NARAYANA ENGINEERING COLLEGE::GUDUR
(AUTONOMOUS)

DEPARTMENT OF MECHANICAL ENGINEERING

List of R- 21 I & II sem Subjects

S.No	BoS Subjects from Department of Mechanical	Sem/Branch	Category
ME Branch Subjects			
1.	Engineering Drawing	I Sem ME	ES
2.	Engineering Workshop	II Sem ME	ES
3.	Material Science and Engineering	II Sem ME	ES
4.	Material Science and Engineering Lab	II Sem ME	ES
Other Branch Subjects			
1.	Engineering Graphics	I Sem CE & CSE and II SemECE & EEE	ES
2.	Engineering and IT Workshop (Engineering Workshop Only)	I Sem EEE & ECE and II Sem CSE	ES
3.	Engineering Mechanics	II Sem CE	ES
4.	Engineering Workshop	II Sem CE	ES

NARAYANA ENGINEERING COLLEGE::GUDUR
(AUTONOMOUS)

DEPARTMENT OF MECHANICAL ENGINEERING

R- 21 I & II sem Syllabus

NARAYANA ENGINEERING COLLEGE: GUDUR								
	ENGINEERING DRAWING LAB							R2021
Semester	Hours / Week			Totalhrs.	Credits	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
I	0	1	4	80	3	40	60	100

Course Objectives:

1. To impart skills on using drawing instruments
2. To explore various Scales in Engineering practice
3. To convey exact information of any physical object on drawing sheet.
4. To Construct Engineering Curves by using general methods
5. To gain knowledge for conversion of isometric views into orthographic views.

Course Outcomes: At the end of the course, student will be able to:	
CO 1	Define the qualities of precision and accuracy in engineering drawing. (BL-1)
CO 2	Draw engineering curves with different methods (BL-3).
CO 3	Develop the orthographic projection of points, lines and planes (BL-3)
CO 4	Construct Projections and sections of solids . (BL-3)
CO 5	Construct Isometric and Perspective views (BL-3).

COURSE CONTENT

TASK – 1	**Introduction & Conic sections**	16 Hours

Introduction to Engineering Drawing: Principles of Engineering Drawing and their significance- various instruments used, drawing sheet sizes and title block, lettering, BIS conventions, types of lines and dimensioning methods.

Geometrical constructions: simple constructions, construction of Pentagon, Hexagon by general method only.

Conic Sections: Types of conics: Ellipse, Parabola and Hyperbola (Eccentricity method only),. Cycloid, Epicycloids and Hypocycloid, Involute

Scales: Reduced and Enlarged scales, Representative fraction, Scales: plain, diagonal only.

TASK -2	**Orthographic Projections**	16 Hours

Objectives and Principle of projection, Methods of projections, Comparison between first angle and third angle projection.

Projections of points: Projection of points placed in different quadrants,

Projection of straight lines: Fundamental concepts**, Line** parallel, perpendicular and inclined to one and two reference planes placed in first quadrant only,

TASK-3	**Projections of Solids**	16 Hours

Projections of planes: Projection of planes (Triangle, Square, Pentagon, Circle) parallel, perpendicular and inclined to one and two reference planes placed in first quadrant only

Types of solids; Polyhedral, Solids of revolution,

Projections of regular solids (Prisms, Pyramids, Cylinder and Cone), with its axis

perpendicular to one plane and parallel to another plane, Axis inclined to one plane and parallel to other plane.

TASK-4	Sections of Solids and Development of Surfaces	16Hours

Sections of Solids: Types of sectional views of solids, cutting planes, Sections of Prism, Pyramids, Cylinder and Cone

Development of surfaces: Development of Surfaces of right regular Solids-Prism, Cylinder, Pyramid, Cone

TASK-5	Isometric and Orthographic Projections	16Hours

Isometric Projections: Principles, Isometric scale, Isometric views, Conventions, Isometric views of lines, planes, simple solids (Prism, Pyramid, Cylinder & Cone),

Conversion of Isometric views in to Orthographic views.

Total hours:	**80 hours**

Text Book(s):

1. Bhatt N.D. "Elementary Engineering Drawing", CharotarPublishers,2014.
2. Shah and Rana, Engineering Drawing, 2/e, Pearson Education,2009
3. K.L. Narayana & P. Kannaiah, Engineering Drawing, 3/e, Scitech Publishers, Chennai, 2012.
4. Engineering Drawing by Dr AVS Sridhar Kumar, Dr Krishnaiah, T P Vara Prasad. , Spectrum education, Sun techno Publications,2019

Reference Book(s):

1. Engineering Drawing and Graphic Technology-International Edition, Thomas E. French, Charles J. Vierck, Robert J. Foster, McGraw-Hill, 2014
2. K.Venugopal "Engineering Drawing and Graphics", New Age International (P)Ltd., New Delhi, 2010

NARAYANA ENGINEERING COLLEGE:GUDUR								
	ENGINEERING WORK SHOP							R2021
Semester	Hours / Week			Totalhrs	Credits	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
II	0	0	3	48	1.5	40	60	100

COURSE CONTENT (TRADES FOR PRACTICE)

Trade -1 Carpentry (10 H)

Familiarity with different types of wood sand tools used in wood working and make following joints from out of 300x40x25mm soft wood stock.

a) Half–Lap joint.

b) Mortise and Tenon joint

Trade-2 Fitting (10 H)

i.]Familiarity with different types of tools used in fitting and do the fitting exercises out of 80 x 50 x 5 mm M.S. stock

a) V-fit b) Dovetail fit

Trade - 3 Sheet Metal Work (10 H)

Familiarity with different types of tools used in sheet metal working, Developments of following sheet metal job from out of 22 or 20 guage G.I. sheet

a) Tapered tray b) Conical funnel

Trade - 4 Electrical House Wiring (9 H)

Familiarities with different types of basic electrical circuits and make the following electrical connections

a) Two lamps in series

b) Two way switch

c) Tube light

d) Two lamps in parallel with 3 pin plug and switches

Trade 5 - Welding (9 H)

Familiarity with different types of tools used in welding and do the following welding exercises

1. Single V butt joint
2. Lap joint

DEMO EXPERIMENTS:

1. Plumbing,
2. Two wheeler tyre puncture
3. Power Tools

Text Book(s):

1. Hajra Choudhury S.K., Hajra Choudhury A.K., Nirjar Roy S.K. "Elements of WorkshopTechnology"Vol-I2008&Vol-II2010MediaPromoters&Publishers Pvt.Limited, Mumbai.
2. Kalpakjian S. and Steven S.Schmid, "Manufacturing Engineering and Technology" 4th Edition, Pearson Education IndiaEdition,2002.
3. P. Kannaiah &K. L. Narayana "Workshop manual" 2nd Ed., Scitech publications Pvt.Ltd.,Hyderabad,2008.

Reference Book(s):

1. Gowri P., Hariharan and Suresh Babu A., "Manufacturing Technology-I", PearsonEducation2008.

NARAYANA ENGINEERING COLLEGE: GUDUR								
	MATERIAL SCIENCE and ENGINEERING							R2021
Semester	Hours / Week			Total hrs	Credits	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
II	3	0	0	48	3	40	60	100

Course Objectives:

1. To study structure of metals and types of solids.
2. To understand about equilibrium diagrams and properties of steel and iron.
3. To learn about heat treatment of steel.
4. To study about properties and structures of ceramic materials.
5. To study about properties and structures of composite materials.

Course Outcomes: After successful completion of the course, the student will be able to:

CO 1	Define bonds, crystallization of metals ,grain sizes of metals and alloys . (BL-1)
CO 2	Understand about construction of equilibrium diagrams and to study about phase diagrams.(BL-2)
CO 3	Understand properties and structures of various ferrous and non-ferrous metals and alloys.(BL-2)
CO 4	apply the concepts of heat treatment of alloys. (BL-3)
CO 5	Find various ceramic materials and composite materials (BL-1)

COURSE CONTENT

MODULE – 1	Structure of Metals	10 H

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

Constitution of Alloys : Necessity of alloying, types of solid solutions,

MODULE -2	Equilibriumof Diagrams	10 H

Experimental methods of construction of equilibrium diagrams, Isomorphism alloy systems, equilibrium cooling and heating of alloys, Lever rule, eutectic systems, peritectic reaction. Transformations in the solid state – allotropy, eutectoid, peritectoid reactions, phase rule.

