MALLA REDDY ENGINEERING COLLEGE (AUTONOMOUS)

Course Structure for B.Tech. Mechanical Engineering

MR20 Regulations - Effective from the Academic Year 2020 – 21 onwards

SEMESTER-I							
Sl. No.	**Category**	**Course Code**	**Name of the Subject**	**L**	**T**	**P**	**Credits**
1.	HSMC	A0H01	English	3	0	0	3
2.	BSC	A0B05	Linear Algebra and Differential Equations	3	1	0	4
3.	BSC	A0B12	Engineering Physics	3	1	0	4
4.	ESC	A0301	Engineering Graphics	2	0	2	3
5.	ESC	A0501	Programming for Problem Solving	3	0	0	3
6.	BSC	A0B13	Engineering Physics Lab	0	0	2	1
7.	ESC	A0502	Programming for Problem Solving Lab	0	0	2	1
8.	HSMC	A0H02	English Language Lab	0	0	2	1
9.	ESC	A0302	Engineering Workshop	0	0	2	1
10.	AC	A00A1	NSS/SPORTS/YOGA	0	0	3	0
Total				**14**	**2**	**13**	**21**
Total Contact Hours				**29**			

SEMESTER-II							
Sl. No.	**Category**	**Course Code**	**Name of the Subject**	**L**	**T**	**P**	**Credits**
1.	BSC	A0B06	Vector Calculus and Numerical Techniques	3	1	0	4
2.	ESC	A0303	Engineering Mechanics	3	0	0	3
3.	BSC	A0B17	Engineering Chemistry	3	1	0	4
4.	ESC	A0201	Basic Electrical and Electronics Engineering	3	0	0	3
5.	ESC	A0527	Basic Python Programming Lab	0	1	2	2
6.	ESC	A0304	Engineering Mechanics Lab	0	0	2	1
7.	BSC	A0B18	Engineering Chemistry Lab	0	0	2	1
8.	ESC	A0202	Basic Electrical and Electronics Engineering Lab	0	0	2	1
Total				**12**	**3**	**8**	**19**
Total Contact Hours				**23**			

SEMESTER-III							
Sl. No.	**Category**	**Course Code**	**Name of the Subject**	**L**	**T**	**P**	**Credits**
1.	BSC	A0B02	Probability and Statistics	3	0	0	3
2.	ESC	A0305	Mechanics of Solids	3	0	0	3
3.	ESC	A0306	Metallurgy and Material Science	3	0	0	3
4.	PCC	A0307	Kinematics of Machines	3	0	0	3
5.	PCC	A0308	Thermodynamics	3	0	0	3
6.	PCC	A0309	Production Technology	3	0	0	3
7.	ESC	A0554	Fundamentals of Data Structures Lab	0	0	4	2
8.	PCC	A0310	Metallurgy and Mechanics of Solids Lab	0	0	2	1
9.	PCC	A0311	Production Technology Lab	0	0	2	1
10.	MC	A00M2	Environmental Sciences	2	0	0	-
			Total	**20**	**0**	**8**	**22**
			Total Contact Hours	**28**			

SEMESTER-IV							
Sl. No.	**Category**	**Course Code**	**Name of the Subject**	**L**	**T**	**P**	**Credits**
1.	PCC	A0312	Dynamics of Machines	3	0	0	3
2.	PCC	A0313	Fluid Mechanics and Hydraulic Machines	3	0	0	3
3.	PCC	A0314	Machine Tools	3	0	0	3
4.	PCC	A0315	Thermal Engineering - I	3	0	0	3
5.	PCC	A0316	Operations Research	3	0	0	3
6.	PCC	A0317	Fluid Mechanics and Hydraulic Machines Lab	0	0	2	1
7.	PCC	A0318	Machine Tools Lab	0	0	2	1
8.	PCC	A0319	Kinematics & Dynamics Lab	0	0	2	1
9.	ESC	A0555	Object Oriented Programming through Java Lab	0	1	2	2
10.	MC	A00M1	Gender Sensitization	0	0	2	-
			Total	**15**	**1**	**10**	**20**
			Total Contact Hours	**26**			

SEMESTER-V							
Sl. No.	**Category**	**Course Code**	**Name of the Subject**	**L**	**T**	**P**	**Credits**
1.	HSMC	A0H08	Engineering Economics & Accountancy	3	0	0	3
2.	PCC	A0320	Metrology & Instrumentation	3	0	0	3
3.	PCC	A0321	Design of Machine Members - I	3	0	0	3
4.	PCC	A0322	Thermal Engineering - II	3	0	0	3
5.	PCC	A0323	Machine Drawing	1	0	2	2
6.	PEC-I	A0326	Refrigeration & Air Conditioning	3	0	0	3
		A0327	Non-Destructive Testing				
		A0328	Applied Hydraulics and Pneumatics				
		A0329	Gas Dynamics and Jet Propulsion				
		A0330	Energy Conservation and Energy Management				
7.	HSMC	A0H03	English Communication and Presentation Skills Lab	0	0	2	1
8.	PCC	A0324	Metrology & Instrumentation Lab	0	0	2	1
9.	PCC	A0325	Computer Aided Modeling Lab	0	0	2	1
10.	ESC	A0562	Fundamentals of Database Management Systems Lab	0	1	2	2
11.	MC	A00M3	Quantitative Aptitude and Verbal Reasoning-I	2	0	0	0
12.	MC	A00M5	Introduction To Cyber Security	2	0	0	0
			Total	**20**	**1**	**10**	**22**
			Total Contact Hours	**31**			

SEMESTER-VI							
Sl. No.	**Category**	**Course Code**	**Name of the Subject**	**L**	**T**	**P**	**Credits**
1.	HSMC	A0H10	Industrial Management	3	0	0	3
2.	PCC	A0331	Design of Machine Members - II	3	0	0	3
3.	PCC	A0332	Heat Transfer	3	0	0	3
4.	PCC	A0333	CAD/CAM/CIM	3	0	0	3
5.	PEC-II	A0337	Automobile Engineering	3	0	0	3
		A0338	Finite Element Methods				
		A0339	Solar Energy Utilization				
		A0340	Unconventional Machining Process				
		A0341	Power Plant Engineering				
6.	OEC-I			3	0	0	3
7.	PCC	A0334	Heat Transfer Lab	0	0	2	1
8.	PCC	A0335	Production Drawing Practice Lab	0	0	2	1
9.	PCC	A0336	Thermal Engineering Lab	0	0	2	1
10.	MC	A00M4	Quantitative Aptitude and Verbal Reasoning-II	2	0	0	0
11.	MC	A00M6	Introduction To Artificial Intelligence	2	0	0	0
			Total	**22**	**0**	**6**	**21**
			Total Contact Hours	**28**			

SEMESTER-VII							
Sl. No.	**Category**	**Course Code**	**Name of the Subject**	**L**	**T**	**P**	**Credits**
1.	PEC-III	A0343	Mechanics of Composite Materials	3	0	0	3
		A0344	Mechanical Vibrations				
		A0345	Computational Fluid Dynamics				
		A0346	Maintenance & Safety Engineering				
		A0347	Engineering Tribology				
2.	PEC- IV	A0348	Production Planning and Control	3	0	0	3
		A0349	Industrial Robotics				
		A0350	Design Of Press tools, jigs and Fixtures				
		A0351	Product Design and Development				
		A0352	Automation In Manufacturing				
3	PEC-V	A0353	Plant Lay out & Material Handling	3	0	0	3
		A0354	Mechatronics				
		A0355	Reliability Engineering				
		A0356	Jet Propulsion & Rocket Engineering				
		A0357	Tool Design				
4	PEC-VI	A0358	Entrepreneurship	3	0	0	3
		A0359	Total Quality Management				
		A0360	Process Planning & Cost Estimation				
		A0361	Foundry Technology				
		A0362	Nano Technology				
5.	OEC-II			3	0	0	3
6	OEC-III			3	0	0	3
7	PCC	A0342	Simulation and Analysis Lab	0	0	4	2
8	PROJ	A00P1	Internship – III / Mini Project	0	0	4	2
Total				**18**	**0**	**6**	**22**
Total Contact Hours				**24**			

SEMESTER-VIII							
Sl. No.	**Category**	**Course Code**	**Name of the Subject**	**L**	**T**	**P**	**Credits**
1.	PROJ	A00P3	Seminar	0	0	2	1
2.	PROJ	A00P2	Major Project	0	0	20	12
			Total	**0**	**0**	**22**	**13**
			Total Contact Hours	**22**			

MALLA REDDY ENGINEERING COLLEGE (AUTONOMOUS)

Open Elective Courses offered by Department of Mechanical Engineering

MR20 Regulations - Effective from the Academic Year 2020 – 21 onwards

S. No.	Branch	Course Code	Name of the Course	Credits
1.	MECH	A0330	Energy Conservation and Energy Management	**3**
2.		A0363	Renewable Energy Sources	**3**
3.		A0359	Total Quality Management	**3**
4.		A0364	Robotics	**3**
5.		A0351	Product Design and Development	**3**
6.		A0337	Automobile Engineering	**3**

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. I Semester		
Code: A0H01	**ENGLISH**	**L**	**T**	**P**
Credits: 3	**(Common for CE,EEE,ME,ECE,CSE,CSE(AIML) CSE(DS), CSE (CS), CSE(IOT),IT and Min.E)**	**3**	**-**	**-**

Course Objectives:

The objective of this course is to improve the English Language and Literary competence of the students. The course provides requisite insights into grammar, vocabulary, prose, and short stories. Further, it alsohelps in developing the skills of Reading and Writing. The course also equips students to study their academic subjects more effectively using the theoretical and practical components of the English language and literature.

MODULE – I

Speech **:** "Go Kiss the World" by Subroto Bagchi

Poem **: "**Leisure" by W. H. Davies

Vocabulary : Formation of Words, Prefixes, Suffixes, and Root Words

Grammar **:** Articles and Prepositions

Reading **:** Skimming and Scanning

Writing **:** Introduction to Writing Skills, Characteristics of Effective Writing

MODULE – II

Short story : "Gift of Magi" by O' Henry

Poem **: "**No Man is an Island" by John Donne
Vocabulary : One Word Substitutions; Synonyms and Antonyms**Grammar** **:** Degrees of Comparison, Voice – Exercises **Reading** **:** Intensive Reading and Extensive Reading

Writing **:** Paragraph Writing- Cohesive devices; Jumbled Sentences; Punctuation

Module – III

Essay **:** "Lucidity, Simplicity, Euphony" by W. Somerset Maugham

Poem **: "**The Mask" by Maya Angelou

Grammar **:** Tense and Aspect

Vocabulary : Homonyms, Homophones, Homographs **Reading :** Reading for Topic and Theme **Writing :** Letter Writing

MODULE – IV

Short story : "The Night Train at Deoli" by Ruskin Bond**Poem : "**Gift of India" by Sarojini Naidu
Grammar : Question Tags; Concord

Vocabulary : Idiomatic Expressions; Phrasal Verbs

Reading : Reading for Interpretation

Writing : Essay Writing, Describing, Defining and Classifying

MODULE – V

Essay : "Toasted English" by R. K. Narayan

Poem : "If" by Rudyard Kipling

Grammar : Direct and Indirect Speech, Misplaced Modifiers

Vocabulary : Redundancies and Clichés

Reading : Reading for Specific Purposes, Reading Comprehension practice

Writing : Paraphrasing & Summarizing,

* Exercises from the texts not prescribed shall also be used for classroom tasks.

Prescribed Textbook:

Reference Books:

1. Azar, Betty and Stacy A, Hagen**.** *Understanding and Using English Grammar*. 4th edition, Foundation Books, 2009.
2. Chaudhuri, Santanu S. *Learn English: A Fun Book of Functional Language***,** *Grammar andVocabulary*. Tata McGraw Hill Education, New Delhi, 2013.
3. Eastwod, John. *Oxford Guide to English Grammar*. 4th edition, Oxford University Press, 1994.
4. Field, Marion**.** *Improve Your Written English*. 5th Edition. How to Books, UK, 2009.
5. Leech, Geoffrey and Svartvik, J. *A Communicative Grammar of English*. 3rd edition, Routledge, 2013.

Related Websites:

1. http://www.slideshare.net/aszardini/word-formationroot-words-prefixes-and-suffixes
2. http://www.scribd.com/doc/37085980/Circulars-Circular-Letters-Notices-Memo#scribd.
3. http://www.zsme.tarnow.pl/jezykiobce/wp-content/uploads/2013/11/writing-letters1.pdf.

Course Outcomes:

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

1. Use Written And Spoken English Considerably Well For Academic Purposes.
2. Communicate In Enrich Accurately And Fluently.
3. Employ Extensive And Intensive Reading Skills.
4. Gain Confidence In Writing For Academic And Real Life Situations.
5. Use Standard Grammar, Punctuation, And Spelling In Technical Documents.

CO- PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak												
COS	**Programme Outcomes(POs)**											
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO1	**3**	**2**	**2**									
CO2	**3**	**2**										
CO3	**3**	**2**		**2**								
CO4	**3**	**2**	**2**									
CO5	**2**	**2**	**1**									

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. I Semester		
Code:A0B05	Linear Algebra and Differential Equations (Common For CE, ME&MINING)	L	T	P
Credits: 4		3	1	-

Prerequisites: Matrices, Differentiation, and Integration

Course Objectives:

1. To learn rank of the matrix and its application to consistency of system of linear equations
2. To learn Eigen Values, Eigen Vectors and nature of Quadratic forms.
3. To learn the concept of the mean value theorems, partial differentiation and maxima and minima.
4. To learn methods of solving differential equations and its applications to basic engineering problems.
5. To learn basics of partial differential equations and the standard forms of partial differential equations.

Module -I: Matrix algebra

Vector Space, basis, linear dependence and independence (Only Definitions)

Matrices: Types of Matrices, Symmetric; Hermitian; Skew-symmetric; Skew- Hermitian; orthogonal matrices; Unitary Matrices; rank of a matrix by Echelon form and Normal form, Inverse of Non-singular matrices by Gauss-Jordan method; solving system of Homogeneous and Non-Homogeneous linear equations. LU - Decomposition Method

Module- II: Eigen Values and Eigen Vectors

Eigen values , Eigen vectors and their properties; Diagonalization of a matrix; Cayley-Hamilton Theorem (without proof); Finding inverse and power of a matrix by Cayley-Hamilton Theorem; Singular Value Decomposition.

Quadratic forms: Nature, rank, index and signature of the Quadratic Form, Linear Transformation and Orthogonal Transformation, Reduction of Quadratic form to canonical forms by Orthogonal Transformation Method.

Module - III: Differential Calculus

Mean value theorems: Rolle's theorem and Lagrange's Mean value theorem with their Geometrical Interpretation and its applications, Cauchy's Mean value Theorem. Taylor's Series. Limits, Continuity, Partial differentiation, partial derivatives of first and second order, Jacobian, Taylor's theorem of two variables (without proof). Maxima and Minima of two variables, Lagrange's method of undetermined Multipliers.

Module –IV: Ordinary Differential Equations

First Order and First Degree ODE: Orthogonal trajectories, Newton's law of cooling, Law of naturalgrowth and decay.

Second and Higher Order ODE with Constant Coefficients: Introduction-Rules for finding complementary function and particular integral. Solution of Homogenous, non-homogeneous differentialequations, Non-Homogeneous terms of the type e^{ax} , sin(ax), cos (ax), polynomials in x, e^{ax} V(x), x V(x),Method of variation of parameters.

Module – V: Partial Differential Equations

Formation of partial differential equations by eliminating arbitrary constants or arbitrary function, solutions of first order linear (Lagrange) equations, solutions of non linear first order equations (four standard types). Equations reducible to linear, Charpit's Method.

Text Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
2. R K Jain SRK Iyengar , Advanced engineering mathematics, Narosa publications.
3. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley publications.

Reference Books:

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson,Reprint,2002.
2. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, LaxmiPublications,Reprint, 2008.
3. V. Krishnamurthy, V.P. Mainra and J.L. Arora, An introduction to Linear Algebra,AffiliatedEast–West press, Reprint 2005.
4. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11thReprint,2010.

E – RESOURCES:

1. https://www.mathplanet.com/education/algebra-2/matrices/how-to-operate-with-matrices(Systems of linear equations, matrices)
2. http://math.mit.edu/~gs/linearalgebra/ila0601.pdf(Eigen values, Eigen vectors)
3. http://www.math.cmu.edu/~wn0g/noll/2ch6a.pdf(Differential Calculus)
4. https://www.intmath.com/differential-equations/1-solving-des.php(Differential Equations)
5. https://www.math.uni-leipzig.de/~miersemann/pdebook.pdf(Partial differential Equations)

NPTEL:

1. https://www.youtube.com/watch?v=NEpvTe3pFIk&list=PLLy_2iUCG87BLKl8eISe4fHKdE2_j2B_T&index=5 (Matrices – System of linear Equations)
2. https://www.youtube.com/watch?v=wrSJ5re0TAw (Eigen values and Eigen vectors)
3. https://www.youtube.com/watch?v=yuE86XeGhEA (Quadratic forms)

Course Outcomes:

1. The student will be able to find rank of a matrix and analyze solutions of system of linear equations.
2. The student will be able to find Eigen values and Eigen vectors of a matrix, diagonalization a matrix, verification of Cayley Hamilton theorem and reduce a quadratic form into a canonical form through a linear transformation.
3. The student will be able to verify mean value theorems and maxima and minima of function of two variables.
4. Formulate and solve the problems of first and higher order differential equations
5. Apply knowledge of Partial differential equations in real world problems.

CO- PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak												
COS	**Programme Outcomes(POs)**											
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO1	**3**	**2**	**2**	**3**	**3**				**2**			**3**
CO2	**3**	**2**	**2**	**3**	**2**				**2**			**3**
CO3	**3**	**2**	**2**	**3**	**2**				**2**			**2**
CO4	**3**	**2**	**2**	**3**	**3**				**2**			**2**
CO5	**3**	**2**	**2**	**3**	**3**				**2**			**2**

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. I Semester		
Code:A0B12	Engineering Physics (Common For CE, ME&MINING)	L	T	P
Credits: 4		3	1	-

Prerequisites: Fundamentals of Physics

Course Objectives:

- The main objective of this course is to provide the basic physics principles, would help engineers to understand the tools and techniques used in the industry and provide the necessary foundations for inculcating innovative approaches.
- This would create awareness about the vital role played by science and engineering in the development of new technologies.

Module – I: Waves and Oscillations

Simple harmonic Oscillator; damped harmonic oscillator; types of damping – heavy, critical and light damping; energy decay in a damped harmonic oscillator; relaxation time, quality factor; Forced harmonicOscillator; electrical and mechanical analogy for a simple oscillator.

Module – II

Acoustics: Introduction, Reverberation and Reverberation time; Basic requirements of acoustically good hall; Absorption coefficient, Jaeger's method for derivation of Sabine's formula; factors affecting the architectural acoustics and their remedies.

Ultrasonics: Introduction, Production of Ultrasonic Waves - Piezo Electric Effect, Inverse piezo electric effect, Piezo-Electric crystal Method, Magnetostriction effect, Magnetostriction Method; Detection ofUltrasonic waves - Piezo Electric detector, Kundt's tube method, Sensitive Flame method and ThermalDetection Method; Applications of Ultrasonics - Medical, SONAR, Ultrasonic drilling and welding, **Module – III: LASERs and Optical Fibers**

LASER: Introduction, Characteristics of LASER; Absorption, spontaneous and Stimulated emission; Einstein's coefficients Derivation; population inversion; pumping mechanisms; Basic components of a laser system; three and four level laser systems; Ruby LASER; He-Ne LASER; Semiconductor diode LASER (Homo junction); Applications of LASER - Computers, Medical, Military.

Optical Fibers: Introduction to Optical fibers, total internal reflection; Acceptance angle, and acceptance cone; numerical aperture; types of optical fibers; Losses in optical fibers - absorption losses, scattering losses and bending losses; Applications of optical fibers - Communications, Level Sensor, LASER angioplasty.

Module – IV

Non-destructive Testing: Introduction; Objectives of Non-destructive testing; Types of defects – Cracking, Spalling, Staining, Construction and Design defects, Honey combing, Dusting, Blistering, Rain damage; Methods of Non-destructive testing – Liquid penetrant testing, Magnetic particle testing, Ultrasonic inspection method and Radiography testing.

Module – V

Dielectric Properties: Electric dipole, Dipole moment, Dielectric constant, Polarizability, Electric Susceptibility, Displacement Vector; Determination of dielectric constant by resonance method; Electronic, Ionic and Orientation Polarizations and Calculation of Polarizabilities - Electronic and ionic; Internal field (qualitative treatment); Clausius-mossotti equation; Applications of Dielectric materials.

Nanomaterials: Introduction to nanomaterials, Types of nano materials; factors affecting the properties of nano materials - surface area to volume ratio and Quantum confinement effect; Properties of nano materials; Synthesis of nanomaterials - Sol-gel and Chemical vapour deposition method; Applications of Nano materials.

Text Books:

1. M N Avadhanulu, P G Kshirsagar, "A Textbook of Engineering Physics", Revised Edition2014.
2. K Vijaya Kumar, S Chandralingam, "Modern Engineering Physics'' Volume I & II, S. Chand, 1st Edition,2017.
3. B K Pandeyand S. Chaturvedi, "Engineering Physics" Cengage Learning India Revised Edition, 2014.

References:

1. P K Palanisamy, "**Engineering Physics"**, 4th Edition, SciTech Publications, 2014.
2. G Prasad and Bhimashankaram, "**Engineering Physics"**, B S Publications, 3rd Edition, 2008.
3. M.K.Verma, "Introduction to Mechanics", Universities Press.
4. Ajoy Ghatak, "Optics", McGraw-Hill Education, 2012

e-Resources

1. http://www.gistrayagada.ac.in/gist_diploma/PHYSICS-StudyMaterial.pdf
2. http://www.faadooengineers.com/threads/3300-Applied-Physics-Ebooks-pdf-free- download?s=1b6cb6b1de4e7152298bd9d60156cd11

Journals:

1. http://aip.scitation.org/journal/jap
2. http://www.springer.com/physics/journal/340

NPTEL Videos:

1. http://nptel.ac.in/courses/115106061/13
2. https://nptel.ac.in/courses/115/106/115106119/

Course Outcomes:

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

1. Distinguish free, damped and forced vibrations.
2. Using the knowledge of acoustics in designing acoustically important buildings and ultrasonicsfor designing materials.

3. Understand the concepts and applications of LASER and Optical fibers.
4. Apply the knowledge of Ultrasonic to understand non-destructive testing.
5. Understand the importance of dielectric and nanomaterials and their properties.

CO- PO,PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak															
CO S	**Programme Outcomes(POs)**												**PSOS**		
	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**	**PS O2**	**PS O3**
CO1	**3**	**2**	**1**										**3**	**2**	
CO2	**2**	**2**	**1**										**3**		
CO3	**3**	**2**	**2**										**3**	**2**	
CO4	**3**	**1**	**2**										**3**		
CO5	**3**	**2**	**2**										**3**		

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. I Semester		
Code: A0301	**ENGINEERING GRAPHICS (Common for CE, ME and Min.E)**	**L**	**T**	**P**
Credits: 3		**2**	**-**	**2**

Prerequisites: Nil

Course Objectives: To develop in students, graphic skills for communication of concepts and ideas of engineeringproducts.

MODULE I: Introduction to Engineering Drawing, Scales and Curves

Introduction to Engineering Drawing: Principles of Engineering Graphics and their significance. Lettering and dimensioning. Geometrical Constructions: Regular polygons only.**Scales:** Plane Scale, Comparative Scale, Diagonal Scale, Vernier Scale

Curves: Conic Sections, Cycloidal Curves and Involutes.

MODULE II: Projection of Points, Lines and Planes

Projection of Points: Principles of Orthographic Projections – Conventions – First and ThirdAngle projections. Projection of points including all four quadrants.

Projection of Lines: Projection of Lines - parallel, perpendicular, inclined to one reference planeand inclined to both reference planes. True length and true angle of a line.

Projection of Planes: Projection of Planes - Axis inclined to one reference plane.

MODULE III: Projection of Solids, Section of Solids and Development ofSurfaces

A. Projection of Solids: Projections of regular solids like cube, prism, pyramid, cylinder andcone by rotating object method. Axis inclined to one reference plane.

B. Section of Solids: Sectioning of single solid with the cutting plane inclined to one plane andperpendicular to the other - true shape of section.

Development of Surfaces: Development of lateral surfaces of simple Solids.

MODULE IV: Isometric Projections and Transformation of Projections

Isometric Projections: Principles of Isometric Projection – Isometric Views– Conventions –PlaneFigures, Simple Solids.

Transformation of Projections: Conversion of Isometric Views to Orthographic Views and viceversa– simple objects.

MODULE V: Introduction to Computer Aided Drafting

CAD workstation, Advantages of CAD, CAD Software, AutoCAD – Opening and Creating Drawings-Exploring the AutoCAD interface-Zooming and Panning, AutoCAD Commands and Toolbars-Basic Drawing and Editing Commands.

TEXT BOOKS

1. K.L.Narayana, S.Bheemanjaneyulu "**Engineering Drawing with Auto CAD-2016**" NewAge International Publishers, 1st Edition, 2018.
2. N.D. Bhat, "**Engineering Drawing**", Charotar Publishing House, 53rd Edition, 2014.

REFERENCES

1 K.L.Narayana, P.Kannaiah, "**Engineering Drawing**", SciTech Publishers. 2nd Edition, 2017

2 K.Venugopal,"**Engineering Drawing**",NewAge International Publishers, 3rd Edition, 2014.

3 K. V. Natarajan, "**A text book of Engineering Graphics**", Dhanalakshmi Publishers, 2015.

4 M.S. Kumar, "**Engineering Graphics**", D.D. Publications, 2011.

5 Trymbaka Murthy, "**Computer Aided Engineering Drawing**", I.K. internationalPublishing House, 3rd Edition, 2011.

E - RESOURCES

1 https://www.slideshare.net/search/slideshow?searchfrom=header&q=engineering+drawing

2 https://www.wiziq.com/tutorials/engineering-drawing

3 http://freevideolectures.com/Course/3420/Engineering-Drawing

4 http://www.worldcat.org/title/journal-of-engineering-graphics/oclc/1781711

5 http://road.issn.org/issn/2344-4681-journal-of-industrial-design-and-engineering-graphics

6 http://nptel.ac.in/courses/112103019/

Course Outcomes:

At the end of the course students will be able to

1. Understand the basics of drawings and importance of curves.
2. Draw the projection of lines and planes.
3. Draw the projection of solids and section of solids.
4. Produce development of surface and isometric projections.
5. Convert orthographic views to isometric views and vice-versa.

CO- PO,PSO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COS	Programme Outcomes(POs)												PSOs		
	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	PS O2	PS O3
CO1	3		1		1					3		3	2		
CO2	3		1		1					3		3	2		
CO3	3		1		1					3		3	2		
CO4	3		1		1					3		3	2		
CO5	3		1							1		1			

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. I Semester		
Code: A0501	**Programming for Problem Solving (Common for ALL)**	**L**	**T**	**P**
Credits: 3		**3**	**-**	**-**

Prerequisites: NIL

Course Objectives:

1. Understand the basic terminology, write, compile and debug programs in computer programming
2. Implement different control statements for solving problems.
3. Understand the concept of structured program and arrays.
4. Implement the idea of strings and pointers.
5. Analyse the usage of structures and different file operations.

MODULE I: Fundamentals and Introduction to 'C' Language

Introduction Fundamentals– Computer Systems, Computing Environments, Computer Languages, Creating and running programs, Software Development Method, Algorithms, Pseudo code, flow charts,applying the software development method.

Introduction to 'C' Language: – Background, C-tokens- Keywords, Identifiers, Basic data types, Variables, Constants, Preprocessor directives-include, define, Managing Input / Output functions - formatted input / output functions, Operators. Expressions, Precedence and Associatively, Expression Evaluation, Type conversions, Simple C Programming examples.

MODULE II: Conditional Statements and Repetition Statements

Control Statements: if and switch statements, Repetition statements – while, for, do-while statements, Loop examples, other statements related to looping – break, continue, go to, Simple C Programming examples.

Repetition statements – while, for, do-while statements, nested looping, other statements related to looping – break, continue, goto, Simple C Programming examples.

MODULE III: Designing Structured Programs and Arrays

Designing Structured Programs-Introduction to function, Advantages, user defined functions, inter function communication-call by value, Storage classes-auto, register, static, extern, scope rules, type qualifiers, recursion – recursive functions-Towers of Hanoi problem.

Arrays: Basic Concepts, Types of arrays, applications- Selection sort, Bubble sort, Insertion sort, Linearsearch and Binary search methods, arrays and functions.

MODULE IV: Strings and Pointers

Strings: Concepts, String Input / Output functions, arrays of strings, string manipulation functions, stringconversion, C program examples.

Pointers – Basic Concepts, Pointers for inter function communication-call by reference, pointers to pointers, Pointer arithmetic, array of pointers, pointers to array, applications, pointers to void, pointers tofunctions, Dynamic memory allocation functions.

MODULE V Structures and File Handling

Structures – Declaration, definition and initialization of structures, accessing structure elements, nestedstructures, arrays of structures, structures and functions, pointers to structures, self-referential structures,unions, difference between structures and union, typedef, bit fields, enumerated types, C programmingexamples.

Files – Basic Concept of a file, file input / output operations, text files and binary files, file statusfunctions (error handling), Random file access functions, command –line arguments.

C program examples.

TEXTBOOKS

1. Computer Fundamentals and Programming in C, P. Dey, M Ghosh, Second edition, OxfordUniversity Press.
2. Problem Solving and Program Design in C, J.R. Hanly and E.B. Koffman, Eighth Edition, PearsonEducation.
3. The C Programming Language, B.W. Kernighan and Dennis M.Ritchie, PHI/Pearson Education

REFERENCES

1. C Programming & Data Structures, B.A.Forouzan and R.F. Gilberg, Third Edition, Cengage Learning
2. C for Engineers and Scientists, H.Cheng, Mc.Graw-Hill International Edition
3. C Programming & Data Structures, P. Dey, M Ghosh R Thereja, Oxford University Press

E–RESOURCES

1. http://oxford university press.ac.in/eBooks/ Programming in C.
2. https://www.journals.elsevier.com/science-of-computer-programming
3. http://www.ejournalofsciences.org
4. http://onlinecourses.nptel.ac.in/iiitk_cs-101
5. http://onlinevideolecture.com/ebooks/?subject=C-Programming

Outcomes:

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

1. Translate the algorithms/flowcharts to programs (in C language).
2. Decompose a problem into functions and to develop modular reusable code.
3. Apply different types of control structures and arrays in a computer programming.
4. Develop programs that make use of concepts such as strings, pointers and structures.
5. Analyse file operations and command line arguments.

CO- PO,PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak															
COS	Programme Outcomes(POs)												PSOs		
	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	PS O2	PS O3
CO1	3	3	2	2	2				2	1	1	3	3	2	2
CO2	3	3	2	2	2				2	1	1	3	3	2	1
CO3	3	3	3	2	2				1			3	3	2	1
CO4	3	2	3	2	2				1		1	2	3	2	1
CO5	3	3	3	2	2				1	1	1	2	3	2	1

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. I Semester		
Code: A0B13	**Engineering Physics Lab (Common to ME, CE and Min. E)**	**L**	**T**	**P**
Credits: 1		**-**	**-**	**2**

Course objectives:

The main objective of this course is to provide the necessary exposure to the practical aspects, which isan essential component for learning science.

List of Experiments:

1 **Melde's Experiment – Longitudinal and Transverse modes**
To determine frequency of electrically maintain Tuning fork using Melde's apparatus.

2 **RLC series circuit**
To determination of resonant frequency, bandwidth and quality factor.

3 **Ultrasonic Interferometer**
To determine the velocity of ultrasonic sound through different liquid media..

4 **Numerical Aperture of an Optical Fiber**
To determine the Numerical aperture of the given fiber.

5 **Bending loss of the given fiber**.
To determine the bending loss of the given fiber.

6 **Diffraction grating**
To determine the wavelength of LASER using Diffraction grating.

7 **B-H Curve**
To study the Magnetization of Ferro magnetic material in presence of magnetic field.

8 **Dispersive Power**
To determine the dispersive power of glass prism.

9 **LASER**
To determination of pitch of the screw gauge using LASER.

10 **Torsional Pendulum**
Determine the rigidity Modulus of given Wire.

11 **Sonometer**
To verify the frequency of AC power Supply**.**

12. **NDT** – Magnetic particle testing

Course Outcomes:

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

1. Develop skills to impart practical knowledge in real time solution.
2. Understand principle, concept, working, application and comparison of results with theoretical calculations.
3. Design new instruments with practical knowledge.
4. Understand measurement technology
5. Use new instruments and real time applications in engineering studies.

CO- PO,PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak															
COS	Programme Outcomes(POs)												PSOs		
	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	PS O2	PS O3
CO1	3	1	1												
CO2	3	1	1												
CO3	3														
CO4	3														
CO5	3														

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. I Semester		
Code: A0502	Programming for Problem Solving Lab (Common for ALL)	L	T	P
Credits: 1		-	-	2

Prerequisites: NIL

Course Objectives:

1. Understand the various steps in Program development
2. Identify syntax and semantics of C Programming Language
3. Illustrate the usage of structured programming approach in solving problems.
4. Develop programs that make use of arrays, strings, pointers and structures in C language
5. Analyse different file operations

Software Requirements: C

List of Programs:

1. a. Practice various Internal and External DOS Commands.
   b. Write sample examples of C programs to implement basic operations.
2. a. Write a C program to find smallest and largest of given three numbers.
   b. Write a C program to find the roots of a quadratic equation.
   c. Write a C program to check whether given character is alphabet, digit or specialsymbol
3. a. Write a C program to find the sum of individual digits of a positive integer.
   b. Write a C program to generate the first 'n' terms of the sequence.
   [A Fibonacci sequence is defined as follows: the first and second terms in the sequence are 0 and 1. Subsequent terms are found by adding the preceding twoterms in the sequence.]
4. a. Write a C program to find whether the given number is palindrome, perfect, Armstrong or strong.
   b. Write a C program to generate all the prime numbers between n1 and n2, wheren1 and n2 are values supplied by the user.
5. Write C programs that use both recursive and non-recursive functions
   a. To find the factorial of a given integer.
   b. To find the GCD (greatest common divisor) of two given integers.
6. a. Write a C program to find both the largest and smallest number in a list of integers.
   b. Write a C program that uses non-recursive function to search for a Key value in agiven list of integers using linear search.

c. Write a C program that uses recursive and non -function to search for a Key valuein a given sorted list of integers using Binary search.

7. a. Write a C program that implements the Bubble sort method to sort a given arrayof integers in ascending order.
   b. Write a C program that implements the Selection sort method to sort a given listof names in ascending order.

8. Write a C program to perform the following:

   a. Addition of Two Matrices
   b. Multiplication of Two Matrices.

9. Write a C program that uses functions to perform the following operations:
   a. To insert a sub-string into given main string from a given position.
   b. To delete n characters from a given position in a given string.
   c. To find substring in a given string

10. a. Write a C program to determine if the given string is a palindrome or not
    b. Write a C program to count the lines, words and characters in a given text.

11. a. Write a C program to swap two numbers, which implement call by value andcall by reference.
    b. Write a C program to display the below student details using structures

Roll Number	Name	Gender	Branch	Attendance percentage
501	John	male	CSE	77.3
502	Alice	male	ECE	80.5
503	Sam	female	IT	90.7

c. Write a C program to find grade of a student using structures.

12. a. Write a C program which copies one file to another
    b. Write a C program to find sum of two numbers using command line arguments

13. a. Develop a mini project which implement the Library Management System
    b. Develop a mini project which implement the Student Record System

TEXT BOOKS:

a. Computer Fundamentals and Programming in C, P. Dey, M Ghosh, Second edition, OxfordUniversity Press
b. Problem Solving and Program Design in C, J.R. Hanly and E.B. Koffman, Eighth Edition, PearsonEducation.
c. The C Programming Language, B.W. Kernighan and Dennis M.Ritchie, PHI/Pearson Education

REFERENCES:

a. C Programming & Data Structures, B.A. Forouzan and R.F. Gilberg, Third Edition, CengageLearning
b. C for Engineers and Scientists, H. Cheng, Mc. Graw-Hill International Edition
c. C Programming & Data Structures, P. Dey, M Ghosh R Thereja, Oxford University Press

Course Outcomes:

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

1. Analyse concepts in problem solving and write diversified solutions for a given problem.
2. Identify situations where computational methods and computers would be useful.
3. Understand the programming tasks using techniques learned and write pseudo-code.
4. Compare the program on a computer, edit, compile, debug, correct, recompile and execute it.
5. Identify tasks in which the numerical techniques learned are applicable and apply them to writeprograms, and hence use computers effectively to solve the task

CO- PO,PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak															
COS	**Programme Outcomes(POs)**												**PSOs**		
	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**	**PS O2**	**PS O3**
CO1	**3**	**2**	**3**										**2**	**2**	
CO2	**3**	**3**	**3**										**2**	**2**	
CO3	**2**	**2**	**2**										**2**	**2**	
CO4															
CO5															

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERINGCOLLEGE (Autonomous)	B.Tech. I Semester		
Code: A0H02	English Language Lab (Common for CE,EEE,ME,ECE,CSE,CSE(AIML) CSE(DS), CSE (CS), CSE(IOT),IT and Min.E)	L	T	P
Credits: 1		-	-	2

The Language Lab focuses on the production and practice of sounds of language and familiarizes thestudents with the use of English in everyday situations and contexts.

Course Objectives:

The course aims to develop students' intelligibility in their pronunciation of English - speech sounds, word accent, intonation and rhythm. It also helps to improve the fluency in spoken English and make them aware of nuances of major skills, namely, listening and speaking skills. It also trains students to understand nuances of both verbal and non-verbal communication during all activities. The course enables the learners to develop their confidence levels so as to participate in discussions, debates andpublic speaking.

Listening Skills:

Objectives:

1. To enable students to develop their listening skill so that they may appreciate its role in the LSRW skillsapproach to language and improve their pronunciation
2. To equip students with necessary training in listening so that they can comprehend the speech of people ofdifferent backgrounds and regions

*Students should be given practice in listening to the sounds of the language to be able to recognize them, awareness regarding stress and recognize and use the right intonation in sentences.

- Listening for general content
- Listening to fill up information
- Intensive listening
- Listening for specific information

Speaking Skills:

Objectives:

1. To make students aware of the role of speaking in English and its contribution to their success.
2. To enable students to express themselves fluently and appropriately in social and professional contexts.

- Oral practice
- Describing objects/situations/people
- Just A Minute (JAM) Sessions.

Syllabus: English Language Communication Skills Lab shall have two parts:

a. Computer Assisted Language Learning (CALL) Lab
b. Interactive Communication Skills (ICS) Lab
The following course content is prescribed for the English Language Communication Skills Lab

Module - I:

CALL Lab : Introduction to Phonetics – Speech Sounds – Vowels and Consonants

ICS Lab : Ice-Breaking activity and JAM session; Listening: listening for sounds incontext, for ideas; Speaking: ideation and translation of ideas into sentences.

Module - II:

CALL Lab : Structure of Syllables - Past Tense Marker and Plural Marker – WeakForms and Strong Forms - Consonant Clusters.

ICS Lab : Situational Dialogues – Role-Play- Expressions in Various Situations –

Self-introduction and Introducing others – Greetings – Apologies – Requests – Social and Professional Etiquette - Telephone Etiquette; Listening: listening for specific purposes, for details; Speaking: speaking in the above situations with clarity, connectivity, maintaining voice characters.

Module - III:

CALL Lab : Word accent and Listening Comprehension-reading(aloud) meaningfully.

ICS Lab : Descriptions- Narrations- Giving Directions and guidelines; Listening:listening for intelligible English; Speaking: formal and informal conversations, register.

Module - IV:

CALL Lab : Intonation and Common errors in Pronunciation- reading aloud (evaluating through recording).

ICS Lab: Extempore- Public Speaking, Oral Presentation Skills; Listening: note taking and listening for speaker's tone/attitude; Speaking: organizing, connecting ideas and sentences, short forms in spoken English, errors in spoken English

Module - V:

CALL Lab : Neutralization of Mother Tongue Influence and Conversation Practice

ICS Lab : Information Transfer, Debate

Minimum Requirement of infra structural facilities for EL Lab:

1. Computer Assisted Language Learning (CALL) Lab:
The Computer aided Language Lab for 40 students with 40 systems, one master console, LAN facility and English language software for self- study by learners.

System Requirement (Hardware component):

Computer network with Lan with minimum 60 multimedia systems with the following specifications:

a) P – IV Processor b) Speed – 2.8 GHZ c) RAM – 512 MB Minimum

d) Hard Disk – 80 GB e) Headphones of High quality

2. **Interactive Communication Skills (ICS) Lab:** The Interactive Communication Skills Lab: A Spacious room with movable chairs and audio-visual aids with a Public Address System, a T. V., a digital stereo –audio & video system and camcorder etc.
Books Suggested for English Language Lab Library (to be located within the lab in addition to the CDs of the text book which are loaded on the systems):

Prescribed Lab Manual:

Rani, Sudha. *English Language Communication Skills Laboratory*. 5th edition, Pearson Publication, 2014.

Reference Books:

1. Gairns, Ruth and Redman, Stuart. *Oxford Word Skills: Learn and Practice English Vocabulary*.
   2nd edition, Oxford University Press, 2008.
2. Hughes, John and Mallett, Andrew. *Successful Presentations DVD and Student's Book Pack*.Oxford University Press, 2013.
3. Hancock, Mark. *English Pronunciation in Use* (Intermediate). 2nd edition, Cambridge UniversityPress, 2009.
4. Karia, Akash. *Public Speaking Mastery: Speak Like a Winner*. Kindle edition, 2013.
5. Lucas, Stephen. *The Art of Public Speaking***.** 11th edition, Tata McGraw Hill, 2011.

Websites:

1. http://www.mindtools.com/CommSkll/ActiveListening.htm
2. http://www.slideshare.net/alisonkis/dialogue-and-roleplay-activity
3. http://www.hse.ru/pubs/lib/data/access/ram/ticket/2/14309868938d576a532b71360b7354268380727a22/An%20article%20for%20Monika%20(2010).pdf

Course Outcomes:

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

1. Understand the nuances of language through audio- visual experience and group activities.
2. Neutralize the accent for intelligibility
3. realize the importance of listening skills and speaking skills and their application in real life situations.
4. Recognize significance of non-verbal communication and develop confidence to face audience and shed inhibitions.
5. Speak with clarity and confidence; thereby enhance employability skills of the students.

CO- PO,PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak															
COS	**Programme Outcomes(POs)**												**PSOs**		
	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**	**PS O2**	**PS O3**
CO1		**1**				**1**		**1**	**2**	**2**		**1**			
CO2										**1**		**1**			
CO3							**1**		**1**	**2**		**2**			
CO4								**1**	**1**	**2**		**2**			
CO5										**2**		**2**			

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. I Semester		
Code:A0302	**ENGINEERING WORKSHOP (Common for CE, ME and Min.E)**	**L**	**T**	**P**
Credits: 1		**-**	**-**	**2**

COURSE OBJECTIVES:

To understand the usage of hand tools, acquire the skills in model / pattern making and familiarizewith various work materials and tools.

I. TRADES FOR EXERCISES:

At least two exercises from each trade:

1. Carpentry 2.Fitting 3. Tin-Smithy
4. House-wiring 5.Foundry 6.Arc welding

II. TRADES FOR DEMONSTRATION & EXPOSURE

1. Machine shop
2. Plumbing
3. Wood working lathe
4. Identification of Electronic Components
5. Black smithy
6. Computer Peripherals

COURSE OUTCOMES

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

1. Knowledge of carpentry process and methods used in the design and fabrication, installation, maintenance and repair of structures and fixtures (e.g., furniture, cabinets) to accomplish work assignments.
2. Assembling together of part and removing metals to secure the necessary joint by using fitting and welding.
3. Understand the hardware components of house wiring.
4. Understand the manufacturing process using machine shop.
5. Analyze the different types of computer Peripherals

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak															
COs	**Programme Outcomes(POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**3**				**2**	**2**	**1**		**3**			**3**		**2**	
CO2	**3**				**2**	**2**	**1**		**3**			**3**		**2**	
CO3	**3**				**2**	**2**	**1**		**3**			**3**		**2**	
CO4	**3**				**2**	**2**	**1**		**3**			**3**		**2**	
CO5	**3**				**2**	**2**	**1**		**3**			**3**		**2**	

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. II Semester		
Code:A0B06	**Vector Calculus and Numerical Techniques (Common For CE,ME&MINING)**	**L**	**T**	**P**
Credits: 4		**3**	**1**	**-**

Pre- requisite: Basics of vectors, Differentiation and Integration.

Course Objectives: To learn

1. The physical quantities involved in engineering field related to vector valued functions.
2. The basic properties of vector valued functions and their applications to line, surface and volumeintegrals.
3. The various numerical techniques which are indispensable tools to solve many algebraic andtranscendental equations.
4. Numerical methods of solving the ordinary differential equations.
5. Evaluation of PDE and their applications by using numerical techniques.

MODULE – I: Vector Differentiation

Vector point functions and scalar point functions. Gradient, Divergence and Curl. Directional derivatives,. Scalar potential functions. Solenoidal and Irrotational vectors. Vector Identities.

MODULE – II: Vector Integration

Line, Surface and Volume Integrals. Green Theorem, Gauss Divergence Theorem and Stokes Theorem(without proofs) and their applications.

MODULE III: : Algebraic and Transcendental equations and Interpolation

(A) Solution of Algebraic and Transcendental Equations: Introduction-Errors, types of errors. Bisection Method, Method of False Position. The Iteration Method – Newton-Raphson Method

(B) Interpolation: Introduction- Errors in Polynomial Interpolation – Finite differences-Forward Differences-Backward differences – Symbolic relations and separation of symbols, Differences of a polynomial-Newton's formulae for interpolation, Central difference interpolation Formulae – Gauss Central Difference Formulae –Interpolation with unevenly spaced points-Lagrange's Interpolation formula.

