120**	**440**	**360**	**800**
Additional Learning*:			*Maximum credits allowed for Honours/Minor*	-	-	-	*7*	-	-	-	-	-
Total credits for Honours/Minor students:				**-**	**-**	**-**	***17+7***	**-**	**-**	**-**	**-**	**-**

** List of courses for additional learning through **MOOCs** towards Honours/Minor in Engineering shall be prescribed by the department under Honours/ Minor Curricula*

L= Lecture, T = Tutorials, P = Practicals & C = Credits; **Contact hours per week: 24**

Professional Elective-III / MOOC-III:	**Professional Elective-IV / MOOC-IV**
U18ME702A: Renewable Energy Sources	U18ME703A: Computer Integrated Manufacturing
U18ME702B: Design of Thermal Equipments	U18ME703B: Modern Machining Processes
U18ME702C: Energy Audit and Management	U18ME703C: Industry 4.0
U18ME702M: MOOCs course	U18ME703M: MOOCs course

U18MH701 MANAGEMENT ECONOMICS AND ACCOUNTANCY

Class: B. Tech. VII-Semester **Branch:** Mechanical Engineering (ME)

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation	40 marks
End Semester Exam	60 marks

Course Learning Objectives (LOs):
This course will develop students' knowledge on /in…
LO1: basic concepts of management
LO2: concepts of economics and forms of business organizations
LO3: fundamentals of accountancy and journalizing
LO4: preparation of final accounts

UNIT-I (9)

Management: Meaning and definition, Scientific Management - Definition, Characteristics, Principles of management

Functions of Management: Planning - Definition, Characteristics; Organizing - Definition, Characteristics; Staffing - Meaning, Functions of personnel management; Directing- Leadership, Nature; Motivation – Nature, Types (financial, non-financial, intrinsic and extrinsic), Communication- Process, Types, Co- ordination- Definition, Steps to achieve effective coordination, Controlling- Definition, process

UNIT-II (9)

Economics: Meaning and definition, Scope, Micro and Macro Economics, Methods of Economics, Laws of Economics

Forms of Business Organization: Sole Proprietor ship, Partnership firm - Types of Partners, Cooperative society, Joint Stock Company - Features, Types, Merits and demerits

UNIT-III (9)

Double Entry System and Book Keeping: Accounting concepts and conventions, Overview of accounting cycle, Journal-meaning, Journalizing, Ledger - Meaning, Ledger posting, Balancing; Cash book (Single column), Preparation of Trial balance

UNIT – IV (9)

Final Accounts: Trading Account, profit and loss account and Balance Sheet with simple adjustment

Text Books:

[1] Y. K. Bhushan, *Fundamentals of Business Organization and Management*, 20th ed. New Delhi: Sultan Chand & Sons, 2017. (*Chapters 1, 2 & 4*)

[2] T. S. Grewal, S.C. Gupta, *Introduction to Accountancy*, 8th ed. New Delhi: S. Chand Publications, 2014. (*Chapters1, 2, 3, 4, 6 & 8*)

Reference Books:

[1] Harold Koontz and Heinz Weihrich, *Essentials of Management*, 6th ed., New Delhi: Tata Mc Graw HillPublications, 2006.

[2] L.M. Prasad, *Principles and Practice of Management*, 9th ed., New Delhi: Sultan Chand, 2016.

[3] R.L. Gupta & V.K. Gupta, *Principles and Practice of Accountancy*, 14th ed., New Delhi: Sultan Chand and Sons, 2018.

Course Learning Outcomes (COs):

On completion of this course, students will be able to…

CO1: comprehend the basic concepts of management
CO2: distinguish between micro &macro economics& forms of business organizations
CO3: pass journal entries & post them into ledgers
CO4: prepare profit & loss accounts and assesses the financial position through the balance sheet

Course Articulation Matrix: U18MH701 MANAGEMENT ECONOMICS AND ACCOUNTANCY

Cos		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	U18MH602/ U18MH701.1	-	-	-	-	-	-	-	-	1	1	1	1	-	-
CO2	U18MH602/ U18MH701.2	-	-	-	-	-	-	-	-	1	1	2	1	-	-
CO3	U18MH602/ U18MH701.3	-	-	-	-	-	-	-	-	-	-	1	1	-	-
CO4	U18MH602/ U18MH701.4	-	-	-	-	-	-	-	-	-	-	1	1	-	-
U18MH602/ U18MH 701		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**1**	**1.25**	**1**	**-**	**-**

Course Research Papers: Research papers (Journal/Conference papers) relevant to the course content will be postedby the course faculty in Course Web page

Course Case Study: Case studies relevant to the course content will be posted by the course faculty in Course Web page

Course Projects: Course project is an independent project carried out by the student during the course period, under the supervision of course faculty. Course faculty will post few course projects titles in Course Web page. Students are encouraged to come up and experiment with the ideas that interest them.

U18ME702A **RENEWABLE ENERGY SOURCES**

Class: B. Tech. VII-Semester **Branch:** Mechanical Engineering (ME)

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation	40 marks
End Semester Exam	60 marks

Course Learning Objectives(LOs):

This course will develop students' knowledge in/on…

LO1: non-conventional energy sources and solar energy technologies

LO2: wind, geothermal and hydrogen energy technologies

LO3: fuel cell, ocean thermal energy and tidal energy

LO4:biomass & biogas energy production, magneto hydro dynamic, thermoelectric & thermo-ionic power generation technologies

UNIT-I (9)

Introduction: Classification of energy sources; distinction between conventional and non-conventional sources of energy; present energy scenario in India

Solar Energy: Introduction; solar constant; estimation of solar radiation on the earth's surface; solar radiation geometry; solar radiation measuring devices- pyrheliometer, pyranometer, sunshine recorder; Solar thermal energy collectors – liquid flat plate, air heaters, collectors with booster mirrors and concentrating collectors, applications of solar thermal collectors - absorption air conditioning system, thermal water pump, furnace, chimney, distillation, pond and cooker; solar energy storage systems–thermal, sensible and latent heat

Solar Photovoltaic (SPV) Systems: Classification and principle of a SPV cell, basic SPV for power generation; PV cell technologies- single, multi-crystalline and thin film; SPV systems – merits, limitations, applications-street lighting, domestic lighting, battery charging and water pumping

UNIT-II (9)

Wind Energy: Origin and nature of winds, principles of wind power, operation of a wind turbine, site selection characteristics; Wind Energy Conversion System (WECS)-basic components, classification, advantages and disadvantages

Geothermal Energy: Origin and types of geothermal energy- vapor dominated, liquid dominated, petro-thermal and hybrid systems, operational and environmental problems, applications

Hydrogen Energy: Basics of hydrogen energy, production methods, storage, transportation and applications

UNIT-III (9)

Fuel Cell: Working principle, basic thermodynamics and electro-chemical principles, classification-phosphoric acid, alkaline, polymer electrolyte membrane, molten carbon and solid oxide fuel cell; applications

Energy from Oceans: Ocean temperature difference; open, closed and hybrid cycle; tidal energy- working principle, classification-single basin and double basin arrangement

UNIT-IV (9)

Bio Energy: Biomass conversion technologies - wet and dry processes; photosynthesis; biogas generation, classification of biogas plants, biogas from plant wastes, site selection for a gas

plant; digester design considerations, methods for maintaining biogas production; utilization of biogas; biomass gasification - classification and applications of gasifiers

Magneto Hydro Dynamic (MHD) Power Generation: Open and closed MHD systems; design problems and developments, advantages

Thermoelectric & Thermo-ionic Power Generation: Thermoelectric effects; principle of thermo electric power generation and thermo-ionic converter, applications

Textbook:

[1] G.D. Rai, *Non-Conventional Energy Sources,* 6th ed., New Delhi: Khanna Publishers, 2017. *(Chapters 1 to 14)*

Reference Books:

[1] Sukhatme, S. P., and Nayak, J. K., *Solar Energy: Principles of Thermal Collection and Storage,* 3rd ed., New Delhi: Tata McGraw-Hill India, 2009.

[2] Khan B. H., *Non-Conventional Energy Resources*, 3rd ed., New Delhi: McGraw-Hill, 2017.

[3] Duffie and Beckman, *Solar Engineering of Thermal Processes*, John Wiley & Sons, New York, 1991.

[4] R.K. Rajput, *Non-Conventional Energy Sources and Utilization,* 2nd ed., S Chand and CompanyLtd., New Delhi, 2019.

[5] Rajesh K. Prasad, Ojha T.P., *Non Conventional Energy Sources,* 4th ed., Jain Brothers, 2012.

Course Learning Outcomes (COs):

On completion of this course, students will be able to…

CO1: classify non-conventional energy sources and solar energy technologies
CO2: discuss the working mechanism of wind, geothermal and hydrogen energy
CO3: explain the methods to extract energy from fuel cell, ocean thermal energy and tidal energy
CO4: describe the working principle of biogas generation, magneto hydro dynamic, thermo-electric and thermo-ionic technologies

Course Articulation Matrix (CAM): U18ME702A: RENEWABLE ENERGY SOURCES

CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	**U18ME702A.1**	2	2	2	-	2	1	2	-	-	1	-	1	2	2
CO2	**U18ME702A.2**	2	2	2	-	2	1	2	-	-	1	-	1	2	2
CO3	**U18ME702A.3**	2	-	2	-	2	1	2	-	-	1	-	1	2	2
CO4	**U18ME702A.4**	2	-	2	-	2	1	2	-	-	1	-	1	2	2
U18ME702A		**2**	**2**	**2**	**-**	**2**	**1**	**2**	**-**	**-**	**1**	**-**	**1**	**2**	**2**

U18ME702B DESIGNOFTHERMALEQUIPMENTS

Class: B.Tech. VII- Semester **Branch:** Mechanical Engineering

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation	40marks
End Semester Examination	60marks

Course Learning Objectives (LOs):

This course will develop students' knowledge in/on….
LO1: classification and design methods of heat exchangers

LO2: convection correlations and analysis of double pipe heat exchanger

LO3: compact heat exchangers and analysis of evaporators

UNIT-I (9)

Heat exchangers: Classification, applications, flow arrangements, temperature distributions and selection considerations; basic design methods-overall heat transfer coefficient (U), Logarithmic Mean Temperature Difference (LMTD), Effectiveness (ε), Number of Transfer Units (NTU); design of heat exchangers subject to fouling

UNITII (9)

Convection Correlations: Laminar forced convection in ducts and concentric annuli; turbulent forced convection in circular pipes, heat transfer in helical coils, spirals and bends

Double pipe heat exchangers: Design process and calculations – heat transfer area, heat transfer coefficient, total pressure drop, hydraulic diameter; Hairpin heat exchanger-parallel and series arrangements, shell side pressure drop, tube side pressure drop and performance analysis

UNIT III (9)

Compact heat exchangers: Plate-fin, tube-fin and gasketedplate; heat transfer and pressure drop calculations

Evaporators: Classification - natural and forced, refrigerant flow inside or outside, flooded and dry type; thermal design - heat transfer area, overall heat transfer coefficient and enhancement; Wilson's plot

UNIT-IV(9)

Thermosyphons and Heat Pipes: Design; thermal and hydraulic models – applications

Two-phase heat exchangers: Classification, working principle, applications and thermal analysis of tubular, plate-type and extended surface type heat exchangers;

micro-channel technology-working principle, benefits and thermal analysis

Textbooks:

[1]. Kakac S., Liu H., and Pramunjaroenkij A, *Heat Exchangers: Selection Rating and Thermal Design,* 4th ed., New York: CRC Press Taylor & Francis Group,2020. (*Chapters 1 to 4 and 6 to 12)*

[2]. Mantelli and Marcia B. H., *Thermosypnones and Heat pipes: Theory and Application*, Switzerland: Springer Nature, 2021. (*Chapters 1 to 4, 6,9 to 11)*

Reference Books:

[1]. Serth R.W, *Process heat transfer principles and applications*, Academic press: Elsevier, 2nd ed., 2014.

[2]. Das S. K., *Process heat transfer,* New Delhi: Narosa Publishing House, 10th ed., 2009.

[3]. Kern D.Q, *Process Heat Transfer*, New Delhi: McGraw-Hill, 2nd ed., 1988.

Data Books:

[1]. C. P. Kothandaraman, *Heat and Mass Transfer Data Book*, New age International publishers, New Delhi, 2018.

Course Learning Outcomes (COs):

Up on completion of this course, students will be able to…
CO1: design heat exchangers by using LMTD and ε-NTU methods

CO2: determine heat transfer rate of a double pipe heat exchanger

CO3: analyze compact heat exchangers and evaporators

Course Articulation Matrix (CAM): U18ME702B DESIGN OF THERMAL EQUIPMENTS

CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	U18ME702B.1	2	2	2	2	-	-	-	-	-	1	2	2	2	2
CO2	U18ME702B.2	2	2	2	2	-	-	-	-	-	1	2	2	2	2
CO3	U18ME702B.3	2	2	2	2	-	-	-	-	-	1	2	2	2	2
CO4	U18ME702B.4	2	2	2	2	-	-	-	-	-	1	2	2	2	2
U18ME702B		2	2	2	2	-	-	-	-	-	1	2	2	2	2

U18ME 702C **ENERGY AUDIT AND MANAGEMENT**

Class: B. Tech. VII-Semester **Branch:** Mechanical Engineering (ME)

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation	40 marks
End Semester Exam	60 marks

Course Learning Objectives(LOs):
This course will develop students' knowledge in/on…
LO1: energy audit and energy management concepts
LO2: energy conservation principles and measures applied to thermal systems
LO3: energy conservation principles and measures applied to electrical utilities
LO4: cogeneration and waste heat recovery

UNIT-I (9)

Energy Audit: Need of Energy Audit, Types of energy audit, Components of energy audit; Energy audit methodology, Instruments used in energy audit, Analysis and recommendations of energy audit, Energy audit reporting, Energy audit software, Current Energy Conservation Act.

Energy Economics: Costing of Utilities-Determination of cost of steam, natural gas, compressed air and electricity; Financial Analysis Techniques (Numerical) - Simple payback, Time value of money, Net Present Value (NPV), Return on Investment (ROI), Internal Rate of Return (IRR), Risk and Sensitivity analysis.

UNIT-II (9)

Energy Efficiency in Thermal Utilities: Energy performance assessment (Numerical) and efficiency improvement of Boilers, Furnaces, Heat exchangers, Cooling tower, Fans and blowers, Pumps, Compressed air system and HVAC systems; Assessment of steam distribution losses, Steam leakages, Steam trapping, Condensate and flash steam recovery system.

UNIT-III (9)

Energy efficiency in Electrical Utilities: Electricity billing, Electrical load management and maximum demand control, penalties, Power factor improvement and benefits; Selection and location of capacitors, Distribution and transformer losses; Electrical motors- types, efficiency and selection, Speed control, Energy efficient motors; Introduction of Electricity Act 2003,Lamp types and their features, recommended illumination levels, Lighting system performance assessment and efficiency improvement (Numerical).

UNIT-IV (9)

Cogeneration and Waste Heat Recovery

Cogeneration: Need, applications, advantages, classification, Introduction to Trigeneration. ***Waste heat recovery***- Classification, Application, Concept of Pinch analysis, Potential of WHR in Industries, Commercial WHR devices, saving potential. CDM projects and carbon credit calculations.

***Case study*:** Energy Audit of Institute/Department.

Textbook:

[1] Sonal Desai, *Handbook of Energy Audit*,McGraw Hill Education (India) Private Limited, 2015.