MODULE-3	Metals & Alloys	9 H

Cast Irons and Steels : Structure and properties of White Cast iron, Malleable Cast iron, grey cast iron, Spheriodal graphite cast iron, Alloy cast irons. Classification of steels, structure and properties of plain carbon steels, Low alloy steels, Hadfield manganese steels, tool and die steels. **Non-ferrous Metals and Alloys:**

Structure and properties of copper and its alloys, Aluminium and its alloys, Titaniumand its alloys.

MODULE-4	Heat treatment of Alloys	10 H

Effect of alloying elements on Iron – Iron carbon system, Annealing, normalizing, Hardening, TTTdiagrams, tempering , Harden ability, surface - hardening methods, Age hardening treatment,.

MODULE-5	Ceramics and Composites	9H

Structure, properties and applications of ceramics, composites.

Introduction to super alloys and nano materials.

Text Book(s):

1. Introduction to Physical Metallurgy / Sidney H.Avener. 2017
2. A Text of Essential of Materials science and engineering/ Donald R.Askeland/Thomson.2013
3. Material Science and Metallurgy/ Dr.V.D.Kodgire,2011

Reference Book(s):

1. Science of Engineering Materials / B.K.Agarwal,2017.
2. Engineering materials and metallurgy/R. K. Rajput/S.Chand,2015.
3. Engineering Materials and Their Applications – R. A Flinn and P K Trojan / Jaico Books 1995.

NARAYANA ENGINEERING COLLEGE: GUDUR								
	Material Science and Engineering Lab							R2021
Semester	Hours / Week			Totalhrs	Credits	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
II	0	0	2	32	1	40	60	100

COURSE CONTENT
Task-1
Study of general procedure for specimen preparation and Metallurgical Microscope.
Task -2
Preparation and study of the Micro Structure of pure metals like Iron, Cu and Al.
Task -3
Preparation and study of the Microstructure of Mild steels.
Task -4
Preparation and study of the Microstructure of low carbon steel.
Task -5
Preparation and study of the Microstructure of high carbon steels.
TASK-6
Study of microstructures of Cast Iron.
TASK-7
Study of microstructures of Nonferrous alloys, Aluminu006D & Copper.
TASK-8
Study of microstructures of Heat-treated steels.
TASK-9
Metallographic study and analysis of Brass
TASK-10
Hardenability of steel by Jominy end Quench Test.
Additional Experiments
TASK-11
Find out the hardness of various treated and untreated steels.
TASK-12
Study of crystal structure of BCC, FCC and HCP crystals.

Text Book(s):

1. Introduction to Physical Metallurgy / Sidney H.Avener. 2017
2. A Text of Essential of Materials science and engineering/ Donald R.Askeland/Thomson.2013
3. Material Science and Metallurgy/ Dr.V.D.Kodgire,2011

Reference Book(s):

1. Science of Engineering Materials/Agarwal
2. Engineering materials and metallurgy/R. K.Rajput/S.Chand.
3. Engineering Materials and Their Applications – R. A Flinn and P K Trojan /Jaico Books

NARAYANA ENGINEERING COLLEGE:GUDUR								
	ENGINEERING GRAPHICS LAB							R2021
Semester	Hours / Week			Total hrs	Credits	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
I	0	1	4	80	3	40	60	100

Pre-Requisite: Basic Mathematics (Geometry)

Course Objectives:

1. To impart skills on using drawing instruments
2. To convey exact and complete information of any physical object.
3. To Construct Engineering Curves.
4. To Learn and practice basic AutoCAD commands.
5. To Instruct the utility of drafting & modelling packages in orthographic and isometric drawings

Course Outcomes: At the end of the course, student will be able to:	
CO 1	Define the qualities of precision and accuracy in engineering drawing. (BL-1)
CO 2	Draw engineering curves with different methods(BL-3).
CO 3	Develop the orthographic projection of points and straight lines(BL-3)
CO 4	Construct the planes and simple solids.(BL-3).
CO 5	Understand and practice basic AUTOCAD commands (BL-2)

COURSE CONTENT

Part-A Manual Drawing

TASK– 1	**Introduction and Conic sections**	10 Hours

Introduction to Engineering graphics: Principles of Engineering Graphics and their significance; various instruments used, drawing sheet sizes and title block, lettering, BIS conventions, types of lines and dimensioning methods.

Geometrical constructions: simple constructions, construction of Pentagon, Hexagon by general Method only.

Conic Sections:. Types of conics: Ellipse, Parabola and Hyperbola (Eccentricity method only),

TASK–-2	**Orthographic Projections**	10 Hours

Objectives and Principle of projection, Methods of projections, Comparison between firstangle and third angle projection.

Projections of points: Projection of points placed in different quadrants.

Projection of straight lines: Fundamental concepts**,** Line parallel, perpendicular and inclined to one and two reference planes placed in first quadrant only.

TASK–3	**Projections of Solids**	15 Hours

Projections of planes: Projection of planes (Triangle, Square, Pentagon, Circle) parallel,Perpendicular and inclined to one and two reference planes placed in first quadrant only.

Types of solids ; Polyhedra, Solids of revolution,

Projections of regular solids (Prisms, Pyramids, Cylinders and Cone),with its axis Perpendicular to one plane and parallel to other plane, Axis inclined to one plane and parallel to other plane.

TASK–4	**Isometric and Orthographic views**	10Hours

Isometric Projections: Principles, Isometric scale, Isometric views, Conventions, Isometric views of lines, planes, simple solids (Cube, Cylinder, and Cone), and Conversion of Isometric views to Orthographic views.

Part B Computer Aided Drafting

TASK–5	**Introduction to AutoCAD**	17 Hours

Basic drawing and editing commands: line, circle, rectangle, erase, view, undo, redo, snap, object editing, moving, copying, rotating, scaling, mirroring, layers, templates, polylines, trimming, extending, stretching, fillets, arrays, dimensions. Dimensioning principles and conventional representations.

TASK–6	**Orthographic and Isometric Projections**	18 Hours

Transformation of Isometric Projections into orthographic projections such as simple solids such ascylinder, cone, square prism, pentagonal pyramid

Draw 3D model of mechanical components such as Stepped block, Bush bearing,

Total hours:	**80 hours**

Text Book(s):

1. Bhatt N.D. "Elementary Engineering Drawing", Charotar Publishers, 2014.
2. Shah and Rana, Engineering Drawing, 2/e, Pearson Education, 2009
3. K.L.Narayana & P.Kannaiah, Engineering Drawing, 3/e, Scitech Publishers, Chennai,2012.
4. Engineering Drawing by Dr AVS Sridhar Kumar, Dr. Krishnaiah, T P Vara Prasad. ,Spectrum education, Sun techno Publications, 2019

Reference Book(s):

1. Engineering Drawing and Graphic Technology -International Edition, Thomas E.French, Charles J. Vierck, Robert J. Foster, McGraw-Hill, 2014
2. Venugopal.K "Engineering Drawing and Graphics", New Age International (P)Ltd., New Delhi,2010

NARAYANA ENGINEERING COLLEGE:GUDUR								
	ENGINEERING AND IT WORK SHOP							R2021
PART – A ENGINEERING WORK SHOP								
Semester	Hours / Week			Total hrs	Credits	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
II	0	0	4	64	2	40	60	100

Pre-requisite: Basic mathematics.

