

SONA COLLEGE OF TECHNOLOGY, SALEM-5

(An Autonomous Institution)

B.E-Mechanical Engineering

CURRICULUM and SYLLABI

[For students admitted in 2021-2022]

B.E / B.Tech Regulation 2019

Approved by BOS and Academic Council meetings

Sona College of Technology, Salem

(An Autonomous Institution)

Courses of Study for B.E/B.Tech. Semester I under Regulations 2019 (CBCS)

Branch: Mechanical Engineering

S.No	Course Code	Course Title	L	T	P	C	Category	Total Contact Hours
Theory								
1	U19CHE104E	Chemistry for Mechanical Engineering	3	1	0	4	BS	60
2	U19MAT102A	Linear Algebra and Calculus	3	1	0	4	BS	60
3	U19EE106	Electrical Drives and ARM Processor	3	0	0	3	ES	45
4	U19EGR106	Engineering Graphics	2	0	2	3	ES	60 (30L+30P)
Practical								
5	U19CHL109	Chemistry Laboratory	0	0	3	1.5	BS	45
6	U19EEL114	Electrical Drives and ARM Processor Laboratory	0	0	4	2	ES	60
7	U19WPL112	Workshop Practice	0	0	2	1	ES	30
8	U19ENL115	Communication Skills in English - I	0	0	2	1	HS	30
9	U19GE101	Basic Aptitude - I	0	0	2	0	EEC	30
Total Credits						19.5		
Optional Language Elective*								
10	U19OLE1101	French	0	0	2	1	HS	30
11	U19OLE1102	German						30
12	U19OLE1103	Japanese						30

*Students may opt for foreign languages viz., German/French/Japanese with additional one credit (Not accounted for CGPA calculation)

Approved By

Chairperson, Science and Humanities BoS	Chairperson, Mechanical Engineering BoS	Member Secretary, Academic Council	Chairperson, Academic Council & Principal
Dr. M. Renuga	Dr. D. Senthilkumar	Dr. R. Shivakumar	Dr. S. R. R. Senthil Kumar

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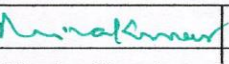

HOD/ Mechanical Engineering, First Semester BE MECH Students and Staff, COE

Sona College of Technology, Salem – 636 005
(An Autonomous Institution)
Courses of Study for BE / B Tech Semester II under Regulations 2019 (CBCS)
Branch: Mechanical Engineering

S.N	Course Code	Course Title	L	T	P	C	Category	Total Contact Hours
Theory								
1	U19MAT202A	Differential Equations and Vector Calculus	3	1	0	4	BSC	60
2	U19PHY203D	Physics for Mechanical Engineering	3	1	0	4	BSC	60
3	U19PPR205	Problem Solving Using Python Programming	3	0	0	3	ESC	45
4	U19ME201	Manufacturing Process	3	0	2	4	ESC	75 (45L+30P)
5	U19ENG201D	Communication Skills in English for Engineers and Technocrats	2	0	2	3	HSC	60 (30L+30P)
Practical								
7	U19PHL210	Physics Laboratory	0	0	3	1.5	BSC	45
8	U19PPL211	Python Programming Laboratory	0	0	2	1	ESC	30
9	U19GE201	Basic Aptitude-II	0	0	2	0	EEC	30
Total Credits						20.5		
Optional Language Elective*								
10	U19OLE1201	French	0	0	2	1	HSMC	30
11	U19OLE1202	German						
12	U19OLE1203	Japanese						

*Students may opt for foreign languages viz., German/French/Japanese with additional one credit (Not accounted for CGPA calculation)

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04.06.2021

B.E/B. Tech Regulations-2019

Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for B.E/B.Tech. Semester III under Regulations 2019
Branch: Mechanical Engineering

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit	Total Contact Hours
Theory							
1	U19MAT301B	Probability and Statistics	3	1	0	4	60
2	U19ME301	Engineering Mechanics - Statics and Dynamics	3	1	0	4	60
3	U19ME302	Engineering Thermodynamics	3	1	0	4	60
4	U19ME303	Fluid Mechanics and Machinery	3	0	0	3	45
5	U19ME304	Conventional and Smart Manufacturing	3	0	0	3	45
6	U19ME305	Instrumentation and Control Systems	3	0	0	3	45
7	U19GE302	Mandatory course: Environment and Climate Science	2	0	0	0	30
Practical							
8	U19ME306	Fluid Mechanics and Machinery Laboratory	0	0	2	1	30
9	U19ME307	Special Machines Laboratory	0	0	2	1	30
10	U19GE301	Soft Skills and Aptitude – I	0	0	2	1	30
Total Credits						24	

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Chairperson, Academic Council & Principal
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HOD/Mechanical Engineering, Third Semester BE Mechanical Students and Staff, COE

Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for B.E/B.Tech. Semester IV Regulations 2019
Branch: Mechanical Engineering

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit	Total Contact Hours
Theory							
1	U19ME401	Thermal Engineering	3	0	0	3	45
2	U19ME402	Strength of Materials	3	0	0	3	45
3	U19ME403	Engineering Materials and Metallurgy	3	0	0	3	45
4	U19ME404	Object Oriented Programming for Mechanical Engineering	3	0	0	3	45
5	U19ME405	Kinematics of Machines	3	0	0	3	45
6	U19GE403	Mandatory Course: Essence of Indian Traditional Knowledge	2	0	0	0	30
Practical							
7	U19ME406	Thermal Engineering Laboratory	0	0	2	1	30
8	U19ME407	Strength of Materials Laboratory	0	0	2	1	30
9	U19ME408	Object Oriented Programming Laboratory for Mechanical Engineering	0	0	2	1	30
10	U19GE401	Soft Skills and Aptitude - II	0	0	2	1	30
Total Credits						19	

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Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for B.E/B.Tech. Semester V Regulations 2019
Branch: Mechanical Engineering

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S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit	Total Contact Hours
Theory							
1	U19ME501	Heat and Mass Transfer	3	0	0	3	45
2	U19ME502	Dynamics of Machinery	3	0	0	3	45
3	U19ME503	Computer Aided Design and Analysis	3	0	0	3	45
4	noc23_cs82	NPTEL : Introduction to Industry 4.0 and Industrial Internet of Things	3	0	0	3	45
5	U19ME901	Professional Elective Machine Learning with Python Programming	3	0	0	3	45
Practical							
6	U19ME504	Heat and Mass Transfer Laboratory	0	0	2	1	30
7	U19ME505	Dynamics of Machinery Laboratory	0	0	2	1	30
8	U19ME506	Computer Aided Design and Analysis Laboratory	0	0	2	1	30
9	U19GE501	Soft Skills and Aptitude - III	0	0	2	1	30
Total Credits						19	

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Member Secretary, Academic Council
Dr.R.Shivakumar


Chairperson, Academic Council & Principal
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05.07.2023


Regulation 2019


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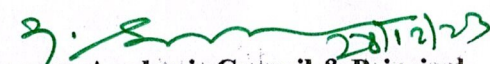
Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for B.E/B.Tech. Semester VI Regulations 2019
Branch: Mechanical Engineering

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit	Total Contact Hours
Theory							
1	U19ME601	Design of Machine Elements	3	1	0	4	60
2	U19ME602	Mechatronics System Design	3	0	0	3	45
3	U19ME603	Operations Research	3	1	0	4	60
4	U19ME910	Professional Elective – Robotics and Automation	3	0	0	3	45
	U19ME911	Professional Elective – Product Design and Development					
5	U19ME904	Professional Elective - Heating Ventilation and Air Conditioning Design	3	0	0	3	45
	U19ME905	Professional Elective - Modern Vehicle Technology and Automotive Testing					
6		*Open Elective – I	3	0	0	3	45
Practical							
7	U19ME604	Mechatronics and Simulation Laboratory	0	0	4	2	60
8	U19ME605	Computer Aided Manufacturing and Measurements Laboratory	0	0	4	2	60
9	U19GE601	Soft Skills and Aptitude – IV	0	0	2	1	30
Total Credits						25	

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22.12.2023


Regulations-2019

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S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit	Total Contact Hours
*Open Elective – I							
1	U19CS1001	Big Data Analytics	3	0	0	3	45
2	U19CS1002	Cloud Computing	3	0	0	3	45
3	U19EE1001	Electric Mobility	3	0	0	3	45
4	U19EE1002	Energy Conservation and Management	3	0	0	3	45
5	U19CE1003	Energy Efficiency and Green Building	3	0	0	3	45
6	U19FT1001	Fundamentals of Fashion Design	3	0	0	3	45
7	U19MC1004	Fundamentals of Robotics	3	0	0	3	45
8	U19FT1002	Garment Manufacturing Technology	3	0	0	3	45
9	U19EE1003	Innovation, IPR and Entrepreneurship Development	3	0	0	3	45
10	U19IT1004	Introduction to Database Technology	3	0	0	3	45
11	U19EC1006	Mobile Technology and its Applications	3	0	0	3	45
12	U19CE1002	Municipal Solid Waste Management	3	0	0	3	45
13	U19EE1004	Renewable Energy Systems	3	0	0	3	45

Approved By


Chairperson, Mechanical Engineering BoS
Dr. D. Senthilkumar


Member Secretary, Academic Council
Dr. R. Shivakumar 24/12/23


Chairperson, Academic Council & Principal
Dr. S. R. R. Senthil Kumar

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22.12.2023

Regulations-2019

Sona College of Technology, Salem-5

List of Professional Electives B.E/B.Tech under Regulation 2019

Department: Mechanical

S.No	Course Code	Course Name	L	T	P	C
1.	noc21-me115	Elective NPTEL Fundamentals of Additive Manufacturing Technologies	3	0	0	3
2.	noc21-cs63	Elective NPTEL Introduction to Internet of Things	3	0	0	3
3.	noc22-cs95	Elective NPTEL Introduction to Industry 4.0 and Industrial Internet of Things	3	0	0	3
4.	U19ME901	Machine Learning with Python Programming	3	0	0	3
5.	U19ME902	Data Analytics	3	0	0	3
6.	U19ME903	Data Structures using Python	3	0	0	3
7.	U19ME904	Heating Ventilation and Air Conditioning Design	3	0	0	3
8.	U19ME905	Modern Vehicle Technology and Automotive Testing	3	0	0	3
9.	U19ME906	Product Life Cycle Management	3	0	0	3
10.	U19ME907	Quality and Reliability Engineering	3	0	0	3
11.	U19ME908	Enterprise Resource Planning	3	0	0	3
12.	U19ME909	Supply Chain Management and Analytics	3	0	0	3
13.	U19ME910	Robotics and Automation	3	0	0	3
14.	U19ME911	Product Design and Development	3	0	0	3

SONA COLLEGE OF TECHNOLOGY, SALEM-5
DEPARTMENT OF MECHANICAL ENGINEERING
LIST OF PROFESSIONAL ELECTIVES FOR HONOURS Degree

Date: 16-5-2023

S.No	Vertical 1: Robotics and Cyber Physical Systems	Vertical 2: Smart Manufacturing	Vertical 3: Product Life Cycle Management	Vertical 4: Futuristic Mobility
1.	Robotic Systems I – Sensors & Actuators	Digital Manufacturing and Factory Automation	PLM Fundamentals	Robotic Systems I – Sensors & Actuators
2.	Robot Programming and Applications	Advanced Manufacturing Technologies	Lean Manufacturing	Intelligent vehicles technologies
3.	Mechatronics and Cyber- physical systems	Additive Manufacturing	Quality and Reliability Engineering	Driverless Car Assistance System
4.	Digital Manufacturing and Factory Automation	Energy Conservation in Industries	Enterprise Resource Planning	Automotive Transmission system
5.	Machine Learning with Python Programming	Machine Learning with Python Programming	Supply Chain management	Modern Vehicle Technology and Automotive Testing
6.	Robotics and Automation	Robotics and Automation	Product Design and Development	Supply Chain management
7.	NPTEL - I	NPTEL - I	NPTEL - I	NPTEL - I
8.	NPTEL - II	NPTEL - II	NPTEL - II	NPTEL - II

SONA COLLEGE OF TECHNOLOGY, SALEM-5

Department of Mechanical Engineering

Honours Degree- Verticals & Courses

(Offered to UG students admitted during AY 2021- 2022 onwards, Regulation 2019)

Vertical 1: Robotics and Cyber Physical Systems

S.No	Course Code	Course Name	L	T	P	C
1	U19ME2001	Robotic Systems I – Sensors & Actuators	3	0	0	3
2	U19ME2002	Robot Programming and Applications	3	0	0	3
3	U19ME2003	Mechatronics and Cyber-physical systems	3	0	0	3
4	U19ME2004	Digital Manufacturing and Factory Automation	3	0	0	3
5	U19ME901	Machine Learning with Python Programming	3	0	0	3
6	U19ME910	Robotics and Automation	3	0	0	3
7	NPTEL	NPTEL - I	3	0	0	3
8	NPTEL	NPTEL - II	3	0	0	3

Vertical 2: Smart Manufacturing

S.No	Course Code	Course Name	L	T	P	C
1	U19ME2004	Digital Manufacturing and Factory Automation	3	0	0	3
2	U19ME2005	Advanced Manufacturing Technologies	3	0	0	3
3	U19ME2006	Additive Manufacturing	3	0	0	3
4	U19ME2007	Energy Conservation in Industries	3	0	0	3
5	U19ME901	Machine Learning with Python Programming	3	0	0	3
6	U19ME910	Robotics and Automation	3	0	0	3
7	NPTEL	NPTEL - I	3	0	0	3
8	NPTEL	NPTEL - II	3	0	0	3

Vertical 3: Product Life Cycle Management

S.No	Course Code	Course Name	L	T	P	C
1	U19ME2008	PLM Fundamentals	3	0	0	3
2	U19ME2009	Lean Manufacturing	3	0	0	3
3	U19ME907	Quality and Reliability Engineering	3	0	0	3
4	U19ME908	Enterprise Resource Planning	3	0	0	3
5	U19ME909	Supply Chain management	3	0	0	3
6	U19ME911	Product Design and Development	3	0	0	3
7	NPTEL	NPTEL - I	3	0	0	3
8	NPTEL	NPTEL - II	3	0	0	3

Vertical 4: Futuristic Mobility

S.No	Course Code	Course Name	L	T	P	C
1	U19ME2001	Robotic Systems I – Sensors & Actuators	3	0	0	3
2	U19ME2010	Intelligent vehicles technologies	3	0	0	3
3	U19ME2011	Driverless Car Assistance System	3	0	0	3
4	U19ME2012	Automotive Transmission system	3	0	0	3
5	U19ME905	Modern Vehicle Technology and Automotive Testing	3	0	0	3
6	U19ME909	Supply Chain management	3	0	0	3
7	NPTEL	NPTEL - I	3	0	0	3
8	NPTEL	NPTEL - II	3	0	0	3

SONA COLLEGE OF TECHNOLOGY, SALEM-5

Department of Mechanical Engineering

Minor Degree- Verticals & Courses

(Offered to UG students admitted during AY 2021- 2022 onwards, Regulation 2019)

Minor Vertical: Intelligent Industrial Automation

S.No	Course Code	Course Name	L	T	P	C
1	U19ME2001	Robotic Systems I – Sensors & Actuators	3	0	0	3
2	U19ME2002	Robot Programming and Applications	3	0	0	3
3	U19ME2004	Digital Manufacturing and Factory Automation	3	0	0	3
4	U19ME2006	Additive Manufacturing	3	0	0	3
5	U19ME901	Machine Learning with Python Programming	3	0	0	3
6	U19ME910	Robotics and Automation	3	0	0	3
7	NPTEL	NPTEL - I	3	0	0	3
8	NPTEL	NPTEL - II	3	0	0	3

Sona College of Technology, Salem

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Courses of Study for B.E/B.Tech. Semester I under Regulations 2019 (CBCS)

Branch: Mechanical Engineering

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3	U19EE106	Electrical Drives and ARM Processor	3	0	0	3	ES	45
4	U19EGR106	Engineering Graphics	2	0	2	3	ES	60 (30L+30P)
Practical								
5	U19CHL109	Chemistry Laboratory	0	0	3	1.5	BS	45
6	U19EEL114	Electrical Drives and ARM Processor Laboratory	0	0	4	2	ES	60
7	U19WPL112	Workshop Practice	0	0	2	1	ES	30
8	U19ENL115	Communication Skills in English - I	0	0	2	1	HS	30
9	U19GE101	Basic Aptitude - I	0	0	2	0	EEC	30
Total Credits						19.5		
Optional Language Elective*								
10	U19OLE1101	French	0	0	2	1	HS	30
11	U19OLE1102	German						30
12	U19OLE1103	Japanese						30

*Students may opt for foreign languages viz., German/French/Japanese with additional one credit (Not accounted for CGPA calculation)

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U19CHE104E - CHEMISTRY FOR MECHANICAL ENGINEERING

L T P C

3 1 0 4

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

CO1: Outline the principle, applications of electrochemistry, types of corrosion and its control methods.

CO2: Describe the basic concepts, applications of surface chemistry and catalysis in engineering and technology.

CO3: Discuss the chemistry of fuels and combustion.

CO4: Analyze the industrial importance of phase rule and alloys.

CO5: Outline the principle and processes of metallurgy and powder metallurgy.

CO / PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
Programme Outcomes (POs) and Programme Specific Outcome (PSOs)														
COs, POs PSOs Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO-1	3	3												2
CO-2	3	3												2
CO-3	3	3												3
CO-4	3	3												3
CO-5	3	3												3

UNIT I - ELECTROCHEMISTRY AND CORROSION

12

Electrode potential – Nernst Equation – derivation and problems based on single electrode potential calculation – reference electrodes – standard hydrogen electrode – calomel electrode – Ion selective electrode – glass electrode – measurement of pH – electrochemical series – significance – electrolytic and electrochemical cells – reversible and irreversible cells – EMF – measurement of emf – potentiometric titrations (redox – Fe^{2+} vs dichromate) – conductometric titrations (acid-base – HCl vs NaOH) – Corrosion – types – dry and wet corrosion – examples – Corrosion control methods – Sacrificial anode and impressed cathode current method.

