

UNIVERSITY COLLEGE OF ENGINEERING KAKINADA (A)
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA

Course Structure (w.e.f. A.Y. 2019-20)

B.Tech. - Mechanical Engineering

I YEAR -I SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1	BS1101	Mathematics - I (Calculus)	3	0	0	3
2	BS1101	Engineering Physics	3	0	0	3
3	ES1102	Engineering Mechanics	3	0	0	3
4	ES1101	Problem Solving and programming using C	3	0	0	3
5	ES1103	Engineering Graphics and Drafting	1	0	3	2.5
6	ES1102	Workshop Practice Lab	0	0	3	1.5
7	BS1103	Engineering Physics Lab	0	0	3	1.5
8	BS1205	Physics Virtual Lab	0	0	2	0
9	ES1104	Problem Solving and programming using C Lab	0	0	3	1.5
10	MC1101	Environmental Science	3	0	0	0
11	MC1102	Physical Fitness Activities	2	0	0	0
		Total Credits				19

I YEAR -II SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1	BS1201	Mathematics - II (Linear algebra and numerical methods)	3	0	0	3
2	BS1202	Engineering Chemistry	3	0	0	3
3	HSS&MS1203	Communicative English	3	0	0	3
4	ES1201	Basic Electrical & Electronics Engineering	3	0	0	3
5	BS1204	Engineering Chemistry Lab	0	0	3	1.5
6	ES1202	Computer Aided Engineering Drawing	1	0	3	2.5
7	BS1205	Basic Electrical Engineering Lab	0	0	3	1.5
8	BS1206	Basic Electronics Engineering Lab	0	0	3	1.5
9	HSS&MS1204	English Communication Skills Lab - I	0	0	2	1
10	MC1201	Constitution of India	3	0	0	0
11	MC1202	Professional Ethics & Human Values	3	0	0	0
		Total Credits				20

Dr. K. Meera Saheb

Dr. V. Ramachandra Raju

Dr. V. V. Subba Rao

Dr. B. Balakrishna

Dr. A. Gopala Krishna

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Dr. N. Mohan Rao

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
Course Structure (w.e.f. A.Y. 2019-20)
B.Tech. - Mechanical Engineering

II YEAR - I SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1	BS2101	Mathematics – III (Vector calculus, Transforms and PDE)	3	0	0	3
2	PCC-ME	Mechanics of Solids	2	1	0	3
3	PCC-ME	Materials Science & Engineering	3	0	0	3
4	PCC-ME	Production Technology	3	0	0	3
5	PCC-ME	Thermodynamics	2	1	0	3
6	PCC-ME	Machine Drawing	0	0	6	3
7	PCC-Lab1	Materials Testing Lab	0	0	3	1.5
8	PCC-Lab2	Production Technology Lab	0	0	3	1.5
9	HSS&MS	Advanced Communication skills Lab	0	0	2	1.0
10	PROJ-2101	Socially Relevant Project				0.5
		Total Credits				22.5

II YEAR - II SEMESTER

S.No	Course Code	Course Title	L	T	P	Credits
1	BS	Mathematics – IV (Complex variables and statistical methods)	2	0	0	2
2	PCC-ME	Kinematics of Machinery	3	0	0	3
3	PCC-ME	Applied Thermodynamics-I	2	1	0	3
4	PCC-ME	Fluid Mechanics & Hydraulic Machines	3	0	0	3
5	PCC-ME	Metal Cutting & Machine Tools	2	0	0	2
6	PCC-ME	Design of Machine Members-I	2	1	0	3
7	PCC-Lab3	Fluid Mechanics & Hydraulic Machines Lab	0	0	3	1.5
8	PCC-Lab4	Machine Tools Lab	0	0	3	1.5
9	DT-PROJ-2201	Engineering Exploration Project - Design Thinking (15 hours per Semester)	0	0	1	0.5
10	MC2201	Essence of Indian Traditional Knowledge	3	0	0	0
		Total Credits				19.5

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B.Tech. - Mechanical Engineering

III YEAR - I SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1	PCC-ME	Dynamics of Machinery	2	1	0	3
2	PCC-ME	Design of Machine Members-II	3	0	0	3
3	PCC-ME	CAD/CAM	3	0	0	3
4	PCC-ME	Applied Thermodynamics-II	2	1	0	3
5	PE-ME1	1. Unconventional Machining Processes 2. Refrigeration & Air Conditioning 3. Industrial Robotics 4. MOOCs (NPTEL/Swayam) Course (12 Week duration)	3	0	0	3
6	PCC-Lab5	Applied Thermodynamics Lab	0	0	3	1.5
7	PCC-Lab6	Theory of Machines Lab	0	0	3	1.5
8	PCC-Lab7	CAD Lab	0	0	3	1.5
9	PROJ-3101	Socially Relevant Project	0	0	1	0.5
10	MC-3101	Employability Skills -1	0	0	2	0
		Total Credits				20

III YEAR - II SEMESTER

S. No	Course Code	Course Title	L	T	P	Credits
1	PCC-ME	Operations Research	3	0	0	3
2	PCC-ME	Heat Transfer	3	0	0	3
3	PCC-ME	Finite Element Methods	3	0	0	3
4	OE-1	OPEN ELECTIVE -I	3	0	0	3
5	PE-ME2	1. Additive Manufacturing 2. Automobile Engineering 3. Control Systems 4. MOOCs (NPTEL/Swayam) Course (12 Week duration)	3	0	0	3
6	PE-ME3	1. Mechanical Vibrations 2. Advanced Mechanics of Solids 3. Production Planning Control 4. MOOCs (NPTEL/Swayam) Course (12 Week duration)	3	0	0	3
7	PCC-Lab8	Heat Transfer Lab	0	0	3	1.5
8	PCC-Lab9	CAM & CAE Lab	0	0	3	1.5
9	MC-3201	Employability Skills -2	0	0	2	0
		Total Credits				21

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B.Tech. - Mechanical Engineering

IV YEAR - I SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1	PCC-ME	Mechanical Measurements & Metrology	3	0	0	3
2	HSS&MS	Managerial Economics and Financial Accounting	3	0	0	3
3	PE- ME4	1. Automation in Manufacturing 2. Power Plant Engineering 3. Tribology 4. Condition Monitoring 5. MOOCs (NPTEL/Swayam) Course (12 Week duration)	3	0	0	3
4	PE- ME5	1. Advanced Manufacturing Processes 2. Mechatronics 3. Computational Fluid Dynamics 4. Noise & Vibration control 5. MOOCs (NPTEL/Swayam) Course (12 Week duration)	3	0	0	3
5	OE-2	OPEN ELECTIVE -II	3	0	0	3
6	PCC-ME Lab10	Measurements & Metrology Lab	0	0	3	1.5
7	PCC-ME Lab11	Simulation Lab	0	0	3	1.5
8	PROJ-4101	Project-I	0	0	8	2
9	PROJ-4102	Summer Internship				1
		Total Credits				21

Note: The students must complete their Internship during summer break with minimum 4 weeks of duration.

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Course Structure (w.e.f. A.Y. 2019-20)
B.Tech. - Mechanical Engineering

IV YEAR II SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1	PE-6	1. Non Destructive Evaluation 2. Gas Dynamics and Jet Propulsion 3. Industrial Hydraulics and Pneumatics 4. Statistical Quality Control 5. Industrial Safety Engineering via MOOCs (NPTEL/Swayam) (12 Week MOOC Course)	3	0	0	3
2	PE-7	1. Mechanics of Composites 2. Nanomaterials 3. Renewable Energy Sources 4. Reliability Engineering 5. Product Design and Manufacturing via MOOCs (NPTEL/Swayam) (12 Week MOOC Course)	3	0	0	3
3	OE-3	OPEN ELECTIVE –III	3	0	0	3
4	PROJ-4201	Project-II	0	0	12	8
		Total Credits				17

OPEN ELECTIVE -I: 1. Green Engineering Systems 2. Optimization Techniques 3. Operations Management 4. Nano Technology	OPEN ELECTIVE -II: 1. Robotics 2. Foundations of Mechanical Engineering 3. Computational Methods in Engineering 4. Materials Technology
OPEN ELECTIVE -III: 1. 3D-Printing Technologies 2. Smart Materials 3. Hybrid Vehicles	Note: Open Elective can also be completed via MOOCs (NPTEL/Swayam) Course (12 Week duration)

TOTAL CREDITS: I Year (39) II Year (42) III Year (41) IV Year (38) = 160 Credits

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Course Structure (w.e.f. A.Y. 2019-20)
B.Tech. - Mechanical Engineering

12 Weeks NPTEL Courses for Honors Degree

S.NO	COURSE NAME	PG	Type	Close Enrollment to the Course
1	Fundamentals of Nuclear Power Generation	PG	Rerun	3-Feb-20
2	Computer Integrated Manufacturing	PG	New	3-Feb-20
3	Introduction To Mechanical Micro Machining	PG	Rerun	3-Feb-20
4	Product Design and Manufacturing	PG	Rerun	3-Feb-20
5	Industrial Automation And Control	PG	Rerun	3-Feb-20
6	Applied Ergonomics	PG	Rerun	3-Feb-20
7	Foundations of Computational Materials Modelling	PG	Rerun	3-Feb-20
8	Financial Mathematics	PG	Rerun	3-Feb-20
9	Industrial Safety Engineering	PG	Rerun	5-Aug-2019
10	Mathematical Modeling Of Manufacturing Processes	PG	New	5-Aug-2019
11	Work System Design	PG	Rerun	5-Aug-2019
12	Energy Conservation and Waste Heat Recovery	PG	Rerun	5-Aug-2019
13	Turbulent Combustion: Theory and Modelling	PG	New	5-Aug-2019
14	Dynamic Behaviour Of Materials	PG	New	5-Aug-2019

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B.Tech. - Mechanical Engineering

15	Plastic Working Of Metallic Materials	PG	New	5-Aug-2019
16	Fundamentals of Surface Engineering: Mechanisms, Processes and Characterizations	PG	Rerun	5-Aug-2019
17	Fundamentals Of Artificial Intelligence	PG	New	5-Aug-2019
18	Aircraft Propulsion	PG	New	5-Aug-2019
19	Principles of Mechanical Measurement	PG	New	4-Feb-2019
20	Industrial Automation and Control	PG	Rerun	4-Feb-2019
21	Rapid Manufacturing	PG	New	4-Feb-2019
22	Machinery Fault Diagnosis And Signal Processing	PG	Rerun	4-Feb-2019
23	Spray Theory	PG	Rerun	4-Feb-2019
24	Financial Mathematics	PG	New	4-Feb-2019
25	Introduction To Composites	PG	Rerun	4-Feb-2019
26	Surface engineering for corrosion and wear resistance	PG	Rerun	4-Feb-2019
27	Material characterization	PG	Rerun	4-Feb-2019

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KAKINADA

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B.Tech. - Mechanical Engineering

12 Weeks NPTEL Courses for Minor Engineering

S.NO	COURSE NAME	Type	Close Enrollment to the Course
1	IC Engines and Gas Turbines	Rerun	3-Feb-20
2	Conduction and Convection Heat Transfer	Rerun	3-Feb-20
	Introduction To Fluid Mechanics	Rerun	3-Feb-20
3	Manufacturing Process Technology I & II	Rerun	3-Feb-20
4	Operations Management	Rerun	3-Feb-20
5	Computational Fluid Dynamics for Incompressible Flows	New	3-Feb-20
6	Experimental Methods in Fluid Mechanics	New	3-Feb-20
7	Principles of Industrial Engineering	New	3-Feb-20
8	Engineering Mechanics	New	5-Aug-2019
9	Engineering Fracture Mechanics	Rerun	5-Aug-2019
10	Solid Mechanics	New	5-Aug-2019
11	Fundamentals of manufacturing processes	Rerun	5-Aug-2019
12	Manufacturing Systems Technology Part I & II	Rerun	5-Aug-2019
13	Advanced Concepts in Fluid Mechanics	New	5-Aug-2019
14	Concepts of Thermodynamics	Rerun	5-Aug-2019
15	Applied Thermodynamics For Engineers	New	5-Aug-2019
16	Fundamentals of Conduction and Radiation	New	5-Aug-2019
17	Fundamentals of Gas Dynamics	Rerun	5-Aug-2019

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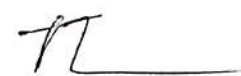
Dr. G. Madhusudan Reddy

UNIVERSITY COLLEGE OF ENGINEERING KAKINADA (A)
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY
KAKINADA

Course Structure (w.e.f. A.Y. 2019-20)

B.Tech. - Mechanical Engineering

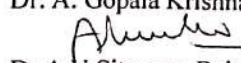
18	Heat Exchangers: Fundamentals and Design Analysis	Rerun	5-Aug-2019
19	Engineering Metrology	Rerun	5-Aug-2019
20	Noise Management and Control	Rerun	5-Aug-2019
21	Convective Heat Transfer	Rerun	5-Aug-2019
22	IC Engines and Gas Turbines	New	4-Feb-2019
23	Thermodynamics	New	4-Feb-2019
24	Manufacturing Process Technology	Rerun	4-Feb-2019
25	Product Design and Manufacturing	Rerun	4-Feb-2019



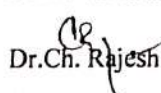
Dr. K. Megra Saheb



Dr. A. Gopala Krishna



Dr. A. V. Sitarama Raju



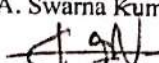
Dr. Ch. Rajesh



Dr. V. Ramachandra Raju

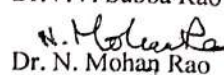


Dr. A. Swarna Kumari



Dr. P. Ramesh Babu

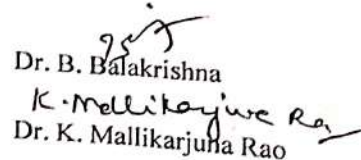
Dr. V. V. Subba Rao



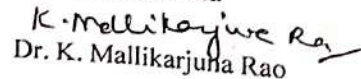
Dr. N. Mohan Rao



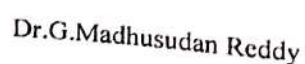
Dr. N. Ramanaiah



Dr. B. Balakrishna



Dr. K. Mallikarjuna Rao



Dr. G. Madhusudan Reddy

I Year B.Tech. – I Sem.

ENGINEERING MECHANICS

Objectives: The students completing this course are expected to understand the concepts of forces and its resolution in different planes, resultant of force system, Forces acting on a body, their free body diagrams using graphical methods. They are required to understand the concepts of centre of gravity and moments of inertia and their application, Analysis of frames and trusses, different types of motion, friction and application of work - energy method.

UNIT – I

Objectives: The students are to be exposed to the concepts of force and friction, direction and its application.

Introduction to Engg. Mechanics – Basic Concepts.

Systems of Forces: Coplanar Concurrent Forces – Components in Space – Resultant – Moment of Force and its Application – Couples and Resultant of Force Systems.

Friction: Introduction, limiting friction and impending motion, coulomb's laws of dry friction, coefficient of friction, cone of friction

UNIT II

Objectives: The students are to be exposed to application of free body diagrams. Solution to problems using graphical methods and law of triangle of forces.

Equilibrium of Systems of Forces: Free Body Diagrams, , Lami's Theorem, Equations of Equilibrium of Coplanar Systems, Graphical method for the equilibrium, Triangle law of forces, converse of the law of polygon of forces condition of equilibrium, Equations of Equilibrium for Spatial System of forces, Numerical examples on spatial system of forces using vector approach, Analysis of plane trusses.

UNIT – III

Objectives : The students are to be exposed to concepts of centre of gravity. The students are to be exposed to concepts of moment of inertia and polar moment of inertia including transfer methods and their applications.

Centroid: Centroids of simple figures (from basic principles) – Centroids of Composite Figures

Centre of Gravity: Centre of gravity of simple body (from basic principles), centre of gravity of composite bodies, Pappus theorems.

Area moments of Inertia: Definition – Polar Moment of Inertia, Transfer Theorem, Moments of Inertia of Composite Figures, Products of Inertia, Transfer Formula for Product of Inertia. **Mass Moment of**

Inertia: Moment of Inertia of Masses, Transfer Formula for Mass Moments of Inertia, mass moment of inertia of composite bodies.

UNIT – IV

Objectives: The students are to be exposed to motion in straight line and in curvilinear paths, its velocity and acceleration computation and methods of representing plane motion.

Rectilinear and Curvilinear motion of a particle: Kinematics and Kinetics- D'Alembert's Principle, Work Energy method and applications to particle motion- Impulse momentum method.

UNIT – V

Objectives: The students are to be exposed to rigid motion kinematics and kinetics

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2019-2020

UNIVERSITY COLLEGE OF ENGINEERING KAKINADA (AUTONOMOUS)
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B.TECH (MECHANICAL ENGINEERING)
EFFECTIVE FROM 2019-20 BATCH

Rigid body Motion: Kinematics and kinetics of translation, Rotation about fixed axis and plane motion, Work Energy method and Impulse momentum method.

TEXT BOOK:

1. Engg. Mechanics - S.Timoshenko & D.H.Young., 4th Edn - , Mc Graw Hill publications.

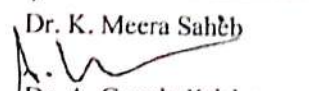
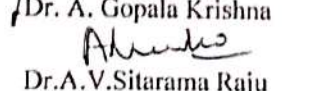
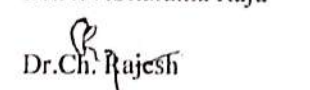
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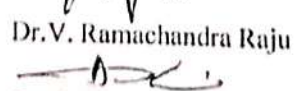
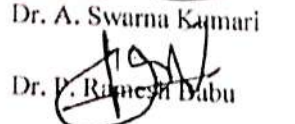
1. Engineering Mechanics statics and dynamics – R.C.Hibbeler, 11th Edn – Pearson Publ.
2. Engineering Mechanics , statics – J.L.Meriam, 6th Edn – Wiley India Pvt Ltd.
3. Engineering Mechanics , dynamics – J.L.Meriam, 6th Edn – Wiley India Pvt Ltd.
4. Engineering Mechanics , statics and dynamics – I.H.Shames, – Pearson Publ.
5. Mechanics For Engineers , statics - F.P.Beer & E.R.Johnston – 5th Edn Mc Graw Hill Publ.
6. Mechanics For Engineers, dynamics - F.P.Beer & E.R.Johnston – 5th Edn Mc Graw Hill Publ.
7. Theory & Problems of engineering mechanics, statics & dynamics – E.W.Nelson, C.L.Best & W.G. McLean, 5th Edn – Schaum's outline series - Mc Graw Hill Publ.
8. Engineering Mechanics , Ferdinand . L. Singer , Harper – Collins.
9. Engineering Mechanics statics and dynamics , A Nelson , Mc Graw Hill publications
10. Engineering Mechanics, Tayal. Umesh Publ.

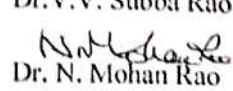
Course outcomes:

- CO1. Apply the principles (Axioms) of statics, able to resolve the system of forces and find the resultant force considering friction.
- CO2. Explore the concepts of constraints, free body diagram and action-reaction.
- CO3. Estimate the geometric parameters like centroid, center of gravity and moment of inertia and identify their application.
- CO4. Determine the motion characteristics of a particle undergoing rectilinear and curvilinear motion and a body making plane motion.
- CO5. Determine the effect of forces on the motion of particles undergoing rectilinear and curvilinear motion and a body making plane motion using impulse momentum and work energy methods.

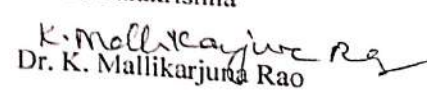
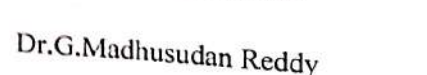
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	-	-	-	-	-	-	-	-	-	√	-
CO2	-	-	-	-	-	-	-	-	-	-	√	-
CO3	√	-	-	-	√	-	-	-	-	-	√	-
CO4	√	-	-	-	√	-	-	-	-	-	√	-
CO5	√	-	-	-	√	-	-	-	-	-	√	-


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UNIVERSITY COLLEGE OF ENGINEERING KAKINADA (AUTONOMOUS)
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B.TECH (MECHANICAL ENGINEERING)
EFFECTIVE FROM 2019-20 BATCH

L	T	P	C
1	0	3	2.5

I BTech - I Semester

ENGINEERING GRAPHICS & DRAFTING

Course Objective: Engineering drawing being the principal method of communication for engineers, the objective is to introduce the students, the techniques of constructing the various types of polygons, curves and scales. The objective is also to visualize and represent the 3D objects in 2D planes with proper dimensioning, scaling etc.

Unit I

Objective: To introduce the students to use drawing instruments and to draw polygons, Engg. Curves.

Polygons: Constructing regular polygons by general methods, inscribing and describing polygons on circles.

Curves: Parabola, Ellipse and Hyperbola by general and special methods, cycloids, involutes, tangents & normals for the curves.

Scales: Plain scales, diagonal scales and vernier scales

Unit II

Objective: To introduce the students to use orthographic projections, projections of points & simple lines. To make the students draw the projections of the lines inclined to both the planes.

Orthographic Projections: Reference plane, importance of reference lines, projections of points in various quadrants, projections of lines, line parallel to both the planes, line parallel to one plane and inclined to other plane.

Projections of straight lines inclined to both the planes, determination of true lengths, angle of inclination and traces.

Unit III

Objective: The objective is to make the students draw the projections of the plane objects/ inclined to both the reference planes.

Projections of planes: regular planes perpendicular/parallel to one reference plane and inclined to the other reference plane; inclined to both the reference planes.

Unit IV

Objective: The objective is to make the students draw the projections of the various types of solids in different positions inclined to one of the planes.

Projections of Solids – Prisms, Pyramids, Cones and Cylinders with the axis inclined to both the planes.

Unit V

Objective: The objective is to represent the object in 3D view through isometric views. The student will be able to represent and convert the isometric view to orthographic view and vice versa.

Conversion of isometric views to orthographic views; Conversion of orthographic views to isometric views.

Computer Aided Drafting, Creating 2D&3D drawings of objects using relevant software.

Note: In the End Examination there will be no question from CAD.

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TEXT BOOKS:

1. Engineering Drawing by N.D. Bhatt, Charotar Publishing House
2. Engineering Drawing by Agarwal & Agarwal, Tata McGraw Hill Publishers

REFERENCE BOOKS:

1. Engineering Drawing by K.L.Narayana & P. Kannaiah, Scitech Publishers
2. Engineering Graphics for Degree by K.C. John, PHI Publishers
3. Engineering Graphics by P. Varghese, McGrawHill Publishers
4. Engineering Drawing + AutoCad – K Venugopal, V. Prabhu Raja, New Age Publishers

Course Outcome: Student must able to

CO1. Use different techniques to draw various geometric elements used in engineering practice.

CO2. Understand and draw orthographic projections of points and lines in various positions with respect to different reference planes.

CO3: Understand and draw orthographic projections of planes in various positions with respect to different reference planes.

CO4: Understand and draw orthographic projections of solids in various positions with respect to different reference planes.

CO5. Draw the 2D and 3D objects using a software.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	√	-	-	-	-	-	-	√	√
CO2	-	-	-	√	-	-	-	-	-	-	√	√
CO3	-	-	-	√	-	-	-	-	-	-	√	√
CO4	-	-	-	√	-	-	-	-	-	-	√	√
CO5	-	-	-	-	-	-	-	-	-	√	√	-

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EFFECTIVE FROM 2019-20 BATCH

L	T	P	C
1	0	3	2.5

I Year B.Tech. – II Sem.

COMPUTER AIDED ENGINEERING DRAWING PRACTICE

Course Objective: To enhance the student's knowledge and skills in engineering drawing and to introduce drafting packages and commands for computer aided drawing and modeling.

UNIT-I:

Objective: The knowledge of projections of solids is essential in 3D modeling and animation. The student will be able to draw projections of solids. The objective is to enhance the skills they already acquired in their earlier course in drawing of projection.

PROJECTIONS OF SOLIDS: Projections of Regular Solids inclined to both planes – Auxiliary Views.

UNIT-II:

The knowledge of sections of solids and development of surfaces is required in designing and manufacturing of the objects. Whenever two or more solids combine, a definite curve is seen at their intersection.

SECTIONS OF SOLIDS: Sections and Sectional views of Right Regular Solids – Prism, Cylinder, Pyramid, Cone – Auxiliary views.

DEVELOPMENT AND INTERPENETRATION OF SOLIDS: Development of Surfaces of Right Regular Solids – Prism, Cylinder, Pyramid, Cone and their parts.

UNIT-III:

The intersection of solids also plays an important role in designing and manufacturing. The objective is to impart this knowledge through this topic. A perspective view provides a realistic 3D View of an object. The objective is to make the students learn the methods of Iso and Perspective views.

INTERPENETRATION OF RIGHT REGULAR SOLIDS: Intersection of Cylinder Vs Cylinder, Cylinder Vs Prism, Cylinder Vs Cone, Prism Vs Cone.

PERSPECTIVE PROJECTIONS: Perspective View: Points, Lines, Plane Figures and Simple Solids, Vanishing Point Methods (General Method only).

In part B computer aided drafting is introduced.

UNIT IV:

The objective is to introduce various commands in AutoCAD to draw the geometric entities and to create 2D and 3D wire frame models.

INTRODUCTION TO COMPUTER AIDED DRAFTING: Generation of points, lines, curves, polygons, dimensioning. Types of modeling : object selection commands – edit, zoom, cross hatching, pattern filling, utility commands, 2D wire frame modeling, 3D wire frame modeling.

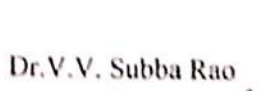
UNIT V:

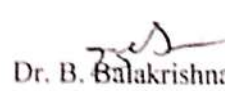
By going through this topic the student will be able to understand the paper-space environment thoroughly.

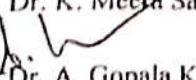
VIEW POINTS AND VIEW PORTS: view point coordinates and view(s) displayed, examples to exercise different options like save, restore, delete, joint, single option.

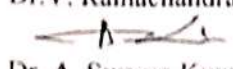

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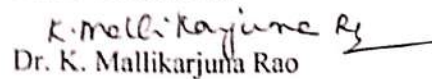

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B.TECH (MECHANICAL ENGINEERING)
EFFECTIVE FROM 2019-20 BATCH

UNIT VI:

The objective is to make the students create geometrical model of simple solids and machine parts and display the same as an Isometric, Orthographic or Perspective projection.

COMPUTER AIDED SOLID MODELING: Isometric projections, orthographic projections of isometric projections, Modeling of simple solids, Modeling of Machines & Machine Parts.

TEXT BOOKS :

1. Engineering drawing by N.D Bhatt , Charotar publications.
2. Engineering Graphics, K.C. John, PHI Publications

REFERENCES:

1. Mastering Auto CAD 2013 and Auto CAD LT 2013 – George Omura, Sybex
2. Auto CAD 2013 fundamentals- Elisemoss, SDC Publ.
3. Engineering Drawing and Graphics using Auto Cad – T Jeyapooan, vikas
4. Engineering Drawing + AutoCAD – K Venugopal, V. Prabhu Raja, New Age
5. Engineering Drawing – RK Dhawan, S Chand
6. Engineering Drawing – MB Shaw, BC Rana, Pearson
7. Engineering Drawing – KL Narayana, P Kannaiah, Scitech
8. Engineering Drawing – Agarwal and Agarwal, Mc Graw Hill
9. Engineering Graphics – PI Varghese, Mc Graw Hill
10. Text book of Engineering Drawing with auto-CAD , K.venkata reddy/B.S . publications.
11. Engineering Drawing with Auto CAD/ James D Bethune/Pearson Publications
12. Engineering Graphics with Auto CAD/Kulkarni D.M, Rastogi A.P, Sarkar A.K/PHI Publications

End Semester examination shall be conducted for **Four** hours with the following pattern:

- a) Two hours-Conventional drawing
- b) Two hours – Computer Aided Drawing

Course outcomes: The student should be able to

CO1: **Draw** Projections of solids inclined to both planes

CO2: Draw Sections and development of solids

CO3: Draw interpenetration and perspective views of solids

CO4: Create geometrical models of solids and machine parts using a software and generate isometric and orthographic projection.

CO5: Use saving, retrieving and modifying the existing data.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√										√	
CO2	√										√	√
CO3	√										√	√
CO4	√			√							√	√
CO5	√			√					√	√	√	

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B.TECH (MECHANICAL ENGINEERING)
EFFECTIVE FROM 2019-20 BATCH

L	T	P	C
2	1	0	3

II Year B.Tech. – I Sem.

MECHANICS OF SOLIDS

Objective: The students completing this course are expected to understand the basic terms like stress, strain, Poisson's ratio...etc and different stresses and deflections induced in beams, thin cylinders, thick cylinders, and columns. Further, the student shall be able to understand the shear stresses due to torsion in circular shafts.

UNIT – I

SIMPLE STRESSES & STRAINS : Elasticity and plasticity – Types of stresses & strains–Hooke's law – stress – strain diagram for mild steel – Working stress – Factor of safety – Lateral strain, Poisson's ratio & volumetric strain – Bars of varying section – composite bars – Temperature stresses- Complex Stresses - Stresses on an inclined plane under different uniaxial and biaxial stress conditions - Principal planes and principal stresses - Mohr's circle - Relation between elastic constants, Strain energy – Resilience – Gradual, sudden, impact and shock loadings.

UNIT – II

SHEAR FORCE AND BENDING MOMENT : Definition of beam – Types of beams – Concept of shear force and bending moment – S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads, u.d.l, uniformly varying loads and combination of these loads – Point of contra flexure – Relation between S.F., B.M and rate of loading at a section of a beam.

UNIT – III

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

SHEAR STRESSES: Derivation of formula – Shear stress distribution across various beams sections like rectangular, circular, triangular, I, T angle sections.

UNIT – IV

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, - U.D.L uniformly varying load. Mohr's theorems – Moment area method – application to simple cases including overhanging beams, Statically indeterminate Beams and solution methods.

TORSION: Introduction-Derivation- Torsion of Circular shafts- Pure Shear-Transmission of power by circular shafts, Shafts in series, Shafts in parallel.