Course Objectives:

1. To know basic workshop processes and adopt safety practices while working with various tools and equipments
2. To identify, select and use various marking, measuring, holding, striking and cutting tools & equipments.
3. To know about the internal parts of a computer, assembling a computer from the parts, preparing a computer for use by installing the operating system
4. To gain knowledge about the usage of tools like Word processors, Spreadsheets, Presentations
5. To learn about Networking of computers and use Internet facility for Browsing andSearching

Course Outcomes: After successful completion of the course, the student will be able to:	
CO 1	Understand the safety aspects in using the tools and equipments. (BL-2)
CO 2	Apply tools for making models in respective trades of engineering workshop.(BL-3)
CO 3	Apply basic electrical engineering knowledge to make simple house wiring circuits and check their functionality.(BL-3)
CO 4	Understand to disassemble and assemble a Personal Computer and prepare the computer ready to use (BL-2)
CO 5	Apply knowledge to Interconnect two or more computers for information sharing (B 3)

COURSE CONTENT (TRADES FOR PRACTICE)

Trade -1 Carpentry (8 H)

Familiarity with different types of woods and tools used in wood working and make following joints from out of 300x40x25mm soft wood stock.

a) Half–Lap joint.

b) Mortise and Tenon joint

Trade-2 Fitting (8 H)

Familiarity with different types of tools used in fitting and do the fitting exercises out of 80 x 50 x 5 mm M.S. stock

a) V-fit b) Dovetail fit

Trade - 3 Sheet Metal Work (8 H)

Familiarity with different types of tools used in sheet metal working, Developments of following sheet metal job from out of 22 or 20 guage G.I. sheet

a) Tapered tray b) Conical funnel

Trade - 4 Electrical House Wiring (8 H)
Familiarities with different types of basic electrical circuits and make the following electrical connections a) Two lamps in series b) Two way switch c) Tube light d) Two lamps in parallel with 3 pin plug and switches

Text Book(s):

1. Hajra Choudhury S.K., Hajra Choudhury A.K., Nirjar Roy S.K. "Elements of WorkshopTechnology"Vol-I2008&Vol-II2010MediaPromoters&Publishers Pvt.Limited, Mumbai.
2. Kalpakjian S. and Steven S.Schmid, "Manufacturing Engineering and Technology" 4thEdition, Pearson Education IndiaEdition,2002.
3. P. Kannaiah &K. L. Narayana "Workshop manual" 2nd Ed., Scitech publications
4. Pvt.Ltd., Hyderabad,2008.

Reference Book(s):

1. Gowri P., Hariharan and Suresh Babu A., "Manufacturing Technology-I",PearsonEducation2008.

NARAYANA ENGINEERING COLLEGE: GUDUR								
	ENGINEERING MECHANICS							R2021
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
II	3	1	0	48	4	40	60	100

Pre-requisite: Differentiation and integration topics in mathematics.

Course Objectives:

1. To learn the fundamentals of mechanics concept of force and its types.
2. To learn the effect of friction on equilibrium.
3. To develop knowledge in analyzing different types of trusses.
4. To gain proficiency in understanding the concept moment of inertia.
5. To learn kinematics, kinetics of particle and rigid body, related principles.

Course Outcomes: After successful completion of the course, the student will be able to:
Compute the resultant of system of forces in plane and space acting on bodies. (BL-3) Solve the mechanics problems associated with friction forces. (BL-3)
Determine the support-reactions and analyze the internal forces of the members of various trusses and frames. (BL-4)
Calculate the location of centroid of composite areas. (BL-4)
Apply transfer theorems to determine properties of various sections. (BL-4)
Solve problems related to kinetics. (BL-3)

COURSE CONTENT

MODULE – 1	**System of Forces**	**10 H**

Composition and resolution of forces, parallelogram law, principle of transmissibility, types of force systems concurrent and concurrent coplanar forces, resultant of coplanar force systems couple, moment of a force Varignon's theorem, concept of free body diagrams, concept of equilibrium of coplanar force systems.

MODULE -2	**Friction**	**09 H**

Definition of Friction and its applications, angle of friction, angle of repose, coefficient of friction. Typesof Friction, laws of static friction, Description and application of friction on blocks on horizontal and inclined planes.

MODULE-3	**Analysis of Trusses**	**09 H**

Introduction to plane trusses, analysis of plane trusses by method of Joints, method of sections & tension coefficient method.

MODULE-4	**Centroid & Moment of Inertia**	**10H**

Definition of Centroid & Centre of Gravity, Axes of Symmetry, Location of Centroid of Rectangle, Triangle, Semicircle, Quadrant and sector of a circle by method of integration. Numerical problems onCentroid of Composite sections.

Concept of Moment of inertia, perpendicular axis theorem, parallel axis theorem, and moment of inertia of Rectangular, Circular, Semicircular, Quadrant of a circle Triangular sections by method of integration. Numerical Problems on moment of inertia of composite section.

MODULE-5	**Kinematics & Kinetics**	**10 H**

Rectilinear and Curvilinear motion, Velocity, Acceleration, and Motion of a projectile, Relative motion. Kinetics of rectilinear motion, Newton's laws of motion, D'Alembert's principle, Work-energymethod, Impulse-momentum equation, Kinetics of circular motion, Rotation.	
Total	**48 h**

Text Book(s):

1. S.S .Bhavikatti, "Engineering Mechanics", 4th edition, New Age International, 2008.
2. R.K. Bansal, "A text book of Engineering Mechanics", LaxmiPublications,2010
3. Irving Shames, GKM Rao, "Engineering Mechanics: Statics and Dynamics", 4thedition, Pearson,2009.

Reference Book(s):

1. Basudeb Bhattacharya., "Engineering Mechanics", 2ndedition, Oxford University Press (India),2015.
2. K L Kumar, Veenu Kumar, "Engineering Mechanics", 4th edition, Tata McGraw-Hill, 2010.
3. Engineering Mechanics, R.S.Khurmi, S.Chand, 2012.

NARAYANA ENGINEERING COLLEGE:GUDUR								
	ENGINEERING WORK SHOP							R2021
Semester	Hours / Week			Totalhrs	Credits	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
II	0	0	3	48	1.5	40	60	100

COURSE CONTENT (TRADES FOR PRACTICE)

Trade -1 Carpentry (10 H)

Familiarity with different types of wood sand tools used in wood working and make following joints from outof 300x40x25mm soft wood stock.

a) Half–Lap joint.
b) Mortise and Tenon joint

Trade-2 Fitting (10 H)

i.]Familiarity with different types of tools used in fitting and do the fitting exercises out of 80 x 50 x 5 mm M.S. stock

a) V-fit b) Dovetail fit

Trade - 3 Sheet Metal Work (10 H)

Familiarity with different types of tools used in sheet metal working, Developments of following sheetmetal job from out of 22 or 20 guage G.I. sheet

a) Tapered tray b) Conical funnel

Trade - 4 Electrical House Wiring (9 H)

Familiarities with different types of basic electrical circuits and make the following electrical connections

a) Two lamps in series
b) Two way switch
c) Tube light
d) Two lamps in parallel with 3 pin plug and switches

Trade 5 - Welding (9 H)

Familiarity with different types of tools used in welding and do the following welding exercises

1. Single V butt joint
2. Lap joint

DEMO EXPERIMENTS:

1. Plumbing,
2. Two wheeler tyre puncture

Text Book(s):

1. Hajra Choudhury S.K., Hajra Choudhury A.K., Nirjar Roy S.K. "Elements of WorkshopTechnology"Vol-I2008&Vol-II2010MediaPromoters&Publishers Pvt.Limited, Mumbai.
2. KalpakjianS. and StevenS.Schmid, "Manufacturing Engineering andTechnology" 4thEdition, Pearson Education IndiaEdition,2002.
3. P. Kannaiah &K. L. Narayana "Workshop manual" 2ndEd., Scitech publications Pvt.Ltd.,Hyderabad,2008.

Reference Book(s):

1. Gowri P., Hariharan and Suresh Babu A., “Manufacturing Technology-I”, Pearson Education2008.

NARAYANA ENGINEERING COLLEGE::GUDUR

AUTONOMOUS

DEPARTMENT OF MECHANICAL ENGINEERING

List of R21 III & IV Sem Subjects

S.No	BoS Subjects from The Department of ME	Sem/Branch	Category
1.	Engineering Mechanics	III Sem ME	ES
2.	Thermodynamics	III Sem ME	ES
3.	Manufacturing Processes	III Sem ME	PC
4.	Fluid Mechanics &Hydraulic Machines	III Sem ME	PC
5.	Computer Aided Drafting and Modeling Lab	III Sem ME	ES
6.	Manufacturing Process Lab	III Sem ME	PC
7.	Fluid Mechanics & Hydraulic Machines Lab	III Sem ME	PC
8.	Thermal Engineering	IV Sem ME	PC
9.	Kinematics of Machinery	IV Sem ME	PC
10.	Mechanics of Solids	IV Sem ME	PC
11.	Metal Forming Processes	IV Sem ME	PC
12.	Thermal Engineering Lab	IV Sem ME	PC
13.	Mechanics of Solids Lab	IV Sem ME	PC
14.	Computer Aided Machine Drawing	IV Sem ME	PC

NARAYANA ENGINEERING COLLEGE: GUDUR								
	ENGINEERING MECHANICS							R2021
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
III	2	1	0	48	3	40	60	100

COURSE CONTENT

MODULE – 1	System of Forces	10 H

Composition and resolution of forces, parallelogram law, principle of transmissibility, types of force systems - concurrent and concurrent coplanar forces, resultant of coplanar force systems couple, moment of a force Varignon's theorem, concept of free body diagrams, concept of equilibrium of coplanar force systems.