MODULE – IV: Numerical solution of Ordinary Differential Equations and Numerical Integration

Numerical solution of Ordinary Differential Equations Introduction-Solution by Taylor's series method - Picard's Method of successive Approximations, Euler's Method,Modified Euler's Method – Runge-Kutta Methods.

Numerical Integration: Trapezoidal Rule, Simpson's $1/3^{rd}$ Rule, Simpson's 3/8 Rule.

MODULE – V: Numerical solution of PDE

Classification of second order equations , Finite difference approximations to derivatives ,- standard 5- point formula ,diagonal 5-point formula , solution of Laplace equation, Solution of Poisson's equation. Solution of one-dimensional heat, wave equations (by Crank-Nicolson explicit/implicit formula only).

Text Books:

1) B.S. Grewal, **HigherEngineering Mathematics**, Khanna Publishers, 36th Edition, 2010.
2) R K Jain S R KIyengar, **Advanced engineering mathematics**, Narosa publications.
3) Erwin Kreyszig, **Advanced Engineering Mathematics**, Wiley publications.
4) M. K Jain, S R K Iyengar, R.K Jain, **Numerical Methods for Scientific andEngineeringComputation**, New age International publishers.
5) S.S.Sastry, **Introductory Methods of Numerical Analysis**,5th Edition,PHI Learning Private Limited

Reference Books:

1. Kanti B. Datta**"Mathematical Methods of Science and Engineering",** Cengage Learning.
2. Alan Jeffrey **"Mathematics for Engineers and Scientists"**, Chapman & Hall/ CRC, 6th Edition2013
3. Michael Greenberg **"Advanced Engineering Mathematics"**, Pearson Education Second Edition.
4. G.B. Thomas and R.L. Finney, **Calculus and Analytic geometry**, 9th Edition, Pearson,Reprint, 2002

E Resources:

a) Concerned Website links

1. http://www.mecmath.net/calc3book.pdf(VectorCalculus)
2. http://www.simumath.com/library/book.html?code=Alg_Equations_Examples (Algebraic andtranscendental equation text book by YURG BERENGARD)
3. http://jupiter.math.nctu.edu.tw/~smchang/9602/NA_lecture_note.pdf (Interpolation)
4. http://nptel.ac.in/courses/104101002/downloads/lecturenotes/module1/chapter6.pdf (Numerical Differentiation and Integration)
5. http://www.sam.math.ethz.ch/~hiptmair/tmp/NPDE10.pdf (Numerical Solution of PartialDifferential Equations)

b) Concerned Journals/Magazines links

1. https://www.jstor.org/stable/27953736?seq=1#page_scan_tab_contents(Algebraic andtranscendental equation by William L. Schaaf)
2. http://www.ijcsi.org/papers/IJCSI-9-6-2-413-419.pdf(Algebraicandtranscendental equation byMd. Golam Moazzam)
3. http://www.iosrjournals.org/iosr-jm/papers/Vol6-issue6/J0665862.pdf (Interpolation)

c) NPTEL Videos

1. http://nptel.ac.in/courses/122102009 (Algebraic andtranscendental equation)
2. http://nptel.ac.in/courses/112104035/14 (Mathematical methods in engineering and science by Prof.Bhaskar Dasgupta)
3. http://nptel.ac.in/courses/111107063 (Numerical solution of Ordinary Differential Equations)
4. http://nptel.ac.in/courses/111105038 (Numerical Solution of Partial Differential Equations)

Course Outcomes:

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

1. Apply the concept of Gradient, Divergence and Curl of a vector valued functions and scalarvalued functions in engineering and physical problems.
2. Apply vector integral theorems in engineering and physical problems.
3. Apply numerical methods to solve some algebraic and transcendental equations to the desiredlevel of accuracy and by applying interpolation concept to evaluate missed data in data analysis.
4. Apply differential equations in engineering-oriented problems and to observe patterns by usingnumerical techniques.
5. To find out the Numerical solution of partial differential equations.

CO- PO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes(POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2								1	3	3	2
CO2	3	3	2	3									3	3	2
CO3	3	3	3	3								1	3	3	3
CO4	3	3	3	3									3	3	3
CO5	3	3	3	3									3	3	3

2020-21 Onwards (MR20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. II Semester		
Code: A0303	ENGINEERING MECHANICS (Common for CE, ME and Min.E)	L	T	P
Credits: 3		3	-	-

Prerequisites: Nil

COURSE OBJECTIVES:

The objective of this subject is to provide the basic concepts and effect of system forces on rigid bodies, Geometrical Properties of Planes and Solids, problem solving in kinematics and kinetics using different methods and to analyze the types of friction for moving bodies and problems related to friction.

MODULE I:Introduction to Mechanics & System of Forces

Introduction: Basic Concepts, Laws of Motion, Force - types, characteristics - Principle of transmissibility - Types of Forces - Concurrent and non-concurrent Forces - Composition of force – Resultant - Triangle, Polygon and Parallelogram Law of Forces - Moment of Force and its Application -Varignon‘s theorem, Couples - Free Body Diagrams, Types of Supports and their reactions, Internal and External Forces - Types of Equilibrium, Equations of Equilibrium, Conditions of Equilibrium - Lami‘s Theorem.

MODULE II: Friction, Centroid and Center of Gravity

Friction: Types of friction, Limiting friction, Laws of friction, static and dynamic friction, application of laws of friction. Motion of bodies - wedge, screw, screw jack.

Centroid and Center of Gravity: Introduction, Centroids of Lines and Areas - simple figures - Centroid of composite figures. Pappus theorem - Centre of gravity of simple solids, composite solids - Centroids of volumes.

MODULE III: Moment of Inertia

A: Area Moment of Inertia: Definition - Moment of Inertia of plane areas, Polar Moment of Inertia,Transfer Theorem, Moments of Inertia of Composite Figures.

B: Mass Moment of Inertia: Introduction-moment of inertia of masses - Radius of gyration-Transfer formula for mass moment of inertia- by integration - Moment of Inertia of composite bodies.

MODULE IV:Kinematics& Kinetic

Kinematics: Rectilinear motion - Motion of Rigid Body under uniform and variable accelerations -motion under gravity- curvilinear motion – Projectiles - rotary motion.

Kinetics: Analysis as a Particle and Analysis as a Rigid Body in Translation - D'AlembertsPrinciple - Connected bodies- Kinetics of rotating bodies.

MODULE V: Work, Power, Energy & Mechanical Vibrations

Work, Power and Energy: Introduction, work-energy equation - motion of connected bodies - work done by a spring - general plane motion. Mechanical Vibrations: Definitions, concepts - simple harmonic motion - free vibrations - Simple and compound pendulums.

TEXT BOOKS

1. S. Timoshenko, D.H. Young, J.V. Rao and Sukumar Pati**, "EngineeringMechanics"**, Tata McGraw-Hill Education, 5th Edition, 2013.
2. K.Vijaya Kumar Reddy, J. Suresh Kumar**, "Engineering Mechanics"**, B SPublications, 3rd Edition, 2013

REFERENCES

1. Beer, F.P and Johnston Jr. E.R. "**Vector Mechanics for Engineers**", Tata McGraw-Hill Education 10th Edition (India) Pvt Ltd.. 2013.
2. Fedinand. L. Singer, **"Engineering Mechanics"**, Harper & Row Publishers, 3rdEdition, 1975.
3. R.S. Khurmi, "**A Text Book of Engineering Mechanics"**, S.Chand Publications, 21st Edition, 2007.
4. K L Kumar, "**Engineering Mechanics"**, Tata McGraw Hill Education, 4th Edition, 2011.
5. D.S.Kumar Patil, "**Engineering Mechanics"**, SK Kataria & Sons Publishers, 2ndEdition, 2009.

E - RESOURCES

1. http://www.mathalino.com/reviewer/engineering-mechanics/equilibrium-force-system
2. http://nptel.ac.in/courses/112103109/
3. http://ascelibrary.org/journal/jenmdt
4. https://tll.mit.edu/sites/default/files/SUTDVideoThumb/freebodydiagrams.pdf
5. http://nptel.ac.in/courses/112106180/

COURSE OUTCOMES

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

1. Determine the resultant of a system of forces and draw free body diagrams and can frameappropriate equilibrium equations from the free body diagram.
2. Understand and solve the fundamental static problems and able to find centroid and centreof gravity.
3. Determine area and mass moment of inertia for various sections.

4. Apply fundamental concepts of kinetics and kinematics of particles to the analysis ofsimple practical problems.
5. Understand and solve fundamental work, power and energy related problems and know the concepts of mechanical vibrations.

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak															
COs	**Programme Outcomes(POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**3**	**3**	**1**	**3**								**3**	**2**		
CO2	**3**	**3**	**1**	**3**								**3**	**2**		
CO3	**3**	**3**	**1**	**3**								**3**	**2**		
CO4	**3**	**3**	**1**	**3**								**3**	**2**		
CO5	**3**	**3**	**1**	**3**								**3**	**2**		

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech II Semester		
Code: A0B17	Engineering Chemistry (Common for CSE, IT, ECE, EEE, CE, ME and Min.E)	L	T	P
Credits: 4		3	1	-

Course objectives:

The purpose of this course is to emphasize the relevance of fundamentals of chemical sciences in the field of engineering and to provide basic knowledge on atomic- molecular orbital's, electrochemistry, batteries, corrosion and the role of water as an engineering material in domestic-industrial use. They will also impart the knowledge of stereochemistry, understanding the chemical reaction path way mechanisms andsynthesis of drugs. Listing out various types of fuels and understanding the concept of calorific value andcombustion.

Module I: Water and its treatment

Introduction to water, hardness of water, causes of hardness, expression of hardness, units and types of hardness-Numerical Problems. Alkalinity of water, specifications of potable water (BIS); Estimation of temporary & permanent hardness of water by EDTA method. Boiler troubles - Scale & Sludge, Priming and foaming, caustic embrittlement and boiler corrosion; Treatment of boiler feed water - Internal treatment (colloidal, phosphate, carbonate and calgon conditioning). External treatment - Lime Soda process (cold & hot) and ion exchange process, Numerical Problems. Disinfection of water by chlorination and ozonization. Desalination by Reverse osmosis and its significance.

Module II: Molecular structure and Theories of Bonding:

Introduction to Molecular orbital Theory. Linear Combination of Atomic Orbital's (LCAO), significance of bonding and anti-bonding molecular orbital, Conditions for the formation of molecular orbital's. Molecular orbital energy level diagrams of diatomic molecules -, N_2 ,O_2 and F_2. Introduction to coordination compounds-ligand-coordination number (CN) - spectrochemical series. Salient features of crystal field theory, Crystal field splitting of transition metal complexes in octahedral ($[CoF_6]^{3-}$ and $[Co(CN)_6]^{3-}$) and tetrahedral ($[NiCl_4]^{2-}$ and [Ni (CO)4]) fields - magnetic properties of complexes. Bandstructure of solids and effect of doping on conductance.

Module III: Electrochemistry and Corrosion

A. Electrochemistry:

Introduction to Electrochemistry-Conductance (Specific and Equivalent) and units. Types of cells- electrolytic & electrochemical cells (Galvanic Cells)-Electrode potential- cell potential (EMF).Electrochemical series and its applications, Nernst equation its applications and numerical problems. Reference electrodes - Calomel Electrode and Glass electrode-determination of pH using glasselectrode. Batteries: Primary (dry cells) and secondary (Lead-Acid cell, Ni-Cd cell) - applications of batteries. Fuel cells: Hydrogen - Oxygen fuel cell and its applications.

B. Corrosion:

Causes and effects of corrosion: Theories of corrosion - Chemical & Electrochemical corrosion, Pilling- Bedworth rule, Types of corrosion: Galvanic and Water-line corrosion. Factors affecting rate of corrosion-Nature of metal and Nature of Environment, Corrosion control methods - Cathodic protection (Sacrificial anodic and impressed current cathodic methods). Surface coatings: Methods of metallic

coatings - hot dipping (Galvanization), Electroplating (Copper) and Electroless plating (Nickel).

Module IV: Stereochemistry, Reaction mechanism & synthesis of drug molecules and NMR spectroscopy:

Introduction to Isomers - classification of isomers - structural (chain, positional & functional) and stereoisomerism-geometrical (cis-trans & E-Z system) - characteristics of geometrical isomerism, optical isomerism (chirality - optical activity, specific rotation, enantiomers and diastereomers) of tartaric acid and lactic acid. Conformational isomerism of n-Butane. Introduction to bond cleavage (homo & hetero cleavage) - reaction intermediates and their stability. Types of organic reactions - Mechanism of substitution (SN^1 & SN^2) and (E1&E2) reactions with suitable example. Ring opening (Beckmann rearrangement), oxidation and reduction (Cannizaro reaction), cyclization (Components of Diels-Alder reaction-Mechanism of Diels-Alder reaction with suitable example) reactions. Synthesis of Paracetamol,Aspirin and their applications.

Introduction to Spectroscopy, Basic concepts of nuclear magnetic resonance spectroscopy, chemical shiftand spin-spin splitting.

Module-V Fuels and Combustion

Fuels: Classification- solid fuels: coal – analysis of coal – proximate and ultimate analysis and theirsignificance. Liquid fuels – petroleum and its refining, cracking – types – moving bed catalytic cracking. Knocking – octane and cetane rating, synthetic petrol - Fischer-Tropsch's process; Gaseous fuels – composition and uses of natural gas, LPG and CNG. **Combustion:** Definition, Calorific value of fuel – HCV, LCV; Calculation of air quantity required for combustion of a fuel. Determination of calorific value by Junkers gas calorimeter-Numerical problems on combustion.

Text Books:

1. P.C.Jain and Monica Jain, "**A Text Book of Engineering Chemistry"**, DhanpatRai Publications, New Delhi, 16th Edition 2014.
2. S.S. Dara and S.S. Umare, "**A Text Book of Engineering Chemistry"**, S Chand Publications,New Delhi, 12th Edition 2010.
3. A.Jaya Shree, "Text book of Engineering Chemistry", Wiley, New Delhi, 2018.

Reference Books:

1. B.Rama Devi, Ch.VenkataRamana Reddy and PrasanthaRath, **"Text Book of Engineering chemistry"**, Cengage Learning India Pvt.Ltd,2016.
2. M.G. Fontana and N. D. Greene, "**Corrosion Engineering"**, McGraw Hill Publications, NewYork, 3rd Edition, 1996.
3. K. P. C. Volhardt and N. E. Schore, **"Organic Chemistry: Structure and**

Function", 5th Edition, 2006.

e-Resources:

a) Concerned Website links:

1) https://books.google.co.in/books?isbn=0070669325 (Engineering chemistry by Sivasankar).
2) https://www.youtube.com/watch?v=yQUD2vzfgh8 (Hot dipping Galvanization).
3)https://archive.org/stream/VollhardtOrganicChemistryStructureFunction6th/Vollhardt_Organic_Chemistry
_Structure_Function_6th_djvu.txt.

b) Concerned Journals/Magazines links:

1) http://americanhistory.si.edu/fuelcells/sources.htm (Fuel Cell Information Sources)
2) https://www.abctlc.com/downloads/courses/WaterChemistry.pdf (Water Chemistry)

c) NPTEL Videos:

1) nptel.ac.in/courses/113108051/ (corrosion & electrochemistry web course)
2) https://www.youtube.com/watch?v=V7-8EOfZKeE (Stereochemistry)

Course Outcomes:

After completion of the course students will be able to:

1. Understand water treatment, specifically hardness of water and purification of water by variousmethods.
2. Analyze microscopic chemistry in terms of atomic and molecular orbital's splitting and band theory related to conductivity.
3. Acquire knowledge on electrochemical cells, fuel cells, batteries and their applications.
4. Acquire basic knowledge on the concepts of stereochemistry, reaction mechanisms and interpretation of NMR in organic molecules.
5. Acquire the knowledge of various fuels and identify a better fuel source of less pollution.

CO- PO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes(POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	2	2										
CO2	2	1		2	1										
CO3	3	3	2	2	1		2								
CO4	3	1	1	1	2	1	3								
CO5	3	3	3	1			3								

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. II Semester		
Code: A0201	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING (Common for ALL)	L	T	P
Credits: 3		3	-	-

Prerequisites: NIL

Course Objectives:

To introduce the concept of electrical circuits and its components. To introduce the characteristics of various electronic devices. To impart the knowledge of various configurations, characteristics and applications of electrical & electronic components.

MODULE I: DC Circuits

Electrical circuit elements (R, L and C), voltage and current sources, Kirchhoff's current and voltage laws

- Series, parallel, series-parallel, star-to-delta and delta-to-star transformation- analysis of simple circuits with dc excitation. Superposition, Thevenin's and Maximum Power Transfer Theorems with DC excitation.

MODULE II: AC Circuits

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC,RLC combinations (series and parallel).

MODULE III: Introduction to Electrical Machines

A: DC Machines: Construction & Principle of Operation of DC Generators – E.M.F Equation. Principle of operation DC Motors – Back E.M.F. - Torque equation – Brake Test - Characteristics.

B: AC Machines: Construction and Principle of operation of Transformer- EMF Equation. Constructionand Principle of Operation of 3 Phase Induction Motors - Brake test on 3-Phase Induction Motor – Applications.

MODULE IV: P-N Junction Diode

P-N Junction Diode: Diode equation, Energy Band diagram, Volt-Ampere characteristics, Temperature dependence, Ideal versus practical, Static and dynamic resistances, Equivalent circuit, Diffusion and Transition Capacitances. Zener diode operation, Zener diode as voltage regulator.

Rectifiers: P-N junction as a rectifier - Half Wave Rectifier, Ripple Factor - Full Wave Rectifier, BridgeRectifier.

Filters: Filters – Inductor Filters, Capacitor Filters, L- section Filters, π- section Filters.

MODULE V: BJT and Junction Field Effect Transistor (JFET)

Bipolar Junction Transistor (BJT): Construction, Principle of Operation, Symbol, Amplifying Action, Common Emitter, Common Base and Common Collector configurations and Input-Output Characteristics, Comparison of CE, CB and CC configurations

Junction Field Effect Transistor and MOSFET: Construction, Principle of Operation, Symbol, Pinch-Off Voltage, Volt-Ampere Characteristic, Comparison of BJT and FET.

TEXT BOOKS

1. M.Surya Kalavathi, Ramana Pilla, Ch. Srinivasa Rao, Gulinindala Suresh, "Basic Electrical and Electronics Engineering", S.Chand and Company Limited, New Delhi, 1st Edition, 2017.
2. R.L.Boylestad and Louis Nashlesky, "Electronic Devices & Circuit Theory", Pearson Education, 2007.

REFERENCES

1. V.K. Mehtha and Rohit Mehta, "Principles of Electrical Engineering and Electronics", S.Chand&Co., 2009.
2. Jacob Milliman, Christos C. Halkias, Satyabrata Jit (2011), "Electronic Devices and Circuits", 3rd edition, Tata McGraw Hill, New Delhi.
3. Thomas L. Floyd and R. P. Jain, "Digital Fundamentals", Pearson Education, 2009.
4. David A. Bell, "Electronic Devices and Circuits", Oxford University Press, 2008.
5. Nagrath I.J. and D. P. Kothari, "Basic Electrical Engineering", Tata McGraw Hill, 2001.
6. Mittle N., "Basic Electrical Engineering", Tata McGraw Hill Education, New Delhi, 2nd Edition,2005.

E - RESOURCES

1. https://www.electrical4u.com/ohms-law-equation-formula-and-limitation-of-ohms-law/
2. https://www.eeweb.com/passives
3. http://nptel.ac.in/courses/108108076/
4. http://nptel.ac.in/downloads/108105053/

Course Outcomes:

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

1. Apply basic laws in electrical circuit.
2. Analyze the single phase circuits
3. Comprehend the construction and Operation of DC and AC machines
4. Know the practical importance of Diode and its characteristics
5. Recognize the construction and operation of BJT and JFET

CO- PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak															
COs	**Programme Outcomes (POs)**												**PSOs**		
	PO 1	**PO 2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	**3**	**3**	**3**									**3**	**3**	**3**	**3**
CO2	**3**	**3**	**3**									**3**	**3**	**3**	**3**
CO3	**3**	**3**	**3**									**3**	**3**	**3**	**3**
CO4	**3**	**3**	**3**									**3**	**3**	**3**	**3**
CO5	**3**	**3**	**3**									**3**	**3**	**3**	**3**

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. II Semester		
Code: A0527	Basic Python Programming Lab (Common for CE, EEE, ME, ECE, MiE)	L	T	P
Credits: 2		-	1	2

Prerequisites: NIL

Course Objectives: To be able to introduce core programming basics and program design with functions using Python programming language, understand a range of Object-Oriented Programming, as well as in-depth data and information processing techniques.

SoftwareRequirements:

Python List of Programs:

1. a) Write a program to demonstrate different number data types in Python.
   b) Write a program to perform different Arithmetic Operations on numbers in Python.

2. a) Write a program to create, concatenate and print a string and accessing sub-string from agiven string.
   b) Write a python script to print the current date in the following format "Sun May 29 02:26:23IST 2017"

3. Write a program to create, append, and remove lists in python.
4. Write a program to demonstrate working with tuples in python.
5. Write a program to demonstrate working with dictionaries in python.
6. a) Write a python program to find largest of three numbers.
   b) Write a Python program to convert temperatures to and from Celsius, Fahrenheit. [
   Formula : c/5 = f-32/9]

7. a) Write a Python script that prints prime numbers less than 20.
   b) Write a python program to find factorial of a number using Recursion.

8. a) Write a python program to define a module to find Fibonacci Numbers and import themodule to another program.
   b) Write a python program to define a module and import a specific function in that module to another program.

9. a) Write a program that defines and print a matrix.
   b) Write a program to perform addition of two square matrices.
   c) Write a program to perform multiplication of two square matrices.
10. a) Write a function dups to find all duplicates in the list.
    b) Write a function unique to find all the unique elements of a list.

11. a) Write a program to print each line of a file in reverse order.
    b) Write a program to compute the number of characters, words and lines in a file.

12. Write a script named copyfile.py. This script should prompt the user for the names of two text files.The contents of the first file should be input and written to the second file.

TEXT BOOKS:

1. Vamsi Kurama, "Python Programming: A Modern Approach", Pearson Publications.
2. Mark Lutz," Learning Python", Orielly Publishers

REFERENCES:

1. Allen Downey, "Think Python", Green Tea Press
2. W. Chun, "Core Python Programming", Pearson.
3. Kenneth A. Lambert, "Introduction to Python", Cengage

Course Outcomes:

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

1. Examine Python syntax and semantics and be fluent in the use of Python flow control andfunctions..
2. Demonstrate proficiency in handling modules, strings and file systems
3. Create, run and manipulate Python Programs using regular expressions andmultithreaded programming environments
4. Interpret the concepts of object-oriented programming in Python.
5. Implement exemplary GUI applications related to Web Programming in Python

CO- PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak															
COs	**Programme Outcomes (POs)**												**PSOs**		
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO1 2**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	**2**		**3**		**3**				**1**		**1**	**2**	**2**	**1**	
CO2			**2**		**3**							**1**	**1**		
CO3			**2**		**2**							**2**			**2**
CO4	**1**	**2**	**3**	**2**	**3**		**1**		**3**		**1**	**2**			**3**
CO5					**3**						**1**	**2**			**2**

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. II Semester		
Code: A0304	**ENGINEERING MECHANICS LAB**	**L**	**T**	**P**
Credits: 1	**(Common for CE, ME and Min.E)**	**-**	**-**	**2**

COURSE OBJECTIVES:

The objective of this subject is to provide the basic concept of force, moment of inertia, reaction and moments by practically.

List of Experiments

1. Verify the triangle law and polygon law of forces.
2. To find the equilibrium of coplanar concurrent force system-forces in the jib crane.
3. To determine the support reaction for a beam.
4. To determine the moment of inertia of a flywheel.
5. To verify the law of moments by disc apparatus.
6. To determine the coefficient of friction.
7. To verify the equilibrium of Non Concurrent forces.
8. To verify the equilibrium of forces using force table.
9. To determine the efficiency of a simple screw jack apparatus.
10. To estimate the value of acceleration due to gravity by using compound pendulum.
11. To determine the efficiency of Worm and Worm Wheel apparatus.
12. To determine the efficiency of a Differential Wheel and Axle apparatus.

COURSE OUTCOMES

At completion of the course, students will be able to

1. Use scalar and vector analytical techniques for analyzing forces in staticallydeterminate structures.
2. Apply basic knowledge of mathematics and physics to solve real-world problems.
3. Determine the coefficient of friction.
4. Determine the efficiency of a simple screw jack apparatus, Worm and Worm Wheelapparatus and Differential Wheel and Axle.
5. Estimate the value of acceleration due to gravity.

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak															
COs	**Programme Outcomes(POs)**												**PSOs**		
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO1 2**	**PSO 1**	**PSO2**	**PSO3**
CO1	3	1	1	3					3			2	2		
CO2	3	1	1	3					3			2	2		
CO3	3	1	1	3					3			2	2		
CO4	3	1	1	3					3			2	2		
CO5	3	1	1	3					3			2	2		

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. II Semester		
Code: A0B18	**Engineering Chemistry Lab (Common for CE, EEE, ME,ECE,CSE,CSE(AIML), CSE(DS), CSE (CS), CSE(IOT),IT and Min.E))**	**L**	**T**	**P**
Credits: 1		-	-	**2**

Course Objectives:

To provide the students with practical knowledge of quantitative analysis of materials by classical andinstrumental methods for developing experimental skills in building technical competence.

List of Experiments:

1. Calibration of Volumetric apparatus.
2. Estimation of Total Hardness of water by EDTA Method.
3. Estimation of an acid by P^H metry.
4. Estimation of alkalinity of water.
5. Estimation of strength of an acid by Conductometry.
6. Estimation of strength of an acid by Potentiometry.
7. Estimation of Mn^{+2} ion in $KMnO_4$ by Colorimetry.
8. Determination of viscosity of given liquids by Ostwald's viscometer.
9. Determination of surface tension of given sample using stalagmometer.
10. Estimation of iron (II) by dichrometry.
11. Determination of rate constant of hydrolysis of methyl acetate.
12. Preparation of Aspirin.

Course outcomes: After completion of the course, students will be able to:

1. Estimate the hardness of given water samples.
2. Select lubricants for various purposes.
3. Prepare advanced polymers & drug materials.
4. Know the strength of an acid present in batteries.
5. Calculate the amount of Mn^{+2} present in unknown substances/ores using instrumental methods.

CO- PO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes(POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1											
CO2	2	1	2												
CO3	2	2		1											
CO4	2	2	1												
CO5	2	1	2												

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. II Semester		
Code: A0202	Basic Electrical and Electronics Engineering Lab (Common for ALL)	L	T	P
Credits: 1		-	-	2

Prerequisites: Nill

Course Objective:

To get practical knowledge about basic electrical circuits, electronic devices like Diodes, BJT, JFET andalso analyse the performance of DC Motors, AC Motors and Transformers.

List of Experiments:

1. Verification of Kirchhoff's Laws.
2. Verification of Maximum Power Transfer Theorem.
3. Determination of Phase Angle for RC series circuit.
4. Brake Test on DC-Shunt Motor. Determination of Performance curves
5. Load Tests on Single Phase Transformer
6. Brake Test on Three Phase Induction Motors. Determination of Performance curves
7. V-I Characteristics of PN junction Diode
8. V-I Characteristics of Zener Diode
9. Half Wave Rectifier and Full Wave rectifier.
10. Input and Output characteristics of BJT with CE configuration
11. Input and Output characteristics of BJT with CB configuration
12. Input and Output Characteristics of JFET.

Course Outcomes:

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

1. Analyze electrical circuits by applying basic laws
2. Analyze the performance of DC Motor, three phase Induction motor and transformer
3. Understand V-I Characteristics of various diodes
4. Design Different Rectifier Circuits
5. Differentiate the Transistors and their Operations

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak															
COs	**Programme Outcomes(POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**3**	**3**	**3**	**3**					**3**			**3**			
CO2	**3**	**3**	**3**	**3**					**3**			**3**			
CO3	**3**	**3**	**3**	**3**					**3**			**3**			
CO4	**3**	**3**	**3**	**3**					**3**			**3**			
CO5	**3**	**3**	**3**	**3**					**3**			**3**			

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. III Semester		
Code:A0B02	PROBABILITY AND STATISTICS (Common for CE, ME & Min. E)	L	T	P
Credits:3		3	-	-

Pre-requisite: Basic Probability

Course Objectives:

This course is meant to provide a grounding in Statistics and foundational concepts that can be applied in modeling processes and decision making. These would come in handy for the prospective engineers in most branches.

Module-I: Probability

Introduction to Probability, events, sample space, mutually exclusive events, Exhaustive events, Addition theorem for 2 & nevents and their related problems. Dependent and Independent events, conditional probability, multiplication theorem, Baye's Theorem, Statement of Weak law of large numbers

Module-II: Random Variables and Probability Distributions

Random variables–Discrete Probability distributions. Bernoulli, Binomial, poisson, mean, variance, moment generating function–related problems. Geometric distributions. Continuous probability distribution, Normal distribution, Exponential Distribution, mean, variance, momentgeneratingfunction–relatedproblems.Gammadistributions(OnlymeanandVariance)CentralLimitTheorem

Module-III: Sampling Distributions & Testing of Hypothesis

A: Sampling Distributions: Definitions of population-sampling-statistic, parameter. Types of sampling, Expected values of Sample mean and variance, sampling distribution, Standard error, Sampling distribution of means and sampling distribution of variance. Parameter estimations – likelihood estimate, point estimation and interval estimation.

B: Testing of hypothesis: Null hypothesis, Alternate hypothesis, type I, & type II errors–critical region, confidence interval, and Level of significance. One tailed test, two tailed test.

Large sample tests:

1. Testing of significance for single proportion.
2. Testing of significance for difference of proportion.
3. Testing of significance for single mean.
4. Testing of significance for difference of means.

Module IV: Small sample tests

Student t-distribution, its properties; Test of significance difference between sample mean and population mean; difference between means of two small samples, Paired t-test, Snedecor's F-distribution and it's properties. Test of equality of two population variances, Chi-square distribution, its properties, Chi-square test of goodness of fit and independence of attributes.

Module V: Correlation, Regression:

Correlation & Regression: Correlation, Coefficient of correlation, the rank correlation. Regression, Regression Coefficient, The lines of regression: simple regression.

TEXTBOOKS:

1. Walpole,Probability&Statistics,forEngineers&Scientists,8th Edition,
2. Pearson Education.
3. Paul A Maeyer Introductory Probability and Statistical Applications, John Wiley Publicaitons.
4. MonteGomery,"AppliedStatisticsandProbabilityforEngineers",6thEdition,WileyPublications.

REFERENCES:

1. Sheldon M Ross, Introduction to Probability & Statistics, for Engineers & Scientists, 5th Edition, Academic Press.
2. Miller & Freund's, Probability & Statistics, for Engineers & Scientists, 6th Edition, Pearson Education.
3. Murray R Spiegel, Probability & Statistics, Schaum's Outlines, 2nd Edition, Tata Mc.Graw Hill Publications.
4. S Palaniammal, Probability & Queuing Theory, 1stEdition, Printice Hall.

E-Resources:

1. http://www.csie.ntu.edu.tw/~sdlin/download/Probability%20&%20Statistics.pdf
2. (Probability & Statistics for Engineers & Scientists textbook)
3. http://www.stat.pitt.edu/stoffer/tsa4/intro_prob.pdf(Randomvariables and its distributions)
4. http://users.wfu.edu/cottrell/ecn215/sampling.pdf(NotesonSampling and hypothesis testing)
5. http://nptel.ac.in/courses/117105085/9 (Mean and variance of random variables)
6. http://nptel.ac.in/courses/111105041/33 (Testing of hypothesis)
7. http://nptel.ac.in/courses/110106064/5(Measures of Dispersion)

Course Outcomes:

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

1. The students will understand central tendency and variability for the given data.
2. StudentswouldbeabletofindtheProbabilityincertainrealisticsituation.
3. Students would be able to identify distribution in certain realistic situation. It is mainly useful for circuit as well as non-circuit branches of engineering. Also able to differentiate among many random variables Involved in the probability models. It is quite useful for all branches of engineering.
4. The student would be able to calculate mean and proportions (large sample) and to make important decisions from few samples which are taken out of unmanageably huge populations.
5. The student would be able to calculate mean and proportions (small sample) and to make important decisions from few samples which are taken out of unmanageably huge populations.

CO- PO Mapping (3/2/1indicatesstrengthofcorrelation)3-Strong,2-Medium,1-Weak

COs	Programme Outcomes(POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	4		3					3	1			
CO2	3	3	2		3			2	1		2				
CO3	3	2	1		3					2	3				
CO4	3	3	2		2		1		1			1			
CO5	3	2	2												

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. III Semester		
Code:A0305	MECHANICS OF SOLIDS	L	T	P
Credits:3		3	-	-

Prerequisites: Physics of Materials and Engineering Mechanics

Course Objectives:

The objective of this subject is to provide the basic concepts of mechanical behaviour of the materials under various loads, provides knowledge on shear force and bending moment diagrams of beams and knowledge about stress distribution across various cross sections of beams.

MODULE I: Simple Stresses & Strains

Elasticity and plasticity – Types of stresses & strains – Hooke's law – stress–strain diagram for ductile and brittle material–Working stress–Factor of safety–Lateral strain, Poisson's ratio & volumetric strain.

Elastic Module & the relationship between them–Bars of varying section–composite bars–Temperature stresses. Strain energy – Resilience–Gradual, sudden, impact and shock loadings

MODULE II: Shear Force and Bending Moment

Definition of beam –Types of beams–Concept of shear force and bending moment–SF and BM diagrams for cantilever, simply supported and overhanging beams subjected to point loads, UDL, UVL and combination of these loads–Point of contra flexure–Relation between SF and BM and rate of loading at section of a beam.

MODULE III: Bending Stresses & Shear Stresses

A: Bending Stresses: Theory of simple bending– Assumptions– Neutral axis – Derivation of bending equation: M/I=f/y=E/R –Determination bending stresses– section modulus of rectangular and circular sections (Solid and Hollow), I, T, Angle and Channel sections–Design of simple beam sections.

B: Shear Stresses: Derivation of formula – Shear stress distribution across various beam sections – rectangular, circular, triangular, I, T and angle sections.

MODULE IV: Deflection of Beams & Torsion

Deflection of Beams**:** Bending into a circular arc–slope, deflection and radius of curvature – Differential equation for the elastic line of a beam– Double integration and Macaulay's methods– Determination of slope and deflection for cantilever and simply supported beams subjected to point loads- UDL – uniformly varying load.

Torsion: Theory of pure torsion – Assumptions – Derivation of torsion equation, polar section modulus – power transmitted by shafts – combined bending and torsion.

MODULE V:Analysis of Pin Jointed Plane Frames , Thin Cylinders

Analysis of Pin- Jointed Plane Frames**:** Determination of forces in the members of various types of cantilever & simply supported trusses using (i) Method of Joints (ii) Method of Sections.

Thin Cylinders**:** Thin seamless cylindrical shells–Derivation of formula for longitudinal and circumferential stresses– hoop, longitudinal and volumetric strains– changes in diameter and volume of thin cylinders.

TEXT BOOKS

1. S.Timshenko **"Strength of Materials",** D. Van Nostr and Company, inc., 3rd edition, 1983
2. Ramamrutham **"Strength of materials",** Dhanpat Rai Publishing, 18th edition, 2014

REFERENCES

1. R..K. Rajput, **"Strength of Materials"** S. Chand company Pvt, 5th edition, 2014
2. R K Bansal **"Strength of Materials"** Lakshmi – publications, 6th edition, 2015
3. Bhavikatti**"Strength of materials"** Lakshmi publications, 4th edition, 2014.
4. R S Khurmi, **"Strength of Materials"** S Chand, revised edition, 2013.
5. D. S. Kumar, **"Strength of Materials,** S K Kataria& Sons, Reprint 2013.

E - RESOURCES

1. nptel.ac.in/courses/112107147
2. nptel.ac.in/courses/Web course- contents/…/strength%20of%20materials/homepage.htm
3. www.springer.com › Home › Materials › Characterization & Evaluation of Materials
4. discovermagazine.com/tags/strength of materials
5. nptel.ac.in/courses/105105108/
6. nptel.ac.in/courses/105105108/30

Course Outcomes:

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

1. Understand types of forces, stresses and strains.
2. Draw shear force and bending moment diagrams for different loaded beams.
3. Analyze the bending stresses in different sections of beams.
4. Analyze the deflections in beams when subjected to different types of loads.
5. Analyze frames and different types of cylinders.

CO- PO Mapping (3/2/1indicatesstrengthofcorrelation)3-Strong,2-Medium,1-Weak															
COs	**Programme Outcomes(POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**1**		**2**	**2**			**1**			**1**		**2**	**2**		
CO2	**2**	**3**	**3**	**2**	**1**					**1**		**2**	**2**		
CO3	**3**	**2**	**2**	**3**						**3**		**2**	**2**		
CO4	**3**	**2**	**2**	**2**			**2**	**1**		**1**	**1**	**2**	**2**		
CO5	**3**	**3**	**2**	**2**			**2**	**1**		**2**	**1**	**3**	**2**		

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. III Semester		
Code:A0306	METALLURGYAND MATERIAL SCIENCE	L	T	P
Credits:3		3	-	-

Prerequisites: Applied Chemistry

Course Objectives:

Apply the knowledge of Physical sciences (basic sciences) and translates this knowledge to understand crystal or amorphous nature of materials various engineering materials, their characteristics and their applications is considered to be the major objective of this course.

MODULE I: Crystallography, Constitution of Alloys & Metallurgy & Materials Science

Crystallography: Review of crystal structure, space lattice, crystal planes and crystal directions, co-ordination number, number of atoms per unit cell, atomic packing factor, Numerical related to crystallography. Imperfection in metal crystals: Crystal imperfections and their classifications, point defects, line defects, edge & screw dislocations.

Constitution of Alloys: Necessity of alloying, types of solid solutions, Hume Rothery's rules, intermediate alloy phases and electron compounds.

Metallurgy & Materials Science : Bonds in Solids – Metallic bond - crystallization of metals, grain and grain boundaries, effect of grain boundaries on the properties of metal / alloys – determination of grain size.

MODULE II: Equilibrium of Diagrams and Phase Transformations

Equilibrium of Diagrams: Experimental methods of construction of equilibrium diagrams, Isomorphous alloy systems, equilibrium cooling and heating of alloys, Lever rule, coringmiscibility gaps, eutectic systems, congruent melting intermediate phases, peritectic reaction.

Phase Transformations: Transformations in the solid state– allotropy, eutectoid, peritectoid reactions, phase rule, relationship between equilibrium diagrams and properties of alloys. Study of important binary phase diagrams of Cu-Ni-, Al-Cu, Bi-Cd, Cu-An, Cu-Sn andFe-Fe3C.

MODULE III: Cast Irons & Steels

A: Cast Irons: Structure and properties of White Cast iron, Malleable Cast iron, grey cast iron, Spheriodal graphite cast iron and alloy cast irons.

B: Steels: Classification of steels, structure and properties of plain carbon steels, Low alloy steels, Hadfield manganese steels, tool and die steels.

MODULE IV: Heat treatment of Alloys & Non-ferrous Metals and Alloys

Heat treatment of Alloys: Effect of alloying elements on Fe-Fe3C system, Annealing, normalizing,Hardening, TTT diagrams, tempering, hardenability, surface hardening methods, Age hardening treatment, Cryogenic treatment of alloys.

Non-ferrous Metals and Alloys: Structure and properties of copper and its alloys, Aluminum and its alloys, Titanium and its alloys. Jomney end quench test apparatus and working description

MODULE V: Ceramic materials & Composite materials

Ceramic materials: Crystalline ceramics, glasses, cermets, abrasive materials, nano-materials– definition, properties and applications.

Composite materials: Classification of composites, various methods of component manufacture of composites, particle reinforced materials, fiber reinforced materials, metal ceramic mixtures, metal-matrix composites and C-composites.

TEXT BOOKS

1. Kodigre V D, Sushil Kodgire, "**Material Science and Metallurgy for Engineers**", Everest Publishing House, ISBN: 9788186314005, 8186314008, 39th edition, 2017.
2. V. Rahghavan**"Elements of Material science",** PHI Publications, 6th edition, 2015

REFERENCES

1 Agarwal, "**Science of Engineering Materials"**, Tata McGrawHill, 8th edition, 2012.
2 William D callister, "**Materials Science and Engineering",** 8th edition, 2010., 4th Edition 2002.
3 Pakirappa, "**Materials Science and Engineering",** 6th edition, 2013
4 SidneyH.Avener**"Introduction to Physical Metallurgy",** Tata McGraw Hill publications, 2nd edition, 2013.

E - RESOURCES

1 http://nptel.ac.in/courses/113106032/
2 https://link.springer.com/journal/10853
3 https://www.journals.elsevier.com/materials-science-and-engineering-a/

Course Outcomes:

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

1. Analyse the structure of materials and the necessity of alloying, solid solutions.
2. Analysing the equilibrium diagrams and applying for cooling and heating of alloys, Lever rule &application of Fe-Fe3C (Iron carbide) diagram.
3. Application of different alloys for creating Cast Iron and Steel types.
4. Understanding Heat treatment of alloys, methods of heat treatment and application of TTT diagram for achieving surface hardening techniques.
5. Understand the Structure and properties of Ceramic material and its classification and its application.

CO- PO Mapping (3/2/1indicatesstrengthofcorrelation)3-Strong,2-Medium,1-Weak															
COs	**Programme Outcomes(POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**1**		**2**	**2**			**1**			**1**		**2**	**2**		
CO2	**2**	**3**	**3**	**2**	**1**					**1**		**2**	**2**		
CO3	**3**	**2**	**2**	**3**						**3**		**2**	**2**		
CO4	**3**	**2**	**2**	**2**			**2**	**1**		**1**	**1**	**2**	**2**		
CO5	**3**	**3**	**2**	**2**			**2**	**1**		**2**	**1**	**3**	**2**		

2020-21 Onwards (MR-20)	MALLAREDDYENGINEERINGCOLLEGE (Autonomous)	B.Tech. III Semester		
Code:A0307	KINEMATICS OF MACHINES	L	T	P
Credits:3		3	-	-

Prerequisites: Engineering Mechanics & Engineering Graphics

Course Objectives:
The objective of this subject is to provide basic concept of Mechanisms used in different machine elements like cams, gears and other power transmitting elements.

MODULE I: Mechanisms & Machines
Mechanisms: Elements or Links, Classification, Rigid Link, flexible and fluid link, Types of kinematic pairs, sliding, turning, rolling, screw and spherical pairs, lower and higher pairs, closed and open pairs, constrained motion, completely, partially or successfully constrained and incompletely constrained.
Machines: Mechanism and machines, classification of machines, kinematic chain, inversion of mechanisms, inversions of quadratic cycle chain, single and double slider crank chains.

MODULE II: Straight Line Motion Mechanisms, Steering Mechanisms & Hooke's Joint
Straight Line Motion Mechanisms: Exact and approximate copiers and generated types Peaucellier, Hart and Scott Russel, Grasshopper, Watt T.Chebicheff and Robert Mechanisms and straight line motion, Pantograph.

Steering Mechanisms: Conditions for correct steering, Davis Steering gear, Ackerman's steering gear mechanisms, velocity ratio. Hooke's Joint – Single and double Hooke's joint, Universal coupling application problems.

MODULE III: Kinematics & Plane motion of body
A: Kinematics: Velocity and acceleration - Motion of link in machine - Determination of Velocity and acceleration diagrams - Graphical method - Application of relative velocity method four bar chain. Analysis of Mechanisms: Analysis of slider crank chain for displacement, velocity and acceleration of slider - Acceleration diagram for a given mechanism, Kleins construction, Coriolis acceleration, determination of Coriolis component of acceleration.
B: Plane motion of body: Instantaneous centre of rotation, centroids and axodes - relative motion between two bodies - Three centres in line theorem - Graphical determination of instantaneous centre, diagrams for simple mechanisms and determination of angular velocity of points and links.

MODULE IV: Cams & Analysis of Motion of Followers

Cams: Definitions of cam and followers, their uses, types of followers and cams, terminology. Types of follower motion - Uniform velocity, Simple harmonic motion and uniform acceleration. Maximum velocity and maximum acceleration during outward and return strokes in the above three cases. Analysis of motion of followers: Roller follower circular cam with straight, concave and convex flanks.

MODULE V: Gears & Gear Trains

Gears: Higher pairs, friction wheels and toothed gears, types, law of gearing, condition for constant velocity ratio for transmission of motion, Forms of teeth: cycloidal and involute profiles. Velocity of sliding phenomena of interferences, Methods of interference. Condition for minimum number of teeth to avoid interference, expressions for arc of contact and path of contact - Introduction to Helical, Bevel and worm gearing.

Gear Trains: Introduction - Train value - Types - Simple and reverted wheel train, Epicyclic gear train. Methods of finding train value or velocity ratio - Epicyclic gear trains. Selection of gear box-Differential gear for automobiles.

TEXT BOOKS

1. Thomas Bevan **"Theory of Machines",** CBS Publishers, 3rd edition, 2005
2. S.S.Rattan**"Theory of Machines and Mechanisms"**, Tata McGraw Hill Publishers, 4th edition, 2014.