UNIT II - SURFACE CHEMISTRY AND CATALYSIS

12

Adsorption – types-physical and chemical adsorption – adsorption of gases on solids-adsorption isotherms – Freundlich and Langmuir isotherms-adsorption of solutes from solution – applications of adsorption-role of adsorption in catalytic reactions – ion exchange adsorption- basic principles in adsorption chromatography – adsorption in pollution abatement (granular activated carbon and powdered activated carbon) – catalysis-types - characteristics of catalysts – autocatalysis – definition and examples.

UNIT III - FUELS AND COMBUSTION

12

Fuels – calorific value – gross and net calorific values - problems based on the calculation of calorific value of a fuel – coal – proximate and ultimate analyses – metallurgical coke – manufacture by Otto-Hoffmann method – Petroleum processing and fractions – cracking – types – Methods of synthesis of petrol – Bergius and Fischer Tropsch processes - knocking – octane number and cetane number – power alcohol – manufacture, advantages and disadvantages – biodiesel manufacture by Transesterification process – advantages and disadvantages - Gaseous fuels – Water gas, producer gas, CNG and LPG, Combustion – flue gas analysis by Orsat's method.

UNIT IV - PHASE RULE AND ALLOYS

12

Statement and explanation of terms involved - limitations and applications of phase rule - simple problems on the calculation of number of phases and number of components of systems in equilibrium (water system, decomposition of CaCO_3 , PCl_5 and NH_4Cl) – Construction of phase diagram for one component system; water system – condensed phase rule – construction of phase diagram by thermal analysis – simple eutectic systems (lead – silver system only).

Alloys: Introduction- Definition- Properties of alloys- Significance of alloying, Functions and effect of alloying elements - ferrous alloys – nichrome and stainless steel – heat treatment of steel, non-ferrous alloys – brass and bronze.

UNIT V – METALLURGY

12

Metallurgy – extraction of metals from its ores – froth floatation, electromagnetic separation and chemical methods – refining of metals – liquation and electrolytic refining methods – metallurgy of iron and nickel - Powder metallurgy – principle – characteristics of metal powders – methods of producing metal powders (mechanical pulverization, atomization, chemical reduction, electrolytic process, decomposition) – mixing and blending – compacting – sintering – applications, advantages and limitations of powder metallurgy, Applications of Chemistry in mechanical engineering.

TOTAL: 60 Hours

TEXT BOOKS

- P.C.Jain and Monica Jain, “Engineering Chemistry” Dhanpat Rai Pub, Co., New Delhi , 2010.
- R. Venkatesh et al, “Chemistry For Mechanical Engineering” Sonaversity, Sona College of Technology, Salem, 2019.

REFERENCE BOOKS

- O G Palana, Engineering Chemistry”, Tata McGraw Hill Education (India) Private Limited, Chennai, Second Edition, 2017.
- B. Sivasankar, “Engineering Chemistry”, Tata McGraw-Hill Pub. Co. Ltd., New Delhi (2008).
- B.K. Sharma, “Engineering Chemistry”, Krishna Prakasan Media (P) Ltd., Meerut (2001).
- N. Krishnamurthy, K. Jeyasubramanian and P. Vallinayagam, “Applied Chemistry”, Tata McGraw-Hill Publishing Company Limited, New Delhi (1999).

U19MAT102A - LINEAR ALGEBRA AND CALCULUS

Common to CIVIL, MECH, EEE, CSE, IT and MCT

L	T	P	C
3	1	0	4

COURSE OUTCOMES

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

1. find the rank of the matrix and solve linear system of equations by direct and indirect methods
2. apply the concepts of vector spaces and linear transformations in real world applications
3. apply the concepts of eigen values and eigen vectors of a real matrix and their properties in diagonalization and the reduction of a real symmetric matrix from quadratic form to canonical form
4. find the Taylor's series expansion, Jacobians and the maxima and minima of functions of two variables
5. apply appropriate techniques of multiple integrals to find the area and volume.

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

UNIT – I LINEAR SYSTEM OF EQUATIONS 12
 Rank of a matrix – Solution of linear system of equations by matrix method, Gauss elimination, Gauss-Jordan, Gauss-Jacobi and Gauss-Seidel methods.

UNIT – II VECTOR SPACES 12
 Vector Space – Linear independence and dependence of vectors – Basis – Dimension – Linear transformations (maps) – Matrix associated with a linear map – Range and kernel of a linear map – Rank-nullity theorem (without proof).

UNIT – III EIGEN VALUES AND EIGEN VECTORS 12
 Eigen values and eigen vectors of real matrices – Properties of eigen values and eigen vectors – Cayley-Hamilton theorem – Diagonalization of real symmetric matrices – Reduction of quadratic form to canonical form.

UNIT – IV MULTIVARIABLE CALCULUS**12**

Functions of several variables – Partial differentiation – Total derivative – Jacobians – Taylor's theorem for function of two variables – Maxima and minima of function of two variables without constraints – Constrained maxima and minima by Lagrange's method of undetermined multipliers.

UNIT – V MULTIPLE INTEGRALS**12**

Double integrals – Change of order of integration – Change of variables from Cartesian to polar coordinates – Area as double integrals in Cartesian coordinates – Triple integrals – Volume as triple integrals in Cartesian coordinates.

Theory: **45 Hours**Tutorial: **15 Hours**Total: **60 Hours****TEXT BOOKS:**

1. T. Veerarajan, "Linear Algebra and Partial Differential Equations", McGraw Hill Publishers, 1st Edition, 2018.
2. T. Veerarajan, "Engineering Mathematics for Semesters I & II", McGraw Hill Publishers, 1st Edition, 2019.

REFERENCE BOOKS:

1. S. Lipschutz and M. L. Lipson, "Linear Algebra", McGraw Hill Publishers, 6th Edition, 2018.
2. E. Kreyszig, "Advanced Engineering Mathematics", Wiley Publishers, 10th Edition, Reprint, 2017.
3. C. Prasad and R. Garg, "Advanced Engineering Mathematics", Khanna Publishers, 1st Edition, 2018.
4. B. V. Ramana, "Higher Engineering Mathematics", McGraw Hill Publishers, 29th Reprint, 2017.
5. B. S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 44th Edition, 2018.

U19EE106 - ELECTRICAL DRIVES AND ARM PROCESSOR

L T P C

3 0 0 3

Course Outcomes: Upon completion of this course the students will be able to

- CO1:** Explain the Construction, operation, starting and characteristics of DC motors.
- CO2:** Explain the Construction, Types, Operation and characteristics of Three Phase and Single Phase Induction motors.
- CO3:** Describe about Types of electric drives, Heating and Cooling curves and selection of power rating for motors.
- CO4:** Discuss about the Solid State Speed control of DC motors and three phase induction motors.
- CO5:** Identify the features of Intel 8085 Microprocessor and writing simple programs.

CO / PO, PSO Mapping														
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
Programme Outcomes (POs) and Programme Specific Outcome (PSOs)														
COs, POs PSOs Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	3	3	3	1	-	-	-	-	-	1	1	3	3
CO 2	3	3	3	3	1	-	-	-	-	-	1	1	3	3
CO 3	3	3	2	3	1	-	-	-	-	-	1	1	3	3
CO 4	3	3	2	3	1	-	-	-	-	-	2	3	3	3
CO 5	3	3	1	3	1	-	-	-	-	-	2	3	3	3

UNIT I - DC MOTORS

L 9

Construction, principle of operation, torque-speed characteristics - Starters-Speed control of DC series and shunt motors (Conventional Methods) – Armature and field control, Ward-Leonard control system, Applications.

UNIT II - INDUCTION MOTORS

L 9

Three-phase induction motor: Construction- types- principle of operation- torque-slip characteristics- starting methods and speed control (Conventional Methods)-Single phase Induction motor, Applications.

UNIT III - ELECTRIC DRIVES INTRODUCTION

L 9

Basic Elements – Types of Electric Drives – factors are influencing the choice of electrical drives –Heating and cooling curves – Loading conditions and classes of duty

U19EGR106 - ENGINEERING GRAPHICS

L T P C
2 0 2 3

Course Outcomes: Upon completion of this course the students will be able to

- CO1:** Predict the construction of various curves in civil elevation, plan and machine components.
- CO2:** Analyze the principles of projection of various planes by different angle to project points, lines and planes.
- CO3:** Draw the principles of projection of simple solid by the axis is inclined to one reference plane by change of position method.
- CO4:** Understand the interior details of complex components, machineries by sectioning the solid body. Study the development of surfaces for prisms and pyramids.
- CO5:** Draw the projection of three dimensional objects representation of machine structure and explain standards of orthographic views by different methods.

CO / PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak Programme Outcomes (POs) and Programme Specific Outcome (PSOs)														
COs, POs PSOs Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	2	2	1	1	1	1	1	3	2	2	3	2	2
CO 2	3	2	2	1	2	1	1	1	3	2	2	3	2	2
CO 3	3	2	2	1	2	1	1	1	3	2	2	3	2	2
CO 4	3	2	2	1	2	1	1	1	3	2	2	3	2	2
CO 5	3	2	2	1	1	1	1	1	3	2	2	3	2	2

CONCEPTS AND CONVENTIONS (Not for Examination)

L 3

Importance of graphics in engineering applications, Use of drafting instrument, BIS conventions and specifications - Size, layout and folding of drawing sheets, Lettering and dimensioning.

COMPUTER AIDED DRAFTING (Not for Examination)

L 3

Importance 2d Drafting, sketching, modifying, transforming and dimensioning.

UNIT I - PLANE CURVES (Manual drafting)

L 6

Curves used in engineering practices Conics – Construction of ellipse – Parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves.

UNIT II - PROJECTION OF POINTS, LINES AND PLANE SURFACES L 12
(CAD Software)

Projection of points – Projection of straight lines located in the first quadrant – Determination of true lengths and true inclinations – Projection of polygonal surface and circular lamina inclined to one reference planes.

UNIT III - PROJECTION OF SOLIDS L 12
(CAD Software)

Creation of 3D CAD models of pyramids, prisms and solids of revolutions - Sectional views - **(Not for Examination)**

Projection of simple solids like prisms – pyramids – cylinder and cone when the axis is inclined to one reference plane by change of position method.

UNIT IV - SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES L 12
(CAD Software)

Sectioning of simple solids like prisms – pyramids, cylinder and cone in simple vertical position by cutting planes inclined to one reference plane and perpendicular to the other, (Obtaining true shape of section is not required). Development of lateral surfaces of simple and truncated solids – Prisms – pyramids – cylinders and cones.

UNIT V - CONVERSION OF ISOMETRIC VIEWS TO ORTHOGRAPHIC VIEWS L 12

(Manual drafting)

Representation of three dimensional objects – General Principles of Orthographic projection – Need for importance of multiple views and their placement – First angle projection – layout of views – Developing visualization skills through free hand sketching of multiple views from pictorial views of objects.

TOTAL: 60 Hours

TEXT BOOKS

1. P. Suresh et al., “Engineering Graphics and Drawing”, Sonaversity, Sona College of Technology, Salem, Revised edition, 2012.
2. K.V. Natarajan Engineering Graphics by, Chennai, 17th edition 2003.

REFERENCE BOOKS

1. Dhananjay A. Jolhe, Engineering Drawing with an introduction to AutoCAD, Tata McGraw Hill Publishing Company Limited, 2008.
2. Basant Agarwal and Agarwal C.M., Engineering Drawing, Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.
3. K. R. Gopalakrishnana, Engineering Drawing (Vol. I & II), Subhas Publications, 1998.
4. Bertoline & Wiebe fundamentals of graphics communication III edition McGrawhill 2002.

U19CHL109 - CHEMISTRY LABORATORY

L T P C
0 0 3 1.5

Course Outcomes: Upon completion of this course the students will be able to

- CO1:** Identify the types of hardness, alkalinity and analyse the amount of total, temporary and permanent hardness, total alkalinity present in the given sample water.
- CO2:** Determine the pH, conductivity and iron content of house hold water sample and suggest the remedial measures.
- CO3:** Determine the amount of copper in brass, chloride content of water and molecular weight of a polymer.

CO / PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak Programme Outcomes (POs) and Programme Specific Outcome (PSOs)														
COs, POs PSOs Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	-	-	1	-	1	-	-	-	-	1	-	-	2
CO 2	3	-	-	1	-	1	-	-	-	-	1	-	-	2
CO 3	3	-	-	1	-	1	-	-	-	-	1	-	-	2

LIST OF EXPERIMENTS

1. Estimation of hardness of water sample by EDTA method.
2. Estimation of alkalinity in water by indicator method.
3. Estimation of chloride ion present in the sample water by Argentometric method.
4. Determination of copper in brass by EDTA method.
5. Estimation of HCl acid by pH metry.
6. Determination of iron content in water by Spectrophotometric method.
7. Estimation of HCl by conductometry. (HCl vs NaOH)
8. Estimation of mixture of acids by conductometry. (HCl + CH₃COOH vs NaOH)
9. Estimation of ferrous ion by potentiometric titration.
10. Determination of Molecular weight of a polymer by viscosity measurements.

Total: 45 Hours

U19EEL114 - ELECTRICAL DRIVES AND ARM PROCESSOR LABORATORY

L T P C
0 0 4 2

Course Outcomes: Upon completion of this course the students will be able to

- CO1** Analyze the characteristics and determine the efficiency of DC and AC motors.
- CO2** Control the speed of DC and AC motors using rheostat and solid state controllers.
- CO3** Execute a simple program interfacing with ARM processor.

CO / PO, PSO Mapping														
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
Programme Outcomes (POs) and Programme Specific Outcome (PSOs)														
COs, POs PSOs Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1														
CO 2														
CO 3														

LIST OF EXPERIMENTS

1. Load test on DC Shunt motor.
2. Load test on DC Series motor.
3. Speed control of DC shunt motor (Armature, Field control)
4. Load test on three phase squirrel cage Induction motor
5. Load test on single phase Induction Motor.
6. Speed control of three phase slip ring Induction Motor.
7. Single phase half controlled converter using R, RL Loads.
8. Single phase fully controlled converter using R, RL Loads.
9. Speed control of DC motor using 3Phase converter.
10. Speed control of 3 Phase Induction motor using Voltage Source Inverter (VSI).
11. Study of ARM evaluation system.
12. Write a program to interface stepper motor using ARM processor.
13. Write a program for an on chip ADC using ARM processor.

TOTAL: 45 hours

U19WPL112 - WORKSHOP PRACTICE

L T P C
0 0 2 1

Course Outcomes: Upon completion of this course the students will be able to

- CO1:** Familiarize with the basic of tools and equipment's used in fitting, carpentry, welding and sheet metal.
- CO2:** Fabricate the different simple products in above trades.
- CO3:** Produce different joining of metals.

CO / PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
Programme Outcomes (POs) and Programme Specific Outcome (PSOs)														
COs, POs PSOs Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	2	3	2	1	3	3	2	3	2	3	3	2	2
CO 2	3	2	3	2	1	3	3	2	3	2	3	3	2	2
CO 3	3	2	3	2	1	3	3	2	3	2	3	3	2	2

LIST OF EXPERIMENTS

SECTION 1: FITTING

Tools and Equipment's- Practice in filling.
Making of Vee joint and square (T-fitting) joint.

SECTION 2: SHEET METAL

Tools and Equipment's- Practice
Making of Dust Pan and Funnel.

SECTION 3: WELDING

Tools and Equipment's – Practice
Arc welding of Butt joint and Lap Joint.

SECTION 4: CARPENTRY

Tools and Equipment's- Planning Practice
Making of Half Lap joint and Dovetail Joint.

TOTAL: 30 Hours

U19ENL115 - COMMUNICATION SKILLS IN ENGLISH – I

L T P C
0 0 2 1

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

- CO1** Communicate competitively among themselves.
- CO2** Demonstrate improved ability to communicate effectively in work place and at home.
- CO3** Introduce themselves, deliver speeches on general topics and make technical presentation.