MODULE -2	Friction	09 H

Definition of Friction and its applications, angle of friction, angle of repose, coefficient of friction. Types of Friction, laws of static friction, Description and application of friction on blocks on horizontal and inclined planes.

MODULE-3	Analysis of Trusses	09 H

Introduction to plane trusses, analysis of plane trusses by method of Joints, method of sections & tension coefficient method.

MODULE-4	Centroid & Moment of Inertia	10H

Definition of Centroid & Centre of Gravity, Axes of Symmetry, Location of Centroid of Rectangle, Triangle, Semicircle, Quadrant and sector of a circle by method of integration. Numerical problems on Centroid of Composite sections.

Concept of Moment of inertia, perpendicular axis theorem, parallel axis theorem, and moment of inertia of Rectangular, Circular, Semicircular, Quadrant of a circle Triangular sections by method of integration. Numerical Problems on moment of inertia of composite section.

MODULE-5	Kinematics & Kinetics	10 H

Rectilinear and Curvilinear motion, Velocity, Acceleration, Motion of a projectile, Relative motion.

Kinetics of rectilinear motion, Newton's laws of motion, D'Alembert's principle, Work-energy method, Impulse-momentum equation, Kinetics of circular motion, Rotation.

Total hours:	48 h

Text Book(s):

1. S S.Bhavikatti, "Engineering Mechanics", 4th edition, New Age International,2008.
2. R.K. Bansal, "A text book of Engineering Mechanics", LaxmiPublications,2010
3. Irving Shames, GKM Rao, "Engineering Mechanics: Statics and Dynamics", 4thedition,Pearson,2009.

Reference Book(s):

1. BasudebBhattacharya.,"EngineeringMechanics",2ndedition,OxfordUniversityPress (India),2015.
2. K L Kumar, Veenu Kumar, "Engineering Mechanics", 4th edition, Tata McGrawHill,2010.
3. Engineering Mechanics, R.S.Khurmi, S.Chand, 2012.
4. Engineering Mechanics Statics and Dynamics by Ferdinand Singer,2011

NARAYANA ENGINEERING COLLEGE:GUDUR								
	THERMODYNAMICS							R2021
Semester	Hours / Week			Total hrs	Credits	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
III	3	0	0	48	3	40	60	100

COURSE CONTENT		
MODULE – 1	**FUNDAMENTAL CONCEPTS**	09 Hours

Fundamental Concepts and Definitions: Microscopic and Macroscopic approaches, Concept of continuum and control volume, Systems of Thermodynamics, State, Property, Process, Homogeneous and Heterogeneous systems Thermodynamic equilibrium, Quasi – static Process, Zeroth Law of Thermodynamics, Temperature Measurement .

Work And Heat Transfer: Thermodynamic Definition of Work and Heat, Different forms of Work and Work transfer and Heat and Heat Transfer, Path Function and Point Function.

MODULE -2	FIRST LAW OF THERMODYNAMICS	10 Hours

First Law of Thermodynamics: First law applied to a closed system undergoing a cyclic process and a change of state, Concept of Energy and its forms – Internal Energy and Enthalpy, Perpetual Motion Machine of First Kin (PMM1), First Law Limitations.

Systems of flow : First law applied to a control volume, Steady flow process and its mass and energy balance, Steady flow energy equation on unit mass and time basis, Application of SFEE for devices like boiler, turbine, compressor, heat exchanger, nozzle, diffuser and throttling device.

MODULE-3	SECOND LAW OF THERMODYNAMICS	10Hours

Second Law of Thermodynamics: Definition of a heat engine and energy reservoir, thermal efficiency of heat engine, Refrigerator and heat pump and their coefficient of performances, Kelvin-Planck and Clausius Statements ofthe Second Law and their equivalence, Carnot Cycle and Reversible Heat Engine, Carnot theorems and corollaries Absolute Thermodynamic Temperature Scale, PMMI and PMM II, Reversible process, Irreversible process, Causes of Irreversibility,

Entropy : Concept of Entropy, Clausius theorem, Clausius inequality, Entropy changes in an irreversible and reversible process, Principle of increase of entropy with its application, Absolute entropy.

MODULE-4	PURE SUBSTANCES	09 Hours

PURE SUBSTANCE: Behavior of pure substance (steam) explained through T-v, P-T, P-v, P-h & T-s diagrams Triple point and critical point, Quality or Dryness Fraction, Wetness Fraction, Steam Tables, Mollier Char Measurement of dryness fraction using throttling and separating- throttling calorimeters and also from steam tables Steam processes; expressions for the change in internal energy, enthalpy, work, heat, entropy in various Processes.

MODULE – 5	IDEAL GASES AND GAS POWER CYCLES	10 Hours

Ideal Gas and Real Gas: Ideal gas, relation among the specific heats, internal energy, enthalpy. Analysis o isochoric, isobaric, isothermal, isentropic, isenthalpic processes, representation of the above processes on P-v, T-planes. Determination of work, heat, entropy and enthalpy changes during the above processes, problems Characteristic gas equations of a real gas, law of corresponding states, compressibility factor, problems.

MODELLING OF BASIC ENERGY CONVERSION CYCLES:

Air standard cycle assumptions, Overview of reciprocating engines, Air standard cycles for reciprocating engines – Otto, Diesel &dual, Derivation for efficiency and Mean effective pressure (MEP) and Problems.

Total hours:	**48 hours**

Text Book(s):

1. P.K.Nag, Engineering Thermodynamics, TMH, New Delhi,2013
2. G.J.Vanwylen and R.E.Sonntag, Fundamentals of Classical Thermodynamics, Wiley Eastern, NewDelhi,2008.
3. Yonus A Cengel and Michael A Boles, Thermodynamics: An Engineering Approach, McGraw Hill, 2002.
4. Principles of engineering thermodynamics by morani 8^{TH}edition, SI version.

Reference Book(s):

1. Thermal engineering by R.K Rajput 6^{th}edition.
2. R. K. Rajput (2010), A text book of Engineering Thermodynamics, Fourth Edition, Laxmi Publications, New Delhi, India.
3. Engineering thermodynamics by RK Rajput,5^{TH} edition, Laxmi Publications, New Delhi, India.
4. Engineering thermodynamics, work and heat transfer by Gordon rogers 4^{TH} edition, person educationindia2002.

NARAYANA ENGINEERING COLLEGE::GUDUR								
	MANUFACTURING PROCESSES							R2021
Semester	Hours / Week			Total hrs	Credits	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
III	3	0	0	48	3	40	60	100

COURSE CONTENT

MODULE – 1	**CASTING PROCESSES**	10 h

Introduction: Importance and selection of manufacturing processes.
Casting Processes: Introduction to casting process, process steps; Sand Casting – Sand Molds - Types of Molding Sands and Testing; pattern: types, materials and allowance; Cores: Types of cores, core prints, principles and design of gating system;
Solidification of casting: Concept, solidification of pure metal and alloy.