Reference Books:

[1] Kennedy, William J., Turner, Wayne C., & Capehart, Barney L.,*Guide to Energy Management,* The Fairmount Press, 8th ed., 2016.

[2] Callaghan, P.W.,*Design and Management for Energy Conservation*, Pergamon Press, Oxford, 1981.

[3] Dryden, I.G.C.,*The Efficient Use of Energy*, Butterworths,2nd ed. London: 2013.

[4] Turner, W.C.,*Energy Management Handbook*, Wiley, New York, 1982.

[5] Y P Abbi, Shashank Jain., *Handbook on Energy Audit and Environment Management,* TERI Press, New Delhi, 2006.

[6] Energy Manager Training Manual (www.energymanagertraining.com).

[7] Guide book for National Certification Examination for Energy Managers and Energy Auditors, Bureau of Energy Efficiencies, 2015.

Course Learning Outcomes (COs):

On completion of this course, students will be able to…

CO1: identify the energy demand supply gap in the World & India and understand energy conservation opportunities available

CO2: quantify the energy conservation opportunities in different thermal systems

CO3: evaluate the common energy conservation opportunities in different electrical utilities

CO4: examine the economic evaluation of energy conservation solutions adopted

Course Articulation Matrix (CAM): U18ME702C ENERGY AUDIT AND MANAGEMENT

CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO1	PSO2
CO1	**U18ME702C.1**	2	2	1	-	-	1	1	-	-	1	1	1	1	-
CO2	**U18ME702C.2**	2	2	1	-	-	1	1	-	-	1	1	1	1	-
CO3	**U18ME702C.3**	2	2	1	-	-	1	1	-	-	1	1	1	1	-
CO4	**U18ME702C.4**	2	2	1	-	-	1	1	-	-	1	1	1	1	-
U18ME702C		**2**	**2**	**1**	-	-	**1**	**1**	-	-	**1**	**1**	**1**	**1**	-

U18ME703A COMPUTER INTEGRATED MANUFACTURING SYSTEMS

Class: B. Tech., VII - Semester **Branch:** Mechanical Engineering

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation	40 marks
End Semester Examination	60 marks

Course Learning Objectives(LO):
This course will develop students' knowledge in/on
LO1: types of automation and automation strategies
LO2: NC part programming, robot configuration, concepts of group technology and cellular manufacturing
LO3: mechatronics, basic building blocks and system models
LO4: programmable logic controllers and closed loop controllers

UNIT-I (9)

Automation in Production Operations: Introduction, functions in manufacturing, types of automations, automation strategies; production concepts and mathematical modeling; Organization and information processing in manufacturing system.
Numerical Control of Production Systems: Basic principle and elements of NC, CNC & DNC systems.

UNIT-II (9)

NC Part programming: Introduction, manual and computer aided part programming.
Introduction to Robots: Types, configuration, sensor technology and applications
Group Technology: Introduction, part families, classification and coding-OPITZ code; benefits of GT; Cellular Manufacturing-Introduction, types of configurations.
CAPP: Introduction, types of process planning- retrieval and generative, applications**.**

UNIT-III (9)

Mechatronics: Introduction**,** Systems, Examples of mechatronic systems.
Basic Models: Mathematical models, mechanical system building blocks, electrical system building blocks, fluid system building blocks and thermal system building blocks.
System Models: Engineering system, rotational-translational system, electro- mechanical systems and hydraulic-mechanical system.

UNIT-IV (9)

Programmable logic controller: Basic PLC structure, Input/output processing, Ladder programming, Logic functions
Closed Loop Controllers: Continuous and discrete processes; Control modes Two step mode and proportional mode; Derivative control, integral control, PID controller, digital controllers, velocity controllers and adaptive control.

Text Books:

1. Mikell P Groover, "Automation, Production system and Computer Integrated Manufacturing", 4th edn., Prentice Hall of India, New Delhi, 2016. (Chapters 1,2,8,9,10,11,16 and 24)
2. Bolton W, "Mechatronics",*6th ed.*, Pearson Education, 2015 (Chapters1, 8,9,11 and 21)

Reference Books:

1. PN Rao, NK Tiwari and TK Kundra, *Computer Aided Manufacturing,* Tata McGraw-Hill, New Delhi,2012.

2. Yorem Koran, *Computer Numerical Control of Manufacturing Systems,* McGraw-Hill, New Delhi, 2004.
3. Nitaigour Premch and Mahalik, *Mechatronics: Principles concepts and applications,* Tata McGraw-Hill, New Delhi, 2012.
4. HMT, *Mechatronics,* Tata McGraw-Hill, New Delhi, 2017.

Course Learning Outcomes (CO):

Upon completion of this course, students will be able to…

CO1: Compare and contrast types of automation and solve problems on production concepts using mathematical models

CO2: develop NC part programming and explain robot configuration, group technology and cellular manufacturing

CO3: build system models using basic building block

CO4: develop ladder programs and suggest a suitable controller for a given industrial application

Course Articulation Matrix(CAM): U18ME703A: COMPUTER INTEGRATED MANUFACTURING SYSTEMS														
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
U18ME703A.1	2	2	-	-	-	-	-	-	-	1	-	-	1	2
U18ME703A.2	2	2	-	-	1	-	-	-	-	1	-	-	1	2
U18ME703A.3	2	2	2	2	2	-	-	-	-	1	-	-	1	2
U18ME703A.4	2	2	1	1	2	-	-	-	-	1	-	-	1	2
U18ME703A	2	2	2	2	2	-	-	-	-	1	-	-	1	2

U18ME703B MODERN MACHINING PROCESSES

Class: B. Tech., VII-Semester **Branch:** Mechanical Engineering

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation	40marks
End Semester Examination	60marks

Course Learning Objectives(LOs):
This course will develop student's knowledge in/on
LO1:mechanical energy based processes
LO2:electrical energy based processes
LO3:chemical energy based processes
LO4:thermal Energy based processes

UNIT-I (9)

Introduction: Comparison of conventional and unconventional machining processes, Technological and commercial need, classification, Applications.

Mechanical Energy Based Processes: Ultrasonic Machining (USM)-working principles, process parameters, material removal rate, and surface finish, applications, advantages and limitations; **Abrasive Jet Machining (AJM)-**elements of the process, types of abrasives, process parameters, advantages applications and limitations**; Water Jet Machining (WJM) –** working principle, jet cutting equipment, applications, advantages and limitations; **Magnetic Abrasive Machining-** working principle, applications, advantages and limitations.

UNIT-II (9)

Electrical Energy Based Processes: Electrical Discharge Machining (EDM)-Classification, Working principle of die sink EDM, mechanism of material removal, feed mechanism, process parameters, analysis of R-C circuit, equations for material removal rate and surface finish, electrode materials and dielectric fluids applications, advantages and limitations; **Wire EDM** and **Micro EDM**-working principle, applications , advantages and limitations; **Hybrid Process- Electrical Discharge Grinding (EDG),** working principle and applications, advantages and limitations.

UNIT-III (9)

Chemical Energy Based Processes: Chemical Machining (CHM)- working principle, equipment, etchants and maskants, applications, advantages and limitations; **Electro Chemical Machining (ECM) -** working principle, chemistry of the process, process parameters, material removal rate and surface finish, applications, advantages and limitations; **Hybrid Processes-Electro Chemical Grinding (ECG**), **Electro chemical deburring (ECD)** and Electro **Chemical Honing, (ECH)** - working principles advantages, limitations and applications.

UNIT-IV (9)

Thermal Energy Based Processes: Plasma Arc Machining (PAM)- working principle, process parameters, types of torches, applications, advantages and limitations; Electron **Beam Machining (EBM)** - working principle, accuracy and surface finish, applications, advantages and limitations; **Laser Beam Machining (LBM)-**production of lasers, types of lasers, material removal, applications, advantages and limitations; **Ion Beam Machining (IBM)**- working principle, applications , advantages and limitations.

Text Books:

1. P. C. Pandey and H.S. Shah, *Modern Machining Processes*, Tata McGraw Hill Publications, 2012.

Reference Books:

1. V. K. Jain, *Advanced Machining Processes,* Allied Publications Limited, 2010.
2. Carl Sommer, *Non-traditional Machining Handbook*, 2nd ed., Advance Publishing Inc., 2009.
3. *HMT Production Technology Hand Book*, 28th reprint *Tata McGraw Hill*, 2008.

Course Learning Outcomes(COs):

Up on completion of this course, students will be able to…

CO1:distinguish mechanical energy based Processes
CO2:demonstrate electrical energy based processes
CO3: select suitable chemical energy based processes for a given material and form
CO4: illustrate thermal energy based processes

Course articulation matrix (Mapping of Cos with POs and PSOs)

Course Articulation Matrix (CAM) : U18ME703B-MODERN MACHINING PROCESSES														
CO		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	U18ME703B.1	2	1	1	-	-	-	-	-	-	-	-	1	1	1
CO2	U18ME703B.2	2	1	1	-	-	-	-	-	-	-	-	1	1	1
CO3	U18ME703B.3	2	1	1	-	-	-	-	-	-	-	-	1	1	1
CO4	U18ME703B.4	2	1	1	-	-	-	-	-	-	-	-	1	1	1
U18ME703B		**2**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**1**	**1**

U18ME703C INDUSTRY 4.0

Class: B. Tech., VII-Semester **Branch:** Mechanical Engineering

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation	40 marks
End Semester Examination	60 marks

Course Learning Objectives(LOs):
This course will develop students' knowledge in/on
LO1: industrial revolutions and conceptual frame work for Industry 4.0
LO2: artificial intelligence and its applications
LO3: robotic technology and augmented reality for Industry 4.0
LO4: industrial internet of things technologies and applications

UNIT-I (9)

Introduction to Industry 4.0: industrial revolutions; industry 4.0-origin concept, characteristics, challenges for transformation, drivers, the value chain, benefits, current state of industry 4.0.

Conceptual Framework for Industry 4.0: Industry 4.0- design principles, supportive technologies, frame work of Industry 4.0; lean production system for industry 4.0, automated based lean production applications; Impact of industry 4.0: society, business, government and people.

UNIT-II (9)

Smart Factories: smart factory, smart factories in action, importance of smart manufacturing; Real World Smart Factories - GE's brilliant factory, Airbus: smart tools and smart apps, Siemen's Amberg Electronics Plant (EWA); Industry 4.0: The way forward.

Industrial Artificial Intelligence: Artificial Intelligence (AI) -history, environment and societal influences, application, domainsand tools, associated technologies, future prospects of AI, challenges of industrial artificial intelligence**.**

UNIT-III (9)

Robotics in the Era of Industry 4.0: Recent technological components of robots-advanced sensor technologies, Internet of Robotic Things (IoRT), cloud robotics, cognitive architecture for cyber physical robotics; Industrial robotic applications**-** manufacturing, maintenance and assembly.

Role of Augmented Reality (AR) in Industry 4.0: AR hardware and software technology, industrial applications of AR.

UNIT-IV (9)

Introduction to Industrial Internet of Thinks(IIoT): conceptual frame work, architecture, design principles and needed capabilities, IoT enabling technologies, sensing, actuation, basics of networking, M2M communication, devices and gateways, role of cloud in IoT.

Applications of IIoT: manufacturing, healthcare, education, aerospace, defense, agriculture, transportation and logistics;

Text Books:

1. Alp Ustundag and Emre Cevikcan, "*Industry 4.0: Managing the Digital Transformation*

springer series in Advanced Manufacturing", Springer, 2018. (Chapters 1 to 8)
2. Raj Kamal, "*Internet of Things: Architecture and Design*", McGraw Hill Education (India) Private Limited, Chennai, 2018. (Chapters 1,2,7,8)

Reference Books:

1. Alasdair Gilchrist, "*Industry 4.0, The Industrial Internet of Things*", Apress Publications, Thailand, 2016.
2. Arsheep Bahga , Vijay Madisetti , "*Internet of Things: A Hands-On Approach*", Universities Press, 2015.

Course Learning Outcomes (COs):

Upon completion of this course, students will be able to…

CO1: explain industry revolutions and frame work of Industry 4.0
CO2: illustrate smart factories and features of AI
CO3: describe robotic technologies and augmented reality for Industry 4.0
CO4: apply IIOT in Industry 4.0

Course Articulation Matrix (CAM) : CourseCode:U18ME703C Course Name: INDUSTRY 4.0

CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	**U18ME703C.1**	2	1	2	1	2	-	-	-	-	1	-	-	2	1
CO2	**U18ME703C.2**	2	1	2	1	2	-	-	-	-	1	-	-	2	1
CO3	**U18ME703C.3**	2	1	2	1	2	-	-	-	-	1	-	-	2	1
CO4	**U18ME703C.4**	2	1	2	1	2	-	-	-	-	1	-	-	2	1
	U18ME703C	2	1	2	1	2	-	-	-	-	1	-	-	2	1

U18ME704 **REFRIGERATION AND AIR CONDITIONING**

Class: B. Tech. VII-Semester **Branch:** Mechanical Engineering

Teaching Scheme:

L	T	P	C
3	0	0	3

Examination Scheme:

Continuous Internal Evaluation	40 marks
End Semester Examination	60 marks

Course Learning Objectives:

This course will develop students' knowledge in/on

LO1: air & vapor compression refrigeration systems and properties of refrigerants
LO2: types of vapor absorption, non-conventional refrigeration systems and cryocoolers
LO3: psychrometry and cooling load calculations
LO4: comfort air conditioning, duct design and applications

UNIT – I (9)

Methods of Refrigeration: Definition of refrigeration; units of refrigeration; evaporative refrigeration; air refrigeration- open and dense air refrigeration systems; Bell-Coleman cycle; necessity of providing air conditioning to the air-crafts.

Refrigerants: Classification; refrigerant nomenclature; properties of refrigerants- thermodynamic, physical and safe working properties; global warming potential; ozone depletion potential.

Vapor Compression Refrigeration Systems: Representation of vapor compression refrigeration cycle on P-h, T-s diagrams; types of vapor compression refrigeration system - wet versus, dry compression, super heating, sub cooling; effect of suction pressure and discharge pressure on COP.

UNIT – II (9)

Vapor Absorption Refrigeration System: Determination of COP; types-aqua-ammonia; lithium bromide –water, Electrolux; comparison of vapor compression and vapor absorption refrigeration systems.

Non conventional refrigeration systems: Thermo-electric refrigeration system – working principle, comparison between thermo electric and vapor compression refrigeration system; Vortex tube – description, advantages, disadvantages and applications.

Cryocoolers: Classification; working principle of Gifford McMahon, Sterling, pulse tube and Joule-Thomson cryocoolers.

UNIT – III (9)

Psychrometry: Definition of air-conditioning; psychrometry- properties, relations, chart; processes-steam injection, water injection, adiabatic saturation and chemical dehumidification; bypass factor; summer, winter and year round air conditioning systems; air washer.

Cooling Load Calculations: Simple air-conditioning system-state and mass rate of supply air; summer air conditioning; apparatus dew point, with and without ventilation of air; purpose of ventilation; sensible heat factor- room, grand and effective sensible heat factor

UNIT – IV (9)

Comfort Air conditioning: Requirements; factors governing optimum effective temperature; metabolic rate; mechanism of body heat loss

Pressure losses and duct sizing: Continuity equation; Bernoulli's equation; pressure losses; variation of pressure losses along a duct; system resistance; duct design methods.

Applications of Refrigeration & Air Conditioning: Household refrigerators; comparison

among window, split and central air-conditioners; design considerations in air-conditioning of bus, theatres, hospitals and cold storage.