CO / PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak Programme Outcomes (POs) and Programme Specific Outcome (PSOs)															
COs, POs PSOs Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
CO 1															
CO 2															
CO 3															

LIST OF EXPERIMENTS

Part – 1

- Extempore presentation – story narration, simple, general, abstract topics and incidents

Part - 2

- Self- introduction - personal information, name, home background, study details, area of interest, hobbies, strengths and weaknesses
- Mini presentation in small groups of two or three on office arrangements, facilities, office functions, sales, purchases, training recruitment, advertising, applying for financial assistance, applying for a job, team work, discussion, presentation
- Situational Role Play - between examiner and candidate, teacher and student, customer and sales manager, hotel manager and organiser, team leader and team member, bank manager and candidate, interviewer and applicant, car driver and client, industrialist and candidate

Total: 24 hours

U19GE101 - BASIC APTITUDE – I
(Common to All Departments)

L T P C
0 0 2 0

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

CO1: Solve fundamental problems in specific areas of quantitative aptitude

CO2: Solve basic problems in stated areas of logical reasoning

CO3: Demonstrate rudimentary verbal aptitude skills in English with regard to specific topics

CO / PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
Programme Outcomes (POs) and Programme Specific Outcome (PSOs)														
COs, POs PSOs Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	1	2	2	2	1	3	3	3	3	1	1	3	2	2
CO 2	3	3	1	1	2	3	2	3	3	2	2	3	3	3
CO 3	1	2	1	2	1	1	1	3	3	3	1	3	3	3

1. Quantitative Aptitude and Logical Reasoning

Solving simple problems with reference to the following topics:

- Numbers – HCF & LCM
- Decimal fractions
- Square roots & cube roots
- Surds & Indices
- Logarithms
- Percentage
- Averages
- Coding and Decoding & Visual language

2. Verbal Aptitude

Demonstrating plain English language skills with reference to the following topics:

- Synonyms
- Antonyms
- Verbal analogy
- Editing passages
- Sentence filler words

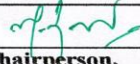

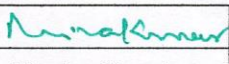

TOTAL: 24 hours

Sona College of Technology, Salem – 636 005
(An Autonomous Institution)
Courses of Study for BE / B Tech Semester II under Regulations 2019 (CBCS)
Branch: Mechanical Engineering

S.N	Course Code	Course Title	L	T	P	C	Category	Total Contact Hours
Theory								
1	U19MAT202A	Differential Equations and Vector Calculus	3	1	0	4	BSC	60
2	U19PHY203D	Physics for Mechanical Engineering	3	1	0	4	BSC	60
3	U19PPR205	Problem Solving Using Python Programming	3	0	0	3	ESC	45
4	U19ME201	Manufacturing Process	3	0	2	4	ESC	75 (45L+30P)
5	U19ENG201D	Communication Skills in English for Engineers and Technocrats	2	0	2	3	HSC	60 (30L+30P)
Practical								
7	U19PHL210	Physics Laboratory	0	0	3	1.5	BSC	45
8	U19PPL211	Python Programming Laboratory	0	0	2	1	ESC	30
9	U19GE201	Basic Aptitude-II	0	0	2	0	EEC	30
Total Credits						20.5		
Optional Language Elective*								
10	U19OLE1201	French	0	0	2	1	HSMC	30
11	U19OLE1202	German						
12	U19OLE1203	Japanese						

*Students may opt for foreign languages viz., German/French/Japanese with additional one credit (Not accounted for CGPA calculation)

Approved by

			
Chairperson, Science and Humanities BoS	Chairperson, Mechanical Engineering BoS	Member Secretary, Academic Council	Chairperson, Academic Council & Principal
Dr. M. Renuga	Dr. D. Senthilkumar	Dr. R. Shivakumar	Dr. S. R. R. Senthil Kumar

Copy to:-HOD/ Mechanical Engineering, Second Semester BE MECH Students and Staff, COE

B. E. / MECHANICAL ENGINEERING

SEMESTER – II	DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS	L	T	P	C
UI9MAT202A		3	1	0	4

COURSE OUTCOMES

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

1. apply the classical methods to solve linear ordinary differential equations.
2. apply the appropriate numerical methods to solve ordinary differential equations.
3. apply the Laplace transforms technique to solve ordinary differential equations.
4. apply the classical method to solve partial differential equations.
5. apply the concepts of vector differentiation and integration to determine the line, surface and volume integrals.

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

UNIT – I ORDINARY DIFFERENTIAL EQUATIONS 12

Linear higher order ordinary differential equations with constant coefficients – Cauchy's and Legendre's homogeneous linear ordinary differential equations – Method of variation of parameters.

UNIT – II NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS 12

Single Step Methods: Taylor's series – Euler and Modified Euler methods – Fourth order Runge – Kutta method for solving first and second order ordinary differential equations.

Multi Step Methods: Milne's and Adam's predictor-corrector methods.

UNIT – III LAPLACE TRANSFORMS 12

Laplace transform: Conditions for existence – Transform of elementary functions – Basic properties – Transform of derivatives and integrals – Transform of unit step function and impulse function – Initial and final value theorems – Transform of periodic functions.

Inverse Laplace transform: Standard results – Statement of convolution theorem and its applications – Solution of linear second order ordinary differential equations with constant coefficients using Laplace transform.

UNIT – IV PARTIAL DIFFERENTIAL EQUATIONS 12

Formation of partial differential equations – Lagrange's linear equation – Solution of standard types of first order partial differential equations – Linear partial differential equations of second and higher order with constant coefficients.

UNIT – V VECTOR CALCULUS 12

Vector differentiation: Scalar and vector valued functions – Gradient, directional derivative, divergence and curl – Scalar potential.


Vector integration: Line, surface and volume integrals – Statements of Green's, Stoke's and Gauss divergence theorem – Simple applications involving squares, rectangles, cubes and rectangular parallelepiped.

Theory: **45 Hours**Tutorial: **15 Hours**Total: **60 Hours****TEXT BOOKS:**

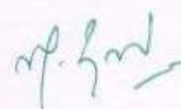
1. T. Veerarajan, "Linear Algebra and Partial Differential Equations", McGraw Hill Publishers, 1st Edition, 2018.
2. T. Veerarajan, "Engineering Mathematics for Semesters I & II", McGraw Hill Publishers, 1st Edition, 2019.

REFERENCE BOOKS:

1. J. Stewart, "Calculus", Cengage Publishers, 8th Edition, 2016.
2. C. Prasad and R. Garg, "Advanced Engineering Mathematics", Khanna Publishers, 1st Edition, 2018.
3. E. Kreyszig., "Advanced Engineering Mathematics", Wiley Publishers, 10th Edition, Reprint, 2017.
4. B. S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 44th Edition, 2018.
5. B. V. Ramana, "Higher Engineering Mathematics", McGraw Hill Publishers, 29th Reprint, 2017.



Prof. S. JAYABHARATHI
Head / Department of Mathematics
Sona College of Technology
Salem – 636 005



Dr. M. RENUGA
BoS - Chairperson
Science and Humanities
Sona College of Technology
Salem – 636 005

10. 05. 2019

B. E. / B. Tech. Regulations 2019

Course Code: U19PHY203D **L T P C**
Course Name: Physics for Mechanical Engineering **3 1 0 4 100**

(for Mechanical Engineering)

COURSE OUTCOMES:

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

- CO1** Explain motion of objects in two dimensions.
- CO2** Discuss different types of waves and their uses.
- CO3** Illustrate electromagnetic waves and their applications.
- CO4** Explain optical phenomena of waves and their propagation.
- CO5** Describe quantum physics concepts and their uses.

CO / PO, PSO Mapping														
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
Programme Outcomes (POs) and Programme Specific Outcome (PSOs)														
COs, POs PSOs Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO – 1	3	2	-	-	-	-	-	-	-	-	2	2	-	3
CO – 2	3	2	-	-	-	-	-	-	-	-	2	2	-	3
CO – 3	3	2	-	-	-	-	-	-	-	-	2	2	-	3
CO – 4	3	2	-	-	-	-	-	-	-	-	2	2	-	3
CO - 5	3	2	-	-	-	-	-	-	-	-	2	2	-	3

UNIT 1 Mechanics 12

Vectors: Introduction to vector – coordinate systems – vector and scalar quantities – some properties of vectors – components of a vector and unit vectors

Motion in Two Dimensions: The position, velocity and acceleration vectors – Two-dimension motion with constant acceleration – Projectile motion – Analysis mode; Particle in uniform circular motion – tangential and radial acceleration – relative velocity and relative acceleration.

UNIT 2 Mechanical Waves 12

Wave Motion: Propagation of a disturbance – Analysis Model – travelling wave – the speed of waves on strings – reflection and transmission – rate of energy transfer by sinusoidal waves on strings – the linear wave equation.

Sound Waves: Pressure variations in sound waves – speed of sound waves – intensity of periodic sound waves – The Doppler effect.

UNIT 3 DC Current and Electromagnetic waves

12

Direct Current Circuits: Electromotive force – Resistors in series and parallel – Kirchhoff's rules – RC circuits – Household wiring and electrical safety.

Electromagnetic waves: Displacement current and the general form of Ampere's law – Maxwell's equations and Hertz's discoveries – plane electromagnetic waves – Energy carried by electromagnetic waves – momentum and radiation pressure – Production of electromagnetic waves by antenna – the spectrum of electromagnetic waves.

UNIT 4 Wave Optics, Diffraction Patterns and Polarization

12

Wave Optics: Young's double-slit experiment – Analysis Model: Waves in interference – Intensity distribution of the double-slit interference pattern – change of phase due to reflection – interference in thin films – The Michelson's interferometer.

Diffraction Patterns and Polarization: Introduction to diffraction patterns – diffraction patterns from narrow slits – resolution of single-slit and circular apertures – The diffraction grating – diffraction of x-ray by crystals – polarization of light waves.

UNIT 5 Quantum Physics

12

Particle nature of radiation: Compton effect - expression for Compton shift (no derivation) **Wave nature of matter:** de Broglie waves - Schrodinger's time independent and time dependent wave equations - Physical significance of wave function - Energy and wave function of an electron trapped in one dimensional box - A particle in a well of finite height and width.

Application of wave nature of particles: Introduction to electron microscope - Comparison of optical and electron microscope - Scanning electron microscope - Limitations of electron microscope

TOTAL: 60 Hours

Text book

1. Physics for Scientists and Engineers by Serway & Jewett – Cengage Publications 9th edition.
2. B. K. Pandey and Manoj K. Harbola, Cengage Learning India Pvt. Ltd., Delhi, 2012.

References

1. C. Shanthi et al., Engineering Physics, Sonaversity, Sona College of Technology, Salem (Revised edition, 2016).
2. M.N. Avadhanulu and PG Kshirsagar, A Text book of Engineering Physics, S.Chand and company, Ltd., New Delhi, 2005.
3. Rajendran.V and Marikani. A, Engineering Physics, Tata Mc Graw Hill Publications Ltd, III Edition, New Delhi, 2004.

COURSE OUTCOMES

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

1. Develop algorithmic solutions to simple computational problems
2. Write simple Python programs
3. Write programs with the various control statements and handling strings in Python
4. Develop Python programs using functions and files
5. Analyze a problem and use appropriate data structures to solve it.

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

UNIT I ALGORITHMIC PROBLEM SOLVING**9**

Need for computer languages, Generation and Classification of computers - Basic organization of a computer, Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion).

UNIT II BASICS OF PYTHON PROGRAMMING**9**

Introduction-Python Interpreter-Interactive and script mode -Values and types, variables, operators, expressions, statements, precedence of operators, Multiple assignments, comments, input function, print function, Formatting numbers and strings, implicit/explicit type conversion.

UNIT III CONTROL STATEMENTS AND STRINGS**9**

Conditional (if), alternative (if-else), chained conditional (if-elif-else). Iteration-while, for, infinite loop, break, continue, pass, else. Strings-String slices, immutability, string methods and operations.

UNIT IV FUNCTIONS AND FILES**9**

Functions - Introduction, inbuilt functions, user defined functions, passing parameters - positional arguments, default arguments, keyword arguments, return values, local and global scope, recursion, lambda functions. Files -Text files, reading and writing files.

UNIT V DATA STRUCTURES: LISTS, SETS, TUPLES, DICTIONARIES**9**

Lists-creating lists, list operations, list methods, mutability list functions, searching and

sorting, Sets-creating sets, set operations. Tuples-Tuple assignment, Operations on Tuples, lists and tuples, Tuple as return value- Dictionaries-operations and methods, Nested Dictionaries.

TOTAL: 45 HOURS

TEXT BOOK

1. Reema Thareja, "Problem Solving and Programming with Python", Oxford University Press, 2018.
2. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016 (<http://greenteapress.com/wp/think-python/>)

REFERENCES

1. Ashok Namdev Kamthane, Amit Ashok Kamthane, "Programming and Problem Solving with Python", Mc-Graw Hill Education, 2018.
2. Robert Sedgewick, Kevin Wayne, Robert Dondero, "Introduction to Programming in Python: An Inter-disciplinary Approach", Pearson India Education Services Pvt. Ltd., 2016.
3. Timothy A. Budd," Exploring Python", Mc-Graw Hill Education (India) Private Ltd., 2015.
4. Kenneth A. Lambert, "Fundamentals of Python: First Programs", CENGAGE Learning, 2012.
5. Charles Dierbach, "Introduction to Computer Science using Python: A Computational Problem Solving Focus", Wiley India Edition, 2013.

Course Outcomes

Upon completion of this course the students will be able to

- CO1** Explain the major concepts of material removal process and characterization of tool wear and its types.
- CO2** Discuss the cutting tool materials and its specific purpose and explain about lathe details, main dissimilarity of capstan and turret lathes.
- CO3** Describe the various types of welding process for the engineering application and investigate the welding defects.
- CO4** Explain the sand casting process, pattern materials and special casting processes.
- CO5** Elaborate the various types of moulding processes in manufacturing of plastic components.

CO / PO, PSO Mapping														
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
Programme Outcomes (POs) and Programme Specific Outcome (PSOs)														
COs, POs PSOs Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	2	2	3	3	3	2	1	2	3	2	3	3	3
CO 2	3	2	2	3	3	3	2	1	2	3	2	3	3	3
CO 3	3	2	2	3	3	3	1	1	2	3	2	3	3	3
CO 4	3	2	2	3	2	3	1	1	2	3	1	3	3	3
CO 5	3	2	2	2	3	3	3	3	3	3	2	3	3	3

SECTION: A

THEORY

Unit – I THEORY OF METAL CUTTING

L 9

Introduction: material removal processes, nomenclature of single point cutting tool- chip formation, orthogonal cutting, oblique cutting- shear angle in orthogonal cutting- cutting tool materials, tool wear, Taylors tool life, factors affecting tool life –Tool life Calculations -surface finish, cutting fluids.

Unit – II CENTRE LATHE AND SPECIAL PURPOSE LATHES

L 9

Centre lathe: constructional features- various operations, tool and work holding devices- taper turning methods, special attachments, Lathe machining time calculations. Capstan and turret lathes – automats –Swiss type- - geneva mechanism, Bar feed mechanism.

Unit – III METAL JOINING PROCESS

L 9

Gas welding: Types- oxy- acetylene, Flame characteristics- Arc welding: Types- Metal arc welding-TIG welding- MIG welding-Plasma arc welding- Submerged arc welding- Electro slag welding - Resistant welding: Butt- Spot- Seam welding, Friction welding- Electron beam welding. Thermit Welding - Brazing- Soldering- Welding defects.

Unit – IV METAL CASTING

L 9

Sand Casting- Moulding Tools- Types of Patterns- Pattern Materials- Pattern Allowances- Types of Moulding Sand- Properties- Core Making- Methods of Sand Testing- Moulding Machines: Types- Melting Furnaces: Cupola, Crucible and Electric arc furnace- Special Casting Process: Shell, Investment Casting - Lost Wax Process- Pressure Die Casting- Centrifugal Casting- CO2 Process- Sand Casting Defects- Inspection Methods.

Unit – V MANUFACTURING OF PLASTIC COMPONENTS

L 9

Types and characteristics of plastics – Moulding of thermoplastics – working principles and typical applications – injection moulding – Plunger and screw machines – Compression moulding, Transfer Moulding – Typical industrial applications – introduction to blow moulding –Rotational moulding – Film blowing – Extrusion.

Number of hours: 45

SECTION: B

PRACTICAL

LIST OF EXPERIMENTS

1. Experiment on Simple Facing &Turning.
2. Exercise on Step and Taper Turning Model.
3. Exercise on Grooving and Thread Cutting Operation.
4. Exercise on Drilling, Boring.
5. Exercise on Arc Welding (Tee Joint)
6. Exercise on TIG Welding
7. Exercise on MIG Welding

LIST OF EQUIPMENTS

1.	Centre Lathe with accessories	-	15 No
2.	Pillar type drilling machine	-	01 No
3.	Table top drilling machine	-	01 No
4.	Arc Welding Unit	-	01 No
5.	TIG Welding Unit	-	01 No
6.	MIG Welding Unit	-	01 No

Number of hours: 30

Total Number of hours (45+30): 75

Learning Resources

Text Books

1. J.P .Kaushish "Manufacturing Processes" PHI Learning Private limited, second edition 2010.
2. Hajra Choudhury, "Elements of Workshop Technology, Vol. I Media Promoters & Publishers pvt ltd .2009

Reference Books

1. B.S. Magendranparashar& R.K. Mittal, "Elements of Manufacturing Processes", Prentice Hall of India, 2003.
2. P.N. Rao, Manufacturing Technology", Tata McGraw-Hill Publishing Limited, II Edition, 2009.

U19ENG201C- Communication Skills in English for Engineers and Technocrats

First year II semester

Mechanical

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

1. Use grammatical components effectively in both written and spoken communication
2. Read for gathering and understanding information, following directions and giving responses
3. Develop effective reading skills and reinforce language skills required for using grammar and building vocabulary.
4. Write email, formal letters and descriptions of graphics
5. Develop skills for writing reports and proposals, and for general purpose and technical writing.

	COURSE OUTCOMES	PROGRAMME OUTCOMES												Pso 1	Pso 2
		1	2	3	4	5	6	7	8	9	10	11	12		
1	Use grammatical components effectively in both written and spoken communication	1	1	1	2	2	2	3	3	3	3	3	3	3	3
2	Read for gathering and understanding information, following directions and giving responses	2	2	1	1	2	3	3	3	3	3	3	3	3	3
3	Develop effective reading skills and reinforce language skills required for using grammar and building vocabulary	2	2	1	1	2	3	3	3	3	3	3	3	3	3
4	Write email, formal letters and descriptions of graphics	1	1	2	2	2	3	2	2	1	3	3	2	3	3
5	Develop skills for writing reports and proposals, and for general purpose and technical writing	1	2	1	2	2	2	2	2	3	3	2	2	2	2

UNIT -I

- Focus on language -articles- prepositions - modal verbs- prefixes and suffixes.
- Understanding notice, messages, timetable, advertisements, graphs, Etc.
- Writing e-mail, constructing paragraphs and essays

UNIT – II

- Focus on language - active and passive voice, tenses
- Reading passages for specific information transfer.
- Letter Writing - inviting dignitaries, accepting and declining invitations letter writing

UNIT - III

- Focus on language - Collocation, concord,
- Reading passage with multiple choice questions
- Proposal

UNIT - IV

- Focus on language - if conditional clauses, cause and effect expressions
- Short reading passage: gap-filling exercise related to grammar
- Writing- resume, instructions.

UNIT - V

- Focus on language - pronoun, adverbs
- Short reading passages for sentence matching exercises, picking out specific information in a short text
- Writing- note making, report writing

Total 60 hours

Textbook:

1. Technical English I & II, Dr. M. Renuga et al. Sonaversity, 2016.

Extensive Reading

1. Who Moved my Cheese? – Spencer Johnson-G. P. Putnam's Sons
2. Discover the Diamond in You – Arindham Chaudhari – Vikas Publishing House Pvt. Ltd.