MODULE -2	**SPECIAL CASTING PROCESSES**	9h

Special casting processes: Process Mechanics, characteristics, parameters and applications of Shellcasting, investment casting, die casting, centrifugal casting;
RISERS – Types, function and design, casting design considerations, Design of feeding systems i.e., sprue, runner, gate and riser, moulding flasks ; casting defects and remedies
METHODS OF MELTING: Crucible melting and cupola operation, steel making processes

MODULE-3	**METAL JOINING PROCESSES - WELDING**	10h

WELDING : Classification of welding processes ;types of welds and welded joints and V-I characteristics, design of welded joints, ARC welding, Forge welding, resistance welding, Thermit welding and Plasma (Air and water) welding submerged arc welding, Laser welding, applications, advantages and disadvantages of the above processes, other fabrication processes.
Heat affected zones in welding; Arc Welding defects: causes and remedies.

MODULE-4	**GAS WELDING**	10h

Gas Welding: – Flame Characteristics-Equipment, fluxes and filler rods-Ultrasonic Welding – Friction Welding-Resistance Spot Welding-Resistance Seam Welding – Stud Welding – Percussion Welding - Brazing:- Filler Metals, Methods - Soldering:- Techniques, Types of Solders and Fluxes ;TIG& MIG welding

CUTTING OF METALS: Oxy – Acetylene Gas cutting, water plasma. Cutting of ferrous, non-ferrous metals soldering and brazing and adhesive bonding : Types and their applications, gas welding defects– causes and remedies– destructive and nondestructive testing of welds

MODULE-5	**SURFACE ENGINEERING & POWDERMETALLURGY**	9 h

SURFACE ENGINEERING: Surface treatment processes and their characteristics and applications.
(a) Overlay coatings (b) Diffusion coatings (c) Thermal or mechanical modification of surfaces. **Ceramics**: Classification of ceramic materials, ceramic powder preparation; Processing of ceramic parts:Pressing, casting, sintering; Secondary processing of ceramics: Coatings, finishing.
Powder Metallurgy: Principle, manufacture of powders, steps involved.

Total hours	48 hours

Text Book(s):

1. Rao P.N.," Manufacturing Technology–Volume I", 5thedition, McGraw-Hill Education, 2018.
2. Kalpak Jains and SchmidS.R.,"Manufacturing Engineering andTechnology",7th edition, Pearson,2018

3. Production Technology by R.K. Jain and S.C. Gupta, Khanna Publishers, 17th edition,2012
4. Ian Gibson, Davin Rosen, Brent Stucker "Additive Manufacturing Technologies, Springer, 2ndEd,2014.
5. Welding and Welding Technology, Richard Little McGraw Hill Education,2017
6. Manufacturing Science by Amitabh Ghosh ,east-west press pvt. Ltd. Second Edition

Reference Book(s):

1. Manufacturing Technology, R.K. Rajput, Laxmi Publications
2. Production Technology by R.K.Jainand S.C.Gupta,KhannaPublishers,17 th qedition,2012
3. Production Technology, K.L Narayana, I.K. International Pub, 3rdEdition,2013
4. Manufacturing Process Vol. I, H.S.ShahPearson,2013,
5. Principles of Metal Castings, Rosenthal, Tata Mc Graw Hill ,2ndEdition,2001
6. Workshop Technology–B.S.RaghuVamshi–Vol I.

NARAYANA ENGINEERING COLLEGE:GUDUR								
	Fluid Mechanics and Hydraulic Machines							R2021
Semester	Hrs / Week			Total hrs	Credits	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
III	3	0	0	48	3	40	60	100

COURSE CONTENT		
MODULE – 1	**PROPERTIES OF FLUIDS**	**10 Hrs**

Definition of fluid, Dimensions and units, physical properties of fluids–density. specific weight, specific gravity, surface tension– vapor pressure and their influence on fluid motion–Newton's Law Of Viscosity,

Fluid Statics-Atmospheric, Gauge and Vacuum pressure–measurement of pressure–Piezometer, manometers-simple, U-tube manometers, U-tube differential manometers.

Fluid Kinematics : stream line, path line and streak lines and steam tube, classification of flows- steady & unsteady, uniform, non-uniform, laminar, turbulent, rotational and irrotational flows-equation of continuity for one dimensional flow.

MODULE -2	**FLUID DYNAMICS**	**9 Hrs**

Fluid Dynamics: surface and body forces – Euler's and Bernoulli's equations for flowing stream line, momentum equation and its application on force on pipe bend

Flow Through Pipes: Reynolds's Number, Darcy Weisbach equation–Minor losses in pipes–pipes in series and pipes in parallel. Measurement of flow: Pitot Tube, Venturi Meter - horizontal position only and Orifice Meter.

MODULE-3	**IMPACT OF JET ON VANES**	**10 Hrs**

Dimensional Analysis- dimensional homogeneity- methods of dimensional analysis-Rayleigh's method-Buckingham theorem.

Impact Of Jet : Introduction to Hydrodynamic Thrust of jet on fixed and moving surfaces (flat and curved), series of flat vanes and series of radial curved vanes -velocity diagrams, work done and efficiency

MODULE-4	**HYDRAULIC TURBINES**	**10 Hrs**

Classification of turbines, Impulse and Reaction turbines, Pelton wheel, Francis turbine and Kaplan turbine-working proportions, work done, efficiencies(theory & derivations), hydraulic design-draft tube-theory- functions and efficiency.

MODULE-5	**CENTRIFUGAL PUMPS**	**9 Hrs**

Introduction, Classification -components and working of centr ifugal pumps, - work done – manom etric head, losses, efficiencies– specific speed–pumps in series and parallel–performance characteristic curves and NPSH.

Total Hrs:	**48 Hrs**

Text Book(s):

1. Hydraulic and Fluid Mechanics including Hydraulic Machines by Modi &Seth, Standard book house

2. A Text of Fluid Mechanics and Hydraulic Machines by Dr.R.K.Bansal – Laxmi Publications (P) Ltd., NewDelhi,2019.

3. Dr D S Kumar, "Fluid Mechanics and Fluid Power Engineering" S K Katariua&Sons,2014.

Reference Book(s):

1. Fluid mechanics and fluid machines by Rajput, S.Chand & Co.

2. Mechanics of Fluids by Potter, Wiggert, Ramadan, M.M.M.SARCAR, Cengage Publishers.

3. Principles of Fluid Mechanics and Fluid Machines by M.Narayana Pillai, Universities Press.

NARAYANA ENGINEERING COLLEGE:GUDUR								
	COMPUTER AIDED DRAFTING AND MODELLING LAB							R2021
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
III	0	0	3	48	1.5	40	60	100

COURSE CONTENT
Task -1 Introduction to AutoCAD commands
Study capabilities of software for Drafting and Modeling – Coordinate systems (absolute, relative, polar, etc.) – Creation of simple figures like polygon and general multi-line figures.
Task -2
. Draw Title Block with necessary text and projection symbol
Task -3
Draw the methods of Dimensioning
TASK-4
Draw front view and top view of pentagon & hexagon by using 2D modeling
TASK-5
Draw front view and top view of simple solids like prism, pyramid, cylinder, cone by using 2D modeling
TASK-6
Draw front view, top view and side view of objects from the given pictorial views (eg. V-block,, steppedblock, pulley, Simple stool,).
TASK-7
Draw sectional views of prism, pyramid, , etc,
TASK-8
Draw isometric projection of simple objects. cylinder, cone and sphere
TASK-9
Creation of 3-D models of simple objects like journal bearing and spiral steps
TASK-10
Draw a layout of Engineering workshop.

Text Book(s):

1. Ibrahim Zeid, "CAD / CAM - Theory and Practice 2E", Tata Mcgraw-Hill, NewDelhi,2010.

2. P. Radhakrishnan, S. Subramanyan, V. Raju "CAD/CAM/CIM", New Age International,2015.

3. M.M.M. Sarcar, K. Mallikarjuna Rao, K. Lalit Narayan "computer aided design and manufacturing", prentice hall of India,2008.