REFERENCES

1. Shiegley**"The Theory of Machines"** , Oxford University Press, 5th edition, 2017.
2. JS Rao and RV Dukkipati, **"Mechanism and Machine Theory",** New Age International Publishers, 2nd edition, 1992.
3. R.K Bansal "**Theory of Machines",** Laxmi Publication, 4th edition, 2006
4. R.S. Khurmi and J K Gupta"**Theory of Machines"**, S Chand Publisher, 14th edition, 2008.
5. B.V. R. Gupta, "**Theory of Machines"**, I. K. International Publishers, 2nd edition, 2011

E - RESOURCES

1. www.umt.fme.vutbr.cz/~ruja/vyuka/kinematics/LectureNotes.pdf.
2. www.springer.com/la/book/9789400711556
3. tps://www.elsevier.com/journals/mechanism-and-machine-theory/0094-114X?...
4. www.nptelvideos.in/2012/12/kinematics-of-machines.html
5. nptel.ac.in/courses/112104121/16

Course Outcomes:

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

1. Analyze the mechanism of the links subjected to various types of mechanisms and analyze the degrees of freedoms.
2. Undertake problem identification, formulation and solution using a range of analytical methods
3. Apply knowledge of links and structural elements to analyze velocity and acceleration for simple mechanisms.
4. Understand the different types of cam and followers
5. Understand the cycloidal and involute profiles

CO- PO Mapping (3/2/1indicatesstrengthofcorrelation)3-Strong,2-Medium,1-Weak															
COs	**Programme Outcomes(POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**1**	**2**	**2**	**3**		**1**	**1**	**2**	**2**	**3**	**1**	**1**	**2**		**2**
CO2	**2**	**2**				**2**						**2**	**2**		**2**
CO3	**1**	**2**	**1**	**3**	**1**	**1**	**1**	**1**				**2**	**2**		**2**
CO4	**2**	**3**				**2**	**1**		**2**		**2**	**2**	**2**		**2**
CO5	**2**	**2**	**3**		**1**	**2**	**2**		**1**		**3**	**2**	**2**		**2**

2020-21 Onwards (MR-20)	MALLAREDDYENGINEERINGCOLLEGE (Autonomous)	B.Tech. III Semester		
Code:A0308	THERMODYNAMICS *(Use of standard Psychrometry charts is permitted)*	L	T	P
Credits:3		3	-	-

Prerequisites: NIL

Course Objectives:

To understand the basic concepts of thermodynamics applied in devices/machines employed in industries/other applications like heat engines, automobiles, heat transfer, refrigeration & air conditioning.

MODULE I: Introduction & Zeroth Law of Thermodynamics

Introduction: System – Control volume –Surrounding – Boundaries – Universe – Types of systems – Macroscopic and Microscopic viewpoints –Concept of continuum –Thermodynamic equilibrium, State, Property, Process, Cycle and reversibility–Quasi-static process –Irreversible process, Causes of irreversibility–Energy in state and intransition – Types – Work and Heat – Point and Path function.

Zeroth Law of Thermodynamics: Concept of quality of Temperature– Principles of Thermometry– Reference Points–Constant Volume gas Thermometer–Scales of Temperature, Ideal Gas Scale – PMM I – Joule's Experiments – First law of Thermodynamics – Corollaries–First law applied to process and applied to a flow process– Steady Flow Energy Equation.

MODULE II: Second Law of Thermodynamics

Second Law of Thermodynamics –Thermal Reservoir – Heat Engine, Heat pump, Parameters of performance, Second law of thermodynamics, Kelvin-Planck and Clausius statements and their equivalence/corollaries, PMM of second kind.

Carnot's principle, Carnot cycle and its specialties, Thermodynamic scale of Temperature, Clausius Inequality, Entropy, Principle of entropy increase –Energy equation –Availability and irreversibility –Thermodynamic potentials –Gibbs and Helmholtz functions –Maxwell relations –Elementary treatment of the Third law of Thermodynamics.

MODULE III: Perfect Gas Laws & Pure Substances

A: Perfect Gas Laws: Equation of State –specific and Universal gas constants – Various Non-flow processes –Properties –End states –Heat and Work Transfer –Changes in Internal Energy– Throttling and free expansion processes–Flow processes–Deviations from perfect gas model– Vander Waals equation of state– Compressibility charts– Variable specific Heats– Gas Tables.

B: Pure Substances: PVT surface, T-s and h-s diagrams, Phase transformations–Triple point – Critical state –Properties during change of phase, Dryness Fraction – Clausius – Clapeyron Equation – Property tables. Various Thermodynamic processes and energy Transfer– use of Mollier charts - Steam Calorimetry.

MODULE IV: Power Cycles & Mixtures of Perfect Gases

Power Cycles: Otto, Diesel, Dual cycles –Sterling cycle –Atkinson cycle – Ericcson cycle – Lenoir cycle–Description and representation on P–V and T-S diagram –Thermal efficiency, Mean effective pressures on Air standard basis– Comparison of Cycles.

Mixtures of perfect Gases–Mole Fraction, Mass fraction – Gravimetric and volumetric analysis– Dalton's law of partial pressure –Avogadro's law of additive volumes–Mole fraction –Volume fraction and partial pressure –Equivalent gas constant and Molecular Internal Energy, Enthalpy, Specific heats and Entropy of mixture of perfect gases and Vapour - Atmospheric air.

MODULE V: Refrigeration Cycles & Introduction to Psychrometry

Refrigeration Cycles: Brayton cycle –Performance evaluation–Combined cycles –Bell-Coleman cycle, Vapour compression cycle – Performance Evaluation.

Introduction to Psychrometry: Psychrometric properties–Dry bulb temperature – Wet bulb temperature –Dew point temperature –Thermodynamic Wet bulb temperature –Specific humidity – Relative humidity –Saturated air –Vapour pressure –Degree of saturation–Adiabatic Saturation – Carrier's Equation–Psychrometric chart.

TEXT BOOKS

1. YunusCengel& Boles, **"Thermodynamics an Engineering Approach"**, 7th edition TMH, 2010
2. P.K. Nag **"Engineering Thermodynamic"**,TMH, 5th Edition, 2013.

REFERENCES

1. Doolittle, "**Thermodynamics for Engineers**", John Wiley & Sons,1984
2. Sonntag& Van Wylen, **"Fundamentals of Thermodynamics"**, Wiley, 8th Edition,2014
3. S.R. de Groot, **"Non Equillibrium Thermodynamics"**, Courier corporation, 1st Edition,2013
4. P.L.Dhar, **"Engineering Thermodynamics"**,Elsevier**,**2008**.**
5. Jones & Dugan **"Engineering Thermodynamics",** Prentice Hall Publisher, 1st Edition, 1996

E - RESOURCES

1. http://ores.su/en/journals/international-journal-of-applied-thermodynamics
2. https://www.journals.elsevier.com/the-journal-of-chemical-thermodynamics
3. http://www.sciencedirect.com/science/book/9780444633736
4. http://nptel.ac.in/courses/112103016/
5. http://nptel.ac.in/courses/112105123/
6. http://nptel.ac.in/courses/101104063/

Course Outcomes:

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

1. Apply the principles Zeroth & first law of thermodynamics to solve relevant engineering problems.
2. Correlate the real life situations to the concept of second law of thermodynamic.
3. Apply the different fundamentals of perfect gases and their mixtures to practical problems.
4. Analyse different power cycles and the effects caused due to mixing of different gases.
5. Analyse different refrigeration cycles and determine Psychometric properties.

CO- PO Mapping (3/2/1indicatesstrengthofcorrelation)3-Strong,2-Medium,1-Weak															
COs	**Programme Outcomes(POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**3**	**3**		**3**		**2**	**1**					**3**	**2**		
CO2	**3**	**3**		**3**		**2**	**1**					**3**	**2**		
CO3	**3**	**3**		**3**		**2**	**1**					**3**	**2**		
CO4	**3**	**3**		**3**		**2**	**1**					**3**	**2**		
CO5	**3**	**3**		**3**		**2**	**1**					**3**	**2**		

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. III Semester		
Code:A0309	PRODUCTION TECHNOLOGY	L	T	P
Credits:3		3	-	-

Prerequisites: Nil

Course Objectives:

The objective of this subject is to provide knowledge of various manufacturing methods of components and various metal joining processes.

MODULE I: Casting & Methods of Melting

Casting: Steps involved in making a casting - Advantage of casting and its applications. Patterns and Pattern making - Types of patterns - Materials used for patterns, pattern allowances and their construction, Principles of Gating, Gating ratio and design of Gating systems. Solidification of casting - Concept - Solidification of pure metal and alloys, short & long freezing range alloys. Risers - Types, function and design, casting design considerations, special casting processes- Centrifugal, Die and Investment casting, Slush casting, Shell mould casting. Defects in casting Mould making machines.

Methods of Melting - Crucible melting, cupola operation and steel making process

MODULE II: Welding & Cutting of Metals

Welding: Classification of welding process types of welds, welded joints and their characteristics, design of welded joints, Gas welding, Arc welding, Forge welding, resistance welding, Thermit welding.

Cutting of Metals: Oxy-acetylene gas cutting, cutting of ferrous metals. Inert Gas welding - TIG & MIG welding, Friction welding, Induction welding, Explosive welding, Laser welding, Submerged Arc Welding, Soldering & Brazing. Heat affected zones in welding; welding defects - causes and remedies - destructive nondestructive testing of welds.

MODULE III: Hot and Cold Working Processes & Stamping, Forming Processes

A: Hot and cold working processes: Cold working, Hot working, strain hardening, recovery, re - crystallization and grain growth, Comparison of properties of Cold and Hot worked parts, Rolling fundamentals - theory of rolling, types of rolling mills and products. Forces in rolling and power requirements.

B: Stamping, forming processes: Blanking, Piercing, Bending, forming drawing and its types, wire drawing and tube drawing, Embossing,coining, hot and cold spinning. Types of presses and press tools. Forces and power requirements in the above operations.

MODULE IV: Extrusion of Metals & Forging Processes

Extrusion of Metals: Basic extrusion process and its characteristics. Hot extrusion and cold extrusion – Forward and backward extrusion, Impact extrusion, Hydrostatic extrusion.

Forging Processes: Principles of forging, Tools and dies, Types of Forging - Smith forging, Drop Forging and Roll forging, forging hammers, forging defects.

MODULE V: Processing of Plastics & Moulding Equipment

Processing of Plastics: Types of Plastics –Thermo Plastics, Thermosets, Rubbers, Carbon fibre reinforced plasticd, Graphite fibre reinforced plastics, Properties, applications and their Processing Methods.

Moulding Equipment: Injection moulding, Types of Injection moulding, Tranfer moulding, Extrusion moulding, Thermo forming, Compression moulding, Blow moulding.

TEXT BOOKS

1. SeropeKalpakjin& Stephen Schmid **"Manufacturing Engineering and Technology",** Pearson Edu, 7th edition, 2014.

2. P.N.Rao, "**Manufacturing Technology**", Tata McGraw-Hill Publishing Limited, II Edition, 2017.

REFERENCES

1. R.K. Jain **"Production Technology",** Khanna Publications, 7th edition, 2012.
2. R. S Paramar**"Welding Processes and Technology",** Khanna Publishers, 2013.
3. B.S. Magendran Parashar & R.K. Mittal, "**Elements of Manufacturing Processes**", Prentice Hall of India, 2004.
4. Rajput R.K, "**A text book of Manufacturing Technology**', Lakshmi Publications, 2015.
5. Sharma P.C **"A text book on Production Technology",** S. Chand Publication, 8th edition, 2014.

E - RESOURCES

1. http://me.emu.edu.tr/me364/lecnotes.html
2. http://www.nptel.ac.in/courses/112107084/
3. https://www.academia.edu/16073401/A_Review_on_Various_Welding_Techniques
4. http://www.nptel.ac.in/courses/112107083/6
5. http://nptel.ac.in/courses/112107215/

Course Outcomes:

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

1. Explain the process involved in design of different foundry elements and foundry techniques
2. Understand different metal cutting and joining processes.
3. Differentiate various hot and cold forming processes
4. Understand various extrusion methods and forging processes
5. Discuss types of plastics for specific applications

CO- PO Mapping (3/2/1indicatesstrengthofcorrelation)3-Strong,2-Medium,1-Weak															
COs	**Programme Outcomes(POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**2**	**1**				**1**	**2**	**1**						**3**	
CO2	**2**	**1**				**1**	**2**	**1**						**3**	
CO3	**2**	**2**				**1**	**2**	**1**						**3**	
CO4	**2**	**3**				**1**	**2**	**1**						**3**	
CO5	**2**	**3**				**1**	**2**	**1**						**3**	

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. III Semester		
Code:A0554	Fundamentals of Data Structures Lab (Common for CE,EEE,ME,ECE, MiE)	L	T	P
Credits:2		-	-	4

Prerequisites: C Programming.

Course Objectives:

Thiscoursewilldelivertheknowledgeinintroducingtheconceptsofvariousdatastructuressuchaslinkedlists,stacks, queues, trees and graphs along with the applications.

Software Requirements: C

List of Programs:

1 ite a program to create one dimensional array, with the following operations:
   Insertion
   Deletion
   Display the elements
   Count number of elements

2 ite a program to create a single linked list, with the following operations:
   Insertion
   Deletion
   Display the elements
   Count number of elements.

3 ite a program to create a circular linked list, with the following operations:
   Insertion
   Deletion
   Display the elements
   Count number of elements.

4 Write a program to create a double linked list, with the following operations:
   a) Insertion
   b) Deletion
   c) Display the elements
   d) Count number of elements.

5 Write a program to implements stack operation susing:

a) Arrays

b) Linked list

6 Write a program to:

a) Evaluate Postfix expression.

b) Convert in fix expression into postfix expression

7 Write a program to implements Linear Queue operations using:

a) Arrays

b) Linked list

8 Write a program to implements Circular Queue operations using Arrays

9 Write a program to implements Double-ended Circular Queue operations using Arrays

10 Write are cursive program to create a Binary Tree of integers, traverse the tree in preorder, in order and post order of the tree.

11 Write a program to create a Binary Search Tree(BST) and perform insert and search operations on it.

12 Write a program for implementing the following graph traversal algorithms:

a) Breadth First Search(BFS)

b) Depth First Search (DFS)

TEXTBOOKS

1. Jean Paul Tremblay, Paul G Sorenson, "**An Introduction to Data Structures with Applications**", Tata Mc Graw Hills, 2ndEdition, 1984.
2. Richard F.Gilberg, Behrouz A.Forouzan, "**Data Structures: A Pseudo code approach with C**", Thomson(India), 2ndEdition, 2004.

REFERENCES

1. Horowitz, Ellis, Sahni, Sartaj, Anderson-Freed, Susan, "**Fundamentals of Data Structure in C**", University Press (India),2nd Edition, 2008.
2. A.K.Sharma, "**Data Structures using C**", Pearson,2nd Edition,June,2013.
3. R.Thareja, "**Data Structures using C**", Oxford University Press, 2nd Edition, 2014.

Course Outcomes:

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

1. Identify the appropriate recursive algorithms and analyze the performance of algorithms.
2. Understand and implement single, double, and circular linked-lists.
3. ImplementlineardatastructuressuchasStacksandQueuesusingarrayandlinked-listrepresentations.
4. Implement nonlinear data structures such as trees and graphs.
5. Linear data structures such as Stacks and Queues

CO- PO Mapping (3/2/1indicatesstrengthofcorrelation)3-Strong,2-Medium,1-Weak															
COs	**Programme Outcomes(POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**2**	**3**	**2**										**3**	**2**	
CO2	**2**	**2**	**3**										**2**	**3**	
CO3		**2**	**3**											**3**	**1**
CO4		**2**	**3**										**2**	**3**	
CO5	**2**	**3**	**2**										**2**	**3**	**2**

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. III Semester		
Code:A0310	METALLURGY AND MECHANICS OF SOLIDS LAB	L	T	P
Credits:1		-	-	2

Course Objectives:
Students will be able to experimentally learn the microstructure, compositions and various mechanical properties of the metals and alloys

List of Experiments

METALLURGY LABORATORY

1. Preparation and study of the microstructure of steels
2. Study of microstructures of cast irons
3. Preparation and study of the microstructure of non ferrous alloys
4. Preparation and study of the microstructure of heat treated steels
5. Hardenability of steels by Jomney end quench test
6. To find out the hardness of various treated and untreated steels.

MECHANICS OF SOLIDS LABORATORY

1. Tensile test using UTM
2. Bending test on a) simply supported beam and b) cantilever beam
3. Torsion test
4. Hardness test on a) Brinell hardness tester and b) Rockwell hardness tester
5. Test on springs a) compression spring b) tension spring
6. Impact test a) Izod b) Charpy
7. Fatigue test.
8. Hoop stress andstrain relationship for the Thin Cylinder

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

1. Understand the microstructures of various metals and alloys.
2. Identify the methods of heat treatment for varying the hardness
3. Understand the measurement of bending and tensile forces using UTM.
4. Understand the hardness, tension, compression and impact testing measurement methods for metals.
5. Find out the Young's modulus of some engineering materials.

CO- PO Mapping (3/2/1indicatesstrengthofcorrelation)3-Strong,2-Medium,1-Weak

COs	Programme Outcomes(POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	3								2	2		
CO2	3	2	2	2					3			2	2		
CO3	3	1	2	3					3			2	2		
CO4	3	2	2	2					3			2	2		
CO5	3	1	2	3					3			2	2		

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. III Semester		
Code:A0311	PRODUCTION TECHNOLOGY LAB	L	T	P
Credits:1		-	-	2

Course Objectives:

Student will be able to learn and practice the various production processes like casting, melting, welding, forming and processing of plastics.

List of Exercises

I. Metal Casting Lab:

1. Pattern making - for one casting drawing.
2. Sand properties testing - Exercise -for strength and permeability.
3. Mould making.
4. Melting and Casting – demonstration.

II. Welding Lab:

1. Arc Welding. 2. Spot Welding. 3. TIG Welding. 4. Gas Welding. 5. Plasma Welding.

III. Mechanical Press Working:

1. Blanking & Piercing operations and study of simple, compound and progressive press tools.
2. Hydraulic Press: Deep drawing.
3. Bending and other operations.

IV. Processing Of Plastics:

1. Injection Moulding. 2.Blow Moulding.

Course Outcomes:

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

1. Prepare the pattern by using wood turning lathe.
2. Create the mould and make the required part by using a casting process.
3. Prepare various joints like lap joint, T-joint and butt joint by using Arc welding, spot welding, TIG welding, gas welding and Plasma welding.
4. Perform various press working operations like bending, blanking and piercing.
5. Make various plastic articles by injection moulding and blow moulding process.

CO- PO Mapping
(3/2/1indicatesstrengthofcorrelation)3-Strong,2-Medium,1-Weak

COs	Programme Outcomes(POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3				3	3	3		3			3		3	
CO2	3				3	3	3		3			3		3	
CO3	3				3	3	3		3			3		3	
CO4	3				3	3	3		3			3		3	
CO5	3				3	3	3		3			3		3	

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. III Semester		
Code:A00M2	ENVIRONMENTAL SCIENCE (Common for CE, ME and Min.E)	L	T	P
Credits: Nil		2	-	-

Pre-requisite: Nil

Course Objectives:

An interdisciplinary approach to complex environmental problems using basic tools of the natural and social sciences, including geo systems, biology, chemistry, economics, political science and international processes. The ability to work effectively as a member of an interdisciplinary team on complex problem of environment.

Module I: Ecosystems:

Definition, Scope and Importance of ecosystem, Concept of ecosystem, Classification of ecosystems, Structure and Structural Components of an ecosystem, Functions of ecosystem, Food chains, food webs and ecological pyramids. Flow of energy. Biogeochemical cycles, Homeostasis/Cybernetics, food chain concentration, Biomagnification, ecosystems value, services, serices and carrying capacity.

Activity: Plantation.

Module II: Natural resources, Biodiversity and Biotic resources

Natural Resources:

Classification of Resources: Living and Non-Living resources, Renewable and non- renewable resources. Water resources: use and over utilization of surface and ground water, floods and droughts, Dams: benefits and problems. Mineral resources: use and exploitation, environmental effects of extracting and using mineral resources–case studies. Energy resources: growing energy needs, introduction to renewable and non renewable energy sources.

Biodiversity and Biotic resources:

Introduction, Definition, genetic, species and ecosystem diversity. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and intrinsic values. Hot spots of biodiversity. Threats to biodiversity: habitat loss, poaching of wildlife, man-Wildlife conflicts, conservation of biodiversity: In-Situ and Ex-situ conservation, food and fodder resources, Timber and non-timber forest products.

Activity: case studies.

Module III: ENVIRONMENTAL POLLUTION AND CONTROL:

Classification of pollution and pollutants, Causes, effects and control technologies. Air Pollution: Primary and secondary pollutants, Automobile and Industrial pollution, Ambient air quality standards. Water pollution: Point and non-point sources of pollution, Major pollutant of water and their sources, drinking water quality standards.

Soil Pollution, Soil as sink for pollutants, Impact of modern agriculture on soil, degradation of soil. Marine Pollution: Misuse of International water for dumping of hazardous waste, Coastal pollution due to sewage and marine disposal of industrial effluents.

Noise Pollution: Sources, Industrial Noise-Occupational Health hazards, standards, Methods of controls of Noise, Thermal pollution : Thermal Comfotrs, Heat Island effect, Radiation effects.
Nuclear Pollution: Nuclear power plants, nuclear radiation, disasters and impacts, genetical disorders, Solid waste types, Collection processing and disposal of industrial and municipal solid wastes composition and characteristics of e-waste and its management.
Activity:Fieldvisit.

Module IV: Global Environmental Problems and Global effects:

Green house effect, Green House Gases (GHG), Global Warming, Sea level rise, climate change and their impacts on human environment. Ozone depletion and Ozone depleting substances (ODS). Deforestation and desertification. International conventions/Protocols: Earth summit, Kyoto protocol and Montréal Protocol.

Activity: Poster Making.

Module V: Towards sustainable future:

Concept of Sustainable Development, Threats to Sustainability, Population and its explosion, Crazy Consumerism, Over-exploitation of resources, Strategies for Achieving Sustainable development, Environmental Education, Conservation of Resources, Urban Sprawl, Sustainable Cities and Sustainable Communities, Human health, Role of IT in Environment, Environmental Ethics, Environmental Economics, Concept of Green Building, Clean Development Mechanism(CDM).

Text Books:

1. R.Rajagopalan,**"Environmental Studies from crisis to cure"**, Oxford University Press 2nd Edition, 2005.
2. Anubha Kaushik, C.P.Kaushik, **"Environmental studies"** New age International Publishers,4th Edition,2012

Reference Books:

1. ErachBharucha,**"Environmental studies"** University Grants Commission, and University Press,I Edition, 2005.
2. M. Anji Reddy **"Text book of Environmental Science and Technology"** 3rd Edition, 2007
3. Richard T.Wright,**"Environmental Science: towards a sustainable future"** PHL Learning, Private Ltd. New Delhi, 2nd Edition., 2008
4. Gilbert McMasters and Wendell P.Ela,**"Environmental Engineering and science"**, 3rd Edition, PHI Learning Pvt. Ltd.,2008.

E-Resources:

a) Concerned Website links:

(1) http://www.gdrc.org/uem/ait-terms.html (Glossary of Environmental terms).

(2) http://www.environmentalscience.org/ (Environmental sciences Lectures series).

b) Concerned Journals/ Magazines links:

(1) Journal of earth science and climatic change (OMICS International Journal).

(2) Journal of pollution effects & control (OMICS International Journal).

c) NPTEL Videos:

(1) nptel.ac.in/courses/120108004/ (Principles of Environment Management Lectures).

(2) http://www.nptelvideos.in/2012/12/fundamentals-of-environmental-pollution.html(NPTEL online video courses IIT lectures).

Course Outcomes:

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

1. To enable the students to realize the importance of ecosystem, its structure, services. To make the students aware of Different natural functions of ecosystem, which helps to sustain the life on the earth.
2. To use natural resources more efficiently.
3. To make the students aware of the impacts of human actions on the environment, its effects and minimizing measures to mitigate them.
4. To educate the students regarding environmental issues and problems at local, national and international level.
5. To know more sustainable way of living

CO- PO Mapping (3/2/1indicatesstrengthofcorrelation)3-Strong,2-Medium,1-Weak															
COs	**Programme Outcomes(POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**1**			**1**		**2**	**3**					**1**			
CO2	**1**			**1**		**2**	**3**					**1**	**1**	**1**	
CO3	**1**			**1**		**2**	**3**					**1**	**1**	**1**	
CO4	**1**			**1**		**2**	**3**					**1**	**1**	**1**	
CO5	**1**			**1**		**2**	**3**					**1**	**1**	**1**	

2020-21 Onwards (MR-20)	MALLAREDDYENGINEERINGCOLLEGE (Autonomous)	B.Tech. IV Semester		
Code:A0312	DYNAMICS OF MACHINES	L	T	P
Credits:3		3	-	-

Prerequisites: Kinematics of Machines

Course Objectives:

The objective of this subject is to understand the static and dynamic behavior of mechanisms under different loading conditions.

MODULE I: Gyroscopic Motion

Gyroscopic Motion: effect of gyroscopic motion on the stability of moving vehicles such as motor car, motor cycle, aero planes and ships.

MODULE II: Static and Dynamic Forces & Synthesis of Linkages

Static and Dynamic Force Analysis of Planar Mechanisms: Introduction - Free Body Diagrams – Conditions for equilibrium – Two, Three and Four Members – Inertia forces and D'Alembert's Principle – planar rotation about a fixed centre.

Synthesis of Linkages: Three position synthesis – Four position Synthesis – Precision positions – Structural error – Chebychev's spacing, Freudenstein's equation, Problems.

MODULE III: Clutches, Brakes, Dynamometers and Fly Wheels

A: Clutches and Brakes: Friction clutches- Single Disc or plate clutch, Multiple Disc Clutch, Cone Clutch, Centrifugal Clutch.: Simple block brakes, internal expanding brake, band brake of vehicle. B: Dynamometers and Fly Wheels: Turning moment – Inertia Torque connecting rod angular velocity and acceleration, crank effort and torque diagrams – Fluctuation of energy – Fly wheels and their design. Dynamometers – absorption and transmission types. General description and methods of operations.

MODULE IV: Balancing & Vibration

Balancing: Balancing of rotating masses Single and multiple - single and different planes. Balancing of Reciprocating Masses - Primary, Secondary and higher order balancing of reciprocating masses. Analytical and graphical methods. Unbalanced forces and couples of V- engine, multi cylinder in line and radial engines for primary and secondary balancing, locomotive engine balancing.

Vibration: Free Vibration, Forced vibration- mass attached to vertical spring - simple problems on forced damped vibration, Vibration Isolation & Transmissibility Whirling of shafts, critical speeds, torsional vibration, two and three rotor systems.

MODULE V: Governors

Governers: Watt, Porter and Proell governors. Spring loaded governors – Hartnell and hartung with auxiliary springs, Pickering governors. Sensitiveness, isochronism and hunting. Effort and Power of Governor, Controlling force of governors and coefficient of Insesitiviness.

TEXT BOOKS

1. Thomas Bevan, **"Theory of Machines",** CBS Publishers, 3rd edition, 2005.
2. Jagadish Lal &J.M.Shah, **"Theory of Machines",** Metropolitan, 2002.
3 Khurmi, **"Theory of machines"**, S.Chand Publications, 14th edtion, 2005

REFERENCES

1. Shiegly"Theory of Machines", MGH Publishers,5th edition,1988.
2. JS Rao and RV Dukkipati, "Mechanism and Machine Theory", New Age International Publishers, 2008.
3. S.S Ratan, "Theory of Machines", Mc. Graw Hill Publishers, 3rd editions, 2009.
4. V.P. Singh, "Theoty of machines", Dhanpat Rai Publishing Company (P) Limited, 2004.

E - RESOURCES

1. nptel.ac.in/courses/112104114/
2. nptel.ac.in/courses/112101096/
3. nptel.ac.in/syllabus/112104114/
4. www.nptelvideos.in/2012/12/dynamics-of-machines.html
5. freevideolectures.com › Mechanical › IIT Kanpur

Course Outcomes:

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

1. Understand the gyroscopic effects in ships, aero planes and road vehicles
2. Understand the Concept of static force and dynamic force analysis.
3. Characterize and design flywheels.
4. Analyze balancing problems in rotating and reciprocating machinery.
5. Analyze and design centrifugal governors.

CO- PO Mapping (3/2/1indicatesstrengthofcorrelation)3-Strong,2-Medium,1-Weak															
COs	**Programme Outcomes(POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**3**	**3**	**3**	**2**	**2**		**2**	**1**	**2**				**3**		
CO2	**3**	**3**	**2**	**2**	**3**				**1**				**2**		
CO3	**3**	**2**	**1**	**2**	**1**								**2**		
CO4	**3**	**3**	**3**		**1**								**3**		
CO5	**3**	**3**	**1**	**3**	**1**		**2**						**3**		

2020-21 Onwards (MR-20)	MALLAREDDYENGINEERINGCOLLEGE (Autonomous)	B.Tech. IV Semester		
Code:A0313	FLUID MECHANICS AND HYDRAULIC MACHINES	L	T	P
Credits:3		3	-	-

Prerequisites: Nil

Course Objectives:

The objective of this subject is to provide the knowledge of fluid power and analyze the performance of various hydraulic machines like turbines, compressors and pumps.

MODULE I: Fluid Statics

Dimensions and units: physical properties of fluids- specific gravity, viscosity surface tension- vapor pressure and their influence on fluid motion- atmospheric gauge and vacuum pressure – measurement of pressure- Piezometer, U-tube and differential manometers.

Hydro static forces on plane and curved surfaces. Buoyancy and floatation: Meta center, stability of floating body, Submerged bodies, Calculation of metacentric height.

MODULE II: Fluid Kinematics & Fluid Dynamics

Fluid kinematics: Stream line, path line and streak lines and stream tube, classification of flows- steady & unsteady, uniform & non uniform, laminar & turbulent, rotational and irrotational flows-equation of continuity for one dimensional flow. Velocity potential and stream function – flow net.

Fluid dynamics : Surface and body forces –Euler‘s and Bernoulli‘s equations for flow along a stream line, Measurement of flow: pitot tube, venturimeter and orifice meter, Flow nozzle, Turbine flow meter, momentum equation and its application on pipe bend.

MODULE III: Closed Conduit Flow & Boundary Layer Concepts

A: Closed conduit flow: Reynold‘s experiment- Darcy Weisbach equation- Minor losses in pipes- pipes in series and pipes in parallel - total energy line - hydraulic gradient line.

B: Boundary Layer Concepts: Definition, thickness, characteristics along thin plate, laminar and turbulent boundary layers (No derivation) boundary layer in transition, separation of boundary layer, submerged objects – drag and lift.

MODULE IV: Turbo Machinery and Hydraulic Turbines

Basics of turbo machinery: Hydrodynamic force of jets on stationary and moving flat, inclined, and curved vanes, jet striking centrally and at tip, velocity diagrams, workdone and efficiency, flow over radial vanes.

Hydraulic Turbines : Classification of turbines, impulse and reaction turbines, Pelton wheel, Francis turbine and Kaplan turbine-working proportions, workdone, efficiencies, hydraulic design – draft tube theory - functions and efficiency. Geometric similarity, Unit and specific quantities, characteristic curves, governing of turbines, selection of type of turbine, cavitation, surge tank, water hammer.

MODULE V: Centrifugal Pumps & Reciprocating Pumps

Centrifugal pumps: Classification, working, workdone – manomertic head- losses and efficiencies specific speed- pumps in series and parallel-performance characteristic curves, NPSH.
Reciprocating pumps: Working, Discharge, slip, indicator diagrams.

TEXT BOOKS

1. Modi and Seth, "**Hydraulics, fluid mechanics including hydraulic machines**", Standard Publishers, 19th Edition, 2013
2. R.K. Bansal, "**Fluid Mechanics and hydraulic Machines**", Laxmi Publications, 9th Edition, 2010.

REFERENCES

1. R.K. Rajput, "**Fluid Mechanics and Hydraulic Machines**", S.Chand, 5th Edition, 2013.
2. D. Rama Durgaiah, **"Fluid Mechanics and Machinery"**, New Age International (P) Ltd, 1st editions, 2007
3. James W. Dally, William E. Riley **"Instrumentation for Engineering Measurements",** John Wiley & Sons Inc. 3rd editions, 1989.
4. Vijay Gupta and S.K.Gupta, "**Fluid Mechanics and Applications**", New-Age International Ltd. 1999.
5. Banga & Sharma, "**Hydraulic Machines**", Khanna Publishers, 7th Edition, 2007

E - RESOURCES

1. nptel.ac.in/courses/112105183/
2. www.nptelvideos.in/2012/11/fluid-mechanics.htm
3. nptel.ac.in/courses/112104117/
4. www.sanfoundry.com/best-reference-books-fluid-mechanics-and-machinery/
5. https://www.elsevier.com/journals

Course Outcomes:

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

1. Understand the behavior fluids at different conditions.
2. Understand the concept of fluid kinematics and dynamics.
3. Understand and solve the problems of closed conduit flow & boundary layer concepts.
4. Analyze the performance of turbo machinery and hydraulic turbines.
5. Understand the principles of centrifugal and reciprocating pumps.

CO- PO Mapping (3/2/1indicatesstrengthofcorrelation)3-Strong,2-Medium,1-Weak															
COs	**Programme Outcomes(POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**3**	**2**	**2**	**1**	**1**		**2**					**1**	**1**		
CO2	**3**	**2**	**2**	**1**	**1**		**2**					**1**	**1**		
CO3	**3**	**2**	**2**	**1**	**1**		**2**					**1**	**2**		
CO4	**3**	**3**	**2**	**2**	**1**		**2**					**1**	**2**		
CO5	**3**	**3**	**2**	**2**	**1**	**1**	**2**					**1**	**2**		

2020-21 Onwards (MR-20)	MALLAREDDYENGINEERINGCOLLEGE (Autonomous)	B.Tech. IV Semester		
Code:A0314	MACHINE TOOLS	L	T	P
Credits: 3		3	-	-

Prerequisites: Production Technology

Course Objectives:

The objective of this subject is to provide knowledge of all machine tools and to measure cutting forces while machining.

MODULE I: Metal Cutting Theory

Metal Cutting Theory: Elements of cutting process- Geometry of single point cutting tool and angles, Tool signature, chip formation and types of chips- built up edge and its effects, chip breakers. Mechanics of orthogonal cutting- Merchant's Force diagram, cutting forces- cutting speeds, feed, depth of cut, tool life, coolants, machinability - Tools materials. Cutting tool temperature measuring methods.

MODULE II: Lathe Machine

Lathe Machine: Principle of working, Specification of Lathe- types of Lathe- Work holders, tool holders-Box tools, Taper turning, thread cutting for Lathe attachments. Turret and Capstan lathe- collet chucks- other work holders- tool holding devices- box and tool layout. Principal features of automatic lathe- Classification- Single spindle and multi-spindle automatic lathe.

MODULE III: Shaping, Slotting, Planning, Drilling and Boring Machines

A: Shaping, Slotting and Planning Machines: Principles of working- Principal parts- specification, classification, operations performed. Machining time calculations.

B: Drilling and Boring Machines: Principles of working, specifications, types, operations performed- tool holding devices- twist drills- Boring machines-Fine Boring machines- Jig Boring machine. Deep hole drilling machine.

MODULE IV: Milling Machine & Grinding Machine

Milling Machine : Principles of working-specifications-classifications of milling machines- principal features of horizontal, vertical and universal milling machines- machining operation types, geometry of milling cutters- milling cutters- methods of indexing.

Grinding Machine: Fundamentals- Theory of grinding- classification of grinding machine- cylindrical and surface grinding machine- Tool and cutter grinding machine- special types of grinding machines- Different types of abrasives- bonds specification of a grinding wheel and selection of a grinding wheel.

MODULE V: Lapping, Honing and Broaching Machines & Principles ofDesign of Jigs and Fixtures

Lapping, Honing and Broaching Machines : Lapping, honing and broaching machines- principle of working, specification of broaching machines, methods of broaching, broaching tools, Classification of Broaching machines, operations.
Comparison to grinding- lapping and honing- Kinematics scheme of Lapping, Honing and Broaching machines. Constructional features of speed and feed units, machining time calculations. Principles of design of Jigs and Fixtures: Classification of Jigs and Fixtures.

TEXT BOOKS

1. P.C. Sharma, **Production Technology (Machine Tools)** , S.Chand Publishers, 7th edition, 2006.
2. Pakirappa, **Metal Cutting and Machine Tool Engineering** , Durga publication house,1st edition, 2012.

REFERENCES

1. C.Elanchezhian and M.Vijayan, "**Machine Tools**", Anuradha Agencies Publishers,2nd edition, 2008
2. B.S.Raghuvamshi, "**Workshop Technology-Vol** II", Anuradha Agencies Publishers,Dhanpat rai & company, 10th revised edition, 2014.
3. Steve F.Krar, Arthur R.Gill, PeterSmid Krar, Stephen F, "**Technology of Machine tools"**,Mc Graw-Hill, 7th edition , 2011.
4. B.L.Juneja,"**Fundamentals of Metal cutting and machine tools**", New age Int. publishers,2nd edition , 2017.
5. R.K.Jain and S.C.Gupta, "**Production Technology**", Khanna Publications, 16th edition,2014.

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1. http://nptel.ac.in/courses/112105126/5
2. https://www.journals.elsevier.com/international-journal-of-machine-tools
3. www.sciencedirect.com/science/journal/08906955/64

Course Outcomes

At the end of the course, students will be able to
1. Understand the basic concepts of metal cutting theory.
2. Know the working principles of different Lathes and its parts.
3. Know the working principles of special machines like shaping, slotting, planning&drilling machines.
4. Know the working principles of milling and grinding machines.
5. Know the working principles of lapping, honing, broaching and jigs & fixtures.

CO- PO Mapping (3/2/1indicatesstrengthofcorrelation)3-Strong,2-Medium,1-Weak

COs	Programme Outcomes(POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1	2									1	1
CO2	3	2	2	1	2									1	1
CO3	3	2	2	1	2									1	1
CO4	2	2	2	1	2									1	1
CO5	2	2	2	1	2									1	1

2020-21 Onwards (MR-20)	MALLAREDDYENGINEERINGCOLLEGE (Autonomous)	B.Tech. IV Semester		
Code:A0315	THERMAL ENGINEERING-I	L	T	P
Credits:3		3	-	-

Prerequisites: Thermodynamics

Course Objectives:

The objective of this course is to provide knowledge on working and performance of IC engines, combustion process and compressors.

MODULE I: Actual Cycles & I.C. Engines

Actual Cycles and their Analysis: Introduction, comparison of air standard and actual cycles. time loss factor, heat loss factor, exhaust blow down, loss due to gas exchange process, volumetric efficiency. loss due to rubbing friction, actual and fuel - air cycles of CI Engines.

I.C. Engines: Classification - working principles, valve and port timing diagrams, air standard efficiency, air - fuel and actual cycles - engine systems - fuel, carburetor, fuel injection system, ignition, cooling and lubrication.

MODULE II: Combustion in S.I. Engines & C.I. Engines

Combustion in S.I. Engines : Normal Combustion and abnormal combustion – Importance of flame speed and effect of engine variables – Type of Abnormal combustion, pre-ignition and knocking – Fuel requirements and fuel rating, antiknock additives – combustion chamber – requirements, types.

Combustion in C.I. Engines : four stages of combustion – delay period and its importance – effect of engine parameters – diesel knock – need for air movement, suction, compression and combustion induced turbulence – open and divided combustion chambers and nozzles used – fuel requirements and fuel rating.

MODULE III: I.C. Engine Testing and Performance

A: Testing and Performance - I: Terminologies, performance parameters - measurement of cylinder pressure, fuel consumption, air intake, exhaust gas composition, torque, brake power, dynamometer working & types.

B: Testing and Performance - II: Determination of brake power, frictional power, indicated power and mechanical efficiency – volumetric efficiency – MEP – Performance test – Heat balance test - Morse Test.

MODULE IV: Reciprocating Compressor

Introduction– Classification –positive displacement and rotor dynamic machinery – Power producing and power absorbing machines, fan, blower and compressor – positive displacement and dynamic types – reciprocating and rotary types.

Reciprocating Compressor: Principle of operation, work required, Isothermal efficiency volumetric efficiency and effect of clearance, stage compression, under cooling, saving of work, minimum work condition for stage compression.

MODULE V: Rotary & Axial Flow Compressors

Rotary Compressors: Roots Blower, vane sealed compressor, Lysholm compressor – mechanical details and principle of working – efficiency considerations. Centrifugal compressors: Mechanical details and principle of operation – velocity and pressure variation. Energy transfer-impeller blade shape - losses, slip factor, power input factor, pressure coefficient and adiabatic coefficient – velocity diagrams – power.

Axial Flow Compressors: Mechanical details and principle of operation – velocity triangles and energy transfer per stage degree of reaction, work done factor - isentropic efficiency - pressure rise calculations – Polytrophic efficiency.

TEXT BOOKS

1. V. Ganesan, **"I.C. Engines",** Tata McGrawHill editions, 4th edition, 2012.
2. SM Yahya, **"Turbines, Pumps, Compressors",** Tata McGrawHill editions, 4th edition, 2005.
3 R.K. Rajput, **"Thermal Engineering**", Lakshmi Publications, 10th Edition,2017

REFERENCES

1. Mathur & Sharma, **"IC Engines",** Dhanpath Rai & Sons, 4th edition, 2010
2. Pulkrabek, **"Engineering fundamentals of IC Engines",** Pearson PHI, 2nd edition, 2004.
3. Rudramoorthy, **"Thermal Engineering",** TMH Publishers, 3rd edition, 2003.
4. B. Yadav, **"Thermodynamics & Heat Engines"**, Central Book Depot., Allahabad, 6th edition, 2012.
5. B.Srinivasulu Reddy, **"Thermal Engineering data book",** JK International Pub, 2014.

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1. https://www.journals.elsevier.com/applied-thermal-eng
2. eds.yildiz.edu.tr/journal-of-thermal-engineering
3. https://www.researchgate.net/.../1359-4311_Applied_Thermodynamics
4. www.nptelvideos.com/mechanical/
5. https://www.btechguru.com/courses--nptel--mechanical

Course Outcomes

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

1. Learn the various types of cycles and various engine systems.
2. Understand the phenomenon of combustion and knock in diesel engine and petrol engine.
3. Analyze the performance parameters of IC engines
4. Understand the working principles of various types of compressors.
5. Understand and analyze the performance of Rotary and axial flow compressors.

CO- PO Mapping (3/2/1indicatesstrengthofcorrelation)3-Strong,2-Medium,1-Weak															
COs	**Programme Outcomes(POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**3**	**1**	**1**	**1**		**1**	**3**						**3**		
CO2	**3**	**1**	**1**	**3**	**1**	**1**	**3**			**1**		**3**	**3**		
CO3	**3**	**3**	**3**	**3**	**1**	**3**		**1**		**3**		**3**	**3**		
CO4	**3**	**1**	**1**	**2**	**1**	**1**	**2**	**1**		**1**	**1**	**2**	**3**		
CO5	**3**	**1**	**1**	**2**	**1**	**1**	**2**	**1**		**1**	**1**	**2**	**3**		

2020-21 Onwards (MR-20)	MALLAREDDYENGINEERINGCOLLEGE (Autonomous)	B.Tech. IV Semester		
Code: A0316	OPERATIONS RESEARCH	L	T	P
Credits: 3		3	-	-

Prerequisites: Nil Course

Objectives:

The objective of this course is to provide knowledge and training in using optimization techniques under limited resources for the engineering and business problems.

MODULE I: Linear Programming and Transportation

Linear Programming: Origin of Operations Research – Study, The phase of an operation research - Linear programming – Formation of model (Product mix Problem) - Graphical method – Simplex algorithm – Artificial variables technique – Big 'M' method - Two phase method .Duality principle

Transportation: Optimal solution by North West corner method – VAM – Least cost method – MODI method.

MODULE II: Assignment and Sequencing

Assignment: Formulation - Unbalanced Assignment Problem – Hungarian algorithm – Traveling Salesman Problem.

Sequencing: Processing 'n' jobs through two machines, processing 'n' jobs through three machines - processing 'n' jobs through 'm' machines.

MODULE III: Replacement and Game Theory

A: Replacement: Replacement of items due to deterioration with and without time value of money, Group replacement policy.

B: Game Theory: Theory of games, competitive games, rules for game theory, saddle point - minimax (maximin) method of optimal strategies, mixed strategies - Value of the game- two person zero sum game, method of dominance, graphical method .

MODULE IV: Queuing and Inventory Models

Queuing Models: Queuing systems and structures – Notation parameter – Single server and multi- server models – Poisson input – Exponential service – Constant rate service – Infinite population.

Inventory Models: Economic order quantity models - With and without shortages. (Deterministic Demand). Quantity discount models –Inventory control models in practice.

MODULE V: Network Model and Simulation

Network Model: Basic terminologies, constructing a project network, network computations in CPM and PERT, Introduction to cost crashing. crashing the network

Simulation: Types of simulation models and phases of simulation - Application, advantages and disadvantages of simulation Inventory and queuing problems.

TEXT BOOKS

1. Premkumar Gupta and D.S.Hira, "**Operations Research**", S.Chand Publications, 2005.
2. S.D.Sharma, "**Operations Research**", Kedarnath ram Nath, Delhi, 2009.

REFERENCES

1. Taha H.A., "**Operations Research**", Prentice Hall of India, New Delhi, 6th Edition, 2003.
2. Shennoy G.V. and Srivastava U.K., "**Operation Research for Management**", New AgeInternational, New Delhi, 2nd Edition, 2009
3. Hillier and Libermann" **Introduction to Operations Research**" McGraw hill edition, 2001
4. Budnick F.S. and Richard D Irwin "**Principles of Operations Research for Management**", 3rd Edition, 2003.
5. Bazara M.J., Jarvis and Sherali H., "**Linear Programming and Network Flows**", John Wiley,New Jersey, 4thEdition, 2010.