Reference

1. Norman Whitby, Business Benchmark – Pre-Intermediate to Intermediate, Students Book, Cambridge University Press, 2006.
2. A Course in Communication Skills, P. Kiranmai Dutt, Geetha Rajeevan, C. L. N. Prakash, published by Cambridge University Press India Pvt. Ltd.

U19PHL210		PHYSICS LABORATORY										L	T	P	C
												0	0	3	1.5
Course Outcomes															
After successful completion of this course, the students should be able to															
CO1:	Apply the principles of Thermal Physics and Elasticity to determine the Engineering properties of materials.														
CO2:	Apply the principles of Optics and Electricity to determine the Engineering properties of materials.														
CO3:	Determine the thickness and resistivity of the given copper turn used for house hold applications.														
Pre-requisite: Capable of using Screw gauge, Vernier calliper, Travelling microscope and Spectrometer															
CO/PO, PSO Mapping															
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak															
Programme Outcomes (POs) and Programme Specific Outcome (PSOs)															
COs	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
CO1	3			1		1					1			2	
CO2	3			1		1					1			2	
CO3	3			1		1					1			2	
Course Assessment methods															
Direct												Indirect			
Mean of 1 st half of Experiment (10)						Quiz on 2 nd half (5)						Course end survey			
Quiz on 1 st half (5)						Internal test II (10)									
Internal test I (10)						RTPS (10)									
Mean of 2 nd half of Experiment (10)						End semester Examination (40)									
List of Experiments															
1	Determination of velocity of ultrasonic waves and compressibility of the given liquid using ultrasonic interferometer.														
2	Determination of Young's modulus of the material of the beam by Non-uniform bending method.														
3	Determination of the thermal conductivity of a bad conductor using Lee's Disc apparatus.														
4	Determination of specific resistance of a given wire using Carey Foster's bridge.														
5	Determination of Rigidity Modulus of given wire using Torsion Pendulum.														
6	Determination of coefficient of viscosity of liquid by Poiseuille's method.														
7	Determination of Young's modulus of the material of the beam by uniform bending method.														
8	Determination of laser wavelength using diode laser.														
9	Determination of particle size of lycopodium powder using diode laser.														
10	Determination of acceptance angle and numerical aperture of an optical fibre using diode laser.														

11	Determination of the thickness of a thin wire by forming interference fringes using air wedge apparatus.
12	Determination of dispersive power of the prism for various pairs of colors in the mercury spectrum using a spectrometer.
13	Determination of Wavelength of Mercury spectrum using spectrometer.
14	Determination of band gap of the given semiconductor diode.
	Total Hours: 45 Hrs

COURSE OUTCOMES

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

1. Implement the algorithms using basic control structures in Python
2. Develop Python programs to use functions, strings and data structures to solve different types of problems
3. Implement persistent storing information through file operations

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

LIST OF EXPERIMENTS

1. Draw flowchart using any open source software.
2. Implement programs with simple language features.
3. Implement various branching statements in python.
4. Implement various looping statements in python.
5. Develop python programs to perform various string operations like concatenation, slicing, indexing.
6. Implement user defined functions using python.
7. Implement recursion using python.
8. Develop python programs to perform operations on list and tuples
9. Implement dictionary and set in python
10. Implement python program to perform file operations.

TOTAL: 30 HOURS

U19GE201 - BASIC APTITUDE - II

L	T	P	C
0	0	2	0

Course Outcomes: At the end of the course, the students will be able to CO1
solve more elaborate problems than those in BA-I in specific areas of

quantitative aptitude.

CO2 solve problems of greater intricacy than those in BA-I in stated areas of logical reasoning.

CO3 demonstrate higher than BA-I level verbal aptitude skills in English with regard to specific topics.

List of Experiments

1. QUANTITATIVE APTITUDE AND LOGICAL REASONING

Solving quantitative aptitude and logical reasoning problems with reference to the following topics:

- a. Ratio and proportion
- b. Partnership
- c. Chain rule
- d. Ages
- e. Profit, loss and discount
- f. Geometry
- g. Area and volume
- h. Data arrangement

2. VERBAL APTITUDE

Demonstrating verbal aptitude skills in English with reference to the following topics:

- a. Jumbled sentences
- b. Reconstructions of sentences (PQRS)
- c. Sentence fillers two words
- d. Idioms and phrases
- e. Spotting errors
- f. Writing captions for given pictures

TOTAL : 24 Hours

Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for B.E/B.Tech. Semester III under Regulations 2019
Branch: Mechanical Engineering

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit	Total Contact Hours
Theory							
1	U19MAT301B	Probability and Statistics	3	1	0	4	60
2	U19ME301	Engineering Mechanics - Statics and Dynamics	3	1	0	4	60
3	U19ME302	Engineering Thermodynamics	3	1	0	4	60
4	U19ME303	Fluid Mechanics and Machinery	3	0	0	3	45
5	U19ME304	Conventional and Smart Manufacturing	3	0	0	3	45
6	U19ME305	Instrumentation and Control Systems	3	0	0	3	45
7	U19GE302	Mandatory course: Environment and Climate Science	2	0	0	0	30
Practical							
8	U19ME306	Fluid Mechanics and Machinery Laboratory	0	0	2	1	30
9	U19ME307	Special Machines Laboratory	0	0	2	1	30
10	U19GE301	Soft Skills and Aptitude – I	0	0	2	1	30
Total Credits						24	

Approved By

Chairperson, Mechanical Engineering BoS
Dr.D.Senthilkumar

Member Secretary, Academic Council
Dr.R.Shivakumar

Chairperson, Academic Council & Principal
Dr.S.R.R.Senthil Kumar

Copy to:-

HOD/Mechanical Engineering, Third Semester BE Mechanical Students and Staff, COE

B. E / MECHANICAL ENGINEERING

SEMESTER – III	PROBABILITY AND STATISTICS	L	T	P	C
UI9MAT301B		3	1	0	4

COURSE OUTCOMES

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

1. apply the concepts of measures of central tendency, dispersion, correlation to the given data and analyze the results.
2. apply the concepts of random variables and their properties to generate the moments.
3. fit the suitable distribution and its properties to the real world problems and interpret the results.
4. apply the concepts of joint probability distribution and its properties to find the covariance.
5. test the hypothesis of the population using sample information.

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

UNIT – I BASIC STATISTICS 12
Measures of central tendency (simple arithmetic mean, median, mode) – Quartiles – Measures of dispersion (range, inter-quartile range, quartile deviation, mean deviation, standard deviation, coefficient of variation) – Simple correlation – Curve fitting (straight line and parabola).

UNIT – II RANDOM VARIABLES 12
Discrete and continuous random variables – Probability mass function, probability density function, moments, moment generating function and their properties.

UNIT – III THEORETICAL DISTRIBUTIONS 12
Binomial, Poisson, geometric, uniform, exponential and normal distributions and their properties - Applications.

UNIT – IV TWO DIMENSIONAL RANDOM VARIABLES 12
Joint distributions, marginal and conditional distributions – Covariance – Correlation – Central limit theorem.

20. 05. 2020

B. E. / B. Tech. Regulations 2019

UNIT – V TESTING OF SIGNIFICANCE

12

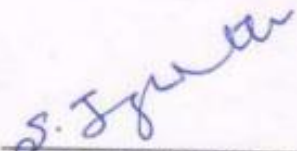
Sampling distributions - Testing of hypothesis for mean, standard deviation, variance, proportion and differences using normal and t distributions - χ^2 - tests for independence of attributes and goodness of fit and F distribution.

Theory: **45 Hours**Tutorial: **15 Hours**Total: **60 Hours****TEXT BOOKS:**

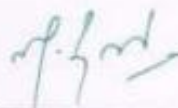
1. S. C. Gupta and V. K. Kapoor, "Fundamentals of Mathematical Statistics", Sultan Chand and Sons Publishers, 11th Edition, Reprint, 2019.
2. T. Veerarajan, "Probability, Statistics and Random Processes with Queueing Theory and Queueing Networks", McGraw Hill Publishers, 4th Edition, 7th Reprint, 2018.

REFERENCE BOOKS:

1. R. A. Johnson and C. B. Gupta, "Miller and Freund's, Probability and Statistics for Engineers", Pearson Publishers, 9th Edition, 2018.
2. S. Ross, "A First Course in Probability", Pearson Publishers, 9th Edition, 2019.
3. P. G. Hoel, S. C. Port and C. J. Stone, "Introduction to Probability Theory", Universal Book Stall Publishers, Reprint, 2003.
4. W. Feller, "An Introduction to Probability Theory and its Applications – Volume I", Wiley Publishers, 3rd Edition, 2008.
5. S. P. Gupta, "Statistical Methods", Sultan Chand and Sons Publishers, 15th Edition, 2012.



Prof. S. JAYABHARATHI
Head / Department of Mathematics
Sona College of Technology
Salem – 636 005



Dr. M. RENUGA
BoS - Chairperson
Science and Humanities
Sona College of Technology
Salem – 636 005

20. 05. 2020

B. E. / B. Tech. Regulations 2019

Unit – IV KINETICS AND KINEMATICS OF PARTICLES

L 9 T 3

Concept of displacement, velocity and acceleration – Newton’s laws of motion(fundamentals) – Work– Energy principle – introduction to Impulse and momentum – analyses of impact of elastic bodies – Introduction to principle of virtual work (Qualitative treatment only).

Unit – V FRICTION

L 9 T 3

Types of friction – laws of sliding friction – Equilibrium analyses of simple systems with sliding friction – Angle of friction – cone of friction – Equilibrium of bodies on inclined plane – Ladder friction- Applications of friction: Wedge and Belt.

Total Number of hours: 60**Learning Resources****Text Books**

1. Bansal R K, "A Textbook of Engineering Mechanics"- 6th edition,2022, Laxmi publications (P) LTD.
2. R. C. Hibbler, Engineering Mechanics: Statics & Dynamics, Person Prentice hall, 14th edition, 2017.
3. Kumar, K.L., "Engineering Mechanics", 4th Revised Edition, Tata McGraw-Hill Publishing Company, New Delhi (2017).

Reference books

1. S. Timoshenko,Engineering Mechanics (In SI Units) (SIE) ,5th Edition,2017, McGraw Hill Education.
2. Beer, F.P and Johnston Jr. E.R., "Vector Mechanics for Engineers (In SI Units): Statics and Dynamics", 12 th Edition, Tata McGraw-Hill Publishing company, New Delhi (2019).
3. Irving H. Shames and Krishna Mohana Rao. G., "Engineering Mechanics – Statics and Dynamics", 4th Edition, Pearson Education (2016)
4. Meriam J.L. and Kraige L.G., " Engineering Mechanics- Statics' - Volume 1, & 'Dynamics' , John Wiley & Sons,(2017 & 2018)
5. Rajasekaran S and Sankarasubramanian G., "Engineering Mechanics Statics and Dynamics", 3rd Edition, Vikas Publishing House Pvt. Ltd., (2005).
6. Bhavikatti, S.S "Engineering Mechanics", 7th New Age International (P) Limited Publishers,(2019).

Course Outcomes

Upon completion of this course the students will be able to

- CO1** Discuss the thermodynamic properties of system and apply the first Law of Thermodynamics to solve engineering problems.
- CO2** Apply the Second law of Thermodynamics and entropy principle to various processes and thermodynamic cycles.
- CO3** Determine the thermodynamic properties of pure substance in flow and non-flow processes.
- CO4** Compare the ideal and real gases and its thermodynamic relations and formulate Maxwell's relation, Clausius Clapeyron equations.
- CO5** Calculate the cooling, heating and humidifier capacities for air-conditioner using psychrometric chart.

CO / PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
Programme Outcomes (POs) and Programme Specific Outcome (PSOs)														
COs, POs PSOs Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO - 1	3	3	1	-	1	2	-	3	-	3	-	3	3	2
CO - 2	3	3	3	2	3	3	2	3	2	3	2	3	3	3
CO - 3	2	3	2	3	3	-	3	1	3	1	3	2	2	2
CO - 4	3	-	3	3	-	3	3	2	1	-	3	2	2	3
CO - 5	2	2	3	3	3	1	3	-	3	3	3	3	3	3

UNIT I BASIC CONCEPTS AND FIRST LAW OF THERMODYNAMICS

L 9 T 3

Basic concepts of thermodynamics, macroscopic and microscopic concepts, system, surroundings, Concept of Universe and control volume, properties of system-Intensive and Extensive, state, process and cycle, Definition of Thermodynamic Work -- Units for Work -- Forms of Work – Definition of Heat -- Inter Convertibility of Heat/work into Work/heat -- Governing Principles -- Sign Convention, temperature, law of conservation of mass, momentum and energy, - Concept of Quasi static process, thermodynamic equilibrium, zeroth law of thermodynamics, Statement of First Law of Thermodynamics , The Constant Volume and Constant Pressure Specific Heats -- The internal Energy, Enthalpy and Specific Heats of An Ideal Gas, application of first law to non-flow processes and steady flow systems.

UNIT II SECOND LAW OF THERMODYNAMICS AND CONCEPTS OF ENTROPY

L 9 T 3

Definition of Heat Engine and Reservoirs -- Kelvin-Planck and Clausius Statements of the Second Law - - Reversible and Irreversible Engines and processes -- Causes of Irreversibility -- Internal and External Irreversibility, heat pump and refrigerator, The Efficiency of a Carnot Cycle -- The Thermodynamic Temperature Scale -, Clausius theorem and third law of thermodynamics, Clausius Inequality --

Entropy -- A Property of A System -- The Entropy of A Pure Substance -- Entropy Change in Reversible Process -- Principle of Increase of Entropy, availability and irreversibility (theory only).

UNIT III PROPERTIES OF PURE SUBSTANCE

L 9 T 3

Properties of pure substance, thermodynamic properties of pure substance in solid, liquid and vapour phases, phase rule, Formation of steam and its thermodynamic properties, p-v, p-T, T-v, T-s, h-s diagrams. p-v-T surface. Use of Steam Table and Mollier Chart. thermodynamic properties of steam. Calculations of work done and heat transfer in non flow and flow processes. Determination of steam quality.

UNIT IV IDEAL AND REAL GASES, THERMODYNAMIC RELATIONS

L 9 T 3

Properties of Ideal gas- Ideal and real gas comparison- Equations of state for ideal and real gases- Reduced properties. Compressibility factor-.Principle of Corresponding states. –Generalized Compressibility Chart and its use-. Maxwell relations, Tds Equations, Difference and ratio of heat capacities, Joule-Thomson Coefficient, Clausius Clapeyron equation.

UNIT V PSYCHROMETRY

L 9 T 3

Psychrometric properties, Psychrometric charts. Property calculations of air vapour mixtures by using chart and expressions. Psychrometric process – adiabatic saturation, sensible heating and cooling, humidification, dehumidification, evaporative cooling and adiabatic mixing.

Total Number of hours: 60

Learning Resources

Text book

1. Chattopadhyaya, P. Engineering Thermodynamics, Oxford university press, New Delhi, 2016.
2. Cengel, 'Thermodynamics – An Engineering Approach' eighth Edition, Tata McGraw Hill, New Delhi, 2014.

Reference books

1. Sonntag, R.E., Borgnakke, C., and Van Wylen, G.J., Fundamentals of Thermodynamics, 6th ed., John Wiley, 2003.
2. Nag, P.K., "Engineering Thermodynamics", Tata McGraw-Hill, New Delhi, 2015.
3. Holman, J.P., "Thermodynamics", 4th Ed. McGraw-Hill, 2008.
4. Michael J Moran, Howard N. Shapiro, Daisie D. Boettner, Margaret B. Baily, "Fundamentals of Engineering Thermodynamics" 8th Edition, John Wiley & sons, 2014
5. Arora C.P, "Thermodynamics", Tata McGraw-Hill, New Delhi, 2004.

COURSE CODE U19ME303

L T P C

COURSE NAME FLUID MECHANICS AND MACHINERY

3 0 0 3

Pre-requisites subject: Engineering Physics and Transforms & Partial differential equations.

Course Outcomes

Upon completion of this course the students will be able to

- CO1** Apply mathematical knowledge to predict the properties and concept of pressure measurement.
- CO2** Analyze the fluid flow problems using continuity equation and Bernoulli’s equation with their applications.
- CO3** Distinguish laminar and turbulent flow through circular pipes and power transmission through pipes.
- CO4** Solve the real time problems with help of dimensional analysis by using Buckingham’s Π theorem.
- CO5** Analyze the performance of hydraulic turbines and pumps.

CO / PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
Programme Outcomes (POs) and Programme Specific Outcome (PSOs)														
COs, POs PSOs Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO – 1	3	-	1	3	-	3	3	2	-	3	-	3	3	3
CO – 2	3	3	3	-	1	3	3	-	3	1	-	2	3	2
CO – 3	-	2	3	3	3	2	3	1	2	3	3	3	2	3
CO – 4	3	3	3	2	3	1	-	3	3	3	3	2	2	2
CO - 5	2	3	2	3	3	3	2	3	3	2	3	3	3	3

Unit – I FLUID PROPERTIES AND PRESSURE MEASUREMENT L 9

Definitions – Fluid - Properties of fluids- mass density, specific weight, specific volume, specific gravity, viscosity, compressibility, vapor pressure, surface tension, cavitation and capillarity - Pressure measurement- manometry, buoyancy, stability of floating bodies, forces on submerged bodies.

Unit – II FLUID KINEMATICS AND DYNAMICS L 9

Types of fluid flow - application of continuity equation, Continuity equations in Cartesian coordinates. Euler’s equation of motion along streamline, Bernoulli’s equation, and its applications- Orifice meter, Venturimeter, Pitot tube.