Reference Book(s):

1. Mikell.P.Groover, "CAD/CAM: Computer-Aided Design and Manufacturing", Prenticehall of India Pvt. Ltd.,NewDelhi.2008

2. Chriss McMahon and Jimmie Browne, "CAD/CAM", Addision Wesley, New York,2000.

3. Tien-chienchang, Richard A wysk, Hsu-pin wang, "Computer-Aided Manufacturing", PearsonEdition,2009.

NARAYANA ENGINEERING COLLEGE::GUDUR								
	Manufacturing process Lab							R2021
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
III	0	0	3	48	1.5	40	60	100

COURSE CONTENT
Task 1
Pattern Design and making on lathe machine
Task 2
Sand Properties Testing – Exercise for Strength and Permeability
Task -3
Gating Design and pouring time and solidification time calculations
TASK -4
Molding, Melting and Casting for ferrous/ non ferrous materials
TASK -5
Arc Welding: Lap & Butt Joint of M.S. plates -5mm
TASK-6
Brazing on copper pipes- 6mm pipe
TASK -7
Spot Welding on M.S PLATE- 2mm size
TASK -8
Tig Welding : Lap & Butt Joint of M.S. plates -5mm
TASK -9
Hydraulic Press: Deep drawing Press Tool: Blanking and Piercing operation with Simple dies
TASK -10
Additive manufacturing-3D printing
ADDITIONAL EXPERIMENTS
TASK-11
Design the mould for making chalk pieces
TASK-12
Design the small components by using 3D Printing

Text Book(s):

1. .W. A. J. Chapman, Workshop Technology Part I, ELBS & Edward Arnold Publishers.
2. A charkan. N., Machine Tool Design Vol. 1 to 4, MIR Publication.
3. HMT, Production Technology, Tata McGraw Hill.

Reference Book(s):

1 .Hajra Choudary, Elements of workshop technology, Vol I & II, Media Publishers,

2 .Malkin Stephen, Grinding Technology: Theory and Applications of Machining with Abrasives,Industrial press,2008

3 .PoulDeGarmo, J.T.Black,R.A.Kosher, Materials and Processes in Manufacturing, Prentice Hall of India Pvt.Ltd.,1997.

NARAYANA ENGINEERING COLLEGE:GUDUR								
	Fluid Mechanics and Hydraulic Machines Lab							R2021
Semester	Hours / Week			Total hrs	Credits	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
III	0	0	3	48	1.5	40	60	100

COURSE CONTENT
Task 1 – Calibration of Venturi Meter
Calibrate the coefficient of Discharge of a Venturi Meter.
Task -2 Calibration of Orifice Meter
Calibrate the coefficient of Discharge of an Orifice Meter.
TASK-3 External Mouth Piece
Calibrate the coefficient of Discharge of external mouth piece.
TASK-4 Rectangular Notch
Calibrate the coefficient of Discharge of Rectangular Notch.
TASK-5 Minor Losses
Find the loss of head due to sudden contraction.
TASK-6 Major Losses
Find the friction factor of pipes having different diameters and same material.
TASK-7 Verification of Bernoulli's Theorem.
Prove that the total energy remains constant by using Bernoulli's tube withdifferent cross section.
TASK -8 Impact of jet on vanes
Measure the co efficient of impact of jet on flat and curved vanes.
TASK-9 Pelton wheel turbine
Conduct performance test on Pelton Wheel and find it's efficiency.
TASK-10 Single stage centrifugal pump.
Calculate the efficiency of a single stage centrifugal pump with constant speed.
ADDITIONAL EXPERIMENTS
TASK-11 Multi stage centrifugal pump.
Calculate the efficiency of a Multi stage centrifugal pump with constant speed.
TASK-12 Reciprocating pump.

Calculate the efficiency of a Reciprocating pump with constant speed.
VirtualLabs: 1http://eerc03-iiith.vlabs.ac.in/ 2.http://fmc-nitk.vlabs.ac.in/fluid-machinery/

Text Book(s): 1. Hydraulic and Fluid Mechanics including Hydraulic Machines by Modi &Seth, Standard book house A Text of Fluid Mechanics and Hydraulic Machines by Dr.R.K.Bansal – Laxmi Publications (P) Ltd.,New Delhi.
Reference Book(s): 1. Fluid mechanics and fluid machines by Rajput, S.Chand & Co. 2. Mechanics of Fluids by Potter, Wiggert, Ramadan, M.M.M.SARCAR, Cengage Publishers. 3. Principles of Fluid Mechanics and Fluid Machines by M.Narayana Pillai, Universities Press.

NARAYANA ENGINEERING COLLEGE:GUDUR								
	THERMAL ENGINEERING							R2021
Semester	Hours / Week			Total hrs	Credits	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
IV	3	0	0	48	3	40	60	100

COURSE CONTENT		
MODULE – 1	**INTRODUCTION TO IC ENGINES**	09 Hours

IC ENGINES: Classification, Various parts and their uses, Materials of parts, Working principles of two stroke and four stroke engines and SI and CI engines, Valve and Port Timing Diagrams, Scavenging of IC Engines.

MODULE -2	**VARIOUS SYSTEMS OF IC ENGINES**	10 Hours

FUEL SUPPLY SYSTEM (IN SI ENGINES) : Line diagram of fuel supply, Fuel pumps – Mechanical and Electrical, Air cleaners , Fuel filters, Simple Carburettor – its working principle and types, Carburettor defects.

COOLING SYSTEM (IN SI ENGINES) : Methods – Air cooling, water cooling and liquid cooling, Types of water cooling – Thermosyphon system and Pump Circulation system, Radiator and Thermostat. Pressure sealed cooling, Anti freeze solutions.

LUBRICATION SYSTEM (IN SI ENGINES) : Dry sump and Wet sump systems. Crankcase ventilation, Oil pumps – Gear pump and Plunger pump, Oil filters – Bypass system and Full flow system.

IGNITION SYSTEM (IN SI ENGINES) : Requirements of ignition system, Types – Battery Ignition, Magneto Ignition and Electronic Ignition, Working principles of all the ignition systems, Spark Advance and Retard Mechanisms.

MODULE -3	**COMBUSTION IN IC ENGINES**	10 Hours

COMBUSTION IN SI ENGINES: Combustion in SI Engines Normal Combustion and abnormal combustion, Importance of flame speed and effect of engine variables, Type of Abnormal combustion, pre-ignition and knocking (explanation of) Fuel requirements and fuel rating, anti-knock additives, combustion chamber – requirements, types.

COMBUSTION IN CI ENGINES: Four stages of combustion, Delay period and its importance, Effect of engine variables, Diesel Knock, Need for air movement, open and divided combustion chambers and nozzles used – fuel requirements and fuel rating.

MODULE-4	**TESTING AND PERFORMANCE OF IC ENGINES**	09 Hours

TESTING AND PERFORMANCE OF IC ENGINES: Parameters of performance, measurement o cylinder pressure, fuel consumption, air intake, exhaust gas composition, Brake power, Determination o frictional losses and indicated power, Performance test, Heat balance sheet.

MODULE-5	**COMPRESSORS**	10 Hours

RECIPROCATING COMPRESSORS: Classification of compressors, Principle of operation o reciprocating compressors, work required, Isothermal efficiency volumetric efficiency and effect of clearance multistage compression, under cooling, saving of work, minimum work condition for multi-stagecompression.

CENTRIFUGAL COMPRESSORS: Mechanical details, principle of operation, velocity and pressure variation, impeller blade shape-losses, slip factor, power input factor, pressure coefficient and adiabatic coefficient, velocity diagrams, power required.

Total hours:	**48 Hours**

Text Book(s):

1. R.S. Khurmi and J.K. Gupta, A Textbook of Thermal Engineering, (2011), 3rd Edition, S. Chand & Company Ltd., New Delhi
2. R. K. Rajput (2011), Thermal Engineering, 18th edition, Lakshmi Publications, New Delhi, India.
3. Dr. Kirpal Singh, Automobile Engineering (Volume II), 6th Edition, Standard Publisher, New Delhi.
4. V. Ganesan (2011), I.C. Engines, 3rd edition, Tata McGraw-Hill, New Delhi,India.

Reference Book(s):

1. Mathur, Sharma (2008), IC Engines, 3rd edition, Dhanpat Rai & Sons, New Delhi,India.

2. B.JohnHeywood (2011), internalcombustionenginefundamentals,2ndedition, TataMcGraw-Hill, NewDelhi.

3. Pulkrabek (2008), Engineering fundamentals of IC Engines, 2nd edition, Pearson Education.

NARAYANA ENGINEERING COLLEGE:GUDUR								
	KINEMATICS OF MACHINERY							R2021
Semester	Hours / Week			Total hrs	Credits	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
IV	3	0	0	48	3	40	60	100

COURSE CONTENT

MODULE – 1	Introduction	10 Hrs

Definitions of link or element, kinematic pairs, degrees of freedom, Grubler's criterion (without derivation), kinematic chain, mechanism, structure, mobility of mechanism, inversion, machine, kinematic chains and inversions. Inversions of four bar chain, single slider crank chain and double slider crank chain, Quick return motion mechanisms – drag link mechanism.