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2. https://www.journals.elsevier.com/european-journal-of-operational-research/
3. http://nptel.ac.in/courses/112106134/
4. http://nptel.ac.in/courses/112106131/
5. http://www.nptel.ac.in/courses/110106059/

Course Outcomes

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

1. Solve problems by using linear programming model and assignment model.
2. Analyze sequencing methods, sequencing models and study on theory of games.
3. Solve waiting problems by various methods and models.
4. Study and Analysis of inventory of given situations and able to solve it by different inventory models.
5. Analyze network model for all type of projects and make use of simulation.

CO- PO Mapping (3/2/1indicatesstrengthofcorrelation)3-Strong,2-Medium,1-Weak															
COs	**Programme Outcomes(POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**3**	**3**	**3**	**3**	**3**	**1**	**2**	**1**			**3**				**1**
CO2	**3**	**3**	**3**	**3**	**3**	**1**	**3**	**3**		**3**	**3**	**1**			**1**
CO3	**3**	**3**	**3**	**3**	**3**	**1**	**3**	**3**			**3**				**1**
CO4	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**		**3**	**2**			**1**
CO5	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**1**	**2**	**3**	**3**			**1**

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. IV Semester		
Code:A0317	FLUID MECHANICS AND HYDRAULIC MACHINES LAB	L	T	P
Credits:1		-	-	2

Course Objectives:

To provide practical knowledge of fluid flow properties, flow losses, performance testing of hydraulic turbines and hydraulic pumps.

List of Experiments

1. Performance test on impact of jet on Vanes.
2. Performance test on Pelton Wheel.
3. Performance test on Francis Turbine.
4. Performance test on Kaplan Turbine.
5. Performance test on Single Stage Centrifugal Pump.
6. Performance test on Multi Stage Centrifugal Pump.
7. Performance test on Reciprocating Pump.
8. Calibration of Venturimeter.
9. Calibration of Orifice meter.
10. Determination of friction factor for a given pipe line.
11. Determination of minor losses (sudden contraction, expansion, pipe bend and union) for a given pipeline.
12. Validation of Bernoulli's Theorem.

Course Outcomes:

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

1. Analyze the performance of turbines.
2. Analyze the performance of centrifugal and reciprocating pump.
3. Analyze the performance of venturimeter and orifice meter.
4. Evaluate the Minor losses in given pipe system
5. Apply the Bernoulli's equation in Bernoulli's apparatus

CO- PO Mapping (3/2/1indicatesstrengthofcorrelation)3-Strong,2-Medium,1-Weak

COs	Programme Outcomes(POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1	1		2				1	1	2		
CO2	3	2	2	1	1		2				1	1	2		
CO3	3	2	2	1	1		2				1	1	2		
CO4	3	2	2	1	1		2				1	1	2		
CO5	3	2	2	1	1		2				1	1	2		

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. IV Semester		
Code:A0318	MACHINE TOOLS LAB	L	T	P
Credits:1		-	-	2

Course Objectives:

Student will be able to learn and practice various operations in lathe machine, shaper, planner, slotter, grinding machine, milling machine, cylindrical grinder, surface grinder and tool and cutter different measuring instruments.

List of Experiments

Note: Any 6 experiments need to be performed from each Lab

Machine Tools Lab

1. Study of general purpose machines - Lathe, Drilling machine, Milling machine, Shaper, Planning machine, slotting machine, Cylindrical Grinder, surface grinder and tool and cutter grinder.
2. Step turning, taper turning (swelling compound rest), grooving on lathe machine.
3. Taper turning by taper turning attachment.
4. Thread cutting and knurling using lathe machine.
5. Make a hole using lathe machine.
6. Drilling and Tapping using Radial drilling machine.
7. Cutting 'V' groove using shaping machine.
8. Cutting slots on circular shaft using slotting machine.
9. Cutting key ways using milling machines.
10. Surface Grinding using surface grinding machine.
11. Setting tool angles using tool & cutter grinder.
12. Cutting grooves/Plain surface using planning machine.
13. Cylindrical grinding by cylindrical grinding machine.

Course Outcomes:

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

1. Perform taper turning, Thread cutting, knurling and Drilling operations on lathe.
2. Perform the Drilling and Tapping using Radial drilling machine
3. Perform machining operations on shaping machine and slotting machine.
4. Perform the machining operations on milling machines and surface grinding machine.
5. Perform the machining operations on Cylindrical grinding machine.

CO- PO Mapping (3/2/1indicatesstrengthofcorrelation)3-Strong,2-Medium,1-Weak															
COs	**Programme Outcomes(POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**2**	**1**					**1**					**1**		**2**	
CO2	**2**	**1**					**1**					**1**		**2**	
CO3	**2**	**1**										**1**		**2**	
CO4	**2**	**1**										**1**		**2**	
CO5	**2**	**1**					**1**					**1**		**2**	

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. IV Semester		
Code:A0319	KINEMATICS AND DYNAMICS LAB	L	T	P
Credits:1		-	-	2

Course Objectives:

The objective of the lab is to practice the elements in kinematics and dynamics such as linkages, gears, cams and provide the basic knowledge to design such elements.

List of Experiments

Note: Any 12 experiments need to be performed

1. Characteristics study of Cam Profile.
2. Determination of Critical Speed.
3. Determination of Gyroscopic Couple.
4. Determination of Natural Frequency of spring and mass system.
5. Determination of Natural Frequency of free transverse system.
6. Determination of Radius of Gyration and Moment of Inertia of compound pendulum.
7. Determination of Radius of Gyration and Moment of Inertia of bifilar system.
8. Characteristics study of Balancing of Rotating Masses-static condition.
9. Characteristics study of Balancing of Rotating Masses-dynamic condition.
10. Determination of Speed Ratio of Epi-cyclic Gear Train.
11. Study of various types of Kinematic links, pairs, chains and Mechanisms.
12. Study of various types of gear trains – simple, compound, reverted, epicyclic and differential.
13. Characteristics study of Governor apparatus with differential attachments.
14. Study of various type of cam and follower arrangements

Course Outcomes

At the end of the course students will be able to

a) Understand types of motion in cam profile.
b) Analyze forces and torques for components in linkages.
c) Understand static and dynamic balancing and natural frequencies of the rotating bodies
d) Understand forward and inverse kinematics for open-loop mechanisms.
e) Identify, formulate and solve engineering problems in gear trains

CO- PO Mapping (3/2/1indicatesstrengthofcorrelation)3-Strong,2-Medium,1-Weak															
COs	**Programme Outcomes(POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**1**	**3**		**3**	**3**		**1**			**3**		**3**	**2**		
CO2	**1**	**3**		**3**			**1**					**3**	**2**		
CO3	**1**	**3**		**3**	**3**		**1**			**3**		**3**	**3**		
CO4	**1**	**3**		**3**	**3**		**1**			**3**		**3**	**3**		
CO5	**1**	**3**		**3**	**3**	**1**	**1**					**3**	**3**		

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. IV Semester		
Code:A0555	Object Oriented Programming through Java Lab (Common for CE,EEE,ME,ECE, MiE)	L	T	P
Credits:2		-	1	2

Prerequisites: NIL

Course Objectives:

This course will make students able to learn and understand the concepts and features of object oriented programming and the object oriented concept like inheritance and will know how to make use of interfaces and package, to acquire the knowledge in Java's exception handling mechanism, multithreading.

Software Requirements: Java

List of Programs:

1. Write a Java Program to implement
   a) Default Constructor
   b) Parameterized constructor

2. Write a Java Program to implement
   a) Method overloading
   b) Constructor overloading
3. Write a Java program to implement
   a) Single Inheritance
   b) Multi level Inheritance
   c) Hierarchical Inheritance
4. Write Java programs that uses the following keywords…
   a) this
   b) super
5. Write Java programs that uses the following keywords…
   a) static
   b) final
6. Write a Java program to implement
   a) Method overriding.
   b) Dynamic method dispatch.
7. Write a Java program to implement
   a) Abstract method
   b) Interfaces
8. Write a Java program to create user defined packages
9. Write a Java program to implement Exception Handling using
   a) try-catch clause
   b) Multiple Catch clauses
   c) Nested try blocks

10. Write a Java program that

a) Create user defined Thread by extending Thread class.
b) Create user defined Thread by implementing runnable Interface
c) Create two user defined Threads i.e. Multi Threading using Thread

11. Write a Java program

a) Checks whether a given string is a palindrome or not.
b) For sorting a given list of names in ascending order.
c) That reads a line if integers and then displays each integer and the sum of all integers(use string tokenizer class of java.util).

12. Write a Java program that

a) reads a file name from the user, and then displays information about whether the file exists, whether the file is readable, whether the file is writable, the type of file and the length of the file in bytes.

b) Reads a file and displays the file on the screen, with a line number before each line.

TEXT BOOKS:

1. Herbert Schildt, "**Java The complete reference**",TMH,8th edition,2011.
2. T.Budd, "**Understanding OOP with Java**", Pearson Education, updated edition,1998.

REFERENCES:

1. P.J.Deitel and H.M.Deitel, "**Java for Programmers**",Pearson education.
2. P.Radha Krishna,"**Object Oriented Programming through Java**",Universities Press.
3. BruceEckel," **Programming in Java**", Pearson Education.
4. S.Malhotra and S.Choudhary," **Programming in Java**",Oxford Univ. Press

Course Outcomes:

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

1. Differentiate structured programming and object oriented programming and know the concepts of classes, objects, members of a class.
2. Apply object oriented programming features and concepts for solving given problems using inheritance and will know how to organize files in packages and concept of interface.
3. Capable of handling runtime errors using Exceptional Handling and exploring strings.
4. Develop applications for concurrent processing using Thread Concept.
5. Capable of handling IO operations using Files.

CO- PO Mapping (3/2/1indicatesstrengthofcorrelation)3-Strong,2-Medium,1-Weak															
COs	**Programme Outcomes(POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1		**2**	**3**										**3**	**2**	
CO2			**3**		**2**								**2**	**3**	
CO3		**2**	**2**		**2**									**2**	
CO4			**3**		**3**									**2**	
CO5		**2**	**2**		**3**								**2**	**2**	

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. IV Semester		
Code:A00M1	GENDER SENSITIZATION (Common for CE, ME and Min.E)	L	T	P
Credits: Nil		-	-	2

Course Objectives:
To develop students' sensibility with regard to issues of gender in contemporary India. To provide a critical perspective on the socialization of men and women. To introduce students to information about some key biological aspects of genders. To expose the students to debates on the politics and economics of work. To help students reflect critically on gender violence. To expose students to more egalitarian interactions between men and women.

MODULE -I:- UNDERSTANDING GENDER

Gender: Why Should We Study It? *(Towards a World of Equals:* Unit -1)
Socialization: Making Women, Making Men *(Towards a World of Equals:* Unit -2)

Introduction. Preparing for Womanhood. Growing up Male. First Lessons in Caste.Different Masculinities.
Just Relationships: Being Together as Equals *(Towards* a *World of Equals:* Unit -*2)* Mary iKorn and Onler. Love and Acid just do not Mix. Love Letters. Mothers aniJFathers.
Further Reading: Rosa Parks-The Brave Heart.

MODULE -II:- GENDER AND BIOLOGY

Missing Women: Sex Selection and Its Consequences *(Towards a World of Equals:* Unit - 4) Declining Sex Ratio. Demographic Consequences.

Gender Spectrum: Beyond the Binary *(Towards* a *World of Equals:* Unit - 10) Two or Many? Struggles with Discrimination.

Additional Reading: Our Bodies, Our Health *(Towards a World of Equals:* Unit -13)

MODULE -III:- GENDER AND LABOUR

A: Housework: the Invisible Labour*(Towards a World* of *Equals:* Unit - 3) "My Mother doesn't Work." "Share the I.oad."

B: Women's Work: Its Politics and Economics *(Towards a World of Equals:* Unit -7)
Fact and Fiction. Unrecognized and Unaccounted work. Further Reading: Wages and Conditions of Work.

MODULE -IV:- ISSUES OF VIOLENCE

Sexual Harassment: Say Nol*(Towards a World of Equals:* Unit -6)

Sexual Harassment, not Eve-teasing- Coping with Everyday Harassment- Further Reading:

"Chdpulum. Domestic Violence: Speaking Out *(Towards a World of Equals:* Unit -5) Is Home a Safe Place? When Women Unite (Film" Rebuilding Lives. Further Reading: New Forums for Justice. Thinking about Sexual Violence *(Towards a World of Equals:* Unit -11)

Blaming the Victim-1 Fought for my Life " - Further Reading: The Caste Face of Violence.

MODULE -V:- GENDER STUDIES

Knowledge: Through the Lens of Gender *(Towards a Work/ of Equals:* Unit -5)

Point of View. Gender and the Structure of Knowledge. Further Reading: Unacknowledged Women Artists of Telangana.

Whose History? Questions for Historians and Others *(Towards a World of Equals:* Unit -9) Reclaiming a Past. Writing other Histories. Further Reading: Missing Pages from Modern Telangana History.

Essential Reading: All the Units In the Textbook, *"Towards a World of Equals: A Bilingual Textbook on Gender"* written by A.Suneetha, Uma Bhrugubanda, DuggiralaVasanta, Rama Melkote, Vasudha Nagaraj, Mina Rasheed, Gogu Shyamala, Deepa Sreenivas and Susie Thant

Note: Since it Is Interdisciplinary Course, Resource Persons can be drawn from the fields of English Literature or Sociology or Political Science or any other qualified faculty who has expertise in this field.

TEXT BOOKS:

1. Towards a World of Equals: A bilingual Textbook on Gender , A Suneetha -etall

REFERENCES:

1. Sen, Amartya. "More than One Million Women are Missing.' New York Review of Books 37.20 (20 December 1990). Print. We *Were Making History...' Life Stories of Women in the ToIrmgana People's Struggle.* New Delhi: Kali for Women, 1989.

2. TriptiLahiri. "By the Numbers: Where Indian Women Work." Women's Studios Journal (14 November 2012) Available online at: http:// blogs.visj.com/ India real time/2012/11/14/by - the-numbers-where-Indan-womenworkP

3. K. Satyanarayana and Susie Thant (Ed.) Steel Nibs Are Sprouting: New Dalit Writing From South India, Dossier 2: Telugu And Kannada htto://harooreollins.co.in/BookDetailasp?FlookCndet,3732

4. Vimata. "Vantillu (The Kitchen)". Women Writing in India: 600 BC to the Present. Volume II: The 20th Century. Ed. Susie Thaw and K. Lalita. Delhi: Oxford University Press 1995. 599-601.

5. Shatrughna, Veena et al. Women's Work and its Impact on Child Health end Nutrition, Hyderabad, National Institute of Nutrition, Indian Council of Medical Research. 1993.

6. Stree Shakti Sanghatana. 'We Were Making I listory ....' Life Stories of Women in the Telangana People's Struggle. New Delhi: Kali for Women, 1989.

E - RESOURCES:

1. http://www.actforyouth.net/resources/rf/rf_gender1_1213.cfm(UNDERSTANDING GENDER)
2. https://www.simplypsychology.org/gender-biology.html(GENDERAND BIOLOGY)
3. http://www.yourarticlelibrary.com/essay/essay-on-gender-issues-in-labour-market-in-india/40442/ (GENDER AND LABOUR)
4. Journals/Magazines links:-
5. http://journals.sagepub.com/doi/abs/10.1177/1077801200006007004 (ISSUES OF VIOLENCE)
6. http://www.nordiclabourjournal.org/emner/likestilling (GENDER AND BIOLOGY)

Course Outcomes:

1. After completion of the course, students will be able to:
2. Develop a better understanding of important issues related to gender in contemporary India.
3. Sensitize about the basic dimensions of the biological, sociological, psychological and legal aspects of gender. This will be achieved through discussion of materials derived from research, facts, everyday life, literature and film.
4. Attain a finer grasp of how gender discrimination works in our society and how to counter it.
5. Acquire insight into the gendered division of labour and its relation to politics and economics.
6. Develop a sense of appreciation of women in all walks of life.

CO- PO Mapping (3/2/1indicatesstrengthofcorrelation)3-Strong,2-Medium,1-Weak															
COs	**Programme Outcomes(POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1						**3**		**3**	**3**		**3**	**3**			
CO2						**3**		**3**	**3**		**3**	**3**			
CO3						**3**		**3**	**3**		**3**	**3**			
CO4						**3**		**3**	**3**		**3**	**3**			
CO5						**3**		**3**	**3**		**3**	**3**			

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. V Semester		
Code: A0H08	ENGINEERING ECONOMICS AND ACCOUNTANCY (Common for CE and ME)	L	T	P
Credits:3		3	-	-

Prerequisites: Nil

Course Objectives:

EEA is a think beyond program which will make the student to examine the application of microeconomics theory as applied to the manager's responsibilities in an organization. To explain the basic principles of managerial economics, accounting and current business environment underlying business decision making. This course should emphasize the quantitative and qualitative applications of economic principle to business analysis

MODULE-I Business Environment and Managerial Economics

A. Business Environment: Characteristic features of Business, Features and evaluation of Sole Proprietorship, Partnership, Joint Stock Company, Public Enterprises and their types, Latest trends in Business Environment (Entrepreneurship).

B. Managerial Economics: Definition, Nature and Scope of Managerial Economics– Demand Analysis: Demand Determinants, Law of Demand and its exceptions. Elasticity of Demand, Types, Significance of Elasticity of Demand, Demand Forecasting, Factors governing demand forecasting, methods of demand forecasting.

MODULE – II Theory of Production and Cost Analysis

A. Theory of Production: Production Function – ISO quants and ISO costs, MRTS, Least Cost Combination of Inputs, Cobb-Douglas Production function, Laws of Returns, Internal and External Economies of Scale.

B. Cost Analysis: Cost concepts, Opportunity cost, fixed vs. Variable costs, explicit costs Vs. Implicit costs, Out of pocket costs vs. Imputed costs. Break-even Analysis (BEA)- Determination of Break-Even Point (simple problems) - Managerial Significance and limitations of BEA.

MODULE – III Market structures and Pricing Policies

A. Introduction to Markets & Market structures: Types of competition, Features of Perfect competition, Monopoly and Monopolistic Competition. Price-Output Determination in case of Perfect Competition and Monopoly.

B. Pricing Policies & Methods: Cost plus Pricing, Marginal Cost Pricing, Sealed Bid Pricing, Going Rate Pricing, PLC based pricing methods.

MODULE – IV Capital and Capital Budgeting

A. Capital: Capital and its significance, Types of Capital, Estimation of Fixed and Working capital requirements, Methods and sources of raising finance.

B. Capital Budgeting : Nature and scope of capital budgeting, features of capital budgeting proposals, Methods of Capital Budgeting: Payback Method, Accounting Rate of Return (ARR) and Net Present Value Method (simple problems)

MODULE – V Financial Accounting and Ratios

Financial Accounting: Introduction, Accounting principles, Accounting Cycle, Journal, Ledger, Trial Balance- Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet with simple adjustments).

A. Financial Analysis Through Ratios: Computation, Analysis and Interpretation of Liquidity Ratios (Current Ratio and quick ratio), Activity Ratios (Inventory turnover ratio and Debtor Turnover ratio), Capital structure Ratios (Debt- Equity ratio, Interest Coverage ratio), and Profitability ratios (Gross Profit Ratio, Net Profit ratio, Operating Ratio, P/E Ratio and EPS).

TEXT BOOKS:

1. Aryasri, **"Managerial Economics and Financial Analysis"**, TMH, 2nd edition, 2005.(UNITS I,II,III,IV,V).
2. Varshney & Maheswari, **"Managerial Economics"**, 5th edition Sultan Chand, 2003.(UNITS, I,II,III).

REFERENCES:

1. H. Craig Peterson & W. Cris Lewis, **"Managerial Economics"**, PHI, 4 Ed.
2. Domnick Salvatore, **"Managerial Economics In a Global Economy"**, Thomson, 4th Edition.
3. Raghunatha Reddy & Narasimhachary, **"Managerial Economics& Financial Analysis"**, 4TH edition Scitech.
4. S.N.Maheswari & S.K. Maheswari, **"Financial Accounting"**, 6th edition Vikas.
5. Dwivedi, **"Managerial Economics"**, Vikas, 6th Edition.

E - RESOURCES:

1. http://www.learnerstv.com/Free-Economics-video-lecture-courses.htm
2. http://nptel.ac.in/courses/110105067/
3. http://nptel.ac.in/courses/110107073/
4. http://nptel.ac.in/courses/110101005/
5. http://nptel.ac.in/courses/109104073/

Course outcomes:

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

1. Understand the concepts of managerial economics and their application in evaluating the demand.
2. Evaluate the production function and identifies the least cost combination to control the costs of production.

3. Understand the structures of various market types and their pricing policies.
4. Understand the types of business forms and also be able to evaluate the investments using capital budgeting techniques.

Understand the basic concepts of financial accounting and evaluation of company performance using ratio analysis.

CO- PO Mapping (3/2/1indicatesstrengthofcorrelation)3-Strong,2-Medium,1-Weak															
COs	**Programme Outcomes(POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO 2**	**PSO 3**
CO1	**1**		**1**	**1**							**1**	**1**		**1**	**1**
CO2	**1**		**1**	**1**		**1**					**1**	**1**		**1**	**1**
CO3	**1**		**1**	**1**					**1**		**1**			**2**	**1**
CO4	**1**		**1**	**1**		**1**			**2**		**1**			**1**	**1**
CO5	**1**		**1**	**1**					**1**		**1**	**1**		**1**	**1**

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. V Semester		
Code:A0320	METROLOGY AND INSTRUMENTATION	L	T	P
Credits:3		3	-	-

Prerequisites: Nil

Course Objectives:

The objective of this subject is to provide basic knowledge of different mechanical measuring instruments and gauges.

MODULE I: Systems of Limits, Fits and Tolerance & Limit Gauges

Systems of Limits and Fits: Introduction, normal size, tolerance limits, deviations, allowance, fits and their types-unilateral and bilateral tolerance system, hole and shaft basis systems - interchangeability and selective assembly. Indian standard Institution system British standard system, International Standard system for plain and screwed work.

Limit Gauges: Taylor's principle, ~~D~~esign of go and No go gauges, plug ring, snap, gap, taper, profile and position gauges.

MODULE II: Linear, Angle and Taper Measurement & Optical Measuring Instruments

Linear Measurement: Length standard, line and end standard, slip gauges calibration of the slip gauges, Dial indicator.

Measurement of Angles and Tapers: Different methods - Bevel Protractor - angle slip gauges- spirit levels – sin bars - Rollers and spheres used to determine the tapers.

Optical Measuring Instruments: Tool Maker Microscope and its uses collimators, optical projector, auto collimator and interferometer.

MODULE III: Surface Roughness Measurement & Instrumentation

A: Surface Roughness Measurement: Profilo graph. Talysurf, ISI symbols for indication of surface finish. Comparators-Types-Mechanical, Electrical, optical and pneumatical compactors.

B: Instrumentation – Basic principles of measurement– Measurement systems, generalized configuration and functional descriptions of measuring instrument~~s~~ examples. Dynamic performance characteristics ~~s~~ources of error, Classification and elimination of error.

MODULE IV: Measurement of Displacement & Temperature

Measurement of Displacement: Theory and construction of various transducers to measure displacement Piezo electric, Inductive, capacitance, resistance, ionization and Photo electric transducers, Calibration procedures.

Measurement of Temperature: Classification RangesVarious Principles of measurement Expansion, Electrical Resistance Thermistor, Thermocouple, Pyrometers,Temperature Indicators

MODULE V: Strain Measurements & Elements of Control Systems

Stress Strain Measurements: Various types of stress and strain measurements electrical strain gauge gauge factor method of usage of resistance strain gauge for bending compressive and tensile strains usage for measuring torque, Strain gauge Rosettes.

Elements of Control Systems: Introduction, Importance Classification Open and closed systems, Servo mechanisms Examples with block diagrams Temperature, speed & position control systems.

TEXT BOOKS

1. R.K. Jain, **"Engineering Metrology",** Khanna Publishers, 2016.
2. Backwith, Marangoni, Lienhard, **"Mechanical Measurements",** Pearson Education, 2015.
3. Dr.D.S.Kumar, **Mechanical Measurements and Control** Metropolitan Book Co.Pvt.Ltd.

REFERENCES

1. M. Mahajan, **"A Text book of Metrology"** Danpath Rai & Co. 2010.
2. J.F.W.Galyer, Charles Reginald Shotboli, **"Metrology for Engineers"** , 5th edition, Cengage Learning Publisher, 2014.
3. Docbelin O.E. Manik. D.N. **"Measurement System"** Tata McGraw Hill, 2015.
4. I C Gupta, **"Engineering Metrology"** Danpath Rai & Co, 2016.
5. S. Bhaskar, **"Instrumentation and Control Systems",** Anuradha Agencies.

E - RESOURCES

1. http://home.iitk.ac.in/~vkjain/Lecture%204-Metrology-F-21-8-14.pdf
2. http://users.encs.concordia.ca/~nrskumar/Index_files/Mech6491/Lecture%201.pdf
3. http://nptel.ac.in/courses/112106179/19
4. https://www.youtube.com/watch?v=qbKnW42ZM5c
5. https://www.degruyter.com/view/j/mms
6. http://www.metrology-journal.org/

Course Outcomes:

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

1. Understand the Systems of Limits, Fits and Tolerance & Limit Gauges.
2. Illustrate Linear, Angle and Taper measurement instruments & optical measuring instruments.
3. Measure Surface Roughness and know about Instrumentation system.
4. Apply the instruments for displacement & temperature.
5. Understand the stress strain measurements & elements of control systems.

CO- PO Mapping (3/2/1indicatesstrengthofcorrelation)3-Strong,2-Medium,1-Weak															
COs	**Programme Outcomes(POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO 2**	**PSO 3**
CO1	**1**	**1**		**3**	**2**		**1**					**3**	**1**	**1**	
CO2	**1**	**1**		**3**	**2**		**1**					**3**	**1**	**1**	
CO3	**1**	**1**		**3**	**2**		**1**					**3**	**1**	**1**	
CO4	**1**	**1**		**3**	**2**		**1**					**3**	**1**	**1**	
CO5	**1**	**1**		**3**	**2**		**1**					**3**	**1**	**1**	

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. V Semester		
Code:A0321	DESIGN OF MACHINE MEMBERS – I	L	T	P
Credits:3		3	-	-

Prerequisites: Mechanics of solids

Course Objectives:

The objective of this subject is to provide the design knowledge about machine members like welded joints, bolted joints, shafts, couplings by considering different stresses.

MODULE I: Introduction & Stresses in Machine Members

Introduction: General considerations in the design of Engineering Materials and their properties – selection – Manufacturing consideration in design. Tolerance and fits - BIS codes of Steels.

Stresses in Machine Members: Simple stresses –mohrs circle – Introduction to Torsion - Complex stresses – impact stresses – stress strain relation – various theories of failure – factor of safety – design for strength and rigidity – preferred numbers. The concept of stiffness in tension, bending, torsion and combined situations.

MODULE II: Fatigue Loading

Fatigue Loading: Stress concentration – Theoretical stress concentration factor – Fatigue stress concentration factor - notch sensitivity – Design for fluctuating stresses – Endurance limit – Estimation of endurance strength – Fatigue theories of failure - Goodman and Soderberg.

MODULE III: Riveted, Welded & Bolted Joints

A: Riveted Joints: Modes of failure of riveted joints – Strength equations – efficiency of riveted joints – Design of Boiler joints - eccentrically loaded riveted joints.

B: Welded Joints: Design of Fillet welds – axial loads – circular fillet welds – bending and torsion

- eccentrically loaded joints.

Bolted Joints: Design of bolts with pre – stresses - Design of joints under eccentric loading - bolt of uniform strength, Cylinder cover joints.

MODULE IV: Design of Shafts, Shaft Coupling & Axially Loaded Joints

Design of Shafts: Design of solid and hollow shafts for strength and rigidity – Design of shafts for combined bending and axial loads – Shaft sizes – BIS code – Design of shaft for a gear and belt drives. Shaft Coupling: Rigid couplings – Muff, Split muff and Flange couplings. Flexible couplings – Pin- Bush coupling.

Axially Loaded Joints: Keys, Cotters and Knuckle Joints: Design of Keys - stresses in keys - cotter joints - spigot and socket, sleeve and cotter, jib and cotter joints - Knuckle joints.

MODULE V: Mechanical Springs

Mechanical Springs: Stresses and deflections of helical springs - Extension -compression springs - Springs for static and fatigue loading- natural frequency of helical springs - Energy storage capacity - helical torsion springs - Co-axial springs.

TEXT BOOKS

1. Shigley, "**Mechanical Engineering Design",** McGraw-Hill, 10th edition, 2014.
2. Pandya& shah, "**Machine design",**Charotar Publishers, 19th edition, 2014.

REFERENCES

1. V.M. Faires, **"Design of Machine Elements",** C.B.S. Publishers & Distributors, The Macmillan company, 4th edition, 1965.
2. Allen S. Hall, **"Machine design"**, Schaum Series, McGraw hill, 1966.
3. S MD Jalaludin, **"Machine Design",** Anuradha Publishers Chennai.3rd edition, 2004.
4. Data Books: (i) P.S.G. College of Technology (ii) Mahadevan, CBS publisher, 4th edition, 2013.
5. V.B. Bhandari, **"Design of Machine Elements",** 4th edition, McGraw-Hill, 2016.

E - RESOURCES

1. nptel.ac.in/courses/IIT...I/...connections/3_welded_and_welding_connections.pdf
2. nptel.ac.in/courses/112106137/pdf/1_1.pdf
3. web.itu.edu.tr/~halit/Makel/Ch_10_slides_m.pdf
4. research.ijcaonline.org/efitra/number2/efitra1014.pdf
5. www.technicaljournalsonline.com/ijaers/VOL%20III/.../395.pdf
6. nptel.ac.in/courses/112105124/34

Course Outcomes

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

1. Understand the general considerations in design.
2. Analyze the fatigue loading and endurance limit.
3. Determine stresses in riveted, threaded and welded joints.
4. Understand the shaft design and shaft couplings.
5. Analyze the natural frequency of helical springs.

CO- PO Mapping (3/2/1indicatesstrengthofcorrelation)3-Strong,2-Medium,1-Weak															
COs	**Programme Outcomes(POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO 2**	**PSO 3**
CO1	**3**	**1**				**1**		**1**				**1**	**2**	**1**	
CO2	**3**	**2**	**2**			**2**						**1**	**2**	**1**	
CO3	**2**	**1**	**2**		**2**	**1**			**2**			**2**	**2**	**1**	
CO4	**2**			**1**		**2**		**2**				**1**	**2**	**1**	
CO5	**2**	**1**	**1**			**1**		**2**				**2**	**2**	**1**	

2020-21 Onwards (MR-20)	MALLAREDDYENGINEERINGCOLLEGE (Autonomous)	B.Tech. V Semester		
Code:A0322	THERMAL ENGINEERING - II	L	T	P
Credits:3	*(Use of standard Steam Tables is permitted)*	3	-	-

Prerequisites: Thermal Engineering - I

Course Objectives:

The objective of this subject is to provide knowledge about different cycle used in power plants, combustion of fuels and to provide knowledge about boilers, Steam Turbines, Steam Condensers & Steam Nozzles, Gas Turbines, Jet Propulsion & Rockets and their principle of operations.

MODULE I: Basic Concepts

Basic Concepts: Rankine cycle - Schematic layout, Thermodynamic Analysis, Concept of Mean Temperature of Heat addition, Methods to improve cycle performance – Regeneration & reheating. Combustion: Fuels and combustion, concepts of heat of reaction, adiabatic flame temperature, stoichiometry and flue gas analysis.

MODULE II: Boilers

Boilers : Classification – Working principles – with sketches including H.P. boilers – Mountings and Accessories – Working principles, Boiler horse power, equivalent evaporation, efficiency and heat balance – Draught, classification – Height of chimney for given draught and discharge, condition for maximum discharge, efficiency of chimney – artificial draught, induced and forced draught.

MODULE III: Steam Condensers & Steam Nozzles

A: Steam Condensers: Requirements of steam condensing plant – Classification of condensers – working principle of different types of condensers vacuum efficiency and condenser efficiency – air leakage, sources and its effects, air pump- cooling water requirement.

B: Steam Nozzles: Function of nozzle – applications - types, Flow through nozzles, thermodynamic analysis – assumptions -velocity of nozzle at exit-Ideal and actual expansion in nozzle, velocity coefficient, condition for maximum discharge, critical pressure ratio, criteria to decide nozzle shape: Super saturated flow, its effects, degree of super saturation and degree of under cooling - Wilson line.

MODULE IV: Steam Turbines & Reaction Turbine

Steam Turbines: Classification – Impulse turbine; Mechanical details – Velocity diagram – effect of friction – power developed, axial thrust, blade or diagram efficiency – condition for maximum efficiency. De-Laval Turbine - its features. Methods to reduce rotor speed-Velocity compounding and pressure compounding, Velocity and Pressure variation along the flow – combined velocity diagram for a velocity compounded impulse turbine.

Reaction Turbine: Mechanical details – principle of operation, thermodynamic analysis of a stage, degree of reaction –velocity diagram – Parson's reaction turbine – condition for maximum efficiency.

MODULE V: Gas Turbines, Jet Propulsion & Rockets

Gas Turbines: Simple gas turbine plant – Ideal cycle, essential components – parameters of performance – actual cycle – regeneration, inter cooling and reheating –Closed and Semi-closed cycles – merits and demerits, Brief concepts about compressors, combustion chambers and turbines of Gas Turbine Plant.

Jet Propulsion: Principle of Operation – Classification of jet propulsive engines – Working Principles with schematic diagrams and representation on T-S diagram - Thrust, Thrust Power and Propulsion Efficiency – Turbo jet engines – Needs and Demands met by Turbo jet – Schematic Diagram, Thermodynamic Cycle, Performance Evaluation Thrust Augmentation – Methods.

Rockets: Application – Working Principle – Classification – Propellant Type – Thrust, Propulsive Efficiency – Specific Impulse – Solid and Liquid propellant Rocket Engines.

TEXT BOOKS

1. R.K. Rajput, "**Thermal Engineering",** Lakshmi Publications, 10th edition, 2017.
2. V.Ganesan "**Gas Turbines",** TMH Publishers, 3rd edition, 2010.

REFERENCES

1. R. Yadav "**Thermodynamics and Heat Engines",** Central Book Depot,7th edition, 2007.
2. P.Khajuria&S.P.Dubey "**Gas Turbines and Propulsive Systems",** Dhanpatrai Publications, 2012.
3. Cohen, Rogers and Saravana Muttoo, Addison Wesley – Longman "**Gas Turbines",** Pearson publishers, 5th edition, 2001.
4. P.L.Bellaney "**Thermal Engineering",** khanna publishers. 5th edition, 2010.
5. M.L.Marthur& Mehta "**Thermal Engineering",** Jain bros Publishers, 3rd edition, 2014.

E - RESOURCES

1. http://nptel.ac.in/courses/112106133/
2. https://www.journals.elsevier.com/applied-thermal-engineering
3. http://www.personal.utulsa.edu/~kenneth-weston/chapter5.pdf
4. https://www.irjet.net/archives/V2/i5/IRJET-V2I5185.pdf
5. http://nptel.ac.in/courses/114105029/
6. http://nptel.ac.in/courses/108105058/

Course Outcomes

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

1. Understand the basic concept of power plant.
2. Understand working principles of boiler, its accessories and losses of energy
3. Analyse the performance of steam nozzle and condenser.
4. Analyse the performance of steam and reaction turbine.
5. Analyse the performance of gas turbines and jet propulsions.

CO- PO Mapping (3/2/1indicatesstrengthofcorrelation)3-Strong,2-Medium,1-Weak															
COs	**Programme Outcomes(POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO 2**	**PSO 3**
CO1	**2**	**2**	**1**	**2**	**3**	**1**	**1**					**3**	**2**		
CO2	**2**	**2**	**1**	**2**	**2**	**1**	**3**				**2**	**2**	**2**		
CO3	**2**	**2**	**1**	**2**	**1**	**1**	**3**				**3**	**2**	**2**	**1**	
CO4	**3**	**2**	**3**	**3**	**1**	**2**	**3**			**3**	**3**	**3**	**2**	**1**	
CO5	**2**	**2**	**2**	**3**	**1**	**2**	**3**			**3**	**2**	**2**	**2**	**1**	

2020-21 Onwards (MR-20)	MALLAREDDYENGINEERINGCOLLEGE (Autonomous)	B.Tech. V Semester		
Code:A0323	MACHINE DRAWING	L	T	P
Credits:2		1	-	2

Prerequisites: Engineering Graphics

Course Objectives:

To understand projections of simple machine elements and understand assembly drawings of typical machine parts such as Connecting rod, Eccentric, Cross head, Screw jack, Plummer block.

Machine Drawing Conventions:

Need for drawing conventions - introduction to IS conventions

a) Methods of dimensioning, general rules for sizes and placement of dimensions for holes, centers, curved and tapered features
b) Types of sections - selection of section planes and drawing of sections and auxiliary sectional views. Parts not usually sectioned.
c) Conventional representation of materials, common machine elements and parts such as screws, nuts, bolts, keys, gears, webs, ribs, springs.
d) Title boxes, their size, location and details - common abbreviations & their liberal usage
e) Assembly drawings - working drawings of machine parts.

I. Drawing of Machine Elements and simple parts:

Selection of Views, additional views for the following machine elements and parts with every drawing proportion.

a) Popular forms of Screw threads, bolts, nuts, stud bolts, tap bolts, set screws.
b) Keys, cotter joints and knuckle joint, bolted joint.
c) Riveted joints for plates
d) Shaft coupling, flange coupling and universal coupling, socket and spigot joint.

II. Assembly Drawings:

a) Engine parts - Stuffing boxes, Cross heads, Eccentrics, Petrol Engine connecting rod, Piston assembly.
b) Other machine parts - Screws jack, Milling machine tail stock, Plummer block, single tool post, Clapper block.

TEXT BOOKS

1. K.L.Narayana, P.Kannaiah**"Machine Drawing"**, New Age Publishers, 5th edition, 2016.
2. RK Dhawan "**Machine Drawing"**, S.Chand Publications, Revised edition, 2014.
3. N.D.Bhatt "**Machine Drawing",** Charotar Publishing House pvt ltd, 48thedition, 2013.

REFERENCES

1. P.S.Gill "**Machine Drawing"**, S.K. Kataria& Sons Publisher, 17th edition, 2009.
2. Rajput "**Machine Drawing",** Lakshmi Publications
3. K.C.JOHN "**Machine Drawing**", PHI Learning Pvt Ltd, 2009
4. N.D. Junnarkar "**Machine Drawing**", Pearson Education India, 2007.

E – RESOURCES

1. http://nptel.ac.in/courses/105108069/
2. http://www.me.metu.edu.tr/courses/me114/Lectures/assembly.htm
3. http://www.nature.com/nature/journal/v58/n1510/abs/058543c0.html

Course Outcomes:

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

1. Understanding of machine conventions in accordance with IS Conventions.
2. Illustrate the screws, bots and nuts.
3. Demonstrate the keys, couplings and joints.
4. Preparation of the part or assembly drawings as per the conventions.
5. Preparation of the machine parts or assembly drawings as per the conventions.

CO- PO Mapping (3/2/1indicatesstrengthofcorrelation)3-Strong,2-Medium,1-Weak															
COs	**Programme Outcomes(POs)**												**PSOs**		
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO1 2**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	**2**	**1**	**1**	**2**	**1**					**1**		**1**	**2**		
CO2	**2**	**1**	**1**		**2**					**1**		**1**	**2**		
CO3	**2**	**1**	**1**	**2**	**2**					**1**		**1**	**2**		
CO4	**2**	**1**	**1**	**2**	**2**					**1**		**1**	**1**		
CO5	**2**	**1**	**1**		**2**					**1**		**1**	**2**		

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. V Semester		
Code:A0327	NON DESTRUCTIVE TESTING	L	T	P
Credits:3	(Professional Elective – I)	3	-	-

Prerequisites: Strength of Materials, and Metallurgy and Material Science

Course Objective: The purpose of NDT is to inspect an engineering materials in a safe, reliable, and cost effective manner without causing damage to the materials. This is in contrast to destructive testing where the material being tested is damaged or destroyed during the inspection process.

MODULE – I : Introduction to NDT – NDT Versus Mechanical testing, Overview on Non Destructive Testing Methods, Material characterization. merits and limitations, Physical characteristics of materials, Applications , Visual inspection.

MODULE – II : Surface NDT Methods: Liquid Penetration Testing , Ultrasonic Test ,Principles, types and properties of liquid penetrants, developers, advantages and limitations, Testing Procedure, Interpretation of results.

MODULE - III: Magnetic Particle Testing- Theory of magnetism, inspection materials Magnetization methods, Interpretation and evaluation of test indications, Principles and methods of demagnetization, Residual magnetism.

MODULE – IV : Thermography Testing– Principles, Contact and non contact inspection methods, Techniques for applying liquid crystals, Advantages and limitation , Infrared radiation and infrared detectors, Instrumentations and methods, applications.

MODULE -V: Eddy Current Testing,. Eddy Current Testing-Generation of eddy currents, Properties of eddy currents, Eddy current sensing elements, Probes, Instrumentation, Types of arrangement, Applications, advantages, Limitations, Interpretation/Evaluation.

TEXT BOOKS:

1. Baldev Raj, T. Jayakumar, M. Thavasimuthu, Practical Non-Destructive Testing¡¨, Narosa Publishing House, 2009.
2. Ravi Prakash, Non-Destructive Testing Techniques¨, 1st revised edition, New Age International Publishers, 2010

REFERENCES:

1. ASM Metals Handbook, ¨Non-Destructive Evaluation and Quality Control¨, American Society of Metals, Metals Park, Ohio, USA, 200, Volume-17.
2. Paul E Mix, “Introduction to Non-destructive testing: a training guide”, Wiley, 2nd Edition New Jersey, 2005
3. Charles, J. Hellier, Handbook of Non-destructive evaluation”, McGraw Hill, New York 2001.

E - RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc20_mm07/preview
2. https://nptel.ac.in/content/storage2/courses/113106065/Week%208/Lesson19.pdf
3. https://nptel.ac.in/courses/112/105/112105051/
4. https://nptel.ac.in/noc/courses/noc19/SEM2/noc19-ph13/
5. https://nptel.ac.in/courses/112/107/112107209/

Course outcomes:

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

1. Able to Understand different methods of Non Destructive Testing.
2. Analyzing Materials and evaluating Defects by Using Liquid Penetration and Ultrasonic test.
3. Analyzing Materials and evaluating Defects by Using Magnetic Penetration Test.
4. Analyzing Materials and evaluating Defects by Using Thermography Test.
5. Analyzing Materials and evaluating Defects by Using Eddy Current Test.

CO- PO Mapping (3/2/1indicatesstrengthofcorrelation)3-Strong,2-Medium,1-Weak															
COs	Programme Outcomes(POs)												PSOs		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	3		2	2	3		3				2				
CO2	1	3	3	2								1			1
CO3	3	3	2	3			2					1		3	
CO4	2		3	2			2				3	3			3
CO5	2		2		2		3				2	3		3	3

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. V Semester		
Code:A0328	**APPLIED HYDRAULICS AND PNEUMATICS**	**L**	**T**	**P**
Credits:3	(Professional Elective – I)	**3**	**-**	**-**

Prerequisites: Nil

Course Objectives:
This course will give an appreciation of the fundamental principles, design and operation of hydraulic and pneumatic machines, components and systems and their application in recent automation revolution.

MODULE I: Fluid Power Principles and Fundamentals
Introduction to Fluid power- Advantages and Applications- Fluid power systems – Types of fluids- Properties of fluids Basics of Hydraulics – Pascal's Law- Principles of flow – Work, Power and Torque. Properties of air– Perfect Gas Laws.

MODULE II: Hydraulic System and Components

Sources of Hydraulic power: Pumping Theory – Pump Classification- Construction, Working, Design, Advantages, Disadvantages, Performance, Selection criterion of Linear, Rotary- Fixed and Variable displacement pumps, Hydraulic Actuators: Cylinders – Types and construction, Hydraulic motors Control Components: Direction control, Flow control and Pressure control valves- Types, Construction and Operation- Applications – Types of actuation. Accessories: Reservoirs, Accumulators, Intensifiers, Pressure Switches- Applications- Fluid Power ANSI Symbol.

MODULE III: Hydraulic Circuits
A: Industrial hydraulic circuits- Regenerative, Pump Unloading, Double-pump, Pressure Intensifier, Air over oil, Sequence, Reciprocation, Synchronization, Fail-safe.
B: Speed control, Hydrostatic transmission, Accumulators, Electro hydraulic circuits, Mechanical Hydraulic servo systems.

MODULE IV: Pneumatic System
Compressors- Filter, Regulator, Lubricator, Muffler, Air control Valves, Quick Exhaust valves, Pneumatic actuators, Servo systems. Introduction to Fluidics, Pneumatic logic circuits.

MODULE V: Design of Hydraulic and Pneumatic Circuits
Design of circuits using the components of hydraulic system for Drilling, Planning, Shaping, Punching, Press. – Selection, fault finding and maintenance of hydraulic components- Sequential circuit design for simple application using cascade method, Electro pneumatic circuits. Selection criteria of pneumatic components – Installation fault finding and maintenance of pneumatic components. Microprocessor and PLC- Applications in Hydraulic and Pneumatics - Low cost Automation – Hydraulic and Pneumatic power packs.

TEXT BOOKS

1. Srinivasan. R, "**Hydraulic and Pneumatic Control**", IInd Edition, Tata McGraw - Hill Education, 2012.
2. Anthony Esposito," **Fluid Power with Applications**", PHI / Pearson Education, 2005.

REFERENCES

1. Shanmugasundaram.K, "**Hydraulic and Pneumatic controls**", Chand & Co, 2006.
2. Majumdar, S.R., "**Oil Hydraulics Systems- Principles and Maintenance**", Tata McGraw Hill, 2001
3. Micheal J, Pinches and Ashby, J.G., "**Power Hydraulics**", Prentice Hall, 1989.
4. Dudelyt, A Pease and John J Pippenger, "**Basic Fluid Power**", Prentice Hall, 1987.
5. Majumdar, S.R., "**Pneumatic Systems – Principles and Maintenance**", Tata McGraw Hill, 2007.