UNIT – V

THIN AND THICK CYLINDERS: Thin seamless cylindrical shells – Derivation of formula for longitudinal and circumferential stresses – hoop, longitudinal and Volumetric strains – changes in dia, and volume of thin cylinders – Riveted boiler shells – Thin spherical shells. Wire wound thin cylinders. Lamé's equation – cylinders subjected to inside & outside pressures –compound cylinders.

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EFFECTIVE FROM 2019-20 BATCH

COLUMNS:

Buckling and Stability, Columns with Pinned ends, Columns with other support Conditions, Limitations of Euler's Formula, Rankine's Formula,

TEXT BOOK:

1. Strength of materials /GH Ryder/ Mc Millan publishers India Ltd.
2. Strength of materials by B.C. Punmia-lakshmi publications pvt.Ltd, New Delhi.

REFERENCES :

1. Mechanics of materials by Gere & Timoshenko
2. Strength of Materials -By Jindal, Umesh Publications.
3. Mechanics of Structures Vol-III, by S.B.Junnarkar- Charotar Publishing House
4. Strength of Materials by S.Timoshenko- D. VAN NOSTRAND Company- PHI Publishers
5. Strength of Materials by Andrew Pytel and Ferdinand L. Singer Longman- Harpercollins College Division
6. Solid Mechanics, by Popov-
7. Mechanics of Materials/Gere and Timoshenko, CBS Publishers

Course outcomes:

On the completion of the course the student will able to

CO1: Model & Analyze the behavior of basic structural members subjected to various loading and support conditions based on principles of equilibrium.

CO2: Understand the apply the concept of stress and strain to analyze and design structural members and machine parts under axial, shear and bending loads, moment and torsional moment.

CO3: Students will learn all the methods to analyze beams, columns, frames for normal, shear, and torsion stresses and to solve deflection problems in preparation for the design of such structural components. Students are able to analyse beams and draw correct and complete shear and bending moment diagrams for beams.

CO4: Students attain a deeper understanding of the loads, stresses, and strains acting on a structure and their relations in the elastic behavior

CO5: Design and analysis of Industrial components like pressure vessels.

CO-PO Matrix

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√					√			√	
CO2	√	√	√					√			√	
CO3	√	√	√					√			√	
CO4	√	√	√					√			√	
CO5	√	√	√					√			√	

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EFFECTIVE FROM 2019-20 BATCH

L	T	P	C
3	0	0	3

II Year B.Tech. – I Sem.

MATERIALS SCIENCE & ENGINEERING

Course Objective: To understand the basic fundamentals of Material science and Physical metallurgy. The basic concepts to be taught will help for the improvement, proper selection and effective utilization of materials which is essential to satisfy the ever increasing demands of the society.

UNIT – I

Learning Objective: To know the basic concepts of bonds in metals and alloys. To understand the basic requirements for the formation of solid solutions and other compounds. To understand the regions of stability of the phases that can occur in an alloy system in order to solve the problems in practical metallurgy.

Structure of Metals and Constitution of alloys: Bonds in Solids, Metallic bond, crystallization of metals, Packing Factor - SC, BCC, FCC & HCP-line density, plane density. Grain and grain boundaries, effect of grain boundaries on the Properties of metal / alloys – determination of grain size. Imperfections – point, line, surface and volume- Slip and Twinning.

Necessity of alloying, types of solid solutions, Hume Rotherys rules, intermediate alloy phases, and electron compounds

Equilibrium Diagrams : Experimental methods of construction of equilibrium diagrams, Isomorphous alloy systems, equilibrium cooling and heating of alloys, Lever rule, coring miscibility gaps, eutectic systems, congruent melting intermediate phases, peritectic reaction. Transformations in the solid state – allotropy, eutectoid, peritectoid reactions, phase rule, relationship between equilibrium diagrams and properties of alloys. Study of binary phase diagrams such as Cu-Ni and Fe-Fe₃C.

UNIT – II

Learning objectives: To study the basic differences between cast irons and steels, their properties and practical applications. To study the properties and applications of widely used non-ferrous metals and alloys so as to use the suitable material for practical applications.

Ferrous metals and alloys: Structure and properties of White Cast iron, Malleable Cast iron, grey cast iron, Spheroidal 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, Titanium and its alloys, Magnesium and its alloys, Super alloys.

UNIT – III

Learning objectives: To study the affect of various alloying elements on iron-iron carbide system. To understand the various heat treatment and strengthening processes used in practical applications.

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.

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B.TECH (MECHANICAL ENGINEERING)
EFFECTIVE FROM 2019-20 BATCH

UNIT – IV

Learning Objective: To study the methods of producing metal powders and use of powders for different industrial applications

Powder Metallurgy: Basic processes- Methods of producing metal powders- milling atomization- Granulation-Reduction-Electrolytic Deposition. Compacting methods – Sintering - Methods of manufacturing sintered parts. Sintering Secondary operations-Sizing, coining, machining -Factors determining the use of powder metallurgy-Application of this process.

UNIT – V

Learning objectives: To study the properties and applications of ceramic, composite and other advanced materials so as to use the suitable material for practical applications.

Ceramic and composite materials: Crystalline ceramics, glasses, cermets, abrasive 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 – C composites. Nanomaterials – definition, properties and applications.

TEXT BOOKS:

1. Introduction to Physical Metallurgy - Sidney H. Avener - McGrawHill
2. Essential of Materials science and engineering - Donald R.Askeland - Cengage.

REFERENCES :

1. Material Science and Metallurgy – Dr. V.D.kodgire- Everest Publishing House
2. Materials Science and engineering - Callister & Baalasubrahmanyam- Wiley Publications
3. Material Science for Engineering students – Fischer – Elsevier Publishers
4. Material science and Engineering - V. Rahghavan-PHI Publishers
5. Introduction to Material Science and Engineering – Yip-Wah Chung CRC Press
6. Material Science and Metallurgy – A V K Suryanarayana – B S Publications
7. Material Science and Metallurgy – U. C. Jindal – Pearson Publications

Course Outcomes:

CO1: Understand the crystalline structure of different metals and study the stability of phases in different alloy systems.

CO2: Study the behavior of ferrous and non ferrous metals and alloys and their application in different domains

CO3: Able to understand the effect of heat treatment, addition of alloying elements on properties of ferrous metals.

CO4: Grasp the methods of making of metal powders and applications of powder metallurgy

CO5: Comprehend the properties and applications of ceramic, composites and other advanced methods.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√	-	-	-	-	-	√	√
CO2	-	√	√	√	-	-	-	-	-	-	-	√
CO3	√	√	√	√	√	-	-	-	-	-	√	√
CO4	√	√	√	√	√	-	-	-	-	-	√	√
CO5	-	√	√	√	-	-	-	-	√	√	-	√

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L	T	P	C
3	0	0	3

II Year B.Tech. – I Sem.

PRODUCTION TECHNOLOGY

Course Objective:

To impart basic knowledge and understanding about the primary manufacturing processes such as casting, joining, bulk forming, sheet metal forming and powder metallurgy and their relevance in current manufacturing industry.

UNIT – I

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, Molding – molding methods - ingredients of molding sand –. Molding materials, Properties of molding sand, Testing of molding sand. Types of molding – Hand molding – Machine molding. Core – different types of cores – materials – properties of core sand – core manufacturing.

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UNIT – II

Principles of Gating, Gating ratio and design of Gating systems. Risers – Types, function and design, casting design considerations. Methods of melting and types of furnaces - cupola, electric arc, resistance and induction furnace. Solidification of castings-Solidification of pure metals and alloys-Short & long freezing range alloys. Fettling. Casting defects. Basic principles and applications of special casting processes - Centrifugal casting – True, semi and centrifuging, Die casting, Investment casting and shell molding.

UNIT – III

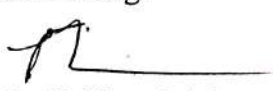
Welding : Classification of welding processes, types of welded joints and their characteristics, Gas welding, Different types of flames and uses, Oxy – Acetylene Gas cutting. Basic principles of Arc welding, power characteristics, Manual metal arc welding, Submerged arc welding, TIG & MIG welding. Electro – slag welding.

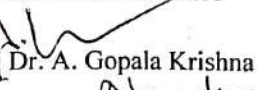
Resistance welding, Friction welding, Friction stir welding, Forge welding, Explosive welding; Thermit welding, Plasma Arc welding, Laser welding, electron beam welding, Soldering & Brazing.

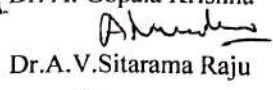
Heat affected zones in welding; pre & post heating, Weldability of metals, welding defects – causes and remedies – destructive and nondestructive testing of welds.

UNIT – IV

Plastic deformation in metals and alloys-recovery, recrystallization and grain growth. Hot working and Cold working-Strain hardening and Annealing. Bulk forming processes: Forging - Types of Forging, Smith forging, Drop Forging, Roll forging, Forging hammers, Rotary forging, forging defects; Rolling – fundamentals, types of rolling mills and products, Forces in rolling and power requirements. Extrusion and its characteristics. Types of extrusion, Impact extrusion, Hydrostatic extrusion; Wire drawing and Tube drawing.

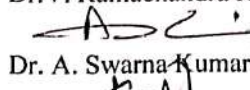

Dr. K. Meera Saheb

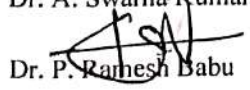

Dr. A. Gopala Krishna


Dr. A.V. Sitarama Raju

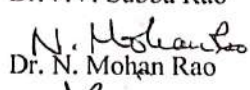

Dr. Ch. Rajesh

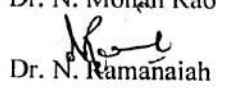

Dr. V. Ramachandra Raju


Dr. A. Swarna Kumari

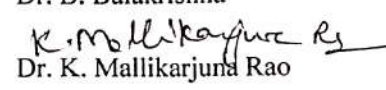

Dr. P. Ramesh Babu

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UNIT – V

Sheet metal forming - Blanking and piercing, Forces and power requirement in these operations, Deep drawing, Stretch forming, Bending, Springback and its remedies, Coining, Spinning, Types of presses and press tools.

High energy rate forming processes: Principles of explosive forming, electromagnetic forming, Electro hydraulic forming, rubber pad forming, advantages and limitations.

TEXT BOOKS:

1. Manufacturing Processes for Engineering Materials - Kalpakjian S and Steven R Schmid- Pearson Publ , 5th Edn.
2. Manufacturing Technology -Vol I- P.N. Rao- TMH

REFERENCES :

1. Manufacturing Science – A.Ghosh & A.K.Malik – East West Press Pvt. Ltd
2. Process and materials of manufacture- Lindberg- PHI
3. Production Technology- R.K. Jain- Khanna
4. Production Technology-P C Sharma-S. Chand
5. Manufacturing Processes- H.S. Shaun- Pearson
6. Manufacturing Processes- J.P. Kaushish- PHI
7. Workshop Technology -WJ Chapman/CBS Publishers&Distributors Pvt.Ltd.
8. Production Technology-HMT- Tata McGrawHill

Course Outcomes:

CO1: Able to design the patterns and core boxes for metal casting processes

CO2: Able to design the gating system for different metallic components

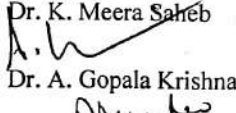
CO3: Know the different types of manufacturing processes

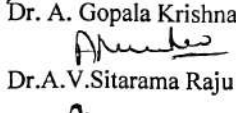
CO4: Be able to use forging, extrusion processes

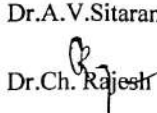
CO5: Learn about the different types of welding processes used for special fabrication.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	-	-	-	-	-	√	√	√	√
CO2	√	√	√	-	-	-	-	-	√	√	√	√
CO3	√	√	√	-	-	-	-	-	√	√	√	√
CO4	√	√	√	-	-	-	-	-	√	√	√	√
CO5	√	√	√	-	-	-	-	-	√	√	√	√

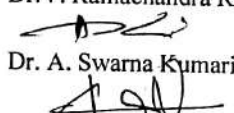

Dr. K. Meera Saheb

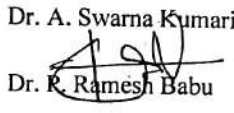

Dr. A. Gopala Krishna


Dr. A. V. Sitarama Raju

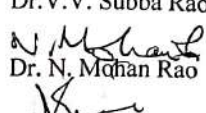

Dr. Ch. Rajesh

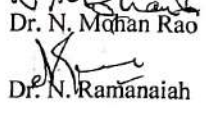

Dr. V. Ramachandra Raju


Dr. A. Swarna Kumari

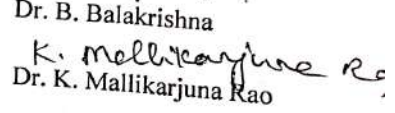

Dr. R. Ramesh Babu

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L	T	P	C
2	1	0	3

II Year B.Tech. – I Sem.

THERMODYNAMICS

Course Objectives:

To impart the knowledge of the thermodynamic laws and principles so as to enable the student to prepare an energy audit of any mechanical system that exchange heat and work with the surroundings.

UNIT – I

Objectives: The student should be able to understand the basic concepts like thermodynamic system, its boundary and related fundamental definitions. Distinguish between point function and path function.

Introduction: Basic Concepts : System, boundary, Surrounding, control volume, Universe, Types of Systems, Macroscopic and Microscopic viewpoints, Concept of Continuum, Thermodynamic Equilibrium, State, Property, Process - Reversible, Quasi static & Irreversible Processes, cycle, Causes of Irreversibility. Energy in State and in Transition - Types, Work and Heat, Point and Path function.

Zeroth Law of Thermodynamics – Concept of Temperature – Principles of Thermometry –Reference Points – Const. Volume gas Thermometer – Scales of Temperature, Ideal Gas Scale.

UNIT – II

Objectives: To learn the first law of thermodynamics, which is also the energy conservation principle, and should be able to apply to different thermodynamic systems. To understand the concept of equality of temperature and the principle of operation of various temperature measuring devices. To learn the applications of steady flow energy equation to various flow systems.

Joule's Experiments – First law of Thermodynamics – Corollaries – First law applied to a Process – applied to a flow system – Steady Flow Energy Equation. Energy balance for closed systems-Specific heats- Internal energy, Enthalpy and Specific heats of Ideal gases- Internal energy, Enthalpy and Specific heats of Solids and liquids

Conservation of mass- Flow work and Energy of a flowing fluid- Energy analysis of steady flow systems- Some steady flow engineering devices, PMM-I.

UNIT III

Objectives: To understand the second law statements and the associated terms and should be able to apply the principles to heat engines & refrigerator/ heat pump. Should be able to analyse the concepts of Carnot cycle, entropy, availability and irreversibility. Should be able to understand the use of Maxwells relations and thermodynamic functions.

Limitations of the First Law – 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 cycle and its specialties, Carnot's theorem, 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.

Dr. K. Meera Saheb

Dr. V. Ramachandra Raju

Dr. V. V. Subba Rao

Dr. B. Balakrishna

Dr. A. Gopala Krishna

Dr. A. Swarna Kumari

Dr. N. Mohan Rao

Dr. K. Mallikarjuna Rao

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UNIT IV

Objectives: The student should understand the process of steam formation and its representation on property diagrams with various phase changes and should be able to calculate the quality of steam after its expansion in a steam turbine, with the help of standard steam tables and charts. Pure Substances, P-V-T- surfaces, T-S and h-s diagrams, Mollier Charts, Phase Transformations – Triple point and critical point, properties during change of phase, Dryness Fraction – Clausius – Clapeyron Equation, Property tables. Various Thermodynamic processes and energy Transfer – Steam Calorimetry.

UNIT – V

Objectives: The student Should be able to solve problems by using various laws of gases , Use Psychrometric chart and calculate various psychrometric properties of air. Ideal Gas equation of state- Compressibility factor- Van der waals equation of state- Beattie-Bridgeman equation of state- Benedict-Webb-Rubin equation of state- Viral equation of state- compressibility charts – variable specific heats – gas tables. Mixtures of perfect Gases – Dalton's Law of partial pressure, Avogadro's Laws of additive volumes- Equivalent Gas constant and Molecular Internal Energy, Enthalpy, sp. Heats and Entropy of Mixture of perfect Gases and Vapour. 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. Engineering Thermodynamics, PK Nag 6th Edn , McGraw Hill.
2. Fundamentals of Thermodynamics – Sonntag, Borgnakke, Van Wylen, 6th Edn, Wiley

REFERENCES:

1. Engineering Thermodynamics – Jones & Dugan PHI
2. Thermodynamics, an Engineering Approach, Yunus A Cengel, Michael A Boles, 8th Edn in SI Units, McGraw Hill.
3. Thermodynamics – J.P.Holman , McGrawHill
4. An Introduction to Thermodynamics - Y.V.C.Rao – Universities press.
5. Thermodynamics – W.Z.Black & J.G.Hartley, 3rd Edn Pearson Publ.
6. Engineering Thermodynamics – D.P.Misra, Cengage Publ.
7. Engineering Thermodynamics – P.Chattopadhyay – Oxford Higher Edn Publ.

COURSE OUTCOMES:

After undergoing the course the student is expected to learn

CO1: Basic concepts of thermodynamics

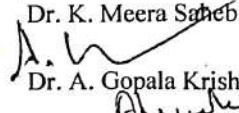
CO2: Laws of thermodynamics

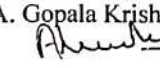
CO3: Concept of entropy

CO4: Property evaluation of vapors and their depiction in tables and charts

CO5: Evaluation of properties of perfect gas mixtures.

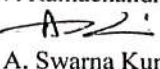

Dr. K. Meera Sathesh

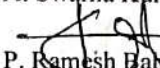

Dr. A. Gopala Krishna

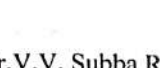

Dr. A.V. Sitarama Raju

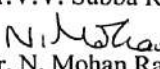

Dr. Ch. Rajesh


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Dr. A. Swarna Kumari

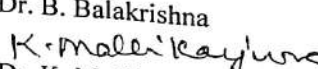

Dr. P. Ramesh Babu

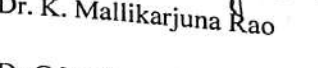

Dr. V.V. Subba Rao


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Dr. N. Ramanaiah


Dr. B. Balakrishna


Dr. K. Mallikarjuna Rao

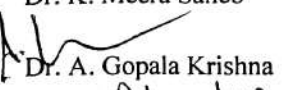

Dr. G. Madhusudan Reddy

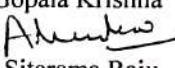
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CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√		√		√	√	√	√	√	√
CO2	√	√	√		√		√	√	√	√	√	√
CO3	√	√	√		√		√	√	√	√	√	√
CO4	√	√	√		√		√	√	√	√	√	√
CO5	√	√	√		√		√	√	√	√	√	√

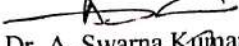

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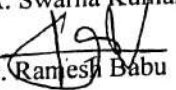

Dr. A. Gopala Krishna


Dr. A. V. Sitarama Raju

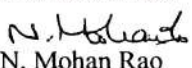

Dr. Ch. Rajesh


Dr. V. Ramachandra Raju


Dr. A. Swarna Kumari

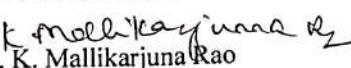

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L	T	P	C
0	0	6	3

II Year B.Tech. – I Sem.

MACHINE DRAWING

Course Objective: The student will acquire knowledge in national and International standards while drawing machine components students will also familiarize in drawing assembly, orthographic and sectional views of various machine components.

Machine Drawing Conventions:

Need for drawing conventions – introduction to IS conventions-Standardization-Interchangeability-Selective assembly-Tolerance

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

PART-A

I. Drawing of Machine Elements and simple parts

Objective: To provide basic understanding and drawing practice of various joint, simple mechanical parts

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

- Popular forms of Screw threads, bolts, nuts, stud bolts, tap bolts, set screws.
- Keys, cottered joints, knuckle joint, Hook's joints
- Riveted joints for plates
- Shaft coupling, spigot and socket pipe joint.
- Journal, pivot and collar and foot step bearings.

PART-B

II. Assembly Drawings:

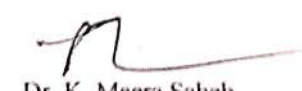
Objective: The student will be able to draw the assembly from the individual part drawing. Drawings of assembled views for the part drawings of the following using conventions and easy drawing proportions.

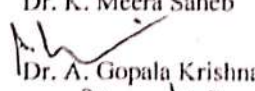
- Engine parts –Gear pump, Fuel pump, petrol Engine connecting rod, piston, stuffing box and eccentric assembly.
- Other machine parts - Screws jack, Machine swivel vice, Plummer block, Tailstock and Tool post.

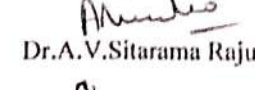
III. Manufacturing Drawing

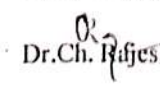
Introduction of Limits and fits, fundamental deviations for Hole based and Shaft based systems, alpha numeric designation of limits & fits. Types of Fits. Form and positional tolerances.

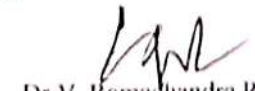
Conventional practices of indicating limits and fits, geometrical form and position tolerances, surface finish and surface treatments requirements. Study of Examples involving selection of fits and calculation of limits. Suggestion of suitable fits for mating parts.

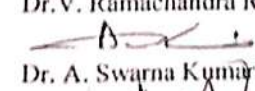

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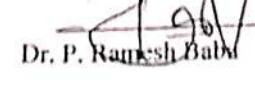

Dr. A. Gopala Krishna


Dr. A.V. Sitarama Raju

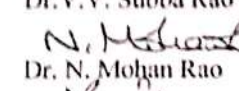

Dr. Ch. Rajesh


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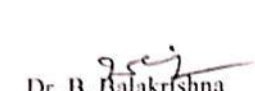

Dr. A. Swarna Kumari

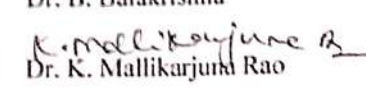

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Representation of limits fits and tolerances for mating parts. Use any four parts of above assembly drawings and prepare manufacturing drawing with dimensional and geometric tolerances.

TEXT BOOKS:

1. Machine Drawing – N.Siddeswar, K.Kannaiah & V.V.S.Sastry - TMH
2. Machine Drawing –K.L.Narayana, P.Kannaiah & K. Venkata Reddy / New Age/ Publishers
3. Production Drawing- K.L.Narayana, P.Kannaiah & K. Venkata Reddy / New Age/ Publishers

REFERENCES:

1. Machine Drawing – P.S.Gill,
2. Machine Drawing – Luzzader
3. Machine Drawing – Rajput
4. Machine Drawing – N.D. Junnarkar, Pearson
5. Machine Drawing – Ajeeth Singh, McGraw Hill
6. Machine Drawing – KC John, PHI
7. Machine Drawing – B Battacharya, Oxford
8. Machine Drawing – Gowtham and Gowtham, Pearson
9. Machine Drawing- Dhawan R K- S.chand&Company

Course Outcome:

- CO1. Draw and represent standard dimensions of different mechanical fasteners and joints and Couplings.
- CO2. Draw different types of bearings showing different components.
- CO3. Assemble components of a machine part and draw the sectional assembly drawing showing the dimensions of all the components of the assembly as per bill of materials
- CO4. Select and represent fits and geometrical form of different mating parts in assembly drawings.
- CO5: To prepare manufacturing drawings indicating fits, tolerances, surface finish and surface treatment requirements.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	-	-	-	-	√	√
CO2	-	-	-	-	-	-	-	-	-	-	√	√
CO3	-	-	-	-	-	-	-	-	-	-	√	√
CO4	-	-	-	-	-	-	-	-	-	-	√	√
CO5	-	-	-	-	-	-	-	-	-	-	√	√

Dr. K. Meera Saheb

Dr. A. Gopala Krishna

Dr.A.V.Sitarama Raju

Dr.Ch. Rajesh

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UNIVERSITY COLLEGE OF ENGINEERING KAKINADA (AUTONOMOUS)
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
B.TECH (MECHANICAL ENGINEERING)
EFFECTIVE FROM 2019-20 BATCH

L	T	P	C
0	0	3	1.5

II Year B.Tech. – I Sem.

MATERIALS TESTING LAB

Course Objective: To impart practical exposure on the microstructures of various materials and their hardness evaluation. Also to impart practical knowledge on the evaluation of material properties through various destructive testing procedures.

NOTE: Any 6 experiments from each section A and B.

(A) MECHANICS OF SOLIDS LAB:

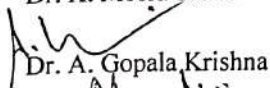
1. Direct tension test
2. Bending test on
 - a) Simple supported
 - b) Cantilever beam
3. Torsion test
4. Hardness test
 - a) Brinells hardness test
 - b) Rockwell hardness test
5. Test on springs
6. Compression test on cube
7. Impact test
8. Punch shear test

(B) METALLURGY LAB:

1. Preparation and study of the Microstructure of pure metals like Iron, Cu and Al.
2. Preparation and study of the Microstructure of Mild steel, Medium carbon steels, High carbon steels.
3. Study of the Micro Structures of Cast Irons.
4. Study of the Micro Structures of Non-Ferrous alloys.
5. Study of the Micro structures of Heat treated steels.
6. Hardeneability of steels by Jominy End Quench Test.
7. To find out the hardness of various treated and untreated steels.



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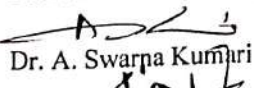
Dr. A. Gopala Krishna



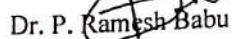
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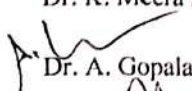
II Year B.Tech. – I Sem.

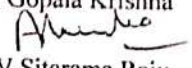
PRODUCTION TECHNOLOGY LAB

Course Objective: To impart hands-on practical exposure on manufacturing processes and equipment.

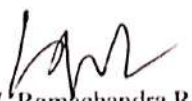
1. Design and making of pattern
 - i. Single piece pattern
 - ii. Split pattern
2. Sand properties testing
 - i. Sieve analysis (dry sand)
 - ii. Clay content test
 - iii. Moisture content test
 - iv. Strength test (Compression test & Shear test)
 - v. Permeability test
3. Mould preparation
 - i. Straight pipe
 - ii. Bent pipe
 - iii. Dumble
 - iv. Gear blank
4. Gas cutting and welding
5. Manual metal arc welding
 - i. Lap joint
 - ii. Butt joint
6. Injection Molding
7. Blow Molding
8. Simple models using sheet metal operations
9. Study of deep drawing and extrusion operations
10. Study of Basic powder compaction and sintering
11. Study of TIG/MIG Welding
12. Study of Resistance Spot Welding
13. Study of Brazing and soldering
14. Study of Plastic Moulding Process.

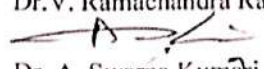

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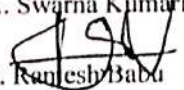

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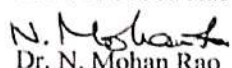

Dr. Ch. Rajesh


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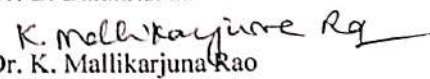

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B.TECH (MECHANICAL ENGINEERING)
EFFECTIVE FROM 2019-20 BATCH

L	T	P	C
3	0	0	3

II Year B.Tech. – II Sem.

KINEMATICS OF MACHINERY

Course objective: The students completing this course are expected to understand the nature and role of the kinematics of machinery, mechanisms and machines. The course includes velocity and acceleration diagrams, analysis of mechanisms joints, Cams and their applications. It exposes the students to various kinds of power transmission devices like belt, rope, chain and gear drives and their working principles and their merits and demerits.

UNIT – I

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.

Grashoff's law, Degrees of freedom, Kutzbach criterion for planar mechanisms, Mechanism and machines – classification of machines – kinematic chain – inversion of mechanism – inversions of quadric cycle chain – single and double slider crank chains.

UNIT – II

LOWER PAIR MECHANISM: Exact and approximate copiers and generated types – Peaucellier, Hart and Scott Russel – Grasshopper – Watt T. Chebicheff and Robert Mechanisms and straight line motion, Pantograph.

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

UNIT – III

KINEMATICS: Velocity and acceleration – Motion of a link in machine – Determination of Velocity and acceleration diagrams – Graphical method – Application of relative velocity method four bar chain. Velocity and acceleration analysis of for a given mechanism, Klein's construction, determination of Coriolis component of acceleration.

PLANE MOTION OF BODY: Instantaneous center 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.

UNIT – IV

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 and retardation. Maximum velocity and maximum acceleration during outward and return strokes in the above 3 cases.

Analysis of motion of followers: Roller follower – circular cam with straight, concave and convex flanks.

BELT DRIVES: Introduction, Belt and rope drives, selection of belt drive- types of belt drives, V-belts, materials used for belt and rope drives, velocity ratio of belt drives, slip of belt, creep of belt, tensions for flat belt drive, angle of contact, centrifugal tension, maximum tension of belt, Chains- length, angular speed ratio, classification of chains.

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B.TECH (MECHANICAL ENGINEERING)
EFFECTIVE FROM 2019-20 BATCH

UNIT – V**GEARS**

Higher pairs, friction wheels and toothed gears–types – law of gearing, condition for constant velocity ratio for transmission of motion, Form 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 to gear Trains, 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 an automobile.

TEXT BOOKS:

1. Theory of Mechanisms & Machines by Jagadeesh Lal, Metropolitan Pvt.Ltd.
2. Theory of Machines by Thomas Bevan/ CBS Publishers

REFERENCES:

1. Theory of Machines – S. S Rattan- TMH Publishers
2. Theory of machines and Machinery /Vickers / Oxford .
3. Theory of Mechanisms and machines – A:Ghosh & A.K.Malik – East West Press Pvt. Ltd.
4. Kinematics and dynamics of Machinery by R.L Norton; TATA McGraw-Hill

Course outcomes:

The student should be able to

CO1: Contrive a mechanism for a given plane motion with single degree of freedom.