MODULE -2	Mechanisms with LowerPairs	9 Hrs

straight line motion mechanisms – Peaucellier'smechanism and Robert's mechanism, intermittent motion mechanisms – Geneva mechanism and ratchetand pawl mechanism, pantograph.
Steering Mechanism: Condition for perfect steering, Steering gear mechanisms, Davis and Ackermann–Hooke's Joint.

MODULE-3	locity and Acceleration of Mechanisms	10 Hrs

Determination of velocity and acceleration of a point/link in simple mechanisms by relative velocity method (graphical) – Coriolis component of acceleration. Instantaneous centre – Centrodes – Kennedy's theorem – To determine linear velocity and angular velocity of links of simple mechanisms by instantaneous center method.

Klein's Construction for velocity and acceleration of slider crank mechanism.

MODULE-4	Gears & Gear Trains	10 Hrs

Classification of Gears – Gear terminology –Law of gearing –Velocity of sliding – Length of path o contact, Arc of contact – Contact ratio – Interference in Involute gears, Methods of avoiding interference – Minimum number of teeth to avoid interference on pinion meshing with gear and on pinion meshing with rack. Characteristics of involutes action, Comparison of Involute and Cycloidal teeth profiles. Numerical problems.
Velocity ratio & Train value, Types of gear trains– Simple, Compound, Reverted & Epicyclic gear trains.
Algebraic/Tabular method of finding Train value of Epicyclic gear trains, Bevel gear Differential of an automobile

MODULE-5	CAMS	9 Hrs

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Types of cams, types of followers, displacement, velocity and acceleration time curves for cam profiles, disc cam with reciprocating follower having knife-edge, roller and flat faced follower, disc cam with oscillating roller follower. Follower motions including, SHM, uniform velocity, uniform acceleration and retardation and Cycloidal motion

Total hours:	48 hours

Text Book(s):

1. Thomas Bevan, Theory of Machines, CBS Publishers,2009.
2. S.S. Rattan, Theory of Machines, Tata McGraw Hill Publishers, 3rd Edition,2009.
3. Kinematics & Theory of Machines, Sadhu Singh,Pearson

Reference Book(s):

1. J.E.Shigley, Theory of Machines, Tata McGraw Hill Publishers, New Delhi, 3rd Edition, 2005.
2.C.S. Sharma and Kamlesh Purohit, Theory of Mechanisms and Machines, PHI Learning Pvt. Limited,2006
3.Amitabh Ghosh and A.K. Mallik, Theory of Machines, East West Publications, 3rd Edition, 2009.

NARAYANA ENGINEERING COLLEGE:GUDUR								
	MECHANICS OF SOLIDS							R2021
Semester	Hours / Week			Total hrs	Credits	Max Marks		
	L	T	P		L	T	P	
IV	2	1	0	48	3	40	60	100

COURSE CONTENT

MODULE – 1	SIMPLE STRESSES AND STRAINS	08 hours

Types of Stresses, Strains, Hooke's law, Stress–Strain diagram for various materials, Working Stress, Factor of safety, Lateral strain, Poisson's ratio, Volumetric strain, relation between three elastic module, Bars of Varying section, Composite bars, Temperature stresses, Strain energy.

MODULE -2	SHEAR FORCE AND BENDING MOMENT	10 hours

Concept of shear force and bending moment, S.F and B.M. diagrams for cantilever, Simply supported, Over hanging beams subjected to Point loads, Uniformly distributed loads, Uniformly varying loads and combinationof these loads, Point of contra flexure.

MODULE-3	BENDING STRESS AND SHEAR STRESS	10 hours

Theory of simple bending, Bending equation, Determination of flexural stresses for simple cases, Section modulus.

Shear stress formula, Shear stress distribution across various beams & sections - Rectangular, Circular, Triangular, I, T sections

MODULE-4	TORSION AND DEFLECTION OF BEAMS	10 hours

Theory of pure torsion, Torsion Equation, transmission of power in solid and hollow circular shafts, comparison o strengths of solid and hollow shafts, shafts in series and parallel, combined bending and torsion.

Relationship between curvature, slope and deflection, Slope and deflection of cantilever and simply supported beams by Double Integration method and Macaulay's method.

MODULE-5	PRESSURE VESSELS AND COMPLEX STRESSES	10 hours

Thin seamless cylindrical shells, Derivation of formula for longitudinal and circumferential stresses, Volumetric strain, Thin spherical shells, Thick cylinders under internal and external pressure.
Complex Stresses - Stresses on an inclined plane under different uniaxial and biaxial stress conditions – Principal planes and principal stresses - Mohr's circle

Total hours:	48 hours

Text Book(s):

1. F.P. Beer, E.R. Johnston, Jr&John.T. DeWolf, "Mechanics of Materials", 7th edition, TataMcGraw-Hill,2016.
2. SS Rattan, Strength of materials, 3rd edition, Tata McGraw-Hill,2016.
3. Strength of Materials by R.K. Bansal, Laxmi Publishers, 5thEdition,2012.
4. Mechanics of Materials, Andrews Pytel,J aan Kiusallaas & M.M.M.Sarcar (Second Edition),CengageLearningPublishers.

Reference Book(s):

1. Timoshenko, “Strength of Materials Part-I&II”, 3rd edition, CBS Publishers,2004.
2. Popov, “Mechanics of Solids”, 2nd edition, New Pearson Education,2015
3. R.K.Rajput, *Strength of materials*, S.Chand Publications, Revised Edition,2006.
4. Strength of Materials by M.Chakraborti, S.K.Kataria &Sons, 2ndEdition,2011.

NARAYANA ENGINEERING COLLEGE:GUDUR								
	METAL FORMING PROCESSES							R2021
Semester	Hours / Week			Total hrs	Credits	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
IV	3	0	0	48	3	40	60	100

COURSE CONTENT		
MODULE – 1	**INTRODUCTION TO METAL FORMING**	**10 Hrs**
Stress, strain, Two-dimensional stress analysis, and three-dimensional stress analysis, the relation between engineering stress and true stress, the relation between engineering strain and true strain, yield criteria, yield locus, theory of plasticity, Hot working, cold working, strain hardening, recovery, recrystallization, and grain Growth		
MODULE -2	**ROLLING & FORGING**	**9Hrs**
Introduction to bulk and sheet metal forming, Economics of bulk-forming ROLLING: principles and theory of rolling, Process description of Rolling. Forces in rolling and powe requirements, applications and, limitations, defects in rolled products – Numerical problems on Rolling. FORGING PROCESSES: Principles of forging – Process description of Forging -Types Forging – Smith forging, Drop Forging – Roll forging –: Rotary forging – forging defects, Forces in forging of the strip,disc and power requirements applications		
MODULE-3	**EXTRUSION PROCESSES**	**10Hrs**
EXTRUSION PROCESSES: Basic extrusion process and its characteristics. Mechanics of hot and cold extrusion - Forward extrusion and backward extrusion – Impact extrusion Hydrostatic extrusion, forces in extrusion of cylindrical and non-cylindrical components – characteristics and defects in extruded parts. WIRE DRAWING: Process Mechanics and its characteristics, determination of the degree of drawing, Drawing force, power, and number of stages-defects in products, Numerical problems on drawing		
MODULE-4	**WIRE DRAWING & SHEET METAL WORKING**	**9Hrs**
Sheet Metal Working – Economical Considerations - Stamping, forming, and other cold working processes Blanking and piercing – Bending and forming – Drawing and its types – Cup drawing and Tube drawing – coining – Hot and cold spinning. Force and power requirements in sheet metal operations, defects in sheet metal products		
MODULE-5	**PROCESSING OF PLASTICS**	**10Hrs**
Processing of plastics, injection and blow molding, calendaring, thermos forming, compression molding, transfer molding, and joining of plastics. Rapid manufacturing: - Introduction – concepts of rapid manufacturing, information flow forrapid prototyping, classification of the rapid prototyping process, stereolithographic process, fused deposition modeling, selective laser sintering		
	Total hours:	48 hours

Text Book(s):

1. Manufacturing Technology, Schmid and kalpak Jain, Pearson Education,2016
2. Production Technology by R.K. Jain and S.C. Gupta, Khanna Publishers, 17th edition,2012
3. Manufacturing technology Vol I by P.N. Rao, Tata McGraw Hill, 4th edition,2013

Reference Book(s):

1. Manufacturing Technology, R.K. Rajput, Laxmi Pub
2. Rapid Prototyping Principles and Applications, Rafiq Noorani, WielyPub

NARAYANA ENGINEERING COLLEGE:GUDUR								
	THERMAL ENGINEERING LAB							R2021
Semester	Hours / Week			Total hrs	Credits	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
IV	0	0	3	48	1.5	40	60	100

COURSE CONTENT

Task 1

Performance test on Spark Ignition engine and Compression Ignition using the alternate fuels.