Textbook:

[1]. Arora S.C. and S. Domkundwar, *A course in Refrigeration and Air Conditioning*, 3rd ed., Dhanpat Rai & Sons., New Delhi, Reprint-2018

Reference Books:

[1]. Arora C.P., *Refrigeration and Air Conditioning*, Tata McGraw-Hill, 3rd edition, New Delhi, 2009

[2]. Wilbert F. Stoecker, Jerold W. Jones , *Refrigeration and Air Conditioning*, McGraw-Hill, New Delhi, 1982.

[3]. Roy J. Dossat, *Principles of Refrigeration*, Prentice Hall International Paperback Editions, 3rd ed., New Delhi, 1991.

[4]. *ASHRAE Hand Book*, McGraw-Hill, New York, 2009.

Data Books:

[2]. C. P. Kothandaraman, P B Nagaraj and D Venkatesh, *Refrigerant Tables and Charts including Air Conditioning Data*, New age International publishers, New Delhi, 2006.

[3]. Mathur, M. L., and Mehta, F. S., *Refrigerant and Psychrometric Properties (Tables & Charts) SI Units*, Jain Brothers publishers, New Delhi, 2010.

[4]. Khurmi, R. S., and Gupta, J. K., *Refrigeration Tables with chart*, S. Chand publishers, New Delhi, 2008.

Course Learning Outcomes (CO):

On completion of this course, students will be able to….

CO1: evaluate the performance of air & vapor compression refrigeration system and explain the desirable properties of refrigerants

CO2: explain the working principle of vapor absorption, non-conventional refrigeration systems and cryocoolers

CO3: estimate the cooling load capacity for a given application

CO4: state the design considerations in refrigeration & air-conditioning applications

Course Articulation Matrix (CAM):U18ME704 REFRIGERATION AND AIR CONDITIONING														
CO		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	**U18ME704.1**	2	2	1	1	-	-	-	-	-	1	-	1	1	1
CO2	**U18ME704.2**	2	2	1	-	-	-	-	-	-	1	-	1	1	1
CO3	**U18ME704.3**	2	2	1	1	-	-	-	-	-	1	-	1	1	1
CO4	**U18ME704.4**	2	2	1	-	-	-	-	-	-	1	-	1	1	1
U18ME704		2	2	1	1	-	-	-	-	-	1	-	1	1	1

U18ME705 THERMAL ENGINEERING LABORATORY

Class: B. Tech. VII-Semester **Branch:** Mechanical Engineering

Teaching Scheme:

L	T	P	C
0	0	2	1

Examination Scheme:

Continuous Internal Evaluation	40 marks
End Semester Examination	60 marks

Course Learning Objectives:

This course will develop students' knowledge in/on

LO5: *coefficient of Performance of various refrigeration systems*
LO6: performance parameters of air-conditioning systems
LO7: characteristics of solar flat plate collectors
LO8: performance characteristics of solar photovoltaic modules

LIST OF EXPERIMENTS

1. Coefficient of Performance of vapour compression refrigeration system.
2. Coefficient of Performance of vapour absorption refrigeration system.
3. Coefficient of Performance parameters of window air-conditioning tutor.
4. Coefficient of Performance of Air-conditioning tutor.
5. Performance of Vortex tube refrigeration system.
6. Performance parameters of solar water heating system.
7. Performance parameters of solar air heating system.
8. Efficiency of a solar flat plate collector for different tilt angles.
9. Performance parameters of a solar PV Module.
10. I-V characteristics of a Solar PV module connected in Series and parallel.
11. Performance of solar PV Modules by sun tracking system.
12. Performance of solar PV Panel with surrounding temperature and intensity.

Laboratory Manual:

[1] Thermal Engineering Laboratory Manual, Dept. of ME, KITSW.

Reference Books:

[1]. Arora S.C. and S. Domkundwar, *A course in Refrigeration and Air Conditioning*, 3rd edition, Dhanpat Rai & Sons., New Delhi, Reprint-2018
[2]. G.D. Rai, *Non-Conventional Energy Sources*, 6th ed., New Delhi: Khanna Publishers, 2017.
[3]. Arora C.P., *Refrigeration and Air Conditioning*, Tata McGraw-Hill, 3rd ed. New Delhi: 2009
[4]. Wilbert F. Stoecker, Jerold W. Jones, *Refrigeration and Air Conditioning*, McGraw-Hill, New Delhi: 1982.
[5]. Sukhatme, S. P., and Nayak, J. K., *Solar Energy: Principles of Thermal Collection and Storage,* 3rd ed., New Delhi: Tata McGraw-Hill India, 2009.
[6]. Rajesh K. Prasad, Ojha T.P., *Non Conventional Energy Sources,* 4th ed., Jain Brothers, 2012.
[7]. R.K. Rajput, *Non-Conventional Energy Sources and Utilization,* 2nd ed., S Chand and Company Ltd., New Delhi: 2019.

Data Books:

[1]. C. P. Kothandaraman, P B Nagaraj and D Venkatesh, *Refrigerant Tables and Charts including Air Conditioning Data*, New age International publishers, New Delhi: 2006.
[2]. Mathur, M. L., and Mehta, F. S., *Refrigerant and Psychrometric Properties (Tables & Charts) SI Units*, Jain Brothers publishers, New Delhi: 2010.
[3]. Khurmi, R. S., and Gupta, J. K., *Refrigeration Tables with chart*, S. Chand publishers, New Delhi: 2008.

Course Learning Outcomes (COs):

On completion of this course, students will be able to….

CO1: compare COP of various refrigeration systems

CO2: compute the performance parameters of air-conditioning systems

CO3: advocate the characteristics of solar flat plate collectors

CO4: determine performance characteristics of solar photovoltaic modules

Course Articulation Matrix (CAM):U18ME705 THERMAL ENGINEERING LABORATORY														
CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	U18ME705.1	2	1	1	1	-	-	1	-	-	1	-	1	1	1
CO2	U18ME705.2	2	1	1	1	-	-	1	-	-	1	-	1	1	1
CO3	U18ME705.3	2	1	1	1	-	-	1	-	-	1	-	1	1	1
CO4	U18ME705.4	2	1	1	1	-	-	1	-	-	1	-	1	1	1
U18ME705		2	1	1	1	-	-	1	-	-	1	-	1	1	1

U18ME706 PRODUCTION ENGINEERING LABORATORY-II

Class: B. Tech. VII -Semester **Branch:** Mechanical Engineering (ME)

Teaching Scheme:

L	T	P	C
-	-	2	1

Examination Scheme:

Continuous Internal Evaluation	40 marks
End Semester Exam	60 marks

Course Learning Objectives(LOs):

This course will develop students' knowledge in/on….

LO1: tool geometry and mechanism of chip formation
LO2: cutting forces ,surface roughness and tool wear in metal cutting operations
LO3:Standard EDM and micro-EDM
LO4: CNC part programming and ladder programming

LIST OF EXPERIMENTS

1. Grinding of single point cutting tool
2. Determination of shear angle in turning and shaping
3. Study of chip formation in ferrous and non ferrous materials
4. Measurement of cutting force in turning using lathe tool Dynamo meter
5. Measurement of surface roughness in turning using surface roughness tester
6. Measurement of tool wear in turning and milling
7. Determination of metal removal rate of mild steel block on electric discharge machine
8. Drilling of a hole on mild steel block using micro - EDM drilling machine
9. Prepare a part program for step turning and tapered component
10. Produce linear and circular profile cut on a component using CNC milling machine.
11. Develop a part program to cut alphabets on CNC milling machine
12. Controlling A.C. Non servomotor clockwise and anti clockwise with time delay

Laboratory Manual:

[1] Production Engineering Laboratory-II Manual, Dept. of ME, KITSW.

Reference Books:

[1] G. K. Lal, "Introduction to Machining Science", *3rd edn.*, New Age International Publishers, 2012.
[2] P. Radha Krishnan," Introduction to CNC Machines", New Age International, New Delhi, 1995.
[3] ATS Manual of L.S. Mechatranics, Secunderabad, 2000.
[4] Bolton W, "Mechatronics", *5th edn.*, Pearson Education, 2010.

Course Learning Outcomes (COs):

On completion of this course, students will be able to…

CO1:describe the mechanism of chip formation in metal cutting and grind single point cutting tool as per ASA system
CO2: measure the cutting forces, surface roughness and tool wear and interpret their importance in machining
CO3: determine the metal removal rate in standard EDM and micro-EDM
CO4:develop CNC part programs for turned, milled parts; ladder programming for various actuators

Course Articulation Matrix (CAM): U18ME706PRODUCTION ENGINEERING LABORATORY-II															
CO		**PO1**	**PO2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO1 2**	**PSO 1**	**PSO 2**
CO1	**U18ME706.1**	2	1	-	-	-	-	-	-	1	1	-	1	1	-
CO2	**U18ME706.2**	2	1	-	-	-	-	-	-	1	1	-	1	1	-
CO3	**U18ME706.3**	2	1	-	-	-	-	-	-	1	1	-	1	1	-
CO4	**U18ME706.4**	2	1	1		1	-	-	-	1	1	-	1	1	1
U18ME706		**2**	1	1		1	**-**	**-**	**-**	**1**	**1**	**-**	**1**	**1**	**1**

U18ME707 MAJOR PROJECT WORK PHASE-I

Class: B. Tech. VII - Semester **Branch:** Mechanical Engineering

Teaching Scheme:

L	T	P	C
-	-	6	3

Examination Scheme:

Continuous Internal Evaluation	100 marks
End Semester Examination	--

Course Learning Objectives (LOs):

The major project work will develop students' knowledge on /in…

LO1:real-world complex engineering problems, literature review, problem formulation; and experimental and data analysis techniques

LO2:design/development of solutions to real-world engineering problems; conduct of investigations of complex problems; modern tool usage to design, build and test a prototype; impact of solution in society, environment and sustainability contexts

LO3:ethics, team work and project management skills such as budgeting, scheduling

LO4:oral, written and multimedia communication skills; self-directed independent learning and life-long learning

1. Final Year Major Project work represents the culmination of study towards the B. Tech degree. ***Major project offers an opportunity to integrate the knowledge acquired from various courses and apply it to solve real-world complex engineering problems***. The **student learning assessment process** (SLAP) shall include good number of presentations, demonstration of work undertaken, submission of a project report, writing project paper in scientific journal style & format, preparing project poster and creating video pitch on the complete project work.
2. Activities of major project SLAP shall be planned in such a way to ensure that the students acquire the essential knowledge, skills and qualities (KSQ) of a professional engineer.
3. **Team work:** Major project work is a team work.
   (i) The students of a project team shall work together to achieve a common objective.
   (ii) Every student of a project team is expected to function effectively as an individual, and also with others as a team member in an ecosystem of team having knowledge diversity, gender diversity, social and cultural diversity among its members.
4. **Two phases:** Major project work shall be carried out in two phases. Nearly 50 - 75% of the proposed work to be completed in 7th semester as *Phase-I* and the remaining work to be continued and completed in 8th semester as *Phase-II*.
5. Every student is expected to put approximately **72 hours of work** into the major project *phase-I* course over the 12 weeks of 7th semester.
6. **Major project work *Phase-I*: 7th semester**
   (i) The HoD shall constitute the ***department project evaluation committee (DPEC)*** with following composition

Department project evaluation committee (DPEC)	
HoD	Chairman
Senior Faculty	Convener
Coordinator(s)	Section - wise coordinator(s) *One coordinator for each section*
Three Faculty members	Section-wise faculty members *Three faculty members for each section representing various socializations.* *(Five specializations will be covered including the coordinator's and Convener's)*

(ii) Major project allotment to students during last working week of 6th semester:

(a) **First / Second week of 6th Semester**: The process shall be initiated during the first / second week of 6th semester by collecting project titles from the department faculty research groups, on offering innovative ideas/solutions for engineering problems.

(b) **MSE-I period of 6th Semester – Notifying project titles**: The finalized project titles shall be notified to students during the MSE-I period of 6th semester and student teams shall be allowed to exercise their options on titles that interest them.

(c) **Last working week of 6th Semester – Allotment of titles and supervisors to project teams**: The project title allotment to major project teams shall be completed before the last day of instruction of 6th semester

(d) **6th semester summer break - Literature review**: This 6th semester schedule enables students to complete literature review, preliminary simulations / investigations / experimentation during 6th semester summer break and *start the work from day-one in 7th semester*

(e) **Registration Presentation - Notifying the tentative dates:** The major project teams are expected to give registration presentation during second / third week from the commencement of 7th semester. The tentative dates for conducting the registration presentation shall be notified at the time of releasing the circular on allotted project title and project supervisors, as indicated in (c) above. This enables student teams to plan the work accordingly during summer break, to complete the literature review, preliminary simulations / investigations and get ready for informative, confident and comfortable presentations on their project work.

(iii) The convener DPEC shall notify, during MSE-I period of 6th semester, the list of implementable project titles offered by the faculty of different research groups of the department

(a) Project titles shall come with the following details to be made available to students on dept webpage and notice boards, facilitating students to select problems that interest them.

i. abstract
ii. deliverables / outcomes
iii. knowledge and skills required to complete the project
iv. resources required
v. one of the deliverables shall be writing a technical paper out of the major project work done for submission to a reputed non-predatory conference/non-paid peer reviewed journal

(iv) The major project teams, finalized by the convener DPEC, shall be allowed to exercise their options on the titles that interest them from the notified list

(v) **Project supervisor allotment**: The convener DPEC shall allot, during the last week of 6th semester, the faculty supervisors to all project teams

(a) **The project supervisors shall**

i. define project objectives and expected deliverables
ii. **help the students plan their project work and timeline**
iii. **provide enough resources for successful project completion**

(vi) The faculty supervisors are expected to provide guidance to project teams on

(a) *Knowledge, skills and qualities (KSQ) to be acquired* to propose solutions to the identified real-world problems

(b) *Problem analysis* - to identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences

(c) *Applying engineering knowledge* - to apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems

(d) *Design/development of solutions* - to design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental Considerations

(e) *Conduct investigations of complex problems* - to use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions

(f) *Modern tool usage* – to create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations

(g) *Engineering and society* – to apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice

(h) *Environment and sustainability* – to understand the impact of the professional engineering solutions in societal and environmental contexts, demonstrate the knowledge of, and need for sustainable development

(i) *Ethics* – to apply ethical principles and commit to professional ethics, responsibilities, and norms of the engineering practice

(j) *Individual and team work* – to function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings

(k) *Communication* – to communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions

(l) *Project management and finance* – to demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments

(m) *Life-long learning* – to recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

(vii) The project supervisors are also expected to continuously emphasize and guide students on

(a) **Meeting Cadence:**

i. **Regular meetings with supervisor:** Short and frequent meetings increase a team's work momentum. Regular meetings with supervisor to review the status of project are very essential. All students of the team shall participate in discussions and take notes.

ii. **Meeting Frequency: Semi-weekly cadence,** i.e., the meeting frequency shall be **twice a week.** Due weightage will be given to meeting cadence and considered for evaluation during presentations, i.e., number of planned meetings and number attended by students

(b) **Project Log Book:** The activity journaling in project log book is very important for a successful project.

i. Project log book is a written record showing the daily project activity on project goals from the very first thing like starting the project (an introduction statement what the project is all about), to the completion of the work (including the final results, and whether project met the core objectives / outcomes, etc.).

ii. In project log book, the activities like regular meetings with project supervisor, and work carried out on daily/weekly basis are to be recorded. This ensures that the student progress is being monitored well.

iii. The project supervisor shall regularly check the log book of every student of project team and endorse each and every activity by affixing his signature with date. With this, the number of planned meetings and number attended by the students will be also monitored.

iv. Log books are to be shown during all presentations and will be graded along with the project.

v. At the conclusion of the project work *phase-I*, the supervisor shall specifically comment, in the project log book, on whether the project team met each of the project work *phase-I* goals and to give evidence which describes the quality of work. For project teams, this also serves as self-assessment.