E - RESOURCES

1. Concerned Website links
2. Concerned Journals/Magazines links
3. NPTEL Videos

Course Outcomes

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

1. Understand the fundamentals of fluids and fluid power systems
2. Functioning and applications of various hydraulic system components
3. Applications of hydraulic servo circuits
4. Functioning and applications of various pneumatic system components
5. Design PLC based hydraulic and pneumatic circuits for low cost automation

CO- PO Mapping (3/2/1indicatesstrengthofcorrelation)3-Strong,2-Medium,1-Weak															
COs	**Programme Outcomes(POs)**												**PSOs**		
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO1 2**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	**3**	**2**			**2**							**1**	**2**		
CO2	**3**	**2**			**2**							**1**	**2**		
CO3	**3**	**2**			**2**							**1**	**2**		
CO4	**2**	**2**			**2**							**1**	**2**		
CO5	**2**	**2**			**2**							**1**	**2**		

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. V Semester		
Code: A0326	REFRIGERATION AND AIR CONDITIONING (Professional Elective – I)	L	T	P
Credits:3		3	-	-

Prerequisites: Thermal Engineering-II

Course Objectives:

The objective of this subject is to provide basic knowledge about different refrigeration cycles, refrigeration systems, air conditioning and air cooler.

Codes/Tables: Refrigeration tables and Psychrometry charts

MODULE I: Introduction to Refrigeration & Air Refrigeration

Introduction to Refrigeration: Necessity and applications – Unit of refrigeration and C.O.P. – Mechanical Refrigeration – Types of Ideal cycles of refrigeration. VAV system

Air Refrigeration: Bell Coleman cycle or Reversed Brayton Cycle, Open and Dense air systems – Actual air refrigeration system problems – Refrigeration needs of Air craft's.

MODULE II: Principles of Evaporators & Vapour Compression Refrigeration.

Principles of Evaporators: Classification – Working Principles, Expansion devices – Types – Working Principles, Refrigerants – Desirable properties – classification - refrigerants used – Nomenclature.

Vapour Compression Refrigeration: Working principle and essential components of the plant – simple Vapour compression refrigeration cycle – COP – Representation of cycle on T-S and p-h charts – effect of sub cooling and super heating – cycle analysis – Actual cycle - Influence of various parameters on system performance – Use of p-h charts – numerical Problems

MODULE III: Vapor Absorption System & Steam Jet Refrigeration System.

A: Vapor Absorption System – Calculation of max COP – description and working of NH3 – water system and Li Br –water (Two shell & Four shell) System. Principle of operation, Three Fluid absorption system, salient features.

B: Steam Jet Refrigeration System – Working Principle and Basic Components. Principle and operation of (i) Thermoelectric refrigerator (ii) Vortex tube or Hilsch tube.

MODULE IV: Introduction to Air Conditioning

Psychrometric Properties & Processes – Characterization of Sensible and latent heat loads - Need for Ventilation, Consideration of Infiltration – Load concepts of RSHF, GSHF- Problems, Concept of ESHF and ADP.

MODULE V: Requirements of Human Comfort and Concept of Effective Temperature & Air Conditioning systems

Requirements of human comfort and concept of effective temperature- Comfort chart –Comfort Air conditioning – Requirements of Industrial air conditioning, Air conditioning - Load Calculations.

Air Conditioning system - Classification of equipment, cooling, heating humidification and dehumidification, filters, grills and registers, fans and blowers. Heat Pump – Heat sources – different heat pump circuits.

TEXT BOOKS

1. C.P. Arora, "**Refrigeration& Air Conditioning",** Tata McGraw-Hill Education, 3rd Edition, 2010.
2. S.C.Arora&Domkundwar "**A Course in Refrigeration and Air conditioning",** Dhanpatrai Publications, 3rd edition, 1980.

REFERENCES

1. Manohar Prasad **"Refrigeration and Air Conditioning"** New Age International, 2nd Edition, 2003
2. Dossat**"Principles of Refrigeration",** Pearson, 4th Edition, 2009.
3. P.L.Bellaney "**Refrigeration and Air Conditioning",** Khanna Publishers, 6thedition, 2013.
4. P.N.Ananthanarayan **"Basic Refrigeration and Air Conditioning"** TMH, 4th Edition,2013
5. R.S. Khurmi& J.K Gupta **"A Text Book of Refrigeration and Air Conditioning",** S. Chand - Eurasia Publishing House (P) Ltd., 2008.

E - RESOURCES

1. http://nptel.ac.in/courses/112105128/
2. http://nptel.ac.in/courses/112105129/
3. http://nptel.ac.in/courses/112107208/
4. International Journal of Refrigeration.
5. International Journal of Air-Conditioning and Refrigeration.

Course Outcomes

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

1. Understand different cycles in refrigeration.
2. Analyse the performance of vapour compression refrigeration.
3. Analyse the performance of vapour absorption system and steam jet refrigeration system.
4. Use the Psychrometry charts in air conditioning problems.
5. Understand the knowledge about the requirement of human comfort, requirement of industrial air conditioning and different types of air conditioning systems.

CO- PO Mapping (3/2/1indicatesstrengthofcorrelation)3-Strong,2-Medium,1-Weak															
COs	**Programme Outcomes(POs)**												**PSOs**		
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO1 2**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	**2**	**2**		**3**		**3**						**2**	**2**		
CO2	**2**	**2**		**3**		**3**						**2**	**2**		
CO3	**2**	**2**		**3**		**3**						**2**	**3**		
CO4	**2**	**2**		**3**		**3**						**2**	**3**		
CO5	**2**	**2**		**3**		**3**						**2**	**3**		

Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. V Semester		
Code: A0329	**GAS DYNAMICS AND JET PROPULSION**	**L**	**T**	**P**
Credits:3	*(Use of Standard Gas Tables is permitted)* (Professional Elective – I)	**3**	**-**	**-**

Prerequisites: Thermodynamics

Course Objectives:

The objective of the course is to understand the fundamental principles, normal and oblique shocks of compressible flow and to apply in the Jet and Space Propulsion systems.

MODULE I: Basic Concepts and Isentropic Flows

Energy and momentum equations of compressible fluid flows - Stagnation states, Mach waves – regions of flow-Mach cone and Mach angle- Crocco number – characteristic Mach number- Effect of Mach number on compressibility - Isentropic flow through variable ducts – mass flow through ducts- Nozzle and Diffusers.

MODULE II: Flow Through Ducts

Flows through constant area ducts with heat transfer (Rayleigh flow)- variation in flow properties – maximum heat transfer. Flow with friction (Fanno flow) – friction factor- variation of flow properties- Isothermal flow.

MODULE III: Normal and Oblique Shocks

A: Normal Shocks: Governing equations - Variation of flow properties across shocks - Static pressure ratio equation, Prandtl - Meyer relations –temperature ratio-Rankine - Hugniot equation- strength of shock-change in entropy-effect of friction.

B: Oblique Shocks: Oblique shock waves- variation of flow parameters – Oblique shock relations from normal shock- Mach waves- properties and Mach number after shock- applications- use of charts.

MODULE IV: Jet Propulsion

Theory of jet propulsion - Thrust equation - Thrust power and propulsive efficiency - Operating principle, cycle analysis and use of stagnation state performance of ram jet, turbojet, turbofan and turbo prop engines.

MODULE V: Space Propulsion

Types of rocket engines - Propellants-feeding systems - Ignition and combustion - Theory of rocket propulsion - Performance study - Staging - Terminal and characteristic velocity - Applications - space flights.

TEXT BOOKS

1. Anderson, J.D., "**Modern Compressible flow**", 3rd Edition, McGraw Hill, 2003.
2. Yahya, S.M. "**Fundamentals of Compressible Flow**", 4th Edition, New Age International (P) Limited, New Delhi, 2009.**REFERENCES**

1. Hill. P. and C. Peterson, "**Mechanics and Thermodynamics of Propulsion**", Addison - Wesley Publishing company, 1992.
2. Zucrow. N.J., "**Aircraft and Missile Propulsion**", Vol.1 & II, John Wiley, 1975.
3. Zucrow. N.J., "**Principles of Jet Propulsion and Gas Turbines**", John Wiley, New York,
4. Sutton. G.P., "**Rocket Propulsion Elements**", John wiley, New York, 1986.
5. Shapiro. A.H.," **Dynamics and Thermodynamics of Compressible fluid Flow**", John wiley, New York, 1953.

E - RESOURCES

1. web.iitd.ac.in/~pmvs/courses/mel7152008/notes-new.pdf
2. https://mycourses.aalto.fi/pluginfile.php/.../GasDynamics-Lecture-AllSlides.pdf
3. https://www.ncbi.nlm.nih.gov/labs/articles
4. www.sciencedirect.com/science
5. nptel.ac.in/courses/112103021/
6. nptel.ac.in/courses/112106166/

Course Outcomes

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

1. Understand the basic difference between incompressible and compressible flow.
2. Understand and apply the principles of compressible flow in the constant area ducts with friction and heat transfer.
3. Understand the phenomenon of shock normal and oblique waves and its effect on flow.
4. Gain basic knowledge about jet propulsion and Jet Propulsion systems.
5. Gain basic knowledge about jet propulsion and Rocket Propulsion systems.

CO- PO Mapping (3/2/1indicatesstrengthofcorrelation)3-Strong,2-Medium,1-Weak															
COs	**Programme Outcomes(POs)**												**PSOs**		
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO1 2**	**PSO1**	**PSO2**	**PSO3**
CO1	**2**	**2**		**3**		**1**	**2**					**1**	**3**		
CO2	**2**	**2**		**3**		**1**	**2**					**1**	**3**		
CO3	**2**	**2**		**3**		**1**	**2**					**1**	**3**		
CO4	**2**	**2**		**3**		**1**	**2**					**1**	**3**		
CO5	**2**	**2**		**3**		**1**	**2**					**1**	**3**		

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. V Semester		
Code: A0330	ENERGY CONSERVATION AND ENERGY MANAGEMENT (Professional Elective – I)	L	T	P
Credits:3		3	-	-

Prerequisites: Nil

Course Objectives:

The students will be able to understand and analyze the energy data of industries, carryout energy accounting and balancing, conduct energy audit and suggest methodologies for energy savings and utilize the available resources in optimal ways

MODULE I: Introduction

Energy - Power – Past & Present scenario of World; National Energy consumption Data – Environmental aspects associated with energy utilization –Energy Auditing: Need, Types, Methodology and Barriers. Role of Energy Managers. Instruments for energy auditing.

MODULE II Thermal Systems

Stoichiometry, Boilers, Furnaces and Thermic Fluid Heaters – Efficiency computation and ENCON measures. Steam: Distribution & Usage: Steam Traps, Condensate Recovery, Flash Steam Utilization, Insulators &Refractory.

MODULE III: Lighting and Electrical Systems

A: Illumination – Lux, Lumens, Types of lighting, Efficacy, LED Lighting and scope of ENCON in Illumination.

B: Components of EB billing – HT and LT supply, Transformers, Cable Sizing, Concept of Capacitors, Power Factor Improvement, Harmonics, Electric Motors - Motor Efficiency Computation, Energy Efficient Motors

MODULE IV: Energy Conservation in Major Utilities

Pumps, Fans, Blowers, Compressed Air Systems, Refrigeration and Air Conditioning Systems – Cooling Towers – D.G. sets

MODULE V Economics

Energy Economics – Discount Rate, Payback Period, Internal Rate of Return, Net Present Value, Life Cycle Costing –ESCO concept

REFERENCE BOOKS

1. Witte. L.C., P.S. Schmidt, D.R. Brown, **"Industrial Energy Management and Utilisation",** Hemisphere Publ, Washington
2. Callaghn, P.W. **"Design and Management for Energy Conservation"**, Pergamon Press, Oxford
3. Dryden. I.G.C., **"The Efficient Use of Energy"** Butterworths, London
4. Steve Doty, Wayne C. Turner **"Energy Management Hand book"**, Fairmont Press; 8th Edition, 2012.
5. W.R. Murphy and G. McKay **"Energy Management"**, Butterworth-Heinemann Ltd, 2009

E - RESOURCES

1. http://www.em-ea.org/
2. https://www.journals.elsevier.com/energy-conversion-and-management/
3. http://aea-al.org/wp-content/uploads/2015/07/1118838254.pdf

Course Outcomes

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

1. Apply the energy management approaches and role of energy manager.
2. Analyse energy conservation measures in lighting and electrical systems
3. Apply the principles of thermal engineering and energy management to improve the performance of thermal systems.
4. Analyse methods of energy conservation and energy efficiency for major utilities.
5. Apply to economic analysis of energy utilization.

CO- PO Mapping (3/2/1indicatesstrengthofcorrelation)3-Strong,2-Medium,1-Weak															
COs	**Programme Outcomes(POs)**												**PSOs**		
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	**3**	**2**	**2**	**1**								**1**	**2**		
CO2	**3**	**2**	**2**	**1**								**1**	**2**		
CO3	**3**	**2**	**2**	**1**								**1**	**2**		
CO4	**2**	**2**	**2**	**1**								**1**	**2**		
CO5	**2**	**2**	**2**	**1**								**1**	**2**		

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. V Semester		
Code: A0H03	ENGLISH COMMUNICATION AND PRESENTATION SKILLS LAB (Common for CE, ME and Min.E)	L	T	P
Credits:1		-	-	2

Course Objective:

The learners need to be aware of the characteristics of technical communication in their workplaces; as a result, they are exposed to different channels of technical communication. Hence the acquired skills make the learners effective communicators using persuasive language. Besides the above said, one of the major objectives is to maintain objectivity in writing documents and to produce professional quality documents using different components of the language.

Methodology: Facilitator's role: Since classroom learning augments thinking process, helping them to develop written, spoken and non verbal communication, the facilitator / Faculty would briefly discuss the topics with the students and later on guide them while the students involved in activities, writing work and while making presentations. The facilitator is required to design a lot of practical/industry oriented project works for the students

*Students are required to participate, perform, write and submit the work in the form of written documents or Power Point Presentations to hone their spoken written and non verbal communication skills. Students are to take up field work and submit the project work.

Module – I: Oral Presentations

Mechanics of Presentations – Methodology of Presentation, Importance of Non-verbal communication during presentations– Nuances of Presentation.

- This particular module is for internal evaluation purpose(s).

Module – II: E - Correspondence and Social Media Etiquette

Common web mail services, yahoo, gmailetc, fields to pay attention- To:, Cc:, Bcc:, Reply All, Subject, Salutation, Body, Signature, Font, Caps Lock , Highlight, The 'KISS' strategy (Keep It Simple and Short,)Points to remember while signing off, Introduction to Technical Vocabulary, Cultural Differences

- This Module is purely for internal assessment/evaluation

Module – III: Group Discussion

Initiators- Contributor-Informer-Team Leader-Motivator-Creative Contributor , Importance of , Non verbal communication -eye contact, voice characters, posture, gestures, do's and don'ts, Role play and Simulation- Learners assuming the roles of characters and participating in Group discussion, analysis, or prediction with strictly defined goals.

Module – IV: Interview Skills & Office Etiquette

Preparing for the interview, types of interviews, interview session, importance of non verbal communication during the interview, do's and don'ts of interview, follow up and thanking letter. FAQ's. Formal Conversation, office attire- do's and don'ts, greetings and meetings, speaking toseniors and handshakes, offering and taking visiting cards, Asking questions and Seeking Clarifications.

Module – V: Career Progression

Job Hunt Process-SWOT analysis, correspondence and browsing the internet to search for a suitable job(s), job application-cover letter drafting, drafting a winning resume', types of resume's

-electronic, video and printed resume's

- Instruction: Students are required to prepare their video resume which will be assessed by the faculty member.

REFERENCES:

1. Chrissie: **Handbook of Practical Communication Skills**: Jaico Publishing house, 1999.
2. Daniels, Aubrey: **Bringing Out the Best in People**: Tata McGraw-Hill: New York, 2003.
3. Wright,Goulstone, Mark: **Just Listen: Discover the Secret to getting through to absolutely anything** : American Management Association, 2010.
4. Leslie. T. Giblin: **Skill with people** Publication details not known
5. Lewis, Norman: **Word Power Made Easy**: Goyal Publications: New Delhi, 2009.
6. Murthy, A.G, Krishna,:**Ten Much** : Tata McGraw-Hill :New Delhi, 2010.

E-RESOURCES:

1. http://www.mindtools.com/pages/article/newTMC_05.htm
2. http://www.kent.ac.uk/careers/intervw.htm
3. http://www.wikihow.com/Write-a-Report

Course Outcomes:

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

1. Give Oral Presentations Confidently.
2. Draft appropriate Resume in accordance with the context.
3. Participate and present their view and ideas logically and confidently.
4. Understand the importance of communication in various settings.
5. Utilize the technology for career advancement

CO- PO Mapping (3/2/1indicatesstrengthofcorrelation)3-Strong,2-Medium,1-Weak															
COs	**Programme Outcomes(POs)**												**PSOs**		
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	**3**				**3**	**2**	**1**		**3**			**2**			
CO2	**3**				**3**	**2**	**1**		**3**			**2**		**3**	
CO3	**3**				**3**	**2**	**1**		**3**			**2**		**3**	
CO4	**3**				**3**	**2**	**1**		**3**			**2**		**3**	
CO5	**3**				**3**	**2**	**1**		**3**			**2**		**3**	

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. V Semester		
Code:A0324	METROLOGY & INSTRUMENTATION LAB	L	T	P
Credits:1		-	-	2

Note: Any 6 Experiments needs to be performed from each section.

A: METROLOGY

1. Measurement of lengths, heights, diameters by vernier caliper and micrometer etc.
2. Measurement of bores by internal micrometer and dial bore indicator.
3. Use of gear teeth vernier caliper and checking the chordal addendum and chordal height of spur gear.
4. Machine tool - alignment test on the lathe.
5. Machine tool alignment test on milling machine.
6. Measurement of screw thread and cutting tool profiles using Tool maker's microscope.
7. Angle and taper measurements by Bevel protractor and Sine bar.
8. Use of spirit level in finding the flatness of surface plate.
9. Measurement of effective diameter of screw thread by two wire / three wire method.
10. Surface roughness measurement.

B: INSTRUMENTATION LAB

1. Calibration of Pressure Gauges
2. Calibration of transducer for temperature measurement.
3. Study and calibration of LVDT transducer for displacement measurement.
4. Calibration of strain gauge for temperature measurement.
5. Calibration of thermocouple for temperature measurement.
6. Calibration of capacitive transducer for angular displacement.
7. Study and calibration of photo and magnetic speed pickups for the measurement of speed.
8. Calibration of resistance temperature detector for temperature measurement.
9. Study and calibration of a rotometer for flow measurement.
10. Study and calibration of Mcleod gauge for low pressure.

Course outcomes:

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

1. To provide knowledge on various Metrological equipments available to measure the dimension of the components.
2. To get familiar with flatness measurement equipment and surface roughness measurement.
3. Compute the internal bore diameter measurement by bore gauge.
4. To provide knowledge about Use of slip gauges, Sine bar and measurement of Screw threads & Gear tooth parameters.
5. Demonstrate the correct methods for measurement and calibration of various measuring devices

CO- PO Mapping
(3/2/1indicatesstrengthofcorrelation)3-Strong,2-Medium,1-Weak

COs	Programme Outcomes(POs)												PSOs		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	3	2	1	1	2	1				1		2		2	
CO2	3	2	1	1		1				1		3		1	
CO3	2	2		1		1				1				2	
CO4	2	1			1							3		1	
CO5	2	2			1	1				1	1	2		1	

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. V Semester		
Code:A0325	COMPUTER AIDED MODELING LABORATORY	L	T	P
Credits:1		-	-	2

Prerequisites: Engineering Graphics

Course Objectives:

To draft the simple machine elements and assembly drawings of typical machine parts such as, Couplings, Screw jack, Plummer block etc. by drafting and modeling software.

Demonstration & Exposure

Practice dimensioning conventions, its components & drafting objects to scale, different machine elements and finishing symbols, Drafting of regular solids - cube, prism, pyramid, cylinder and cone.

List of Experiments

Any Six exercises from each section.

Part A

1. Drafting development of surface of regular solids
2. Drafting of Machine components – Hexagonal Nuts, bolts and washer Assembly
3. Drafting of Riveted Joints
4. Isometric Drawing of simple components
5. Generation of various 3D model through Extrude
6. Generation of 3D models through revolve
7. Generation of 3D models though Blend and Sweep

Part B

1. Modeling and Assembly of Gear train – Simple, Compound.
2. Modeling and Assembly of Knuckle Joint
3. Modeling and Assembly of universal coupling
4. Modeling and Assembly of Connecting rod
5. Modeling and Assembly of cylinder head
6. Modeling and Assembly of Piston
7. Modeling and Assembly of Plummer block
8. Modeling and Assembly of Lathe Single point cutting tool post

Course Outcomes:

After completing the course the students will be able to

1. Draft machine elements and dimension various components using drafting software
2. Complete the machine components like screw heads, studs bolts set screws in drafting software
3. Able to draft machine parts like Knuckle Joint and riveted joints with standard bolted joints using drafting software
4. Able to Model and assembling of engine parts by using modeling software
5. Able to Model and assembling of machine parts by using modeling software

CO- PO Mapping (3/2/1indicatesstrengthofcorrelation)3-Strong,2-Medium,1-Weak															
COs	**Programme Outcomes(POs)**												**PSOs**		
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO1 2**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	**2**		**1**		**3**			**1**	**2**	**3**		**2**	**3**		
CO2	**2**		**1**		**3**			**1**	**2**	**3**		**2**	**3**		
CO3	**2**		**1**		**3**			**1**	**2**	**3**		**2**	**3**		
CO4	**2**		**1**		**3**			**1**	**2**	**3**		**2**	**3**		
CO5	**2**		**1**		**3**			**1**	**2**	**3**		**2**	**3**		

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. V Semester		
Code:A0562	Fundamentals of Database Management Systems Lab	L	T	P
Credits: Nil	(Common for CE, EEE, ME, ECE, MiE) *(Open Elective)*	2	-	-

Prerequisites: NIL

Course Objectives: This course enables the students to practice the concepts learnt in the subject DBMS by developing a database for an example project. The student is expected to practice the querying a relational database i.e., "Mysql" with various functionalities of SQL and PL/SQL statements using a sample database.

Sample Database:

Railway Reservation System -(Redesigning IRCTC database)
Train (train Number, name, source, destination, start_time, reach_time, traveltime, distance, class, days, type)
Ticket (PNRNo, Transactionid, from_station, To_station, date_of_journey, class date_of_booking, total_ticket_fare, train number)
Passenger (PNR No, Serial no, Name, Age, Reservation_status)
Train_Route(Train_No, route_no, station_code, name, arrival_time, depart_time, distance, day)
Train_Ticket_fare(Train_No, class, base_fare, reservation_charge, superfast_charge, other_charge, tatkal_charge, service_tax)

List of experiments:

1	SQL Data Definition Language Commands: Create all the tables specified above. Make underlined columns as primary key. (use number, number(m,n), varchar(n), date, time, timestamp data types appropriately) Insert at least 5 rows to each table. (Check www.irctc.co.in website for actual data)
2	SQL Data Manipulation Language Commands: 1. Change the name of the Passenger table to Passenger_Details. 2. List all train details. 3. List all passenger details. 4. Give a list of trains in ascending order of number. 5. List the senior citizen passengers details. 6. List the station names where code starts with 'M'. 7. List the trains details within a range of numbers. 8. Change the super fast charge value in train fare as zero, if it is null. 9. List the passenger names whose tickets are not confirmed. 10. Remove all the rows from Passenger table permanently.
3	Create (Alter table to add constraint) the necessary foreign keys by identifying the relationships in the table. 1) Add a suitable constraint to train table to always have train no in the range 10001 to 99999. 2) Add a suitable constraint for the column of station name, so that does not take duplicates. 3) Change the data type of arrival time, depart time (date -> timestamp or timestamp to date), and do the necessary process for updating the table with new values. 4) Add a suitable constraint for the class column that it should take values only as 1A, 2A, 3A, SL, C.

	5) Add a not null constraint for the column distance in train_route.
4	Designing Employee Database with MySQL (Create and insert data in EMP table, DEPT table and SALGRADE table)
5	Multi row functions, GROUP By clause, HAVING clause, ORDER BY clause in SQL on sample database.
6	Use Join Query 1. Find the train names that stop in 'Katpadi'. 2. Find the train names that are superfast and the service tax is zero. 3. Find the Passenger name (and train name) who have booked for the train that starts from 'Chennai'. 4. Display the trains names, each type of class and the total fare for each type of class. 5. Display all the train details and the ticket details (if booked any).
7	Use Nested Query(in Operators) 1. Find the train names that stop in 'Warangal'. 2. Find the train names that are superfast and the service tax is zero. 3. Find the Passenger name who have booked for the train that starts from 'Secunderabad'. 4. Find the trains names that have all the AC coaches and the base fare is less than 3000 for each case.
8	Create sample Views and practice basic operation
9	Write a PL/SQL procedures to practice Conditional Statements
10	Write a PL/SQL procedures to practice Iterative Statements
11	Implementing simple trigger
12	Implementing simple cursor

Textbooks:

1. Database Management Systems, Raghurama Krishnan, Johannes Gehrke, Tata Mc Graw Hill 3rd Edition
2. Database System Concepts, Silberschatz, Korth, Mc Graw hill, V edition.

References:

1. Database Systems design, Implementation, and Management, Peter Rob & Carlos Coronel, 7th Edition.
2. SQL The Complete Reference, James R. Groff, Paul N. Weinberg, 3rd Edition,
3. Oracle for Professionals, The X Team, S. Shah and V. Shah, SPD.
4. Database Systems Using Oracle: A Simplified guide to SQL and PL/SQL, Shah, PHI.

CO- PO Mapping (3/2/1indicatesstrengthofcorrelation)3-Strong,2-Medium,1-Weak															
COs	**Programme Outcomes(POs)**												**PSOs**		
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	**2**	**2**	**2**												
CO2		**2**	**2**										**1**	**2**	
CO3	**2**	**2**	**2**	**3**										**2**	**2**
CO4															
CO5															

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. V Semester		
Code: A00M3	Quantitative Aptitude and Verbal Reasoning-I	L	T	P
Credits: 0		2		-

Prerequisites: NIL

Module – I

Quants: Percentages, Profit and Loss.

- **Percentages-** Percentage Increase/Decrease; Results on Population; Results on Depreciation.
- **Profit & Loss-**Cost Price; Selling Price: Profit or Gain; Gain Percentage; Loss Percentage.

Verbal: Articles, Para Jumbles

- **Articles-** Types of articles, Countable nouns, Uncountable nouns, Usage of articles, Omission of articles.
- **Para Jumbles-** Para Jumbles, Types of Para Jumbles, Strategies to answer questions on Jumbled Paragraphs.

Logical: Data Arrangements, Blood Relation

- **Data Arrangements-** Linear Arrangement, Circular Arrangement, Multi-Dimensional Arrangement.
- **Blood Relations-** Classification of blood relations, Pointing a person, Equation related problems.

Module – II

Quants: Interests

- **Interests-**Types of interest; Simple interest; principle; Rate of interest; compound interest; interest is compounded Annually; interest is compounded Half-yearly; interest is compounded Quarterly; Rates are different for different years, say R1%, R2%, R3% for 1^{st}, 2^{nd} and 3^{rd} year respectively; Present worth of Rs. x due n years.

Verbal: Sentence Completion, Prepositions

- **Sentence Completion-** Formats of Question; Strategies to solve sentence completion questions- Proactive and reactive solving, Identifying clues- Signposts, Types of signposts, Root words, Sentence structure clues.
- **Prepositions-** Definition, Types of prepositions, Preposition of Place, Preposition of Time, Preposition of Direction, Compound Prepositions, Prepositional Phrases.

Logical: Coding and Decoding

- **Coding and Decoding-**Number Series, Alphabet Series, Analogy, Odd Man Out, Visual Reasoning.

Module–III

Ratios & Proportion-The ratio of two quantities a and b in the same units; Proportion; The equality of two ratios is called proportion; Fourth Proportional; Mean Proportional; Comparison of Ratios; Duplicate Ratios; Variations.

- **Averages-** Average Speed, Weighted average

Verbal: Vocabulary

- **Vocabulary-**Etymology, Root Words, Prefixes and Suffixes; Synonyms and Antonyms, Tips to solve questions on Synonyms and Antonyms; Word Analogy, Patterns of questions on Word Analogy; Miscellaneous Vocabulary.

Logical: Data Interpretation and Data Sufficiency

- **Data Interpretation-** Tables, Pie charts, Bar Graphs, Line graphs
- **Data Sufficiency-**Strategies to solve.

Module – IV **[**

Quants: Time and Work;

- **Time & Work-** Work from Days: Calculate the one-day work; Days from Work: Shortcut to calculate the work in given time;

Verbal: Sentence Correction

- **Sentence Correction-** Subject-Verb Agreement; Modifiers; Parallelism; Pronoun-Antecedent Agreement; Verb Time Sequence; Comparisons; Determiners; Exercise Questions.

Logical: Clocks and Calendars

- **Clocks:**Introduction, Derivation of angles, Angles between hands of the clock, Hands together, Hands at angular distance, Gain & Loss problems.
- **Calendars:** - Leap year-Non leap year, Odd days, Finding the day from date, Repeated years.

Module - V:

Quants: Mixtures and Alligations;

- **Alligation**- Mean Price; Rule of Alligation; a container contains x of liquid from which y units are taken out and replaced by water;

Verbal: Reading Comprehension, Critical Reasoning

- **Reading Comprehension-** Speed reading strategies; Reading Comprehension - types of questions, tackling strategies; Critical Reasoning.

Logical: Directions, Cubes, Syllogisms

- **Directions -**Introduction, Direction based questions, Shadow based problems.
- **Cubes**- Cube & cuboid concepts, 3-2-1-0 faced problems.
- **Syllogisms**- Statements and Conclusion, Syllogisms using Venn Diagrams.

Co-Po mapping

:

CO- PO Mapping (3/2/1indicatesstrengthofcorrelation)3-Strong,2-Medium,1-Weak															
COs	**Programme Outcomes(POs)**												**PSOs**		
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	**2**	**2**	**2**												
CO2		**2**	**2**										**1**	**2**	
CO3	**2**	**2**	**2**	**3**										**2**	**2**
CO4															
CO5															

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech.		
Code:A00M5	Introduction to Cyber Security (Common for CE, EEE, ME, ECE, MiE) *(Open Elective)*	L	T	P
Credits: Nil		2	-	-

Prerequisites: NIL

Course objectives:

- To familiarize various types of cyber-attacks and cyber-crimes
- To give an overview of the cyber laws
- To study the defensive techniques against these attacks

Module - I

Introduction to Cyber Security: Basic Cyber Security Concepts, layers of security, Vulnerability, threat, Harmful acts, Internet Governance – Challenges and Constraints, Computer Criminals, CIA Triad, Assets and Threat, motive of attackers, active attacks, passive attacks, Software attacks, hardware attacks, Spectrum of attacks, Taxonomy of various attacks, IP spoofing, Methods of defense, Security Models, risk management, Cyber Threats-Cyber Warfare, Cyber Crime, Cyber terrorism, Cyber Espionage, etc., Comprehensive Cyber Security Policy.

Module - II

Cyberspace and the Law & Cyber Forensics: Introduction, Cyber Security Regulations, Roles of International Law. The INDIAN Cyberspace, National Cyber Security Policy.
Introduction, Historical background of Cyber forensics, Digital Forensics Science, The Need for Computer Forensics, Cyber Forensics and Digital evidence, Forensics Analysis of Email, Digital Forensics Lifecycle, Forensics Investigation, Challenges in Computer Forensics, Special Techniques for Forensics Auditing.

Module - III

Cybercrime: Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops.

Module - IV

Cyber Security: Organizational Implications: Introduction, cost of cybercrimes and IPR issues, web threats for organizations, security and privacy implications, social media marketing: security risks and perils for organizations, social computing and the associated challenges for organizations.
Cybercrime and Cyber terrorism: Introduction, intellectual property in the cyberspace, the ethical dimension of cybercrimes the psychology, mindset and skills of hackers and other cyber criminals.

Module - V

Privacy Issues: Basic Data Privacy Concepts: Fundamental Concepts, Data Privacy Attacks, Data linking and profiling, privacy policies and their specifications, privacy policy languages, privacy in different domains- medical, financial, etc.

Cybercrime: Examples and Mini-Cases

Examples: Official Website of Maharashtra Government Hacked, Indian Banks Lose Millions of Rupees, Parliament Attack, Pune City Police Bust Nigerian Racket, e-mail spoofing instances.

Mini-Cases: The Indian Case of online Gambling, An Indian Case of Intellectual Property Crime, Financial Frauds in Cyber Domain.

TEXT BOOKS:

1. Nina Godbole and Sunit Belpure, Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley
2. B. B. Gupta, D. P. Agrawal, Haoxiang Wang, Computer and Cyber Security: Principles, Algorithm, Applications, and Perspectives, CRC Press, ISBN 9780815371335, 2018.

REFERENCES:

1. Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press.
2. Introduction to Cyber Security, Chwan-Hwa(john) Wu,J. David Irwin, CRC Press T&F Group.

Course Outcomes: The students will be able to understand cyber-attacks, types of cybercrimes, cyber laws and also how to protect them self and ultimately the entire Internet community from such attacks.

CO- PO Mapping (3/2/1indicatesstrengthofcorrelation)3-Strong,2-Medium,1-Weak															
COs	**Programme Outcomes(POs)**												**PSOs**		
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	**2**	**-**	**-**												
CO2	**-**	**2**	**2**										**1**	**2**	
CO3	**2**	**2**	**2**	**3**											
CO4	**2**	**2**	**2**	**2**										**2**	**2**
CO5	**1**	**2**													

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. VI Semester		
Code:A0H10	INDUSTRIAL MANAGEMENT (Common for CE, ME &Min.E)	L	T	P
Credits: 3		3	-	-

Prerequisites: Nil

Course Objectives:

Through reading the text, references and discussion of cases students should be able to understand the fundamentals underlying the management of an organization and Industrial Management.

MODULE – I Introduction to Management

A. **Introduction to Management:** Entrepreneurship and organization, Concepts of Management, nature, importance and Functions of Management, Taylor's Scientific Management Theory, Systems Approach to Management, Fayol's Principles of Management,: Mayo's Hawthorne Experiments.
B. **Management Theories:** Maslow's Theory of Human Needs, Douglas McGregor's Theory X and Theory Y, Herzberg's Two-Factor Theory of Motivation, Leadership Styles, Corporate Social responsibility.

MODULE – II Organizational Structures and Types

A. **Organizational Structures:** Basic concepts related to Organization - Departmentation and Decentralization, Types of mechanistic and organic structures of organization
B. **Types of Organizations:** Line organization, Line and staff organization, functional organization, committee organization, matrix organization, Virtual Organization, Cellular Organization, team structure, boundary less organization, inverted pyramid structure, lean and flat Organization structure.

MODULE – III Operations Management

A. **Operations Management**: Objectives- product design process- Process selection-Types of production system (Job, batch and Mass Production), Plant location-factors- Urban-Rural sites comparison.
B. **Plant layout:** Types of Plant Layouts- Design of product layout- Line balancing (RPW method) Value analysis-Definition-types of values- Objectives- Phases of value analysis-Fast diagram

MODULE – IV Work Study and Statistical Quality Control

A. **Work Study:** Introduction, definition, objectives, steps in work study, Method study, definition, objectives, and steps of method study. Work Measurement, purpose, types of study, stop watch methods, steps, key rating, allowances, standard time calculations, work sampling.
B. **Statistical Quality Control:** variables-attributes, Shewart control charts for variables-chart, R chart, – Attributes-Defective-Defect- Charts for attributes-p-chart -c chart (simple Problems), acceptance Sampling- Single sampling- Double sampling plans-OC curves, Deming's contribution to quality.

MODULE – V Project Management and contemporary practices

A. **Project Management (PERT/CPM):** Network Analysis, Programme Evaluation and Review Technique (PERT), Critical Path Method (CPM), Identifying critical path, Probability of completing the project within given time, Project Cost Analysis, Project Crashing. (Simple problems)

B. **Contemporary Management Practices:** Basic concepts of ERP, Just-In-Time (JIT) System, Total Quality Management (TQM), Six sigma, Capability Maturity Model (CMM), Bench marking, Balanced Score card.

TEXT BOOKS:

1. Aryasri: ***Management Science,*** 4th edition, TMH, 2004.(UNITS I,II,III,IV,V)
2. Stoner, Freeman, Gilbert, ***Management,*** **6th** Ed, Pearson Education, New Delhi, 2004. (UNITS I,II)

REFERENCES*:*

1. Kotler Philip & Keller Kevin Lane, **"Marketing Management"**, PHI, 12th edition, 2005
2. Koontz &Weihrich, **"Essentials of Management"**, TMH, 6th edition, 2005.
3. Panneerselvam**" Production and Operations Management"** PHI,2012.
4. Memoria & S.V. Gauker, **"Personnel Management"**, Himalaya, 25th edition, 2005
5. Samuel C. Certo, **"Modern Management"**, PHI, 9th edition, 2005.

E- RESOURCES:

1.http://www.learnerstv.com/Free-Management-Video-lectures-ltv656-age1.htm
2.http://www.learnerstv.com/Free-Management-Video-lectures-ltv728-age1.htm
3.http://freevideolectures.com/Course/2371/Project-and-Production-management
4. Journal of Management
5. Asia Pacific Journal of research in Business management
6. Journal of Management Development,
7. Journal of Management And Organization.
8.http://nptel.ac.in/courses/110106044/

Course Outcomes:

At the end of the course students will be able to

1. Understand the various concepts, principles and theories of management.
2. Understand the structure of an organization through understanding various structures of organizations.
3. Analyze the basic concepts and processes of operations management and Quality control
4. Apply the basic concept of Human Resource Management and project management.
5. Understand the basics of strategic management and also learns various contemporary management practices.

CO- PO Mapping (3/2/1indicatesstrengthofcorrelation)3-Strong,2-Medium,1-Weak															
COs	**Programme Outcomes(POs)**												**PSOs**		
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO1 2**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	**3**					**1**			**2**			**3**	**3**		**3**
CO2	**3**					**1**	**3**	**3**	**3**			**3**			**3**
CO3	**3**					**2**	**1**	**1**	**1**		**3**	**3**	**3**		**3**
CO4	**3**	**1**	**3**	**1**		**3**		**1**	**2**	**1**	**3**	**2**	**2**		**3**
CO5	**3**			**2**		**2**			**2**		**1**	**3**	**2**		**3**

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. VI Semester		
Code:A0331	DESIGN OF MACHINE MEMBERS – II	L	T	P
Credits: 3		3	-	-

Prerequisites: Design of Machine Members-I

Course Objectives:

The objective of this subject is to provide analytical knowledge of designing bearings, engine components, machine members and power transmissions systems.

MODULE I: Bearings

Sliding Contact Bearings: Types of Journal bearings – Basic modes of Lubrication – Bearing construction –bearing design –bearing materials – Selection of Lubricants. sommerfeld number Rolling Contact Bearings: Types of Rolling Contact bearings – Selection of bearing type – Selection of Bearing life – Design for cyclic loads and speeds – Static and Dynamic loading of ball & roller bearings.

MODULE II: Design of IC Engine Parts

Connecting Rod: Thrust in connecting rod – stress due to whipping action on connecting rod ends –Crank Shaft: Cranks and Crank shafts, strength and proportions of over hung and center cranks – Crank pins, Crank shafts. Piston: Pistons, forces acting on piston construction design and proportions of piston. Cylinder: Cylinder, cylinder liners.

MODULE III: Power Transmissions Systems - Belts, Ropes, Pulleys & Chains

A: Belts: Transmission of power by Belt and Rope drives, Transmission efficiencies. Belts Flat and V types.

B: Ropes, Pulleys & Chains: Rope pulleys for belt and rope drives, Materials, Chain drives.

MODULE IV: Gear Drives – Spur, Helical and Bevel Gear Drives

Spur Gear Drives: Spur gears- gear terminology –tooth profiles-Load concentration factor – Dynamic load factor. Surface compressive strength – Bending strength – Design analysis of spur gears – Estimation of centre distance, Module and face width, check for plastic deformation. Check for dynamic and wear considerations.

Helical and Bevel Gear Drives: Introduction of Helical and Bevel gears – Load concentration factor – Dynamic load factor. Surface compressive strength – Bending strength – Design analysis of Helical and Bevel gears – Estimation of centre distance, Module and face width, check for plastic deformation. Check for dynamic and wear considerations.

MODULE V: Design of Worm Gears & Power Screws

Design of Worm Gears: Worm gears – Properties of Worm gears – Selection of materials – Strength and wear rating of worm gears – Force analysis – Friction in worm gears – thermal considerations.

Design of Power Screws: Design of screw, Square ACME, Buttress screws, design of nut, compound screw, differential screw, ball screw- possible failures.

TEXT BOOKS

1. V.B. Bhandari "**Machine Design",** Tata McGraw-Hill Education, 1994.
2. R S khurmi& J S Gupta "**Machine Design",** S Chand Publishers, 25th edition 2005.

REFERENCES

1. R.N. Norton "**Machine Design",** Penton IPC, 2000.
2. Kannaiah "**Machine Design",** Scietech Publishers, 2010 .
3. S MD Jalaludin "**Machine Design",** Anuradha Publishers
4. JE Shigley "**Mech. Engg. Design",** Tata McGraw-Hill Education, 6th edition, 2001
5. Data Books: (I) P.S.G. College of Technology (ii) Mahadevan, CBS publishers, 4th edition 2013.

E - RESOURCES

1. www.globalspec.com › ... › POWER TRANSMISSION › GEARS
2. nptel.ac.in/courses/112106137/pdf/2_15.pdf
3. nptel.ac.in/courses/112106137/pdf/5_1.pdf
4. mechanicaldesign.asmedigitalcollection.asme.org/article.aspx?articleid=1452606
5. https://www.youtube.com/watch?v=ePVReO5pRvU
6. https://www.youtube.com/watch?v=8bml2pK6Ra0

Course Outcomes

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

1. Understand the bearings &its applications.
2. Design and analyze the performance of IC engine parts.
3. Analyze the power transmission in belt rope & chain drives.
4. Analyze design performance of spur gear drives, helical and bevel gear drives.
5. Analyze design performance of warm gears.

CO- PO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	ProgrammeOutcomes(POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1									1	2		
CO2	2	2	1									1	2		
CO3	2	2	1				1					1	2		
CO4	2	2	1				1					1	2		
CO5	2	2	1				1					1	2		

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. VI Semester		
Code:A0332	HEAT TRANSFER	L	T	P
Credits: 3	*(Use of Standard HMT data book is permitted)*	3	-	-

Prerequisites: Thermal Engineering – I

Course Objectives:

The objective of the course is to provide knowledge of different modes of heat transfer and their applications.

MODULE I: Introduction& 1D Steady State Heat Conduction

Introduction: Modes and mechanisms of heat transfer–Basic laws of heat transfer–General discussion about applications of heat transfer.

Conduction Heat Transfer: Fourier rate equation–General heat conduction equation in Cartesian, Cylindrical and Spherical coordinates. Simplification and forms of the field equation – steady, unsteady and periodic heat transfer – Initial and boundary conditions.

One Dimensional Steady State Conduction Heat Transfer: Homogeneous slabs, hollow cylinders and spheres – overall heat transfer coefficient – electrical analogy – Critical radius of insulation.

MODULE II: Extended surfaces & 1D Transient Heat Conduction

One Dimensional Steady State Conduction Heat Transfer: Variable Thermal conductivity– systems with heat sources or Heat generation. Extended surface (fins) Heat Transfer – Long Fin, Fin with insulated tip and Short Fin, Application to error measurement of Temperature.

One Dimensional Transient Conduction Heat Transfer: Systems with negligible internal resistance – Significance of Biot and Fourier Numbers - Chart solutions of transient conduction systems.

MODULE III: Fundamentals of Convective heat transfer & Forced convection

A: Convective Heat Transfer : Classification of systems based on causation of flow, condition of flow, configuration of flow and medium of flow – Dimensional analysis as a tool for experimental investigation –Buckingham Pi Theorem and method, application for developing semi – empirical non- dimensional correlation for convection heat transfer – Significance of non-dimensional numbers – Concepts of Continuity, Momentum and Energy Equations.

B: Forced convection: External Flows: Concepts about hydrodynamic and thermal boundary layer and correlations for convective heat transfer -Flat plates, Cylinders and spheres. Internal Flows: Concepts of Hydrodynamic and Thermal Entry Lengths –Flow through the pipes and ducts–Use of empirical relations for Pipe Flow and annulus flow.

MODULE IV: Natural Convection, Boiling and Condensation

Free Convection: Development of Hydrodynamic and thermal boundary layer along a vertical plate –heat transfer coefficient- Empirical relations for Vertical plates and pipes-Horizontal plates, cylinders and spheres.

Boiling: Pool boiling–Regimes, heat transfer correlations for Nucleate boiling, Critical Heat

flux and Film boiling.

Condensation: Film wise and drop wise condensation–Nusselt's Theory of Condensation for vertical plate - Film condensation on vertical and horizontal cylinders using empirical correlations.

MODULE V: Heat Exchangers & Radiation Heat Transfer

Heat Exchangers: Classification of heat exchangers–overall heat transfer Coefficient and fouling factor – Concepts of LMTD and NTU methods - Problems using LMTD and NTU methods-effectiveness of heat exchanger.

Radiation Heat Transfer: Principle and laws of radiation–Irradiation – emissivity- black and white body- total and monochromatic quantities– Radiation heat exchange between the surfaces – concepts of shape factor – reciprocity theorem – Emissivity – heat exchange between grey bodies use of electrical analogy for radiation heat exchange– radiation shields.