CO2: Suggest and analyze a mechanism for a given straight line motion and automobile steering motion.

CO3: Analyze the motion (velocity and acceleration) of a plane mechanism.

CO4: Suggest and analyze mechanisms for a prescribed intermittent motion like opening and closing of IC engine valves etc.

CO5: Select a power transmission system for a given application and analyze motion of different transmission systems

CO-PO Matrix

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√		√		√							√
CO2	√		√									√
CO3	√	√										√
CO4	√										√	√
CO5	√										√	√

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EFFECTIVE FROM 2019-20 BATCH

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2 1 0 3

II Year B.Tech. – II Sem.

APPLIED THERMODYNAMICS - I
(Use of steam tables and Mollier chart is allowed)

Course objectives:

This course is intended to study the thermodynamic analysis of major components of Rankine cycle, refrigeration cycles and compressible fluids and to analyze the energy transfers and transformations in these components including individual performance evaluation.

UNIT – I

VAPOUR POWER CYCLES: Carnot, Rankine cycle - schematic layout, thermodynamic analysis, concept of mean temperature of heat addition, methods to improve cycle performance – regeneration & reheating.

UNIT II

COMBUSTION: Fuels and combustion, concepts of heat of reaction, adiabatic flame temperature, Stoichiometry, flue gas analysis.

BOILERS : Classification – working principles of L.P & H.P boilers with sketches – 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.

UNIT – III

STEAM NOZZLES: Function of a nozzle – applications - types, flow through nozzles, thermodynamic analysis – assumptions -velocity of fluid at nozzle exit-Ideal and actual expansion in a 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.

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 - methods to reduce rotor speed-velocity compounding, pressure compounding and velocity & pressure compounding, velocity and pressure variation along the flow – combined velocity diagram for a velocity compounded impulse turbine, condition for maximum efficiency

UNIT IV

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 – calculation of blade height.

STEAM CONDENSERS: Requirements of steam condensing plant – classification of condensers – working principle of different types – vacuum efficiency and condenser efficiency – air leakage, sources and its affects, air pump, cooling water requirement.

UNIT – V

COMPRESSORS – Classification – fan, blower and compressor - positive displacement and non positive displacement type – reciprocating and rotary types.

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

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Rotary (Positive displacement type)

Roots Blower, vane sealed compressor, Lysholm compressor – mechanical details and principle of working – efficiency considerations.

Rotary (non positive displacement type)

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.

TEXT BOOKS:

1. Heat Engineering (MKS and SI units), VP Vasandani, DS Kumar, Metropolitan books
2. Basics & Applied Thermodynamics- P.K.Nag – 4th edition- McGraw Hill

REFERENCES:

1. Thermal Engineering- Mahesh Rathore, TataMcGrawHill
2. Applied Thermodynamics by R Yadhav
3. Applied Thermodynamics by Eastop & McConkey, 5th Edn, Pearson
4. Fluid Mechanics Fundamentals and Applications by Y.A.Cengel, J.M.Cimbala, McGrawHill
5. Thermal Engineering-M.L.Marthur & Mehta/Jain bros. Publishers
6. Thermal Engineering / RK Rajput/ Lakshmi Publications

Course outcomes:

- CO1: Expected to learn the working of steam power cycles and also should be able to analyze and evaluate the performance of individual components
- CO2: Student is able to learn the principles of combustion, stoichiometry and flue gas analysis
- CO3: Students will be able to design the components and calculate the losses and efficiency of the boilers, nozzles and impulse turbines.
- CO4: Students will be able to design the components and calculate the losses and efficiency of reactions turbines and condensers.
- CO5: Student is able to learn various types of compressors, principles of working and their performance evaluation.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√				√					√	√	
CO2	√	√	√		√			√			√	√
CO3	√	√	√		√			√			√	√
CO4	√	√	√		√			√			√	√
CO5	√	√	√		√			√			√	√

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B.TECH (MECHANICAL ENGINEERING)
EFFECTIVE FROM 2019-20 BATCH

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II Year B.Tech. – II Sem

FLUID MECHANICS & HYDRAULIC MACHINES

Course Objectives: The students completing this course are expected to understand the properties of fluids, its kinematic and dynamic behavior through various laws of fluids like continuity, Euler's, Bernoulli's equations, energy and momentum equations. Further, the student shall be able to understand the theory of boundary layer, working and performance characteristics of various hydraulic machines like pumps and turbines.

UNIT I

Objective: After studying this unit student will know the concept of fluid and its properties, manometry, hydrostatic forces acting on different surfaces and also problem solving techniques.

Fluid statics: Dimensions and units: physical properties of fluids - specific gravity, viscosity and its significance, surface tension, capillarity, vapor pressure. Atmospheric, gauge and vacuum pressure, Measurement of pressure – Manometers - Piezometer, U-tube, inverted and differential manometers. Pascal's & hydrostatic laws.

Buoyancy and floatation: Meta center, stability of floating body. Submerged bodies. Calculation of metacenter height. Stability analysis and applications.

UNIT II

Objective: In this unit student will be exposed to the basic laws of fluids, flow patterns, viscous flow through ducts and their corresponding problems.

Fluid kinematics: Introduction, flow types. Equation of continuity for one dimensional flow, circulation and vorticity, Stream line, path line and streak lines and stream tube. Stream function and velocity potential function, differences and relation between them. Condition for irrotational flow, flow net, source and sink, doublet and vortex flow.

Fluid dynamics: surface and body forces –Euler's and Bernoulli's equations for flow along a stream line, momentum equation and its applications, force on pipe bend.

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.

UNIT III

Objective: At the end of this unit student will be aware of the concepts related to boundary layer theory, flow separation, basic concepts of velocity profiles, dimensionless numbers and dimensional analysis.

Boundary Layer Theory: Introduction, momentum integral equation, displacement, momentum and energy thickness, separation of boundary layer, control of flow separation, Stream lined body, Bluff body and its applications, basic concepts of velocity profiles.

Dimensional Analysis: Dimensions and Units, Dimensional Homogeneity, Non dimensionalization of equations, Method of repeating variables and Buckingham Pi Theorem.

UNIT IV

Objective: In this unit student will know the hydrodynamic forces acting on vanes and their performance evaluation.

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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, work done and efficiency, flow over radial vanes.

Centrifugal pumps: classification, working, work done – manometric head- losses and efficiencies- specific speed- pumps in series and parallel-performance characteristic curves, cavitation & NPSH.

Reciprocating pumps: Working, Discharge, slip, indicator diagrams.

UNIT V

Objective: After studying this unit student will be in a position to evaluate the performance characteristics of hydraulic turbines. Also a little knowledge on hydraulic systems and fluidics is imparted to the student.

Hydraulic Turbines: classification of turbines, impulse and reaction turbines, Pelton wheel, Francis turbine and Kaplan turbine-working proportions, work done, efficiencies, hydraulic design – draft tube- theory- functions and efficiency.

Performance of hydraulic turbines: Geometric similarity, Unit and specific quantities, characteristic curves, governing of turbines, selection of type of turbine, cavitation, surge tank, water hammer.

TEXT BOOKS:

1. Fluid Mechanics- Fundamentals and Applications by Y.A. Cengel, J.M.Cimbala, 6th Edn, McGrawHill
2. Fluid Mechanics and Fluid Power Engineering by D.S. Kumar, Kotaria & Sons.

REFERENCE BOOKS:

1. Hydraulics, fluid mechanics and Hydraulic machinery Modi and Seth
2. Fluid Mechanics and Hydraulic Machines/ RK Bansal/Laxmi Publications (P) Ltd.
3. Fluid Mechanics and Hydraulic Machines by Rajput
4. Fluid Mechanics & Turbo machinery by Dixon, 7th Edn, Elsevier
5. Fluid Mechanics and Machinery by D. Rama Durgaiah, New Age International.

COURSE OUTCOMES:

From this course the student is expected to learn

CO1: The basic concepts of fluid properties.

CO2: The mechanics of fluids in static and dynamic conditions.

CO3: Boundary layer theory, flow separation and dimensional analysis.

CO4: Hydrodynamic forces of jet on vanes in different positions.

CO5: Working Principles and performance evaluation of hydraulic pump and turbines.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√				√			√	√	√	√	√
CO2	√	√	√		√			√	√	√	√	√
CO3	√	√	√		√			√	√	√	√	√
CO4		√	√		√			√	√	√	√	√
CO5		√	√		√			√	√	√	√	√

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II Year B.Tech. – II Sem.

METAL CUTTING & MACHINE TOOLS

Course objectives:

1. The course provides students with fundamental knowledge and principles in material removal processes.
2. In this course, the students apply the fundamentals and principles of metal cutting to practical applications through multiple labs using lathes, milling machines, grinding machines, and drill presses, Computer Numerical Control etc
3. To demonstrate the fundamentals of machining processes and machine tools.
4. To develop knowledge and importance of metal cutting parameters.
5. To develop fundamental knowledge on tool materials, cutting fluids and tool wear mechanisms.
6. To apply knowledge of basic mathematics to calculate the machining parameters for different machining processes.

UNIT – I

FUNDAMENTAL OF MACHINING:

Elementary treatment of metal cutting theory – element of cutting process – Single point cutting tools, nomenclature of single point cutting tool, tool signature, tool angles, mechanism of metal cutting, types of chips and chip formation – built up edge and its effects, chip breakers, mechanics of orthogonal and oblique cutting – Merchant's force diagram, cutting forces, velocity ratio, cutting speeds, feed, depth of cut, tool life, Taylor's tool life equation, simple problems - Tool wear, tool wear mechanisms, machinability, economics of machining, coolants, tool materials and properties.

UNIT – II

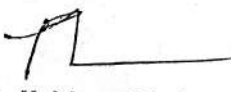
LATHE MACHINES:

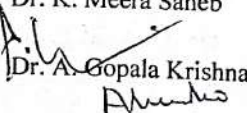
Introduction- types of lathe - Engine lathe – principle of working - construction - specification of lathe - work holders and tool holders – accessories and attachments – lathe operations – taper turning methods and thread cutting – drilling on lathes – cutting speed and feed - constructional features of speed gear box and feed gear box - turret and capstan lathes – collet chucks – other work holders – tool holding devices – box and tool layout- principal features of automatic lathes – classification – single spindle and multi-spindle automatic lathes – tool layout and cam design for automats.

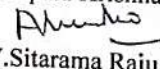
UNIT – III

SHAPING, SLOTTING AND PLANNING MACHINES: Introduction - principle of working – principle parts – specifications - operations performed - slider crank mechanism - machining time calculations.

DRILLING & BORING MACHINES: Introduction – construction of drilling machines – types of drilling machines - principles of working – specifications- types of drills – geometry of twist drill - tool holding devices - operations performed – tool holding devices – cutting speed and feed – machining time calculations - Boring Machines – fine Boring Machines – jig boring machines - deep hole Drilling Machines.

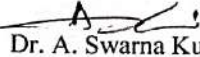

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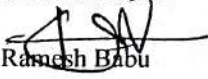

Dr. A. Gopala Krishna


Dr. A.V. Sitarama Raju


Dr. Ch. Rajesh


Dr. V. Ramachandra Raju

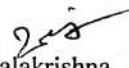

Dr. A. Swarna Kumari

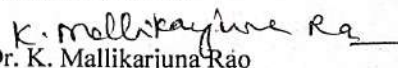

Dr. P. Ramesh Babu

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Dr. K. Mallikarjuna Rao

Dr. G. Madhusudan Reddy

2019-2020

UNIVERSITY COLLEGE OF ENGINEERING KAKINADA (AUTONOMOUS)
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
B.TECH (MECHANICAL ENGINEERING)
EFFECTIVE FROM 2019-20 BATCH

UNIT – IV

MILLING MACHINES: Introduction - principle of working – specifications – milling methods - classification of Milling Machines – principle features of horizontal, vertical and universal Milling Machine, machining operations, types of cutters - geometry of milling cutters – methods of indexing, accessories to milling machines - cutting speed and feed – machining time calculations.

UNIT –V

FINISHING PROCESSES: Introduction - theory of grinding – classification of grinding machines- cylindrical and surface grinding machines- tool and cutter grinding machines- different types of abrasives- bonds, specification and selection of a grinding wheel-lapping, Honing & Broaching operations- comparison to grinding.
Introduction to unconventional machining process.

Note: Requested to adopt digital teaching methodology at least for two weeks during the semester.

TEXT BOOKS:

1. Manufacturing Processes / JP Kaushish/ PHI Publishers-2nd Edition
2. Manufacturing Technology Vol-II/P.N Rao/Tata McGraw Hill

REFERENCES:

1. Metal cutting and machine tools /Geoffrey Boothroyd, Winston A.Knight/ Taylor & Francis
2. Production Technology / H.M.T. Hand Book (Hindustan Machine Tools).
3. Production Engineering/K.C Jain & A.K Chitale/PHI Publishers
4. Technology of machine tools/S.F.Krar, A.R. Gill, Peter SMID/ TMH
5. Manufacturing Processes for Engineering Materials-Kalpakjian S & Steven R Schmid/Pearson Publications 5th Edition

Course Outcomes:

CO1: Learned the fundamental knowledge and principals in material removal process.

CO2: Acquire the knowledge on operations in conventional, automatic, Capstan and turret lathes

CO3: capable of understanding the working principles and operations of shaping, slotting, planning , drilling and boring machines.

CO4: able to make gear and keyway in milling machines and understand the indexing mechanisms

CO5: Understand the different types of unconventional machining methods and principles of finishing processes.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√	-	√	√	√	√	√	√
CO2	√	√	√	√	√	-	√	√	√	√	√	√
CO3	√	√	√	√	√	-	√	√	√	√	√	√
CO4	√	√	√	√	√	-	√	√	√	√	√	√
CO5	-	√	√	√	√	-	√	√	√	√	√	√

Dr. K. Meera Saheb

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B.TECH (MECHANICAL ENGINEERING)
EFFECTIVE FROM 2019-20 BATCH

2/6

L	T	P	C
2	1	0	3

II Year B.Tech. – II Sem.

DESIGN OF MACHINE MEMBERS – I

Course Objectives:

1. The student shall gain appreciation and understanding of the design function in mechanical engineering, the steps involved in designing and the relation of design activity with manufacturing activity
2. Able to select proper materials to different machine elements based on their physical and mechanical properties.
3. Learn and understand of the different types of failure modes and criteria.
4. Procedure for the different machine elements such as fasteners, shafts, couplings, keys, axially loaded joints etc.
5. To be able to know standards in design.

UNIT – I

INTRODUCTION: General considerations in the design of Engineering Materials and their properties – selection – Manufacturing consideration in design – BIS codes of steels.

STRESSES IN MACHINE MEMBERS: Simple stresses – combined stresses – torsional and bending 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 – static strength design based on fracture toughness.

UNIT – II

STRENGTH OF MACHINE ELEMENTS: Stress concentration – theoretical stress concentration factor – fatigue stress concentration factor notch sensitivity – design for fluctuating stresses – endurance limit – estimation of endurance strength – goodman's line – soderberg's line – modified goodman's line, Gerber's parabola.

UNIT – III

RIVETED AND WELDED JOINTS – design of joints with initial stresses – eccentric loading.

Bolted joints – design of bolts with pre-stresses – design of joints under eccentric loading – locking devices – bolts of uniform strength.

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.

UNIT – IV

SHAFTS: Design of solid and hollow shafts for strength and rigidity – design of shafts for combined bending and axial loads – shaft sizes – BIS code. Use of internal and external circlips, gaskets and seals (stationary & rotary).

SHAFT COUPLING: Rigid couplings – muff, split muff and flange couplings, rigid flanged coupling, protected rigid flanged coupling, Bushed pin type flexible coupling.

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EFFECTIVE FROM 2019-20 BATCH

UNIT – V

MECHANICAL SPRINGS:

Stresses and deflections of helical springs – extension -compression springs – springs for fatigue loading, energy storage capacity – helical torsion springs – co-axial springs, leaf springs.

Note: Design data book is NOT Permitted for examination

TEXT BOOKS:

1. Machine Design/ Shigley, J.E/McGraw Hill
2. Machine Design/V.B.Bhandari/ McGrawHill Education

REFERENCES:

1. Machine design / Schaum Series/McGrawHill Professional
2. Machine Design –Norton/ Pearson publishers
3. Machine design / NC Pandya & CS Shah/Charotar Publishing House Pvt. Limited

COURSE OUT COMES:

Students must be able to

1. Calculate different stresses in the machine components subjected to various static loads, failures and suitability of a material for an engineering application.
2. Calculate dynamic stresses in the machine components subjected to variable loads.
3. Design riveted, welded, bolted joints, keys, cotters and knuckle joints subjected to static loads and their failure modes
4. Design the machine shafts and suggest suitable coupling for a given application.
5. Calculate stresses in different types of springs subjected to static loads and dynamic loads.

CO-PO Matrix

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√					√			√	
CO2	√	√	√					√			√	
CO3	√	√	√					√			√	
CO4	√	√	√					√			√	
CO5	√	√	√					√			√	

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UNIVERSITY COLLEGE OF ENGINEERING KAKINADA (AUTONOMOUS)
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
B.TECH (MECHANICAL ENGINEERING)
EFFECTIVE FROM 2019-20 BATCH

L	T	P	C
0	0	3	1.5

II Year B.Tech. – II Sem.

MACHINE TOOLS LABORATORY

Course objectives:

The students are required to understand the parts of various machine tools and operate them. They are required to understand the different shapes of products that can be produced on these machine tools.

1. Introduction of general purpose machines -Lathe, Drilling machine, Milling machine, Shaper, Planing machine, Slotting machine, Cylindrical grinder, Surface grinder and Tool and cutter grinder.
2. Operations on Lathe machines
 - (i) Step turning and Knurling
 - (ii) Taper turning and Knurling
 - (iii) Thread cutting and knurling
 - (iv) Drilling and tapping
3. Operations on Drilling machine
 - (i) Drilling, reaming and tapping
 - (ii) Rectangular drilling
 - (iii) circumferential drilling
4. Operations on Shaping machine
 - (i) Round to square
 - (ii) Round to Hexagonal
5. Operations on Slotter –
 - (i) Keyway (T –slot)
 - (ii) Keyway cutting
6. Operations on milling machines
 - (i) Indexing
 - (ii) gear manufacturing

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UNIVERSITY COLLEGE OF ENGINEERING KAKINADA (A)
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY
KAKINADA

Course Structure (w.e.f. A.Y. 2019-20)

B.Tech. - Mechanical Engineering

L	T	P
2	0	0

THERMAL AND HYDRO PRIME MOVERS (For EEE only)

Part-A: Thermal prime movers

Course Objectives: To make the student understand the types of prime movers, which can be connected to generators for power production and should obtain the skills of performing the necessary calculations with respect to the functioning of the prime movers.

UNIT I:

Objectives: To make the student learn about the constructional features, operational details of various types of internal combustion engines through the details of several engine systems and the basic air standard cycles, that govern the engines.

I.C Engines: Classification, working principles – valve and port timing diagrams – air standard cycles – Engine systems like fuel injection, carburetion, ignition, cooling and lubrication.

UNIT II:

Objectives: To train the student in the aspects of steam formation and its utilities through the standard steam data tables and charts. To make the student understand the working of steam turbines.

Properties of Steam and use of Steam Tables- T-S and H-S Diagrams. Analysis of Various Thermodynamic Processes undergone by Steam.

Vapor Power Cycles: Carnot Cycle-Rankine Cycle- Thermodynamic Variables Effecting Efficiency and output of Rankine Cycle-. Analysis of simple Rankine Cycle.

Steam Turbines: Schematic layout of steam power plant - Classification of Steam Turbines- Impulse Turbine and Reaction Turbine.

UNIT III:

Objectives: To impart the knowledge of gas turbine fundamentals, the governing cycles and the methods to improve the efficiency of gas turbines.

Gas Turbines: Simple gas turbine plant-ideal cycle, closed cycle -open cycle-. Efficiency, Work ratio and optimum pressure ratio for simple gas turbine cycle.

Part-B: Hydro prime movers

UNIT IV:

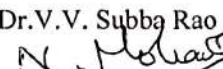
Objectives: To impart the knowledge of various types of pumps, their constructional features, working. To make the student learn about the constructional features, operational details of various types of hydraulic turbines.

PUMPS: Types of pumps, Centrifugal pumps: Main components, working principle.

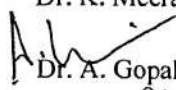
HYDRAULIC TURBINES: Classification of turbines; Working principle, Efficiency calculation and working principles for Pelton Wheel, Francis and for Kaplan turbines; Governing of turbines.

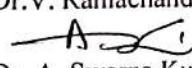

Dr. K. Meera Saheb

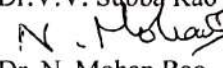

Dr. V. Ramachandra Raju

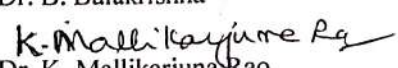

Dr. V.V. Subba Rao

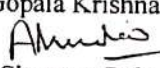

Dr. B. Balakrishna

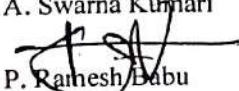

Dr. A. Gopala Krishna


Dr. A. Swarna Kumari

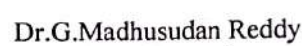

Dr. N. Mohan Rao


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Dr. Ch. Rajesh

UNIVERSITY COLLEGE OF ENGINEERING KAKINADA (A)
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY
KAKINADA

Course Structure (w.e.f. A.Y. 2019-20)

B.Tech. - Mechanical Engineering

UNIT V:

Objectives: To train the student in the areas of types of hydro electric power plants, estimation and calculation of different loads by considering various factors.

HYDRO POWER: Components of Hydro electric power plant: pumped storage systems, Estimation of water power potential; Estimation of load on turbines: load curve, load factor, capacity factor, utilization factor, diversity factor, load – duration curve, firm power, secondary power, prediction of load.

TEXT BOOKS:

1. Thermal Engineering by Rajput, Lakshmi publications
2. Thermal engineering by M.L.Mathur and F.S.Mehta, Jain Brothers.
3. Hydraulics & Fluid Mechanics, P.N. Modi and S.M. Seth, Standard Book House, Delhi

REFERENCE BOOKS:

1. Fluid Mechanics & Hydraulic Machinery, A.K.Jain, , Khanna Publishers, Delhi
2. Fluid Mechanics” by Victor.L.Streeter
3. “Introduction to Fluid Mechanics” Edward .J. Shaughnessy Jr.
4. “Fluid Mechanics & Its Applications”, Vijay Gupta, Santhosh.k.Gupta
5. “Fluid Mechanics & Fluid power Engineering, Dr D.S.Kumar
6. “Water Power Engineering” M.M Desumukh.

Course outcomes:

CO1: Air standard cycles, constructional & operational details of I.C Engines.

CO2: Properties of steam, Rankine cycle, principle and working of steam turbines.

CO3: Fundamentals, governing cycle, working and efficiency of gas turbines.

CO4: Working principle of pumps and hydraulic turbines.

CO5: Details and working of Hydro electric power plants and various loads.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√			√			√	√		√	√	√
CO2	√	√	√	√			√	√		√	√	√
CO3	√	√	√	√			√	√		√	√	√
CO4	√	√	√	√			√	√		√	√	√
CO5	√	√	√	√		√	√	√	√	√	√	√

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KAKINADA

Course Structure (w.e.f. A.Y. 2019-20)
B.Tech. - Mechanical Engineering

THERMAL AND HYDRO LABORATORY (For EEE only)

Course Objective: To impart practical knowledge on the performance evaluation methods of various internal combustion engines, flow measuring equipment and hydraulic turbines and pumps.

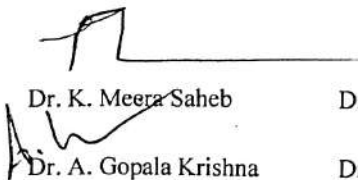
NOTE: TO CONDUCT MINIMUM OF 12 EXPERIMENTS BY CONDUCTING MINIMUM OF SIX FROM EACH SECTION.

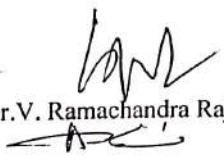
SECTION A - THERMAL ENGINEERING LAB

1. I.C. Engines valve / port timing diagrams.
2. I.C. Engines performance test on 4 -stroke Diesel engine.
3. I.C. Engines performance test on 2-stroke petrol engine.
4. Evaluation of engine friction by conducting Morse test on 4-stroke multi cylinder petrol engine
5. Determination of FP by retardation and motoring test on IC engine
6. I.C. Engine heat balance on petrol / Diesel engines.
7. Economical speed test of an IC engine
8. Study of boilers

SECTION B – HYDRAULIC MACHINES LAB

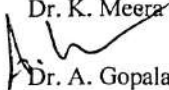
1. Impact of jets on Vanes.
2. Performance Test on Pelton Wheel.
3. Performance Test on Francis Turbine.
4. Performance Test on Kaplan Turbine.
5. Performance Test on Single Stage Centrifugal Pump.
6. Performance Test on Reciprocating Pump.
7. Calibration of Venturimeter.
8. Calibration of Orifice meter.
9. Determination of loss of head due to sudden contraction in a pipeline.

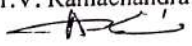

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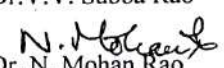

Dr. V. Ramachandra Raju

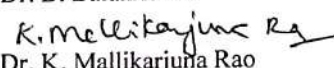
Dr. V.V. Subba Rao


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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY
KAKINADA

Course Structure (w.e.f. A.Y. 2019-20)

B.Tech. - Mechanical Engineering

L	T	P
2	0	0

ELEMENTS OF MECHANICAL ENGINEERING (Only for PE & Chemical Engg.)

Learning Objectives:

- The content of this course shall provide the student the basic concepts of various mechanical systems and exposes the student to a wide range of equipment and their utility in a practical situation. It shall provide the fundamental principles of materials, fuels, Steam, I.C. Engines, compressors, hydraulic machines and transmission systems that usually exist in any process plant.

UNIT -I:

Stresses and strains: kinds of – stress-strains, elasticity and plasticity, Hooks law, stress – strain diagrams, modules of elasticity, Poisson's ratio, linear and volumetric strain, relation between E, N, and K, bars of uniform strength, compound bars and temperature stresses.

UNIT-II:

Types of supports – loads – Shear force and bending moment for cantilever and simply supported beams without overhanging for all types of loads.

UNIT-III:

Thin cylindrical shells: stress in cylindrical shells due to internal pressures, circumferential stress, longitudinal stress, design of thin cylindrical shells, spherical shells, change in dimension of the shell due to internal pressure, change in volume of the shell due to internal pressure.

Thick Cylinders: Lamé's equation- cylinders subjected to inside and outside pressures columns and Struts.

UNIT-IV:

Steam boilers: Classification of boilers, essentialities of boilers, selection of different types of boilers, study of boilers, boiler mountings and accessories.

Internal combustion engines: classification of IC engines, basic engine components and nomenclature, working principle of engines, Four strokes and two stroke petrol and diesel engines, comparison of CI and SI engines, comparison of four stroke and two stroke engines, simple problems such as indicated power, brake power, friction power, specific fuel consumption, brake thermal efficiency, indicated thermal efficiency and mechanical efficiency.

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KAKINADA

Course Structure (w.e.f. A.Y. 2019-20)

B.Tech. - Mechanical Engineering

UNIT-V:

Transmission systems: Belts –Ropes and chain: belt and rope drives, velocity ratio, slip, length of belt, open belt and cross belt drives, ratio of friction tensions, centrifugal tension in a belt, power transmitted by belts and ropes, initial tensions in the belt, simple problems.

Outcomes:

After completing the course, the student shall be able to determine:

- The stress/strain of a mechanical component subjected to loading.
- The performance of components like Boiler, I.C. Engine, Compressor, Steam/Hydraulic turbine, Belt, Rope and Gear.
- The type of mechanical component suitable for the required power transmission.

Text Books:

1. Strength of Materials and Mechanics of Structures, B.C.Punmia, Standard Publications and distributions, 9th Edition, 1991.
2. Thermal Engineering, Ballaney,P.L., Khanna Publishers, 2003.
3. Elements of Mechanical Engineering, A.R.Asrani, S.M.Bhatt and P.K.Shah, B.S. Publs.
4. Elements of Mechanical Engineering, M.L.Mathur, F.S.Metha&R.P.Tiwari Jain Brothers Publs., 2009.

Reference Book:

1. Theory of Machines, S.S. Rattan, Tata McGraw Hil., 2004 & 2009.

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UNIVERSITY COLLEGE OF ENGINEERING KAKINADA (AUTONOMOUS)
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA, KAKINADA

Department of Mechanical Engineering

BOS Meeting Conducted on 15.02.2020

MINUTES OF THE MEETING

A BOS meeting is convened on 15.02.2020 (Saturday) with various stake holders, Experts from Academic institutions, Industry and Alumni to discuss on following Agenda.