(c) **Following project timeline**: completing the tasks as planned in project timeline

(d) The relevant knowledge, skills and qualities (**KSQ**) an engineering graduate should possess, which can be specially acquired by participating in major project work

(e) **Writing down whatever is done and making notes of whatever is read**. Writing down the procedures/models followed, designs made, experiments conducted, simulations carried out, intermediate results obtained, ***difficulties faced and how they were fixed*** are very important. This kind of documenting the whole process as we go with project implementation is a very effective way and will help preparing a well-documented report having original content. Note down and include information about all the resources that you used, magazines, Journals, patents, books, and so on.

This information will be needed for the bibliography in your project report. On the other hand, documenting a report ***on the spur of the moment*** would end up copying things from other sources resulting in a plagiarized document.

(f) **Good and sufficient literature review**: Literature review is a description and analysis of information related to the topic of project work. Reading good number of review articles, research articles published in recent issues of peer reviewed journals, technical magazines, patents, reference books on the topics of potential interest, will help one understand what has already been discovered and what questions remain to identify gaps in the literature.

(g) Completing nearly 50 - 75% of the proposed work during phase-I

(h) Right conduct of research to promote academic integrity, honesty and time management

(i) Preparing a well-documented report in proper format, covering the progress made during Phase-I

(j) Consequences of plagiarism and use of anti-plagiarism software to detect plagiarism in documents

(k) Submission of major project phase-I report within acceptable plagiarism levels, as per the ***Anti-plagiarism policy-2020 of our institute***.

(l) **Video pitch:** Capturing short videos, photos, screenshots on experiments conducted, simulations carried out, prototype / working model / process / software package / system developed during course of project execution, photos showing interaction with supervisor for creating a short video pitch on the work done during *phase-I.*

(m) **Project Paper**: Writing a technical paper at the end of *phase-II* based on the solution(s) proposed, results obtained and prototype / working model / process / software package / system developed, for submission to a reputed non-predatory conference/non-paid peer reviewed journal.

(n) **Project poster**: At the end of phase-II, the project teams shall have to present their project in the form of posters, at the time of demonstration of complete porotype / working model / software package / system developed.

(viii) Phase – I evaluation: There shall be only Continuous Internal Evaluation (CIE) for major project work *phase-I* with following components

(a) **Registration Presentation** *(during second / third week of 7th semester):* The Registration Presentation shall include a brief report and presentation focusing the identified problem, objective(s), literature review, identifying research gap in the literature, implementation of existing methods, proposed solution, and expected outcome(s).

i. The registration presentation shall invariably include the **project plan timeline** with actual start and finish dates– monthly/weekly project milestones/ timeline prepared in MS Excel or any other project management tool.

ii. **Project timeline –** *Weekly project milestones*: It's a compact and creative way to present a project plan. Identify the project intermediate goals and related tasks for completing each of those goals. Categorize tasks for each week. In the project timeline use different colors to the tasks for each week. Horizontal timeline layouts shall be preferred or any other layout of team's choice.

iii. Project teams shall create and present the following during registration presentation
   1. *Complete project timeline*
   2. *Phase-I project timeline*
   3. *Phase-II project timeline*

iv. During every presentation, project teams shall compulsorily show the following as part of their presentation
   1. *The slides on project timeline and*
   2. *A table showing targeted tasks as per timeline and status – whether tasks accomplished?*

v. **Project log book**: Every student of the Project team shall compulsorily show the activity journaling in the log book (*with due signatures of project supervisor*) during presentations

(b) **Progress Presentation-I** *(during penultimate week of 7th semester):* At the end of first stage (7th semester), student teams shall be required present, before the DPEC, the progress made during phase-I and submit a well-documented report of work done for evaluation to the project coordinator

i. **Following project timeline**: The project timeline shall be meticulously followed and the tasks shall be completed as planned in project timeline.

ii. Project teams shall compulsorily show the following as part of their progress presentation-I
    1. *The slides on project timeline and*
    2. *A table showing targeted tasks as per timeline and whether tasks accomplished?*

iii. **Project log book**: Every student of the Project team shall compulsorily show the activity journaling in the log book (*with due signatures of project supervisor*)

(c) **CIE schedule**: The convener DPEC shall release complete schedule of CIE before start of 7th semester well in advance, so that student teams will complete the scheduled works and get ready with informative, confident and comfortable presentation for registration and progress presentations.

(ix) CIE for the Major project work phase-I shall be as given below:

Major project work Phase-I Assessment *(7th semester)*	**Weightage**
A. Supervisor Assessment	**20%**
B. DPEC Assessment *(i) Registration Presentation (10%)* *(ii) Progress Presentation-I (20%)* *(iii) Project progress*: Part of working model/ process/software package/system developed (30%)* *(iii) Well-documented Progress Report on Phase-I work (10%)* *(iv) Video pitch on Phase-I (10%)*	**80%**
Total Weightage	**100 %**

* *Students are advised to complete major part of the project in phase-I only*

(a) **Working Model:** Every project team shall be required to develop a working model/ process/software package/system, on the chosen work. The progress made in this shall be demonstrated during progress presentation-I at the end of *phase-I* and the completed working model/ process/software package/system before the DPEC as per the dates specified by DPEC at the end of *phase-II*.

(b) **Progress Report on *phase-I*:** Every project team shall be required to submit a well-documented progress report on dissertation phase-I as per format specified by DPEC.

a. **Tangible outcomes of *phase-I* in Conclusions - Chapter:** These are the lessons learnt from doing a project work. The students have to describe in their own words what they learnt from the *phase-I* project work experience. They have to describe what specific KSQs are acquired by them, with reference to the expected COs, after successful completion of *phase-I* work. Finally, a table depicting systematic mapping of what they have learnt and the expected major project work COs, is to be presented in the conclusions chapter of *phase-I* report

(c) **Video pitch on *phase-I*:** Every project team shall be required to create a pitch video, which is a video presentation on their major project work *phase-I*. The project team shall present the produced video pitch during progress presentation-I. The produced video pitch should

a. be 3 to 5-minute-long video (no longer than 5 minutes)
b. be concise and to the point, on the problem and proposed solution
c. show project timeline and sample page of log book
d. highlight the progress made at various stages during *phase-I* project implementation with the help of short videos / photos / screenshots on experiments conducted, simulations carried out, part of prototype / working model / process / software package / system being under development as part of proposed solution and also photos showing team interactions with supervisor and the team working in the lab on project
e. discuss the impact of proposed solution in *ethical*, *environmental*, *societal and sustainable development contexts*.
f. emphasize key points about *business idea, potential market for the proposed solution*

(x) It is mandatory for

(a) every student of the team to *appear for oral presentation and viva-voce*, as part of progress presentation -I to qualify for course evaluation
(b) every project team *to submit a well-documented progress report on major project work phase-I*, as part of progress presentation -I to qualify for course evaluation
(c) every project team to create and present a good video pitch on major project work *phase-I*, as part of progress presentation -I to qualify for course evaluation

(xi) A student shall register for supplementary examination for the Major project work *phase-I* in the following cases:

(a) He/she is absent for oral presentation and viva-voce as part of progress presentation-I
(b) The project team fails to submit the progress report on *phase-I* in prescribed format
(c) The project team fails to submit the video pitch on the progress made during the *phase-I* period.
(e) he/she fails to fulfill the requirements of Major project work *phase-I* evaluation as per specified guidelines

(xii) Supplementary examination for Major project work *phase-I*

(a) The CoE shall send the list of students, registered for supplementary examination, to the HoDs concerned
(b) The DPEC, duly constituted by the HoD, shall conduct Major project phase-I supplementary exam and send the award list to the CoE within the stipulated time

****

Course Learning Outcomes (COs):
Upon completion of major project work, students will be able to…

CO1: review research literature, identify gaps in the literature, formulate problem, apply knowledge of mathematics, sciences, engineering fundamentals, experimental and data analysis techniques; synthesize technical knowledge and innovative approaches to generate suitable solutions for real-world complex engineering problems (**Technical skills**)

CO2: *design a system or product based on product/customer specifications; develop, analyze, and critically evaluate the design alternatives in order to justify the solutions to a real-world problem guided by ethical, environmental, societal and sustainable development considerations; use modern engineering and IT tools to design, build and test a prototype within specified project timeline and budget* (**Problem solving and critical thinking skills**)

CO3: apply project management and organizational skills; demonstrate integrity, leadership, creativity, professional and ethical responsibilities as an individual and as a member or leader to produce time-sensitive deliverables in a multi-disciplinary team (**Ethics and teamwork**)

CO4: *collate the results, compare performance of prototype to design specifications and present clearly and effectively the proposed solution, conclusions and/or recommendations in written (report, poster, technical paper), oral (presentations) and multimedia formats (video pitch) and engage in self-directed independent learning and life-long learning demonstrating the KSQ of a professional engineer* (**Communication skills and life-long learning**)

Course Articulation Matrix (CAM) : U18ME707 MAJOR PROJECT WORK PHASE-I

CO	CO Code	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	**U18ME707.1**	2	2	2	2	-	-	-	3	-	2	-	3	2	2
CO2	**U18ME707.2**	2	2	2	-	2	2	2	3	-	-	-	3	2	2
CO3	**U18ME707.3**	-	-	-	-	-	-	-	3	2	-	2	3	-	-
CO4	**U18ME707.4**	-	-	2	2	-	-	-	3	-	2	-	3	-	-
U18ME707		**2**	**2**	**2**	**2**	**2**	**2**	**2**	**3**	**2**	**2**	**2**	**3**	**2**	**2**

U18ME708 INTERNSHIP EVALUATION

Class: B. Tech. VII–Semester **Branch: Mechanical Engineering**

Teaching Scheme:

L	T	P	C
6 - 8 weeks internship			

Examination Scheme:

Continuous Internal Evaluation	100 marks
End Semester Examination	--

Course Learning Objectives (LOs):

The internships will develop student interns' knowledge in real-world or industry environment in/on

LO1: pre-employment training opportunities, career information and employability-enhancement skills
LO2: communication and personal development skills
LO3: critical thinking and problem-solving skills
LO4: professionalism / work ethics and teamwork / collaboration in real organizational setting

Mandatory Internships:

1. The internships provide exposure to the real-world, get a feel for the work environment and how a professional workplace operates.
2. During the internship, students will experience a real-life engineering workplace and understand how their engineering and professional knowledge, skills and qualities (KSQs) can be utilized in industry.
3. Students can learn, more importantly, how to apply the KSQs they have acquired during an internship to their future workplaces.
4. Students will also be able to demonstrate functioning engineering knowledge, both new & existing, and identify areas of further development for their future careers.
5. Internships give the student an opportunity to bridge theory and practice
6. Internships also provide students with the soft skills needed at workplace and leadership positions.
7. The internship guidelines are governed by the rules stipulated in the Institute's Internship policy-2020 document.
8. The students shall have to undergo 6-8 weeks of mandatory internship during summer/winter vacation at industry/R&D organization / Academic Institutes like IITs, IIITs& NITs.
9. HoD, along with Prof i/c internships, shall address students (*of 2nd, 4th and 6th semesters*) during last week of even semester of every academic year on the following
   a. creating awareness on mandatory 6-8 weeks internship by every student
   b. creating awareness on COs of internships
   c. KSQs the students would acquire doing internships
   d. expected internship outcomes
   e. available internship options, and organizations offering internships
   f. progressively completing 6-8 weeks internship by the end of 6th semester summer, starting from 2nd semester summer break.
   g. internship evaluation in 7th semester
   h. internship report submission and oral presentation (through PPT) by student
10. Students undergoing the internship shall be required to submit their details to the department internship coordinators of the respective branches. He will coordinate all the internship activities of the students of that department.
11. Students have to submit a signed undertaking to the department internship coordinator for demonstrating honesty, integrity, professionalism and regular attendance at work place to add value to the organization where the internship is allotted. Students also have to uphold the professional image of our institute.

12. In case, a student is found to violate the internship rules and regulations, the student will have to produce a valid reason for the violation of internship rules. Without a valid reason, the student will be debarred from taking part in subsequent placement activities of the institute.
13. The students preferably shall undergo internship at one organization only. In case of any difficulty, the stipulated period of internship shall be completed at different organizations with minimum of one week internship at every stage.
14. The internship evaluation shall be done in the VII semester of study and hence the students shall complete the prescribed period of internship before start of VII semester (from end of II semester to commencement of VII semester).
15. The student learning assessment process (SLAP): The SLAP in internships shall include feedback from internship supervisor, submission of internship report on the complete internship and PPT presentation.
16. Internship Log Book: The activity journaling in a log book is very important for a successful internship.
    a. The internship supervisor identifies the work goals at the beginning of the internship
    b. Student has to maintain internship log book, where in the activities undertaken during internship and timely submission at periodic intervals are to be documented.
    c. At the conclusion of the internship, the supervisor shall specifically comment, in the internship log book, on whether the student met each of the work goals and to give evidence which describes the quality of work. For student, this also serves as a self-assessment.
    d. Internship log book *(with due signatures of the internship supervisor)* shall be considered for evaluation during presentation, i.e., number of planned meetings with internship supervisor and number attended by student

17. **Meeting Cadence:**
    i. **Regular meetings with internship supervisor:** Regular meetings with the internship supervisor to discuss work goals and review the status of activities undertaken are very essential. Student shall participate in discussions and take notes.
    ii. **Meeting Frequency:** The meeting cadence, *i.e., meeting frequency* shall be fixed in consultation with the internship supervisor and accordingly student has to participate in discussions and take notes. Take signatures of internship supervisor as per the planned cadence in the internship log book.
18. The internship evaluation shall be done by ***department internship evaluation committee* (DIEC)** based on the submitted report by student and oral presentation.
19. There shall be only Continuous Internal Evaluation (CIE) for internship evaluation.
20. CIE for the Internship evaluation in VII semester shall be as below:

Internship evaluation	Weightage
A. **Internship Supervisor's Assessment** *(i) Feedback from the internship supervisor* *- on completion of internship assignment / work (20%)* *(ii) Feedback from the internship supervisor* *- on quality of work in internship assignment / work (10%)* *(iii) Feedback from the internship supervisor* *- internship log book (10%)* *(iv) Feedback from the internship supervisor* *- on attendance, punctuality and work hours (10%)* (For the case of 6-8 weeks internship done in more than one spell, it will be average of all the internship supervisors' assessment)	**50%**

B. DIEC Assessment *(i) Internship duration (8 /6 weeks) (15% / 10%)* *(ii) Internship Report (20%)* *(iii) Oral Presentation (with PPT) and viva voce (15%)*	**50%**
Total Weightage:	**100%**

Note: *It is mandatory for the student to appear for oral presentation (with PPT) and viva voce to qualify for course evaluation*

(a) Internship Report: Each student is required to submit a well-documented internship report (both *soft copy and softbound hard copy*) as per format specified by DIEC. In case of completing the 6-8 weeks internship in more than one organization, the student shall be required to prepare separate softbound internship reports signed by the internship supervisor(s)along with the seal(s) of the organization(s). The student shall submit two final softbound internship reports along with a soft copy, keeping all the certificate(s) issued by the internship supervisor(s) and all the individual internship reports cleared by respective internship supervisor. The Chapter-1 of the final internship report shall clearly describe the following indicating overall summary.