TEXT BOOKS

1. R.C.Sachdeva, **"Fundamentals of Engg. Heat and Mass Transfer**, New Age International, 2010.
2. C.P.Kothandaraman, **"Fundamentals of Heat and Mass Transfer",** New Age International Publishers, 2012.

REFERENCES

1. Frank P. Incropera, David P. Dewitt, Therodre L Bergman & Adrienne S. Lavene, **"Fundamentals of Heat Transfer & Mass Transfer",** Wiley India Pvt. Ltd., 7th edition, 2011.
2. P.K.Nag, **"Heat Transfer",** TMH Publications, 2011.
3. Ghoshdastidar, **"Heat Transfer",** Oxford University Press, 2nd Edition 2008.
4. YunvsCengel and AfshinGhajar ,**"Heat and Mass Transfer"**, McGraw Hill Publications, 2011.
5. R S Yadav, **"Heat and Mass Transfer",** Centre Publishing House, 1992.

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1. http://wins.engr.wisc.edu/teaching/mpfBook/node26.html
2. http://wins.engr.wisc.edu/teaching/mpfBook/node8.html
3. http://nptel.ac.in/courses/112101097/4
4. http://nptel.ac.in/courses/112101097/6
5. http://nptel.ac.in/courses/112101097/10
6. http://nptel.ac.in/courses/112101097/18

Course Outcomes

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

1. Apply the concepts of conduction heat transfer to determine heat transfer parameters for different solids with different initial and boundary conditions.
2. Analyze the cases of convective heat transfer and understand the significance of non-dimensional numbers.
3. Apply the forced and natural convection correlations to analyze the impact of heat transfer parameters.
4. Apply the principles of conduction and convection heat transfer to analyze phase change heat

transfer and design heat exchangers

5. Analyze different aspects and parameters of radiation heat transfer using relevant laws.

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak															
COs	**Programme Outcomes(POs)**												**PSOs**		
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	**1**	**3**	**2**					**1**	**2**	**1**			**2**		
CO2	**1**	**3**	**2**					**1**	**2**	**1**			**2**		
CO3	**1**	**2**						**1**					**2**		
CO4	**1**	**2**				**2**	**2**	**1**					**2**		
CO5	**1**	**3**	**2**			**2**	**2**	**1**	**2**	**1**		**1**	**2**		**2**

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. VI Semester		
Code:A0333	CAD / CAM / CIM	L	T	P
Credits: 3		3	-	-

Prerequisites: Machine drawing and Metal cutting and Machine Tools

Course Objectives:

The objective of the this subject is to enable the students to understand and handle design problems, 2D drafting and 3D modeling software systems, manual part programming, NC and CNC machines, group technology, FMS and computer aided quality control.

MODULE I: Introduction to Computers & Computer Graphics

Basics of Computers: Computers in Industrial Manufacturing, Product cycle, CAD / CAM Hardware- Basic structure, CPU, Memory types, input devices, display devices, hard copy devices and storage devices.

Computer Graphics: Raster scan graphics - Line Algorithms, coordinate system, database structure for graphics modeling, transformation of geometry, 2D & 3D transformations, mathematics of projections, clipping, hidden surface removal.

MODULE II: Geometric Modeling

Geometric modeling: Requirements, geometric modeling, geometric construction methods. Wireframe modeling, Curve representation methods, Surface representation methods, Solid representation Methods-CSG, B-rep, modeling facilities desired.

MODULE III: Drafting and Modeling Systems & Numerical Control

A: Drafting and Modeling Systems: Basic geometric commands, layers, display control commands, editing, dimensioning and solid modeling.

B: Numerical control: NC, NC modes, NC elements, NC machine tools, structure of CNC machine tools, features of Machining center, turning center, CNC Part Programming fundamentals, manual part programming methods, Computer Aided Part Programming.

DNC –Components, types, functions and advantages.

MODULE IV: Group Technology and FMS

Group Technology: Part family, coding and classification, production flow analysis, advantages and limitations. Computer Aided Processes Planning- Retrieval type and Generative type.

Flexible Manufacturing Systems: Introduction of FMS, FMS equipments, Material handling and control systems Advantages and limitations of FMS.

MODULE V: Computer Aided Quality Control & Computer Integrated Manufacturing Systems

Computer Aided Quality Control: Terminology in quality control, the computer in QC, contacts inspection methods, noncontact inspection methods-optical and non optical. Computer aided testing, integration of CAQC with CAD/CAM.

Computer Integrated Manufacturing Systems: Types of Manufacturing systems, Machine tools and related equipment, computer control systems, and human labor in the manufacturing systems, CIMS benefits. Introduction, working principle of 3D printing.

TEXT BOOKS

1. Mikell P.Groover,E. Zimmers, "**CAD/CAM",** Pearson education, Inc. Twelfth impression, 2013.
2. P.N. Rao, "**CAD/CAM** - Principles and applications", 3rdEdition, Tata McGraw-Hill Education Pvt. Ltd., 2010.

REFERENCES

1. Ibrahim Zeid& R. Sivasubramanian, "**CAD / CAM Theory and Practice**", 2ndEdition, Tata Mcgraw Hill, 2009.
2. P. Radhakrishnan, S. Subramanian and VRaju, "**CAD / CAM / CIM**", 4rd Edition, New Age Publishers, 2016.
3. Groover, "**Automation, Production systems & Computer integrated Manufacturing**", Pearson Education, 4rd edition, 2016.
4. Chennakesava R. Alavala "**CAD/CAM Concepts and applications"**, PHI learning Private limited , 2009.
5. Farid Amirouche, "**Principles of Computer Aided Design and Manufacturing**", Pearson Prentice Hall, 2004.

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2. http://iare.ac.in/sites/default/files/lecture_notes/merged%20cad-cam%20lecture%20notes%2026-9-15_0.pdf
3. https://www.journals.elsevier.com/computer-aided-design/
4. https://www.slideshare.net/AbhayGore/mcq-for-cadcam
5. http://nptel.ac.in/courses/112102101/
6. https://www.youtube.com/watch?v=EgKc9L7cbKc&list=PLC3EE33F27CF14A06

Course Outcomes

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

1. Understand the fundamentals of computer aided drafting, design & manufacturing, 2D & 3D transformations.
2. Understanding wire frame modeling, surface & solid modeling Techniques and parametric & non parametric representation of curves and surfaces.
3. Understanding about Drafting system, NC & CNC and to write part programming for CNC Machines.
4. Identify part families and know about group technology , manufacturing systems and

CAPP.

5. Understand basics of Computer Aided Quality Control &Identify the various elements and their activities in the Computer Integrated Manufacturing Systems.

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak															
COs	**ProgrammeOutcomes(POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1			**2**		**2**				**2**	**2**		**1**		**3**	
CO2	**1**	**1**	**2**	**1**	**3**				**2**	**2**		**2**	**1**	**1**	**2**
CO3	**2**	**1**	**3**	**1**	**3**				**2**	**2**		**1**		**3**	**2**
CO4	**2**		**2**	**2**	**3**				**2**	**2**		**2**		**3**	
CO5	**1**		**3**		**3**				**2**	**3**		**2**		**3**	**3**

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. VI Semester		
Code: A0337	AUTOMOBILE ENGINEERING (Professional Elective – II)	L	T	P
Credits: 3		3	-	-

Prerequisites: Nil

Course Objectives:

The objective of this subject is to provide knowledge about various systems involved in automobiles.

MODULE I: Introduction, Fuel System & C.I. Engines

Introduction : Components of four wheeler automobile – chassis and body – Types of chassis - power unit –power transmission – rear wheel drive, front wheel drive, 4 wheel drive – types of automobile engines, engine construction, turbo charging and super charging – engine lubrication, splash and pressure lubrication systems, oil filters, oil pumps – crank case ventilation – engine service, re boring, de carbonization, nitriding of crank shaft.

Fuel System: S.I. Engine: Fuel supply systems, Mechanical and electrical fuel pump – filters – carburetor – types – air filters – petrol injection. C.I. Engines: Requirements of diesel injection systems, types of injection systems, fuel pump, nozzle, spray formation, injection timing, testing of fuel pumps.

MODULE II: Cooling System & Ignition System

Cooling System : Cooling Requirements, Air Cooling, Liquid Cooling, Thermo, water and Forced Circulation System – Radiators – Types – Cooling Fan - water pump, thermostat, evaporating cooling – pressure sealed cooling – antifreeze solutions.

Ignition System: Function of an ignition system, battery ignition system, constructional features of storage, battery, auto transformer, contact breaker points, condenser and spark plug – Magneto coil ignition system, electronic ignition system using contact breaker, electronic ignition using contact triggers – spark advance and retard mechanism.

MODULE III: Emission, Electrical System & Safety Electronics

A: Emission from Automobiles: Pollution standards National and international – Pollution Control – Techniques – Multipoint fuel injection for SI Engines. Common rail diesel injection Energy alternatives – Solar, Photo-voltaic, hydrogen, Biomass, alcohols, LPG, CNG, liquid fuels and gaseous fuels, electrical-their merits and demerits.

B: Electrical System: Charging circuit, generator, current – voltage regulator – starting system, bendix drive mechanism solenoid switch, lighting systems, Horn, wiper, fuel gauge – oil pressure gauge. Safety electronics: electronics circuit airbag, anti slip regulation (ASR), electronic stability programs (ESP).

MODULE IV: Transmission System

Transmission System: Clutches, principle, types, cone clutch, single plate clutch, multi plate clutch,

magnetic and centrifugal clutches, fluid fly wheel – gear boxes, types, sliding mesh, construct mesh, synchro mesh gear boxes, epicyclic gear box, over drive torque converter. Propeller shaft – Hotch – Kiss drive, Torque tube drive, universal joint, differential rear axles – types – wheels and tyres.

MODULE V: Suspension, Braking & Steering System

Suspension System: Objects of suspension systems – rigid axle suspension system, torsion bar, shock absorber, Independent suspension system, active and passive suspensions, magnetic dampers. Braking System: Mechanical brake system, Hydraulic brake system, Master cylinder, wheel cylinder tandem master cylinder Requirement of brake fluid, Pneumatic and vacuum brakes, antilock braking systems (ABS) and EBS.

Steering System: Steering geometry – camber, castor, king pin rake, combined angle toe - in, center point steering. Types of steering mechanism – Ackerman steering mechanism, Davis steering mechanism, steering gears – types, steering linkages, power steering.

TEXT BOOKS

1. Kirpal Singh, "**Automobile Engineering", Vol.1 & 2**, Seventh Edition, Standard Publishers, 1997.
2. Jain K.K. and Asthana. R.B, "**Automobile Engineering**" Tata McGraw Hill Publishers, 2002.

REFERENCES

1. Newton, Steeds and Garet, "**Motor Vehicles**", Butterworth Publishers,1989.
2. Joseph Heitner, "**Automotive Mechanics**," Second Edition, East-West Press, 1999.
3. Martin W, Stockel and Martin T Stockle , "**Automotive Mechanics Fundamentals**," The Good heart –Will Cox Company Inc, USA, 1978.
4. Heinz Heisler, "**Advanced Engine Technology**", SAE International Publications USA, 1998.
5. Ganesan V. "**Internal Combustion Engines**", Third Edition, Tata McGraw-Hill, 2007.

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1. https://ocw.mit.edu/courses/mechanical-engineering/2-61-internal-combustion-engines-spring-2008/
2. http://test.araiindia.com/index.php?option=com_content&view=article&id=36&Itemid=36
3. http://www.dli.ernet.in/handle/2015/205420
4. International Journal of Automotive Technology - http://www.springer.com/engineering/mechanical+engineering/journal/12239

Course Outcomes

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

1. Understand the various vehicle structure and Components of IC engine.
2. Gain Knowledge in various auxiliary systems used in an automobile.
3. Understand the principle and application of Transmission systems in an automobile.
4. .Demonstrate the use of steering, braking and suspension systems in an automobile.
5. .Apply the advantages of various alternative energy sources.

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak															
COs	**Programme Outcomes(POs)**												**PSOs**		
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO5**	**PO 6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	**2**		**2**	**3**	**3**		**1**				**1**	**1**	**1**		
CO2	**3**	**3**	**2**	**3**	**3**		**1**				**1**	**1**	**1**		
CO3	**3**	**2**	**3**	**2**	**3**	**1**	**1**				**1**	**2**	**1**		
CO4	**2**	**3**	**3**	**3**	**3**	**1**	**1**						**2**	**2**	
CO5	**2**	**3**	**3**	**3**	**3**	**3**	**1**				**1**	**1**	**2**	**2**	

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. VII Semester		
Code:A0338	FINITE ELEMENT METHODS (Professional Elective – II)	L	T	P
Credits: 3		3	-	-

Prerequisites: Advanced Calculus

Course Objectives:

The objective of the course is to provide knowledge of formulate, apply and solving the engineering problems using the finite element methods.

MODULE I: Introduction to FEM

Introduction to FEM: basic concepts, historical back ground, application of FEM, general description, comparison of FEM With other methods. Weighted residual methods –general– comparisons – piecewise continuous trial functions example of a bar finite element –functional and differential forms – principle of stationary total potential – Rayleigh Ritz method – piecewise continuous trial functions – finite element method – application to bar element

MODULE II: One Dimensional Problems

General form of total potential for 1-D applications – generic form of finite element equations – linear bar element – quadratic element –nodal approximation – development of shape functions – element matrices and vectors – example problems – extension to plane truss– development of element equations – assembly – element connectivity – global equations – solution methods – beam element – nodal approximation – shape functions – element matrices and vectors – assembly – solution – example problems

MODULE III: Two Dimensional Problems

A:Introduction – approximation of geometry and field variable – 3 noded triangular elements – CST Elements – four noded rectangular elements – higher order elements – generalized coordinates approach to nodal approximations -– natural coordinates and coordinate transformations – triangular and quadrilateral elements.

B: Isoparametric elements – structural applications in 2D - elasticity equations –stress strain relations – plane problems of elasticity – element equations – assembly –need for quadrature – transformations to natural coordinates – numerical integration -Gaussian quadrature –problems axisymmetric problems-applications

MODULE IV: Applications in heat transfer & fluid mechanics

One dimensional heat transfer element – application to one-dimensional heat transfer problems-Plane wall, composite wall and fins -scalar variable problems in 2-Dimensions – Applications to 2D heat transfer problems– Application to problems in fluid mechanics in 1D and 2-D

MODULE V: Dynamic Analysis

Introduction – vibration problems – equations of motion based on weak form – longitudinal vibration of bars – transverse vibration of beams – consistent mass matrices

– element equations –solution of eigen value problems – vector iteration methods – normal

modes – transient vibrations – modeling of damping – mode superposition technique – direct integration methods

TEXT BOOKS

1. S.S.Rao, **"The Finite Element Methods in Engineering",** Elsevier Publishers, 5th edition, 2010.
2. Tirupati.KChandrupatla and Ashok. D. Belagunda**"Introduction to Finite Elements in Engineering",** Pearson Prentice Hall, 3rd edition, 2011 .

REFERENCES

1 Alavala**"Finite Element Methods",** PHI Publishers, 2008.
2 J.N.Reddy**"An Introduction to finite element methods"**, TMH Publishers, 3rd edition, 2005.
3 O.C.Zienkowitz, **"The Finite element method in engineering science",** McGrawhill Publishers, 2010.
4 Robert Cook **"Concepts and Applications of finite element analysis"** Wiley Publishers, 2009.

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1 http://icas.bf.rtu.lv/doc/Book.pdf
2 http://www.ceb.ac.in/knowledgecenter/EBOOKS/The%20Finite%20Element%20Method%20Vol1%20%20The%20Basis%20-%20R.%20Taylor.pdf
3 https://www.journals.elsevier.com/finite-elements-in-analysis-and-design/
4 http://www.sciencedirect.com/science/journal/0168874X
5 http://nptel.ac.in/courses/112104116/
6 http://nptel.ac.in/courses/112106135/

Course Outcomes

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

1. Obtain an understanding of the fundamental theory and the use of basic finite element method. And able to write down the basic equation for elasticity by different methods.
2. Develop the ability to solve the 1D and 2D problems using FEA for different types of loads.
3. Understand the problems and able to solve on beams. And able to write stiffness matrix for the given problems.
4. Develop and solve 2D and 3D problems related to CST and isoperimetric elements.
5. Understand the heat conduction in 1D and 2D elements for fins, thin plates, composite slabs. Able to perform dynamic analysis for bars and beams.

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak															
COs	**Programme Outcomes(POs)**												**PSOs**		
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	**1**		**2**		**3**	**2**		**1**				**2**	**2**		
CO2	**1**		**2**	**2**		**2**		**1**				**2**	**3**		
CO3	**1**		**2**	**3**		**2**		**1**	**2**			**2**	**3**		
CO4	**1**	**3**	**2**	**3**				**1**	**2**			**2**	**3**		
CO5	**1**		**2**		**3**	**2**		**1**	**2**			**2**	**3**		

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. VI Semester		
Code: A0339	SOLAR ENERGY UTILIZATION	L	T	P
Credits:3	(Professional Elective –II)	3	-	-

Prerequisites: Nil

Course Objectives:

To apply the concepts of solar energy utilization for various collection devices like collectors, PV Modules, etc.

MODULE I: Solar Resource

Solar Resource: Introduction, solar radiation spectra, solar geometry, Sun–Earth Geometric Relationship, observer Sun angles, solar day length, solar constant, solar radiation on titled surface, Extraterrestrial and TerrestrialSolar Radiation, Instruments for measuring solar radiation and sun shine.

MODULE II: Photovoltaic Conversion Systems

IntroductionCell PhysicsThe p–n JunctionSolar Cell EquationsCharacterization, Concentrating Solar Cells, Tandem Cells, Thin Film Technologies, Quantum Dots

Basic Module Electrical Concepts – PV Electrical Characteristics, PV Arrays,Photovoltaic System Sizing and Design

MODULE III: Performance Analysis of Flat Plate Collector

Introduction: Constructional Details of Flat Plate Collector, Performance Analysis, Transmissivity and absorptivity Product, Overall Heat loss Coefficient, Collector Efficiency, Transient Analysis,

Air Heaters: Performance Analysis of Conventional Air Heater, types of air heater, Testing Procedure.

MODULE IV: Performance Analysis of Concentrating Collector

Introduction: Flat plate collector with reflectors Cylindrical Parabolic Collector, Compound Parabolic Collector, Paraboloid Dish Collector, Heliostat, solar tower, Performance analysis of Parabolic Trough Collector, Overall heat loss coefficient.

MODULE V: Thermal Storage and other utilization

Thermal Storage: Introduction, Sensible Heat Storage, Latent Heat Storage, Thermochemical Heat Storage,

Wind Energy Utilization, Energy from Bio-mass, Wave Energy, Ocean Thermal Energy Conversion

TEXT BOOKS

1. S P Sukhatme, **"Solar Energy Principles of thermal Collection and Storage",** Tata McGraw Hill Publishing Company, second edition, 2010

2. P.C.Sharma, **"Power Plant Engineering"**, S.K.Kataria Publisher, 2013.

REFERENCES

1. P.K.Nag, "**Power Plant Engineering"**, TMH Publishers, II Edition, 2006.
2. ElWakil, **"Power station Engineering",**McHill Publisher, 2nd edtion, 2013.
3. G.D.Rai,**"An Introduction to Power Plant Technology",**Khanna Publishers,3rd edition, 2013.
4. Elanchezhian, **"Power plant Engg",** I.K. International Pub, 2007.
5. Rajput, "**A Text Book of Power Plant Engineering",** Laxmi Publications, 4th edition, 2007.

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2. *lecturenotes.in/note/1968/power-plant-engineering*
3. https://www.slideshare.net/.../power-plant-engineering-complete-five-unit-vtu-notes
4. www.scirp.org/journal/jpee/
5. https://www.irjet.net/archives/V2/i5/IRJET-V2I5185.pdf
6. *powerengineeringmagazine.com*

Course Outcomes

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

1. Explain the working of solar radiation measuring instruments
2. Evaluate the performance of PV modules
3. Evaluate the performance of flat plate collectors
4. Analyse the performance of concentrating collectors
5. Explain the principles of thermal storage and other utilization of solar energy

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak															
COs	**Programme Outcomes(POs)**												**PSOs**		
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO1 2**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	**1**		**2**		**3**	**2**		**1**				**2**	**2**		
CO2	**1**		**2**	**2**		**2**		**1**				**2**	**3**		
CO3	**1**		**2**	**3**		**2**		**1**	**2**			**2**	**3**		
CO4	**1**	**3**	**2**	**3**				**1**	**2**			**2**	**3**		
CO5	**1**		**2**		**3**	**2**		**1**	**2**			**2**	**3**		

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. VI Semester		
Code: A0340	UNCONVENTIONAL MACHINING PROCESSES	L	T	P
Credits: 3	(Professional Elective – II)	3	-	-

Prerequisites: Nil

Course Objectives:

The objective of this subject is to provide knowledge of using various unconventional machining processes and their applications in industries.

MODULE I: Introduction & Ultrasonic Machining

Need for non-traditional machining methods-Classification of modern machining processes – considerations in process selection - Materials - Applications.

Ultrasonic machining – Elements of the process, mechanics of metal removal process parameters, economic considerations, applications and limitations, recent development.

MODULE II: Abrasive Jet, Water Jet and Abrasive Water Jet Machining & Electro Chemical Processes

Abrasive Jet Machining, Water Jet Machining and Abrasive Water Jet Machining: Basic principles, equipments, process variables, and mechanics of metal removal, MRR, application and limitations. Electro - Chemical Processes : Fundamentals of electro chemical machining, electrochemical grinding, electro chemical honing and deburring process, metal removal rate in ECM, Tool design, Surface finish and accuracy economic aspects of ECM – Simple problems for estimation of metal removal rate.

MODULE III: Thermal Metal Removal Processes

A: Thermal Metal Removal Processes: General Principle and applications of Electric Discharge Machining, Electric Discharge Grinding and electric discharge wire cutting processes – Power circuits for EDM, Mechanics of metal removal in EDM.

B: Parameters, Tool and Dielectric Fluid: Process parameters, selection of tool electrode and dielectric fluids, methods surface finish and machining accuracy, characteristics of spark eroded surface and machine tool selection. Wire EDM, principle, applications.

MODULE IV: Electron Beam Machining and Laser Beam Machining

Generation and control of electron beam for machining, theory of electron beam machining. General Principle and application of laser beam machining – thermal features, cutting speed and accuracy of cut. Comparison of thermal and non-thermal processes

MODULE V: Advanced Machining Methods

Application of plasma for machining, metal removal mechanism, process parameters, accuracy and surface finish and other applications of plasma in manufacturing industries. Fundamentals of Chemical machining - principle- maskants –etchants- advantages and applications. Magnetic abrasive finishing, Abrasive flow finishing, Electro stream drilling, shaped tube electrolytic machining.

TEXT BOOKS

1. V.K Jain, **"Advanced machining processes"**, Allied publishers, 2010.
2. P. K. Mishra, **"Unconventional machining process",** Standard Publishers, 2014.

REFERENCES

1. Pandey P.C. and Shah H.S., **"Modern Machining Process",** TMH Publishers, 1st edition, 2012.
2. Bhattacharya A, **"New Technology",** the Institution of Engineers India, 1984.
3. Baffa & Rakesh Sarin, **"Modern Production and Operations Management",** John Wiley & Sons, 8th edition, 2017.
4. Kalpakjian, " **Manufacturing Engineering and Technology**", Pearson Publications, 4th edition, 2002.
5. HMT, "**Production Technology**", Tata McGraw-Hill Education, 2006.

E - RESOURCES

1. www.nmri.go.jp/eng, Elementary knowledge of metalworking
2. Videos about machining published by Institut für den Wissenschaftlichen Film.
3. www.iaeng.org/publication/WCE2011/WCE2011_pp2154-2158.pdf4
4. www.tandfonline.com/doi/abs/10.1080/21693277.2014.899934
5. nptel.ac.in/courses/112105126/36
6. nptel.ac.in/downloads/112105127/

Course Outcomes

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

1. Understand the basics of non-traditional machining methods.
2. Understand the process of Abrasive Jet Machining, Water Jet Machining and Abrasive Water Jet Machining & Electro Chemical Processes.
3. Understand the process of Thermal Metal Removal Processes.
4. Understand the process of Electron Beam Machining and Laser Beam Machining.
5. Understand the process of plasma machining, chemical machining, magnetic abrasive finishing, and abrasive flow machining processes.

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak															
COs	**Programme Outcomes(POs)**												**PSOs**		
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	**1**				**2**	**1**	**3**					**3**		**3**	
CO2	**1**				**2**	**1**	**3**					**3**		**3**	
CO3	**1**				**2**	**1**	**3**					**3**		**3**	
CO4	**1**				**2**	**1**	**3**					**3**		**3**	
CO5	**1**				**2**	**1**	**3**					**3**		**3**	

2020-21 Onwards (MR-20)	MALLAREDDYENGINEERINGCOLLEGE (Autonomous)	B.Tech. VISemester		
Code: A0341	POWERPLANTENGINEERING (Professional Elective–II)	L	T	P
Credits:3		3	-	-

Prerequisites: Thermal Engineering – II

Course Objectives:

The objective of this subject is to provide knowledge of Power generation units & their working principles and non-conventional resources.

MODULE I: Steam Power Plant & Combustion Process

Introduction to the Sources of Energy: Resources and Development of Power in India.

Steam Power Plant: Plant Layout, Working of different Circuits, Fuel and handling equipments, types of coals, coal handling, choice of handling equipment, coal storage, ash handling systems. Combustion Process: Properties of coal – overfeed and underfeed fuel beds, traveling grate stokers, spreader stokers, retort stokers, pulverized fuel burning system and its components, combustion needs and draught system, cyclone furnace, design and construction, Dust collectors, cooling towers and heat rejection. Corrosion and feed water treatment.

MODULE II: Diesel Power Plant & Gas Turbine Plant

Diesel Power Plant: Diesel Power Plant Introduction – IC Engines, types, construction– Plant layout with auxiliaries – fuel supply system, air starting equipment, lubrication and cooling system – super charging.

Gas Turbine Plant: Introduction – classification - construction – Layout with auxiliaries – Principles of working of closed and open cycle gas turbines. Combined Cycle Power Plants and comparison..

MODULEIII: Hydro Power Plant, Power from Non-Conventional Sources

A: Hydro Electric Power Plant: Classification – Typical layouts – plant auxiliaries – plant operation pumped storage plants. Water power – Hydrological cycle / flow measurement – drainage area characteristics – Hydrographs – storage and Bondage – classification of dams and spill ways.

B: Power From Non-Conventional Sources: Utilization of Solar- Collectors- Working Principle, Wind Energy – types – HAWT and VAWT -Tidal Energy. Direct Energy Conversion - Solar energy, Fuel cells, Thermo electric and Thermo ionic, MHD generation

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MODULE IV: Nuclear Power Station, Types of Reactors

Nuclear Power Station: Nuclear fuel – breeding and fertile materials – Nuclear reactor –reactor operation.

Types of Reactors: Pressurized water reactor, Boiling water reactor, sodium-graphite reactor, fast Breeder Reactor, Homogeneous Reactor, Gas cooled Reactor, Radiation hazards and shielding – radioactive waste disposal.

MODULE V: Power Plant Economics and Environmental Considerations

Capital cost, investment of fixed charges, operating costs, general arrangement of power distribution, Load curves, load duration curve. Definitions of connected load, Maximum demand, demand factor, average load, load factor, diversity factor – related exercises. Effluents from power plants and Impact on environment – pollutants and pollution standards – Methods of Pollution control.

TEXT BOOKS

1. Arora and S. Domkundwar, **"A Course in Power Plant Engineering",** Dhanpat Rai Publisher,
   6^{th} edition, 2011.
2. P.C.Sharma, **"Power Plant Engineering"**, S.K.Kataria Publisher, 2013.

REFERENCES

1. P.K.Nag, "**Power Plant Engineering"**, TMH Publishers, II Edition, 2006.
2. ElWakil, **"Power station Engineering",** McHill Publisher, 2^{nd}edtion, 2013.
3. G.D.Rai,**"An Introduction to Power Plant Technology",**Khanna Publishers,3^{rd}edition, 2013.
4. Elanchezhian, **"Power plant Engg",** I.K. International Pub, 2007.
5. Rajput, "**A Text Book of Power Plant Engineering",** Laxmi Publications, 4^{th} edition, 2007.

E - RESOURCES

1. nptel.ac.in/courses/108105058/8
2. lecturenotes.in/note/1968/power-plant-engineering
3. https://www.slideshare.net/.../power-plant-engineering-complete-five-unit-vtu-notes

Course Outcomes

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

1. Understand the process of steam power plants and combustion.
2. Get a clear view of the diesel power plant, Gas Turbine Plant and cycles.
3. Understand the functioning of Hydro Power Plant and sources of Power from Non-Conventional Sources.
4. Understand the functioning of Nuclear Power Station, Types of Reactors.
5. Know and analyse the Power Plant Economics and Environmental Considerations.

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak															
COs	**Programme Outcomes(POs)**												**PSOs**		
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	**1**			**3**		**3**						**2**	**3**		
CO2	**1**			**3**		**3**						**2**	**3**		
CO3	**1**			**3**		**3**						**2**	**3**		
CO4	**1**			**3**		**3**						**2**	**3**		
CO5	**1**			**3**		**3**						**2**	**3**		

2020-21 Onwards (MR-20)	MALLAREDDYENGINEERINGCOLLEGE (Autonomous)	B.Tech. VI Semester		
Code:A0334	HEAT TRANSFER LAB	L	T	P
Credits:1		-	-	2

Course Objectives:

Student will be able to understand the laws of heat transfer like Fourier's law, Newton's law of cooling and Stefan Boltzmann law through experimental setup.

List of Experiments

Any 12 exercises out of fourteen should be done

1. Performance study of Composite Slab Apparatus – Overall heat transfer co-efficient.
2. Performance study on Heat transfer through lagged pipe.
3. Performance study on Heat Transfer through a Concentric Sphere
4. Performance study on Thermal Conductivity of given metal rod.
5. Performance study on Heat transfer in pin-fin apparatus.
6. Experiment on Transient Heat Conduction.
7. Performance study on Heat transfer in forced convection apparatus.
8. Performance study on Heat transfer in natural convection.
9. Performance study on Parallel and counter flow heat exchanger.
10. Performance study of Emissivity apparatus.
11. Performance study on Stefan Boltzmann Apparatus.
12. Performance study on Heat transfer in drop and film wise condensation.
13. Performance study of Critical Heat flux apparatus.
14. Study of heat pipe and its demonstration.

Course Outcomes

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

1. Calculate heat transfer coefficient in both Natural and forced convection..
2. Calculate the efficiency and effectiveness of the fins.
3. Understand the mechanisms of heat transfer.
4. Calculate thermal conductivity of various materials.
5. Understand the Boiling and condensation processes.

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak															
COs	**Programme Outcomes(POs)**												**PSOs**		
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	**2**	**1**		**3**					**3**			**2**	**3**		
CO2	**2**	**1**		**3**					**3**			**2**	**3**		
CO3	**2**	**1**		**3**					**3**			**2**	**3**		
CO4	**2**	**1**		**3**					**3**			**2**	**3**		
CO5	**2**	**1**		**3**					**3**			**2**	**3**		

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. VI Semester		
Code: A0335	PRODUCTION DRAWING PRACTICE LAB	L	T	P
Credits: 1		-	-	2

Course Objectives:

The objective of this subject is to provide knowledge of drawing Part drawings with surface roughness and tolerance values.

MODULE – I

Conventional representation of Materials – conventional representation of parts – screw joints, welded joints, springs, gears, electrical, hydraulic and pneumatic circuits – methods of indicating notes on drawings.

MODULE – II Limits and Fits

Types of fits, exercises involving selection / interpretation of fits and estimation of limits from tables.

MODULE – III Form and Positional Tolerances

Introduction and indication of the tolerances of from and position on drawings, deformation of run out and total run out and their indication.

MODULE – IV Surface roughness and its indication

Definitions – finishes obtainable from various manufacturing processes, recommended surface roughness on mechanical components. Heat treatment and surface treatment symbols used on drawings.

MODULE – V Part drawings

Drawing of parts from assembly drawings with indications of size, tolerances, roughness, form and position errors etc.

TEXT BOOKS:

1.K.L. Narayana & P. Kannaiah, “Production and Drawing”, New Age .
2.Pohit and Ghosh, PE, “Machine Drawing with Auto CAD”

REFERENCES:

1. James D. Meadows, “Geometric dimensioning and tolerancing”, B.S Publications.

Course Outcome:

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

1. Know the application of fits and tolerances.
2. Know conventional representations of materials screw joints, welded joints, springs. gears etc. type of fits, interpretation of fits and estimation.
3. Know how to draw production drawings (parts drawings with all representations from assembly drawing).
4. Draw production drawing of various mechanical components with all tolerances, allowances, surface roughness values and process sheet.
5. To draw the part drawing.

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak															
COs	**Programme Outcomes(POs)**												**PSOs**		
	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**	**PSO 3**
CO1	**1**		**1**			**2**		**1**	**2**	**3**			**2**	**3**	
CO2	**1**		**1**			**2**		**1**	**2**	**3**			**2**	**3**	
CO3	**1**		**1**			**2**		**1**	**2**	**3**			**2**	**3**	
CO4	**1**		**1**			**2**		**1**	**2**	**3**			**2**	**3**	
CO5	**1**		**1**			**2**		**1**	**2**	**3**			**2**	**3**	

2020-21 Onwards (MR-20)	MALLAREDDYENGINEERINGCOLLEGE (Autonomous)	B.Tech. VI Semester		
Code:A0336	THERMAL ENGINEERINGLAB	L	T	P
Credits:1		-	-	2

Course Objectives:

To know and analyze the performance of Internal Combustion Engines, reciprocating compressor and boilers.

List of Experiments

1. I.C. Engine Valve/ Port timing diagrams.
2. I.C. Engine Performance Test (4 -Stroke Diesel Engine).
3. I.C. Engine Performance Test (2-Stroke Petrol engine).
4. Evaluation of Engine friction by conducting Morse test on 4-Stroke Multi cylinder Petrol engine.
5. Evaluation of Engine friction by conducting Motoring /Retardation test on 4 stroke Diesel Engine.
6. Heat balance Test on Diesel Engine.
7. Determination of A/F Ratio and Volumetric Efficiency on 4 Stroke Multi Cylinder Petrol Engine.
8. Determine of Economical speed test for fixed load on 4-stroke Petrol Engine.
9. Determine optimum cooling water temperature on Diesel Engine.
10. Disassembly / Assembly of Engine.
11. Performance test on Reciprocating Air-compressor Test Rig.
12. Study of Boilers.

Course Outcomes

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

1. Construct the actual valve and port timing diagrams.
2. Analyse the performance of IC engines.
3. Investigate the performance of air compressor.
4. Evaluate the performance of steam generators.
5. Understand and analyse the performance of variable compression I.C. engines.

CO- PO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes(POs)												PSOs		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	2	1		3					3			2	3		
CO2	2	1		3					3			2	3		
CO3	2	1		3					3			2	3		
CO4	2	1		3					3			2	3		
CO5	2	1		3					3			2	3		

2020-21 On wards (MR20)	MALLAREDDYENGINEERINGCOLLEGE (Autonomous)	B.Tech. VI Semester		
Code: A00M4	QUANTITATIVE APTITUDE & VERBAL REASONING-II	L	T	P
Credits:0		2	-	-

Module – I Quants: Number System (NS)

Number Systems-Factors and Multiples: The H.C.F. of two or more than two numbers; Factorization Method Division Method; Finding the H.C.F. of more than two numbers; product of two numbers = Product of their H.C.F. and L.C.M.; Co-primes; H.C.F. and L.C.M. of Fractions: Comparison of Fractions.

Verbal: Articles, Para Jumbles

- **Articles-** Types of articles, Countable nouns, Uncountable nouns, Usage of articles, Omission of articles.
- **Para Jumbles-** Para Jumbles, Types of Para Jumbles, Strategies to answer questions on Jumbled Paragraphs.

Logical: Data Arrangements, Blood Relation

- **Data Arrangements-** *Linear Arrangement, Circular Arrangement, Multi-Dimensional Arrangement.*
- **Blood Relations-** Classification of blood relations, Pointing a person, Equation related problems.

Module – II

Quants: Time and Distance, Pipes

- **Time & Distance-**;Km/hr to m/sec conversion; m/sec to km/hr conversion**;** man covers a certain distance at x km/hr and an equal distance at y km/hr

Verbal: Sentence Completion, Prepositions

- **Sentence Completion-** Formats of Question; Strategies to solve sentence completion questions- Proactive and reactive solving, Identifying clues- Signposts, Types of signposts, Root words, Sentence structure clues.
- **Prepositions-** Definition, Types of prepositions, Preposition of Place, Preposition of Time, Preposition of Direction, Compound Prepositions, Prepositional Phrases.

Logical: Coding and Decoding

- **Coding and Decoding-***Number Series, Alphabet Series, Analogy, Odd Man Out, Visual Reasoning.*

Module–III

Quants: Ages, Progression, Logarithms

- **Ages, Progression-**; Arithmetic progression; Arithmetic mean; Geometric progression and mean

- **Logarithms-**Why logarithms: Properties of Logarithms: Laws of logarithm: Characteristic of logarithm:

Verbal: Vocabulary

- **Vocabulary-**Etymology, Root Words, Prefixes and Suffixes; Synonyms and Antonyms, Tips to solve questions on Synonyms and Antonyms; Word Analogy, Patterns

of questions on Word Analogy; Miscellaneous Vocabulary Logical: Data Interpretation and Data Sufficiency

- **Data Interpretation-** *Tables, Pie charts, Bar Graphs, Line graphs*
- **Data Sufficiency-***Strategies to solve.*

Module – IV
Quants: Permutations and Combinations, Probability

- **Permutations-**Factorial Notation: The different arrangements; Number of Permutations: number of all permutations of n things, taken all at a time; n subjects of which p1 are alike of one kind; p2 are alike of another kind; p3 are alike of third kind; Number of Combinations: The number of all combinations of n things, taken r at a time.

Verbal: Sentence Correction

- **Sentence Correction-** Subject-Verb Agreement; Modifiers; Parallelism; Pronoun-Antecedent Agreement; Verb Time Sequence; Comparisons; Determiners; Exercise Questions.

Logical: Clocks and Calendars

- **Clocks:** Introduction, Derivation of angles, Angles between hands of the clock, Hands together, Hands at angular distance, Gain & Loss problems.

- **Calendars:** - Leap year-Non leap year, Odd days, Finding the day from date, repeated years.

Module - V
Quants: Areas and Volumes (Mensuration)

- **Areas & Volumes**-Pythagoras Theorem Results on Quadrilaterals Perimeter; Area of a circle Circumference Length of an arc Area of a sector; Area of a triangle.

Verbal: Reading Comprehension, Critical Reasoning

- **Reading Comprehension-** *Speed reading strategies; Reading Comprehension*- types of questions, tackling strategies; Critical Reasoning.

- Logical: Directions, Cubes, Syllogisms
- **Directions -**Introduction, Direction based questions, Shadow based problems.
- **Cubes**- Cube & cuboid concepts, 3-2-1-0 faced problems.
- **Syllogisms**- Statements and Conclusion, Syllogisms using Venn Diagrams.

Mapping (3/2/1indicatesstrengthofcorrelation)3-Strong,2-Medium,1-Weak												
COs	**Programme Outcomes(POs)**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1						**2**		**2**				**2**
CO2						**2**		**2**				**2**
CO3						**2**		**2**				**2**
CO4						**2**		**2**				**2**
CO5						**2**		**2**				**2**

2020-21 Onwards (MR-20)	MALLAREDDY ENGINEERINGCOLLEGE (Autonomous)	B.Tech. VI Semester		
Code: A00M6	**INTRODUCTION TO ARTIFICIAL INTELLIGENCE**	**L**	**T**	**P**
Credits: 0		**2**	**-**	**-**

Prerequisites: Nil

Course Objectives:

To train the students to understand different types of AI agents, various AI search algorithms, fundamentals of knowledge representation, building of simple knowledge-based systems and to apply knowledge representation, reasoning. Study of Markov Models enable the student ready to step into applied AI.

MODULE I: Introduction, Basic Search Strategies:

Introduction: AI problems, Agents and Environments, Structure of Agents, Problem Solving Agents.

Basic Search Strategies: Problem Spaces, Uninformed Search (Breadth-First, Depth-First Search, Depth-first with Iterative Deepening), Heuristic Search (Hill Climbing, Generic Best-First, A*), Constraint Satisfaction (Backtracking, Local Search)

MODULE II:

Advanced Search: Constructing Search Trees, Stochastic Search, A* Search implementation,Minimax Search, Alpha-Beta Pruning.

Basic Knowledge Representation and Reasoning: Propositional Logic, First-Order Logic, Forward Chaining and Backward Chaining, Introduction to Probabilistic Reasoning, Bayes Theorem.

MODULE III:

Advanced Knowledge Representation and Reasoning: Knowledge Representation Issues, Nonmonotonic Reasoning, Other Knowledge Representation Schemes.

Reasoning Under Uncertainty: Basic probability, Acting Under Uncertainty, Bayes' Rule, Representing Knowledge in an Uncertain Domain, Bayesian Networks.

MODULE IV:

Learning: What Is Learning? Rote Learning, Learning by Taking Advice, Learning in Problem Solving, Learning from Examples, Winston's Learning Program, Decision Trees.

MODULE V:

Expert Systems: Representing and Using Domain Knowledge, Shell, Explanation, Knowledge Acquisition.

TEXT BOOKS:

1. Russell, S. and Norvig, P, Artificial Intelligence: A Modern Approach, Third Edition, Prentice-Hall, 2010.

REFERENCES:

1. Artificial Intelligence, Elaine Rich, Kevin Knight, Shivasankar B. Nair, The McGraw Hill publications, Third Edition, 2009.
2. George F. Luger, Artificial Intelligence: Structures and Strategies for Complex Problem Solving, Pearson Education, 6th ed., 2009.

E-RESOURCES:

1. https://i4iam.files.wordpress.com/2013/08/artificial-intelligence-by-rich-and-knight.pdf
2. https://books.google.co.in/books?id=pVR9W5LEZUwC&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false
3. https://www.journals.elsevier.com/artificial-intelligence/
4. http://www.ceser.in/ceserp/index.php/ijai
5. http://ndl.iitkgp.ac.in/document/yVCWqd6u7wgye1qwH9xY7_M07uyea_7zp_zRG3BvdUVy2TIab45fvPeNJfynQsAbmBEgDSUqzidwcse6xwotJA

6. http://ndl.iitkgp.ac.in/document/xttk-4kfhvUwVlXBW-YWRBg_vrHK12-lgOzTVbb5oZ6eQOBjCWDfRvquHJLEOFENjI5AmOqRc9Ar3eJF4CGFrw

Course Outcomes:

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

1. **Apply** basic principles and evolution of artificial intelligence and intelligent agents
2. **Identify** various problem solving strategies in terms of Searching and apply them to real world problems
3. **Construct** the solution for the problem using various logic and knowledge representation techniques
4. Students will be able to **summarize** different learning methods used in artificial intelligence
5. **Demonstrate** the fundamental Knowledge of artificial intelligence (AI) and expert systems

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak															
COs	**Programme Outcomes(POs)**												**PSOs**		
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	**2**												**1**	**1**	
CO2	**1**	**2**	**2**										**1**	**1**	
CO3	**2**	**2**	**2**										**1**	**1**	
CO4	**2**	**2**	**2**										**1**	**2**	**2**
CO5	**1**	**2**	**1**												

2020-21 Onwards (MR-20)	MALLAREDDY ENGINEERINGCOLLEGE (Autonomous)	B.Tech. VII Semester		
Code: A0343	**MECHANICS OF COMPOSITE MATERIALS**	**L**	**T**	**P**
Credits: 3	(Professional Elective – III)	**3**	**-**	**-**

Prerequisite: Mechanics, Strength of Materials

Course Objectives:

The objective of the subject is to provide the knowledge on the stress-strain relationship of composite lamina and laminates.

Module – I: Basic concepts and characteristics, Reinforcements & Manufacturing methods

A.Basic concepts and characteristics: Geometric and Physical definitions, natural and man-made composites, Aerospace and structural applications, types and classification of composites.

B.Reinforcements: Fibers- Glass, Silica, Kevlar, carbon, boron, silicon carbide, and born carbide fibers. Particulate composites, Polymer composites, Thermoplastics, Thermosetting plastics, metal matrix and ceramic composites.

C.Manufacturing methods: Autoclave, tape production, moulding methods, filament winding, man layup, pultrusion, RTM.

Module – II: Micromechanics

Micromechanics: Unidirectional composites, constituent materials and properties, elastic properties of a lamina, properties of typical composite materials, laminate characteristics and configurations. Characterization of composite properties.

Module – III: Coordinate transformations

Coordinate transformations: Hooke's law for different types of materials, Hooke's law for two dimensional unidirectional lamina, transformation of stress and strain, Numerical examples of stress strain transformation, Graphic interpretation of stress – strain relations. Off - axis, stiffness modulus, off - axis compliance.

Module – IV: Elastic behavior of unidirectional composites

A. Elastic behavior of unidirectional composites: Elastic constants of lamina, relationship between engineering constants and reduced stiffness and compliances, analysis of laminated composites, constitutive relations.

B. Strength of unidirectional lamina: Micro mechanics of failure, Failure mechanisms, Strength of an orthotropic lamina, Strength of a lamina under tension and shear maximum stress and strain criteria, application to design. The failure envelope, first ply failure, free-edge effects.Micro mechanical predictions of elastic constants.

Module – V: Elastic behavior of laminates

Elastic behavior of laminates: Basic Assumptions, Strain –Displacement relations, Stress-Strain relations, laminate stiffness, laminate compliance, symmetric laminates, Orthotropic Laminates, laminate engineering properties, computational procedure for determination of elastic properties.