1. Finalization of B.Tech Course structure as per R19 Regulations
2. Finalization of Syllabi for 2nd years.
3. Finalization of courses for Honor's and Minor Degree
4. Preparing Course Outcomes and CO –PO

Following members of the BOS were present and actively participated:

S. NO	NAME OF THE MEMBER	DESIGNATION	ORGANIZATION
1.	Dr. K. Meera Saheb	Chairman	Professor & HOD Dept of ME, UCEK, JNTUK
2.	Dr.V.Ramachandra Raju	Internal Member	Professor, Dept of ME UCEK, JNTUK
3.	Dr.V.V.Subba Rao	Internal Member	Professor, Dept of ME UCEK, JNTUK
4.	Dr. B. Balakrishna	Internal Member	Professor, Dept of ME UCEK, JNTUK
5.	Dr. A. Gopala Krishna	Internal Member	Professor, Dept of ME UCEK, JNTUK
6.	Dr. A. Swarna Kumari	Internal Member	Professor, Dept of ME UCEK, JNTUK
7.	Dr. N. Mohan Rao	Internal Member	Professor, Dept of ME UCEK, JNTUK
8.	Dr. K. Mallikarjuna Rao	Internal Member	Adjunct Professor, Dept of ME,UCEK
9.	Dr. A. V. Sitarama Raju	External Member	Professor,Dept of ME JNTUH, Hyderabad
10.	Dr. P. Ramesh Babu	External Member	Professor, Dept of ME OU, Hyderabad
11.	Dr. N. Ramanaiah	External Member	Professor, Dept of ME, Andhra University Visakhapatnam
12.	Dr.Ch. Rajesh	External Member	Alumni, Professor, Pragathi Engg. College, Surampalem

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Dr.G.Madhusudan Reddy

Dr.Ch. Rajesh

The following resolutions were taken based on the discussions and suggestions of various members of the BOS:

1. Course structure is discussed for all the four years of B Tech program and Syllabi are finalized for 2nd year courses as per the AICTE guide lines.
2. The following Course subject titles were renamed by members of the BOS

S.No	Course titles in I BOS Meeting	Course titles in II BOS Meeting
1	Calculus and Linear Algebra	Mathematics-I
2	Programming for Problem Solving	Problem Solving and Programming using C
3	Lab Programming for Problem Solving Lab	Problem Solving and Programming using C
4	Differential Equations & Complex Variables	Mathematics-II
5	Probability & Statistics	Mathematics-III
6	Numerical Methods	Mathematics-IV
7	Materials Engineering	Materials Science & Engineering

3. The following Course subject ~~titles~~ were proposed by members of the BOS.

S.No	Course titles in I BOS Meeting	Course titles in II BOS Meeting
1	Instrumentation & Control Systems	Metal Cutting & Machine Tools
2	Mechanical Vibrations	CAD/CAM
3	Composite Materials	Mechanics of composites
4	Metrology	Mechanical Measurements & Metrology
5	Engineering Metrology Lab	Mechanical Measurements & Metrology Lab

4. Socially relevant project has been introduced in the 2nd year 1st Semester to inculcate social awareness in students.
5. The students can take up the project in the broad areas where the Air pollution, noise pollution, water pollution, adult education, artificial limbs, Swachh Bharath, waste disposal, solid, liquid and electronic waste

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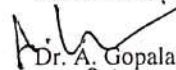
Dr. G. Madhusudan Reddy

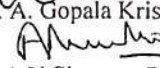
Dr. Ch. Rajesh

disposal, Hygeine and sanitation to public, women empowerment programs, cyber security , girl child education, awareness on ODF, ethics to public, constitutional and RTI awareness, consumer rights, use of energy saving appliances, road safety, rain harvesting, low cost houses, food wastage, blood donation, plantation.

6. Engineering Exploration project has been introduced in the 2nd year 2nd Semester for bridging the gap between basic sciences and engineering aspects.
7. The BoS members introduced new lab courses such as CAD Lab, CAM & CAE Lab and Simulation Lab to improve placement opprtunities.
8. Seven number of Professional Electives are finalized based on employment opportunities.
9. The BoS members introduced following new course in Professional core electives in 3rd year 2nd Semester and 4th year 2nd Semester
 - (1)Control Systems Theory
 - (2)Mechanics of Composites
- 10.Three number of open electives are finalized and these electives can be offered for other departmental students.
- 11.The BoS Members suggested to form a departmental subcommittee to suggest updated MOOCs courses to be offered in a particular semester.
- 12.Project work is split into two parts and introduced in 7th & 8th semesters.
- 13.Open electives have been introduced from 3rd year 2nd Semester onwards.
- 14.Summer internship must be completed in 3rd year 2nd Semester and is evaluated in 4th year 1st semester and carries weightage of 1 credit.
- 15.Introduced mandatory Courses like Environmental Science, Physical fitness activity, Professional Ethics and & Human Values , Eessence of Indian traditional knowledge, Employability skills 1 & 2 and Constitution of India as per the guidelines of AICTE.
- 16.Syllabus of core subjects is designed by keeping in view of syllabus of GATE and IES exams.
- 17.Open elective subjects are designed & offered for students of other branches.
- 18.Subjects are included in R-19 Regulations as per the suggestions of internal BOS members, academia from other institutions, industry and alumni.

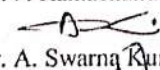

Dr. K. Meera Saheb

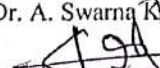

Dr. A. Gopala Krishna


Dr.A.V.Sitarama Raju

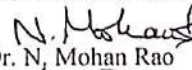

Dr.Ch. Rajesh

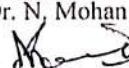

Dr.V. Ramachandra Raju


Dr. A. Swarna Kumari

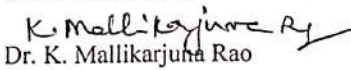

Dr. P. Ramesh Babu


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UNIVERSITY COLLEGE OF ENGINEERING KAKINADA (AUTONOMOUS)
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA

B.Tech. (Mechanical Engineering)
EFFECTIVE FROM 2019-20 BATCH

III Year B.Tech. – I Sem.

DYNAMICS OF MACHINERY

Course Objectives:

1. To equip the students with fundamental knowledge of dynamics of machines so that student can appreciate problems of dynamic force balance, transmissibility of forces, isolation of systems, vibrations.
2. Develop knowledge of analytical and graphical methods for calculating balancing of rotary and reciprocating masses.
3. Develop & understanding of vibrations and its significance on engineering design
4. Develop & understanding of dynamic balancing, flywheel analysis, gyroscopic forces and moments

UNIT – I

FRICTION: Inclined plane, friction of screw and nut, pivot and collar, uniform pressure, uniform wear, friction circle and friction axis, lubricated surfaces, boundary friction, film lubrication.

CLUTCHES: Friction clutches- single disc or plate clutch, multiple disc clutch, cone clutch, centrifugal clutch.

BRAKES AND DYNAMOMETERS: Simple block brakes, internal expanding brake, band brake of vehicle. General description and operation of dynamometers: Prony, Rope brake, Epicyclic, Bevis Gibson and belt transmission.

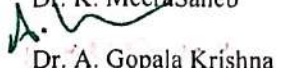
UNIT – II

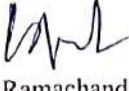
TURNING MOMENT DIAGRAMS: Static and dynamic force analysis of planar mechanisms and slider crank mechanism, inertia torque, angular velocity and acceleration of connecting rod, crank effort and turning moment diagrams – fluctuation of energy – fly wheels and their design.

UNIT-III

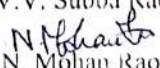
PRECESSION: Gyroscopes, effect of precession motion on the stability of moving vehicles such as motor car, motor cycle, aero planes and ships, (Demonstration of models with video show).

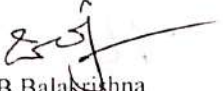
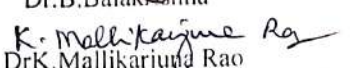
GOVERNERS: Watt, porter and proell governors, spring loaded governors – Hartnell and Hartung with auxiliary springs. sensitiveness, isochronism and hunting.


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Dr. N. Ramanaiah

Dr. Ch. Rajesh

UNIT – IV

BALANCING: Balancing of rotating masses single and multiple – single and different planes, use analytical and graphical methods. Primary, secondary, and higher balancing of reciprocating masses. analytical and graphical methods, unbalanced forces and couples – examination of “V” multi cylinder in line and radial engines for primary and secondary balancing, locomotive balancing, hammer blow, swaying couple, variation of tractive effort.

UNIT – V

VIBRATIONS: Free Vibration of spring mass system – Natural frequency-types of damping – damped free vibration, Simple problems on forced damped vibration, vibration isolation and transmissibility transverse loads, vibrations of beams with concentrated and distributed loads. Dunkerley’s method, Raleigh’s method, whirling of shafts, critical speeds, torsional vibrations, two and three rotor systems.

NOTE: Requested to adopt digital teaching methodology atleast for two weeks during the semester

TEXT BOOKS:

1. Theory of Machines / S.S Rattan/ Mc. Graw Hill
2. Mechanism and machine theory /Ashok G. Ambedkar/PHI Publications.

REFERENCES:

1. Mechanism and Machine Theory / J.S.Rao and R.V.Dukkipati / New Age
2. Theory of Machines / Shigley / MGH
3. Theory of Machines / Thomas Bevan / CBS Publishers
4. Theory of machines / Khurmi/S.Chand.

Course outcomes:

Upon successful completion of this course the student should be able to:

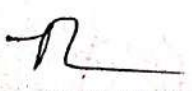
CO1: Compute frictional losses, torque transmission of mechanical systems

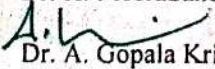
CO2: Analyze dynamic force analysis of slider crank mechanism and design of flywheel

CO3: understand the principle of working of different types of governors and Analyze stabilization of sea vehicles, aircrafts and automobile vehicles

CO4: Understand balancing of reciprocating and rotary masses.

CO5: Develop understanding of vibrations and its significance on engineering design.


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Dr. A. Gopala Krishna

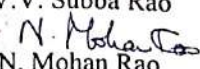
Dr. A. V. Sitarama Raju


Dr. V. Ramachandra Raju

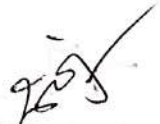
Dr. A. Swarna Kumari

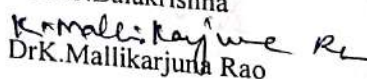
Dr. P. Ramesh Babu

Dr. V. V. Subba Rao


Dr. N. Mohan Rao

Dr. N. Ramanaiah

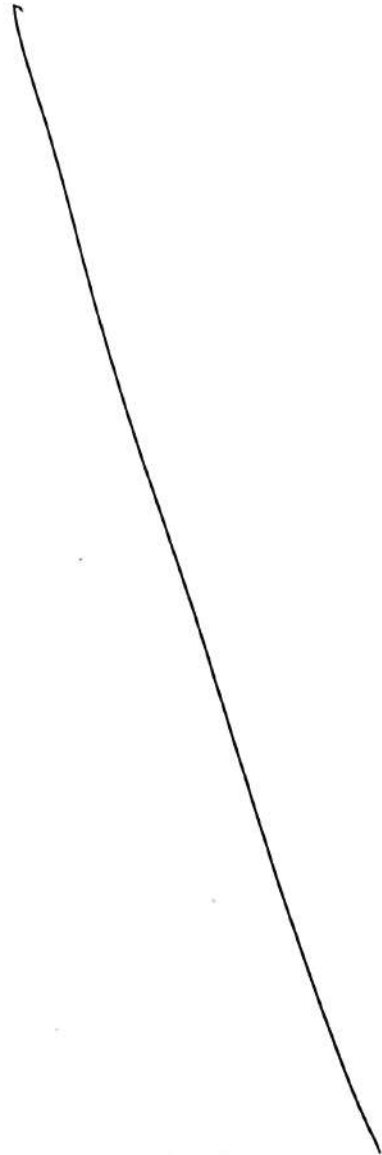

Dr. B. Balakrishna


Dr. K. Mallikarjuna Rao

Dr. Ch. Rajesh

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√		√				√		√	
CO2	√	√	√		√				√		√	
CO3	√	√	√		√				√		√	
CO4	√	√	√		√				√		√	
CO5	√	√	√		√				√		√	



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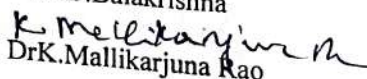
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B.Tech. (Mechanical Engineering)

EFFECTIVE FROM 2019-20 BATCH

III Year B.Tech. – I Sem.

DESIGN OF MACHINE MEMBERS– II

Course Objectives:

- This course gives the insight of slider and roller bearings and the life prediction.
- Learn to design I.C engine parts
- Design the mechanical systems for power transmission elements such as gears, belts, ropes, chains, and levers
- Design & analysis of mechanical devices such as crane hook, chain links, machine frames

UNIT – I

BEARINGS: Classification of bearings- applications, types of journal bearings – lubrication – bearing modulus – full and partial bearings – clearance ratio – heat dissipation of bearings, bearing materials – journal bearing design – ball and roller bearings – static loading of ball & roller bearings, bearing life, Tilting pad bearings.

UNIT – II

ENGINE PARTS: Connecting Rod: Thrust in connecting rod – stress due to whipping action on connecting rod ends – cranks and crank shafts, strength and proportions of over hung and center cranks – crank pins, crank shafts.

Pistons, forces acting on piston – construction, design and proportions of piston, cylinder, cylinder liners.

UNIT – III

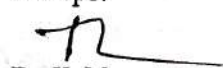
POWER TRANSMISSION SYSTEMS: PULLEYS: Transmission of power by belt and rope drives, transmission efficiencies, belts – flat and V types – rope drives - pulleys for belt and rope drives, materials, chain drives

Wire Ropes: Construction, Designation, Stresses in wire ropes, rope sheaves and drums

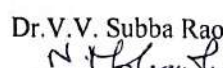
DESIGN OF POWER SCREWS: Design of screw, square, ACME, buttress screws. design of nut, compound screw, differential screw, ball screw- possible failures.

UNIT – IV

Design of curved beams: introduction, stresses in curved beams, expression for radius of neutral axis for rectangular, circular, trapezoidal and T-section, design of crane hook, C – clamps.

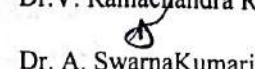

Dr. K. Meera Saheb

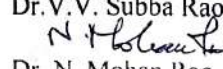

Dr. V. Ramachandra Raju

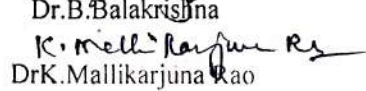

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UNIT – V

SPUR & HELICAL GEAR DRIVES: Spur gears- helical gears – 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.

Note: Requested to adopt digital teaching methodology at least for two weeks during the semester

TEXT BOOKS:

1. Machine Design/V.B.Bandari/TMH Publishers
2. Machine Design/ NC Pandya & CS Shaw/ Charotar publishers
3. Design data book/ V.B.Bandari/TMH Publishers

REFERENCES:

1. Machine Design: An integrated Approach / R.L. Norton / Pearson Education
2. Mech. Engg. Design / JE Shigley/Tata McGraw Hill education
3. Design of machine elements- spots/Pearson Publications
4. Machine Design-Norton/Pearson Publications

Course outcomes:

Upon successful completion of this course the student should be able to:

CO1: Understand to select the suitable bearing based on the application of the loads and predict the life of the bearing

CO2: apply the design procedures of engine parts such as connecting rod, crank and crank shaft, piston, cylinder and cylinder liners

CO3: Design of curved beams with various cross sections and crane hooks

CO4: Design power transmission elements such as belts, chains, ropes and power screws.

CO5: Design the spur and helical gear drives

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√		√				√		√	
CO2	√	√	√		√				√		√	
CO3	√	√	√		√				√		√	
CO4	√	√	√		√				√		√	
CO5	√	√	√		√				√		√	

Dr. K. MegraSaheb
Dr. A. Gopala Krishna

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B.Tech. (Mechanical Engineering)
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III Year B.Tech. – I Sem.

CAD/CAM

Course Objectives:

The general objectives of the course are to enable the students to

1. Understand the basic fundamentals of computer aided design and manufacturing.
2. To learn 2D & 3D transformations of the basic entities like line, circle, ellipse etc
3. To understand the different geometric modeling techniques like solid modeling, surface modeling, feature based modeling etc. and to visualize how the components look like before its manufacturing or fabrication
4. To learn the part programming, importance of group technology, computer aided process planning, computer aided quality control
5. To learn the overall configuration and elements of computer integrated manufacturing systems.

UNIT – I

Computers in industrial manufacturing, product cycle, CAD / CAM Hardware.

INTRODUCTION TO COMPUTER GRAPHICS: Raster scan graphics coordinate system, database structure for graphics modeling, transformation of geometry, 3D transformations, mathematics of projections, clipping, hidden surface removal.

UNIT – II

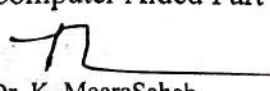
GEOMETRIC MODELING: Requirements, geometric models, geometric construction models, curve representation methods, surface representation methods, modeling facilities desired.

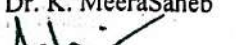
DRAFTING AND MODELING SYSTEMS: Basic geometric commands, layers, display control commands, editing, dimensioning, solid modeling.

Introduction to Data exchange formats.

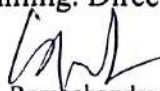
UNIT – III

PART PROGRAMMING FOR NC MACHINES: NC, NC modes, NC elements, CNC 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- APT language, simple problems in manual part programming and Computer Aided Part Programming. Direct Numerical Control, Adaptive Control.


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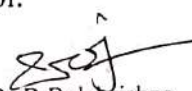

Dr. A. Swarna Kumari

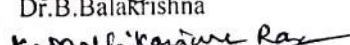
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Dr. N. Ramanaiah


Dr. B. Balakrishna


Dr. K. Mallikarjuna Rao

Dr. Ch. Rajesh

UNIT – IV

GROUP TECHNOLOGY: Part family, coding and classification, optiz and MICLASS classification system, benefits of group technology - production flow analysis, types and advantages.

Computer aided processes planning – importance, types – variant process planning and generative procee planning-Implementation considerations.

FMS-Introduction, types of FMS, Equipment, Tool management systems, Layouts, FMS Control.

UNIT – V

COMPUTER AIDED QUALITY CONTROL: Introduction - terminology used in quality control, use of computers in Quality control – inspection – objectives of CAQC - Inspection methods- contact and noncontact types –coordinate measuring machines - computer aided testing, integration of CAQC with CAD/CAM.

COMPUTER INTEGRATED MANUFACTURING SYSTEMS: Types of manufacturing systems, machine tools and related equipment, material handling systems, material requirement planning, roll of MRP –II in a CIM system, computer control systems, human labor in manufacturing systems, CIMS benefits.

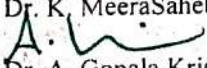
Note: Requested to adopt digital teaching methodology at least for two weeks during the semester.

TEXT BOOKS:

1. Automation, Production systems & Computer integrated Manufacturing/ M.P. Groover/Pearson Education
2. Mastering CAD / CAM / Ibrahim Zeid / McGraw-Hill

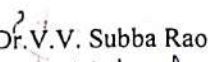
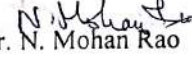
REFERENCES

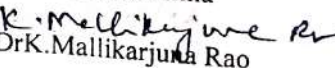
1. CAD / CAM Principles and Applications/PN Rao / McGraw-Hill
2. Principles of Computer Aided Design and Manufacturing / Farid Amirouche / Pearson
3. Computer Numerical Control Concepts and programming / Warren S Seames / Thomson learning, Inc
4. Product manufacturing and cost estimation using CAD/CAE/ Kuang Hua Chang/Elsevier Publishers


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Dr. N. Mohan Rao
Dr. N. Ramanaiah


Dr. B. Balakrishna

Dr. K. Mallikarjuna Rao
Dr. Ch. Rajesh

Course Outcome:

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

CO1: Understand the basic fundamentals of computers in industrial manufacturing and applications of computer graphics.

CO2: Describe the mathematical basis in the technique of representation of geometric entities including points, lines, and parametric curves, surfaces and solid, and the technique of transformation of geometric entities using transformation matrix.

CO3: Develop part programming for NC and CNC machines.

CO4: Describe the use of group technology and computer aided process planning for the product development.

CO5: Understand the concepts of computer aided quality control and Identify the various activities in the Computer Integrated Manufacturing Systems

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√		√				√		√	
CO2	√	√	√		√				√		√	
CO3	√	√	√		√				√		√	
CO4	√	√	√		√				√		√	
CO5	√	√	√		√				√		√	

Dr. K. MeeraSaheb

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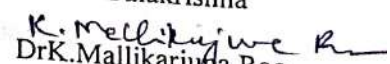
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B.Tech. (Mechanical Engineering)
EFFECTIVE FROM 2019-20 BATCH

III Year B.Tech. – I Sem.

APPLIED THERMODYNAMICS-II

UNIT-I

Power Cycles : Otto, Diesel, Dual Combustion cycles, Sterling Cycle, Atkinson Cycle, Ericsson 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.

Refrigeration Cycles : Brayton and Rankine cycles – Performance Evaluation – combined cycles, Bell- Coleman cycle, Vapour compression cycle-performance Evaluation.

UNIT-II

Actual Cycles and their Analysis: Introduction, Comparison of Air Standard and Actual Cycles, Time Loss Factor, Heat Loss Factor, Exhaust Blowdown-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, - Engine systems – Fuel, Carburettor, Fuel Injection System, Ignition, Cooling and Lubrication, principle of Wankle engine, principles of supercharging and turbo charging.

UNIT-III

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

Combustion in C.I. Engines : Four stages of combustion – Delay period and its importance – Effect of engine variables – 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.

UNIT-IV

Measurement, Testing and Performance: Parameters of performance - measurement of cylinder pressure, fuel consumption, air intake, exhaust gas composition, Brake power – Determination of frictional losses and indicated power – Performance test – Heat balance sheet and chart.



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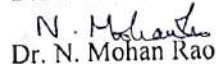


Dr. V. Ramachandra Raju



Dr. A. Swarna Kumari

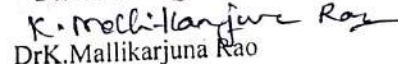
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Dr. Ch. Rajesh

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, types of combustion chambers.

UNIT-V

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.

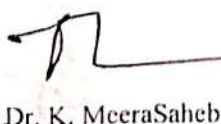
Rockets : Application – working principle – classification – propellant type – thrust, propulsive efficiency – specific impulse – solid and liquid propellant rocket engines.

Text Books:

1. I.C. Engines / V. Ganesan- TMH
2. Heat engines, Vasandani& Kumar publications
3. Gas Turbines /V.Ganesan /TMH

References:

1. Thermodynamics – PK Nag
2. Thermal Engineering / RK Rajput/ Lakshmi Publications
3. IC Engines – M.L.Mathur&R.P.Sharma – DhanpathRai& Sons.
4. Thermodynamics and Heat Engines/R.Yadav, Volume -II /Central Publishing House
5. I.C.Engines–AppliedThermosciences–C.R.Ferguson&A.T.Kirkpatrick-2ndEdition-Wiley Publ
6. I.C. Engines - J.B.Heywood /McGrawHill.
7. Thermal Engineering – R.S.Khurmi&J.S.Gupta- S.chandPubl
8. Thermal Engineering / PL Ballaney, Khanna Publishers
9. Gas Turbines and Propulsive Systems /P.Khajuria&S.P.Dubey /Dhanpatrai
10. Gas Turbines / Cohen, Rogers and SaravanaMuttoo / Addison Wesley – Longman



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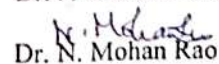


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Dr. A. Swarna Kumari

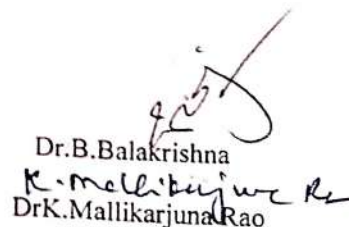
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Course Outcomes:

Upon successful completion of this course the student should be able to:

CO1:understand the concepts of thermodynamic cycles used in steam power plants, IC engines and Gas turbines

CO2:Understand the various losses occur in the actual engine operation and familiarize the concepts of various engine systems along with their function and necessity.

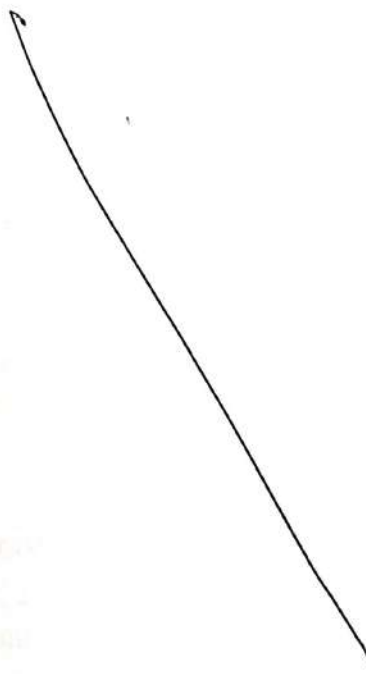
CO3:Acquire the principles of combustion phenomena and the effects of parameters associated in combustion for both SI and CI engines.

CO4:Evaluate the performance of SI and CI engines and gas turbine plants.

CO5:Study the principles of jet propulsion and rocket systems along with their performance.

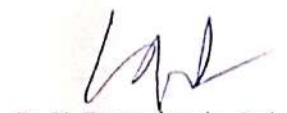
CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√		√				√		√	
CO2	√	√	√		√				√		√	
CO3	√	√	√		√				√		√	
CO4	√	√	√		√				√		√	
CO5	√	√	√		√				√		√	

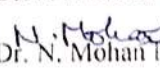


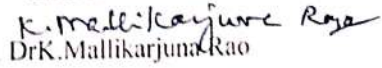

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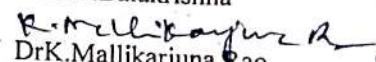
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III Year B.Tech. – I Sem.

UN CONVENTIONAL MACHINING PROCESSES
(PROGRAM ELECTIVE-1)

Course Objectives:

- The course aims in identifying the classification of unconventional machining processes.
- To understand the principle, mechanism of metal removal of various unconventional machining processes.
- To study the various process parameters and their effect on the component machined on various unconventional machining processes.
- To understand the applications of different processes.

UNIT – I

INTRODUCTION: Need for non-traditional machining methods-classification of modern machining processes – considerations in process selection, applications.

Abrasive jet machining(AJM), Water jet machining(WJM) and abrasive water jet machining(AWJM): Basic principles, equipments, process variables, mechanics of material removal, MRR, application and limitations. Magnetic abrasive finishing, abrasive flow finishing, Electrostream drilling, shaped tube electrolytic machining. Simple problems for estimation of metal removal rate and economic considerations of AJM, WJM and AWJM.

UNIT – II

ELECTRO – CHEMICAL MACHINING: Fundamentals of Chemical machining (CM), electro chemical machining, electrochemical grinding, electro chemical honing and deburring process, equipments, process variables, metal removal rate in CM, ECM, Tool design, Surface finish and accuracy, advantages and applications. – Simple problems for estimation of metal removal rate and economic aspects of CM and ECM

UNIT - III

THERMAL METAL REMOVAL PROCESSES: General principle and applications of Electric Discharge Machining, Electric Discharge Grinding and wire EDM – Power circuits for EDM, Mechanics of metal removal in EDM, Process parameters, selection of tool electrode and dielectric fluids, surface finish and machining accuracy, characteristics of spark eroded surface. – Simple problems for estimation of metal removal rate and economic aspects of EDM and wire EDM

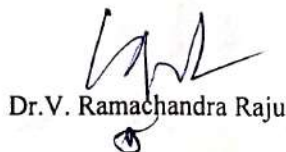


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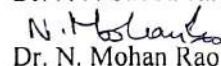


Dr.V. Ramachandra Raju

Dr. A. SwarnaKumari

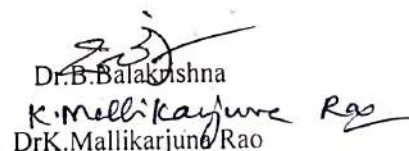
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UNIT – VI

Electron Beam Machining(EBM) and Laser Beam Machining (LBM)- Basic principles and theory, equipments, process variables, mechanics of material removal, process parameters, efficiency & accuracy, applications- – Simple problems for estimation of metal removal rate and economic aspects of EBM and LBM

UNIT-V

Plasma Machining (PM): Application of plasma for machining, metal removal mechanism, process parameters, accuracy and surface finish and other applications of plasma in manufacturing industries.

Ultrasonic machining(USM) – Basic principles, equipments, process variables, mechanics of material removal, MRR process parameters, economic considerations, applications and limitations.

– Simple problems for estimation of metal removal rate and economic aspects of CMPM and USM.

Note: Requested to adopt digital teaching methodology at least for two weeks during the semester.

TEXT BOOK:

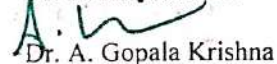
1. Fundamentals of Machining Processes-Conventional and non – conventional processes/Hassan Abdel –Gawad El-Hafy/CRC Press-2016.

REFERENCES:

1. Modern Machining Process / Pandey P.C. and Shah H.S./ TMH.
2. New Technology / Bhattacharya A/ the Institution of Engineers, India 1984.
3. Non Traditional Manufacturing Processes / Benedict /



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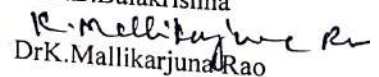


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Dr.Ch. Rajesh

Course outcomes:

CO1: Identify the selection of processes and analyze the process parameters to be adopted and applicability of various materials that are suitable for mechanical energy based machining processes.

CO2 Illustrate the chemical, electrical & mechanical machining process and its applications

CO3: Understand the Electro Discharge Machining process and its applications, and gains knowledge on mechanics of metal removal in EDM and its process parameters.

CO4: Identify the principle of Electron beam and laser beam machining, process parameters, their effect and applications

CO5: Identify the application of plasma machining, mechanism of metal removal, process parameters, their effect and applications

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√		√				√		√	
CO2	√	√	√		√				√		√	
CO3	√	√	√		√				√		√	
CO4	√	√	√		√				√		√	
CO5	√	√	√		√				√		√	

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III Year B.Tech. – I Sem.

REFRIGERATION & AIR CONDITIONING

(Refrigeration and Psychrometric tables and charts allowed)

(PROGRAM ELECTIVE-1)

Course objectives:

The course is to understand the basic cycles of various refrigerating systems, their performance evaluation along with details of system components and refrigerant properties. The course is also aimed at imparting knowledge of psychrometric properties, processes which are used in air-conditioning systems for comfort and industrial applications.

UNIT – I

INTRODUCTION TO REFRIGERATION: Necessity and applications – unit of refrigeration and C.O.P. – Mechanical refrigeration – types of ideal cycles of refrigeration.

Air refrigeration: Bell Coleman cycle - open and dense air systems – refrigeration systems used in air crafts and problems.

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.

UNIT II

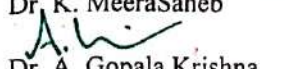
VCR Cycle analysis –actual cycle - influence of various parameters on system performance – use of p-h charts – numerical problems.