(i) **Internship(s) attended**: A table with name & address of organization, organization's vision and mission, internship weeks attended, internship period (exact dates attended), internship supervisor, head of the section and head of the organization

(ii) **Duties/tasks during internship(s)**: Table describing name & address of organization, and the duties / tasks undertaken during internships. This indicates what opportunities and learning experiences the interns got to get hands-on experience on a wide range of KSQs of a professional engineer.

(iii) **Tangible outcomes of internship:** These are the lessons learnt from internship experience. The students have to describe in their own words what they learnt from the internship experience. The student has to describe what specific KSQs are acquired by him, with reference to the expected internship COs, after successful completion of internship(s). Finally, a table depicting systematic mapping of what they have learnt and the expected internship COs, is to be shown

(iv) **Student feedback on internship:** To gather information on whether internship was useful and gave practical experience on chosen field of interest, and other learning, a well-defined feedback questionnaire (*made available by the dept*)with closed and open questions shall be kept in the report.

(v) **Pictures at the worksite**: Student has to keep, in the report, his working pictures at the worksite, discussing with the internship supervisor, the creative project he is working on, or an event he is attending for work, group photo of the team/section/department he worked with.

(b) Anti-Plagiarism Check: The internship report should clear plagiarism check as per the Anti-Plagiarism policy-2020 of the institute.

(c) Presentation: Each student should prepare PPT with informative slides and make an effective oral presentation before the DIEC as per the schedule notified by the department. The presentation shall compulsorily have slides on the points mentioned in (a)(i)-(v)

(d) It is mandatory for every student to *appear for oral presentation(with PPT) and viva-voce*, to qualify for internship evaluation

(e) A student shall register for supplementary examination for the internship evaluation in the following cases:

(i) absent for oral presentation and viva-voce

(ii) fails to submit the internship report in prescribed format

(iii) fails to fulfill the requirements of internship evaluation as per specified guidelines

(f) Supplementary examination for internship evaluation

(i) The CoE shall send the list of students, registered for supplementary examination, to the HoD concerned

(ii) The DIEC, duly constituted by the HoD, shall conduct internship evaluation supplementary exam and send the award list to the CoE within the stipulated time

****

Course Learning Outcomes (COs):

Upon completion of the internship, student interns will be able to…

CO1: *gain career awareness, company/industry/workspace related knowledge, skills and work experience to add to resume, employer expectations for workplace behaviours; explore career alternatives prior to graduation; initiate and build a professional network and acquire employment contacts leading directly to a full-time job following graduation from institute; apply practice-oriented 'hands-on' interdisciplinary working experience in the real world or industry to solve real life challenges in the workplace by integrating academic theory and practice and analysing work environment and conditions; commitment to quality and continuous improvement; integrate internship experience with academic plan and articulate career options* **(Career information and employability-enhancement skills)**

CO2: *receive and interpret messages in the communication; present thoughts and ideas clearly and effectively in oral, written, computer-based, graphical forms as required for particular workplace settings; collaborate effectively and appropriately with different professionals in the work environment; demonstrate time management, planning, independence, professional judgement and positive attitudes (self-reliance & self-confidence, openness, respect, proactive attitude, conscientiousness*)**(Communication and personal development skills)**

CO3: *review research literature, apply the knowledge of science, mathematics, and engineering with higher order cognitive skills to solve real-world problems and impact of solutions in society, environment and sustainability contexts; integrate existing and new technologies for industrial application; conduct investigations of problems; demonstrate analytical skills, including the ability to understand information and interpret data; exhibit foresight, independent thinking, resourcefulness, and the ability to make decisions; design systems, devices and components as needed and use the right tool (e.g., strategy, system, technology, etc.) for the right task* **(Critical thinking and problem solving skills)**

CO4: *demonstrate effective leadership with work ethics including time management, punctuality, honesty, integrity, personal accountability, adaptability; work effectively in teams and real multidisciplinary organizational settings; interact respectfully with all people and understand individuals' differences; build professional relationships with interpersonal skills; maintain a sense of commitment to professional, ethical and social responsibilities; engage on life-long learning of technologies through critical reflection of internship experiences and the KSQ of a professional engineer* **(Professionalism / Work ethic and Teamwork / Collaboration)**

Course Articulation Matrix (CAM) :U18ME708 INTERNSHIP

CO	CO code	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	U18ME708.1	3	-	-	-	-	3	-	3	-	-	3	3	2	2
CO2	U18ME708.2	-	-	-	-	-	-	-	3	-	3	3	3	-	-
CO3	U18ME708.3	3	3	3	3	3	3	3	3	-	-	3	3	2	2
CO4	U18ME708.4	-	-	-	-	-	-	-	3	3	-	3	3	-	-
U18ME708		**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**2**

DEPARTMENT OF MECHANICAL ENGINEERING
KAKATIYA INSTITUTE OF TECHNOLOGY & SCIENCE, WARANGAL – 15
(An Autonomous Institute under Kakatiya University, Warangal)

SCHEME OF INSTRUCTION AND EVALUATION
VIII-SEMESTER OF 4-YEAR B.TECH DEGREE PROGRAMME

[3Th+1Major Project]

Sl. No	Category	Course Code	Course Title	Hours per week			Credits	Evaluation Scheme				
								CIE			ESE	Total Marks
				L	T	P	C	TA	MSE	Total		
1	PE	U18ME801	Professional Elective - V / MOOC-V	3	-	-	3	10	30	40	60	100
2	PE	U18ME802	Professional Elective - VI / MOOC-VI	3	-	-	3	10	30	40	60	100
3	OE	U18OE803	Open Elective - IV / MOOC-VII	3	-	-	3	10	30	40	60	100
4	PROJ	U18ME804	Major Project - Phase – II	-	-	14	7	60	-	60	40	100
Total:				**9**	**-**	**14**	**16**	**90**	**90**	**180**	**220**	**400**
Additional Learning*: *Maximum credits allowed for Honours/Minor*				-	-	-	*7*	-	-	-	-	-
Total credits for Honours/Minor students:				**-**	**-**	**-**	***16+7***	**-**	**-**	**-**	**-**	**-**

** List of courses for additional learning through **MOOCs** towards Honours/Minor in Engineering shall be prescribed by the department under Honours/ Minor Curricula*

L= Lecture, T = Tutorials, P = Practicals & C = Credits Contact hours per week : 23

Professional Elective-V / MOOC-V:	**Professional Elective-VI/ MOOC-VI:**	**Open Elective-IV/MOOC-VII:**
U18ME801A: Power Plant Engineering	U18ME802A: Additive Manufacturing	U18OE803A: Operations Research
U18ME801B: Total Quality Management	U18ME802B: Automobile Engineering	U18OE803B: Management Information Systems
U18ME801C: MEMS and Nano Technology	U18ME802C: Computational Fluid Dynamics	U18OE803C: Entrepreneurship Development
U18ME801M: MOOCs course	U18ME802M: MOOCs course	U18OE803D: Forex and Foreign Trade
		U18OE803M: MOOCs course

U18ME801A **POWER PLANT ENGINEERING**

Class: B. Tech. VII-Semester **Branch:** Mechanical Engineering (ME)

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation	40 marks
End Semester Exam	60 marks

Course Learning Objectives(LOs):

This course will develop students' knowledge in/on…

LO1: energy resources and types of nuclear power stations

LO2: working principles of steam and combined cycle power plants

LO3: hydrology and hydroelectric power plants

LO4: power plant economics

UNIT-I (9)

Energy Resources: Classification, present scenario in modern power plants, types of power plants, power potentiality in India

Nuclear power plants: Indian nuclear power stations, site selection, principle of nuclear fission, fuels, components of reactor; properties of coolants and moderators; types of reactors - boiling water, pressurized water, gas cooled, breeder and liquid metal cooled; types and disposal of nuclear waste; comparison between nuclear and thermal power plants

UNIT-II (9)

Steam power plants: Classification, site selection, modern power plant layout and system components; fuel handling, burning-over feed and under feed stokers, pulverized fuel and its advantages, air circulation, water treatment, cooling towers, principle of fluidized bed combustion and its advantages, ash handling and dust collection.

Combined cycle power plants: Topping cycle, bottoming cycle, gas and steam turbine combined cycle power plant-working principle, layout, advantages, limitations; Heat Recovery Steam Generator (HRSG).

UNIT-III (9)

Hydrology: Hydro-cycle, rain fall, run-off and its measurements, flow duration curves, mass curves and storage, hydrograph

Hydel power plants: Site selection, advantages of hydel plants over thermal plants, classification - high, medium and low head plants, runoff river plants, storage reservoir and pumped storage plants

UNIT-IV (9)

Power plant economics: Introduction, load curves, demand, load, diversity and plant capacity factor; elements of costs of power, fixed and operating costs, depreciation methods; selection of power generation method; input and output curves; economical load division; tariff methods for electrical energy

Textbook:

1. S. C. Arora & S. Domakundwar, —A Course in Power Plant Engineering", Dhanpat Rai & Sons, 3rd ed. New Delhi: 2013.

Reference Books:

1. WakilM.M.El., —Power Plant Technology", McGraw-Hill, New York, 1988
2. Nag P.K., —Power Plant Engineering", Tata McGraw-Hill, New Delhi, 2002
3. Nagpal G.R., —Power Plant Engineering", Khanna Publishers, New Delhi, 1988
4. R.K Rajput - Power plant Engineering , Laxmi publication PVT LTD, 5th edition, New Delhi, 2007

Course Learning Outcomes (CO):

Upon completion of this course, students will be able to…

CO1: explain the working of nuclear power plants and waste disposal techniques

CO2: discuss the working principles of steam and combined cycle power plants

CO3: describe hydrology and hydroelectric power plants

CO4: evaluate the power plant economic parameters

Course Articulation Matrix (CAM): U18ME801A POWER PLANT ENGINEERING

CO		PO1	PO2	PO 3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	**U18ME801A.1**	2	2	2	1	-	-	-	-	-	1	-	1	2	1
CO2	**U18ME802A.2**	2	2	2	1	-	-	-	-	-	1	-	1	2	1
CO3	**U18ME803A.3**	2	2	2	1	-	-	-	-	-	1	-	1	2	1
CO4	**U18ME804A.4**	2	2	2	1	-	-	-	-	-	1	-	1	2	1
U18ME801A		**2**	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**1**	**2**	**1**

U18ME801B: TOTAL QUALITY MANAGEMENT

Class: B. Tech. VIII – Semester **Branch:** MECHANICAL ENINEERING (ME)

Teaching Scheme:

L	T	P	C
3	–	–	3

Examination Scheme:

Continuous Internal Evaluation	40 marks
End Semester Examination	60 marks

Course Learning Objectives:

This course will develop students' knowledge in/on

LO9: total quality management (TQM) & TQM philosophies
LO10: planning and quality management systems
LO11: TQM principles and customer satisfaction
LO12: statistical process control, tools and techniques of quality management

UNIT – I (9)

Total quality management (TQM) – Definition, Need for TQM, basic approach, traditional approach to the quality management– inspection, rejection; evolution of quality, concept of quality, benefits and obstacles of TQM

TQM philosophies – Philosophies of Deming, Juran, Crosby; TQM models.

UNIT – II (9)

Planning - Vision, mission, quality policy, objective planning and organization for quality; quality policy deployment, quality function deployment (QFD), introduction to business process reengineering (BPR) and analysis of Quality Costs.

Quality management systems (QMS): Need for ISO 9000 systems, clauses, documentation, implementation; Introduction toISO14000, QS9000 and CMM levels; case studies.

UNIT – III (9)

TQM principles: customer focus, leadership and top management commitment; Employee involvement – empowerment and team work, performance, reward, motivation, recognition, empowerment and gain sharing, types of team work; supplier quality management, continuous process improvement; training, performance measurement;

Customer satisfaction: Customer satisfaction model, customer perception of quality, tools to collect information about the customer, customer complaints & service quality

UNIT – IV (9)

Statistical Process Control charts for TQM: Process Flow chart, brainstorming, fishbone diagram check sheets, Pareto analysis, Histogram and scatter diagram; control charts- control charts for variables and control charts for attributes.

TQM tools and techniques: Plan-Do-Check- Act (PDCA), Bench marking, concept of six sigma, failure mode effect analysis (FMEA), , Just in time (JIT), POKA-YOKE, 5S, KAIZEN, Quality circles

Textbooks:

1. Dale H. Besterfield, "*Total Quality Management*", 4th edn. , Pearson Education India, 2015. (Chapter 1-7, 10, 12, 14, 17, 18)
2. Suganthi L. and Samuel A., "*Total Quality Management*", Prentice Hall India, 2006 (Chapter 1-6)

Reference Books:

1. Kulkarni V. A. and Bewoor A.K., "*Quality Control*", 1stedn., Wiley India Ltd. New Delhi, 2009.
2. Juran J. M and Frank M. Gryna Jr., "*Quality Planning and Analysis*", Tata MacGraw Hill, 1982
3.

Course Learning Outcomes (COs):
On completion of this course, the students will be able to…
CO1: differentiate between traditional approach and TQM; assess & implement TQM philosophies
CO2: analyze quality statements; implement quality management systems
CO3: appraise the importance of TQM leadership, management commitment, teamwork and customer satisfaction
CO4: select statistical process control charts, tools and techniques to enhance the quality of processes or products

Course Articulation Matrix (CAM) : U18ME801B TOTAL QUALITY MANAGMENT														
COs		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	U18ME801B.1	2	1	1	-	1	-	-	-	2	-	1	1	2	1
CO2	U18ME801B.2	2	1	1	-	1	-	-	-	2	-	1	1	2	1
CO3	U18ME801B.3	2	1	1	-	1	-	-	-	2	-	1	1	2	1
CO4	U18ME801B.4	2	1	1	-	1	-	-	-	2	-	1	1	2	1
U18ME801B		2	1	1	-	1	-	-	-	2	-	1	1	2	1

U18ME801C MEMS AND NANOTECHNOLOGY

Class: B. Tech. VIII – Semester **Branch: Mechanical Engineering (ME)**

Teaching Scheme:

L	T	P	C
3	–	–	3

Examination Scheme:

Continuous Internal Evaluation	40 marks
End Semester Examination	60 marks

Course Learning Objectives (LOs):
This course will develop students' knowledge in/on…
LO1: MEMS, working principles and applications of microsystems
LO2: materials for MEMS and microsystems, scaling laws in miniaturization
LO3: microsystems design and micro-system fabrication processes
LO4: nanotechnology, synthesis and fabrication methods of nano materials

UNIT – I (9)

MEMS and Microsystems: typical MEMS and microsystem products, evolution of micro-fabrication, microsystems and miniaturization, application of microsystems in industrial products and telecommunications

Working Principles of Microsystems: micro-sensors, micro-actuation, MEMS with micro-actuators, micro-accelerators and micro-fluidics

UNIT –II (9)

Materials for MEMS and Microsystems: Substrates and wafers, active substrate materials, silicon compounds, silicon piezo resistors, gallium arsenide, quartz, piezoelectric crystals, polymers and packaging materials

Scaling Laws in Miniaturization: scaling- geometry, rigid-body dynamics, electrostatic forces, electromagnetic forces, electricity, fluid mechanics and heat transfer

UNIT– III (9)

Microsystem Fabrication Processes: photolithography, ion implantation, diffusion, oxidation, chemical vapor deposition, physical vapor deposition-sputtering, deposition by epitaxy, etching; Micro manufacturing - bulk micro manufacturing, surface micromachining and LIGA (Lithographie, Galvanoformung, Abformung) process

Microsystems Design: ions and ionization, doping of semiconductors, diffusion process, plasma physics, electrochemistry, and quantum physics, design considerations, design constraints, selection of materials, manufacturing processes, signal transduction, electromechanical system and Computer Aided Design of microsystems

UNIT - IV (9)

Nanotechnology: History of Nano science, Nanometer, Nanomaterials and Nanotechnology, Nanomaterials- classification, properties, and safety precautions.