Unit – III FLOW THROUGH PIPES L 9

Laminar flow through circular pipes – Hagen Poiseuille equation - Boundary layer concept- Turbulent flow through circular pipes - Darcy Weisbach equation – friction factor - Moody diagram - Energy losses, pipes in series and parallel - Power transmission through pipes.

Unit – IV DIMENSIONAL ANALYSIS

L 9

Need for dimensional analysis – methods of dimensional analysis – Buckingham's π theorem, Dimensionless parameters - application of dimensionless parameters. Models and Similitude - Model laws.

Unit – V HYDRAULIC TURBINES AND PUMPS

L 9

Hydraulic turbines-classification and working principle. Pelton wheel turbine -Francis turbine -Kaplan turbine- Velocity triangle-work done- Efficiencies- Performance calculations.

Centrifugal pumps- working principle – work done by the impeller – performance curves – Reciprocating pump- working principle – comparison.

Total Number of hours: 45**Learning Resources****Text Books**

1. Sukumar Pati., "Fluid Mechanics and Hydraulics Machines", Tata McGraw Hill publications (P) Ltd, New Delhi, 2015.
2. Bansal, R.K., Fluid Mechanics and Hydraulics Machines, (9th edition), Laxmi publications (P) Ltd, New Delhi, 2017.

Reference Books

1. C.S.P.Ojha, R.Berndtsson, P.N.Chandramouli., Fluid Mechanics and Machinery, Oxford University Press, New Delhi, 2010
2. Modi P.N. and Seth, S.M. "Hydraulics and Fluid Mechanics", Standard Book House 20th edition, New Delhi 2015.
3. Streeter, V. L. and Wylie E. B., "Fluid Mechanics", McGraw Hill Publishing Co. 2010.9th edition.
4. Kumar K. L., "Engineering Fluid Mechanics", Eurasia Publishing House(p) Ltd., New Delhi 2004.
5. Ramamritham. S, Hydraulics, Fluid Mechanics and Fluid Machines, Dhanpat Rai & Sons, Delhi, edition 2012.

COURSE CODE U19ME304

L T P C

COURSE NAME CONVENTIONAL AND SMART MANUFACTURING

3 0 0 3

Pre-requisites subject: Manufacturing Process

Course Outcomes

Upon completion of this course the students will be able to

- CO1** Acquire knowledge about principle of special machine tools and its operating mechanisms.
- CO2** Demonstrate the working of various bulb deformation processes involving drawing, forging, rolling, and extrusion process.
- CO3** Acquire knowledge and analyze the various sheet metal processes.
- CO4** Classify additive manufacturing process and identify suitable RP process for product manufacturing.
- CO5** Enhance and adopt smart manufacturing knowledge towards industry development.

CO / PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
Programme Outcomes (POs) and Programme Specific Outcome (PSOs)														
COs, POs PSOs Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO - 1	3	-	-	-	-	3	2	3	2	3	3	2	3	2
CO - 2	3	2	1	2	3	-	3	1	3	3	-	3	3	3
CO - 3	2	1	3	3	2	3	3	-	3	2	2	3	2	3
CO - 4	2	3	3	3	3	2	2	2	3	1	3	3	2	3
CO - 5	1	3	2	3	3	2	3	3	2	3	3	3	2	3

Unit – I SPECIAL MACHINE TOOLS

L 9

Construction, Types, Operations and mechanisms of Shaper, Planner, Slotter and Broaching. Operations: drilling –Reaming, Boring- Tapping. Milling operations-types of milling cutter. Gear: cutting, forming, milling, hobbing and gear shaping. Grinding: cylindrical grinding, surface grinding, Centreless grinding – honing, lapping and buffing.

Unit – II SHEET METAL PROCESSES

L 9

Sheet metal: characteristics-typical shearing operations-bending and drawing operations – stretch forming operations – formability of sheet metal – test methods–working principle and application of special forming processes –hydro forming - Rubber pad forming - Metal spinning-Introduction to Explosive forming - Magnetic pulse forming-peen forming - super plastic forming.

Unit – III BULK DEFORMATION PROCESSES

L 9

Hot and Cold working Process- Drawing Process: Wire drawing, Tube drawing, Metal Spinning, Embossing- Coining- **Forging Process:** Open and closed die forging- operations- Forging machine, **Rolling:** Type of rolling mills- Principle of rod and wire drawing – Tube drawing- Defects in rolling parts, **Extrusion:-** Principles of Extrusion – Types – Hot and Cold extrusion.

Unit – IV DIGITAL MANUFACTURING

L 9

Introduction, Classification, Fusion Deposition Modeling, Stereo-lithography, Solid Ground Curing, Selective Laser Sintering, 3D printers: Principle – process parameters – process details – machine details, Software's, Applications.

Unit – V SMART MANUFACTURING

L 9

Introduction, Industry 4.0, Internet of Things (IoT) for manufacturing, IoT enabling technologies, IoT design methodology, logical design, IoT physical devices. Cloud computing-introduction, Cloud services and platforms, Case studies: Industrial automation, Production Monitoring, Applications.

Total Number of hours: 45**Learning Resources****Text Book**

1. Mikell P Groover, " Principles of Modern Manufacturing" Wiley India Pvt Ltd. 2016.
2. S. Jeschke, C Brecher, H. Song and D.B Rawat, "Industrial Internet of Things: Cyber manufacturing Systems", Springer, 1st edition, 2013.
3. Pham D.T. & Dimov.S.S., "Rapid manufacturing", Springer-Verlag, London, 2001.

Reference Books

1. P.N. Rao, "Manufacturing Technology: Metal Cutting and Machine Tools, Volume 2"
2. Published by Tata McGraw-Hill Education Pvt. Ltd (2013)
3. B.L. Juneja,G.S. Sekhon, Nitin Seth, "Fundamentals of Metal Cutting and Machine Tools" Published by New Age International (P) Limited (2014)
4. P.C. Sharma, "A Text Book of Production Engineering", S. Chand and Company Ltd, revised edition, 2011.
5. Rajput R.K, 'A text book of Manufacturing Technology', Lakshmi Publications, 2007.
6. Ian Gibson, "Advanced Manufacturing Technology for Medical applications: Reverse Engineering, Software conversion and Rapid Prototyping", Wiley, 2006.

COURSE CODE U19ME305

L T P C

COURSE NAME INSTRUMENTATION AND CONTROL SYSTEMS

3 0 0 3

Pre-requisites subject: Physics for Mechanical Engineering

Course outcome:

Upon completion of this course the students will be able to

- CO1** Explain the fundamental elements of instrumentation, measurement and control systems.
- CO2** Measure the parameters and performance of transducers.
- CO3** Develop the measurement techniques used for mechanical systems.
- CO4** Apply control engineering techniques to the automatic control systems found in modern manufacturing, processing and transportation environments.
- CO5** Design the mechanical control system for automation.

CO / PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak Programme Outcomes (POs) and Programme Specific Outcome (PSOs)														
COs, POs PSOs Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO – 1	3	-	-	2	1	3	-	3	1	3	3	1	3	2
CO – 2	3	1	2	2	3	-	-	-	-	3	3	3	2	3
CO – 3	2	2	3	3	2	3	1	2	3	2	3	3	3	2
CO – 4	1	3	3	3	2	2	2	3	3	2	2	2	3	3
CO – 5	-	3	3	3	3	1	3	1	3	2	-	3	2	3

Unit – I MEASURING SYSTEM

L 9

General concepts of Mechanical measuring instruments – Elements of a measuring system
– Requirements of measuring instruments – Static and dynamic characteristics of measuring instruments – Errors in measurements - Loading effect and impedance matching- statistical analysis-Least square method- uncertainty analysis- Zero and first order system- step response and impulse response.

Unit – II TRANSDUCER ENGINEERING

L 9

Transducers and Sensors–Classification and types- Mathematical model of transducer-static and dynamic characteristics- resistive transducers- Inductive and capacitive transducers -Transducer Troubleshooting- special transducers-Smart sensors-Nano sensors.

Unit – III INDUSTRIAL INSTRUMENTATION

L 9

Measurement of vibrations – Accelerometer – Measurement of Low, Medium, and High pressures- Measurement of temperature: pyrometer, Fiber optics sensor for temperature measurement - Measurement of flow- hot wire anemometer – magnetic flow meter– ultrasonic meter. Measurement of displacement – Measurement of Force –Strain gauge, Load cells- Measurement of torque – Measurement of Speed – Case study assignments.

Unit – IV CONTROL SYSTEM

L 9

Introduction to Control systems – Open and Closed loop systems – servomechanisms. Transfer function: Block diagram reduction algebra, signal flow graphs – Pollution Control system- Basics of Controllers and response analysis- Problems.

Unit – V DESIGN OF AUTOMATION AND CONTROLS SYSTEM

L 9

Automated systems- introduction to systems –design of hydraulic and pneumatic control system controls- sequence operations- Applications of relays/switches- design of – electro pneumatics - Programmable controllers - Design of components for assembly - Cost considerations - programmable logic controllers - PLC languages- case studies.

Total Number of hours: 45**Learning Resources****Text Book**

1. Ernest O. Doebelin, Dhanesh N. Manik (2019) Doebelin's Measurement Systems: 7th Edition, McGraw-Hill; Seventh edition, ISBN-13: 978-9353168711.
2. Alan S. Morris, Reza Langari (2016) Measurement and Instrumentation: Theory and application, Academic Press, ISBN No. 978-0-12-3819604.

Reference Books

1. D Patranabis (2017) Transducers and Instrumentation, McGraw Hill education; 3 edition, ISBN-13: 978-0070699717
2. Arun K. Ghosh (2012) Introduction to measurements and instrumentation, PHI Learning Pvt. Ltd.
3. U.A.Bakshi A.V. Bakshi (2009) Measurements and instrumentation, Technical Publications, ISBN No. 9788184315295
4. Zoran Gajić, M. Lelic (2013) Modern control systems Engineering, Dover Publications.

COURSE CODE U19GE302

L T P C

COURSE NAME MANDATORY COURSE:

ENVIRONMENT AND CLIMATE SCIENCE

2 0 0 0

Course outcome:

Upon completion of this course the students will be able to

- CO1** Describe the importance of the acute need for environmental awareness and discuss significant aspects of natural resources like forests, water and food resources.
- CO2** Illustrate the concepts of an ecosystem and provide an overview of biodiversity and its conservation.
- CO3** Analyze the causes, effects of various environmental pollution and their appropriate remedial measures.
- CO4** Provide solutions to combat environmental issues like global warming, acid Rain, ozone layer depletion.
- CO5** Analyze the effect of climate change in various sectors and their remedial measures.

CO / PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak Programme Outcomes (POs) and Programme Specific Outcome (PSOs)														
COs, POs PSOs Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO – 1	3	2	-	-	-	2	2	-	-	-	-	-	-	-
CO – 2	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO – 3	3	2	-	-	-	2	2	-	-	-	-	-	-	2
CO – 4	3	2	-	-	-	2	2	-	-	-	-	-	-	2
CO - 5	3	2	-	-	-	2	2	-	-	-	-	-	-	2

Unit I INTRODUCTION TO ENVIRONMENTAL STUDIES AND NATURAL RESOURCES

L 6

Definition, Scope and Importance Forest Resources: - Use and over - exploitation, deforestation, Case Studies, Water Resources: - Use and Over-Utilization of Surface and ground water, Floods, Drought, Food Resources- Effects of Modern Agriculture, Fertilizer- Pesticide Problems–Role of an Individual in Conservation of Natural Resources.

Unit II ECOSYSTEMS AND BIODIVERSITY

L 6

Structure and Function of an Ecosystem– Energy Flow in the Ecosystem -Food Chains, Food Webs and Ecological Pyramids. Introduction to Biodiversity –Value of Biodiversity: Consumptive Use, Productive Use, Social, Ethical, Aesthetic and Option Values –India as a Mega-Diversity Nation -- Threats to Biodiversity: Habitat Loss, Poaching of Wildlife, Man-Wildlife Conflicts – Endangered and Endemic Species of India – Conservation of Biodiversity: In-Situ and Ex-Situ conservation of Biodiversity.

Unit III ENVIRONMENTAL POLLUTION

L 6

Definition – Causes, Effects and Control Measures of:-(A) Air Pollution(B) Water Pollution (C) Soil Pollution (D) Marine Pollution (E) Noise Pollution (F) Thermal Pollution, Solid Waste Management- Effects and Control Measures of Acid Rain,- Role of an Individual in Prevention of Pollution.

Unit IV FUNDAMENTALS OF CLIMATE CHANGE

L 6

Sustainable Development- - Climate Change-Causes and effects of Global Warming - Effect of global warming in food supply, plants, sea, coral reef, forest, agriculture, economy- Kyoto Protocol in reduction of greenhouse gases - Ozone Layer Depletion-mechanism, effects and control measures Montreal Protocol to protect ozone layer depletion -Rain Water Harvesting - .Effect of climate change due to air pollution Case study - CNG vehicles in Delhi.

Unit V EFFECT OF CLIMATE CHANGE

L 6

Fungal diseases in forests and agricultural crops due to climatic fluctuations - Growing energy needs - effect of climate change due to non-renewable energy resources. Renewable energy resources in the prevention of climatic changes- Effect of climatic changes in ground water table, garments, monuments, buildings, consumption of energy, agriculture and in electric power sector -Carbon credit - carbon footprint - disaster management -Role of an individual to reduce climate change.

Total Number of hours: 30

Learning Resources

Text Book

1. Miller, T.G. Jr., "Environmental Science", Wadsworth Pub. Co. 2018
2. Anubha Kaushik and Kaushik, "Environmental Science and Engineering" New Age International Publication, 4th Multicolour Edition, New Delhi, 2014.

Reference Books

1. S. Radjarejesri et al., "Environmental Science" Sonaversity, Sona College of Technology, Salem, 2018.
2. Masters, G.M., "Introduction to Environmental Engineering and Science", Pearson Education Pvt., Ltd., 2nd Edition, 2004.
3. Erach, B., "The Biodiversity of India", Mapin Publishing P.Ltd., Ahmedabad, India.
4. ErachBharucha, "Textbook of Environmental Studies for Undergraduate Courses", 2005, University Grands Commission, Universities Press India Private Limited, Hyderguda, Hyderabad – 500029.

COURSE CODE U19ME306

L T P C

COURSE NAME FLUID MECHANICS AND MACHINERY
LABORATORY

0 0 2 1

Course Outcomes

Upon completion of this course the students will be able to

CO1 Calibrate the various flow measuring instruments.

CO2 Analyze the energy losses occur in flow of fluid through pipes.

CO3 Analyze the performance of the various pumps and turbines (Pelton, Francis and Kaplan turbine).

CO / PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak Programme Outcomes (POs) and Programme Specific Outcome (PSOs)														
COs, POs PSOs Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO – 1	3	2	-	2	-	2	3	3	3	-	3	2	3	3
CO – 2	1	3	3	3	2	3	3	-	3	3	3	3	2	3
CO – 3	2	2	3	3	3	2	1	3	3	3	1	3	2	3

LIST OF EXPERIMENTS

1. Determination of the Coefficient of discharge of given Orifice meter.
2. Determination of the Coefficient of discharge of given Venturi meter.
3. Determination of friction factor for a given set of pipes.
4. Determination of minor losses for a given set of pipes.
5. Determination of velocity of air using pitot tube.
6. Conducting experiments and drawing the characteristic curves of Pelton wheel.
7. Conducting experiments and drawing the characteristics curves of Francis turbine.
8. Conducting experiments and drawing the characteristic curves of Kaplan turbine.
9. Conducting experiments and drawing the characteristic curves of centrifugal pump.
10. Conducting experiments and drawing the characteristic curves of Reciprocating pump.

List of Equipment's: (for a batch of 30 students)

1. Orifice meter setup.
2. Venturi meter setup.
3. Friction loss setup.
4. Fitting loss setup.
5. Pitot-tube setup.
6. Pelton wheel turbine setup.
7. Francis turbine setup.
8. Kaplan turbine setup.
9. Centrifugal pump.
10. Reciprocating pump.

Total Number of hours 30

COURSE CODE U19ME307

L T P C

COURSE NAME SPECIAL MACHINES LABORATORY

0 0 2 1

Pre-requisites subject: Manufacturing technology Laboratory

Course Outcomes

Upon completion of this course the students will be able to

- CO1** Perform various metal cutting operations to generate gears.
- CO2** Do grinding operations using commonly used machine tools.
- CO3** Demonstrate shaping and slotting operations using commonly used machine tools.

CO / PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
Programme Outcomes (POs) and Programme Specific Outcome (PSOs)														
COs, POs PSOs Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO – 1	3	2	-	2	2	3	3	3	3	3	3	2	2	3
CO – 2	3	2	3	3	2	-	3	-	3	3	-	3	2	2
CO – 3	-	3	2	3	3	1	-	2	3	2	3	3	3	3

LIST OF EXPERIMENTS

1. Exercises on Horizontal milling machine –gear generating.
2. Exercises on Vertical milling machine –key way generating.
3. Grinding of flat surface using surface grinder machine.
4. Grinding of cylindrical surfaces using cylindrical grinding machine.
5. Shaping operations- two or more Exercises (Round to square, Hexagonal Shape and dovetail)
6. Internal key way slotting in slotting machine.
7. Exercises on capstan or turret lathe and study of bar feed mechanism in turret lathe.