REFRIGERANTS – Desirable properties – classification - refrigerants used – nomenclature – ozone depletion – global warming

VCR SYSTEM COMPONENTS: Compressors – general classification – comparison – advantages and disadvantages, condensers – classification – working principles, evaporators – classification – working principles, expansion devices – types – working principles

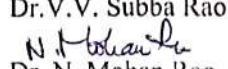
UNIT III

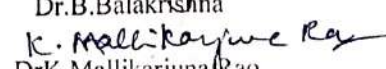
VAPOR ABSORPTION SYSTEM: Calculation of maximum COP – description and working of NH_3 – water absorption system and Li Br –water System (Two shell & Four shell), principle of operation, three fluid absorption system, salient features.


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STEAM JET REFRIGERATION SYSTEM: Working Principle and basic components.
Principle and operation of (i) thermoelectric refrigerator (ii) vortex tube.

UNIT – IV

INTRODUCTION TO AIR CONDITIONING: Psychometric 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 temperature.

UNIT – V

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 SYSTEMS: Classification of equipment, cooling, heating humidification and dehumidification, filters, grills and registers, fans and blowers. heat pump – heat sources – different heat pump circuits.

Note: Requested to adopt digital teaching methodology at least for two weeks during the semester.

TEXT BOOKS:

1. A Course in Refrigeration and Air conditioning / SC Arora & Domkundwar / Dhanpatrai
2. Refrigeration and Air Conditioning / CP Arora / TMH.

REFERENCES:

1. Refrigeration Tables and Psychrometric charts - Refrigeration and Air Conditioning / Manohar Prasad / New Age.
2. Principles of Refrigeration / Dossat / Pearson Education.
3. Basic Refrigeration and Air-Conditioning / Ananthanarayanan / TMH

Course outcomes:

Upon successful completion of this course the student should be able to:

CO1: Illustrate the operating cycles and different systems of refrigeration and Analyze cooling capacity and performance.

CO3: Demonstrate the properties, applications and environmental issues of different refrigerants

CO4: Analyze cooling capacity and performance of steam jet and vapour absorption refrigeration systems

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CO5: Calculate cooling load for air conditioning systems used for various applications and describe different components of refrigeration and air conditioning systems and processes.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√		√				√		√	
CO2	√	√	√		√				√		√	
CO3	√	√	√		√				√		√	
CO4	√	√	√		√				√		√	
CO5	√	√	√		√				√		√	

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III Year B.Tech. – I Sem.

INDUSTRIAL ROBOTICS
(PROGRAM ELECTIVE-1)

Course Objectives:

1. To give students practice in applying their knowledge of mathematics, science, and Engineering and to expand this knowledge into the vast area of robotics.
2. The students will be exposed to the concepts of robot kinematics, Dynamics, Trajectory planning.
3. Mathematical approach to explain how the robotic arm motion can be described.
4. The students will understand the functioning of sensors and actuators.

UNIT-I

INTRODUCTION: Automation and Robotics, CAD/CAM and Robotics – An overview of Robotics – present and future applications – classification by coordinate system and control system.

COMPONENTS OF THE INDUSTRIAL ROBOTICS: Robot anatomy, work volume, components, number of degrees of freedom – robot drive systems, function line diagram representation of robot arms, common types of arms – requirements and challenges of end effectors, determination of the end effectors, comparison of Electric, Hydraulic and Pneumatic types of actuation devices.

UNIT – II

MOTION ANALYSIS: Homogeneous transformations as applicable to rotation and translation – problems.

MANIPULATOR KINEMATICS: Specification of matrices, D-H notation joint coordinates and world coordinates Forward and inverse kinematics – problems.

UNIT – III

Differential transformation and manipulators, Jacobians – problems, robot dynamic arm dynamics: Lagrange – Euler and Newton – Euler formulations – Problems – generalized D – Alembert's Equation of motion.

UNIT IV

General considerations in path description and generation – Trajectory planning and avoidance of obstacles, path planning, Skew motion, joint integrated motion – straight line motion – Robot programming, languages and software packages – description of paths with a robot programming language..

UNIT V

ROBOT ACTUATORS AND FEEDBACK COMPONENTS:

Actuators: Pneumatic, Hydraulic actuators, electric & stepper motors.

Feedback components: position sensors – potentiometers, resolvers, encoders – Velocity sensors.

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ROBOT APPLICATIONS IN MANUFACTURING: Material Transfer- Material handling, loading and unloading- Processing -spot and continuous arc welding & spray painting- Assembly and Inspection.

Note: Requested to adopt digital teaching methodology at least for two weeks during the semester.

TEXTBOOKS:

1. Industrial Robotics / Groover MP / Pearson Edu.
2. Robotics and Control / Mittal R K & Nagrath I J / TMH.

REFERENCES:

1. Robotics / Fu KS / McGraw Hill.
2. Robotic Engineering / Richard D. Klafter, Prentice Hall
3. Robot Analysis and Control / H. Asada and J.J.E. Slotine / BSP Books Pvt. Ltd.
4. Introduction to Robotics / John J Craig / Pearson Edu.

Course outcomes:

Upon successful completion of this course the student should be able to:

CO1: Understand different types of robots, classification of coordinate system and control systems and challenges of end effectors of robot.

CO2: Comprehend numerous Sensors and Actuators appropriate to robots and the applications of robots in different industrial and other areas.

CO3: Conclude kinematic analysis with D-H notation, forward and inverse kinematics

CO4: Solve dynamic analysis with Lagrange – Euler and Newton – Euler formulations

CO5: Model trajectory planning for a manipulator by avoiding obstacles

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√		√				√		√	
CO2	√	√	√		√				√		√	
CO3	√	√	√		√				√		√	
CO4	√	√	√		√				√		√	
CO5	√	√	√		√				√		√	



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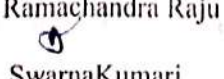
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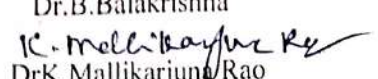
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III Year B.Tech. – I Sem.

APPLIED THERMODYNAMICS LAB

Course objective: To provide hands on experience in operating various types of internal combustion engines and understand their functioning and performance.

1. To determine the actual Valve Timing diagram of a four stroke Compression/Spark Ignition Engine.
2. To determine the actual Port Timing diagram of a two stroke Compression/Spark Ignition Engine.
3. Determination of Flash & Fire points of Liquid fuels / Lubricants using (i) Abels Apparatus; (ii) Pensky Martin's apparatus and (iii) Cleveland's apparatus.
4. Determination of Viscosity of Liquid lubricants/Fuels using (i) Saybolt Viscometer and (ii) Redwood Viscometer.
5. Determination of Calorific value of Gaseous Fuels using Junkers Gas Calorimeter.
6. Evaluation of engine friction by conducting Morse test on 4-stroke multi cylinder petrol/diesel engine.
7. Evaluation of Engine Friction by Motoring/Retardation Test on a Single Cylinder 4 Stroke Petrol/Diesel Engine.
8. To perform the Heat Balance Test on Single Cylinder four Stroke Petrol/Diesel Engine.
9. Determination of Air/Fuel Ratio and Volumetric Efficiency on a four Stroke Petrol/Diesel Engine.
10. To conduct a load test on a single cylinder Petrol/Diesel engine to study its performance under various loads.
11. To determine the optimum cooling temperature of a Petrol/Diesel engine.
12. To conduct economical speed test on a four stroke Petrol/Diesel engine.
13. To conduct a performance test on a VCR engine, under different compression ratios and determine its heat balance sheet.
14. To conduct a performance test on an air compressor and determine its different efficiencies.
15. Dis-assembly / assembly of different parts of two wheelers. 3 wheelers & 4 wheelers. Tractor & Heavy duty engines covering 2-stroke and 4 stroke, SI and CI engines.
16. Study of Boilers with mountings and accessories.

Course Outcomes:

Upon successful completion of this course the student should be able to:

CO1: Determine different properties of liquid fuels/lubricants by testing.

CO2: Understand the working of different engines and their parts.

CO3:Conduction of appropriate tests on IC Engines/Compressor for the determination of various performance parameters.



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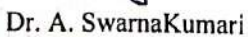


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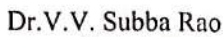


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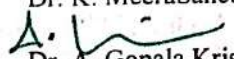
CO4: Preparation of Heat balance sheet of an IC engine and evaluate the effect of cooling water, air/fuel ratio, engine speed and Volumetric efficiency on the performance of the engine.

CO5: Analyzing the opening/closing of Valves/Ports of an IC engine and understand the timing diagram of the respective engine.

CO-PO Mapping

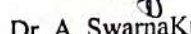
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√	√			√		√	√
CO2	√	√	√	√	√	√			√		√	√
CO3	√	√	√	√	√	√			√		√	√
CO4	√	√	√	√	√	√			√		√	√
CO5	√	√	√	√	√	√			√		√	√


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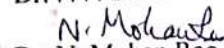
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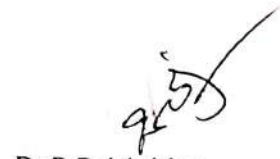

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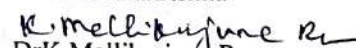
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III Year B.Tech. – I Sem.

THEORY OF MACHINES LAB

1. To determine whirling speed of shaft theoretically and experimentally.
2. To determine the position of sleeve against controlling force and speed of a Hartnell governor and to plot the characteristic curve of radius of rotation.
3. To analyse the motion of a motorized gyroscope when the couple is applied along its spin axis
4. To determine the frequency of undamped free vibration of an equivalent spring mass system.
5. To determine the frequency of damped force vibration of a spring mass system
6. To study the static and dynamic balancing using rigid blocks.
7. To find the moment of inertia of a flywheel
8. To plot follower displacement Vs cam rotation for various Cam Follower systems.
9. To plot slider displacement, velocity and acceleration against crank rotation for single slider crank mechanism/Four bar mechanism
10. To find coefficient of friction between belt and pulley.
11. To study simple and compound screw jack and determine the mechanical advantage, velocity ratio and efficiency
12. To study various types of gears- Spur, Helical, Worm and Bevel Gears

Course outcomes:

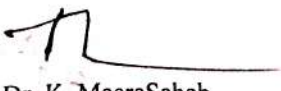
Upon successful completion of this course the student should be able to:

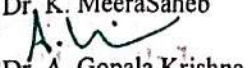
CO1: Evaluate performance of a Hartnell governor

CO2: Determine the frequencies of vibration in case of free and forced vibrations of a spring-mass system and whirling speed of a shaft

CO3: Determine motion characteristics of a slider crank mechanism and cam-follower mechanism

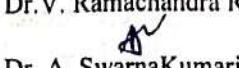
CO4: Demonstrate various mechanical power transmission devices / components like screw jack, gears etc


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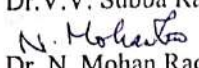
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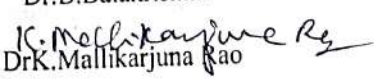
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CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√	√			√		√	√
CO2	√	√	√	√	√	√			√		√	√
CO3	√	√	√	√	√	√			√		√	√
CO4	√	√	√	√	√	√			√		√	√



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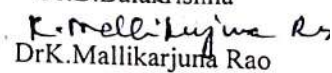
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III Year B.Tech. – I Sem.

CAD LAB

Course Objectives:

1. To impart basic knowledge on Computer Aided Design methods and procedures
2. To introduce the fundamentals of solid modeling.
3. To develop skill of creating 2D and 3D models using CATIA software.

1. **DRAFTING:** Development of part drawings for various components in the form of orthographic and isometric. Representation of dimensioning and tolerances, Study of DXE, IGES files.
2. **SURFACE MODELING** - Generation of various Surfaces using surface modeling.
3. **PART MODELING:** Generation of various 3D models through Pad, revolve, shell, sweep, parent child relation, Boolean operations and various standard translators.
4. **PART/ASSEMBLY DRAWINGS**-Generation of various Parts/assemblies: (Any three from the following) like Screw Jack, Oldham's Coupling, Foot step bearing, Couplings, knuckle and cotter joints, Crankshaft, Connecting Rod, Piston and Cylinder. etc.,

Course outcomes:

CO1: Ability to use the software packages for drafting and modeling

CO2: Ability to create 2D and 3D models of Engineering Components

CO3: Students able to create different types of curves used in creating geometry

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√	√			√		√	√
CO2	√	√	√	√	√	√			√		√	√
CO3	√	√	√	√	√	√			√		√	√
CO4	√	√	√	√	√	√			√		√	√
CO5	√	√	√	√	√	√			√		√	√

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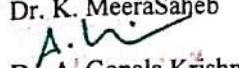
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SOCIALLY RELEVANT PROJECT

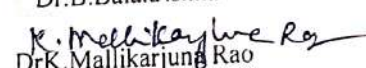

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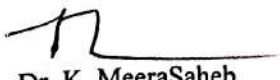
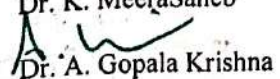
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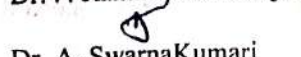
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EMPLOYABILITY SKILLS-I


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OPERATIONS RESEARCH

Course Objectives:

To learn the importance of Operations Research in the design, planning, scheduling, manufacturing and business applications and to use the various techniques of Operations Research in solving such problems.

UNIT – I

Development – definition– characteristics and phases – types of operation research models – applications.

ALLOCATION: Linear programming problem formulation – graphical solution – simplex method – artificial variables techniques -two–phase method, big-M method, dual simplex method – duality principle.

UNIT – II

TRANSPORTATION PROBLEM: Formulation – basic feasible solution methods - North West Corner method, Least Cost method, Vogels approximation (VAM) method - optimal solution – UV method - unbalanced transportation problem – degeneracy, assignment problem – formulation – Hungarian method - optimal solution - variants of assignment problem- traveling salesman problem.

SEQUENCING – Introduction – flow –shop sequencing – n jobs through two machines – n jobs through three machines – job shop sequencing – two jobs through ‘m’ machines.

UNIT – III

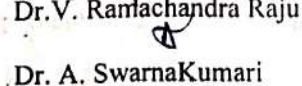
REPLACEMENT: Introduction – replacement of items that deteriorate with time – when money value is not counted and counted – replacement of items that fail completely, group replacement.

THEORY OF GAMES: Introduction – pure and mixed strategy - mini. max (max. mini) principle – criterion and optimal strategy – solution of games with saddle points – rectangular games without saddle points – 2×2 games – dominance principle – $m \times 2$ & $2 \times n$ games - graphical method.

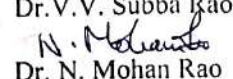

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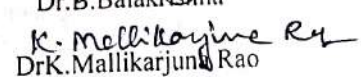
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UNIT – IV

WAITING LINES: Introduction – single channel – poisson arrivals – exponential service times – with infinite population and finite population models– multichannel – poisson arrivals – exponential service times with infinite population single channel poisson arrivals.

INVENTORY : Introduction – single item – deterministic models – purchase inventory models with one price break and multiple price breaks – shortages are not allowed – stochastic models – demand may be discrete variable or continuous variable – instantaneous production. Instantaneous demand and continuous demand and no set up cost. ABC & VED Analysis.

UNIT – V

DYNAMIC PROGRAMMING: Introduction – Bellman's principle of optimality – applications of dynamic programming- capital budgeting problem – shortest path problem – linear programming problem.

SIMULATION: Definition – types of simulation models – phases of simulation– applications of simulation – inventory and queuing problems – advantages and disadvantages – simulation languages.

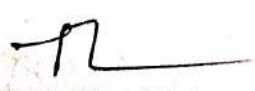
Note: Requested to adopt digital teaching methodology at least for two weeks during the semester.

TEXT BOOKS:

1. Operations Research-An Introduction/Hamdy A Taha/Pearson publishers
2. Operations Research –Theory & publications / S.D.Sharma-Kedarnath/McMillan publishers India Ltd

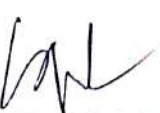
REFERENCES:

1. Introduction to O.R/Hiller & Libermann/TMH
2. Operations Research /A.M.Natarajan,P.Balasubramani,A. Tamilarasi/Pearson Education.
3. Operations Research: Methods & Problems / Maurice Saseini, Arhur Yaspan & Lawrence Friedman/Wiley
4. Operations Research / R.Pannerselvam/ PHI Publications.
5. Operations Research / Wagner/ PHI Publications.
6. Operation Research /J.K.Sharma/MacMilan Publ.
7. Operations Research/ Pai/ Oxford Publications
8. Operations Research/S Kalavathy / Vikas Publishers
9. Operations Research / DS Cheema/University Science Press
10. Operations Research / Ravindran, Philips, Solberg / Wiley publishers


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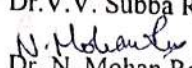
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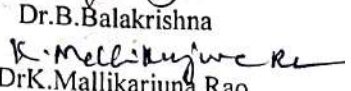

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Course Outcomes:

CO1: Identify the OR models and solve Linear Programming problems using Graphical and Appropriate methods

CO2: Solve Transportation, Assignment and Sequencing problems

CO3: Develop various replacement theories and solve game theory problems under competitive environment.

CO4: Formulate Queuing models for service and manufacturing systems and analyze the inventory models for continuous and discrete models

CO5: Summarize the concepts of dynamic programming and Simulate different real life probabilistic situations using Monte Carlo simulation technique

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√		√				√		√	
CO2	√	√	√		√				√		√	
CO3	√	√	√		√				√		√	
CO4	√	√	√		√				√		√	
CO5	√	√	√		√				√		√	

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EFFECTIVE FROM 2019-20 BATCH

III Year B.Tech. –II Sem.

HEAT TRANSFER

(Heat transfer data book allowed)

Course Objectives:

This course is intended to impart knowledge of principles of heat transfer and analyze the heat exchange process in various modes for the evaluation of rate of heat transfer and the temperature distribution in different configurations.

UNIT – I

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. 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- Variable thermal conductivity – systems with heat sources or heat generation.

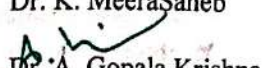
Extended surface (fins) heat Transfer – long fin, fin with insulated tip and short fin. application to error measurement of temperature.

UNIT – II

ONE DIMENSIONAL TRANSIENT CONDUCTION HEAT TRANSFER: Systems with negligible internal resistance – significance of Biot and Fourier numbers - chart solutions of transient conduction systems.

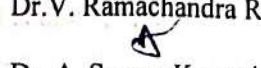
CONVECTIVE HEAT TRANSFER: Classification of convective heat transfer – dimensional analysis as a tool for experimental investigation – Buckingham Pi Theorem for forced and free convection, application for developing semi – empirical non- dimensional correlation for convective heat transfer – Significance of non-dimensional numbers – concepts of continuity, momentum and Energy Equations.


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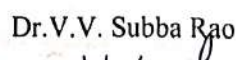

Dr. A. Gopala Krishna

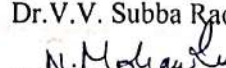
Dr. A. V. Sitarama Raju


Dr. V. Ramachandra Raju


Dr. A. Swarna Kumari

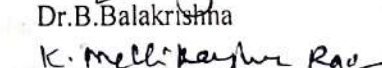
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UNIT -III

FORCED CONVECTION

EXTERNAL FLOWS: Concepts about hydrodynamic and thermal boundary layer and use of empirical correlations for convective heat transfer -flat plates and cylinders.

INTERNAL FLOWS: Concepts about hydrodynamic and thermal entry lengths – division of internal flow based on this –use of empirical relations for horizontal pipe flow and annulus flow.

FREE CONVECTION: Development of hydrodynamic and thermal boundary layer along a vertical plate – use of empirical relations for vertical plates and pipes.

UNIT IV

HEAT TRANSFER WITH PHASE CHANGE

BOILING: Pool boiling – regimes- calculations on nucleate boiling, critical heat flux and film boiling.

CONDENSATION: Film wise and drop wise condensation –Nusselt's theory of condensation on a vertical plate - film condensation on vertical and horizontal cylinders using empirical correlations.

HEAT EXCHANGERS:

Classification of heat exchangers – overall heat transfer coefficient and fouling factor – concepts of LMTD and NTU methods – Problems.

UNIT V

RADIATION HEAT TRANSFER:

Emission characteristics and laws of black-body radiation – Irradiation – total and monochromatic quantities – laws of Planck, Wien, Kirchoff, Lambert, Stefan and Boltzmann– heat exchange between two black bodies – concepts of shape factor – Emissivity – heat exchange between grey bodies – radiation shields – electrical analogy for radiation networks.

Note: Requested to adopt digital teaching methodology at least for two weeks during the semester.

TEXT BOOKS:

1. Heat Transfer /P.K.Nag/ TMH
2. Heat and Mass Transfer /Cengel& Boles/McGraw Hill



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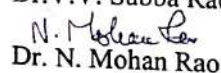


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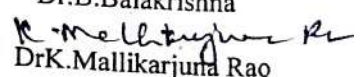
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REFERENCE BOOKS:

1. Heat and Mass Transfer /Arora and Domkundwar/Dhanpatrai& sons
2. A Text book on Heat Transfer-S.P Sukhatme,4th Edition/ /Universities Press
3. Fundamentals of Engg. Heat and Mass Transfer / R.C.Sachdeva / New Age International
4. Heat and Mass Transfer /D.S.Kumar / S.K.Kataria& Sons
5. Principles of Heat Transfer /Frank Kreith, RM Manglik& MS Bohn/Cengage learning publishers
6. Heat Transfer /JP HOLMAN/TMH
7. Heat and Mass Transfer Data Hand Book – C.P. Kondandaraman

Course outcomes:

Upon successful completion of this course the student should be able to:

CO1: Understand the basic principles of heat transfer involving steady state heat conduction and analyze heat transfer through fins

CO2: Solve the transient heat conduction problems and dimensional analysis for forced and free convection problems.

CO3: Compute the heat transfer coefficients for natural and forced convection applications.

CO4: Explain the boiling and condensation processes and solve problems involving heat exchangers using LMTD and NTU methods

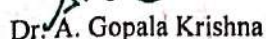
CO5: Understand the concept of monochromatic and total radiations, intensity of radiation, shape factor and estimation of radiation heat exchange between two or more surfaces of different geometries

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√		√				√		√	
CO2	√	√	√		√				√		√	
CO3	√	√	√		√				√		√	
CO4	√	√	√		√				√		√	
CO5	√	√	√		√				√		√	



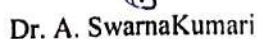
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Dr. A. V. Sitarama Raju

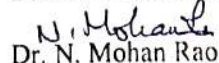


Dr. V. Ramachandra Raju

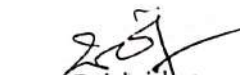


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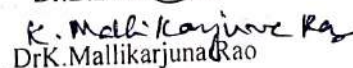
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FINITE ELEMENTMETHODS

Course Objectives:

1. To learn basic principles of finite element analysis procedure
2. To learn the theory and characteristics of finite elements that represent engineering structures
3. To learn and apply finite element solutions to structural, thermal, dynamic problems to develop the knowledge and skills needed to effectively evaluate finite element analysis performed by others
4. Learn to formulate complex geometry problems and solution techniques.

UNIT-I

Introduction to finite element method, stress and equilibrium, strain –displacement relations, stress-strain relations, plane stress and plane strain conditions, variational and weighted residual methods, concept of potential energy, one dimensional problems.

UNIT – II

Bar element formulation, Discretization of domain, element shapes, discretization procedures, assembly of stiffness matrix, band width, node numbering, mesh generation, interpolation functions, local and global coordinates, convergence requirements, treatment of boundary conditions.

UNIT – III

Analysis of Trusses: Finite element modeling, coordinates and shape functions, assembly of global stiffness matrix and load vector, finite element equations, treatment of boundary conditions, stress, strain and support reaction calculations. Analysis of Beams: Element stiffness matrix for Hermite beam element, derivation of load vector for concentrated and UDL, simple problems on beams.

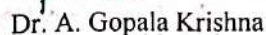
UNIT – IV

Finite element modeling of two dimensional stress analysis with constant strain triangles and treatment of boundary conditions, formulation of axisymmetric problems.

Higher order and isoparametric elements: One dimensional, quadratic and cubic elements in natural coordinates, two dimensional four noded isoparametric elements and numerical integration.



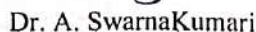
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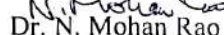


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UNIT – V

Steady state heat transfer analysis: one dimensional analysis of a fin and two dimensional analysis of thin plate, analysis of a uniform shaft subjected to torsion. Dynamic Analysis: Formulation of finite element model, element consistent and lumped mass matrices, evaluation of eigen values and eigen vectors, free vibration analysis.

NOTE: Requested to adopt digital teaching methodology at least for two weeks during the semester

TEXTBOOKS:

1. The Finite Element Methods in Engineering / S.S. Rao / Pergamon.
2. Introduction to Finite Elements in Engineering, Second Edition / Tirupati Reddy Chandrupatla. / Prentice-Hall.

REFERENCES:

1. Finite Element Method with applications in Engineering / YM Desai, Eldho & Shah / Pearson publishers
2. An introduction to Finite Element Method / JN Reddy / McGraw Hill
3. The Finite Element Method for Engineers – Kenneth H. Huebner, Donald L. Dewhirst, Douglas E. Smith and Ted G. Byrom / John Wiley & sons (ASIA) Pte Ltd.
4. Finite Element Analysis: Theory and Application with Ansys, Saeed Moaveni, Pearson Education
5. Finite Element Methods / Chen
6. Finite Element Analysis: for students & Practicing Engineers / G. Lakshmi Narasaiah / BSP Books Pvt. Ltd.
7. Applied Finite Element Analysis / Larry. J. Segerlind / John Wiley & Sons

Course outcomes:

Upon successful completion of this course the student should be able to:

CO1: Understand the concepts behind variational methods and weighted residual methods in FEM

CO2: Develop element characteristic equation procedure and generation of global stiffness equation will be applied

CO3: Identify the application and characteristics of FEA elements such as bars, beams, trusses and isoparametric elements.

CO4: Apply suitable boundary conditions for 2D stress analysis, formulation of axis-symmetric problems and higher order isoparametric elements.

CO5: Evaluate the concepts of steady state heat transfer analysis and dynamic analysis

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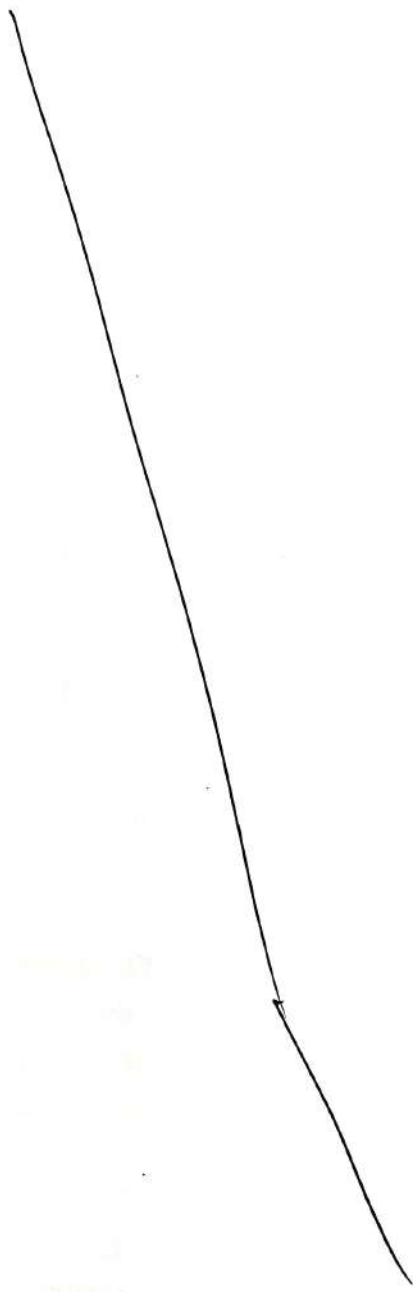
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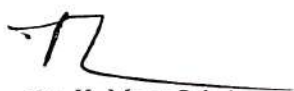
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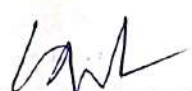
CO-PO Mapping:

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CO1	√	√	√		√				√		√	
CO2	√	√	√		√				√		√	
CO3	√	√	√		√				√		√	
CO4	√	√	√		√				√		√	
CO5	√	√	√		√				√		√	

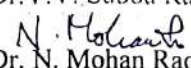


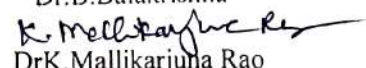

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ADDITIVE MANUFACTURING

(PROGRAM ELECTIVE-2)

Course Objectives:

The course aims at the importance of Additive Manufacturing, classifications, models, specifications of various Additive Manufacturing Techniques. To learn the different tools, soft-wares required and the applications of Additive Manufacturing.

UNIT – I

INTRODUCTION: Prototyping fundamentals, historical development, fundamentals of rapid prototyping, advantages and limitations of rapid prototyping, commonly used terms, classification of RP process.

LIQUID-BASED RAPID PROTOTYPING SYSTEMS: Stereo lithography Apparatus (SLA): models and specifications, process, working principle, photopolymers, photo polymerization, layering technology, laser and laser scanning, applications, advantages and disadvantages, case studies. Solid Ground Curing (SGC): models and specifications, process, working principle, applications, advantages and disadvantages, case studies.

UNIT-II

SOLID-BASED RAPID PROTOTYPING SYSTEMS: Laminated object manufacturing (LOM) - models and specifications, process, working principle, applications, advantages and disadvantages, case studies. Fused deposition modeling (FDM) - models and specifications, process, working principle, applications, advantages and disadvantages, case studies.

UNIT – III

POWDER BASED RAPID PROTOTYPING SYSTEMS: Selective laser sintering (SLS): models and specifications, process, working principle, applications, advantages and disadvantages, case studies. three dimensional printing (3DP): models and specifications, process, working principle, applications, advantages and disadvantages, case studies.

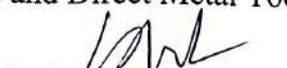
UNIT-IV

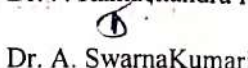
RAPID TOOLING: Introduction to rapid tooling (RT), conventional tooling Vs RT, Need for RT. rapid tooling classification: indirect rapid tooling methods: spray metal deposition, RTV epoxy tools, Ceramic tools, investment casting, spin casting, die casting, sand casting, 3D Keltool process. Direct rapid tooling: direct AIM, LOM Tools, DTM Rapid Tool Process, EOS Direct Tool Process and Direct Metal Tooling using 3DP.