Synthesis of Nano Materials and Device Fabrication: synthesis of bulk poly crystalline samples, synthesis techniques for preparation of nano particles-bottom-up approach-sol-gel synthesis, hydro thermal growth, thin film growth, physical vapor deposition and chemical vapor deposition; top-down approach-ball milling, microfabrication, lithography and ion-beam lithography; applications of nanotechnology in different fields

Textbooks:

[1] Tai-Ran Hsu, *MEMS and Microsystems: Design, Manufacture and nanoscale engineering,* 2nd ed., John Wiely&Sons,New Jersey, 2008.(Chapters 1, 2,3, 6 ,7,10)

[2] B. S. Murty, P. Shankar, Baldev Raj et al.,*Textbook on Nanoscience and Nanotechnology,* 1st ed., Springer-Verlag Berlin Heidelberg, 2013.(chapter 1,2,3,6)

Reference Books:

[1] M. S. Ramachandra Rao, Shuba Singh, *Nanoscience and Nanotechnology: Fundamentals to Frontiers,* 1st ed., New Delhi: Wiley India Pvt Ltd., 2013. (Chapters1, 4 & 10)

[2] M. Elwenspoek and R. Wiegerink, *Mechanical Microsensors*, Springer-Verlag Berlin Heidelberg, 2001

[3] Charles P. Poole, Jr., Frank J. Owens, *Introduction to Nanotechnology*, John Wiley & Sons, New Jersey: 2003.

[4] G.T.A. Kovacs, *Micromachined Transducers Source Book,* McGraw-Hill, 1998.

[5] S.D. Senturia, *Microsystem Design*, Kluwer, New York: 2001.

[6] K. Eric Drexler, *Nanosystems: Molecular Machinery, Manufacturing, and Computation*, John Wiley & Sons, New York: 2002.

Course Learning Outcomes (COs):

On completion of this course, students will be able to ...

CO1: appraise the working principles and applications of MEMS & microsystems
CO2: identify the materials for MEMS &microsystems and explain different scaling laws in miniaturization
CO3: design microsystems and select the appropriate fabrication processes
CO4: Distinguish Nanomaterials and select fabrication methods of Nano Materials

Course Articulation Matrix(CAM): U18ME801C MEMS AND NANOTECHNOLOGY

CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	U18ME801C.1	2	1	-	-	1	1	-	-	-	-	-	1	2	1
CO2	U18ME801C.2	2	1	-	1	-	1	-	-	-	-	-	1	2	1
CO3	U18ME801C.3	2	1	1	1	1	1	-	-	-	-	-	1	2	1
CO4	U18ME801C.4	2	1	1	1	1	1	-	-	-	-	-	1	2	1
U18ME801C		**2**	**1**	**1**	**1**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**1**	**2**	**1**

U18ME802A ADDITIVE MANUFACTURING

Class: B. Tech., VIII-Semester **Branch:** Mechanical Engineering

Teaching Scheme:

L	T	P	C
3	–	–	3

Examination Scheme:

Continuous Internal Evaluation	40 marks
End Semester Examination	60 marks

Course Learning Objectives(LOs):

This course will develop students' knowledge in/on

LO1:fundamentals of rapid prototyping process and liquid based rapid prototyping systems

LO2: solid based and powder based rapid prototyping systems

LO3: extrusion based rapid prototyping systems and rapid tooling

LO4: rapid prototyping data formats and rapid prototyping applications

UNIT-I (9)

Introduction to Rapid Prototyping: Fundamentals of rapid prototyping, advantages and limitations, classification of rapid prototyping, rapid prototyping process chain; materials used in rapid prototyping, multifunctional and graded materials.

Liquid based Rapid Prototyping Systems: Stereo Lithography Apparatus (SLA), Solid Ground Curing (SGC)-working principle, applications, advantages and disadvantages, vat photopolymerization process principle, applications and drawbacks.

UNIT-II (9)

Solid Based Rapid Prototyping Systems: Laminated Object Manufacturing (LOM), Stratasys', Kira's Paper Lamination Technology (PLT)-working principle, applications, advantages and disadvantages, shape deposition manufacturing process.

Powder Based Rapid Prototyping Systems: Selective Laser Sintering (SLS), powder fusion mechanism and powder handling, Electron Beam Melting (EBM), Fraunhofer's Multiphase Jet Solidification (MJS),Thericsinc's theriform technology-working principle, applications, advantages and disadvantages.

UNIT-III (9)

Extrusion Based Rapid Prototyping Systems: Fused Deposition Modelling (FDM), principles, process modelling, plotting and path control, bio-extrusion, contour crafting, process benefits, drawbacks and applications of extrusion-based processes.

Rapid Tooling: Conventional tooling and Rapid tooling, classification of rapid tooling, direct and indirect tooling methods, soft and hard tooling methods.

UNIT-IV (9)

Rapid Prototyping Data Formats: STL format, STL file problems, consequence of building valid and invalid tessellated models, STL file repair, other translators and newly proposed formats.

Rapid Prototyping Applications: Applications-design, engineering, analysis and planning, aerospace industry, automotive industry, biomedical industry, jewelry industry and coin industry.

Textbook:

1. Chua Chee Kai., Leong Kah Fai. and Chu Sing Lim, *Rapid Prototyping: Principles and Applications in Manufacturing*, 2nd edn., World Scientific, 2003.

Reference Books:

1. Ian Gibson., David W Rosen. and Brent Stucker., *Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing*, 1st edn., Springer, 2010.
2. D.T. Pham, Duc, S.S. Dimov, *Rapid Manufacturing: The Technologies and Applications of Rapid Prototyping and Rapid Tooling*, 1st edn. Springer 2001.
3. RafiqNoorani, Rapid Prototyping: *Principles and Applications in Manufacturing,*2nd edn.,John Wiley & Sons, 2006.

Course Learning Outcomes (COs):

Upon completion of this course, students will be able to…

CO1: classify the rapid prototyping systems and explain the Liquid based rapid prototyping systems

CO2: apply the knowledge of solid and powder based processes in rapid prototyping components

CO3: select the rapid prototyping tool in preparation of various parts of a functional CAD model in relatively less time and cost

CO4: describe rapid prototyping data formats and explore the applications of rapid prototyping systems in various fields

Course Articulation Matrix (CAM):U18ME802 A :ADDITIVE MANUFACTURING															
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	U18ME802A.1	2	1	2	1	1	-	-	-	-	1	-	-	2	1
CO2	U18ME802A.2	2	1	2	1	1	-	-	-	-	1	-	-	2	1
CO3	U18ME802A.3	2	1	2	1	1	-	-	-	-	1	-	-	2	1
CO4	U18ME802A.4	2	1	2	1	1	-	-	-	-	1	-	-	2	1
U18ME802 A		2	1	2	1	1	-	-	-	-	1	-	-	2	1

U18ME802B **AUTOMOBILE ENGINEERING**

Class: B. Tech, VIII-Semester **Branch:** Mechanical Engineering

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation	40 marks
End Semester Exam	60 marks

Course Learning Objectives (LOs):

This course will develop students' knowledge in/on

LO1: classification of automobiles and elements of transmission system

LO2: propeller shaft,axle, steering system and braking system

LO LO3: suspension system elements, wheels, tyres and electrical system

LO4: lubrication, cooling systems, emissions controls and current trends of automobiles

UNIT-I (9)

Automobile: Introduction, classification and parts; **Chassis**- chassis layout; frames

Transmission system: Requirements, types and elements

Clutch-Function, types- friction clutches - single plate, multi-plate, centrifugal and semi-centrifugal; automatic transmission device- fluid flywheel

Gear box: Types-sliding mesh, constant mesh, synchromesh and automatic gear box; over drive

UNIT-II (9)

Propeller shaft: Types- hotchkiss and torque tube; final drive and differential

Axle System: Functions; front axle types -rigid and independent; rear axle mounting

Steering system: Principle, need, layout, steering gear, steering ratio, steering lock, turning radius, wheel geometry; Power steering- hydraulic and electronic

Braking system: Classification, principle, requirements; types- disc, hydraulic, power and servo; automatic and antilock braking system

UNIT-III (9)

Suspension system: Functions, elements, torsion bars, stabilizer bars and shock absorbers; types-rigid axle, solid leaf spring and coil spring, air suspension

Wheels: Assembly, pressed and cast wheel; wheel rim; wheel balancing

Tyre: Specifications, construction, tyre treads and tubeless tyres

Electrical systems: Wiring diagram, head lights- high beam, restricted high beam; electrical circuits- flashers, horn and wiper; air-conditioning; heating and ventilating

UNIT-IV (9)

Lubrication: Functions, properties; types - splash, pressure, dry sump, wet sump and mist; **cooling systems:** Air cooling, water-cooling and oil cooling

Emissions and Control: Effects of emissions, pollution control, Euro norms, Bharat norms; testing devices, engine tuning, engine re-boring; vehicle standard service and maintenance

Current Trends in Automobiles: autonomous, artificial intelligence and machine learning, electric vehicle, hybrid electric vehicle and solar vehicle

Textbook:

1. Srinivasan, S, "Automotive Mechanics', 2nd ed., Tata McGraw-Hill, 2003. (Chapters 1,2,3,4,5,6,9,19,20 & 26)

Reference Books:

1. Dr. Kirpal Singh, —Automobile Engineering, Vol. I & II, 14th ed., Standard Publishers, New Delhi,2017
2. R. K. Rajput —Automobile Engineering", 2nd ed., Laxmi Publishers, 2017.
3. Kamaraju Ramakrishna, "Automobile Engineering", 1st ed., PHI Learning, New Delhi, 2016.
4. William H.Crouse and Donald L. Anglin "Automotive Mechanics", 10th ed., Tata McGraw-Hill, 2006
5. Joseph Heitner "Automotive Mechanics Principles and Practices" 2nded.,CBS Publishers & Distributors Pvt. Ltd, 2004.
6. K M Gupta, Automobile Engineering, Vol. I & II, Delhi, Umesh Publications, 2002.

Course Learning Outcomes (COs):

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

CO1: classify automobiles and explain elements of transmission system like clutch, gear box and automatic transmission

CO2: examine the working principle of propeller shaft, axle and explain various parts of steering system, braking system

CO3: illustrate suspension system elements, wheels, tyres and electrical system

CO4: explain lubrication and cooling systems, emission norms and current trends in automobiles

Course Articulation Matrix (CAM):U18ME802BAUTOMOBILE ENGINEERING

CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	U18ME802B.1	2	1	1	-	-	-	-	-	-	1	-	1	1	1
CO2	U18ME802B.2	2	1	1	-	-	-	-	-	-	1	-	1	1	1
CO3	U18ME802B.3	2	1	1	-	-	-	-	-	-	1	-	1	1	1
CO4	U18ME802B.4	2	1	1	-	-	-	1	-	-	1	-	1	1	1
U18ME802B		2	1	1	-	-	-	1	-	-	1	-	1	1	1

U18ME802C COMPUTATIONAL FLUID DYNAMICS

Class: B.Tech. VIII-Semester **Branch:** Mechanical Engineering

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation	40marks
End Semester Examination	60marks

Course Learning Objectives (LOs):

This course will develop students' knowledge in/on

LO1: basics, solution procedure of CFD and Navier-Stokes Equations

LO2: turbulence and classification of partial differential equations

LO3: nature of parabolic and elliptic partial differential equations

LO4: nature of hyperbolic partial differential equations, stability analysis and FVM

UNIT-I(9)

Introduction: history and philosophy of Computational Fluid Dynamics (CFD), CFD as a design and research tool, applications of CFD in engineering.

CFD solution procedure: creation of geometry, specification of fluid properties; specification of boundary conditions; numerical solution – initialization, solution control, convergence, post processing – x-y plots, vector plots, contours plots.

Governing equations of fluid dynamics: flow models, substantial derivative, physical meaning of the divergence of velocity, continuity equation, momentum equation, energy equation, Navier-Stokes equations for viscous flow

UNITII(9)

Governing equations of fluid dynamics: Euler equations for inviscid flow, physical boundary conditions, forms of the governing equations suited for CFD, conservative form of the Navier-Stokes equations

Turbulence: definition, its source, its impact on solution methodology, k-ε two equation model, k-ω equation model - applications, significance of above models, significance of Coupled, PISO, Convergence criteria, Reynolds averaged Navier Stokes component.

Mathematical behavior of partial differential equations: Classification of quasi-linear partial differential equations

UNITIII (9)

Parabolic partial differential equations: finite difference formulations; explicit methods - Forward Time Centered Space (FTCS), Richardson and DuFort-Frankel methods, Implicit methods - Lasonen, Crank-Nicolson and Beta formulation methods, approximate factorization, fractional step methods, consistency analysis, linearization.

Elliptic equations: finite difference formulation, solution algorithms, Jacobi-iteration method, Gauss Siedel iteration method, point- and line-successive over-relaxation methods, alternative direction implicit methods.

UNIT-IV(9)

Hyperbolic equations: explicit and implicit finite difference formulations, splitting methods, multi-step methods, applications to linear and nonlinear problems, linear damping, flux corrected transport, monotone and Total Variation Diminishing (TVD) schemes, TVD formulations, entropy condition, first-order and second-order TVD schemes.

Stability analysis: discrete perturbation stability analysis, Von Neumann stability analysis, error analysis, modified equations, artificial dissipation and dispersion.

Finite Volume Method (FVM): Introduction of FVM - 1-D, 2-D, 3-D steady state diffusion equations

Textbook:

1. John, D. Anderson Jr., Computational Fluid Dynamics, *McGraw Hill Education*, 1995.

Reference Books:

1. Hoffman, K.A., and Chiang, S.T., Computational Fluid Dynamics, Vol. I, II and III, Engineering Education System, Kansas, USA, 2000.
2. S.V.Patankar,-Numerical Heat Transfer and Fluid Flow, *McGraw-Hill*, 1980.
3. JohnC. Tannehill, DaleA. Andersonand Richard H. Pletcher, Vijay Shankar *Computational Fluid Mechanics and Heat Transfer*, Taylor & Francis, 4thedn.,2020.
4. H.K. Versteeg & W. Malalasekera, *An Introduction to Computational Fluid Dynamics*, *Pearson*, 2ndedn., 2008.