Task-2

Valve Timing Diagram of an 4 stroke diesel engine .

Task-3

Port Timing Diagram of an 2-Stroke Petrol engine.

TASK-4

Performance Test on a 4 -Stroke Diesel Engines.

TASK-5

Performance Test on 2-Stroke Petrol engine.

TASK-6

Evaluation of Engine friction by conducting Morse test on 4-Stroke Multi cylinderEngine.

TASK-7

Retardation and motoring test on 4- stroke engine.

TASK-8

Heat Balance of an I.C. Engine.

TASK-9

/Fuel Ratio and Volumetric Efficiency of an I.C. Engines.

TASK-10

Performance Test on Variable Compression Ratio Engines for CI Engines.

Additional Experiments

TASK -11

Performance Test on Reciprocating Air – Compressor Unit.

TASK -12

Study of Boilers.

Text Book(s):

1. Vasandani V.P. and Kumar, D.S., Treatise on Heat Engineering, Chand & Co Publishers, New Delhi,2011.
2. Ganesan, V., Gas Turbines 3rd Edition, Tata McGraw Hill Book Company, New Delhi,2010.
3. Internal Combustion Engines / V. Ganesan- TMH, 4thEdition,2012
4. Thermal Engineering / Rajput / Lakshmi Publications, 9thEdition,2013

Reference Book(s):

1.I.C. Engines fundamentals, Heywood, McGraw-Hill, 1st Edition,2011
2. IC Engines – Mathur & Sharma – DhanpathRai&Sons,,2010
3. Engineering fundamentals of IC Engines – Pulkrabek, Pearson, PHI, 2ndEdition,2009
4. Thermal Engineering, Rudra moorthy – TMH, 10thEdition,2010

NARAYANA ENGINEERING COLLEGE:GUDUR								
	Mechanics of Solids Lab							R2021
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
IV	0	0	3	48	1.5	40	60	100

COURSE CONTENT

Task 1 Tension on U.T.M.

Study the stress – strain relations of (a) Mild Steel b) Cast iron and (c) Tor Steel be conducting tension test on U.T.M

Task 2 Compression test on U.T.M.

Study the stress – strain relations of (a) Mild Steel b) Cast iron and (c) Tor Steel be conducting compression test on U.T.M

Task -3 Compressive and Shear strength.

Find the compressive and shear strength of wood and shear strength of GI sheet by conducting relevant tests.

TASK -4 Brinnell's and Vicker's hardness.

Find the Brinnell's and Vicker's hardness numbers of (a) Steel (b) Brass (c) Aluminium (d) Copper.

TASK -5 Modulus of rigidity.

Determine the Modulus of rigidity (a) Solid shaft (b) Hollow shaft made of steel and aluminium.

TASK-6 Compression and Tensile tests.

Find the spring index and modulus of rigidity of the material of a spring by conducting compression and tensile tests.

TASK -7 Deflection test.

Determine the Young's modulus of the material by conducting deflection test on a simply supported, and continuous beams.

TASK -8 Deflection test.

Determine the Young's modulus of the material by conducting deflection test on propped cantilever beam

TASK -9 Impact strength .

Find impact strength of a given material by conducting a Charpy test

TASK -10 Impact strength.

Find impact strength of a given material by conducting a Izod test

Additional Experiments:

TASK -11 Deflection.

Determine the deflection in leaf spring with a single leaf and multiple leafs.

TASK -12 Bending Test

Determine the bending stress by conducting Bending test on 1. Mild steel 2. Wood

VirtualLabs

http://sm-nitk.vlabs.ac.in/

Text Book(s):

1. F.P.Beer,E.R.Johnston,Jr&John.T.DeWolf,"Mechanics ofMaterials",7thedition,TataMcGraw-Hill,2016.
2. SS Rattan, Strength of materials, 3rd edition, Tata McGraw-Hill,2016.
3. Strength of Materials by R.K. Bansal , Laxmi Publishers, 5thEdition,2012.
4. Mechanics of Materials, Andrews Pytel,JaanKiusallaas&M.M.M.Sarcar (SecondEdition),Cengage Learning Publishers.

Reference Book(s):

1. Timoshenko, "Strength of Materials Part-I& II", 3rd edition, CBS Publishers,2004.
2. Popov, "Mechanics of Solids", 2nd edition, New Pearson Education,2015
3. R.K.Rajput, *Strength of materials*, S.Chand Publications, Revised Edition,2006.
4. Strength of Materials by M.Chakraborti, S.K.Kataria& Sons, 2ndEdition,2011.

NARAYANAENGINEERINGCOLLEGE:GUDUR								
	Computer Aided Machine Drawing Lab							R2021
Semester	Hours /Week			Total hrs	Credit	MaxMarks		
	L	T	P		C	CIE	SEE	TOTAL
IV	0	1	2	48	2	40	60	100

COURSE CONTENT
PART -A The following contents are to be done by any 2D software package
Task 1
1. Conventional representation of materials. 2. Conventional representation of machine components.
Task 2 Conventional representation
1. Conventional representation of dimensioning on the drawings. 2. Conventional representation sectional views.
Task -3 Detachable joints
Drawing of thread profiles, hexagonal and square-headed bolts and nuts, bolted joint with washer and locknut, stud joint, screw joint and foundation bolts.
PART B **The following contents are to be done by any 2D software package**
TASK -4 Riveted joints
Drawing of rivet, lap joint, butt joint with single strap, single riveted , double riveted double strap joints.,
TASK -5 Welded joints
Lap joint and T joint with fillet, butt joint with conventions
TASK-6 Keys & Couplings
Taper key, sunk taper key, round key, saddle key, feather key, woodruff key. Shaft coupling, bushed pin-type flange coupling, universal coupling, Oldhams' coupling
PART-C The following contents are to be done by any 3D software package:
TASK -7 Assembly drawings
Lathe tool post, , tail stock, machine vice, gate valve
TASK -8 Assembly drawings
screw jack, plumber block, clamping device, Geneva cam, universal coupling, connecting rod, eccentric.

Additional Experiments:
TASK -9 Manufacturing drawing
Representation of limits, fits and tolerances for mating parts. Use any four parts of above assembly drawings and prepare manufacturing drawing with dimensional and geometric tolerances.

Text Book(s):

1.K.L. Narayana, P. Kannaiah, "A text book on Engineering Drawing", SciTech Publications, 2014

2. N.D.Bhatt, "Machine Drawing", Charotar, 50th edition, 2014.

3"Software tools/packages", Auto CAD, Solid works or equalent.

4.Machine Drawing With AutoCAD, GoutamPohit, GoutamGhosh, Pearson Publications

Reference Book(s):

1. CecilJensen, JayHelsel and Donald D.Voisinet, "Computer Aided Engineering Drawing", TataMcGraw-Hill, NY,2000.

2. James Barclay, Brain Griffiths, "Engineering Drawing for Manufacture", Kogan PageScience,2003.

3. K.L. Narayana, "Production Drawing", NewAge International Publishers, 3rdedition,2014

4.P I Varghese and K C John, Machine Drawing, VIP Publishers,2011