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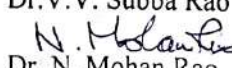
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Dr.V. Ramachandra Raju


Dr. A. Swarna Kumari

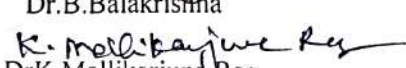
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UNIT – V

RAPID PROTOTYPING DATA FORMATS: STL Format, STL File Problems, consequence of building valid and invalid tessellated models, STL file Repairs: Generic Solution, other Translators, Newly Proposed Formats.

RAPID PROTOTYPING SOFTWARE'S: Features of various RP software's like Magics, Mimics, Solid View, View Expert, 3 D View, Velocity 2, Rhino, STL View 3 Data Expert and 3 D doctor.

RP APPLICATIONS: Application in engineering, analysis and planning, aerospace industry, automotive industry, jewelry industry, coin industry, GIS application, arts and architecture. RP medical and bioengineering applications: planning and simulation of complex surgery, customized implants & prosthesis, design and production of medical devices, forensic science and anthropology, visualization of bimolecular.

Note: Requested to adopt digital teaching methodology at least for two weeks during the semester.

TEXT BOOK:

1. Rapid prototyping: Principles and Applications /Chua C.K., Leong K.F. and LIM C.S/World Scientific publications

REFERENCE BOOKS:

1. Rapid Manufacturing / D.T. Pham and S.S. Dimov/Springer
2. Wohlers Report 2000 /Terry T Wohlers/Wohlers Associates
3. Rapid Prototyping & Manufacturing / Paul F.Jacobs/ASME Press
4. Rapid Prototyping / Chua & Liou

Course Outcomes:

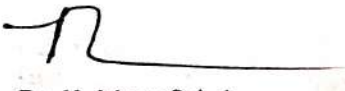
CO1: Demonstrate the knowledge of AM Techniques in the manufacturing of complex components and principles of liquid based RP techniques.

CO2: understand the principles of LOM and fusion deposition modeling processes.

CO3: understand the principles powder based RP techniques.

CO4: Use appropriate rapid tooling techniques for manufacturing components.

CO5: Identify the Rapid Prototyping Data Formats, softwares and Applications of AM in different fields


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Dr. A. Gopala Krishna

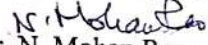
Dr.A.V.Sitarama Raju


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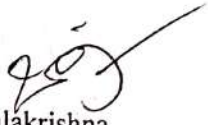

Dr. A. Swarna Kumari

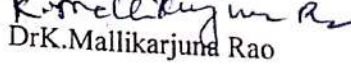
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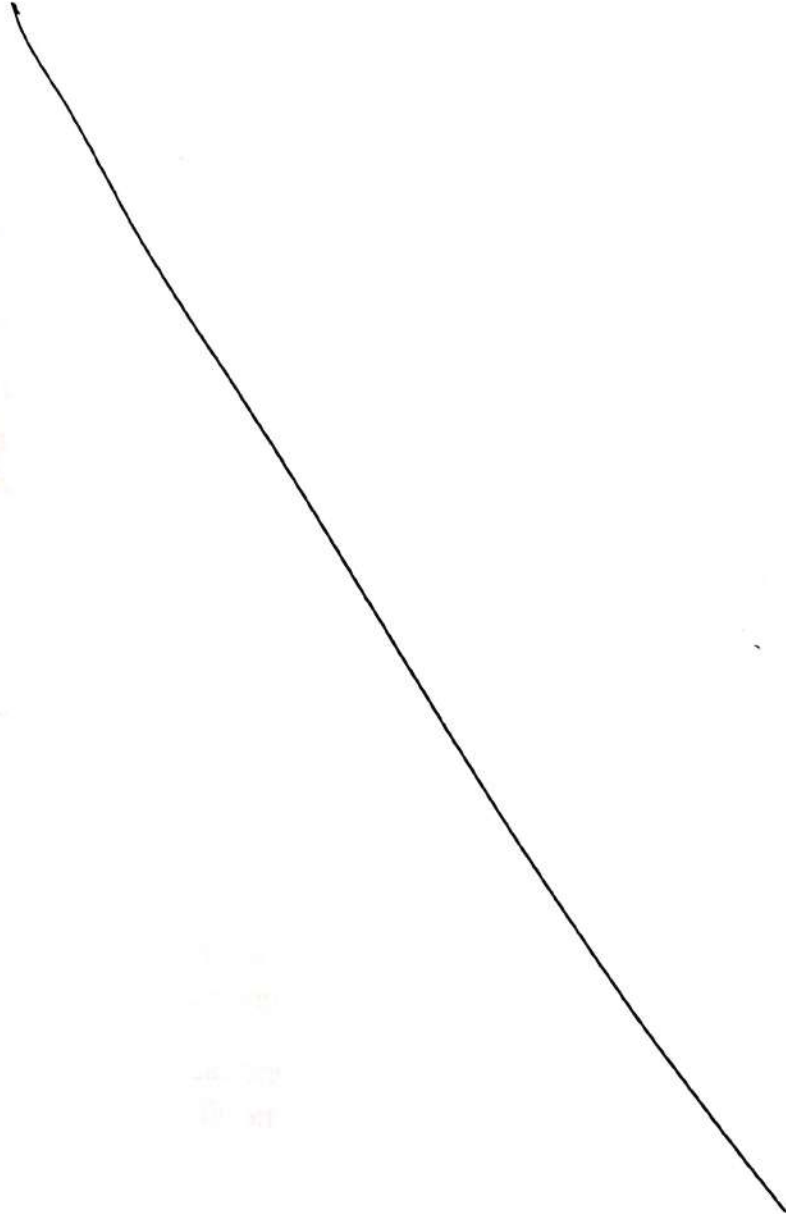

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Dr.K.Mallikarjuna Rao

Dr.Ch. Rajesh

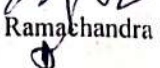
CO-PO Mapping

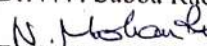
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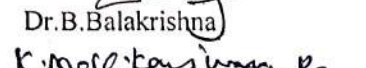



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III Year B.Tech. –II Sem.

AUTOMOBILE ENGINEERING

(PROGRAM ELECTIVE-2)

Course Objectives:

The course imparts the principles of automobile systems and provides the salient features of safety, emission and service of automobiles.

UNIT – I

INTRODUCTION: Components of four wheeler automobile – chassis and body – power unit – power transmission – rear wheel drive, front wheel drive, 4 wheel drive – types of automobile engines, engine construction, oil filters, oil pumps – crank case ventilation – engine service, reboring, decarbonisation, Nitriding of crank shaft.

STEERING SYSTEM: Steering geometry – camber, castor, king pin rake, combined angle train, center point steering. types of steering mechanism – Ackerman steering mechanism, Davis steering mechanism, steering gears – types, steering linkages.

UNIT-II

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.

UNIT – III

SUSPENSION SYSTEM: Objects of suspension systems – rigid axle suspension system, torsion bar, shock absorber, Independent suspension system.

BRAKING SYSTEM: Mechanical brake system, hydraulic brake system, master cylinder, wheel cylinder tandem master cylinder requirement of brake fluid, pneumatic and vacuum brakes.

UNIT – IV

ELECTRICAL SYSTEM: Charging circuit, generator, current – voltage regulator – starting system, bendix drive mechanism, solenoid switch, lighting systems, horn, wiper, fuel gauge – oil pressure gauge, engine temperature indicator etc.


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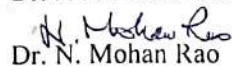
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ENGINE SPECIFICATION AND SAFETY SYSTEMS: Introduction- engine specifications with regard to power, speed, torque, no. of cylinders and arrangement, lubrication and cooling etc. Safety: Introduction, safety systems - seat belt, air bags, bumper, anti-lock brake system (ABS), wind shield, suspension sensors, traction control, mirrors, central locking and electric windows, speed control.

UNIT-V

ENGINE EMISSION CONTROL: Introduction – types of pollutants, mechanism of formation, concentration measurement, methods of controlling-engine modification, exhaust gas treatment-thermal and catalytic converters-use of alternative fuels for emission control – National and International pollution standards

ENGINE SERVICE: Introduction, service details of engine cylinder head, valves and valve mechanism, piston-connecting rod assembly, cylinder block, crank shaft and main bearings, engine reassembly-precautions.

Note: Requested to adopt digital teaching methodology at least for two weeks during the semester.

TEXT BOOKS:

1. Automotive Mechanics – Vol. 1 & Vol. 2 / Kirpal Singh/standard publishers
2. Automobile Engineering / William Crouse/TMH Distributors
3. Automobile Engineering/P.S Gill/S.K. Kataria& Sons/New Delhi.

REFERENCES:

1. Automotive Engines Theory and Servicing/James D. Halderman and Chase D. Mitchell Jr./ Pearson education inc.
2. Automotive Engineering / K Newton, W.Steeds& TK Garrett/SAE
3. Automotive Mechanics : Principles and Practices/ Joseph Heitner/Van Nostrand Reinhold
4. Automobile Engineering / C Srinivasan/McGrawHill

Course Outcomes:

Upon successful completion of this course the student should be able to:

CO1:Acquire the basic knowledge of anatomy of an automobile and realize the functions of various steering systems.

CO2:Understand the systems of automobile transmission systems

CO3:Understand various braking and suspension systems used in automobiles

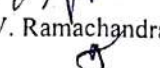
CO5:Acquire the knowledge of engine specifications and safety systems and its components


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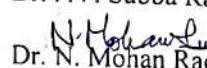
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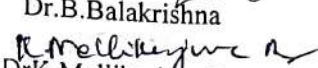
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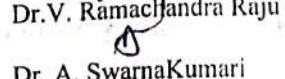
CO6: Explain the systems of engine servicing and emission control systems

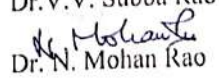
CO-PO Mapping

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CO1	√	√	√		√				√		√	
CO2	√	√	√		√				√		√	
CO3	√	√	√		√				√		√	
CO4	√	√	√		√				√		√	
CO5	√	√	√		√				√		√	


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III Year B.Tech. –II Sem.

CONTROL SYSTEMS

(PROGRAM ELECTIVE-2)

Unit-I Introduction:

Concept of automatic controls, Open loop and closed loop systems, Concepts of feedback, requirements of an ideal control system, Types of controllers-Proportional, Integral, Differential, Proportional & Integral, Proportional Differential and Proportional Integral Differential controllers.

Unit-II

Modeling of Physical Systems :

Mathematical Models of Mechanical, Electrical, Thermal, Hydraulic and Pneumatic Systems.

Analogous Systems:

Direct and inverse analogs for mechanical, thermal and fluid systems.

Block diagram Algebra:

General representation of a feedback control system, transfer functions, rules of block diagram algebra, reduction of block dia. to obtain closed loop transfer function.

Signal flow graphs : Mason's gain formula.

Unit-III

Steady state operation:

Steady state analysis for general block dia. for a control system, steady state characteristics, equilibrium in a system.

Transient Response:

Transient response and steady state analysis of unit, step input, general operational representation for a differential equation of control system, distinct, repeated and complex conjugate zeros, general form of transient response, Routh's stability criterion for a control system.

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Root Locus Plots:

Root locus method: Significance of Root locus, angle and magnitude conditions, breakaway points, angles of departure and arrival, construction of Root locus using general rules and steps, Lead and Lag compensation.

Unit-IV

Frequency Domain Analysis:

Relationship between time and frequency response, Polar plot, Bode's Plot, Nyquist plot and Nyquist stability criterion, Relative Stability, Phase and Gain Margins.

Unit-V

System Compensation and State Variable Characteristics of Linear Systems:

Series and feedback compensation, Introduction to state concepts, state equation of linear continuous data system. Matrix representation of state equations, controllability and observability, Kalman and Gilberts test.

Text Books:

1. Modern control theory, Katsuhiko Ogata, Pearson Education International, Fifth edition.
2. Control systems Principles and Design, M.Gopal, 3rd Edition, TMH, 2000.

Reference Books:

1. Control system engineering, Norman S Nise, John Wiley & Sons, Inc., Sixth edition
2. Modern control systems, Richard C. Dorf, Robert H Bishop, Pearson Education International, Twelfth edition.
3. Automatic control systems, Farid Golnaraghi, Benjamin C Kuo, John Wiley & Sons, Inc., Ninth edition
4. J.Nagrath and M.Gopal, Control System Engineering, New Age International Publishers, 5th Edition, 2007
5. Feedback control systems, Schaum's series, 2001.
6. System dynamics and control, Eronini-Umez, Thomas Asia Pte Ltd., Singapore 2002

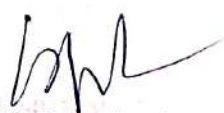
Course Outcomes

- CO1: 
- CO2: 
- CO3: 
- CO4: 
- CO5: 


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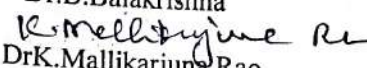
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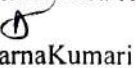
MOOCS


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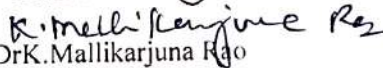
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III Year B.Tech. –II Sem

HEAT TRANSFER LAB

OBJECTIVES:

The laboratory course is aimed to provide the practical exposure to the students with regard to the determination of amount of heat exchange in various modes of heat transfer including condensation & boiling for several geometries.

1. COP of VCR System with Capillary and thermal expansion valve.
2. Determination of overall heat transfer co-efficient of a composite slab
3. Determination of heat transfer rate through a lagged pipe.
4. Determination of heat transfer rate through a concentric sphere
5. Determination of thermal conductivity of a metal rod.
6. Determination of efficiency of a pin-fin
7. Determination of heat transfer coefficient in natural and forced convection
8. Determination of effectiveness of parallel and counter flow heat exchangers.
9. Determination of emissivity of a given surface.
10. Determination of Stefan Boltzman constant.
11. Determination of heat transfer rate in drop and film wise condensation.
12. Determination of critical heat flux.
13. Determination of Thermal conductivity of liquids and gases.
14. Investigation of Lambert's cosine law.

Course Outcomes:

Upon successful completion of this course the student should be able to:

CO1: Estimate the thermal conductivity of different materials and powders.

CO2: Calculate heat transfer coefficient for free and forced convection

CO3: Validate the Stefan Boltzmann Constant and estimate emissivity of grey body.

CO4: Compare parallel and counter flow heat exchanger performance characteristics

CO5: Estimate the heat transfer rate through lagged pipes and evaluate the overall heat transfer coefficient for composite slab and pin fin apparatus .


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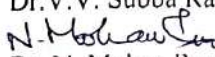
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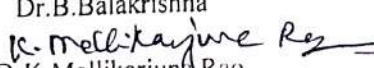
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CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
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CO2	√	√	√	√	√	√			√		√	√
CO3	√	√	√	√	√	√			√		√	√
CO4	√	√	√	√	√	√			√		√	√
CO5	√	√	√	√	√	√			√		√	√

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III Year B.Tech. –II Sem

CAM & CAE LAB

Course Objectives:

- 1 To impart the fundamental knowledge on using various analytical tools like ANSYS, for Engineering Simulation
2. To Create CAM Tool path and prepare NC- G&M codes.
 1. a). Determination of deflection and stresses in 2D and 3D trusses and beams.
 - b).Determination of principal and Von-mises stresses in plane stress, plane strain and axisymmetric components.
 - c). Determination of stresses in 3D and shell structures (at least one example in each case)
 - d). Estimation of natural frequencies and mode shapes, Harmonic response of 2D beam.
 - e). Steady state heat transfer Analysis of plane and Axisymmetric components.
 - f). Buckling analysis
2. (a). Study of CNC part programming fundamentals and writing part programs for simple components on CNC lathe and Mill.
 - (b) CNC part programming for turned components using FANUC Controller
 - (c) CNC programming for milled components using FANUC Controller
 - (d) Automated CNC Tool path & G-Code generation using CAM packages.
3. Study and demonstration of RP machine- creation of simple parts.

Packages to be provided to cater to drafting, modeling & analysis from the following:

ANSYS, CATIA, ABAQUS, UNIGRAPHICS.

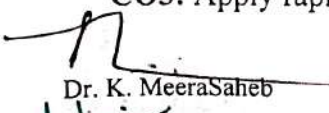
Course outcomes:

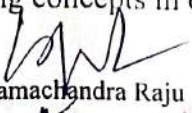
Upon successful completion of this course student should be able to:

CO1: Identify the tools for Analysis of a complex engineering components.

CO2: Generate CNC Turning and Milling codes for different operations using standard CAM packages.

CO3: Apply rapid prototyping concepts in engineering and real time applications


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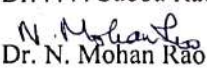

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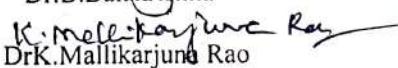
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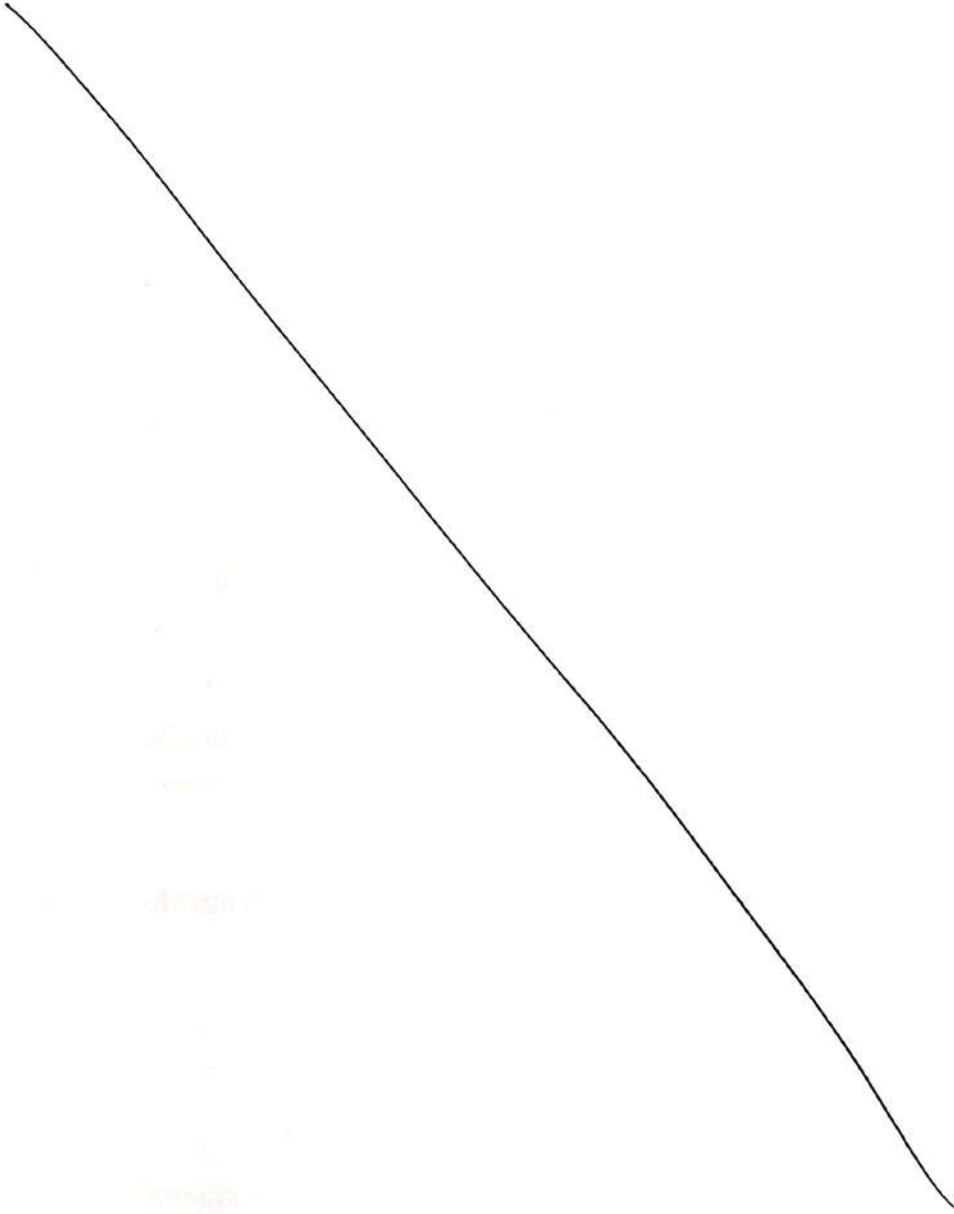
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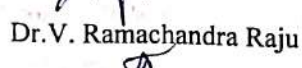
CO-PO Mapping

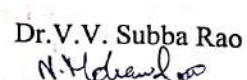
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CO2	√	√	√	√	√	√			√		√	√
CO3	√	√	√	√	√	√			√		√	√
CO4	√	√	√	√	√	√			√		√	√
CO5	√	√	√	√	√	√			√		√	√

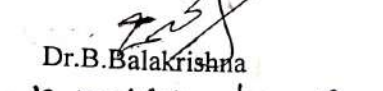



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EMPLOYABILITY SKILLS-II

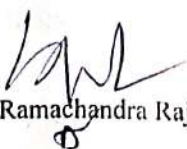


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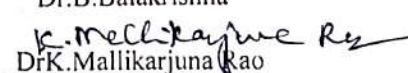
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EFFECTIVE FROM 2019-20 BATCH

IV Year B.Tech. –I Sem

MECHANICAL MEASUREMENTS & METROLOGY

Course objectives:

The students will learn

1. Inspection of engineering parts with various precision instruments
2. Design of part, tolerances and fits
3. Principles of measuring instruments and gauges and their uses
4. Evaluation and inspection of surface roughness
5. Inspection of spur gear and thread elements
6. Machine tool testing to evaluate machine tool quality

UNIT-I

Definition – Basic principles of measurement – generalized configuration- dynamic performance characteristics –

sources of error, classification and elimination of error.

Measurement of Displacement: Theory and construction of various transducers to measure displacement – piezo electric, inductive, capacitance, resistance, ionization and photo electric transducers.

Measurement of Temperature: Classification – ranges – various principles of measurement – expansion, electrical resistance – thermistor – thermocouple – pyrometers –temperature indicators.

Measurement of Pressure: Units – classification – different principles used. manometers, piston, bourdon pressure gauges, bellows – diaphragm gauges. low pressure measurement – thermal conductivity gauges – ionization pressure gauges, mcLeod pressure gauge.

UNIT – II

Measurement of Force, Torque And Power- Elastic force meters, load cells, torsion meters, dynamometers.

Flow Measurement: Rotameter, magnetic, ultrasonic, turbine flow meter, hot – wire anemometer, laser doppler anemometer (LDA).

Measurement of Strain : 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.

Measurement of Speed : Mechanical tachometers – electrical tachometers – stroboscope. noncontact type of tachometer

UNIT-III

SYSTEMS OF LIMITS AND FITS: Introduction, nominal size, tolerance, limits, deviations, different types of fits -Unilateral and bilateral tolerance system, hole and shaft basis systems- interchangeability, deterministic & statistical tolerances, selective assembly- International standard system of tolerances, selection of limits and tolerances for correct functioning, simple problems related to limits and fits, Taylor's principle – design of go and no go gauges; plug, ring, snap, gap, taper, profile and position gauges – inspection of gauges.

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Dr. N. Ramanaiyah

Dr. Ch. Rajesh

SURFACE ROUGHNESS MEASUREMENT: Differences between surface roughness and surface waviness – Numerical assessment of surface finish-CLA, Rt., R.M.S. Rz, R10 values, simple problems - method of measurement of surface finish – Profilograph, Talysurf, ISI symbols for indication of surface finish.

UNIT-IV

LINEAR MEASUREMENT: Length standards, end standards, slip gauges- calibration of the slip gauges, dial indicators, micrometers and vernier calipers.

MEASUREMENT OF ANGLES AND TAPERS:

Different methods – bevel protractor, angle slip gauges- angle dekkor- spirit levels- sine bar- sine table, rollers and spheres used to measure angles and tapers.

OPTICAL MEASURING INSTRUMENTS: Tools maker's microscope, Autocollimators, Optical projector, Optical flats-working principle, construction, merits, demerits and their uses.

UNIT – V

COMPARATORS: Introduction – dial gauge -Types - mechanical, optical , electrical and electronic, pneumatic comparators- working principle, construction, merits, demerits and their uses.

GEAR MEASUREMENT: Nomenclature of gear tooth, tooth thickness measurement with gear tooth vernier & flange micro meter, pitch measurement, total composite error and tooth to tooth composite errors, rolling gear tester, involute profile checking.

SCREW THREAD MEASUREMENT: Elements of measurement – errors in screw threads- concept of virtual effective diameter, measurement of effective diameter-Two wire and Three wire method, angle of thread and thread pitch, and profile thread gauges.

Note: Requested to adopt digital teaching methodology at least for two weeks during the semester.

TEXT BOOKS:

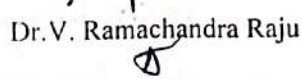
1. Dimensional Metrology/Connie Dotson/Cengage Learning
2. Engineering Metrology / R.K.Jain / Khanna Publishers

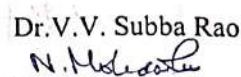
REFERENCE BOOKS:

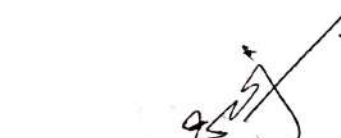
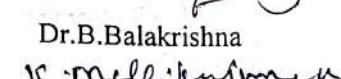
1. Engineering Metrology / Mahajan / Dhanpat Rai Publishers
2. Engineering Metrology / I.C.Gupta / Dhanpat Rai Publishers
3. Precision Engineering in Manufacturing / R.L.Murthy / New Age
4. Engineering Metrology and Measurements / NV Raghavendra, L Krishna murthy/ Oxford publishers.
5. Engineering Metrology / KL Narayana/Scitech publishers


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Dr. N. Ramanaiah

Dr. Ch. Rajesh

Course outcomes:

CO1: Understand the principles of measurement and Illustrate the methods used for the measurement of pressure, displacement and temperature.

CO2: Apply the fundamental principles to understand working principle of various force, torque, flow and strain measuring instruments.

CO3: Illustrate the fundamentals of Limits, Fits and Tolerances including the gauge design and principles of surface roughness.

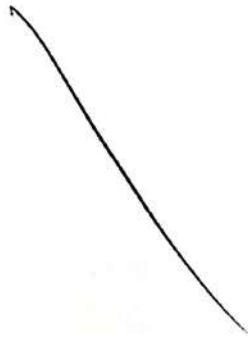
Study the basic principles of optical measuring instruments and interferometry

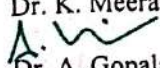
CO4: Describe various industrial metrological linear, angular and optical measuring instruments

CO5: Identify the uses of various comparators and understand the measurement of screw thread and gear profiles.

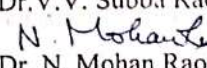
CO-PO Mapping

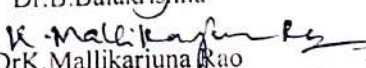
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√		√				√		√	
CO2	√	√	√		√				√		√	
CO3	√	√	√		√				√		√	
CO4	√	√	√		√				√		√	
CO5	√	√	√		√				√		√	




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MANEGERIAL ECONOMICS AND FINANCIAL ACCOUNTING


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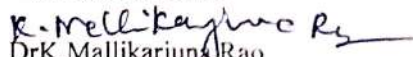
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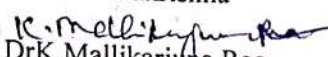
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IV Year B.Tech. –I Sem

AUTOMATION IN MANUFACTURING

(PROGRAM ELECTIVE-4)

Course objectives:

1. To study the types and strategies and various components in Automated Systems.
2. To understand the automated flow lines, line balancing, material storage and retrieval and inspection

UNIT-I INTRODUCTION: Types and strategies of automation, pneumatic and hydraulic components, circuits, automation in machine tools, mechanical feeding and tool changing and machine tool control.

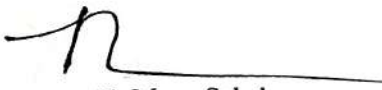
UNIT – II AUTOMATED FLOW LINES: Methods of part transport, transfer mechanism, buffer storage, control function, design and fabrication considerations. Analysis of automated flow lines - General terminology and analysis of transfer lines without and with buffer storage, partial automation, implementation of automated flow lines.

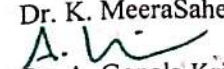
UNIT – III ASSEMBLY SYSTEM AND LINE BALANCING: Assembly process and systems, assembly line, line balancing methods, ways of improving line balance, flexible assembly lines.

UNIT – IV AUTOMATED MATERIAL HANDLING and STORAGE SYSTEMS: Types of equipment, functions, analysis and design of material handling systems, conveyor systems, automated guided vehicle systems. Automated storage and retrieval systems; work in process storage, interfacing handling and storage with manufacturing.

AUTOMATED INSPECTION: Fundamentals, types of inspection methods - Contact and Non-Contact type – equipment - Principles.

UNIT – V ADAPTIVE CONTROL SYSTEMS: Introduction, adaptive control with optimization, adaptive control with constraints, application of adaptive control in machining operations. Consideration of various parameters such as cutting force, temperatures, vibration and acoustic emission in the adaptive controls systems.