Course Learning Outcomes (COs):

Up on completion of this course, students will be able to…
CO1: design a simple geometry using CFD procedure and derive the Navier-Stokes Equations
CO2: derive the Navier-Stokes equations in conservative forms, explain turbulence models and classify partial differential equations
CO3: solve parabolic and elliptic partial differential equations
CO4: evaluate hyperbolic partial differential equations, understand stability analysis and FVM

Course Articulation Matrix (CAM): U18ME802C COMPUTATIONAL FLUID DYNAMICS														
CO		**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	U18ME802C.1	2	2	2	-	-	-	-	-	-	1	1	-	2	1
CO2	U18ME802C.2	2	2	2	2	2	-	-	-	-	1	1	-	2	1
CO3	U18ME802C.3	2	2	2	2	2	-	-	-	-	1	1	-	2	1
CO4	U18ME802C.4	2	2	2	2	2	-	-	-	-	1	1	-	2	1
U18ME802C		2	2	2	2	2	-	-	-	-	1	1	-	2	1

U18OE803A - OPEARTIONS RESEARCH

Class: B. Tech. VIII – Semester **Branch(s):** ME, CSE, CE, EEE, ECE, EIE

Teaching Scheme:

L	T	P	C
3	–	–	3

Examination Scheme:

Continuous Internal Evaluation	40 marks
End Semester Examination	60 marks

Course Learning Objectives:

This course will develop students' knowledge in/on

LO13: concepts to solve linear programming problems which arise in real life using various methods and their advantages

LO14: *applications of linear programming namely transportation and assignment problems which arise in different engineering fields.*

LO15: *non-linearity in optimization problems, direct search techniques and iterative methods.*

LO16: *various queuing systems and their practical relevance.*

UNIT – I(9)

Linear Programming Problem (LPP): Mathematical models and basic concepts of linear programming problem; Solution of linear programming problem - Graphical method, Simplex method, Artificial variable techniques (Big-M and Two-phase method), Duality in linear programming, dual simplex method.

UNIT – II (9)

Special types of LPP: Mathematical model of transportation problem, Methods of finding initial basic feasible solution, optimal solution of transportation problem, Degeneracy in transportation problem; Exceptional cases in transportation problem- Unbalanced transportation problem, Maximization transportation problem; Assignment problem- Mathematical formulation of the problem, Hungarian method to solve an assignment problem, Special cases in assignment problem- Maximization assignment problem.

UNIT – III (9)

Non-linear Programming Problem (NLPP): Classical method of optimization using Hessian matrix; Iterative methods - Random search methods-Random jump method, Random walk method, Steepest decent method and Conjugate gradient method; Direct methods - Lagrange's method, Kuhn-Tucker conditions.

UNIT – IV (9)

Queueing Theory: Queueing system- Elements and operating characteristics of a queuing system; Probability distributions in queueing systems- Distribution of arrivals (Pure Birth Process); Classification of queueing models; Poisson queueing systems- Study of various characteristics of single server queuing model having infinite population $\{(M/M/1):(\infty/FIFO)\}$ and single server queuing model having finite population $\{(M/M/1):(N/FIFO)\}$, Generalized model (Birth-Death process).

Textbook:

[1]. Kanti swarup et.al, *Operations Research*, 16th ed., New Delhi: S. Chand & Sons, 2013. (Unit-I, Unit-II, Unit-IV)

[2]. Singiresu S. Rao, *Engineering Optimization Theory and Practice*, 4th ed., Hoboken, New Jersey: John Wiley & Sons, Inc, 2009 (Unit-III)

Reference Books:

[1]. Hamdy. A. Taha, *Operations Research*, 7th ed., New Delhi: Prentice Hall of India Ltd, 2002.
[2]. J.C. Pant, *Introduction to Optimization*, 7th ed., New Delhi*: Jain* Brothers, 2012.

Course Research Papers: Research papers (Journal/Conference papers) relevant to the course content will be postedby the course faculty in Course Web page

Course Patents: Patents relevant to the course content will be posted by the course faculty in Course Web page

Course Projects: Course project is an independent project carried out by the student during the course period, under the supervision of course faculty. Course faculty will post few course projects titles in Course Web page. Students are encouraged to come up and experiment with the ideas that interest them.

Course Learning Outcomes (COs):
On completion of this course, the students will be able to…

CO1: model engineering real time problems and solve them using various LPP techniques

CO2: obtain the optimal solution of transportation, assignment problems and their real time applications

CO3: optimize the engineering problems using NLPP techniques

CO4: differentiate various queueing models and their practical relevance

Course Articulation Matrix: U18OE803A - OPEARTIONS RESEARCH

CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	U18OE803A.1	2	2	-	-	-	-	-	-	-	1	-	1	-	-
CO2	U18OE803A.2	2	2	-	-	-	-	-	-	-	1	-	1	-	-
CO3	U18OE803A.3	2	2	-	-	-	-	-	-	-	1	-	1	-	-
CO4	U18OE803A.4	2	2	-	-	-	-	-	-	-	1	--	1	-	-
U18OE803A		2	2	-	-	-	-	-	-	-	1		1	-	-

U18OE803B MANAGEMENT INFORMATION SYSTEMS

Class: B.Tech. VIII- Semester **Branch:** Mechanical Engineering (ME)

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation	40 Marks
End Semester Exam	60 Marks

Course Learning Objectives (LOs):

This course will develop students' knowledge in/on…

LO1: basic concepts and challenges of management information systems
LO2: e-business and decision support systems techniques
LO3: development process and design of management information systems
LO4: different applications of management information systems

UNIT – I (9)

Management Information Systems: Systems: An Overview : Introduction, Need for management information systems, Management information systems: A concept, MIS: A definition, Management information system and Information technology, Nature and scope of MIS, MIS characteristics, Structure of MIS, Types of MIS, Role of MIS in global business, Challenges of managing information systems, IT Infrastructure and Emerging Technology

UNIT - II (9)

Business Applications of Information Systems:

E-Commerce, E-Business and E-Governance: Introduction, E-commerce, E-commerce sales life cycle, E-commerce infrastructure, E-commerce applications, E-commerce payment systems, Management challenges and opportunities, E-business, E-governance

Decision Support Systems: Introduction, Decision-Making: A concept, Simon's model of decision-making, Types of decisions, Methods for decision-making, Decision support techniques, Decision-making and role of MIS, Decision support systems, Business intelligence, Knowledge management systems

UNIT - III (9)

Development process of MIS : Development of long range plans of the MIS, Ascertaining the class of information, Determining the information requirement, Development and implementation of the MIS, Management of information quality in the MIS, Organisation for development of MIS, MIS: Development process mode

Strategic Design of MIS : Strategic management of the business, Why strategic design of MIS, Balance score card, Score card and Dash board, Strategic design of MIS, Development process steps for strategic design (SD) of MIS, Illustrating SD of MIS for big bazaar, Strategic management of business and SD of MIS, Business strategy determination, Business strategy implementation

UNIT - IV (9)

Management of Global Enterprise : Enterprise management system, Enterprise resource planning (ERP) System, ERP model and modules, Benefits of the ERP, ERP product evaluation, ERP implementation, Supply chain management (SCM), Information management in SCM, Customer relationship management (CRM), Management of global enterprise, EMS and MIS

Applications in Manufacturing Sector: Introduction, Personnel management (PM), Financial management (FM), Production management (PM), Raw materials management (RMM), Marketing management, Corporate overview.

Text Books:

[1] D.P.Goyal, Vikas, *Management Information Systems–Managerial Perspective*, 4th ed. Addison-Wesley, 2014. *(Unit 1)*

[2] Waman S. Jawadekar, *Management Information Systems Text and Cases: a Global Digital Enterprise Perspective,* 5th ed. McGraw Hill, 2014 *(Unit 2,3,4)*

Reference Books:

[1] Kenneth C. Laudon & Jane P. Laudon, *Management Information Systems,12th ed.* Prentice Hall, 2012.

[2] S. Sadagopan, *Management Information Systems,2nd ed.,* PHI Learning, 2014.

Course Learning Outcomes (COs):

On completion of this course, students' will be able to…

CO1: explain the structure and importance of management information systems
CO2: analyze management information systems for decision making
CO3: explain the methodology to design and develop a management information system
CO4: describe different applications of management information systems in various manufacturing sectors

Course Articulation Matrix (CAM): U18OE803B MANAGEMENT INFORMATION SYSTEMS

Course Outcomes		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**U18OE803B**.1	2	2	1	1	1	-	-	-	-	1	-	1	-	-
CO2	**U18OE803B**.2	2	2	2	1	1	-	-	-	-	1	-	1	-	-
CO3	**U18OE803B**.3	2	2	2	3	1	-	-	-	-	1	-	2	-	-
CO4	**U18OE803B**.4	2	2	3	3	1	-	-	-	-	1	-	2	-	-
U18OE803B		2	2	2	2	1	-	-	-	-	1	-	1.5	-	-

U18OE803C ENTREPRENEURSHIP DEVELOPMENT

Class: B. Tech. VIII Semester **Branch:** Mechanical Engineering(ME)

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation	40 marks
End Semester Examination	60 marks

Course Learning Objectives (LOs):
This course will develop students' knowledge in/on
LO1: various characteristics of entrepreneur and his role in development of the nation
LO2: creativity and business plan
LO3: functions of various managements/managers in industry
LO4: legal issues in entrepreneurship and intellectual property rights

UNIT –I (9)

Entrepreneurship: Definition, role of entrepreneurship in economic development, characteristics and types of an entrepreneur, Forms of business organizations; agencies dealing with entrepreneurship and small scale Industries; Case studies of successful entrepreneurs-identification of business opportunities in various branches of engineering

UNIT-II (9)

Creativity and Business Idea: Sources of new ideas, methods of generating ideas and creative problem solving, concepts of innovation and incubation.
Business Plan: definition, scope and value of business plan, market survey and demand survey.
Feasibility studies: Technical feasibility, financial viability and social acceptability; Preparation of preliminary and bankable project reports;

UNIT-III (9)

Project Planning: Product planning and development process, Sequential steps in executing the project.
Plant layout: Principles, types and factors influencing layouts,
Material Management: Purchase procedures, Issues of Materials -LIFO,FIFO,HIFO and Base stock;.
Fundamentals of Production Management: Production Planning and Control (PPC)-Concepts and functions, Long & short run problems.
Marketing Management: Definition, functions and market segmentation.

UNIT-IV (9)

Financial Management: Introduction, Sources of finance-internal and external.
Human Resource Management: Introduction, importance, selection, recruitment, training, placement, development;
Legal Issues in Entrepreneurship: Mechanisms for resolving conflicts; Industrial laws-Indian Factories Act, Workmen Compensation Act; Intellectual Property Rights (IPR) – patents, trademarks, and copyrights

Textbook:

1. Robert D.Hisrich, Michael P. Peters, "Entrepreneurship", *Tata McGraw-Hill*, 9th Edition 2014

(Chapters 1,2,4,5,6,7,8,11 and13).

Reference Books

1. David H. Holt, "Entrepreneurship New venture creation" *Prentice Hall of India*.2004.
2. Handbook for "New Entrepreneurs", *Entrepreneurship Development Institute of India*, Ahmadabad.
3. T.R. Banga, "Project Planning and Entrepreneurship Development", *CBS Publishers*, New Delhi,1984.
4. Personnel efficiency in Entrepreneurship Development-"A Practical Guide to Industrial Entrepreneurs", *S. Chand & Co.*, New Delhi.

Course Research Papers: Research papers (Journal/Conference papers) relevant to the course content will be postedby the course faculty in CourseWeb page

Course Patents: Patents relevant to the course content will be posted by the course faculty in CourseWeb page

Course Projects: Course project is an independent project carried out by the student during the course period, under the supervision of course faculty. Course faculty will post few course projects titles in Course Web page. Students are encouraged to come up and experiment with the ideas that interest them.

Course Learning Outcomes (COs):

Upon completion of this course, students will be able to…

CO1: analyze the characteristics of entrepreneur and his role in economic development

CO2: apply creative problem solving methods to real time situations

CO3: describe the functions of production and marketing managements

CO4: identify the legal issues in entrepreneurship and explain intellectual property rights

Course Articulation Matrix (CAM): U18OE803C ENTREPRENEURSHIP DEVELOPMENT														
CO	**PO 1**	**PO2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO12**	**PSO1**	**PSO2**
U18OE803C 1	-	-	1	-	-	2	2	1	2	2	2	1	-	-
U18OE803C2	-	2	1	-	-	2	2	1	2	2	2	1	-	-
U18OE803C3	-	-	1	-	-	2	2	1	2	2	2	1	-	-
U18OE803C4	-	-	1	-	-	2	2	1	2	2	2	1	-	-
U18OE803C	-	2	1	-	-	2	2	1	2	2	2	1	-	-

U18OE803D FOREX & FOREIGN TRADE

Class: B.Tech VIII Semester **Branch**: Mechanical Engineering (ME)

Teaching Scheme :

L	T	P	C
3	-	-	3

Examination Scheme :

Continuous Internal Evaluation	40 marks
End Semester Exam	60 marks

Course Learning Objectives (LO):
This course will develop students' knowledge in/on…..
LO1: business, business system, objectives and types of companies
LO2: fundamentals of foreign trade and EXIM procedure
LO3: foreign exchange rate and methods of payments
LO4: foreign exchange control

UNIT–I (9)

Business: Nature and scope, Classification of business activities, Functions of commerce and trade.
Business System: Characteristics and components of business system, objectives of business, classification of business objectives; Types of Business.

UNIT-II(9)

Foreign Trade: Introduction of International Trade, Reasons for External Trade, Special problems of Foreign Trade; EXIM-objectives, roles of EXIM in Foreign Trade, Stages in Import procedure, Stages in export procedure-bill of lading, mate's receipt, certificate of origin.
Corporations Assisting Foreign Trade: State Trading Corporation of India, Export Credit and Guarantee Corporation, Minerals and Metals Trading Corporation of India.

UNIT–III (9)

Foreign Exchange Rate: Meaning and importance of Foreign exchange rate, Methods of foreign payments; Exchange rates- Spot, Forward and Cross Rates; Demand and supply of foreign exchange rate, Equilibrium rate of foreign exchange, Theories of determining foreign exchange rate, International Parity condition - Balance of payments.
Foreign Exchange Markets: Functions of exchange markets, Components and Players in Exchange Markets; FEMA-objectives and its role in Foreign Trade.

UNIT–IV (9)

Foreign Exchange Control: objectives, characteristics, advantages and disadvantages, Methods: intervention, exchange restriction, multiple exchange rates,exchange clearing agreements, method of operation, exchange clearing agreements in practice, payments agreements, transfer moratoria; indirect methods.

Text Books:

1. C.B. Guptha, *Business Organization & Management,* 15th ed. New Delhi: SultanChand & Sons,2015(*Units 1,5*)
2. M.L. Seth, *Macro Economics,* 22nd ed. New Delhi; Lakshmi Narayan Agarwal Publishers, 2014.
3. M.C. Vaish, Ratan Prakashan Mandir, *Monetary Theory,* 16th ed. New Delhi: Vikas Publications,2016

Reference Books:

1. Y.K.Bhushan, "Business Organization and Modern Management" *Sultan & Sons Publishers, NewDelhi. 15/e,* 2014.
2. S.A. Sherlekhar "Business Organization and Management", *Himalaya Publishing House, 2000.*
3. K.P.M. Sundaram, "Money Banking, Trade & Finance ", *Sultan & Sons Publishers, New Delhi.*
4. P.N.Chopra, "Macro Economics", *Kalyani Pubnlishers, 1/e, Ludhiana*

Course Learning Outcomes (CO):

Upon completion of the course, the student will be able to…

CO1: evaluate the objectives and types of industries and companies.