Text Books:

1. R. M. Jones, "**Mechanics of Composite Materials**, Mc Graw Hill Company, New York, 2nd edition, 1993.
2. Isaac and M.Daniel"**Engineering Mechanics of Composite Materials,** Oxford University Press. Vol. 13, 2006.

Reference Books:

1. B. D. Agarwal and L. J. Broutman, "**Analysis and performance of fibre Composites"**, Wiley-Interscience, New York.
2. L. R. Calcote, "**Analysis of Laminated Composite Structures"**, Van Nostrand Rainfold

Course Outcomes:

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

1. Describe the basic characteristics, applications and manufacturing methods of composites and its constituents.
2. Estimate the elastic properties of unidirectional composites using micromechanics approach, and identify the configurations and characteristics of laminate.
3. Derive the stress – strain relations for different types of materials using coordinate transformations and obtain the stiffness and compliance matrices respectively.
4. Determine the engineering constants, reduced stiffness and compliances of 2D unidirectional lamina and relate micro and macro mechanics of failure of composites.
5. Analyze the elastic behavior of different types of composite laminates and estimate stiffness and compliance of laminates.

CO- PO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes(POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3											1	3		
CO2	3	1	1	1								1	3		
CO3	3	1	2	1								2	3		
CO4	3	2	3	2								2	3		
CO5	3	3	3	3								3	3		

2020-21 Onwards (MR-20)	MALLAREDDY ENGINEERINGCOLLEGE (Autonomous)	B.Tech. VII Semester		
Code: A0344	**MECHANICAL VIBRATIONS**	**L**	**T**	**P**
Credits: 3	(Professional Elective – III)	**3**	**-**	**-**

Prerequisite: Dynamics of Machines

Course Objectives:

An introductory course in linear mechanical vibrations where students acquire the ability to formulate mathematical models of problems in vibrations using Newton's second law or energy principles, determine a complete solution to mechanical vibration problems using mathematical or numerical techniques and physical and design interpretations from the results.

Module – I: Introduction

Introduction: Importance and scope ,definition and terminology, simple harmonic motion, combination of simple harmonic motions, Fourier analysis.

MODULE – II: Single Degree Freedom Systems-I, Single Degree Freedom Systems-II &

Single Degree Freedom Systems with Forced Vibrations

A: Single Degree Freedom Systems-I: Un damped free vibration: Classical method, Energy method, phase plane method, equivalent systems, torsional systems.

B: Single Degree Freedom Systems-II: Damped free vibration: Viscous damping, under damping, critical damping, coulomb damping, equivalent damping coefficient

C: Single Degree Freedom Systems With Forced Vibrations: Steady state forced vibration, sources of excitation, impressed harmonic force, impressed force due to unbalance, motion excitation, transmissibility and isolation, performance of different type of isolators, power absorbed by viscous damping, General theory of seismic instruments, accelerometer and vibro meter, methods of vibration control, excitation reduction at source, system modification.

Module - III: Two Degree Freedom Systems

Two Degree Freedom Systems: Natural frequencies and modes of vibration by classical method of spring-mass system, forced vibration, dynamic vibration absorber

Module - IV: Multi Degree Freedom Systems

Multi Degree Freedom Systems: Influence co-efficient method, damped mass and distributed mass systems, stodola method, Holzer's method, newtons iteration method, orthogonality of mode shapes.

Module - V: Vibration in Continuous Systems

Vibration In Continuous Systems: Longitudinal vibration of bars, torsional vibrations of circular rods or shafts, lateral vibrations of beams and shafts.

Whirling of shafts critical speed of shafts, Rayleigh's upper bound approximation, Dunkerley's lower bound approximation, critical speed of shafts with damping.

Text Books:

1. G.K.Grover "**Mechanical Vibrations",** Nem Chand Publisher
2. J.S.Rao and K.Gupta "**Theory and practice of mechanical Vibrations",** New Age International Publishers

Reference Books:

1. W.T.Thomson "**Vibration Theory and Applications",** CRC Press Publishers

2. Timeshenko and Young "**Vibration problems in Engineering",** Oxford City Press Publishers
3. S.S. Rao "**Mechanical Vibrations",** Pearson Edu
4. Tongue "**Principles of Vibrations",** Oxford Univ. Press
5. "**Mechanical Vibration"**, Shyam Series.

Course Outcomes:

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

1. Construct the equations of motion from free-body diagrams.
2. Solve the motion and the natural frequency of (a) a freely vibrating single degree of freedom undamped and damped motion.
3. Construct the governing differential equation and its solution for a vibrating mass subjected to an arbitrary force.
4. Decompose any periodic function into a series of simple harmonic motions using Fourier series analysis.
5. Solve the motion and the natural frequency for forced vibration of a single degree of freedom damped or un-damped system.

CO- PO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes(POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	2	3	2	1			2			2	3		
CO2	2	1	2	3	2	1			2			2	3		
CO3	2	1	2	3	2	1			2			2	3		
CO4	3	1	3	3	2	1			2			2	3		
CO5	3	1	3	3	2	1			2			2	3		

2020-21 Onwards (MR-20)	MALLAREDDY ENGINEERINGCOLLEGE (Autonomous)	B.Tech. VII Semester		
Code: A0345	**COMPUTATIONAL FLUID DYNAMICS**	**L**	**T**	**P**
Credits: 3	(Professional Elective – III)	**3**	**-**	**-**

Prerequisite: Fluid Mechanics and hydraulic machines.

Course Objectives:

To develop an understanding of the major theories, approaches and implementation of CFD methods and gain experience in the application of CFD analysis to real engineering designs.

Module – I: Elementary details in numerical Techniques

Elementary details in numerical Techniques: Number system and errors, Representation of integers, Fractions, Floating point Arithmetic, loss of significance and error propagation, condition and instability, computational methods for error estimation, Convergence of Sequences.

Module – II: Applied Numerical Methods

Applied Numerical Methods: Solution of a system of simultaneous Linear Algebraic Equations, iterative schemes of Matrix Inversion, Direct Methods for Matrix inversion, Direct Methods for banded matrices.

Finite Difference Applications in Heat conduction and Convention - Heat conduction, steady heat conduction in a rectangular geometry, transient heat conduction, and finite difference application in convective heat transfer.

Module - III:

Finite Differences, discretization, consistency, stability, and Fundamentals of fluid flow modeling: Introduction, elementary finite difference quotients, implementation aspects of finite-difference equations, consistency, explicit and implicit methods.

Module - IV:

Introduction to first order wave equation, stability of hyperbolic and elliptic equations, fundamentals of fluid flow modeling.conservative property, the upwind scheme.

Review of Equations Governing Fluid Flow and Heat Transfer: Introduction, conservation of mass, Newton's second law of motion, expanded forms of Navier stokes equations, conservation of energy principle, special forms of the Navier-stokes equations.

Module - V:

Steady flow, dimensionless form of Momentum and Energy equations, Stokes equation, conservative body force fields, stream function - Vorticity formulation.

Finite Volume Method: Approximation of surface integrals, volume integrals, interpolation and differentiation practices, Upwind interpolation, Linear interpolation and Quadratic interpolation

Text Books:

1. Suhas V. Patankar "**Numerical Heat Transfer and Fluid Flow",** Butter-Worth Publications.
2. John. D. Anderson "**Computational Fluid Dynamics - Basics with applications",** Mc Graw Hill Publications.

Reference Books:

1. Niyogi "**Computational Fluid Flow and Heat Transfer",** Pearson Publications.
2. Tapan K. Sengupta "**Fundamentals of Computational Fluid Dynamics",** Universities Press.
3. Jiyuan and Others "**Computational Fluid Dynamics",** Elsevier Publications.

Course Outcomes:

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

1. Apply the appropriate computational methods for error estimation and convergence of mathematical sequences.
2. Apply the matrix based numerical methods for solving steady state, transient heat conduction and convective heat transfer.
3. Understand the basics of consistency, stability and discretization of finite difference equation and apply them with specific emphasis on explicit and implicit methods to model the fundamental aspects of fluid flow.
4. Apply hyperbolic and elliptic partial differential equations to fundamental aspects of fluid flow and analyze the conservation of energy principle and Navier-stokes equations.
5. Apply finite volume method including different interpolation techniques and understand the elements of steady flow and conservative force fields.

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak															
COs	**Programme Outcomes(POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**3**				**3**			**2**			**3**	**2**	**2**		
CO2	**3**				**3**			**2**			**3**	**2**	**2**		
CO3	**3**				**3**			**2**			**3**	**2**	**2**		
CO4	**3**				**3**			**2**			**3**	**2**	**2**		
CO5	**3**				**3**			**2**			**3**	**2**	**2**		

2020-21 Onwards (MR-20)	MALLAREDDY ENGINEERINGCOLLEGE (Autonomous)	B.Tech. VII Semester		
Code: A0346	**MAINTENANCE & SAFETY ENGINEERING**	**L**	**T**	**P**
Credits: 3	(Professional Elective – III)	**3**	**-**	**-**

Prerequisite: No
Course Objectives:

The objective of this subject is to provide knowledge of types of maintenance, quality, safety, Inventory and Reliability control in maintenance.

Module – I: Introduction

Introduction: Need for Maintenance, Facts and Figures, Modern Maintenance, Problem and Maintenance Strategy for the 21st century, Engineering Maintenance Objectives and Maintenance in Equipment Life Cycle, Terms and Definitions.

Module – II: Maintenance Management and Control & Types of Maintenance

A: Maintenance Management and Control: Maintenance Manual, Maintenance, Facility Evaluation, Functions of Effective Maintenance Management. Maintenance project control Methods, Maintenance Management Control Indices.

B: Types of Maintenance: Preventive maintenance elements of preventive, maintenance program, Establishing Preventive maintenance program PM Program Evaluation and improvement, PM Measures, PM Models, Corrective maintenance, maintenance types Corrective maintenance steps and Downtime Components, Corrective maintenance measures Corrective maintenance models

Module - III: Inventory control in Maintenance

A: Inventory control in Maintenance - I: Inventory control Objectives and basic Inventory decision, ABC Inventory control method.

B: Inventory control in Maintenance - II: Inventory Control Models Two-Bin inventory control and Safety Stock, Spares Determination factors Spares calculation Methods.

Module - IV: Quality and Safety in Maintenance

Quality and Safety in Maintenance: Needs for Quality Maintenance process, Maintenance work quality, Use of quality Control charts in Maintenance Work Sampling, post Maintenance Testing, Reasons of Safety problems in Maintenance, Guidelines to improve safety in Maintenance work, Safety Officer's Role in Maintenance Work, protection of Maintenance workers. Maintenance Costing: Reasons for Maintenance costing, Maintenance Budget preparation Methods and Steps, Maintenance Labor cost Estimation, Material cost Estimation, Equipment Life Cycle Maintenance Cost Estimation, Maintenance Cost Estimation Models.

Module - V: Reliability, Reliability controlled Maintenance, RCM, & Maintainability

A: Reliability, Reliability controlled Maintenance, RCM: Goals and principles, RCM process and Associated Questions, RCM program Components Effectiveness Measurement Indicators. RCM Benefits and Reasons for its Failures. Reliability Versus Maintenance and Reliability in support Phase. Bathtub Hazard Rate Concept, Reliability Measures and Formulas Reliability Networks, Reliability analysis Techniques.

B: Maintainability: Maintainability Importance and Objective Maintainability in Systems Life

Cycle, Maintainability Design Characteristics, Maintainability Functions and Measures, Common Maintainability Design Errors.

Text Books:

1.Dr. A.K.Guptha "**Reliability: Maintenance and Safety Engineering",** Laxmi Publications.

2.L.M. Deshmukh "**Industrial Safety Management",** TMH Pulications

Reference Books:

1. R.C.Mishra "**Maintenance Engineering & Management"**, PHI Publications
2. Elsayed"**Reliability Engineering",** Pearson Publishers
3.B.S.Dhallon"**Engineering Maintenance a Modern Approach**" C.R.R publishers, 2002

Course Outcomes:

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

1. To understand basic need of maintenance system in plants.
2. Apply basic models of maintenance systems, including various aspects of breakdown & prevention of breakdown in respect of the maintenance and their controls.
3. Analyse the inventory control system and their different control methods.
4. Apply spares management, costing and budgeting of equipment maintenance resources planning.
5. Analyse the importance and application of reliability and reliability controlled maintenance (RCM).

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak															
COs	**Programme Outcomes(POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**2**		**2**		**2**				**1**						**2**
CO2	**1**		**1**		**1**				**1**			**1**			**2**
CO3	**2**	**1**	**2**		**2**				**1**			**1**			**2**
CO4	**2**	**1**	**2**		**2**				**1**			**1**			**2**
CO5	**2**	**2**	**2**		**2**				**1**			**1**			**2**

2020-21 Onwards (MR-20)	MALLAREDDY ENGINEERINGCOLLEGE (Autonomous)	B.Tech. VII Semester		
Code: A0347	**ENGINEERING TRIBOLOGY**	**L**	**T**	**P**
Credits: 3	(Professional Elective – III)	**3**	**-**	**-**

Prerequisites: Nil

Course Objectives: The main objective of this course is to describe surface topography, physio-chemical aspects of solid surfaces, laws of friction, various types of wear and lubricants and surface interactions.

MODULE I: Introduction to Tribo Design

Specific principles, Tribological problems in machine design, Surface topography, Tribological processes: Contact process-contact mechanics, friction process-sliding and rolling friction, wear process-wear mechanisms, Stick-slip effects, Friction and wear test methods, Tribological materials.

MODULE II: Lubrication

Purpose of lubrication, Basic modes of lubrication-Stribeck curve, hydrodynamic lubrication, Elastodynamic lubrication, Mixed lubrication, Boundary lubrication; Hydrostatic lubrication, Properties of lubricant, Additives, Choice of lubricant, oil, grease and solid lubricants, lubrication systems and their selection, oil conservation.

Selection of Rolling Element Bearings - Nominal life, static and dynamic capacity, equivalent load, probabilities of survival - cubic mean load, Selection of ball and roller bearings, bearing mounting details, preloading of bearings.

MODULE III: Hydrostatic Bearings

A: Arrangement, advantages and limitations, Hydrostatic step bearing analysis-energylosses, optimum design, temperature rise; Hydrostatic conical thrust bearing, pad coefficients; Hydrostatic journal bearings - design procedures; Hydrostatic squeeze film bearings-analysis, thrust bearings and journal bearings - design procedure.

B: Fundamentals of fluid film formation, Mechanisms of pressure development in oil film, Reynold's equation, Hydrodynamic journal bearing-Sommerfeld number, bearing performance, temperature rise; Hydrodynamic thrust bearings - Raimondi and Boyd Method, fixed and tilting pads, single and multiple pad bearings.

MODULE IV: Computational Hydrodynamics

Finite difference equivalent of the Reynolds equation, Numerical analysis of hydrodynamic lubrication in idealized journal and partial arc bearings, Vibrational stability in journal bearings-determination of stiffness and damping coefficients. Elasto- Hydrodynamic Lubrication-Pressure-viscosity term in Reynold's Equation - Hertz theory - Ertel-Grubin Equation, lubrication of spheres, introduction to thermo-hydrodynamic lubrication.

MODULE V: Surface Engineering

Surface modifications - transformation hardening, surface fusion - thermo chemical processes - surface coatings - plating and anodizing - fusion processes - vapour phase processes.

TEXT BOOKS

1. Majumdar, B.C, "**Introduction to Tribology of Bearings",** S.Chand, 2nd Edition,2008.
2. Kenneth C Ludema, "**Friction. Wear, Lubrication: A Text book in Tribology",** CRC Press, 1st Edition, 1996.
3. John Williams, "**Engineering Tribology"**, Cambridge University Press, 2006.

REFERENCES

1. Neale M J,**"Tribology Handbook"**, Neumann Butterworths, 1975.

2. Connor J J O and Boyd, **"Standard Handboook of Lubrication Engineers",** ASLE,McGraw Hill Book Co., 1966.
3. Basu S K, Sengupatha S N and Ahuja D B, "Fundamentals of Tribology", Prentice Hallof India Pvt. Ltd., 2005.

E Resources:

1. itmmec.iitd.ac.in/
2. www.emeraldinsight.com/loi/ilt
3. www.tribology.fink.rs/guide.html
4. tribology.asmedigitalcollection.asme.org/journal.aspx
5. nptel.ac.in/courses/112102015/
6. nptel.ac.in/courses/112102014/

Course Outcomes:

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

1. Understand the concepts of tribological contacts and systems, the interrelation ofparameters.
2. Methodology for deciding lubricants and lubrication regimes for different operatingconditions.
3. Analyze hydrostatic and hydrodynamic journal bearings for given load / speedconditions.
4. Evaluate the performance of computational hydrodynamics and Elasto-hydrodynamicbearing lubrications.
5. Ability to work as an expert engineer and researcher in multicultural and interdisciplinary teams in the broad field of tribology, surfaces, interfaces and maintenance.

CO- PO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes(POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1								3		2	2	2		
CO2	1								3		2	2	2		
CO3	1								3		2	2	2		
CO4	1								3		2	2	2		
CO5	1								3		2	2	2		

2020-21 Onwards (MR-20)	MALLAREDDY ENGINEERINGCOLLEGE (Autonomous)	B.Tech. VII Semester		
Code: A0348	**PRODUCTION PLANNING AND CONTROL**	**L**	**T**	**P**
Credits: 3	(Professional Elective – IV)	**3**	**-**	**-**

Prerequisite: Industrial Management.

Course Objectives:

The objective of this subject is to provide knowledge of Planning, scheduling and various production activities of an Industry.

Module – I: Introduction

Introduction: Definition – Objectives of production Planning and Control – Functions of production planning and control – Elements of production control – Types of production – Organization of production planning and control department – Internal organization of department.

Module – II: Forecasting

Forecasting – Importance of forecasting – Types of forecasting, their uses – General principles of forecasting – Forecasting techniques – qualitative methods and quantitative methods.

Module - III: Inventory management & Inventory control systems

Inventory management – Functions of inventories – relevant inventory costs – ABC analysis – VED analysis – EOQ model

Inventory control systems – P–Systems and Q-Systems, Introduction to MRP & ERP, LOB (Line of Balance), JIT inventory, and Japanese concepts.

Module - IV: Routing

Routing – Definition – Routing procedure –Route sheets – Bill of material – Factors affecting routing procedure. Schedule –definition – Difference with loading, Scheduling Policies – Techniques, Standard scheduling methods,

Module - V: Line Balancing, Aggregate planning

Line Balancing, Aggregate planning, Chase planning, Expediting, controlling aspects.
Dispatching – Activities of dispatcher – Dispatching procedure – follow-up – definition – Reason for existence of functions – types of follow-up, applications of computer in production planning and control.

Text books:

1. Samuel Eilon **"Elements of Production Planning and Control",** Macmillan Publishers
2. Baffa & Rakesh Sarin **"Modern Production and operation managements",** John Wiley Publishers

Reference books:

1. S.N. Chary **"Operations Management",** TMH Publishers
2. Martin K. Starr and David W. Miller **"Inventory Control Theory and Practice",** Prentice-Hall Publishers
3. Dr. C. Nadha Muni Reddy and Dr. K. Vijaya Kumar Reddy **"Reliability Engineering & Quality Engineering",** Galgotia Publications, Pvt., Limited.
4. John E. Biegel **"Production ControlA Quantitative Approach",**Prentice-Hall
5. Moore **"Production Control",**McGraw-Hill Publishers
6. Joseph Monks **"Operations Management",** McGraw-Hill Ryerson Publishers

Course Outcomes:

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

1. Understand the elements of PPC and analyse the types of organization
2. Analyse the types of forecasting techniques
3. Analyse the functions of inventory and the various inventory models
4. Analyse the various methods for routing and scheduling.
5. Illustrate the principles of line balancing and dispatching.

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak															
COs	**Programme Outcomes(POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**1**	**1**									**1**	**1**		**2**	**1**
CO2	**2**	**1**	**1**								**1**	**1**		**2**	**1**
CO3	**2**	**2**	**2**	**2**	**1**		**1**		**1**		**2**	**1**		**2**	**1**
CO4	**2**	**2**	**2**	**2**	**1**		**1**		**1**		**2**	**2**		**2**	**1**
CO5	**3**	**2**	**2**	**2**	**1**		**1**		**1**		**2**	**2**		**2**	**1**

2020-21 Onwards (MR-20)	MALLAREDDY ENGINEERINGCOLLEGE (Autonomous)	B.Tech. VII Semester		
Code: A0349	**INDUSTRIAL ROBOTICS**	**L**	**T**	**P**
Credits: 3	(Professional Elective – IV)	**3**	**-**	**-**

Prerequisite: Kinematics and dynamics of machinery

Course Objectives:

The objective of this subject is to provide knowledge of design of robot arm, kinematics anddynamics, Trajectory planning of robot and its applications in automation of Industries.

Module – I: Introduction

Automation and Robotics, CAD/CAM and Robotics – An over view of Robotics – present and future applications – classification by coordinate system and control system.

Components of the Industrial Robotics:-Degrees of freedom-End effectors: Mechanical gripper-magnetic-vacuum cup and other types of grippers-General consideration on gripper selection and design.

Module – II: Motion Analysis & Manipulator Kinematics

A: Motion Analysis: Homogeneous transformations as applicable to rotation and translation – problems.

B: Manipulator Kinematics: Specifications of matrices, D-H notation joint coordinates and world coordinates Forward and inverse kinematics – problems.

Module - III: Dynamics

Differential transformation and manipulators, Jacobians – problems.

Lagrange – Euler and Newton – Euler formations – Problems.

Trajectory planning and avoidance of obstacles, path planning, Skew motion, joint integrated motion – straight line motion – Robot programming, languages and software packages.

Module - IV: Robot actuators and Feedback components

Actuators: Pneumatic, Hydraulic actuators, electric & stepper motors. Feedback components: position sensors – potentiometers, resolvers, encoders – Velocity sensors.

Module - V: Robot Application in Manufacturing:

Material Transfer - Material handling, loading and unloading- Processing - spot and continuous arc welding & spray painting - Assembly and Inspection.

Text books:

1. Groover M P "**Industrial Robotics",** Pearson Edu.
2. Mittal R K & Nagrath I J "**Robotics and Control",** TMH.

Reference books:

1. Fu K S "**Robotics",** McGraw Hill.
2. P. Coiffet and M. Chaironze "**An Introduction to Robot Technology**", Kogam Page Ltd. 1983 London.
3. Richard D. Klafter "**Robotic Engineering",** Prentice Hall Publishers
4. Asada and Slow time "**Robot Analysis and Intelligence",** Wiley Inter-Science.
5. John J Craig "**Introduction to Robotics",** Pearson Edu.
6. Mark W. Spong and M. Vidyasagar "**Robot Dynamics & Control",** John Wiley & Sons (ASIA) Pvt Ltd.

Course outcomes:

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

1. Understand and analysethe basic concepts of automation and components of robotics.
2. Solve the homogeneous transformation matrices for Forward and inverse kinematics – problems.
3. Understand and analyse the trajectory planning of the robot.
4. Understand the Robot actuators and Feedback components.
5. Analyse the applications of robots in industries.

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak															
COs	**Programme Outcomes(POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**3**		**2**	**2**	**3**		**3**				**2**			**1**	
CO2	**1**	**3**	**3**	**2**								**1**			**1**
CO3	**3**	**3**	**2**	**3**								**1**		**3**	
CO4	**2**		**3**	**2**			**2**				**3**	**3**			**3**
CO5	**2**		**2**		**2**		**3**				**2**	**3**		**3**	**3**

2020-21 Onwards (MR-20)	MALLAREDDY ENGINEERINGCOLLEGE (Autonomous)	B.Tech. VII Semester		
Code: A0350	DESIGN OF PRESS TOOLS,JIGS AND FIXTURES (Professional Elective – IV)	L	T	P
Credits: 3		3	-	-

Prerequisites: Nil

Approved Design Data Book is permitted.

Course Objectives:

To understand the functions and design principles of Jigs, fixtures and press tools and to gain proficiency in the development of required views of the final design.

MODULE I: Locating and Clamping Principles

Objectives of tool design- Function and advantages of Jigs and fixtures – Basic elements – principles of location – Locating methods and devices – Redundant Location – Principles of clamping – Mechanical actuation – pneumatic and hydraulic actuation Standard parts – Drill bushes and Jig buttons – Tolerances and materials used.

MODULE II: Jigs and Fixtures

Design and development of jigs and fixtures for given component- Types of Jigs – Post, Turnover, Channel, latch, box, pot, angular post jigs – Indexing jigs – General principles of milling, Lathe, boring, broaching and grinding fixtures – Assembly, Inspection and Welding fixtures – Modular fixturing systems- Quick change fixtures**.**

MODULE III: Press Working Terminologies and Elements of Cutting Dies

A: Press Working Terminologies – operations – Types of presses – press accessories – Computation of press capacity – Strip layout – Material Utilization – Shearing action – Clearances – Press Work Materials – Center of pressure.

B: Design of various elements of dies – Die Block – Punch holder, Die set, guide plates – Stops

– Strippers – Pilots – Selection of Standard parts – Design and preparation of four standard views of simple blanking, piercing, compound and progressive dies.

MODULE IV: Bending and Drawing Dies

Difference between bending and drawing – Blank development for above operations – Types of Bending dies – Press capacity – Spring back – knockouts – direct and indirect – pressure pads – Ejectors – Variables affecting Metal flow in drawing operations – draw die inserts – draw beadsironing – Design and development of bending, forming, drawing, reverse redrawing and combination dies – Blank development for axisymmetric, rectangular and elliptic parts – Single and double action dies.

MODULE V: Other Forming Techniques

Bulging, Swaging, Embossing, coining, curling, hole flanging, shaving and sizing, assembly. Blanking dies – recent trends in tool design- computer Aids for sheet metal forming Analysis – basic introduction - tooling for numerically controlled machines- setup reduction for work holding – Single minute exchange of dies – Poka Yoke.

TEXT BOOKS

1. Joshi, P.H. "**Jigs and Fixtures**", Second Edition, Tata McGraw Hill Publishing Co., Ltd., New Delhi, 2010.
2. Joshi P.H "**Press tools - Design and Construction**", wheels publishing, 4th edition, 1996.

REFERENCES

6. Venkataraman. K., "**Design of Jigs Fixtures & Press Tools**", Tata McGraw Hill, New Delhi, 2015.
7. Donaldson, Lecain and Goold "**Tool Design**", 4th Edition, Tata McGraw Hill, 2012.
8. Kempster, "**Jigs and Fixture Design**", Third Edition, Hoddes and Stoughton, 1998.
9. Hoffman "**Jigs and Fixture Design**", Thomson Delmar Learning, Singapore, 2012.
10. ASTME "**Fundamentals of Tool Design**" Prentice Hall of India, 2013.

E - RESOURCES

1. nptel.ac.in/courses/112105127/pdf/LM-33.pdf
2. nptel.ac.in/courses/112105126/34
3. nptel.ac.in/courses/112105126/35
4. nptel.ac.in/courses/112105126/

Course Outcomes

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

1. Understand the functions of jigs &fixtures, elements, principles of location and clamping methods.
2. Understand design of jigs & fixtures, fixture assembly, fixturing systems.
3. Understand types of presses & press working, design of dies for various operations.
4. Understand blank development, design &development of dies for bending &drawing.
5. Understand design of forming dies, recent trends in tool design.

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes(POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1		3		3							2	3		1
CO2	1		3		3							2	3		1
CO3	1		3		3							2	3		1
CO4	1		3		3							2	3		1
CO5	1		3		3							2	3		1

2020-21 Onwards (MR-20)	MALLAREDDY ENGINEERINGCOLLEGE (Autonomous)	B.Tech. VII Semester		
Code: A0351	PRODUCT DESIGN AND DEVELOPMENT	L	T	P
Credits: 3	(Professional Elective – IV)	3	-	-

Prerequisites: Nil

Course Objectives:

The students will be able to get knowledge about product development, specifications, concepts and architecture which is followed in the industry.

MODULE I: Product Development

Product development versus design, product development process, product cost analysis, cost models, reverse engineering and redesign product development process, new product development, tear down method.

MODULE II: Product Specifications

Establishing the product specifications– Target specifications – Refining specifications, concept generation-Clarify the problem – Search internally – Search externally – Explore systematically - Reflect on the Results and the Process.

MODULE III: Product Concepts

A: Concept generation, product configuration, concept evaluation and selection, product embodiments.

B: Quality function deployment, product design specification, physical prototypes-types and technique, dimensional analysis, design of experiments.

MODULE IV: Product Architecture

Concept selection- Screening – scoring, Product architecture – Implication of architecture - Establishing the architecture – Related system level design issues.

MODULE V:Product Improvement

Reliability, failure identification techniques, Poka-Yoke, Design for the environment, design for maintainability, product safety, liability and design, design for packaging, factorial analysis-ANOVA, factorial experiments, examples.

TEXT BOOKS

1. Kevin Otto and Kristin Wood, "**Techniques in Reverse Engineering and New Product Development"**, Pearson Education, Chennai, Edition III, 2014.
2. Karl T.Ulrich and Steven D.Eppinger "**Product Design and Development**", McGrawHill International, 4th Edition, 2014.

REFERENCES

1. Chitale A.V. and Gupta R.C., "**Product Design and Manufacturing**", 6th Edition, PHI,

2013.

2. Kemnnech Crow, "**Concurrent Engg. Integrated Product Development**", DRM Associates, 26/3 via Olivera, Palas Verdes, CA 90274 (310) 377-569, Workshop Book.
3. Stephen Rosenthal, "**Effective Product Design and Development**", Business OneOrwin Homewood, 1992, ISBN, 1-55623-603-434.
4. Stuart Pugh, "**Total Design – Integrated Methods for successful Product Engineering**", Addison Wesley Publishing, Neyourk, NY, 1991, ISBN 0-202-41639-5.

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Course Outcomes

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

1. Apply the concept for new product development.
2. Apply knowledge on the concepts of product specification.
3. Describe the principles of industrial design and prototyping.
4. Apply knowledge on product architecture.
5. Examine the concept of product development and customer needs.

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak															
COs	**Programme Outcomes(POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**1**		**3**		**3**							**2**	**3**		**2**
CO2	**1**		**3**		**3**							**2**	**3**		**2**
CO3	**1**		**3**		**3**							**2**	**3**		**2**
CO4	**1**		**3**		**3**							**2**	**3**		**2**
CO5	**1**		**3**		**3**							**2**	**3**		**2**

2020-21 Onwards (MR-20)	MALLAREDDY ENGINEERINGCOLLEGE (Autonomous)	B.Tech. VII Semester		
Code: A0352	**AUTOMATION IN MANUFACTURING**	**L**	**T**	**P**
Credits: 3	(Professional Elective – IV)	**3**	**-**	**-**

Prerequisites: Metal Cutting & Machine Tools and CNC Technology.

Course Objectives:

The objective of this subject is to provide knowledge of automated flow lines, line balancing, adoptive control systems and Business process Re- Engineering in manufacturing units.

MODULE I: Introduction to Automation

Introduction Types and strategies of automation, pneumatic and hydraulic components circuits, Automation in machine tools. Mechanical feeding and tool changing and machine tool control transfer the automaton.

MODULE II: Automated Flow Lines

Methods or work part transport transfer Mechanical buffer storage control function, design and fabrication consideration. General terminology and analysis of transfer lines without and with buffer storage, partial automation, implementation of automated flow lines.

MODULE III: Line Balancing & Automated Material Handling

A: Line balancing: Assembly process and systems assembly line, line balancing methods, ways of improving line balance, flexible assembly lines.

B: Automated material handling: Types of equipment, functions, analysis and design of material handling systems conveyor systems, automated guided vehicle systems.

MODULE IV: Adaptive Control Systems

Automated storage systems, automated storage and retrieval systems, work in process storage, interfacing handling and storage with manufacturing.

Adaptive control systems: Introduction, adaptive control with optimization, Adaptive control with constraints, Application of A.C. in machining operations. Use of various parameters such as cutting force, Temperatures, vibration and acoustic emission.

MODULE V: Business process Re-engineering

Business process Re-engineering: Introduction to BPE logistics, ERP, Software configuration of BPE, concurrent Engineering, Techniques of Rapid Proto typing.

TEXT BOOKS:

1. M.P. Groover, **Automation, Production Systems and Computer Integrated Manufacturing**",PHI Publishers, 2009.
2. M.P. Groover, "**CAD / CAM**", PHI Publishers, Pearson, 2008.

REFERENCES:

1. Computer control of Manufacturing Systems by Yoram Coreom / TMH Publishers, 1989.
2. Radhakrishnan, "**CAD / CAM/ CIM**", New Age International Publishers, 2016.
3. W. Buekinsham, "**Automation",** Prometheus Books Publishers.
4. Beno Benhabib, "**Manufacturing: Design, Production, Automation, and Integration**", Beno Benhabib, CRC Press, 2003.
5. Tien chien chang,Richard A.Wysk and Hsu-Pin Wang, "**Computer aided manufacturing",** Pearson, 2009.

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1. https://www.automationmag.com/
2. https://www.automationworld.com/
3. https://www.journals.elsevier.com/journal-of-manufacturing-processes/

Course Outcomes

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

1. Understand the concept of pneumatic and hydraulic component circuits for automation.
2. Understand and analyze the automated flow lines system.
3. Understand assembly line and automated material handling system.
4. Know various types of automated storage systems and concept of adaptive control.
5. Learn the concept of Business process reengineering (BPR) and Rapid proto typing.

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak															
COs	**Programme Outcomes(POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**1**	**3**	**3**		**3**	**1**	**2**					**3**		**3**	
CO2	**1**	**3**	**3**		**3**	**1**	**2**					**3**		**3**	
CO3	**1**	**3**	**3**		**3**	**1**	**2**					**3**		**3**	
CO4	**1**	**3**	**3**		**3**	**1**	**2**					**3**		**3**	
CO5	**1**	**3**	**3**		**3**	**1**	**2**					**3**		**3**	

2020-21 Onwards (MR-20)	MALLAREDDY ENGINEERINGCOLLEGE (Autonomous)	B.Tech. VII Semester		
Code: A0353	**PLANT LAYOUT AND MATERIAL HANDLING** (Professional Elective – V)	**L**	**T**	**P**
Credits: 3		**3**	**-**	**-**

Prerequisites: Nil

Course Objectives:

The objective of this subject is to provide knowledge of Layout planning and different material handling equipments.

MODULE I: Introduction & Process Layout and Product Layout

Introduction, Classification of Layout, Advantages and Limitations of different layout, Layout design procedures, Overview of the plant layout, Types of material handling equipments, Selection and application. Preventive and break- down maintenance

Process layout and product layout: Selection, specification Implementation and follow up, comparison of product and process layout.

MODULE II: Heuristics for Plant Layout & Group Layout, Fixed Position Layout

Heuristics for plant layout- ALDEP, CORELAP, CRAFT.

Group Layout, Fixed position layout. Quadratic assignment model Branch and Bound method.

MODULE III: Introduction to Material Handling Systems

A: Introduction to Material Handling Systems: Material handling principles.

B: Classification of Material Handling Equipment, Relationship of Material Handling to plant layout.

MODULE IV: Methods of Material Handling Systems

Selection, Material Handling method path, Equipment, function oriented systems.

MODULE V: Methods to minimize cost of material handling

Maintenance of material handling equipments, Safety in handling. Ergonomics of Material Handling equipment. Design, miscellaneous equipments., methods to minimize cost of material handling

TEXT BOOKS

1. P.B. Mahapatra, **"Operation Management",** PHI Publications, 2010.
2. DR. K C Arora & Shinde **"Aspects of Material Handling",** Lakshmi Publications, 2007.

REFERENCES

1. RL Francis **"Facility Layout and Location: An Analytical Approach",** LF Mc Linnis jr and White, PHI Publications, 1992.
2. R Pannerselvam **"Production and Operation Management",** PHI Publications, 2012.

3. Ray and Sidhartha **"Introduction to Material Handling",** New Age Publications, 2007.

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2. www.strategosinc.com/facilities_planning.htm
3. serialsjournals.com/serialjournalmanager/pdf/1331984010.pdf
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Course outcomes

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

1. Understand the material flows, inventory handling and management, thereby improving the efficiency.
2. Design where the work stations and equipment are to be located along the line of production.
3. Creates awareness on objectives of plant layout – Sense of Unity, Minimum Movement of People, material and Resources, Safety and Flexibility.
4. Learn Variety of material Handling Systems – Manual, Semi-Automated and Automated.
5. Learn maintenance of Material Handling Equipments and their Safety Measures.

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak															
COs	**Programme Outcomes(POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**1**				**3**	**3**	**1**					**3**		**3**	**3**
CO2	**1**				**3**	**3**	**1**					**3**		**3**	**3**
CO3	**1**				**3**	**3**	**1**					**3**		**3**	**3**
CO4	**1**				**3**	**3**	**1**					**3**		**3**	**3**
CO5	**1**				**3**	**3**	**1**					**3**		**3**	**3**

2020-21 Onwards (MR-20)	MALLAREDDY ENGINEERINGCOLLEGE (Autonomous)	B.Tech. VII Semester		
Code: A0354	**MECHATRONICS**	**L**	**T**	**P**
Credits: 3	(Professional Elective – V)	**3**	**-**	**-**

Prerequisites: Nil

Course Objectives:

The objectives of this course are to introduce students to Mechatronics systems, Solid state electronic devices, Hydraulic and pneumatic actuating systems, and Digital electronics and systems. The course is intended for students who are thinking about advanced studies in engineering.

MODULE I: Introduction

Definition – Trends - Control Methods: Standalone, PC Based (Real Time Operating Systems, Graphical User Interface, and Simulation) - Applications: SPM, Robot, CNC, FMS, CIM.

MODULE II: Signal Conditioning & Electronic Interface Subsystems

Signal Conditioning : A: Introduction – Hardware - Digital I/O, Analog input – ADC, resolution, speed channels Filtering Noise using passive components – Resistors, capacitors - Amplifying signals using OP amps –Software - Digital Signal Processing – Low pass, high pass, notch filtering.

Electronic Interface Subsystems : TTL, CMOS interfacing - Sensor interfacing – Actuator interfacing – solenoids, motors Isolation schemes- opto coupling, buffer IC's - Protection schemes – circuit breakers, over current sensing, resettable fuses, thermal dissipation - Power Supply - Bipolar transistors / mosfets.

MODULE III : Precision Mechanical Systems & Electromechanical Drives

A: Precision Mechanical Systems : Pneumatic Actuation Systems - Electro-pneumatic Actuation Systems - Hydraulic Actuation Systems - Electro-hydraulic Actuation Systems - Timing Belts – Ball Screw and Nut - Linear Motion Guides - Linear Bearings - Harmonic Transmission - Bearings- Motor / Drive Selection, 555 timers and its applications

B: Electromechanical Drives: Relays and Solenoids - Stepper Motors - DC brushed motors – DC brushless motors - DC servo motors - 4-quadrant servo drives, PWM's - Pulse Width Modulation

– Variable Frequency Drives, Vector Drives - Drive System load calculation.

MODULE IV Microcontrollers Overview & PLC

Microcontrollers Overview: 8051 Microcontroller, micro processor structure – Digital Interfacing

- Analog Interfacing - Digital to Analog Convertors - Analog to Digital Convertors - Applications. Programming – Assembly, C (LED Blinking, Voltage measurement using ADC).
Programmable Logic Controllers: Basic Structure - Programming : Ladder diagram - Timers, Internal Relays and Counters - Shift Registers - Master and Jump Controls - Data Handling - Analog input / output - PLC Selection - Application.

MODULE V Programmable Motion Controllers

Programmable Motion Controllers : Introduction - System Transfer Function – Laplace transform and its application in analyzing differential equation of a control system - feedback devices : Position, Velocity Sensors - Optical Incremental encoders - Proximity Sensors, Inductive, Capacitive, Infrared - Continuous and discrete processes - Control System Performance & tuning

Digital Controllers - P, PI , PID Control - Control modes – Position, Velocity and Torque - Velocity Profiles – Trapezoidal - S. Curve - Electronic Gearing - Controlled Velocity Profile - Multi axis Interpolation, PTP, Linear, Circular - Core functionalities – Home, Record position, Go to Position - Applications : SPM, Robotics, Binary Ripple counter and BCD ripple counter

TEXT BOOKS

1. KP Ramachandran & GK Vijaya Raghavan, "**Mechatronics Integrated Mechanical Electronics Systems",** WILEY India Edition, 2008 .
2. W Bolton, **"Mechatronics Electronics Control Systems in Mechanical and Electrical Engineering**", Pearson Education Press, 6th Edition, 2015.

REFERENCES

1. N. Shanmugam, "**Mechatronics"**, Anuradha Agencies Publishers, 2009.
2. Devdasshetty Richard,"**Mechatronics System Design"**, Thomson, 2nd Edition, 2010.
3. M.D.Singh"**Mechatronics",** J.G.Joshi, PHI.
4. W. Bolton, "**Mechatronics – Electronic Control Systems in Mechanical and Electrical Engg",** 4th Edition, Pearson, 2012.
5. Godfrey C. Onwubolu, **"Mechatronics – Principles and Application",** Elsevier, 2006.

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2. https://www.journals.elsevier.com/mechatronics/most-downloaded-article
3. www.sciencedirect.com/science/journal/09574158
4. https://en.wikipedia.org/wiki/List_of_engineering_journals_and_magazines
5. www.servomagazine.com/index.php/magazine/article/ccs_mechatronics
6. nptel.ac.in/courses/112103174/
7. https://www.btechguru.com/courses--nptel--mechanical-engineering--mechatronics-an..

Course Outcomes

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

1. Understand the electronic interface machines.
2. Recognize basic electronics terminology and basic sensors.
3. Understand mechanical, electro, pneumatic power driven system.
4. Study the architect of Microcontroller and PLC.
5. Understand various controllers and its application.

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak															
COs	**Programme Outcomes(POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**1**				**3**	**2**	**2**					**2**	**2**		
CO2	**1**				**3**	**2**	**2**					**2**	**2**		
CO3	**1**				**3**	**2**	**2**					**2**	**2**		
CO4	**1**				**3**	**2**	**2**					**2**	**2**		
CO5	**1**				**3**	**2**	**2**					**2**	**2**		

2020-21 Onwards (MR-20)	MALLAREDDY ENGINEERINGCOLLEGE (Autonomous)	B.Tech. VII Semester		
Code: A0355	**RELIABILITY ENGINEERING**	**L**	**T**	**P**
Credits: 3	(Professional Elective – V)	**3**	**-**	**-**

Pre-Requisites: Industrial Management

Course Objectives:

The objectives of this course know about the approaches and techniques to assess and improve process and/or product quality and reliability

MODULE I: Quality value and engineering – quality systems

Quality engineering in product design and production process – system design –parameter design – tolerance design, Quality costs – quality improvement.

MODULE II: Statistical Process control

X, R, p, c charts, other types of control charts, process capability, process capability analysis, process capability index. Acceptance sampling by variables and attributes, design of sampling plans, single, double, sequential and continuous sampling plans, design of various sampling plan

MODULE III: Loss function, tolerance design

N type, L type, S type; determination of tolerance for these types. Online quality control– variable characteristics attribute characteristics, parameter design

MODULE IV : Quality function deployment and reliability

House of quality, QFD matrix, and total quality management concepts. Quality information systems, quality circles, introduction to ISO 9000 standards. Reliability– Evaluation of design by tests - Hazard Models, Linear, Raleigh, Weibull. Failure Data Analysis, reliability prediction based on weibull distribution, Reliability improvement

MODULE V: Complex system

Reliability, reliability of series, parallel, standby systems, reliability prediction and system effectiveness. Maintainability Availability, economics of reliability engineering, replacement of items, maintenance costing and budgeting, reliability testing.

TEXTBOOKS

1. Statistical Process Control, by Eugene Grant, Richard Leavenworth, McGraw Hill.
2. Quality Engineering in Production Systems, by G Taguchi , McGraw Hill, 1989
3. Optimization &Variation Reduction in Quality, byW.A. Taylor,Tata McGraw Hill, 1991.

REFERENCES

1. Jurans Quality Planning and Analysis, by Frank. M.Gryna Jr. McGrawHill
2. Taguchi Techniques for Quality Engineering, (2ndEdition) by Philipposs, McGraw Hill, 1996,.
3. Reliability Engineering, (3rdEdition), by LS Srinath, Affiliated East West Pvt Ltd, 1991.
4. Reliability Engineering, by E.Bala Guruswamy, Tata McGraw Hill, 1994.

Course Outcomes

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

1. Attain the basic techniques of quality improvement, fundamental knowledge of statistics and probability
2. Use control charts to analyze for improving the process quality
3. Describe different sampling plans.
4. Acquire basic knowledge of total quality management

5. Understand the concepts of reliability and maintainability

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak															
COs	**Programme Outcomes(POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**1**	**1**	**1**	**1**	**1**							**1**			**1**
CO2	**2**	**2**	**1**	**1**	**2**							**1**			**1**
CO3	**2**	**2**	**2**	**2**	**2**							**2**			**1**
CO4	**2**	**2**	**2**	**2**	**2**							**2**			**1**
CO5	**3**	**2**	**2**	**2**	**2**							**2**			**1**

2020-21 Onwards (MR-20)	MALLAREDDY ENGINEERINGCOLLEGE (Autonomous)	B.Tech. VII Semester		
Code: A0356	JET PROPULSION & ROCKET ENGINEERING (Professional Elective – V)	L	T	P
Credits: 3		3	-	-

Pre-Requisites: Thermodynamics

Course Objectives:

The objectives of this course know about turbo jets and rocket technology

MODULE I: Elements of Gas Turbine Theory

Thermo dynamic Cycles, open closed and semi-closed- parameters of performances cycles modifications for improvement of performance

MODULE II: Jet Propulsion

Historical sketch reaction principle- essential features of propulsion devices- Thermal Engines, Classification of – Energy flow thrust, Thrust power and propulsion efficiency- Need for Thermal Jet Engines and applications

MODULE III: Turboprop and Turbo Jet

Turboprop and Turbo Jet-I: Thermo dynamic cycles plant layout essential components principles of operation, Performance evaluation**.**

Turboprop and Turbo Jet-II: Thrust Augmentation and Thrust reversal Contrasting with piston Engine Propeller plant.