List of Equipment's: (for a batch of 30 students)

1. Turret and Capstan Lathes - 1 No
2. Horizontal Milling Machine - 1 No
3. Vertical Milling Machine - 1 No
4. Surface Grinding Machine - 1 No
5. Cylindrical Grinding Machine - 1 No
6. Shaper - 2 Nos.
7. Slotter - 1 No

Total Number of hours 30

Semester-III	U19 GE301- SOFT SKILLS AND APTITUDE – I	L	T	P	C	Marks
		0	0	2	1	100
Course Outcomes						
At the end of the course the student will be able to:						
1. Demonstrate capabilities in specific soft-skill areas using hands-on and/or case-study approaches						
2. Solve problems of greater intricacy in stated areas of quantitative aptitude and logical reasoning						
3. Demonstrate higher levels of verbal aptitude skills in English with regard to specific topics						
1.Soft Skills	Demonstrating soft-skill capabilities with reference to the following topics:					
	<ul style="list-style-type: none"> a. Attitude building b. Dealing with criticism c. Innovation and creativity d. Problem solving and decision making e. Public speaking f. Group discussions 					
2. Quantitative Aptitude and Logical Reasoning	Solving problems with reference to the following topics:					
	<ul style="list-style-type: none"> a. Vedic Maths: Fast arithmetic, multiplications technique, Criss cross, Base technique, Square root, Cube root, Surds, Indices, Simplification. b. Numbers: Types, Power cycle, Divisibility, Prime factors & multiples, HCF & LCM, Remainder theorem, Unit digit, highest power. c. Averages: Basics of averages and weighted average. d. Percentages: Basics of percentage and Successive percentages. e. Ratio and proportion: Basics of R &P, Alligations, Mixture and Partnership. f. Profit ,Loss and Discount: Basic & Advanced PLD g. Data Interpretation: Tables, Bar diagram, Venn diagram, Line graphs, Pie charts, Caselets, Mixed varieties, Network diagram and other forms of data interpretation. h. Syllogism: Six set syllogism using Venn diagram and tick and cross method 					
3. Verbal Aptitude	Demonstrating English language skills with reference to the following topics:					
	<ul style="list-style-type: none"> a. Verbal analogy b. Tenses c. Prepositions d. Reading comprehension e. Choosing correct / incorrect sentences f. Describing pictures g. Error spotting 					

S. Ant

Department of Placement Training
Sona College of Technology,
Salem-636 005.

1

MANDATORY COURSES

Sona College of Technology, Salem

Department of Sciences (Chemistry)

COURSE CODE **U19GE302** **L T P C**
COURSE NAME **MANDATORY COURSE:**
ENVIRONMENT AND CLIMATE SCIENCE **2 0 0 0**

Course outcome:

Upon completion of this course the students will be able to

- CO1** Describe the importance of the acute need for environmental awareness and discuss significant aspects of natural resources like forests, water and food resources.
- CO2** Illustrate the concepts of an ecosystem and provide an overview of biodiversity and its conservation.
- CO3** Analyze the causes, effects of various environmental pollution and their appropriate remedial measures.
- CO4** Provide solutions to combat environmental issues like global warming, acid Rain, ozone layer depletion.
- CO5** Analyze the effect of climate change in various sectors and their remedial measures.

CO / PO, PSO Mapping														
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
Programme Outcomes (POs) and Programme Specific Outcome (PSOs)														
COs, POs PSOs Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO - 1	3	2				2	2							-
CO - 2	2	-												-
CO - 3	3	2				2	2							2
CO - 4	3	2				2	2							2
CO - 5	3	2				2	2							2

Unit I INTRODUCTION TO ENVIRONMENTAL STUDIES AND NATURAL RESOURCES L 6

Definition, Scope and Importance Forest Resources: - Use and over - exploitation, deforestation, Case Studies, Water Resources: - Use and Over-Utilization of Surface and ground water, Floods, Drought, Food Resources- Effects of Modern Agriculture, Fertilizer- Pesticide Problems--Role of an Individual in Conservation of Natural Resources.

Unit II ECOSYSTEMS AND BIODIVERSITY L 6

Structure and Function of an Ecosystem- Energy Flow in the Ecosystem -Food Chains, Food Webs and Ecological Pyramids. Introduction to Biodiversity -Value of Biodiversity: Consumptive Use, Productive Use, Social, Ethical, Aesthetic and Option Values -India as a Mega-Diversity Nation -- Threats to Biodiversity: Habitat Loss, Poaching of Wildlife, Man-Wildlife Conflicts - Endangered and Endemic Species of India - Conservation of Biodiversity: In-Situ and Ex-Situ conservation of Biodiversity.

Unit III ENVIRONMENTAL POLLUTION L 6

29.08.2022

B.E. / B.Tech. Regulations 2019

Definition – Causes, Effects and Control Measures of:-(A) Air Pollution(B) Water Pollution (C) Soil Pollution (D) Marine Pollution (E) Noise Pollution (F) Thermal Pollution, Solid Waste Management- Effects and Control Measures of Acid Rain,- Role of an Individual in Prevention of Pollution.

Unit IV FUNDAMENTALS OF CLIMATE CHANGE

L 6

Sustainable Development- - Climate Change-Causes and effects of Global Warming - Effect of global warming in food supply, plants, sea, coral reef, forest, agriculture, economy- Kyoto Protocol in reduction of greenhouse gases - Ozone Layer Depletion-mechanism, effects and control measures Montreal Protocol to protect ozone layer depletion -Rain Water Harvesting - .Effect of climate change due to air pollution Case study - CNG vehicles in Delhi.

Unit V EFFECT OF CLIMATE CHANGE

L 6

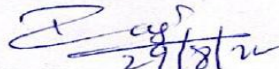
Fungal diseases in forests and agricultural crops due to climatic fluctuations - Growing energy needs - effect of climate change due to non-renewable energy resources. Renewable energy resources in the prevention of climatic changes- Effect of climatic changes in ground water table, garments, monuments, buildings, consumption of energy, agriculture and in electric power sector - Carbon credit - carbon footprint - disaster management -Role of an individual to reduce climate change.

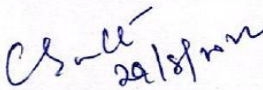
Total Number of hours: 30**Learning Resources****Text Book:**

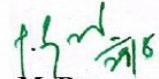
1. Miller, T.G. Jr., "Environmental Science", Wadsworth Pub. Co. 2018
2. Anubha Kaushik and Kaushik, "Environmental Science and Engineering" New Age International Publication, 4th Multicolour Edition, New Delhi, 2014.

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1. S. Radjarejesri et al., "Environmental Science" Sonaversity, Sona College of Technology, Salem, 2018.
2. Masters, G.M., "Introduction to Environmental Engineering and Science", Pearson Education Pvt., Ltd., 2nd Edition, 2004.
3. Erach, B., "The Biodiversity of India", Mapin Publishing P.Ltd., Ahmedabad, India.
4. ErachBharucha, "Textbook of Environmental Studies for Undergraduate Courses", 2005, University Grands Commission, Universities Press India Private Limited, Hyderguda, Hyderabad - 500029.


Dr. M. Raja
Course Coordinator / Sciences


Dr. C. Shanthi
HOD / Sciences


Dr. M. Renuga
Chairperson BOS,
Science and Humanities

29.08.2022

B.E. / B.Tech. Regulations 2019

Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for B.E/B.Tech. Semester IV Regulations 2019
Branch: Mechanical Engineering

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit	Total Contact Hours
Theory							
1	U19ME401	Thermal Engineering	3	0	0	3	45
2	U19ME402	Strength of Materials	3	0	0	3	45
3	U19ME403	Engineering Materials and Metallurgy	3	0	0	3	45
4	U19ME404	Object Oriented Programming for Mechanical Engineering	3	0	0	3	45
5	U19ME405	Kinematics of Machines	3	0	0	3	45
6	U19GE403	Mandatory Course: Essence of Indian Traditional Knowledge	2	0	0	0	30
Practical							
7	U19ME406	Thermal Engineering Laboratory	0	0	2	1	30
8	U19ME407	Strength of Materials Laboratory	0	0	2	1	30
9	U19ME408	Object Oriented Programming Laboratory for Mechanical Engineering	0	0	2	1	30
10	U19GE401	Soft Skills and Aptitude - II	0	0	2	1	30
Total Credits						19	

Approved By

Chairperson, Mechanical Engineering BoS
Dr.D.Senthilkumar

Member Secretary, Academic Council
Dr.R.Shivakumar

Chairperson, Academic Council & Principal
Dr.S.R.R.Senthil Kumar

Copy to:-
HOD/Mechanical Engineering, Fourth Semester BE Mechanical Students and Staff, COE

COURSE CODE **U19ME401**
COURSE NAME **THERMAL ENGINEERING**

L T P C
 3 0 0 3

Pre-Requisites Subject: Engineering Physics, Engineering Mathematics, Python Programming and Engineering Thermodynamics.

Course Outcomes

Upon completion of this course the students will be able to

- CO1** Calculate the mean effective pressure and air standard efficiency of various gas power cycles.
- CO2** Test the performance of Internal Combustion engines under different load conditions.
- CO3** Estimate steam flow rate through nozzle and analyze steam power cycle.
- CO4** Determine various performance characteristics of air compressors.
- CO5** Determine the COP of vapor compression refrigeration systems and solve cooling load estimation problems with python programming.

CO / PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
Programme Outcomes (POs) and Programme Specific Outcome (PSOs)														
Cos, POs, PSOs Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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CO-2	3	3	3	2	3	3	2	3	2	3	2	3	3	3
CO-3	2	3	2	3	3	-	3	1	3	1	3	2	2	2
CO-4	3	-	3	3	-	3	3	2	1	-	3	2	2	3
CO-5	2	2	3	3	3	1	3	-	3	3	3	3	3	3

Unit – I GAS POWER CYCLES

L 9

Otto, Diesel, Dual, Stirling, Brayton cycles. P-V and T-S diagram, Calculation of mean effective pressure and air standard efficiency, comparison of Otto, diesel and dual cycles.

Unit – II INTERNAL COMBUSTION ENGINES

L 9

Classification of I.C engines, four stroke and two stroke cycle engines, combustion phenomenon and knocking in SI and CI engine, Valve and port timing diagrams – super-charging - Ignition system and fuel injection system. Cooling and lubrication system. Engine tests - performance, heat balance, and retardation - Morse test.

Unit – III NOZZLES AND STEAM POWER CYCLES

L 9

Steam nozzles- flow through steam nozzles, effect of friction, critical pressure ratio and super saturated flow. Steam power cycle-, Rankine, Reheat and regeneration cycle.

Unit – IV AIR COMPRESSORS

L 9

Classifications of compressors - Reciprocating air compressor - performance characteristics, effect of clearance volume, free air delivery and displacement, intercooler, –Description of Rotary compressor, vane, centrifugal and axial compressors.

Unit – V REFRIGERATION AND AIR CONDITIONING

L 9

Fundamentals of refrigeration – COP - Vapour compression refrigeration system - cycle, p-h chart, Vapour absorption system- comparison, properties of refrigerants. Fundamentals of air conditioning system, types and working principles. Python programming for solving cooling load estimation in air conditioning design (simple problems).

Total Number of hours: 45**Learning Resources****Text Books**

1. R.K.Rajput, "Thermal Engineering" , Laxmi Publications, New Delhi, Sixth edition, 2005
2. Kothandaraman C.P, Domkundwar and A.V. Domkundwar, "A course in Thermal Engineering", Dhanpat Rai & Sons, Fifth Edition, 2002.
3. Ashok Namdev Kamthane, Amit Ashok Kamthane, "Programming and Problem Solving with Python", Mc-Graw Hill Education, 2018.

Reference Books

1. Sarkar B.K., "Thermal Engineering", Tata McGraw-Hill, New Delhi New Delhi, 2001
2. Arora C.P., "Refrigeration and Air conditioning", Tata McGraw-Hill, New Delhi, 2000.
3. Holman J.P. "Thermodynamics", McGraw-Hill, 1985.
4. V.Ganesan, "Internal Combustion Engines", Tata McGraw-Hill, New Delhi, 2008.
5. Robert Sedgewick, Kevin Wayne, Robert Dondero, "Introduction to Programming in Python: An Inter-disciplinary Approach", Pearson India Education Services Pvt. Ltd., 2016.

Pre-requisite subjects: Engineering Physics, Engineering Mechanics, Python Programming

Course Outcomes

Upon completion of this course the students will be able to

- CO1** Categorize the stresses and strains for various engineering components with different loading conditions.
- CO2** Determine the effect of the two-dimensional stresses under various loading combinations on structural parts and thin cylinders.
- CO3** Construct the shear force and bending moment diagrams for simply supported, cantilever and over hanging beams.
- CO4** Analyze pure torsion on solid and hollow circular shafts and Design of Leaf and closed coil helical springs.
- CO5** Evaluate slope and deflection of beams and buckling of columns using analytical methods and python programming.

CO / PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
Programme Outcomes (POs) and Programme Specific Outcome (PSOs)														
COs, POs PSOs Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO – 1	3	3	2	2	1	2	2	2	2	3	3	3	3	3
CO – 2	3	3	2	2	1	2	2	2	2	3	3	3	3	3
CO – 3	3	3	2	2	1	2	2	2	2	3	3	3	3	3
CO – 4	3	3	2	2	1	2	2	2	2	3	3	3	3	3
CO - 5	3	3	2	2	1	2	2	2	2	3	3	3	3	3

Unit – I STRESS, STRAIN AND DEFORMATION OF SOLIDS

L 9

Simple stress and strain – Stresses and strains due to axial force - Stress-strain curve – Hooke’s law - Factor of safety – Stepped shafts – Uniformly varying sections – Stresses in composite sections - Temperature stresses – Poisson’s ratio - elastic constants.

Unit – II ANALYSIS OF STRESSES IN TWO DIMENSIONS

L 9

State of stresses at a point – Normal and tangential stresses on inclined planes - Principal planes and stresses – Plane of maximum shear stress - Mohr’s circle for biaxial stresses –Hoop and longitudinal stresses in thin cylinders and shells – under internal pressure – deformation of thin cylinders and shells.

Unit – III BEAMS - LOADS AND STRESSES

L 9

Beams – types of supports – simple and fixed, types of load – concentrated, uniformly distributed, varying distributed load, combination of above loading. Bending moment, shear force diagram for simply supported, cantilever and over hanging beams – Point of contra flexure. Introduction to Theory of simple bending.

Unit – IV TORSION IN SHAFTS AND SPRINGS

L 9

Analysis of torsion of circular bars – Shear stress distribution – Bars of Solid and hollow circular section – Stepped shaft – Twist and torsion stiffness. Springs- Classification – Leaf springs, closed coil helical springs - Application of various springs – Maximum shear stress in spring – Deflection of helical coil springs under axial loads.

Unit – V DEFLECTION OF BEAMS

L 9

Deflection of beams – double integration method – Macaulay's method – slope and deflection using moment area method. Columns: Buckling of long columns due to axial load - Equivalent length of a column – Euler's and Rankine's formulae for columns of different end conditions –Slenderness ratio. Introduction to Python- Write a Python program to find slope and deflection of Beams.

Total Number of hours: 45**Learning Resources****Text Books**

1. SS Rattan, "Strength of Materials", McGraw Hill Education (India) Private Limited. Chennai, Third Edition, 2017.
2. R K Bansal, "A text book of Strength of Materials", Lakshmi Publications (P) Limited, New Delhi, Sixth Edition, 2018.
3. R K Rajput, "Strength of Materials", S Chand & Co., New Delhi, Sixth Edition 2018.

Reference books

1. Nash W.A, "Theory and problems in Strength of Materials", Schaum Outline Series, McGraw-Hill Book Co, New York, 1995.
2. Singh D.K "Mechanics of Solids" Pearson Education 2002.
3. Ryder G.H, "Strength of Materials", Macmillan India Ltd., Third Edition, 2002.
4. Popov E.P, "Engineering Mechanics of Solids", Prentice-Hall of India, New Delhi, Second Edition 2012.
5. Robert L Mott and Joseph A. Untener, "Applied Strength of Materials", CRC Press, Sixth Edition, 2016.
6. Nagar Sandeep. Introduction to Python: For Scientists and Engineers, independently published (2016)
7. Robert Sedgewick, Kevin Wayne, Robert Dondero, Introduction to Programming in Python: An Inter- disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016
8. Opensource documentation at <https://docs.python.org/3/library/index.html>

COURSE CODE U19ME403

L T P C

COURSE NAME ENGINEERING MATERIALS AND METALLURGY

3 0 0 3

Pre-requisites subjects: Chemistry for Mechanical Engineering, Physics for mechanical engineering.

COURSE OUTCOME:

Upon completion of this course the students will be able to

- CO1** Discuss constitutions of alloys with their formation reactions of solid solutions and phase diagrams.
- CO2** Analyze the various heat treatments process and different kinds of heat treatment diagrams for real time applications.
- CO3** Compare the Various ferrous & non-ferrous metals and its various alloys in the engineering scope.
- CO4** Discuss the various non-metallic materials with its properties and applications.
- CO5** Test the mechanical properties of various materials by different testing methods and identify suitable material for emerging products.

CO / PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
Programme Outcomes (POs) and Programme Specific Outcome (PSOs)														
COs, POs PSOs Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO – 1	3	1	2	1	2	3	3	1	1	3	2	3	3	3
CO – 2	3	1	2	1	2	3	3	1	1	3	2	3	3	3
CO – 3	3	2	2	1	2	3	3	2	1	3	2	3	3	3
CO – 4	3	2	2	1	2	3	3	2	1	3	2	3	3	3
CO – 5	3	2	2	1	2	3	3	1	2	3	3	3	2	2

Unit I CONSTITUTION OF ALLOYS AND PHASE DIAGRAMS

L 9

Constitution of alloys – Solid solutions, substitutional and interstitial – phase diagrams, Isomorphous, eutectoid, eutectic, peritectic, and peritectoid reactions, imperfections in solids: vacancies, interstitials, linear defects, edge and screw dislocations, interfacial defects, Equilibrium diagram- Iron – Iron carbon.

Unit II HEAT TREATMENT

L 9

Diffusion-steady-state and non-steady-state, Isothermal transformation diagrams – cooling curves superimposed on I.T diagram- CCR. Full annealing, recrystallization and spheroidising –normalizing, hardening, Jominy end quench test –Austempering, martempering – case hardening - carburizing, nitriding, cyaniding, carbonitriding, flame and induction hardening.

Unit III FERROUS AND NONFERROUS METALS

L 9

Effect of alloying elements on steel (Mn, Si, Cr, Mo, V, Ti& W) - stainless and tool steels- HSLA - maraging steels – Cast Irons - Grey, White, malleable, spheroidal graphite, alloy cast irons, Copper and Copper alloys - Brass, Bronze and Cupronickel – Aluminum and Al alloys – Bearing alloys.