CO2: assess the procedure in imports and exports

CO3: analyze the foreign exchange rate and methods of foreign payments

CO4: Adapt the methods of exchange control

Course Articulation Matrix (CAM): U18OE803D FOREX AND FOREIGN TRADE														
CO	**PO 1**	**PO2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO12**	**PSO1**	**PSO2**
U18OE803D 1	-	-	-	-	-	-	-	-	-	2	2	-	-	-
U18OE803D2	-	-	-	-	-	-	-	-	-	2	2	-	-	-
U18OE803D3	-	-	-	-	-	-	-	-	-	2	2	-	-	-
U18OE803D4	-	-	-	-	-	-	-	--	-	2	2	-	-	-
U18OE803D	-	-	-	-	-	-	-	-	-	2	2	-	-	-

U18ME804: MAJOR PROJECT WORK PHASE-II

Class: B. Tech. VIII - Semester

Branch: Mechanical Engineering

Teaching Scheme:

L	T	P	C
-	-	14	7

Examination Scheme:

Continuous Internal Evaluation	60 marks
End Semester Examination	40 marks

Course Learning Objectives (LOs):

The major project work will develop students' knowledge on /in…

- *LO1: real-world complex engineering problems, literature review, problem formulation; and experimental and data analysis techniques*
- *LO2: design/development of solutions to real-world engineering problems; conduct of investigations of complex problems; modern tool usage to design, build and test a prototype; impact of solution in society, environment and sustainability contexts*
- *LO3: ethics, team work and project management skills such as budgeting, scheduling*
- *LO4: oral, written and multimedia communication skills; self-directed independent learning and life-long learning*

1. **Major project work shall be continued in 8th semester as major project *phase-II*:** All the major project teams shall take the *phase -I* work forward and complete the remaining work as *Phase-II* in the 8th semester.

2. Final Year Major Project work represents the culmination of study towards the B. Tech degree. **Major project offers an opportunity to integrate the knowledge acquired from various courses and apply it to solve real-world complex engineering problems**. The **student learning assessment process** (SLAP) shall include good number of presentations, demonstration of work undertaken, submission of a project report, writing project paper in scientific journal style & format, preparing project poster and creating video pitch on the complete project

3. Activities of major project SLAP shall be planned in such a way to ensure that the students acquire the essential knowledge, skills and qualities (KSQ) of a professional engineer.

4. **Team work:** Major project work is a team work

   (i) The students of a project team shall work together to achieve a common objective.

   (ii) Every student of a project team is expected to function effectively as an individual, and also with others as a team member in an ecosystem of team having knowledge diversity, gender diversity, social and cultural diversity among its members.

5. Every student is expected to put approximately **168 hours of work** into the major project *phase-II* course over the 12 weeks of 8th semester.

6. **Major project work *Phase-II*: 8th semester**

   (i) The convener DPEC shall release complete schedule of *phase-II* CIE during last week of 7th semester (*well in advance before start of 8th semester*), immediately after completion of progress presentation-I, so that student teams would complete the scheduled works during inter-semester break and get ready with informative, confident and comfortable presentation for progress presentation-II.

   (ii) **The project supervisors**: The project supervisors are expected to guide the students to systematically continue the *phase-I* work, useful work during inter-semester break, meeting the deadlines as proposed in project timeline.

(iii) The project supervisors shall ensure students focus on the project objectives and expected deliverables

(iv) The project supervisors shall ensure students have sufficient resources for successful project completion.

(v) The project supervisors shall continue guiding students on

(a) *Knowledge, skills and qualities (KSQ) of a professional engineer to be acquired* to propose solutions and design the systems to the identified real-world problems.

(b) *Problem analysis* - to identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences

(c) *Applying engineering knowledge* - to apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems

(d) *Design/development of solutions* - to design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental Considerations

(e) *Conduct investigations of complex problems* - to use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions

(f) *Modern tool usage* – to create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations

(g) *Engineering and society* – to apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice

(h) *Environment and sustainability* – to understand the impact of the professional engineering solutions in societal and environmental contexts, demonstrate the knowledge of, and need for sustainable development

(i) *Ethics* – to apply ethical principles and commit to professional ethics, responsibilities, and norms of the engineering practice

(j) *Individual and team work* – to function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings

(k) *Communication* – to communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions

(l) *Project management and finance* – to demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments

(m) *Life-long learning* – to recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

(vi) The project supervisors are also expected to continuously emphasize and guide the students on

(a) **Following project timeline**: completing the tasks as planned in project timeline

(b) **Meeting Cadence:**

i. **Regular meetings with supervisor:** Short and frequent meetings increase a team's work momentum. Regular meetings with supervisor to review the status of project are very essential. All students of the team shall participate in discussions and take notes.
ii. **Meeting Frequency: Semi-weekly cadence,** i.e., the meeting frequency shall be **twice a week.** Due weightage will be given to meeting cadence and considered for evaluation during presentations, i.e., number of planned meetings and number attended by students

(c) **Project Log Book:** The activity journaling in project log book is very important for a successful project.
i. Project log book is a written record showing the daily project activity on project goals from the very first thing like starting the project (an introduction statement what the project is all about), to the completion of the work (including the final results, and whether project met the core objectives / outcomes, etc.).
ii. In project log book, the activities like regular meetings with project supervisor, and work carried out on daily/weekly basis are to be recorded. This ensures that the student progress is being monitored well.
iii. The project supervisor shall regularly check the log book of every student of project team and endorse each and every activity by affixing his signature with date. With this, the number of planned meetings and number attended by the students will be also monitored.
iv. Log books are to be shown during all presentations and will be graded along with the project.
v. At the conclusion of the project work *phase-II*, the supervisor shall specifically comment, in the project log book, on whether the project team met each of the project work outcomes and to give evidence which describes the quality of work. For project teams, this also serves as self-assessment.

(d) **Writing down whatever is done and making notes of whatever is read**. Writing down the procedures / models followed, designs made, experiments conducted, simulations carried out, intermediate results obtained, ***difficulties faced and how they were fixed*** are very important. This kind of documenting the whole process as we go with project implementation is a very effective way and will help preparing a well-documented report having original content. Note down and include information about all the resources that you used, magazines, Journals, patents, books, and so on. This information will be needed for the bibliography in your project report. On the other hand, documenting a report ***on the spur of the moment*** would end up copying things from other sources resulting in a plagiarized document.

(e) The relevant knowledge, skills and qualities (**KSQ**) an engineering graduate should possess, which can be specially acquired by participating in major project work

(f) **Good and sufficient literature review**: Literature review is a description and analysis of information related to the topic of project work. Reading good number of review articles, research articles published in recent issues of peer reviewed journals, technical magazines, patents, reference books on the topics

of potential interest, will help one understand what has already been discovered and what questions remain to identify gaps in the literature.

(g) Completing the proposed work by the end of *phase-II*

(h) Right conduct of research to promote academic integrity, honesty and time management

(i) Preparing a well-documented overall project report in proper format, covering the complete work carried out during both the phases (*phase-I and phase-II*).

(j) Consequences of plagiarism, and use of anti-plagiarism software to detect plagiarism in the report

(k) Submission of major project work report within acceptable plagiarism levels, as per the ***Anti-plagiarism policy-2020 of our institute***

(l) **Video pitch on complete project work**: Capturing short videos, photos, screenshots on experiments conducted, simulations carried out, prototype / working model / process / software package / system developed during course of project execution, photos showing interaction with supervisor for creating a short video pitch on the complete work done during both phases (*phase-I and phase-II*).

(m) **Project Paper**: Writing a technical paper at the end of *phase-II* based on the solution(s) proposed, results obtained and prototype / working model / process / software package / system developed, for submission to a reputed non-predatory conference/non-paid peer reviewed journal.

(n) **Project poster**: At the end of phase-II, the project teams shall have to present their project in the form of posters, at the time of demonstration of complete prototype / working model / software package / system developed.

(vii) Phase – II evaluation: There shall be only Continuous Internal Evaluation (CIE) for major project work *phase-I* with following components

(a) **Progress Presentation -II** *(during third / fourth week of 8th semester):* The progress presentation-II shall include the identified problem, objective(s), literature review, expected outcome(s), results of work done as per project plan timeline.

i. **Following project timeline**: The project timeline shall be meticulously followed and the tasks shall be completed as planned in project timeline.

ii. 80-85% of work is expected to be completed

iii. Project teams shall compulsorily show the following as part of their progress presentation-II

1. *The slides on project timeline and*
2. *A table showing targeted tasks as per timeline and status – whether tasks accomplished?*

iv. **Project log book**: Every student of the Project team shall compulsorily show the activity journaling in the log book (with due signatures of project supervisor) during presentations

(b) **Final Presentation** *(during penultimate week of 8th semester):* **Project supervisor shall ensure that the project team has accomplished 100% of work proposed**. The project team shall

i. **Follow project timeline**: The project timeline shall be meticulously followed and the tasks shall be completed as planned in project timeline.
ii. compulsorily show the following as part of their final presentation
    1. *The slides on project timeline and*
    2. *A table showing targeted tasks as per timeline and whether all the identified tasks accomplished?*

iii. **show project log book**: Every student of the Project team shall compulsorily show the complete activity journaling in the log book (*with due signatures of project supervisor*)
iv. present complete results & analysis
v. **demonstrate the completed project**: working model / process / software package / system developed
vi. demonstrate the completed project with the **project poster presentation**

(viii) Evaluation for Major project phase-II:

There shall be continuous internal evaluation (CIE) and end semester examination (ESE). The evaluation for *phase-II* shall be as given below:

Assessment	Weightage
A. CIE **(i) Supervisor Assessment (10%)** **(ii) DPEC Assessment (50%)** *(a) Progress presentation-II (10%)* *(b) Final presentation (10%)* *(c) Working model / process / software package / system developed (20%)* *(d) Project video pitch (5%)* (e) *Project paper (5%)*	**60%**
B. ESE *(i) Well-documented project report (15%)* *(DPEC shall evaluate the project reports, as per the rubrics, well before the ESE. At the time of ESE, evaluated project report marks shall be posted in the award list, along with the ESE oral presentation marks. Students shall appear for Viva-Voce with project report)* *(ii) Oral presentation with PPTs and viva-voce (15%)* *(iii) Project poster (5%)* *(DPEC shall evaluate the project poster, as per the rubrics, well before the ESE. At the time of ESE, evaluated project poster marks shall be posted in the award list. Students shall appear for Viva-Voce with project poster)*	**40%**
Total Weightage	**100%**

(d) **Working Model:** Every project team shall be required to develop a working model/ process/software package/system, on the chosen work. The completed working model/ process/software package/system shall be demonstrated during final presentation at the end of *phase-II*.

(e) **Video pitch**: Every project team shall be required to create a pitch video, which is a video presentation on their major project work *phase-I & phase-II*. The project team shall present the produced video pitch during Final presentation. The produced video pitch should
a. be 3 to 5-minute-long video (no longer than 5 minutes)
b. be concise and to the point, on the problem, proposed solution and its salient features.
c. show project timeline and sample page of log book

d. highlight the various stages during project implementation with the help of short videos / photos / screenshots on experiments conducted, simulations carried out, prototype / working model / process / software package / system developed as part of proposed solution and also photos showing team interactions with supervisor and the team working in the lab on project.
e. discuss the impact of proposed solution in *ethical*, *environmental*, *societal and sustainable development contexts*.
f. emphasize key points about *business idea, potential market for the proposed solution*

(f) **Project poster**: At the end, the project teams shall present their project in the form of posters (A2 size). The teams shall have to present their work during the poster presentation session scheduled at the end of the 8th semester, at the time of demonstration of complete porotype / working model / software package / system developed.

(g) **Well-documented plagiarism-cleared project report**: Every project team shall be required to submit a well-documented project report on the work carried out, as per the format specified by the DPEC. The report should clear plagiarism check as per the anti-plagiarism policy-2020 of the institute. The following shall compulsorily be included in the Results-Chapter of the project report
(i) Photos / screen shots taken at various stages during the development of working model/ process/software package/system as part of Results-Chapter
(ii) Snapshot of final working model/ process/software package/system developed
(iii) Pictures of the team working in the lab, the team discussing with the project supervisor, working on creative project, or an event they are attending for work.
(iv) All these photos / screen shots shall be properly referred in the project report by assigning figure numbers

(h) **Tangible outcomes of project work in Conclusions - Chapter:** These are the lessons learnt from doing a project work. The students have to describe in their own words what they learnt from the project work experience. They have to describe what specific KSQs are acquired by them, with reference to the expected COs, after successful completion of major project work. Finally, a table depicting systematic mapping of what they have learnt and the expected major project work COs, is to be shown in the conclusions chapter.

(i) **Student feedback on major project in Conclusions - Chapter:** To gather information on whether project work was useful and gave practical experience on chosen field of interest, and other learning, a well-defined feedback questionnaire (*made available by the dept*) with closed and open questions shall be kept in the conclusions chapter of the project report.

(ix) It is mandatory for
(a) every student of the team to appear for ESE oral presentation and viva-voce, to qualify for course evaluation
(b) every project team to write a technical paper based on the solution(s) proposed, results obtained and prototype / working model / process / software package / system developed, for submission to a reputed non-predatory conference/non-paid peer reviewed journal
(c) every project team shall be required to create a pitch video, which is a video presentation on their major project work *phase-I & phase-II*
(d) every project team shall present their project in the form of a poster, during the demonstration of complete porotype / working model / software package / system developed

(x) The student has to register for the Major project work *phase-II* as supplementary examination in the following cases:

(a) he/she is absent for oral presentation and viva-voce as part of ESE presentation

(b) he/she fails to fulfill the requirements of Major project work *phase-II* evaluation as per specified guidelines

(xi) Supplementary examination for Major project work *phase-II*

(a) The CoE shall send the list of students, registered for supplementary examination, to the HoDs concerned

(b) The DPEC, duly constituted by the HoD, shall conduct Major project *phase-II* supplementary exam and send the award list to the CoE within the stipulated time

****

Course Learning Outcomes (COs):

Upon completion of the major project work, students will be able to…

CO5: review research literature, formulate problem, apply knowledge of mathematics, sciences, engineering fundamentals, experimental and data analysis techniques; synthesize technical knowledge and innovative approaches to generate suitable solutions for real-world complex engineering problems **(Technical skills)**

CO6: design a system or product based on product/customer specifications; develop, analyze, and critically evaluate the design alternatives in order to justify the solutions to a real-world problem guided by ethical, environmental, societal and sustainable development considerations; use modern engineering and IT tools to design, build and test a prototype within specified project timeline and budget **(Problem solving and critical thinking skills)**

CO7: apply project management and organizational skills; demonstrate integrity, leadership, creativity, professional and ethical responsibilities as an individual and as a member or leader to produce time-sensitive deliverables in a multi-disciplinary team (**Ethics and teamwork**)

CO8: *collate the results, compare performance of prototype to design specifications and present clearly and effectively the proposed solution, conclusions and/or recommendations in written (report, poster, technical paper), oral (presentations) and multimedia formats (video pitch) and engage in self-directed independent learning and life-long learning demonstrating the KSQ of a professional engineer* (**Communication skills and life-long learning**)

Course Articulation Matrix (CAM) : U18ME804 MAJOR PROJECT WORK PHASE-II

CO	CO Code	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	**U18ME804.1**	2	2	2	2	-	-	-	3	-	2	-	3	2	2
CO2	**U18ME804.2**	1	2	2	-	2	2	2	3	-	-	-	3	2	2
CO3	**U18ME804.3**	-	-	-	-	-	-	-	3	2	-	2	3	-	-
CO4	**U18ME804.4**	-	-	2	2	-	-	-	3	-	2	-	3	-	-
U18ME804		**1.5**	**2**	**2**	**2**	**2**	**2**	**2**	**3**	**2**	**2**	**2**	**3**	**2**	**2**