Ram Jet: Thermo dynamic cycle, plant lay-out essential components- principles of operation- performance evaluation comparison among atmospheric thermal jet engines, serqujet and pulse jet, elementary treatment

MODULE IV : Rocket Engines

Need for applications, - Basic principles of operation and parameters of performance- classification of solid and liquid propellant rocket engines advantages, domains of applications- propellants- comparison of propulsion systems

MODULEV: Rocket Technology

Rocket Technology –I: Flight mechanics, Applications Thrust profiles, Acceleration – staging of rockets need for- Feed systems, injectors and expansion nozzles- Rocket heat transfer and ablative cooling.

Rocket Technology –II: Testing and instrumentation- Need for Cryogenics- Advanced propulsion Systems elementary treatment of Electrical Nuclear and plasma Arc Propulsion.

TEXTBOOKS

1. Gas Turbines and Propulsive Systems / P.Khajuria& S.P.Dubey/ Dhanpatrai Publishers.
2. Gas Dynamics & Space Propulsion / M.C.Ramaswamy / Jaico Publishing House**.**

REFERENCES

1 .Rocket Propulsion / Sutton / John Wiley & Sons Publishers

2. Gas Turbines / Cohen, Rogers &SarvanaMuttoo / Addision Wesley & Longman Publishers. 3.Gas Turbines / V. Ganesan / TMH Publishers

Course Outcomes

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

1. Understand the basic difference between incompressible and compressible flow
2. Understand and apply the principles of compressible flow in the constant area ducts with friction and heat transfer
3. Understand the phenomenon of shock normal and oblique waves and its effect on flow.
4. Gain basic knowledge about jet propulsion and Jet Propulsion systems.
5. Gain basic knowledge about jet propulsion and Rocket Propulsion systems.

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak															
COs	**Programme Outcomes(POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**2**	**2**		**3**		**1**	**2**					**1**	**3**		
CO2	**2**	**2**		**3**		**1**	**2**					**1**	**3**		
CO3	**2**	**2**		**3**		**1**	**2**					**1**	**3**		
CO4	**2**	**2**		**3**		**1**	**2**					**1**	**3**		
CO5	**2**	**2**		**3**		**1**	**2**					**1**	**3**		

2020-21 Onwards (MR-20)	MALLAREDDY ENGINEERINGCOLLEGE (Autonomous)	B.Tech. VII Semester		
Code: A0357	**TOOL DESIGN**	**L**	**T**	**P**
Credits: 3	(Professional Elective – V)	**3**	**-**	**-**

Prerequisites: Production Technology, Machine Tools

Course Objectives:

The objectives of this course know about design of jigs, fixtures and various dies

MODULE I: Design of Jigs

Introduction – Location Principles – Six Point Location Principle – Locators – Clamping Principles – Clamping Devices – Drill Jigs – Drill Bushes – Drill Jig Types – Design and Development of Jigs for given components.

MODULE II: Design of Fixtures

Milling Fixtures – Milling Methods – Milling Fixture Types – Turning fixtures – Broaching Fixtures – Grinding Fixtures – Assembly, Inspection and Welding Fixtures – Modular Fixtures – Design and Development of Fixtures for given components

MODULE III: Design of Dies

Power presses types and construction details, die cutting operation, cutting action in die and punch, center Of pressure, clearance and its significance, cutting forces, methods of reducing cutting forces, methods of Punch Support, strippers, stock stops, guide pilots, knockout, design of blanking and piercing dies. Design Concepts and description of the components of progressive dies. Design of progressive dies. Design of compound dies. Design of combination dies.

MODULE IV: Drawing Dies

Metal flow and factors affecting drawing, blank size calculations, drawing force, single and double acting drawing dies, design and development of drawing dies for different components.

MODULEV: Bending and Forming Dies

Spring back, bend allowance; calculation of development length, bending force calculations types of bending dies. Curling dies

TEXTBOOKS

1. P. H. Joshi – 'Jigs and Fixtures Design Manual' – McGraw Hill – 2002
2. Kempster M. H. A. – 'An Introduction to Jig and Tool Design' – Viva Books Pvt. Ltd. – 2002
3. Paquin and Crowley – 'Die Design Fundamentals' – Industrial Press, New York – 1979

REFERENCES

1. John G. Nee – 'Fundamentals of Tool Design' – Society of Manufacturing – 1998 – 4th Edition
2. Production Techno1ogy Hand Book' – HMT – Tata McGraw Hill
3. E. K. Henriksen – 'Jig and Fixture Design Manual' – Industrial Press, New York – 1973
4. Donaldson, Lecain and Goold – 'Tool Design' – McGraw Hill, New York – 1976

Course Outcomes

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

1. Design jigs and clamping devices.
2. Design milling, turning, grinding and modular fixtures.
3. Design blanking, piercing and compound dies

6. Know about design and development of drawing dies.
7. Design bending and forming dies.

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak															
COs	**Programme Outcomes(POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**2**	**2**		**3**		**1**	**2**					**1**	**3**		
CO2	**2**	**2**		**3**		**1**	**2**					**1**	**3**		
CO3	**2**	**2**		**3**		**1**	**2**					**1**	**3**		
CO4	**2**	**2**		**3**		**1**	**2**					**1**	**3**		
CO5	**2**	**2**		**3**		**1**	**2**					**1**	**3**		

2020-21 Onwards (MR-20)	MALLAREDDY ENGINEERINGCOLLEGE (Autonomous)	B.Tech. VII Semester		
Code: A0358	**ENTREPRENEURSHIP**	**L**	**T**	**P**
Credits: 3	(Professional Elective – VI)	**3**	**-**	**-**

Prerequisite: Nil

Course Objectives:

The aim of this course is to inspire students to become entrepreneurs so that they will emerge as job providers rather than job seekers.

Module -I:

Understanding Entrepreneurial Mindset-characteristics of an entrepreneur -The evolution of entrepreneurship-Approaches to entrepreneurship- The challenges of new venture start-ups-Critical factors for new venture development.-

Module -II:

Twenty first centaury trends in entrepreneurship- Difference between entrepreneur and entrepreneurship.The individual entrepreneurial mind-set and Personality-The entrepreneurial journey-Women entrepreneurship:

Module- III

growth problems in India-Entrepreneurial motivations. Corporate Entrepreneurial Mindset-the nature of corporate entrepreneur- -sustaining corporate entrepreneurship.

Module -IV:

Launching Entrepreneurial Ventures-opportunities identification-entrepreneurial Imagination and Creativity-the nature of the creativity process

Module -V:

Innovation and entrepreneurship.Methods to initiateVentures-Creating new ventures-Acquiring an Established entrepreneurial venture -Intellectual property protection-Patents, Copyrights-Trademarks and Trade secrets.

Text books:

4 D F Kuratko and T V Rao "Entrepreneurship-A South-Asian Perspective "Cengage
5 Learning, 2012. (For PPT, Case Solutions Faculty may visit : login.cengage.com)

Reference books:

1. Vasant Desai "Small Scale industries and entrepreneurship" Himalaya publishing 2012.
2. Rajeev Roy "Entrepreneurship" 2e, Oxford, 2012.
3. B.Janakiramand M.Rizwana" Entrepreneurship Development :Text & Cases,Excel Books,2011.

Course Outcomes:

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

1. To know the **i**ntroduction to entrepreneurship: Understanding individual Entrepreneurial Mindset and personality.
2. To know the Entrepreneurship development programs in India

3. To know the financial institutions supporting entrepreneurship in India.
4. To know the legal challenges of Entrepreneurship-Intellectual property protection-Patents Copyrights.
5. To know Strategic perspectives in entrepreneurship.

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak															
COs	**Programme Outcomes(POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1		**1**			**1**	**1**			**2**		**1**	**1**		**1**	**1**
CO2		**1**			**1**	**1**			**2**		**1**	**1**		**1**	**1**
CO3		**1**			**1**	**1**		**1**	**2**		**1**	**1**		**1**	**1**
CO4		**2**			**1**	**1**		**1**	**2**		**1**	**1**		**1**	**1**
CO5		**2**			**1**	**1**		**1**	**2**		**1**	**1**		**1**	**1**

2020-21 Onwards (MR-20)	MALLAREDDY ENGINEERINGCOLLEGE (Autonomous)	B.Tech. VII Semester		
Code: A0359	**TOTAL QUALITY AND MANAGEMENT**	**L**	**T**	**P**
Credits: 3	(Professional Elective – VI)	**3**	**-**	**-**

Prerequisites: Nil

Course Objectives:

To give the students an overview of quality and TQM and explaining the salient contributions of Quality Gurus like Deming, Juran and Crosby and general barriers in implementing TQM and also get basic knowledge about ISO.

MODULE I: Introduction

Introduction - Need for quality - Evolution of quality - Definitions of quality - Dimensions of product and service quality - Basic concepts of TQM - TQM Framework - Contributions of Deming, Juran and Crosby - Barriers to TQM - Quality statements - Customer focus - Customer orientation, Customer satisfaction, Customer complaints, and Customer retention - Costs of quality.

MODULE II: TQM Principles

Leadership - Strategic quality planning, Quality Councils - Employee involvement - Motivation, Empowerment, Team and Teamwork, Quality circles Recognition and Reward, Performance appraisal - Continuous process improvement - PDCA cycle, 5S, Kaizen - Supplier partnership - Partnering, Supplier selection, Supplier Rating.

MODULE III: Statistical Process Control (SPC)

A: Statistical fundamentals – Measures of central Tendency and Dispersion - Population and Sample.

B: Control Charts for variables and attributes, Industrial Examples. Process capability. Concept of six sigma – New seven Management tools.

MODULE IV: TQM Tools

Bench marking -Reason to bench mark, Bench marking process - FMEA - Stages, Types. Quality Function Deployment (QFD) - House of Quality - Taguchi quality loss function - TPM - Concepts, improvement needs - Performance measures

MODULE V: Quality Systems

Need for ISO 9000 and Other Quality Systems - ISO 9000-2008 Quality System - Elements, Implementation of Quality System Documentation, Quality Auditing - QS 9000 - ISO 14000 - ISO 18000, ISO 20000, ISO 22000 TS 16949, ISO 14000, AS9100– Concept, Requirements and

benefits – case studies.

TEXT BOOKS

1. Dale H. Besterfiled,"**Total Quality Management**", 3rd, Pearson Education Asia, 2010.
2. Subburaj Ramasamy" **Total Quality Management**" Tata McGraw - Hill publishers, 2012.

REFERENCES

1. Suganthi.L and Anand Samuel, "**Total Quality Management**", Prentice Hall Pvt. Ltd., 2011.
2. James R. Evans and William M. Lindsay, "**The Management and Control of Quality**", 8th Edition, Cengage Learning, 2012.
3. Janakiraman. B and Gopal .R.K., "**Total Quality Management - Text and Cases**", Prentice Hall (India) Pvt. Ltd., 2006.
4. Dr S. Kumar, "**Total Quality Management**", Laxmi Publications Ltd., New Delhi 2015.
5. P. N. Muherjee, "**Total Quality Management**", Prentice Hall of India, New Delhi, 2006.

E - RESOURCES

1. https://src.alionscience.com/pdf/RAC-1ST/SOAR7_1st_Chapter.pdf
2. https://onlinecourses.nptel.ac.in/noc17_mg18
3. nptel.ac.in/courses/122106032/Pdf/4_2.pdf
4. www.thecqi.org
5. www.emeraldinsight.com/journal/tqm
6. www.emeraldinsight.com/doi/pdf/10.1108/09544789710367712
7. www.statit.com/statitcustomqc/StatitCustomQC_Overview.pdf

Course outcomes

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

1. Gain basic knowledge in total quality management relevant to both manufacturing and service industry.
2. Implement the basic principles of TQM in manufacturing and service based organization.
3. Apply various SPC tools in real time manufacturing and service industry.
4. Implement various TQM tools like FMEA & QFD.
5. Apply various ISO Standards for real time applications.
6.

CO- PO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes(POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1				3	2			3		3	3	2		3
CO2	1				3	2			3		3	3	2		3
CO3	1				3	2			3		3	3	2		3
CO4	1				3	2			3		3	3	2		3
CO5	1				3	2			3		3	3	2		3

2020-21 Onwards (MR-20)	MALLAREDDY ENGINEERINGCOLLEGE (Autonomous)	B.Tech. VII Semester		
Code: A0360	**PROCESS PLANNING & COST ESTIMATION**	**L**	**T**	**P**
Credits: 3	(Professional Elective – VI)	**3**	**-**	**-**

Prerequisites: Nil

Course Objectives:

The objective of this subject is to provide knowledge of Planning and analyze the cost requirements of various production activities.

MODULE I: Introduction to Process Planning

Introduction- Methods of process planning - Drawing interpretation-Material evaluation – Steps in process selection - Production equipment and Tooling selection.

MODULE II: Process Planning Activities

Process parameters calculation for various production processes - Selection of jigs and fixtures Selection of quality assurance methods - Set of documents for process planning - Economics of process planning- case studies.

MODULE III: Introduction to Cost Estimation

A: Importance and Aims of costing and estimation – Difference between costing and estimation - methods of costing-Elements of cost estimation –Types of estimates.

B: Estimating procedure - Estimation of labour cost, Material cost - Allocation of overhead charges- Calculation of depreciation cost.

MODULE IV: Production Cost Estimation

Estimation of Different Types of Jobs - Estimation of Forging Shop, Estimation of Welding Shop and Gas Cutting - Estimation of Foundry Shop - Estimation of pattern cost and casting cost – Problems.

MODULE V: Machining Time Calculation

Estimation of Machining Time - Importance of Machine Time Calculation- Calculation of Machining Time - Different Lathe Operations, Drilling, Boring, Milling, Shaping, Planning and Grinding.

TEXT BOOKS

1. G.B.S.Narang and V.Kumar,"**Production and Costing**", Khanna Publishers,1995.
2. R.Panneerselvam,P.Sivasankara "**Process Planning and Cost Estimation**" Laxmi Pubication, 2015.

REFERENCES

1. Russell.R.S and Tailor, B.W, "**Operations Management**", PHI, 6th Edition, 2009.
2. Chitale.A.V. and Gupta.R.C., "**Product Design and Manufacturing**", PHI, 2nd Edition, 2002.Gideon Halevi and Roland Weill, "**Principles of Process Planning – A Logical Approach**" Chapman and Hall, London, 2014
3. S. K. Mukhopadhyay, "**Production Planning and Control-Text and cases**", PHI Pvt. Ltd 2007.
4. Mikell.P.Groover "**Automation, Production Systems and Computer Integrated Manufacturing**", Prentice Hall of India, New Delhi, 2008, 3rd edition.

E - RESOURCES

1. nptel.ac.in/courses/112102103/Module%20G/Module%20G(5)/p4.htm
2. nptel.ac.in/courses/106105087/pdf/m11L27.pdf
3. www.engr.psu.edu/cim/ie550/ie550capp.ppt

Course Outcomes

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

1. Relate the concepts of process planning and selection.
2. Maintain the various documents used in process planning.
3. Analyse various cost involved in a product and control it.
4. Make estimation for product.
5. Appraisal the costs and machining times for various manufacturing processes.

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak															
COs	**Programme Outcomes(POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**1**	**2**	**3**	**3**	**1**			**1**	**3**		**3**	**3**			**3**
CO2	**1**	**2**	**3**	**3**	**1**			**1**	**3**		**3**	**3**			**3**
CO3	**1**	**2**	**3**	**3**	**1**			**1**	**3**		**3**	**3**			**3**
CO4	**1**	**2**	**3**	**3**	**1**			**1**	**3**		**3**	**3**			**3**
CO5	**1**	**2**	**3**	**3**	**1**			**1**	**3**		**3**	**3**			**3**

2020-21 Onwards (MR-20)	MALLAREDDY ENGINEERINGCOLLEGE (Autonomous)	B.Tech. VII Semester		
Code: A0361	**FOUNDRY TECHNOLOGY**	**L**	**T**	**P**
Credits: 3	(Professional Elective – VI)	**3**	**-**	**-**

Prerequisite: Production Technology.

Course Objectives:

Provide the students with knowledge on the principles that guides production of soundengineering castings

Module – I: Introduction to Foundry

Introduction to Foundry: Steps involved in making a casting - Advantage of casting and its applications. Patterns and Pattern making - Types of patterns - Materials used for patterns, pattern allowances and their construction, Principles of Gating, Gating ratio and design of Gating systems.

Module – II: Solidification of casting

Solidification of casting: Concept - Solidification of pure metal and alloys, short & long freezingrange alloys. Risers - Types, function and design, casting design considerations, special casting processes 1) Centrifugal 2) Die, 3) Investment., Mould making machines.

Module – III: Directionality of Solidification & Methods of Melting

A: Directionality of Solidification, Characteristics of different alloys, system of determining thefeeder head requirements, Feeder head efficiency, and concept of feeding range,

B: Methods of Melting: Crucible melting, blast furnace and cupola operation, steel makingprocesses.

Module – IV: Special casting processes & Industrial melting practices A: Special casting processes: Investment casting, Die casting, centrifugal casting, full mould casting, vacuum shield casting etc.

B: Industrial melting practices: Aim of melting and melting practices as adopted in case of CastIrons, Steel, Cu, Al and its alloys.

Module – V: Casting defects & their remedies

Casting defects & their remedies: Shaping faults arising in pouring, Inclusions and sand defects, gas defects, shrinkage defects during solidification in liquid phase. Contraction defects, Dimensional errors, compositional errors and segregation.

Text Books:

1. Beeley, P.R., "**Foundry Technology"**, Butterworth and Co, 1st edition, 1972.
2. Webster, P.D., "**Fundamentals of Foundry Technology"**Redhill, Surrey: Portcullis Press, 2nd edition, 1980.

Reference books:

1. Mukherjee, P.C, **"Fundamentals of Metal casting Technology"**, 2nd edition, 1988
2. O P Khanna, **"Foundry Technology", Dhanpat Rai Publications"**, 17th edition, 2011

Course Outcomes:

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

1. Explain the application of casting processes, design and allowances of pattern.
2. Describe the process of core, mould making and explain about mould making machines.
3. Explain the feed head requirements and concept of feeding range.
4. Suggest suitable moulding techniques, melting furnaces and foundry practices for ferrousand non-ferrous castings.
5. Describe the inspection methods for casting defects and provide remedies.

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak															
COs	**Programme Outcomes(POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**1**	**1**		**1**			**1**					**1**		**2**	
CO2	**2**	**1**					**1**					**1**		**2**	
CO3	**2**	**3**					**1**					**1**		**2**	
CO4	**3**	**2**					**2**					**1**		**2**	
CO5	**2**	**1**		**1**								**1**		**2**	

2020-21 Onwards (MR-20)	MALLAREDDY ENGINEERINGCOLLEGE (Autonomous)	B.Tech. VII Semester		
Code: A0362	**NANO TECHNOLOGY**	**L**	**T**	**P**
Credits: 3	(Professional Elective – VI)	**3**	**-**	**-**

Prerequisite: basic chemical and physical concepts of mechanics and Thermodynamics.

Course Objectives:
The objective of this subject is to understand basic nano systems and physical reasoning to develop simple nano scale models to interpret the behavior of such physical systems.

Module-I: General Introduction:
Basics of Quantum Mechanics, Harmonic oscillator, magnetic Phenomena, band structure in solids, Mossbauer and Spectroscopy, optical phenomena bonding in solids, Anisotropy.

Silicon Carbide: Application of Silicon carbide, nano materials preparation, Sintering of SiC, X-ray Diffraction data, electron microscopy sintering of nano particles, Nano particles of Alumina and Zirconia:
Nano materials preparation, Characterization, Wear materials and nano composites,

Module-II: Mechanical properties:
Strength of nano crystalline SIC, Preparation for strength measurements, Mechanical properties, Magnetic properties.
Electrical properties: Switching glasses with nano particles, Electronic conduction with nano particles
Optical properties: Optical properties, special properties and the coloured glasses

Module-III:
Processes: Process of synthesis of nano powders, Electro deposition, Important nano materials
Investigating and manipulating materials in the nano scale:
Electron microscopics, scanning probe microscopics, optical microscopic for nano science and technology, X-ray diffraction.

Module-IV: Nano biology:
Interaction between bimolecules and nano particle surface, Different types of inorganic materials used for the synthesis of hybrid nano-bio assemblies, Application of nano in biology, nano probes for Analytical Applications-A new Methodology in medical diagnostics and Biotechnology, Current status of nano Biotechnology, Future perspectives of Nano biology, Nano sensors.

Module -V: Nano Medicines:
Developing of Nano medicens Nano sytems in use, Protocols for nano drug Administration, Nano technology in Diagnostics applications, materials for used in Diagnostics and Therapeutic applications, Molecular Nano mechanics, Molecular devices, Nano tribology, studying tribology at nano scale,Nano tribology applications.

Textbooks:

1. A.K.Bandyopadhyay/**Nano Materials**/NewAge Publishers/2011.
2. T.Pradeep/**Nano Essentials**/TMHPublishers/2007.

Reference books:

1. CharlesP.PooleJr/**IntroductiontoNanotechnology**/FrankJ.Owens,WileyIndiaPvt. Ltd.

2. Chatopadhya.K.K,BenerjeeA.N./**IntroductiontoNanoscienceandNanotechnology**
3. PhaniKumar/**IntroductiontoNanotechnology**.

Course Outcomes:

After completion of the course, students will be:

1. Understand the major issues in producing a sustainable nano tech industry.
2. Obtain good knowledge on basics of Quantum Mechanics.
3. Understand the Process of Synthesis of Nano Powders, Electro deposition and Nano Materials.
4. Learn Interaction between bimolecular and nano particle surface and different types of in organic materials used for the synthesis of hybrid nano-bio assemblies.
5. Investigate and manipulate materials in the nano scale.

CO-POMapping
(3/2/1indicatesstrengthof correlation) 3-Strong,2-Medium,1-Weak

COs	Programme Outcomes(POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3		1					3		3		1			
CO2	3		3					3		3		1			
CO3	3	1						3		3		1			
CO4	3							3		3		2			
CO5	3							3		3		1			

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. VII Semester		
Code: A0342	SIMULATION AND ANALYSIS LAB	L	T	P
Credits: 2		-	-	2

Course Objectives:

To give exposure to software tools needed to analyze engineering problems and to expose the students to different applications of simulation and analysis tools.

List of Experiments

A. SIMULATION

1. MATLAB basics, Dealing with matrices, Graphing-Functions of one variable and two variables.
2. Use of Matlab to solve simple problems in vibration.
3. Mechanism Simulation using Multi body Dynamic software.

B. ANALYSIS

1. Force and Stress analysis using link elements in Trusses, cables etc.
2. Stress and deflection analysis in beams with different support conditions.
3. Stress analysis of flat plates and simple shells.
4. Stress analysis of axi - symmetric components.
5. Thermal stress and heat transfer analysis of plates.
6. Thermal stress analysis of cylindrical shells.
7. Vibration analysis of spring-mass systems.
8. Model analysis of Beams.
9. Harmonic, transient and spectrum analysis of simple systems.

Course Outcomes

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

1. Exploit software tools needed to analyze engineering problems.
2. Model, analyze and simulate experiments to meet real world system.
3. Expand knowledge on different applications of simulation and analysis tools.
4. Solve vibration based problems.
5. Understand the time domain problems.

CO-POMapping (3/2/1indicatesstrengthof correlation) 3-Strong,2-Medium,1-Weak

COs	Programme Outcomes(POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1		1		3	2			1			2	3		
CO2	1		1		3	2			1			2	3		
CO3	1		1		3	2			1			2	3		
CO4	1		1		3	2			1			2	3		
CO5	1		1		3	2			1			2	3		

OPEN ELECTIVES

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech.		
Code: A0330	ENERGY CONSERVATION AND ENERGY MANAGEMENT (Open Elective)	L	T	P
Credits:3		3	-	-

Prerequisites: Nil

Course Objectives:

The students will be able to understand and analyze the energy data of industries, carryout energy accounting and balancing, conduct energy audit and suggest methodologies for energy savings and utilize the available resources in optimal ways

MODULE I: Introduction

Energy - Power – Past & Present scenario of World; National Energy consumption Data – Environmental aspects associated with energy utilization –Energy Auditing: Need, Types, Methodology and Barriers. Role of Energy Managers. Instruments for energy auditing.

MODULE II Thermal Systems

Stoichiometry, Boilers, Furnaces and Thermic Fluid Heaters – Efficiency computation and ENCON measures. Steam: Distribution & Usage: Steam Traps, Condensate Recovery, Flash Steam Utilization, Insulators &Refractory.

MODULE III: Lighting and Electrical Systems

A: Illumination – Lux, Lumens, Types of lighting, Efficacy, LED Lighting and scope of ENCON in Illumination.

B: Components of EB billing – HT and LT supply, Transformers, Cable Sizing, Concept of Capacitors, Power Factor Improvement, Harmonics, Electric Motors - Motor Efficiency Computation, Energy Efficient Motors

MODULE IV: Energy Conservation in Major Utilities

Pumps, Fans, Blowers, Compressed Air Systems, Refrigeration and Air Conditioning Systems – Cooling Towers – D.G. sets

MODULE V Economics

Energy Economics – Discount Rate, Payback Period, Internal Rate of Return, Net Present Value, Life Cycle Costing –ESCO concept

REFERENCE BOOKS

1. Witte. L.C., P.S. Schmidt, D.R. Brown, **"Industrial Energy Management and Utilisation",** Hemisphere Publ, Washington
2. Callaghn, P.W. **"Design and Management for Energy Conservation"**, Pergamon Press, Oxford
3. Dryden. I.G.C., **"The Efficient Use of Energy"** Butterworths, London
4. Steve Doty, Wayne C. Turner **"Energy Management Hand book"**, Fairmont Press; 8th Edition, 2012.
5. W.R. Murphy and G. McKay **"Energy Management"**, Butterworth-Heinemann Ltd, 2009

E - RESOURCES

1. http://www.em-ea.org/
2. https://www.journals.elsevier.com/energy-conversion-and-management/
3. http://aea-al.org/wp-content/uploads/2015/07/1118838254.pdf

Course Outcomes

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

1 Apply the energy management approaches and role of energy manager.
2 Analyse energy conservation measures in lighting and electrical systems
3 Apply the principles of thermal engineering and energy management to improve the performance of thermal systems.
4 Analyse methods of energy conservation and energy efficiency for major utilities.
5 Apply to economic analysis of energy utilization.

CO- PO Mapping (3/2/1indicatesstrengthofcorrelation)3-Strong,2-Medium,1-Weak															
COs	**Programme Outcomes(POs)**												**PSOs**		
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	**3**	**2**	**2**	**1**								**1**	**2**		
CO2	**3**	**2**	**2**	**1**								**1**	**2**		
CO3	**3**	**2**	**2**	**1**								**1**	**2**		
CO4	**2**	**2**	**2**	**1**								**1**	**2**		
CO5	**2**	**2**	**2**	**1**								**1**	**2**		

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech.		
Code: A0363	RENEWABLE ENERGY SOURCES (Open Elective)	L	T	P
Credits: 3		3	-	-

Prerequisites: Nil

Course Objectives:

The objective of this subject is to provide knowledge about different non-conventional energy sources.

MODULE I: Principles of Solar Radiation

Role and potential of new and renewable source, the solar energy option, Environmental impact of solar power, physics of the sun, the solar constant, extraterrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sun shine, solar radiation data.

MODULE II: Solar Energy

Solar Collectors: Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors.
Solar Energy Storage and Applications: Different methods, Sensible, latent heat and stratified storage, solar ponds. Solar Applications- solar heating/cooling technique, solar distillation and drying, photovoltaic energy conversion.

MODULE III: Wind Energy & Bio-Mass

A: Wind Energy: Sources and potentials, horizontal and vertical axis windmills, performance characteristics, Betz criteria.
B: Bio-Mass: Principles of Bio-Conversion, Anaerobic/aerobic digestion, types of Bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking, I.C. Engine operation and economic aspects.

MODULE IV: Geothermal Energy & Ocean Energy

Geothermal Energy: Resources, types of wells, methods of harnessing the energy, potential in India. Ocean Energy: OTEC, Principles utilization, setting of OTEC plants, thermodynamic cycles. Tidal and wave energy: Potential and conversion techniques, mini-hydel power plants and their economics.

MODULE V: Direct Energy Conversion

Need for DEC, Carnot cycle, limitations, principles of DEC. Thermo-electric generators, Seebeck, Peltier and Joule Thomson effects, merit, materials, applications. MHD generators - principles, dissociation and ionization, hall effect, magnetic flux, MHD accelerator, MHD Engine, power generation systems. Electron gas dynamic conversion - economic aspects. Fuel cells - Principles of Faraday's law's, thermodynamic aspects, selection of fuels and operating conditions.

TEXT BOOKS

1. G.D. Rai, "**Non-Conventional Energy Sources",** Khanna publishers, 2011.
2. Tiwari and Ghosal, "**Renewable Energy Resources"**, Narosa Publishing House, 2007.

REFERENCES

1. Twidell & Weir, "**Renewable Energy Sources",** Taylor and Francis Group Publishers,2015.
2. Sukhatme, **"Solar Energy",** McGraw-Hill-third edition, 2008.
3. B.S Magal Frank Kreith& J.F Kreith "**Solar Power Engineering",** McGraw-Hill Publications, 2010.
4. Frank Krieth & John F Kreider, "**Principles of Solar Energy",** McGraw-Hill, 1981.
5. Ashok V Desai, "**Non-Conventional Energy**", New International (P) Limited, 2003.

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1. nptel.ac.in/courses/112105051/
2. https://www.vssut.ac.in/lecture_notes/lecture1428910296.pdf
3. faculty.itu.edu.tr/onbasiogl1/DosyaGetir/62002
4. https://www.journals.elsevier.com/renewable-energy/
5. www.ijrer.org

Course Outcomes

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

1. Understand the principles of solar radiation
2. Recognize solar collectors, Solar energy storage and its applications
3. Classify the harvesting of wind energy & bio-mass energy.
4. Understand the harvesting of geothermal energy & ocean energy.
5. Apply the direct energy conversion methods

CO- PO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes(POs)												PSOs		
	PO 1	PO2	PO3	PO4	PO5	PO 6	PO 7	PO8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	1					3	3					3			
CO2	1					3	3					3			
CO3	1					3	3					3			
CO4	1					3	3					3			
CO5	1					3	3					3			

2020-21 Onwards (MR-20)	MALLAREDDY ENGINEERINGCOLLEGE (Autonomous)	B.Tech.		
Code: A0359	**TOTAL QUALITY AND MANAGEMENT**	**L**	**T**	**P**
Credits: 3	(Open Elective)	**3**	**-**	**-**

Prerequisites: Nil

Course Objectives:

To give the students an overview of quality and TQM and explaining the salient contributions of Quality Gurus like Deming, Juran and Crosby and general barriers in implementing TQM and also get basic knowledge about ISO.

MODULE I: Introduction

Introduction - Need for quality - Evolution of quality - Definitions of quality - Dimensions of product and service quality - Basic concepts of TQM - TQM Framework - Contributions of Deming, Juran and Crosby - Barriers to TQM - Quality statements - Customer focus - Customer orientation, Customer satisfaction, Customer complaints, and Customer retention - Costs of quality.

MODULE II: TQM Principles

Leadership - Strategic quality planning, Quality Councils - Employee involvement - Motivation, Empowerment, Team and Teamwork, Quality circles Recognition and Reward, Performance appraisal - Continuous process improvement - PDCA cycle, 5S, Kaizen - Supplier partnership - Partnering, Supplier selection, Supplier Rating.

MODULE III: Statistical Process Control (SPC)

A: Statistical fundamentals – Measures of central Tendency and Dispersion - Population and Sample.

B: Control Charts for variables and attributes, Industrial Examples. Process capability. Concept of six sigma – New seven Management tools.

MODULE IV: TQM Tools

Bench marking -Reason to bench mark, Bench marking process - FMEA - Stages, Types. Quality Function Deployment (QFD) - House of Quality - Taguchi quality loss function - TPM - Concepts, improvement needs - Performance measures

MODULE V: Quality Systems

Need for ISO 9000 and Other Quality Systems - ISO 9000-2008 Quality System - Elements, Implementation of Quality System Documentation, Quality Auditing - QS 9000 - ISO 14000 - ISO 18000, ISO 20000, ISO 22000 TS 16949, ISO 14000, AS9100– Concept, Requirements and

benefits – case studies.

TEXT BOOKS

3. Dale H. Besterfiled,"**Total Quality Management**", 3rd, Pearson Education Asia, 2010.
4. Subburaj Ramasamy" **Total Quality Management**" Tata McGraw - Hill publishers, 2012.

REFERENCES

1. Suganthi.L and Anand Samuel, "**Total Quality Management**", Prentice Hall Pvt. Ltd., 2011.
2. James R. Evans and William M. Lindsay, "**The Management and Control of Quality**", 8th Edition, Cengage Learning, 2012.
3. Janakiraman. B and Gopal .R.K., "**Total Quality Management - Text and Cases**", Prentice Hall (India) Pvt. Ltd., 2006.
4. Dr S. Kumar, "**Total Quality Management**", Laxmi Publications Ltd., New Delhi 2015.
5. P. N. Muherjee, "**Total Quality Management**", Prentice Hall of India, New Delhi, 2006.

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1. https://src.alionscience.com/pdf/RAC-1ST/SOAR7_1st_Chapter.pdf
2. https://onlinecourses.nptel.ac.in/noc17_mg18
3. nptel.ac.in/courses/122106032/Pdf/4_2.pdf
4. www.thecqi.org
5. www.emeraldinsight.com/journal/tqm
6. www.emeraldinsight.com/doi/pdf/10.1108/09544789710367712
7. www.statit.com/statitcustomqc/StatitCustomQC_Overview.pdf

Course outcomes

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

1. Gain basic knowledge in total quality management relevant to both manufacturing and service industry.
2. Implement the basic principles of TQM in manufacturing and service based organization.
3. Apply various SPC tools in real time manufacturing and service industry.
4. Implement various TQM tools like FMEA & QFD.
5. Apply various ISO Standards for real time applications.

CO- PO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes(POs)												PSOs		
	PO 1	PO2	PO3	PO4	PO5	PO 6	PO 7	PO8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	1				3	2			3		3	3	2		3
CO2	1				3	2			3		3	3	2		3
CO3	1				3	2			3		3	3	2		3
CO4	1				3	2			3		3	3	2		3
CO5	1				3	2			3		3	3	2		3

2020-21 Onwards (MR-20)	MALLAREDDY ENGINEERINGCOLLEGE (Autonomous)	B.Tech.		
Code: A0364	**ROBOTICS**	**L**	**T**	**P**
Credits: 3	(Open Elective)	**3**	**-**	**-**

Prerequisite: Nill

Course Objectives:

The objective of this subject is to provide knowledge of design of robot arm, kinematics anddynamics, Trajectory planning of robot and its applications in automation of Industries.

Module – I: Introduction

Automation and Robotics, CAD/CAM and Robotics – An over view of Robotics – present and future applications – classification by coordinate system and control system.

Components of the Industrial Robotics:-Degrees of freedom-End effectors: Mechanical gripper-magnetic-vacuum cup and other types of grippers

Module – II: Motion Analysis & Manipulator Kinematics

A: Motion Analysis: Homogeneous transformations as applicable to rotation and translation – problems.

B: Manipulator Kinematics: Specifications of matrices, D-H notation joint coordinates and world coordinates.

Module - III: Dynamics

Differential transformation and manipulators, Jacobians – problems.

Lagrange – Euler and Newton – Euler formations – Problems.

Trajectory planning and avoidance of obstacles, path planning,

Module - IV: Robot actuators and Feedback components

Actuators: Pneumatic, Hydraulic actuators, electric & stepper motors. Feedback components: position sensors – potentiometers, resolvers, encoders – Velocity sensors.

Module - V: Robot Application in Manufacturing:

Material Transfer - Material handling, loading and unloading- Processing - spot and continuous arc welding & spray painting

Text books:

1. Groover M P "**Industrial Robotics",** Pearson Edu.
2. Mittal R K & Nagrath I J "**Robotics and Control",** TMH.

Reference books:

1. Fu K S "**Robotics",** McGraw Hill.
2. P. Coiffet and M. Chaironze "**An Introduction to Robot Technology"**, Kogam Page Ltd. 1983 London.
3. Richard D. Klafter "**Robotic Engineering",** Prentice Hall Publishers
4. Asada and Slow time "**Robot Analysis and Intelligence",** Wiley Inter-Science.
5. John J Craig "**Introduction to Robotics",** Pearson Edu.
6. Mark W. Spong and M. Vidyasagar "**Robot Dynamics & Control",** John Wiley & Sons (ASIA) Pvt Ltd.

Course outcomes:

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

1. Understand and analysethe basic concepts of automation and components of robotics.
2. Solve the homogeneous transformation matrices for Forward and inverse kinematics –problems.
3. Understand and analyse the trajectory planning of the robot.
4. Understand the Robot actuators and Feedback components.
5. Analyse the applications of robots in industries.

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak															
COs	**Programme Outcomes(POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**3**		**2**	**2**	**3**		**3**				**2**			**1**	
CO2	**1**	**3**	**3**	**2**								**1**			**1**
CO3	**3**	**3**	**2**	**3**								**1**		**3**	
CO4	**2**		**3**	**2**			**2**				**3**	**3**			**3**
CO5	**2**		**2**		**2**		**3**				**2**	**3**		**3**	**3**

2020-21 Onwards (MR-20)	MALLAREDDY ENGINEERINGCOLLEGE (Autonomous)	B.Tech.		
Code: A0351	PRODUCT DESIGN AND DEVELOPMENT	L	T	P
Credits: 3	(Open Elective)	3	-	-

Prerequisites: Nil

Course Objectives:

The students will be able to get knowledge about product development, specifications, concepts and architecture which is followed in the industry.

MODULE I: Product Development

Product development versus design, product development process, product cost analysis, cost models, reverse engineering and redesign product development process, new product development, tear down method.

MODULE II: Product Specifications

Establishing the product specifications– Target specifications – Refining specifications, concept generation-Clarify the problem – Search internally – Search externally – Explore systematically - Reflect on the Results and the Process.

MODULE III: Product Concepts

A: Concept generation, product configuration, concept evaluation and selection, product embodiments.

B: Quality function deployment, product design specification, physical prototypes-types and technique, dimensional analysis, design of experiments.

MODULE IV: Product Architecture

Concept selection- Screening – scoring, Product architecture – Implication of architecture - Establishing the architecture – Related system level design issues.

MODULE V:Product Improvement

Reliability, failure identification techniques, Poka-Yoke, Design for the environment, design for maintainability, product safety, liability and design, design for packaging, factorial analysis-ANOVA, factorial experiments, examples.

TEXT BOOKS

1. Kevin Otto and Kristin Wood, "**Techniques in Reverse Engineering and New Product Development"**, Pearson Education, Chennai, Edition III, 2014.
2. Karl T.Ulrich and Steven D.Eppinger "**Product Design and Development**", McGrawHill International, 4th Edition, 2014.

REFERENCES

1. Chitale A.V. and Gupta R.C., "**Product Design and Manufacturing**", 6th Edition, PHI, 2013.
2. Kemnnech Crow, "**Concurrent Engg. Integrated Product Development**", DRM Associates, 26/3 via Olivera, Palas Verdes, CA 90274 (310) 377-569, Workshop Book.
3. Stephen Rosenthal, "**Effective Product Design and Development**", Business OneOrwin Homewood, 1992, ISBN, 1-55623-603-434.
4. Stuart Pugh, "**Total Design – Integrated Methods for successful Product Engineering**", Addison Wesley Publishing, Neyourk, NY, 1991, ISBN 0-202-41639-5.

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2. nptel.ac.in/courses/112107143/26
3. nptel.ac.in/courses/112107217/14
4. nptel.ac.in/courses/112107143/35
5. nptel.ac.in/courses/112107217/10

Course Outcomes

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

1. Apply the concept for new product development.
2. Apply knowledge on the concepts of product specification.
3. Describe the principles of industrial design and prototyping.
4. Apply knowledge on product architecture.
5. Examine the concept of product development and customer needs.

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak															
COs	**Programme Outcomes(POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**1**		**3**		**3**							**2**	**3**		**2**
CO2	**1**		**3**		**3**							**2**	**3**		**2**
CO3	**1**		**3**		**3**							**2**	**3**		**2**
CO4	**1**		**3**		**3**							**2**	**3**		**2**
CO5	**1**		**3**		**3**							**2**	**3**		**2**

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech.		
Code: A0337	AUTOMOBILE ENGINEERING (Open Elective)	L	T	P
Credits: 3		3	-	-

Prerequisites: Nil

Course Objectives:

The objective of this subject is to provide knowledge about various systems involved in automobiles.

MODULE I: Introduction, Fuel System & C.I. Engines

Introduction : Components of four wheeler automobile – chassis and body – Types of chassis - power unit –power transmission – rear wheel drive, front wheel drive, 4 wheel drive – types of automobile engines, engine construction, turbo charging and super charging – engine lubrication, splash and pressure lubrication systems, oil filters, oil pumps – crank case ventilation – engine service, re boring, de carbonization, nitriding of crank shaft.

Fuel System: S.I. Engine: Fuel supply systems, Mechanical and electrical fuel pump – filters – carburetor – types – air filters – petrol injection. C.I. Engines: Requirements of diesel injection systems, types of injection systems, fuel pump, nozzle, spray formation, injection timing, testing of fuel pumps.

MODULE II: Cooling System & Ignition System

Cooling System : Cooling Requirements, Air Cooling, Liquid Cooling, Thermo, water and Forced Circulation System – Radiators – Types – Cooling Fan - water pump, thermostat, evaporating cooling – pressure sealed cooling – antifreeze solutions.

Ignition System: Function of an ignition system, battery ignition system, constructional features of storage, battery, auto transformer, contact breaker points, condenser and spark plug – Magneto coil ignition system, electronic ignition system using contact breaker, electronic ignition using contact triggers – spark advance and retard mechanism.

MODULE III: Emission, Electrical System & Safety Electronics

A: Emission from Automobiles: Pollution standards National and international – Pollution Control – Techniques – Multipoint fuel injection for SI Engines. Common rail diesel injection Energy alternatives – Solar, Photo-voltaic, hydrogen, Biomass, alcohols, LPG, CNG, liquid fuels and gaseous fuels, electrical-their merits and demerits.

B: Electrical System: Charging circuit, generator, current – voltage regulator – starting system, bendix drive mechanism solenoid switch, lighting systems, Horn, wiper, fuel gauge – oil pressure gauge. Safety electronics: electronics circuit airbag, anti slip regulation (ASR), electronic stability programs (ESP).

MODULE IV: Transmission System

Transmission System: Clutches, principle, types, cone clutch, single plate clutch, multi plate clutch,

magnetic and centrifugal clutches, fluid fly wheel – gear boxes, types, sliding mesh, construct mesh, synchro mesh gear boxes, epicyclic gear box, over drive torque converter. Propeller shaft – Hotch – Kiss drive, Torque tube drive, universal joint, differential rear axles – types – wheels and tyres.

MODULE V: Suspension, Braking & Steering System

Suspension System: Objects of suspension systems – rigid axle suspension system, torsion bar, shock absorber, Independent suspension system, active and passive suspensions, magnetic dampers.
Braking System: Mechanical brake system, Hydraulic brake system, Master cylinder, wheel cylinder tandem master cylinder Requirement of brake fluid, Pneumatic and vacuum brakes, antilock braking systems (ABS) and EBS.
Steering System: Steering geometry – camber, castor, king pin rake, combined angle toe - in, center point steering. Types of steering mechanism – Ackerman steering mechanism, Davis steering mechanism, steering gears – types, steering linkages, power steering.

TEXT BOOKS

1 Kirpal Singh, "**Automobile Engineering", Vol.1 & 2**, Seventh Edition, Standard Publishers, 1997.
2 Jain K.K. and Asthana. R.B, "**Automobile Engineering**" Tata McGraw Hill Publishers, 2002.

REFERENCES

1 Newton, Steeds and Garet, "**Motor Vehicles**", Butterworth Publishers,1989.
2 Joseph Heitner, "**Automotive Mechanics**," Second Edition, East-West Press, 1999.
3 Martin W, Stockel and Martin T Stockle , "**Automotive Mechanics Fundamentals**," The Good heart –Will Cox Company Inc, USA, 1978.
4 Heinz Heisler, "**Advanced Engine Technology**", SAE International Publications USA, 1998.
5 Ganesan V. "**Internal Combustion Engines**", Third Edition, Tata McGraw-Hill, 2007.

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1 https://ocw.mit.edu/courses/mechanical-engineering/2-61-internal-combustion-engines-spring-2008/
2 http://test.araiindia.com/index.php?option=com_content&view=article&id=36&Itemid=36
3 http://www.dli.ernet.in/handle/2015/205420
4 International Journal of Automotive Technology - http://www.springer.com/engineering/mechanical+engineering/journal/12239

Course Outcomes

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

1. Understand the various vehicle structure and Components of IC engine.
2. Gain Knowledge in various auxiliary systems used in an automobile.
4. Understand the principle and application of Transmission systems in an automobile.
4. Demonstrate the use of steering, braking and suspension systems in an automobile.
5. Apply the advantages of various alternative energy source

CO- PO Mapping (3/2/1 indicates strength of correlation) 3- Strong, 2-Medium, 1-Weak															
COs	Programme Outcomes(POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO1 2	PSO1	PS O2	PS O3
CO1	2		2	3	3		1				1	1	1		
CO2	3	3	2	3	3		1				1	1	1		
CO3	3	2	3	2	3	1	1				1	2	1		
CO4	2	3	3	3	3	1	1						2	2	
CO5	2	3	3	3	3	3	1				1	1	2	2	