Unit IV NON-METALLIC MATERIALS

L 9

Polymers – types of polymer, commodity and engineering polymers – Properties and applications of PE, PP, PS, PVC, PMMA, PET, PC, PA, ABS, PI, PAI, PPO, PPS, PEEK,PTFE, Polymer Composites -particle and fibre reinforced plastics. Ceramics, Cermets, Glass (amorphous) and Carbon Products.

Unit V TESTING AND THE METHODOLOGY OF MATERIAL SELECTION

L 9

Mechanism of plastic deformation, slip and twinning, Types of fracture, Corrosion and Degradation of Materials -Testing of materials under tension, compression and shear loads, Hardness tests (Brinell, Vickers and Rockwell), Impact test - Izod and Charpy, Fatigue and creep tests. Selection of Materials: part and material requirements- material system- list candidate materials- properties of requirements- select best match and specify it- case histories.

Total Number of hours: 45**Learning Resources****Text books:**

1. O.P. Khanna, A text book of Materials Science and Metallurgy, Khanna Publishers, 2014.
2. Kenneth G.Budinski and Michael K.Budinski "Engineering Materials properties and selection" Pearson India Education Services Pvt Ltd, 9 edition, 2017.
3. William D.Callister,Jr and David G.Rethwisch " Materials science and Engineering, An introduction" Wiley, 10th Edition, 2020.

Reference books:

1. R.K.Rajput "Engineering Materials & Metallurgy" S Chand Publications. 2006.
2. Sydney H.Avner "Introduction to Physical Metallurgy" McGraw Hill Book Company, 2007.
3. Zainul Huda, Robert Bulpett "Materials Science and Design for Engineers" Trans Tech Publications Limited, 2012.
4. T. DebRoy, H. K. D. H. Bhadeshia "Innovations in Everyday Engineering Materials" Springer International Publishing. 2021.

COURSE CODE U19ME404

L T P C

COURSE NAME OBJECT ORIENTED PROGRAMMING FOR
MECHANICAL ENGINEERING

3 0 0 3

Course Outcomes

Upon completion of this course the students will be able to

- CO1** Demonstrate the use of various OOPs concepts in connection with C++.
- CO2** Describe arrays, function arguments and utilization of constructors and destructors.
- CO3** Write C++ program to solve real world problem with code reusability through inheritance.
- CO4** Write C++ programs for various applications with file handling.
- CO5** Illustrate the various templates and applications of exceptional handling.

CO / PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
Programme Outcomes (POs) and Programme Specific Outcome (PSOs)														
COs, POs PSOs Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO - 1	3	2	2	2	2	2	-	2	1	1	-	-	1	3
CO - 2	3	3	3	3	3	2	1	2	2	3	-	-	2	3
CO - 3	3	3	3	3	3	3	3	3	3	3	1	2	2	3
CO - 4	3	3	3	2	3	2	3	2	2	2	1	2	2	3
CO - 5	3	3	2	1	3	1	1	2	1	1	-	2	1	3

Unit – I INTRODUCTION TO OOP'S

L 9

Overview of C - Basic concepts and benefits of OOP - Structure of C++ program - Tokens-Keywords - Identifiers - constants - Data types - Basic, User defined, Derived - Reference variables - Scope resolution operator - Type casting - Function Prototyping - call by reference, return by reference - Inline function - Default arguments - Function overloading. Solve problems of Projectile's, Centroid of symmetrical, T - Section and Principal stresses by using user defined function.

Unit – II CLASSES AND OBJECTS

L 9

Class specification - Access qualifiers - Static data members and member functions - Array of objects - Objects as function arguments - Friend functions - Returning objects - Local classes -Constructors - Destructors - Operator Overloading: Operator function - Overloading unary and binary operator - Overloading the operator using friend function. Program for inventory management of Hydraulic pump, Air compressor and Electric vehicle industries.

Unit – III INHERITANCE AND POINTERS

L 9

Derived classes - Single Inheritance - Multiple Inheritance - Multi level inheritance - Hierarchical Inheritance - Hybrid Inheritance - Constructors in derived classes. Pointers - Pointers to objects - this pointer - Virtual functions. Program for vehicles production management of an automobile industry.

Unit – IV MANAGING CONSOLES AND WORKING WITH FILES

L 9

Stream classes - Formatted I/O - I/O Manipulators - User defined manipulators File handling - File pointer and manipulation - Sequential and random access - Error handling.

Unit – V TEMPLATES AND EXCEPTION HANDLING

L 9

Function templates, overloaded function templates, user defined template arguments, class templates. Exception Handling: Exception handling mechanism, multiple catch, nested try, re-throwing the exception.

Total Number of hours: 45**Learning Resources****Text Books:**

1. E. Balagurusamy, "Object Oriented Programming with C++", Tata McGraw Hill, Sixth Edition, 2013.

Reference Books:

1. K.S. Easwarakumar, " Object Oriented Data Structures Using C++", Vikas Publication House Pvt Ltd, First Edition, 2000.
2. Hubbard John, "Programming with C++" , Tata McGraw Hill, 2000.
3. Robert Lafore, "Object Oriented Programming in Turbo C++", Galgotia Publications, 2006.
4. K. R.Venugopal, Rajkumar, T.Ravishankar, "Mastering C++", Tata McGraw Hill, 2007.
5. B.Trivedi, "Programming with ANSI C++", Oxford University Press, 2007.
6. Bjarne Stroustrup, "The C++ Programming Language", Pearson Education, Fourth Edition, 2013.

COURSE CODE U19ME405

L T P C

COURSE NAME KINEMATICS OF MACHINES

3 0 0 3

Pre-requisites subject: Engineering Mechanics, Problem Solving using Python Programming

Course outcome:

Upon completion of this course the students will be able to

- CO1** Apply Kutzbach and Gruebler’s criterion, Grashoff’s law to solve problems in various mechanisms using python.
- CO2** Determine the displacement, velocity, and acceleration in simple mechanisms.
- CO3** Construct displacement diagrams and cam profile for radial cam.
- CO4** Design the simple, compound and epicyclic geartrains.
- CO5** Synthesize a four-bar mechanism and analyze the characteristics of robot arm kinematics.

CO / PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
Programme Outcomes (POs) and Programme Specific Outcome (PSOs)														
COs, POs PSOs Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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CO – 4	3	3	3	3	3	2	1	1	1	1	1	2	3	3
CO – 5	3	3	3	3	3	2	1	2	1	1	1	3	3	3

Unit – I BASICS OF MECHANISMS

L 9

Basic concepts of Link, Kinematic pair, Kinematic chain, Mechanism, Machine, Degree of Freedom, Kutzbach and Grubler’s criterion and Grashoff’s law- Degree of freedom calculation using python programming - Kinematic Inversions of four bar chain and slider crank chain - Mechanical Advantage - Transmission angle. Description of common Mechanisms – Single, Double and Offset slider mechanism. Straight line Mechanisms (Exact & Approximate Straight line).

Unit – II KINEMATICS OF LINKAGE MECHANISMS

L 9

Analysis of simple mechanisms (single slider crank mechanism, four bar mechanism) - Graphical methods for displacement, velocity and acceleration polygons; Coincident points – Coriolis acceleration. Velocity analysis using instantaneous centers of simple mechanisms (Single slider crank mechanism and four bar mechanism).

Unit – III KINEMATICS OF CAM MECHANISMS

L 9

Classifications of cam and follower – Displacement, Velocity & Acceleration diagram – Follower Motion (Uniform Velocity Motion, Simple Harmonic Motion, Uniform Acceleration and Retardation motion, Cycloidal motions) – Graphical construction of displacement, Velocity & Acceleration diagram and cam profile for a radial cam - Pressure angle and undercutting.

Unit – IV GEARS AND GEAR TRAINS

L 9

Classification of gears – Gear tooth terminology – involute tooth profile. Fundamental Law of toothed gearing and involute gearing – Length of path of contact and contact ratio - Interference and undercutting – Nonstandard gear teeth – helical, bevel, worm, rack and pinion gears (basics only). Gear trains – Simple, compound and Epicyclic gear trains.

Unit – V SYNTHESIS OF MECHANISMS AND ROBOT ARM KINEMATICS L 9

Classification of synthesis – type, dimension, number, Synthesis of four bar mechanism -Chebyshev Method. Robot Arm kinematics – Denavit - Hartenberg Parameters - Forward and inverse kinematics of a two dimensional 2 degree of freedom manipulators (type RR).

Total Number of hours: 45**Learning Resources****Text Book:**

1. Robert L. Norton, "Kinematics and Dynamics of Machinery", Tata McGraw-Hill, 2010. ISBN: 9789351340201
2. K.S. Fu, R.C Gonzalez, "Robotics control, sensing, Vision, and Intelligence", Tata McGraw-Hill, 2016, ISBN-13: 978-0-07-026510-3.
3. Reema Thareja, Problem Solving and Programming with Python: With Free Access to Coding Simulator, Oxford University Press, 2018, ISBN-13: 978-0-19-948949-7.

Reference Books:

1. Rao J.S and Dukkupati R.V, "Mechanism and Machine Theory", Wiley-Eastern Ltd., New Delhi, 2nd Edition, 1992, ISBN-13: 978-8122404265.
2. Sadhu Singh, "Theory of Machines", Pearson Education, New Delhi, 3rd Edition, 2011, ISBN-13: 978-8131760697.
3. S.S.Rattan, "Theory of Machines & Mechanisms", Tata Mcgraw hill publishers, 4th Edition, 2014, ISBN-13: 978-9351343479.
4. Uicker J.J.,Pennock G.R., Shigley J.E., "Theory of Machines and Mechanisms" (Indian Edition), Oxford University Press, 2014, ISBN-13: 978-0199454167.
5. John Hannah and Stephens R.C, "Mechanics of Machines", Viva Low-Prices, Student Edition, 1999.
6. P.L.Ballaney, "Theory of Machines", Khanna publishers, 23rd Edition, 2003, ISBN 817409122X, 9788174091222.
7. Thomas Bevan, "Theory of Machines", CBS Publishers and Distributors, 3rd Edition, 2005, ISBN-13: 978-8123908748.
8. Ghosh A and A.K.Mallick, "Theory of Mechanisms and Machines", Affiliated East- West Pvt. Ltd., New Delhi, 2008, ISBN-13: 978-8185938936.
9. Ramamurti,V., "Mechanism and Machine Theory", Second Edition, Narosa Publishing House, New Delhi, 3rd Edition, 2010, ISBN: 978-81-7319-892-2.

COURSE CODE U19ME406

L T P C

COURSE NAME THERMAL ENGINEERING LABORATORY

0 0 2 1

Pre-requisites subject: Engineering thermodynamics and Thermal engineering.

Course Outcomes

Upon completion of this course the students will be able to

- CO1** Identify components and experience the function of each component of Internal combustion engine and analyze the suitability of fuels for engines.
- CO2** Compare the volumetric efficiency of IC engines and air compressors under various delivery pressures.
- CO3** Determine the COP of refrigeration and air conditioning systems for the given set of conditions.

CO / PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak Programme Outcomes (POs) and Programme Specific Outcome (PSOs)														
COs, POs PSOs Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO – 1	3	2	-	2	-	2	3	3	3	-	3	2	3	3
CO – 2	1	3	3	3	2	3	3	-	3	3	3	3	2	3
CO – 3	2	2	3	3	3	2	1	3	3	3	1	3	2	3

List of Experiments:

1. Valve Timing and Port Timing Diagrams.
2. Performance Test on 4-stroke Diesel Engine.
3. Heat Balance Test on 4-stroke Diesel Engine.
4. Retardation Test to find Frictional Power of a Diesel Engine.
5. Determination of Calorific value of Fuel using Bomb Calorimeter.
6. Determination of Viscosity using Red Wood Viscometer.
7. Determination of Flash Point and Fire Point.
8. Performance test on reciprocating air compressor.
9. Determination of COP of a Refrigeration system.
10. Determination of COP of an air conditioning system.
11. Demo on Morse Test on Multi cylinder Petrol Engine.

List of Equipment's: (for a batch of 30 students)

1. Single Cylinder 4-Stroke 5 HP Kirloskar Diesel Engines with Eddy Current Dynamometer.
2. Single Cylinder 4-Stroke 5 HP Kirloskar Diesel Engine With Electrical Loading.
3. Single Cylinder 4-Stroke 5 HP Kirloskar Diesel Engine With Mechanical Loading.
4. Multi-cylinder 4-Stroke Isuzu Petrol Engine with Hydraulic Dynamometer and Exhaust Gas Calorimeter.
5. Twin Cylinder 4-Stroke Texvel Diesel Engine with Bulb Loading and Exhaust Gas Calorimeter.
6. Cut Section Model of Actual Single Cylinder 4-Stroke Petrol Engine.
7. Cut Section Model of Actual Single Cylinder 4-Stroke Diesel Engine.
8. Section Model of Actual Single Cylinder 2-Stroke Petrol Engine.
9. Two Stage Air Compressor Test Rig.
10. Flash and Fire Point Apparatus.
11. Red Wood Viscometer.
12. Refrigeration Test Rig.
13. Air Conditioning Test Rig.
14. Bomb Calorimeter.

Total Number of hours: 30

Course Outcomes

Upon completion of this course the students will be able to

- CO1** Determine the compressive strength and tensile strength of various engineering.
- CO2** Calculate various mechanical properties of materials using appropriate testing machines.
- CO3** Analyze the real time bending moments for different beams.

CO / PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak Programme Outcomes (POs) and Programme Specific Outcome (PSOs)														
COs, POs PSOs Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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CO – 2	3	3	2	2	1	2	2	2	2	3	3	3	3	3
CO – 3	3	3	2	2	1	2	2	2	2	3	3	3	3	3

List of Experiments:

1. Tension test on MS rod.
2. Compression test – Bricks & Concrete cubes.
3. Double shear test.
4. Deflection test – Cantilever & Simply supported beam.
5. Impact test – Charpy & Izod.
6. Hardness test on various materials (Vickers, Rockwell & Brinell).
7. Tests on spring – Tension & Compression.
8. Study of Fatigue test of metallic materials.
9. Torsion test of metallic materials.
10. Study of Non –destructive testing (NDT) on materials.
11. Micro hardness test on coated and hardened samples.

List of Equipment’s (for a batch of 30 students)

1. Universal testing machine.
2. Compression testing machine.
3. Shear testing machine.
4. Deflection testing machine.
5. Rockwell hardness tester.
6. Brinell hardness tester.
7. Vickers hardness tester.
8. Fatigue testing machine.
9. Impact testing machine.
10. Ultrasonic pulse velocity.
11. Vickers micro hardness tester.

Total Number of hours 30

COURSE CODE U19ME408

L T P C

COURSE NAME OBJECT ORIENTED PROGRAMMING LABORATORY FOR MECHANICAL ENGINEERING

0 0 2 1

Course Outcomes

Upon completion of this course the students will be able to

- CO1** Design and develop programs using the concept of classes, static members and constructors
- CO2** Apply polymorphism using operator overloading, virtual functions and inheritance.
- CO3** Develop file handling, exception handling and generic programming.

CO / PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
Programme Outcomes (POs) and Programme Specific Outcome (PSOs)														
COs, POs PSOs Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO – 1	2	2	3	1	3	1	1	1	3	3	-	2	2	3
CO – 2	3	1	3	1	3	3	2	3	3	3	1	3	2	3
CO – 3	3	2	3	1	3	3	2	3	3	3	1	3	2	3

List of Experiments:

1. A projectile is launched at an angle θ and speed of V_0 . Write a C++ program to find the projectile's travel time, maximum travel distance and maximum height. The projectile's travel time t_{travel} , maximum travel distance x_{max} , and maximum height h_{max} are given by :

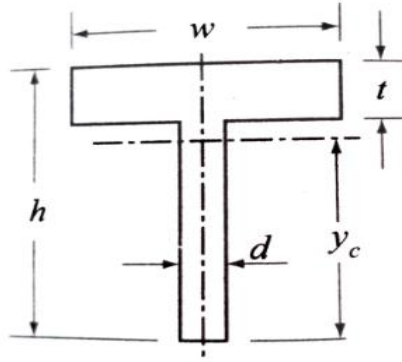
$$t_{travel} = 2 \frac{V_0}{g} \sin \theta \quad x_{max} = 2 \frac{V_0^2}{g} \sin \theta \cos \theta \quad h_{max} = \frac{V_0^2}{2g} \sin^2 \theta$$

2. Write a C++ program to implement the matrix operations using a class. a) Reading a matrix. b) Addition of matrices. c) Printing a matrix. d) Subtraction of matrices. e) Multiplication of matrices
3. A two dimensional state of stress at a point in a loaded material is defined by three components of stress σ_{xx} , σ_{yy} and τ_{xy} . The maximum and minimum nominal stresses σ_{max} and σ_{min} are calculated from the stress components by

$$\sigma_{max/min} = \frac{\sigma_{xx} + \sigma_{yy}}{2} \pm \sqrt{\left[\frac{\sigma_{xx} - \sigma_{yy}}{2}\right]^2 + \tau_{xy}^2}$$

Write a user defined function that determines the principal stresses from the stress components. For the function name and arguments use principalstress (Sxx,Syy,Sxy).

4. Write a user defined function that determines the coordinate y_c of the centroid of the T-shaped cross-sectional area shown in the figure. For the function name and arguments use $y_c = \text{centroidT}(w,h,t,d)$, where the input arguments w , h , t and d are the dimensions shown in the figure.



5. Write a C++ program to illustrate the usage of following: Default Constructor, Parameterized Constructor and Copy Constructor.
6. Write a C++ Program to create a class vehicle and then declare its two derived classes.
7. Write a C++ program that overloads the binary + operator and the unary ++ operators.
8. Write a C++ program to display the contents of a text file.
9. Write a program to define the function template for calculating the square of given numbers with different data types.
10. Write a program to raise an exception if any attempt is made to refer to an element whose index is beyond the array size.