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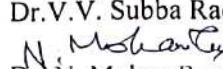
Dr. A. V. Sitarama Raju


Dr. V. Ramachandra Raju

Dr. A. Swarna Kumari

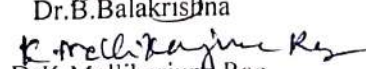
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Dr. N. Ramanaiah


Dr. B. Balakrishna


Dr. K. Mallikarjun Rao

Dr. Ch. Rajesh

TEXT BOOK:

1. Automation, Production Systems and Computer Integrated Manufacturing/ M.P. Groover./ Prentice Hall

REFERENCES:

1. Computer Control of Manufacturing Systems / Yoram Koren/Tata McGraw-Hill edition
2. CAD / CAM/ CIM /P. Radhakrishnan,S.Subrahmanyam,V.Raju/New Age international Publishers
3. Automation / W. Buekinsham, 3rd Edition/PHI Publications

Course outcomes: Upon successful completion of this course student should be able to: Solve the line balancing problems in the various flow line systems with and without use buffer storage Understand the different automated material handling, storage and retrieval systems and automated inspection systems. Use of Adaptive Control principles and implement the same online inspection and control

Course Outcomes:

CO1: Understands the types and strategies and various components in Automated Systems

CO2: Classify the types of automated flow lines and analyze automated flow lines

CO3: Solves the line balancing problems in the various flow line systems with and without use buffer storage

CO4: Interpret different automated material handling systems, storage and retrieval systems and automated inspection systems

CO5: Understand the principles of Adaptive Control systems.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√		√				√		√	
CO2	√	√	√		√				√		√	
CO3	√	√	√		√				√		√	
CO4	√	√	√		√				√		√	
CO5	√	√	√		√				√		√	

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EFFECTIVE FROM 2019-20 BATCH

IV Year B.Tech. –I Sem

POWER PLANT ENGINEERING
(PROGRAM ELECTIVE-4)

Course Objectives:

The course is aimed at providing knowledge of power generation through different prime movers viz steam, ICGT, Hydro, nuclear and hybrid systems along with their economics and environmental considerations.

UNIT – I

Introduction to the sources of energy – resources and development of power in India.

STEAM POWER PLANT: Plant layout, working of different circuits, fuel handling equipments, types of coals, coal handling, choice of handling equipment, coal storage, ash handling systems. Combustion: properties of coal – overfeed and underfeed fuel beds, traveling grate stokers, spreader stokers, retort stokers, pulverized fuel burning system and its components,

UNIT – II

STEAM POWER PLANT: Combustion needs and draught system, cyclone furnace, design and construction, dust collectors, cooling towers and heat rejection, corrosion and feed water treatment.

INTERNAL COMBUSTION AND GAS TURBINE POWER PLANTS:

DIESEL POWER PLANT: Plant layout with auxiliaries – fuel supply system, air starting equipment, super charging.

GAS TURBINE PLANT: Introduction – classification - construction – layout with auxiliaries, combined cycle power plants and comparison.

UNIT – III

HYDRO ELECTRIC POWER PLANT: Water power – hydrological cycle / flow measurement – drainage area characteristics – hydrographs – storage and pondage – classification of dams and spill ways.

HYDRO PROJECTS AND PLANT: Classification – typical layouts – plant auxiliaries – plant operation pumped storage plants.

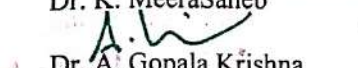
NUCLEAR POWER STATION: Nuclear fuel – breeding and fertile materials – nuclear reactor – reactor operation.

UNIT – IV

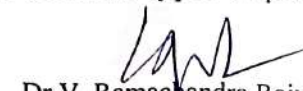
TYPES OF NUCLEAR REACTORS: Pressurized water reactor, boiling water reactor, sodium-graphite reactor, fast breeder reactor, homogeneous reactor, gas cooled reactor, radiation hazards and shielding – radioactive waste disposal.

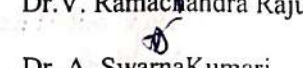
COMBINED OPERATIONS OF DIFFERENT POWER PLANTS: Introduction, advantages of combined working, load division between power stations, storage type hydro-electric plant in combination with steam plant, run-of-river plant in combination with steam plant, pump storage plant in combination with steam or nuclear power plant, co-ordination of hydro-electric and gas turbine stations, co-ordination of hydro-electric and nuclear power stations, co-ordination of different types of power plants.


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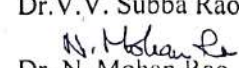
Dr. A. V. Sitarama Raju


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Dr. A. Swarna Kumari

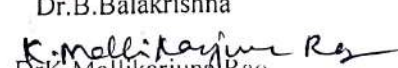
Dr. P. Ramesh Babu

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Dr. N. Ramanaih


Dr. B. Balakrishna


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Dr. Ch. Rajesh

UNIT – V

POWER PLANT INSTRUMENTATION AND CONTROL: Importance of measurement and instrumentation in power plant, measurement of water purity, gas analysis, O₂ and CO₂ measurements, measurement of smoke and dust, measurement of moisture in carbon dioxide circuit, nuclear measurements.

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.

Note: Requested to adopt digital teaching methodology at least for two weeks during the semester.

TEXT BOOKS:

1. A course in Power Plant Engineering /Arora and Domkundwar/Dhanpatrai& Co.
2. Power Plant Engineering /P.C.Sharma / S.K.KatariaPub

REFERENCES:

1. Power Plant Engineering: P.K.Nag/ II Edition /TMH.
2. Power station Engineering – ElWakil / McGrawHill.
3. An Introduction to Power Plant Technology / G.D. Rai/Khanna Publishers

Course outcomes:

Upon successful completion of this course the student should be able to:

CO1: Illustrate the functions of different components of steam power plant

CO2: Describe basic working principles, performance characteristics and components of gas turbine and diesel engine power plants

CO3: Illustrate basic working principles of hydroelectric power plants and analyze the importance of hydrological cycles, measurements and drainage characteristics

CO4: Evaluate the principal components and types of nuclear reactors and analyze the working of combined of power plants

CO5: Estimate economics, environmental considerations of power plants and power plant instrumentation and control.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√		√				√		√	
CO2	√	√	√		√				√		√	
CO3	√	√	√		√				√		√	
CO4	√	√	√		√				√		√	
CO5	√	√	√		√				√		√	

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EFFECTIVE FROM 2019-20 BATCH

IV Year B.Tech. –I Sem

TRIBOLOGY

(PROGRAM ELECTIVE-4)

UNIT – I

Introduction: Nature of surfaces and contact-Surface topography-friction and wear mechanisms, wear maps, effect of lubricants- methods of fluid film formation.

Lubrication: Choice of lubricants, types of oil, Grease and solid lubricants- additives- lubrication systems and their selection.

UNIT – II

Selection of rolling element bearings: Nominal life, static and dynamic capacity-Equivalent load, probabilities of survival- cubic mean load- bearing mounting details, pre loading of bearings, conditioning monitoring using shock pulse method.

UNIT – III

Hydrostatic Bearings: Thrust bearings – pad coefficients- restriction- optimum film thickness-journal bearings – design procedure –Aerostatic bearings; Thrust bearings and Journal bearings – design procedure.

UNIT – IV

Hydrodynamic bearings: Fundamentals of fluid formation – Reynold's equation; Hydrodynamic journal bearings – Sommerfield number- performance parameters – optimum bearing with maximum load capacity – Friction – Heat generated and Heat dissipated. Hydrodynamic thrust bearings; Raimondi and Boyd solution for hydrodynamic thrust bearings- fixed tilting pads, single and multiple pad bearings-optimum condition with largest minimum film thickness.

UNIT – V

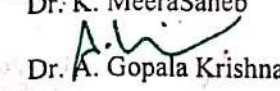
Seals: different type-mechanical seals, lip seals, packed glands, soft piston seals, Mechanical piston rod packing, labyrinth seals and throttling bushes, oil flinger rings and drain grooves – selection of mechanical seals.

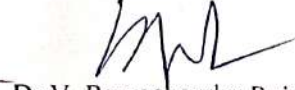
Failure of Tribological components: Failure analysis of plain bearings, rolling bearings, gears and seals, wear analysis using soap and Ferrography.

Dry rubbing Bearings: porous metal bearings and oscillatory journal bearings – qualitative approach only.

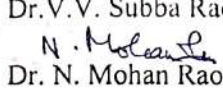
TEXT BOOKS:

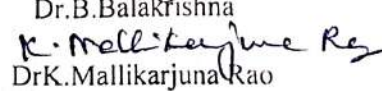
- 1.Rowe WW& O' Dionoghue,"Hydrostatic and Hybrid bearing design " Butterworths& Co.Publishers Ltd,1983.
- 2.Collacott R.A," Mechanical Fault diagnosis and condition monitoring", Chapman and Hall, London 1977.
3. Bernard J.Hamrock, " Fundamentals of fluid film lubricant", Mc Graw-Hill Co.,1994.


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REFERENCES:

1. Neale MJ, (Editor) " Tribology hand Book" Neumann Butterworths, 1975.
2. Connor and Boyd JJO (Editors) " Standard hand book of lubrication engineers " ASLE, McGraw Hill Book & Co., 1968
1. Shigley J, E Charles, " Mechanical Engineering Design", McGraw Hill Co., 1989

Course outcomes:

Upon successful completion of this course the student should be able to:

CO1: Understand the friction, wear and lubrication of contacting surfaces

CO2: Outlines of selection of rolling element bearings

CO3: Demonstrate the theory of thrust and journal bearings

CO4: Explain the hydrodynamic theory of film formation

CO5: Explain the seals and tribological failures and concepts related to dry rubbing bearings

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√		√				√		√	
CO2	√	√	√		√				√		√	
CO3	√	√	√		√				√		√	
CO4	√	√	√		√				√		√	
CO5	√	√	√		√				√		√	

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EFFECTIVE FROM 2019-20 BATCH

IV Year B.Tech. –I Sem

CONDITION MONITORING

(PROGRAM ELECTIVE-4)

Course Objectives:

- This course is designed to introduce the benefits and opportunities of health Monitoring and covers a range of techniques
- The students will be exposed to a range of techniques from Vibration based methods, Thermography, Oil conditions, Debris and ultrasonic monitoring
- Using overall vibration, vibration limit zones, broadband vibration bandwidth, alert levels, typical severity guidelines, recording overall vibration, using overall vibration for fault finding, trending overall vibration.
- Identifying Resonance, Hammer Test, Self Excitation, Exciter Testing. Reducing Resonance - Effects of Frequency, Stiffness, Mass, Damping, Isolation

UNIT-I

BASICS OF VIBRATION: Basic motion: amplitudes, period, frequency, basic parameters: displacement, velocity, acceleration, units (including dB scales) and conversions, Mass, spring and damper concept, Introduction to SDOF and MDOF systems, Natural frequencies and resonance, Forced response.

UNIT-II

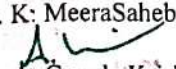
VIBRATION MEASUREMENTS AND ANALYSIS: Transducers and mounting methods, data acquisition using instrumentation recorders/data loggers, time domain signal analysis, orbit analysis, Filters, Frequency domain analysis (Narrow band FFT analysis), Nyquist criteria, Sampling, aliasing, windowing and averaging.

Use of phase; bode, polar and water fall plots, constant percentage band width analysis (1/3 and 1/1 Octave analysis), envelope detection /spike energy analysis, cepstral analysis, advances in analysis (PC based and portable instruments for vibration analysis).

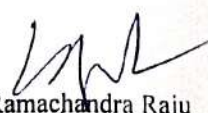
UNIT-III

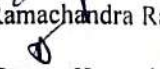
Fault Diagnosis, Interpreting vibration measurements for common machine faults , imbalance, misalignment, mechanical looseness, bearing and gearing faults, faults in induction motors, resonances, some case studies, static and dynamic balancing, international standards for vibration condition monitoring.


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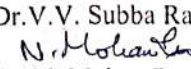
Dr. A. V. Sitarama Raju


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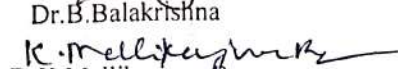
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UNIT-IV

THERMOGRAPHY: The basics of infrared thermography, differences in equipment and specific wave length limitations, application of ir to: electrical inspection, mechanical inspection, energy conservation, how to take good thermal images, hands-on demonstrations focusing on proper camera settings and image interpretation, analysis of thermal images and report generation, study of thermo graphy applications

ULTRASONIC MONITORING AND ANALYSIS: Ultrasonic monitoring – basic principle – theory - test taking philosophy - mathematics of ultrasound - equipment and transducers - inspection parameters and calibration - immersion theory - equipment quality control - flaw origins and inspection methods - UT Procedure familiarization and study recommendations - application of ultrasound to: air leaks, steam trap testing, bearing lubrication, electrical inspection, case studies.

UNIT-V

OIL AND WEAR DEBRIS ANALYSIS: Basics of oil analysis, monitoring condition of oil, lubricant analysis, physio – chemical properties, moisture, TAN, TBN, wear debris analysis, particle counting, spectroscopy, ferrography wear particle analysis, concept of ferrography, principle, particle classification- size, shape, composition, concentration, analysis procedure, sampling & analytical ferrographyequipments, severity rating, merits, demerits and applications.

Note: Requested to adopt digital teaching methodology at least for two weeks during the semester.

TEXT BOOKS:

1. Mechanical fault diagnosis and condition monitoring/RA Collacott(1977)
/Chapman and Hall
2. Machinery Vibration Condition Monitoring/Lynn/Butterworth(1989)

REFERENCE BOOKS:

1. Machinery Vibration: Measurement and Analysis/Victor Wowk/Mc GrawHill Professional
2. The Vibration Monitoring Handbook/Charles W Reeves/Coxmoor publishing company
3. The Vibration Analysis Handbook/J I Taylor (1994)/Vibration consultants Incorporate Publishers

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Course outcomes:

Upon successful completion of this course the student should be able to:

CO1: Understand the basic parameters of vibrations and determine free and forced vibration response of a spring mass system

CO2: Study of data recording instruments, transducers, bandwidth plots, envelop detection etc.

CO3: Identifying faults like inbalance, misalignment, loosened etc. International standards for condition monitoring

CO4: Inspection of systems using thermography, analysis and ultrasonic monitoring

CO5: Measurement of debris concept of ferrography, condition of oil, spectroscopy etc.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√		√				√		√	
CO2	√	√	√		√				√		√	
CO3	√	√	√		√				√		√	
CO4	√	√	√		√				√		√	
CO5	√	√	√		√				√		√	

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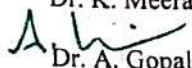
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MOOCS

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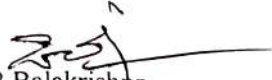

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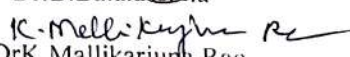
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IV Year B.Tech. –I Sem

ADVANCED MANUFACTURING PROCESSES

(PROGRAM ELECTIVE-5)

Course Objectives:

- To understand the various coating techniques and their importance.
- To make the students understand the properties, processing and design of ceramics and materials.
- To introduce the concepts and principles of MEMS fabrication methods.
- To learn various Rapid Prototyping (RP) processes and their applications.

UNIT-I

SURFACE TREATMENT: Scope, Cleaners, Methods of cleaning, Surface coating types, ceramic and organic methods of coating, and economics of coating. Electro forming. Chemical vapor deposition, Physical vapor deposition, thermal spraying, Ion implantation, diffusion coating, Diamond coating and cladding.

UNIT- II

PROCESSING OF CERAMICS: Applications, characteristics, classification .Processing of particulate ceramics, Powder preparations, consolidation, hot compaction, drying, sintering, and finishing of ceramics, Areas of application.

UNIT- III

PROCESSING OF COMPOSITES: Composite Layers, Particulate and fiber reinforced composites, Elastomers, Reinforced plastics, Polymer matrix composites- Hand layup, Pultrusion, filament winding, MMC-stir casting, infiltration methods, C-C composite processing methods.

UNIT – IV

FABRICATION OF MICROELECTRONIC DEVICES:

Crystal growth and wafer preparation, Film Deposition, oxidation, lithography, bonding and packaging, reliability and yield, Printed Circuit boards, surface mount technology, Integrated circuit economics.

UNIT -V

RAPID PROTOTYPING: Methods- Stereo Lithography, Laser Sintering, Fused Deposition Method, working principles , merits, demerits and Applications, Techniques of Rapid tooling.

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TEXT BOOKS:

1. Manufacturing Engineering and Technology / Kalpakijian / Adisson Wesley, 1995.
2. Process and Materials of Manufacturing / R. A. Lindburg / 1th edition, PHI 1990.

REFERENCES:

- 1 Microelectronic packaging handbook / Rao. R. Thummala and Eugene, J. Rymaszewski / Van Nostrand Renihold,
- 2 MEMS & Micro Systems Design and manufacture / Tai — Run Hsu / TMGH
- 3 Advanced Machining Processes / V.K.Jain / Allied Publications.
4. Introduction to Manufacturing Processes / John A Schey / Mc Graw Hill.

Course outcomes:

CO1: Illustrate the various cleaning and coating methods of a surface

CO2: Learn novel and promising techniques in the processing of ceramics

CO3: understand different types of composites and processing methods for PMC, MMCs.

CO4: understand fabrication methods for MEMS components

CO5: Illustrate the working principles of RP and select appropriate RP tooling for complex components.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√		√				√		√	
CO2	√	√	√		√				√		√	
CO3	√	√	√		√				√		√	
CO4	√	√	√		√				√		√	
CO5	√	√	√		√				√		√	

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IV Year B.Tech. – I Sem

MECHATRONICS

(PROGRAM ELECTIVE-5)

Course Objective

The main objective of this course is to introduce the integrative nature of Mechatronics. To describe the different components and devices of mechatronics systems.

UNIT-I

Mechatronics systems – integrated design issues in mechatronics – mechatronics elements key & levels of mechatronics system - Mechatronics design process – advanced approaches in mechatronics - measurement systems, control systems, microprocessor-based controllers, advantages and disadvantages of mechatronics systems.

UNIT-II

Sensors and transducers – introduction – sensors for motion and position measurements – force, torque and tactile sensors – flow sensors – temperature sensing devices – ultrasonic sensors – range sensors – fiber optic devices in mechatronics.

Actuating devices - Hydraulic and pneumatic actuating systems - Fluid systems, Hydraulic systems, and pneumatic systems, components, control valves, electro-pneumatic, hydro-pneumatic, electro-hydraulic servo systems. Mechanical actuating systems and electrical actuating systems – basic principles and elements.

UNIT-III

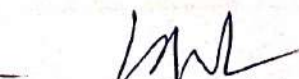
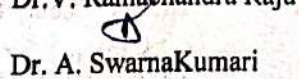
Mathematical models – mechanical system building blocks – electrical system building blocks – fluid system building blocks – thermal system building blocks – rotational – translational systems – electromechanical systems - the transfer function – first order systems – second order systems – systems in series – systems with feedback loops.

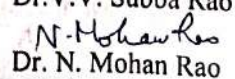
UNIT-IV

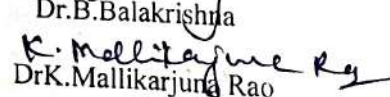
System and interfacing and data acquisition – Data Acquisition Systems, Analog to Digital and Digital to Analog conversions; Digital Signal Processing – data flow in DSPs, block diagrams, typical layouts, Interfacing motor drives.


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UNIT -V

Digital electronics and systems, digital logic control, micro processors and micro controllers, programming, process controllers, programmable logic controllers, PLCs versus computers, application of PLCs for control.

Note: Requested to adopt digital teaching methodology at least for two weeks during the semester.

TEXT BOOK:

1. MECHATRONICS Integrated Mechanical Electronics Systems/KP Ramachandran, GK VijayaRaghavan& MS Balasundaram/WILEY India Edition

REFERENCES:

- 1 Mechatronics /Smaili A, Mrad F/ Oxford Higher Education, Oxford University Press
- 2 Mechatronics Source Book / Newton C Braga/Thomson Publications, Chennai.
- 3 Mechatronics – N. Shanmugam / Anuradha Agencies Publishers.
- 4 Mechatronics System Design / Devdasshetty/Richard/Thomson.
- 5 Mechatronics/M.D.Singh/J.G.Joshi/PHI.
- 6 Mechatronics – Electronic Control Systems in Mechanical and Electrical Engg. 4th Edition / W. Bolton/ Pearson, 2012
- 7 Mechatronics – Principles and Application / Godfrey C. Onwubolu/Elsevier, Indian print

Course outcomes:

Upon successful completion of this course the student should be able to:

CO1: Explain Mechatronics design process

CO2: Select appropriate sensor and actuating devices for an engineering application

CO3: Develop Mathematical model for different systems

CO4: Understand various data acquisition system and processing

CO5: Write simple micro controller programs

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√		√				√		√	
CO2	√	√	√		√				√		√	
CO3	√	√	√		√				√		√	
CO4	√	√	√		√				√		√	
CO5	√	√	√		√				√		√	

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IV Year B.Tech. –I Sem

COMPUTATIONAL FLUID DYNAMICS

(PROGRAM ELECTIVE-5)

Course Objectives:

The course aims at providing required numerical and software techniques for solving various engineering problems involving fluid flow.

UNIT - I:

Basic Aspects of the Governing Equations – Physical Boundary Conditions – Methods of solutions of Physical Problems – Need for Computational Fluid Dynamics – Different numerical/CFD techniques – FDM, FEM, FVM etc., - Main working principle - CFD as a research and design tool – Applications in various branches of Engineering
Mathematical behavior of Partial Differential Equations (Governing Equations):
Classification of linear/ quasi linear PDE – Examples - Physical Processes: Initial and Boundary Conditions
Solution of Simultaneous Algebraic Equations: Direct Method – Gauss Elimination – LU Decomposition
– Pivoting – Treatment of Banded Matrices – Thomas
Algorithm Iterative Method: Gauss Seidel and Jordan Methods

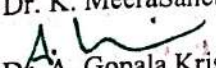
UNIT - II:

Finite Difference Method: Basic aspects of Discretization –
Finite Difference formulae for first order and second order terms – Solution of physical problems with Elliptic type of Governing Equations for different boundary conditions -
Numerical treatment of 1D and 2D problems in heat conduction, beams etc., - Solutions.

UNIT - III:

FDM: Solution of physical problems with Parabolic type of Governing Equations – Initial Condition – Explicit, implicit and semi implicit methods – Types of errors – Stability and Consistency – Von Neumann Stability criterion – Solution of simple physical problems in 1D and 2D – Transient Heat conduction problems – ADI scheme – Simple Hyperbolic type PDE – First order and Second order wave equations – Discretization using Explicit method - Stability criterion – Courant Number – CFL Condition - Its significance - Treatment of simple problems


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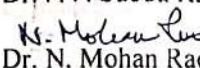
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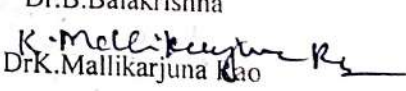
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UNIT - IV: Finite Difference Solution of Unsteady Inviscid Flows: Lax – Wendroff Technique – Disadvantages – Maccormack's Technique
Fluid Flow Equations – Finite Difference Solutions of 2D Viscous Incompressible flow problems – Vorticity and Stream Function Formulation –Application to Cylindrical Coordinates with example of flow over infinitely long cylinder and sphere

UNIT - V:

Finite Difference Applications in Fluid flow problems: Fundamentals of fluid Flow modeling using Burger's Equation – Discretization using FTCS method with respect to Upwind Scheme and Transport Property – Upwind Scheme and Artificial Viscosity
Solution of Navier Stokes Equations for Incompressible Fluid Flows: Staggered Grid – Marker and Cell (MAC) Formulation – Numerical Stability Considerations – Pressure correction method - SIMPLE Algorithm

TEXT BOOKS:

1. Computational Fluid Dynamics: The basics with applications/ John D Anderson/McGraw Hill Publications
2. Numerical Heat Transfer and Fluid Flow/ S.V. Patankar/ Mc GrawHill

REFERENCE BOOKS:

1. Computational Fluid Flow and Heat Transfer / K Muralidharan and T Sudarajan/ Narosa Publishers.
2. Chung T.J Computational Fluid Dynamics Cambridge University Press, 2003

Course Outcomes:

CO1: Understand the basic concepts and different methods in CFD

CO2: Solve the Elliptical Equations related to Heat Transfer and beams using FDM

CO3: Solve the Parabolic and hyperbolic equations using FDM and perform stability analysis

CO4: Analyze in viscid incompressible flows in FDM

CO5: Solve Navier Stokes equation for incompressible fluid flows and apply staggered grid to the solution

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√		√				√		√	
CO2	√	√	√		√				√		√	
CO3	√	√	√		√				√		√	
CO4	√	√	√		√				√		√	
CO5	√	√	√		√				√		√	

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IV Year B.Tech. – I Sem

NOISE AND VIBRATION CONTROL

(PROGRAM ELECTIVE-5)

Course Objectives:

The Course aims to understand the sources of vibration and noise in automobiles and make design modifications to reduce the vibration and noise and improve the life of the components

UNIT I BASICS OF VIBRATION

Introduction, classification of vibration: free and forced vibration, undamped and damped vibration, linear and non linear vibration, response of damped and undamped systems under harmonic force, analysis of single degree and two degree of freedom systems, torsional vibration, determination of natural frequencies.

UNIT II BASICS OF NOISE

Introduction, amplitude, frequency, wavelength and sound pressure level. addition, subtraction and averaging decibel levels, noise dose level, legislation, measurement and analysis of noise, measurement environment, equipment, frequency analysis, tracking analysis, sound quality analysis.

UNIT III AUTOMOTIVE NOISE SOURCES

Noise Characteristics of engines, engine overall noise levels, assessment of combustion noise, assessment of mechanical noise, engine radiated noise, intake and exhaust noise, engine accessory contributed noise, transmission noise, aerodynamic noise, tyre noise, brake noise.

UNIT IV CONTROL TECHNIQUES

Vibration isolation, tuned absorbers, untuned viscous dampers, damping treatments, application of dynamic forces generated by IC engines, engine isolation, crank shaft damping, modal analysis of the mass elastic model shock absorbers.

UNIT V SOURCE OF NOISE AND CONTROL

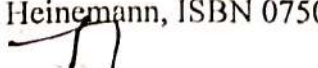
Methods for control of engine noise, combustion noise, mechanical noise, predictive analysis, palliative treatments and enclosures, automotive noise control principles, sound in enclosures, sound energy absorption, sound transmission through barriers

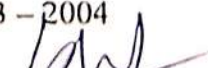
TEXT BOOKS:

1. Singiresu S. Rao – “Mechanical Vibrations” – Pearson Education, ISBN – 81-297-0179-0 – 2004.
2. Kewal Pujara “Vibrations and Noise for Engineers”, Dhanpat Rai & Sons, 1992.

REFERENCES:

1. Bernard Challen and Rodica Baranescu – “Diesel Engine Reference Book” – Second edition – SAE International – ISBN 0-7680-0403-9 – 1999.
2. Julian Happian-Smith – “An Introduction to Modern Vehicle Design” – Butterworth-Heinemann, ISBN 0750-5044-3 – 2004

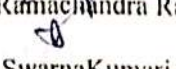

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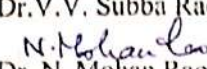

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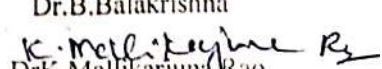

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3. John Fenton – “Handbook of Automotive body Construction and Design Analysis – Professional Engineering Publishing, ISBN 1-86058-073- 1998.

Course outcomes:

Upon successful completion of this course the student should be able to:

CO1: Understanding basics of vibration-determination of natural frequencies of 1-DOF and torsional

systems

CO2:Defining basic terminology and concepts of noise

CO3:To list and identify various sources of noise from an automobile

CO4:Understand various vibration control techniques and apply to different machines

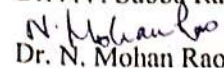
CO5:Study of control principles of mechanical noise; Noise transmission etc.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√		√				√		√	
CO2	√	√	√		√				√		√	
CO3	√	√	√		√				√		√	
CO4	√	√	√		√				√		√	
CO5	√	√	√		√				√		√	


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IV Year B.Tech. –I Sem

MEASUREMENTS & METROLOGY LAB

Course Objectives:

- Measurement of linear and angular dimensions
- To perform various alignment tests on machine tools
- Measurement of pressure, flow, speed, displacement and temperature.

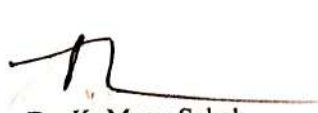
Note: The students have to conduct at least 8 experiments from each lab

Measurements Laboratory

1. Calibration of pressure gauge.
2. Calibration of transducer for temperature measurement.
3. Study and calibration of LVDT transducer for displacement measurement.
4. Calibration of strain gauge.
5. Calibration of thermocouple.
6. Calibration of capacitive transducer.
7. Study and calibration of photo and magnetic speed pickups.
8. Calibration of resistance temperature detector.
9. Study and calibration of a rotameter.
10. Study and use of a seismic pickup for the measurement of vibration amplitude of an engine bed at various loads.

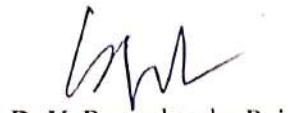
METROLOGY LABORATORY

1. Calibration of vernier calipers, micrometers, vernier height gauge and dial gauges.
2. Measurement of bores by internal micrometers and dial bore indicators.
3. Use of gear tooth vernier caliper for tooth thickness inspection and flange micro meter for checking the chordal thickness of spur gear.
4. Machine tool alignment test on the lathe.
5. Machine tool alignment test on drilling machine.
6. Machine tool alignment test on milling machine.
7. Angle and taper measurements with bevel protractor, Sine bar, rollers and balls.
8. Use of spirit level in finding the straightness of a bed and flatness of a surface.
9. Thread inspection with two wire/ three wire method & tool makers microscope.
10. Surface roughness measurement with roughness measuring instrument.


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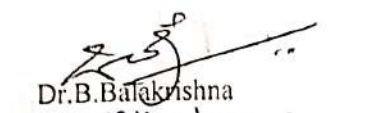
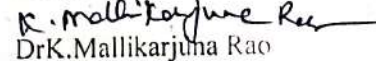
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Course outcomes:

CO1: Demonstrate the use of instruments for measuring pressure, flow, speed, displacement and temperature

CO2: Demonstrate the use of instruments for measuring linear (internal and external) and angular dimensions

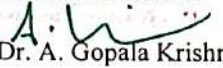
CO3: Perform alignment tests on various machine tools.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√	√	√	√			√		√	√
CO2	√	√	√	√	√	√			√		√	√
CO3	√	√	√	√	√	√			√		√	√
CO4	√	√	√	√	√	√			√		√	√
CO5	√	√	√	√	√	√			√		√	√



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Dr. A. V. Sitarama Raju



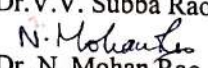
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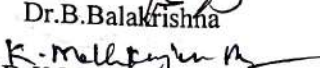


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B.Tech. (Mechanical Engineering)
EFFECTIVE FROM 2019-20 BATCH

IV Year B.Tech. –I Sem

SIMULATION LAB

OBJECTIVES:

- To give exposure to software tools needed to analyze engineering problems.
- To expose the students to different applications of simulation and analysis tools.

LIST OF EXPERIMENTS

PART A

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. Computer aided Analysis of Planar mechanisms (ADAMS)

PART-B

Using ANSYS-FLUENT solve the following problems of heat transfer analysis

- a. steady state conduction
- b. Stress Analysis of Constant, tapered and stepped bars with uniform and varying cross section areas.
- c. Lumped heat transfer
- d. Convective heat transfer – Internal flow (study both velocity and thermal boundary layers)
- e. Convective heat transfer – External flow (study both velocity and thermal boundary layers)
- f. Radiation heat transfer– Emissivity
- g. Analysis of laminated composites
- h. Coupled field analysis (Thermal-structural problem)

Course outcomes

CO1: simulate the working principle of air conditioning system, hydraulic and pneumatic cylinder and cam follower mechanisms using MATLAB.

CO2: analyze the stresses and strains induced in plates, brackets and beams and heat transfer problems.

CO3: calculate the natural frequency and mode shape analysis of 2D components and beams.

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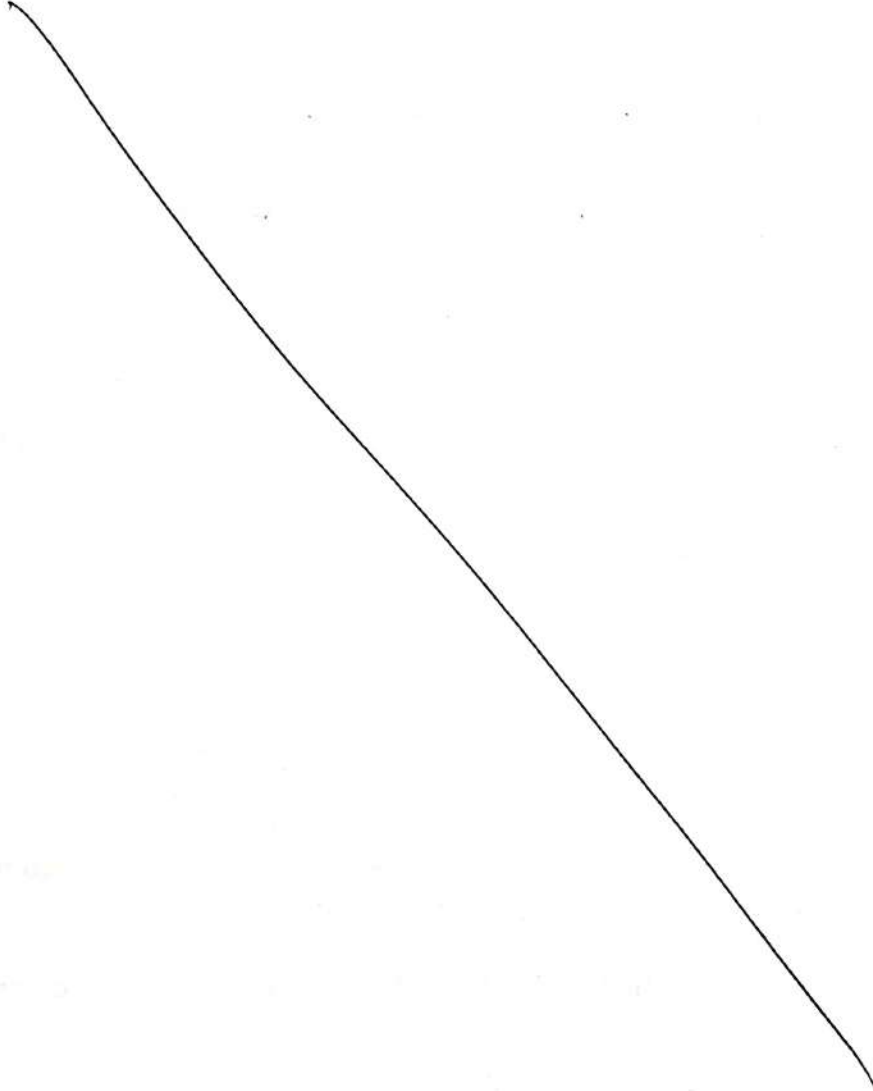
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CO-PO Mapping

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CO1	√	√	√	√	√	√			√		√	√
CO2	√	√	√	√	√	√			√		√	√
CO3	√	√	√	√	√	√			√		√	√
CO4	√	√	√	√	√	√			√		√	√
CO5	√	√	√	√	√	√			√		√	√

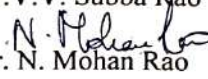


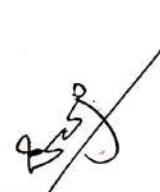
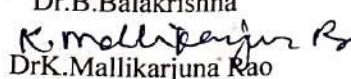

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B.Tech. (Mechanical Engineering)
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IV Year B.Tech. –II Sem

NON-DESTRUCTIVE EVALUATION
(PROGRAM ELECTIVE-6)

Course Objectives

- The students are to be exposed to the concepts of various NDE techniques using radiography, ultrasonics, liquid penetrates, magnetic patches and Eddy currents
- They will learn basic principles of these methods and will be able to select a testing process
- They will understand the advantages and disadvantages of these techniques.

UNIT – I

Introduction to non-destructive testing: Visual inspection, Radiographic test, Sources of X and Gamma Rays and their interaction with Matter, Radiographic equipment, Radiographic Techniques, Safety Aspects of Industrial Radiography

Ultrasonics test: Principle of Wave Propagation, Reflection, Refraction, Diffraction, Mode Conversion and Attenuation, Sound Field, Piezo-electric Effect, Ultrasonic Transducers and their Characteristics, Ultrasonic Equipment and Variables Affecting Ultrasonic Test. Ultrasonic Testing, Interpretations and Guidelines for Acceptance, Rejection - Effectiveness and Limitations of Ultrasonic Testing.

UNIT – II

Liquid Penetrant Test: Liquid Penetrant Test, Basic Concepts, Liquid Penetrant System, Test Procedure, Effectiveness and Limitations of Liquid Penetrant Testing,

Eddy Current Test: Principle of Eddy Current, Eddy Current Test System, Applications of Eddy Current Testing, Effectiveness of Eddy Current Testing for inspection of tube wall thickness. Internal rotary inspection system (IRIS).

UNIT – III

Magnetic Particle Test: Magnetic Materials, Magnetization of Materials, Demagnetization of Materials, Principle of Magnetic Particle Test, Magnetic Particle Test Equipment, Magnetic Particle Test Procedure, Standardization and Calibration, Interpretation and Evaluation, Effective Applications and Limitations of the Magnetic Particle Test

UNIT – IV

Infrared And Thermal Testing: Introduction and fundamentals to infrared and thermal testing–Heat transfer –Active and passive techniques –Lock in and pulse thermography–Contact and non contact thermal inspection methods–Heat sensitive paints –Heat sensitive papers –thermally quenched phosphors liquid crystals –techniques for applying liquid crystals –other temperature sensitive coatings –Inspection methods –Infrared radiation and infrared detectors–thermo mechanical behavior of materials–IR imaging in aerospace applications, electronic components, Honey comb and sandwich structures–Case studies.

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UNIT – V

Industrial Applications of NDE: Span of NDE Activities Railways, Nuclear, Non-nuclear and Chemical Industries, Aircraft and Aerospace Industries, Automotive Industries, Offshore Gas and Petroleum Projects, Coal Mining Industry, NDE of pressure vessels, castings, welded constructions

NOTE: Requested to adopt digital teaching methodology atleast for two weeks during the semester.

TEXT BOOKS:

1. Non destructive test and evaluation of Materials/J Prasad, GCK Nair/TMH Publishers
2. Ultrasonic testing of materials/ H Krautkramer/Springer
3. Non destructive testing/Warren, J Mc Gonnagle / Godan and Breach Science publishers
4. Nondestructive evaluation of materials by infrared thermography / X. P. V. Maldague, Springer-Verlag, 1st edition, (1993)

REFERENCES:

1. Ultrasonic inspection training for NDT/ E. A. Gingel/Prometheus Press,
2. ASTM Standards, Vol 3.01, Metals and alloys
3. Non-destructive, Hand Book – R. Hamchand

Course Outcomes:

CO1: Understand the concepts of various NDE techniques and interpret the principles and procedure of ultrasonic testing

CO2: Understands the principles and procedure of Liquid penetration testing

CO3: Illustrate the principles and procedure of Magnetic particle testing

CO4: Interpret the principles and procedure of Eddy current testing and its applications

CO5: Recognize the industrial applications of various NDE techniques

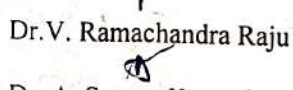
CO-PO Mapping

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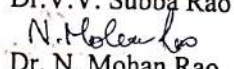

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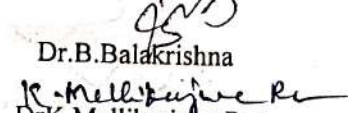
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IV Year B.Tech. –II Sem

GAS DYNAMICS AND JET PROPULSION
(PROGRAM ELECTIVE-6)

Course objectives:

The purpose of this course is to provide the student with the knowledge of basic principles of gas dynamics and its importance in jet propulsion applications.

UNIT-I

Introduction to gas dynamics: control volume and system approaches acoustic waves and sonic velocity - mach number - classification of fluid flow based on mach number - mach cone-compressibility factor - general features of one dimensional flow of a compressible fluid - continuity and momentum equations for a control volume.

UNIT-II

Isentropic flow of an ideal gas: basic equation - stagnation enthalpy, temperature, pressure and density-stagnation, acoustic speed - critical speed of sound- dimensionless velocity-governing equations for isentropic flow of a perfect gas - critical flow area - stream thrust and impulse function.

Steady one dimensional isentropic flow with area change-effect of area change on flow parameters- choking- convergent nozzle - performance of a nozzle under decreasing back pressure -De level nozzle - optimum area ratio effect of back pressure - nozzle discharge coefficients - nozzle efficiencies.

UNIT- III

Simple frictional flow: adiabatic flow with friction in a constant area duct-governing equations - fanno line limiting conditions - effect of wall friction on flow properties in an Isothermal flow with friction in a constant area duct-governing equations - limiting conditions.

Steady one dimensional flow with heat transfer in constant area ducts- governing equations - Rayleigh line entropy change caused by heat transfer - conditions of maximum enthalpy and entropy.

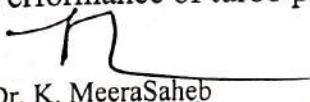
UNIT-IV

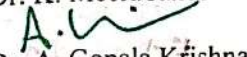
Effect of heat transfer on flow parameters: Intersection of Fanno and Rayleigh lines. Shock waves in perfect gas- properties of flow across a normal shock - governing equations - RankineHugoniat equations - Prandtl's velocity relationship - converging diverging nozzle flow with shock thickness - shock strength.

UNIT- V

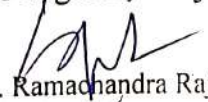
Propulsion: Air craft propulsion: - types of jet engines - energy flow through jet engines, thrust, thrust power and propulsive efficiency turbojet components-diffuser, compressor, combustion chamber, turbines, exhaust systems.

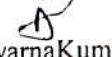
Performance of turbo propeller engines, ramjet and pulsejet, scramjet engines.


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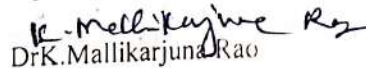
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Rocket propulsion - rocket engines, Basic theory of equations - thrust equation - effective jet velocity - specific impulse - rocket engine performance - solid and liquid propellant rockets - comparison of various propulsion systems.

Note: Requested to adopt digital teaching methodology at least for two weeks during the semester.

TEXT BOOKS:

1. Fundamentals of compressible flow with aircraft and rocket propulsion/S. M. Yahya/New Age international Publishers
2. Fundamental of Gas dynamics-2nd edition/ M J Zucker/ Wiley publishers
3. Compressible fluid flow /A. H. Shapiro / Ronald Press Co., 1953

REFERENCES

1. Elements of gas dynamics / HW Liepman& A Roshko/Wiley
2. Aircraft & Missile propulsion /MJ Zucrow/Wiley
3. Gas dynamics / M.J. Zucrow& Joe D.Holfman / Krieger Publishers

Course Outcomes:

Upon successful completion of this course the student should be able to:

CO1: Understand the basic concepts of gas dynamics and describe the basic fundamental equations of one dimensional flow of compressible fluid

CO2: Analyze the steady one-dimensional isentropic flow and express the concepts of steady one dimensional flow with heat transfer.

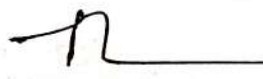
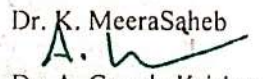
CO3: Applying the various principles of gas dynamics to frictional ad adiabatic flows

CO4: Analyze the various flow properties of shock waves in various flow regions.

CO5: Describing the different air craft propulsion enginesandUnderstanding the various rocket propulsion systems

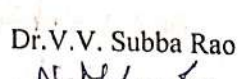
CO-PO Mapping

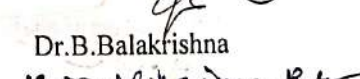
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CO2	√	√	√		√				√		√	
CO3	√	√	√		√				√		√	
CO4	√	√	√		√				√		√	
CO5	√	√	√		√				√		√	


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IV Year B.Tech. –II Sem

INDUSTRIAL HYDRAULICS AND PNEUMATICS

(PROGRAM ELECTIVE-6)

Course objective

1. Understand the underlying principles of Industrial Hydraulics & Pneumatic System
2. Analyze circuits and Enumerate the functions & characteristics of circuit elements
3. Attend to troubleshooting in fluid power systems
4. identify and describe the basic operation of Hydraulic / Pneumatic systems, the various equipment used in their operation

UNIT – I Fundamentals of Fluid Power Systems-Introduction-types advantages, disadvantages & applications fluid characteristics-terminologies used in fluid power-hydraulic symbols-hydraulic systems and components-sources-pumping theory-gear, vane & piston pumps.

Fluid Power Actuators: Introduction-hydraulic actuators-hydraulic cylinders-types, construction, specifications and special types. hydraulic motors- working principle-selection criteria for various types-hydraulic motors in circuits- formulae-numerical problems

UNIT-II Hydraulic elements in the design of circuits- Introduction-control elements-direction control valve check valve-pressure control valve-relief valve-throttle valve-temperature & pressure compensation locations of flow control valve

UNIT-III Accumulators & intensifiers-types, size & function of accumulators-application & circuits of accumulators- intensifiers-circuit & applications. Design & drawing of hydraulic circuits-Introduction-case study & specifications-method of drawing a hydraulic circuit-hydraulic cylinder-quick return of a hydraulic cylinder

UNIT-IV Pneumatic systems-Introduction-symbols used-concepts & components-comparison-types & specifications of compressors-arrangement of a complete pneumatic system-compressed air behavior- understanding pneumatic circuits-direction control valves Electro pneumatics- Introduction-Pilot operated solenoid valve-electrical connections to solenoid electro pneumatic circuit switches-relays-solenoids-P.E converter-concept of latching

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UNIT-V Applications-servo systems-introduction-closed loop, hydro-mechanical and electro hydraulic – conventional and proportional valves-characteristics of proportional and servo valves- PLC applications in fluid power – selected pneumatic / electro pneumatic circuit problems – failure and trouble shooting in fluid power systems.

TEXT BOOKS:

1. Introduction to Hydraulics and Pneumatics / S. Ilango and V. Soundararajan/PHI , New Delhi
2. Applied hydraulics and pneumatics/T. Sunder Selwyn & R. Jayendiran/Anuradha Publications.

REFERENCE BOOKS:

1. Oil Hydraulic Systems/S.R .Majumdar/McGrawHill Companies
2. Pneumatic Systems: Principles and Maintenance/SR Majumdar/Tata McGrawHill

Course outcome: Upon successful completion of this course student should be able to:

CO1: understand the general concepts associated with Hydraulic and Pneumatic equipment as found in industry today.

CO2: Describe the various types of Hydraulic / Pneumatic equipment as well as the different types of Seals used in such equipment

CO3. Understand advantages of fluid power, applications

CO4. Understand the operation of hydraulics & pneumatics circuits and components typically used in industry

Course Outcomes:

CO1:

CO2:

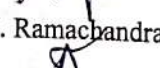
CO3:

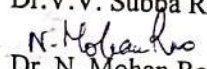
CO4:

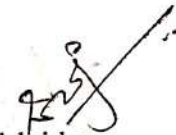
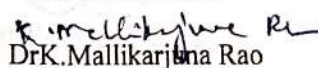
CO5:


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IV Year B.Tech. –II Sem

STATISTICAL QUALITY CONTROL

(PROGRAM ELECTIVE-6)

UNIT-I Introduction

The Meaning of Quality and Quality Improvement; Brief History of Quality Methodology; Statistical Methods for Quality Control and Improvement; Total Quality Management (quality philosophy, links between quality and productivity, quality costs, legal aspects of quality implementing, quality improvement).

Modeling Process Quality

Mean, Median, Mode, Standard deviation, Calculating area, The Deming funnel experiment, Normal distribution tables, Finding the Z score, Central limit theorem.

UNIT-II

Methods And Philosophy Of Statistical Process Control

Chance and assignable causes, Statistical Basis of the Control Charts (basic principles, choices of control limits, significance of control limits, sample size and sampling frequency, rational subgroups, analysis of pattern on control charts, warning limits, Average Run Length-ARL)

UNIT-III Control Charts For Variables

Control Charts for X-Bar and R- Charts, Type I and Type II errors, the probability of Type II error. Simple Numerical Problems

Process Capability

The foundation of process capability, Natural Tolerance limits, cp – process capability index, cpk, pp – process performance index, summary of process measures. Numerical problems

UNIT-IV Control Charts For Attributes

Binomial distribution, Poisson distribution (from the point of view of Quality control) Control Chart for Fraction Nonconforming, Control Chart for number Nonconforming. Control Charts for Nonconformities or Defects, Control Chart for Number of non conformities per unit. Numerical problems

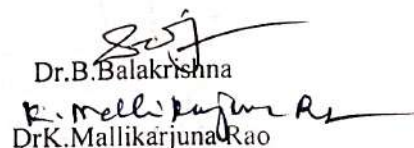


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UNIT-V Lot-By-Lot Acceptance Sampling For Attributes

The acceptance sampling problem, single sampling plan for attributes, Double, Multiple, and Sequential sampling, AOQL, LTPD, OC curves, Military Standard 105E, the Dodge-Romig sampling plans. Numerical problems

Course Outcomes:

CO1: Attain the basic techniques of quality control and improvement

CO2: Use control charts to analyze for improving the process quality

CO3: Apply statistical process control charts in a manufacturing environment to improve quality of processes / products.

CO4:

CO5:

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
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IV Year B.Tech. –II Sem

MECHANICS OF COMPOSITES

(PROGRAM ELECTIVE-7)

UNIT-I

Introduction to Composites: Introduction, materials- matrix and reinforcement, classification of composites, Applications,

UNIT-II

Micromechanical Analysis of a Lamina :Introduction, Volume and Mass Fractions, Density, and Void Content, Evaluation of the Four Elastic Moduli, Strength of Materials Approach, Semi-Empirical Models ,Elasticity Approach, Elastic Moduli of Lamina with Transversely Isotropic Fibers, Ultimate Strengths of a Unidirectional Lamina, Coefficients of Thermal Expansion, Coefficients of Moisture Expansion

UNIT-III

Hooke's Law for a Two-Dimensional Angle Lamina, Engineering Constants of an Angle Lamina, Invariant Form of Stiffness and Compliance Matrices for an Angle Lamina Strength Hydrothermal Stresses and Strains in a Lamina: Hydrothermal Stress–Strain Relationships for a Unidirectional Lamina, Hydrothermal Stress–Strain Relationships for an Angle Lamina

UNIT-IV

Macromechanical Analysis of a Lamina :Introduction ,Definitions: Stress, Strain ,Elastic Moduli, Strain Energy. Hooke's Law for Different Types of Materials, Hooke's Law for a Two-Dimensional Unidirectional Lamina, Plane Stress Assumption, Reduction of Hooke's Law in Three Dimensions to Two Dimensions, Relationship of Compliance and Stiffness Matrix to Engineering Elastic Constants of a Lamina, Laminate Code , Stress–Strain Relations for a Laminate, In-Plane and Flexural Modulus of a Laminate , Hydrothermal Effects in a Laminate, Warpage of Laminates,

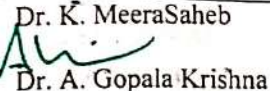
UNIT-V

Design of Laminates : Introduction , thin plate theory, specially orthotropic plate, cross and angle ply laminated plates, problems using thin plate theory, Failure theories, Design of a Laminated Composites.

TEXT BOOKS:

- 1.Engineering Mechanics of Composite Materials by Isaac and M Daniel, Oxford University Press, 1994.
- 2.B. D. Agarwal and L. J. Broutman, Analysis and performance of fibre Composites,Wiley-Interscience, New York, 1980.


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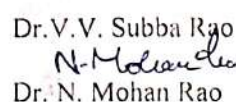

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Dr.K.Mallikarjuna Rao

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3. Mechanics of Composite Materials, Second Edition (Mechanical Engineering), By Autar K. Kaw , CRC press

REFERENCES:

1. R. M. Jones, Mechanics of Composite Materials, Mc Graw Hill Company, New York, 1975.
2. L. R. Calcote, Analysis of Laminated Composite Structures, Van Nostrand Reinhold, New York, 1969.

Course Outcomes:

CO1: _____

CO2: _____

CO3: _____

CO4: _____

CO5: _____



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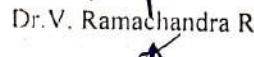


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Dr. V. Ramachandra Raju



Dr. A. SwarnaKumari

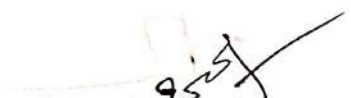
Dr. P. Ramesh Babu



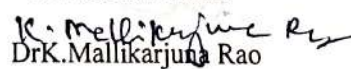
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Dr. Ch. Rajesh

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B.Tech. (Mechanical Engineering)
EFFECTIVE FROM 2019-20 BATCH

IV Year B.Tech. –II Sem

NANO MATERIALS
(PROGRAM ELECTIVE-7)

CO-1.

UNIT-I

General Introduction: Basics of Quantum Mechanics, Harmonic oscillator, magnetic Phenomena, band structure in solids, Mossbauer and Spectroscopy, optical phenomena bonding in solids, Anisotropy.

UNIT-II

Synthesis of nano powders- Top down & Bottom up approaches, Ball milling, Electro deposition, vapour deposition techniques,

UNIT-III

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,

UNIT-IV

Mechanical properties: Strength of nano crystalline SiC, Preparation for strength measurements, Mechanical properties, Magnetic properties,

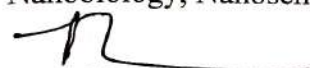
Electrical properties: Switching glasses with nanoparticles, Electronic conduction with nano particles

Optical properties: Optical properties, special properties and the coloured glasses

Investigating and manipulating materials in the nanoscale: Electron microscopies, scanning probe microscopies, optical microscopies for nano science and technology, X-ray diffraction.

UNIT-V

Nanobiology : Interaction between biomolecules and nanoparticle surface, Different types of inorganic materials used for the synthesis of hybrid nano-bio assemblies, Application of nano in biology, nanoprobe for Analytical Applications-A new Methodology in medical diagnostics and Biotechnology, Current status of nano Biotechnology, Future perspectives of Nanobiology, Nanosensors.


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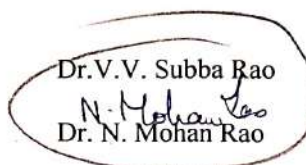

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RENEWABLE ENERGY RESOURCES

(PROGRAM ELECTIVE-7)

UNIT-I

INTRODUCTION:

SOLARRADIATION: Role and potential of new and renewable sources, the solar energy option, Environmental impact of solar power, structure of the sun, the solar constant, sun-earth relationships, coordinate systems and coordinates of the sun, extraterrestrial and terrestrial solar radiation, solar radiation on tilted surface, instruments for measuring solar radiation and sun shine, solar radiation data, numerical problems. Photo voltaic energy conversion – types of PV cells, I-V characteristics

SOLARENERGYCOLLECTION: Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors.

UNIT – II

SOLARENERGYSTORAGEANDAPPLICATIONS: Different methods, sensible, latent heat and stratified storage, solar ponds, solar applications-solar heating/cooling technique, solar distillation and drying, solar cookers, central power tower concept and solar chimney.

GEO THERMAL ENERGY: Structure of earth, Geothermal Regions, Hot springs. Hot Rocks, Hot Aquifers. Analytical methods to estimate thermal potential. Harnessing techniques, Electricity generating systems.

UNIT-III

DIRECT ENERGY CONVERSION: Nuclear Fusion, Fusion reaction, P,P cycle, Carbon cycle, Deuterium cycle, Condition for controlled fusion, Fuel cells and photovoltaic. Thermionic & thermoelectric generation, MHD generator.

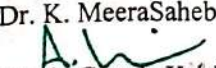
HYDROGEN GAS AS FUEL: Production methods, Properties, I.C. Engine applications, Utilization strategy, Performance.

UNIT-IV

BIO,ENERGY: Biomass energy sources. Plant productivity, Biomass wastes, aerobic and Anaerobic bioconversion processes, Raw material and properties of bio, gas, Bio, gas plant technology and status, the energetic and economics of biomass systems, Biomass gasification

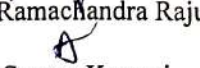
WIND ENERGY: Wind, Beaufort number, Characteristics, Wind energy conversion systems. Types, Betz model. Interference factor. Power coefficient, Torque coefficient and Thrust coefficient, Lift machines and Drag machines. Matching, Electricity generation.


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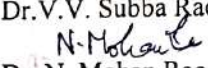
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Dr. V. Ramachandra Raju


Dr. A. Swarna Kumari

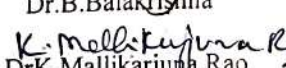
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Dr. Ch. Rajesh

UNIT-V

ENERGY FROM OCEANS: Tidal energy, Tides, Diurnal and semi-diurnal nature, Power from tides, Wave Energy, Waves, Theoretical energy available. Calculation of period and phase velocity of waves, Wave power systems, Submerged devices. Ocean thermal Energy, Principles, Heat exchangers, Pumping requirements, Practical considerations.

TEXT BOOK:

1. Renewable Energy Resources/ John Twidell & Tony Weir/Taylor & Francis/2nd edition
2. Solar Energy – Principles of Thermal Collection and Storage/Sukhatme S.P. and J.K.Nayak/ TMH

REFERENCES:

1. Renewable Energy Resources, Basic Principles and Applications/ G.N.Tiwari and M.K.Ghosal/ Narosa Publications
 2. Biological Energy Resources/ Malcolm Fleischer & Chris Lawis/ E&FN Spon
- Renewable Energy Sources / G.D Rai /Khanna Publishers

Course Outcomes:

Upon successful completion of this course the student should be able to:

CO1: Understand the basics of Solar Radiation, its measurement and collection

CO2: Explain the solar energy storage and concepts of Geo thermal energy

CO3: Understand the direct energy conversion and hydrogen powered systems

CO4: Acquire the knowledge of Bio energy and Wind energy generation systems and their applications

CO5: Understand the concepts of tidal energy and its production

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√	√	√		√				√		√	
CO2	√	√	√		√				√		√	
CO3	√	√	√		√				√		√	
CO4	√	√	√		√				√		√	
CO5	√	√	√		√				√		√	

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IV Year B.Tech. –II Sem

RELIABILITY ENGINEERING

(PROGRAM ELECTIVE-7)

C02

Course objectives:

1. The aim of this course is to provide students with a basic understanding of the approaches and techniques to assess and improve process and/or product quality and reliability.
2. The objectives are to introduce the principles and techniques of Statistical Quality Control and their practical uses in product and/or process design and monitoring
3. To understand techniques of modern reliability engineering tools.

UNIT – I Basic Probability Theory: Elements of probability, probability distributions, Random variables, Density and Distribution functions- Binomial distribution- Expected value and standard deviation - Binomial distribution, Poisson distribution, normal distribution, exponential distribution, Weibull distribution. Definition of Reliability: Definition of terms used in reliability, Component reliability, Hazard rate, derivation of the reliability function in terms of the hazard rate. Hazard models - Bath tub curve, Effect of preventive maintenance. Measures of reliability: Mean Time to Failure and Mean Time Between Failures.

UNIT – II Network Modeling and Evaluation Of Simple Systems: Basic concepts- Evaluation of network Reliability / Unreliability - Series systems, Parallel systems- Series-Parallel systems, Partially redundant systems- Examples. Network Modeling and Evaluation of Complex systems: Conditional probability method tie set, Cutset approach- Event tree and reduced event tree methods- Relationships between tie and cutsets- Examples.

UNIT – III Time Dependent Probability: Basic concepts- Reliability function $f(t)$, $F(t)$, $R(t)$ and $h(t)$ - Relationship between these functions. Network Reliability Evaluation Using Probability Distributions: Reliability Evaluation of Series systems, Parallel systems – Partially redundant systems- determination of reliability measure- MTTF for series and parallel systems – Examples.

UNIT – IV Discrete Markov Chains: Basic concepts- Stochastic transitional probability matrix- time dependent probability evaluation- Limiting State Probability evaluation- Absorbing states – Examples Continuous Markov Processes: Modeling concepts- State space diagrams- Unreliability evaluation of single and two component repairable systems

UNIT – V Frequency and Duration Techniques: Frequency and duration concepts, application to multi state problems, Frequency balance approach. Approximate System Reliability Evaluation: Series systems – Parallel systems- Network reduction techniques- Cut set approach- Common mode failures modeling and evaluation techniques- Examples.

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