Total Number of hours: 30

Semester – IV	U19GE401-SOFT SKILLS AND APTITUDE – II	L T P C Marks 0 0 2 1 100
Course Outcomes		
At the end of the course the student will be able to:		
1. Demonstrate capabilities in additional soft-skill areas using hands-on and/or case-study approaches		
2. Solve problems of increasing difficulty than those in SSA-I in given areas of quantitative aptitude and logical reasoning and score 65-70% marks in company-specific internal tests		
3. Demonstrate greater than SSA-I level of verbal aptitude skills in English with regard to given topics and score 65-70% marks in company-specific internal tests		
1.Soft Skills	Demonstrating soft-skill capabilities with reference to the following topics: a. SWOT b. Goal setting c. Time management d. Stress management e. Interpersonal skills and Intrapersonal skills f. Presentation skills g. Group discussions	
2. Quantitative Aptitude and Logical Reasoning	Solving problems with reference to the following topics: a. Equations: Basics of equations , Linear, Quadratic Equations of Higher Degree and Problem on ages. b. Logarithms, Inequalities and Modulus c. Sequence and Series: Arithmetic Progression, Geometric Progression, Harmonic Progression, and Special Series. d. Time and Work: Pipes & Cistern and Work Equivalence. e. Time, Speed and Distance: Average Speed, Relative Speed, Boats & Streams, Races and Circular tracks and Escalators. f. Arithmetic and Critical Reasoning: Arrangement, Sequencing, Scheduling, Network Diagram, Binary Logic, and Logical Connection. g. Binary Number System.- Binary to decimal, Octal, Hexadecimal	
3. Verbal Aptitude	Demonstrating English language skills with reference to the following topics: a. Critical reasoning b. Theme detection c. Verbal analogy d. Prepositions e. Articles f. Cloze test g. Company specific aptitude questions	

S. Anita
06/01/2023

Dr.S.Anita

Head/Training
Department of Placement Training
Sona College of Technology,
Salem-636 005.

SEMESTER – IV

MANDATORY COURSE

U19GE403 - ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE

(Common for EEE, CIVIL, MECH and CSE)

L	T	P	C
2	0	0	0

Course Outcomes

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

1. understand, connect up and explain basics of Indian traditional knowledge in modern scientific perspective.
2. show an ability to comment critically on curriculum proposals that aim to promote science citizenship/scientific literacy
3. communicate using common medical and psychological terminology, including the skill to discuss commonly used medications, supplements, and surgical procedures
4. use effective oral and written language skills to communicate scientific data and ideas
5. describe the fundamentals of yoga and its importance

Unit I

- Introduction to Vedas
- Traditional methodology of Veda – Sat Angas
- Types of Vedas and their application
- Sub Veda – Ayurveda - their modern day application

Unit II

- Basics of Applied Vedic Science
- Modern day application of Vedas and procedure
- Ancient Indian Scientific thoughts
- Introduction to the Vedic language “Sanskrit”

UNIT – III- Modern science

- Introduction – modern science
- Objectives – modern science
- Architecture in ancient India

UNIT – IV Technology

- India's contribution to science and technology (from ancient to modern)
- Nobel laureates of Indian origin and their contribution
- India in space
- Latest achievement from Jan – 2017

23.01.2021

B.E. / B.Tech. Regulations 2019

UNIT – V- Yoga and Holistic Health Care

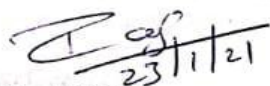
6

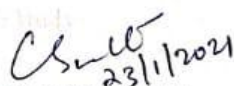
- Fundamentals of yoga and holistic health
- Human biology
- Diet and nutrition
- Life management
- Contemporary yogic models – case study

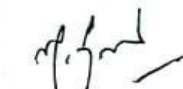
References

1. V. Sivaramakrishna (Ed.), Cultural Heritage of India-Course Material, Bharatiya Vidya Bhavan, Mumbai, 5th Edition, 2014
2. Swami Jitatanand, Modern Physics and Vedant, Bharatiya Vidya Bhavan
3. RN Jha, Science of Consciousness Psychotherapy and Yoga Practices, Vidyanidhi Prakasham, Delhi, 2016.
4. Roshan Dalal The Vedas: An Introduction to Hinduism's Sacred Texts, Penguin Books 2014. ISBN 13: 9780143066385
5. Raja Ram Mohan Roy, Vedic Physics, Mount Meru Publication ISBN : 9781988207049

Total: 30 HOURS


23/1/21
Dr. M. Raja
Course Coordinator / Sciences


23/1/2021
Dr. C. Shanthi
HOD / Sciences


Dr. M. Renuga
Chairperson BOS,
Science and Humanities

Total: 30 HOURS

23.01.2021

B.E. / B.Tech. Regulations 2019


Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for B.E/B.Tech. Semester V Regulations 2019
Branch: Mechanical Engineering

Mech
V

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit	Total Contact Hours
Theory							
1	U19ME501	Heat and Mass Transfer	3	0	0	3	45
2	U19ME502	Dynamics of Machinery	3	0	0	3	45
3	U19ME503	Computer Aided Design and Analysis	3	0	0	3	45
4	noc23_cs82	NPTEL : Introduction to Industry 4.0 and Industrial Internet of Things	3	0	0	3	45
5	U19ME901	Professional Elective Machine Learning with Python Programming	3	0	0	3	45
Practical							
6	U19ME504	Heat and Mass Transfer Laboratory	0	0	2	1	30
7	U19ME505	Dynamics of Machinery Laboratory	0	0	2	1	30
8	U19ME506	Computer Aided Design and Analysis Laboratory	0	0	2	1	30
9	U19GE501	Soft Skills and Aptitude - III	0	0	2	1	30
Total Credits						19	

Approved By


Chairperson, Mechanical Engineering BoS
Dr.D.Senthilkumar


Member Secretary, Academic Council
Dr.R.Shivakumar


Chairperson, Academic Council & Principal
Dr.S.R.R.Senthil Kumar

Copy to: - HOD/Mechanical Engineering, Fifth Semester BE Mechanical Students and Staff, COE.


05.07.2023

Regulation 2019

SONA COLLEGE OF TECHNOLOGY
(Autonomous)
DEPARTMENT OF MECHANICAL ENGINEERING
Regulation – 2019
CHOICE BASED CREDIT SYSTEM

V-SEMESTER

S. No	Course Code	Course Title	L	T	P	C
THEORY						
1	U19ME501	Heat and Mass Transfer	3	0	0	3
2	U19ME502	Dynamics of Machinery	3	0	0	3
3	U19ME503	Computer Aided Design and Analysis	3	0	0	3
4	noc23_cs82	Professional Elective NPTEL Introduction To Industry 4.0 And Industrial Internet Of Things	3	0	0	3
5	U19ME901	Professional Elective Machine Learning with Python Programming	3	0	0	3
PRACTICAL						
6	U19ME504	Heat and Mass Transfer Laboratory	0	0	2	1
7	U19ME505	Dynamics of Machinery Laboratory	0	0	2	1
8	U19ME506	Computer Aided Design and Analysis Laboratory	0	0	2	1
9	U19GE501	Soft Skills and Aptitude - III	0	0	2	1
Total						19


Dr. D. SENTHIL KUMAR, M.E., Ph.D
PROFESSOR & HEAD
DEPT. OF MECHANICAL ENGG.
SONA COLLEGE OF TECHNOLOGY
JUNCTION MAIN ROAD, SALEM-5.

COURSE CODE U19ME501
COURSE NAME HEAT AND MASS TRANSFER

L T P C
 3 0 0 3

Pre-Requisites Subject: Engineering Thermodynamics, Thermal Engineering.

Course Outcomes

Upon completion of this course the students will be able to

- CO1** Evaluate the heat conduction through plane walls, cylinder and composite walls and with internal heat generation.
- CO2** Analyze the various fin efficiencies and effectiveness and unsteady heat conduction with lumped heat system.
- CO3** Apply the convective heat transfer concepts in forced convection and free convection systems and describe the concept of boiling and condensation.
- CO4** Determine the heat transfer in heat exchangers by LMTD and NTU methods and analysis the mass diffusion.
- CO5** Evaluate the radiation heat exchange between surfaces and thermal shields.

CO / PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak Programme Outcomes (POs) and Programme Specific Outcome (PSOs)														
COs, POs PSOs Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO - 1	3	3	3	3	3	3	2	3	3	1	3	1	2	2
CO - 2	3	3	3	2	3	3	3	3	3	3	-	2	3	2
CO - 3	3	3	3	2	3	3	3	3	-	3	3	3	3	3
CO - 4	3	3	3	3	3	3	3	2	3	2	-	2	2	3
CO - 5	3	3	3	3	-	3	3	3	3	1	3	3	3	2

Unit - I CONDUCTION

L 9

Introduction - modes of heat transfer - conduction - steady state heat conduction - Fourier Law of Conduction - thermal conductivity - General Differential equation of Heat Conduction - Cartesian and Cylindrical Coordinates - One Dimensional Steady State Heat Conduction through Plane Wall, Cylinders and Spherical systems - Composite Systems - Conduction with Internal Heat Generation - Critical radius of insulation.

Solving simple steady state conduction problems using Python.

Unit - II EXTENDED SURFACES & UNSTEADY STATE HEAT CONDUCTION

L 9

Types of Fins - Circumferential and longitudinal fins- Heat Flow Calculations - Evaluation of fin performance: Fin efficiency, Fin effectiveness. Introduction to unsteady state heat conduction - transient heat conduction - Lumped systems - Semi Infinite Solid and Infinite Solid - Use of Heisler's Chart.

Unit – III CONVECTION, BOILING AND CONDENSATION

L 9

Boundary Layer Concept - Types of Convection - Forced Convection - External Flow - Flow over Plates, Cylinders and Spheres. Internal Flow - Laminar and Turbulent Flow - Combined laminar and Turbulent.

Free Convection - Flow over Vertical Plate, Horizontal Plate, Cylinders and Spheres. Introduction to Boiling and condensation – Pool Boiling, Flow Boiling, Boiling Curve - film wise and drop wise condensation (elementary treatment only).

Unit – IV HEAT EXCHANGERS

L 9

Heat Exchangers types - Overall Heat Transfer Coefficient - Fouling Factors - LMTD Method of heat Exchanger Analysis - Effectiveness - NTU Method of Heat Exchanger Analysis - Physical significance of NTU - Introduction to compact heat exchangers.

Unit – V RADIATION & MASS TRANSFER

L 9

Fundamental Concepts - Stefan Boltzman Law – Kirchhoff's law - Relation to Irradiation and Radiosity – Absorptivity, Reflectivity and Transmissivity. Radiation exchange between surfaces - Shape Factor relations – Electrical Analogy - Radiation Shields - Introduction to Gas Radiation. Introduction to mass transfer - Fick's Law of Diffusion - Diffusion Mass Transfer - transient diffusion- Steady state Molecular Diffusion..


Note: (Use of standard heat and mass transfer data book is permitted in the University examination)

Total Number of hours: 45**Learning Resources****Text Books**

1. Kothandaraman C.P "Fundamentals of Heat and Mass Transfer" New Age International, New Delhi, 2015.
2. Sachdeva R C, "Fundamentals of Engineering Heat and Mass Transfer" New Age International, 2016.

Reference Books

1. Incropera, Frank.P; Dewitt,David. P "Fundamentals of Heat and Mass Transfer", John Wiley & Sons Pvt. Ltd., 2010.
2. Holman J.P "Heat and Mass Transfer" Tata McGraw-Hill, 2012.
3. Cengel, Y.A. "Heat Transfer: A Practical Approach", Tata McGraw, Hill. Second edition 2008.
4. Nag P.K, "Heat Transfer", Tata McGraw-Hill, New Delhi, 2002.


Dr. D. SENTHIL KUMAR, M.E., Ph.D
PROFESSOR & HEAD
DEPT. OF MECHANICAL ENGG.
SONA COLLEGE OF TECHNOLOGY
JUNCTION MAIN ROAD, SALEM-57

COURSE CODE U19ME502
COURSE NAME DYNAMICS OF MACHINERY

L T P C
 3 0 0 3

Pre-Requisites Subject: Kinematics of Machinery

Course Outcomes

Upon completion of this course the students will be able to

- CO1** Explain the force-motion relationship in components subjected to external forces.
- CO2** Analyze balancing problems in rotating and reciprocating machinery
- CO3** Analyze the principles in mechanisms used for governing of machines and gyroscopes.
- CO4** Analyze the free and forced vibrations of single degree freedom systems.
- CO5** Calculate the effect of Dynamics of undesirable vibrations.

CO / PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak Programme Outcomes (POs) and Programme Specific Outcome (PSOs)														
COs, POs PSOs Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO - 1	3	3	2	3	3	3	2	2	1	2	3	-	3	2
CO - 2	3	3	1	3	3	3	1	-	1	-	3	2	2	2
CO - 3	3	3	3	3	3	3	-	2	2	2	3	1	2	2
CO - 4	3	3	3	3	3	3	2	1	-	2	3	2	2	3
CO - 5	3	3	3	3	3	3	1	2	2	-	3	2	3	3

Unit - I FORCE ANALYSIS

L 9

D'Alembert's principle - Applied and constraint forces - Free body diagrams - Static equilibrium conditions - Two, three & four members - Static force analysis of simple mechanisms - Dynamic equivalent system - correction couple - Inertia force and Inertia torque - Dynamic Analysis in reciprocating engines - Bearing loads - Crank shaft torque - Equivalent masses. Turning moment diagrams - Single and multi-cylinder engines & double acting engines - Maximum fluctuation of energy and its determination - Coefficient of fluctuation of speed - Fly Wheel Analysis.

Unit - II BALANCING

L 9

Balancing and its types - Rotor balancing - Single plane and two plane balancing. Unbalanced forces and couples - Static and dynamic balancing of rotating masses - Balancing of reciprocating masses - Balancing of locomotives - Balancing of Multi-cylinder engines.

Unit – III MECHANISM FOR CONTROL

L 9

Necessity of governor- Types of governors- Working principle of centrifugal governors- Gravity controlled and spring controlled governors - Control force diagram- Characteristics of governors. Gyroscopic couple – Gyroscopic effects on the movement of air planes and ships – Stability of two wheel drive and four wheel drive – Gyroscope stabilization.

Unit – IV LONGITUDINAL VIBRATIONS

L 9

Introduction to vibration – Terminology – Classification of vibrations – Undamped and Damped free vibration of single degree of freedom systems-springs in series springs in parallel and combinations-concepts of critical damping coefficient and damping factor- under damping-critical damping and over damping - Forced vibration of single degree of freedom system- Logarithmic decrement-Vibrations of spring mass damper system under harmonic excitation-magnification factor, vibration isolation and transmissibility-Phase difference between excitation and motion – Estimation of natural frequencies for simple longitudinal vibration systems using python programming.

Unit – V TRANSVERSE AND TORSIONAL VIBRATIONS

L 9

Transverse vibrations of shafts and beams-natural frequency- whirling of shafts-Application of Dunkerley's method and Rayleigh's method for estimating the critical speed of shafts – Estimation of Natural frequencies for simple transverse vibration systems using python programming. Torsional vibrations -equivalent shafts- natural frequencies-mode shapes, nodes-single rotor, two rotor and three rotor systems.

Total Number of hours: 45**Learning Resources****Text Books**

1. Rattan .S.S, "Theory of Machines", Fifth Edition, Tata McGraw-Hill Publishing Company Ltd, 2019.
2. Sadhu Singh "Theory of Machines", Pearson Education, 3rd edition, 2019.

Reference Books

1. Shigley J.E. and Uicker J.J., "Theory of Machines and Mechanisms", 4th edition, oxford university press, 2018.
2. Thomas Bevan, "Theory of Machines" CBS Publishers and Distributers, 3rd edition, 2018.
3. Rao J.S and Dukkupati R.V, "Mechanism and Machine Theory", New Age International, New Delhi, 2018.
4. Dr.V.P.Singh, Mechanical Vibrations, PHI, 2018.
5. Python - A Beginners Complete Reference Guide to Learn the Python Programming Language, Nexcod publishing, 2019.

COURSE CODE U19ME503 L T P C
COURSE NAME COMPUTER AIDED DESIGN AND ANALYSIS 3 0 0 3
Pre-Requisites Subject: Engineering graphics, Strength of material, Python programming

Course Outcomes

Upon completion of this course the students will be able to

- CO1** Find 2D and 3D transformation matrix also Construct the 2D and 3D model for the product by using CAD.
- CO2** Solve the problem using the potential energy and weighted residual method.
- CO3** Analyze one dimensional bar element and heat transfer element and find the solution.
- CO4** Solve the two dimensional elements problems like scalar variable problems and vector variable problems.
- CO5** Solve the integration using gauss quadrature and write the python program for finding the solution of Finite Element problems.

CO / PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
Programme Outcomes (POs) and Programme Specific Outcome (PSOs)														
COs, POs PSOs Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO - 1	3	1	-	2	3	1	1	2	1	3	3	3	2	2
CO - 2	3	3	2	3	2	2	-	-	1	2	2	3	2	2
CO - 3	3	3	1	3	1	3	1	-	2	1	1	3	3	3
CO - 4	3	3	-	3	-	3	2	1	-	1	-	3	2	3
CO - 5	3	3	2	3	2	3	-	2	1	2	-	3	3	3

Unit - I COMPUTER AIDED DESIGN

L 9

Introduction and overview. Need and Scope of Computer Aided Machine Design, CAD design process, Graphic standards, 2D and 3D geometric Transformation- Scaling, Translation and Rotation. Geometric Modeling- Role of Geometric Modeling, Wire Frame Modeling, Surface Modeling, Solid Modeling-Constructive solid geometry (CSG), Boundary Representation (B-Rep). Importance of Finite element mesh, Automatic meshing techniques.

Unit - II INTRODUCTION TO FEM

L 9

Finite element modeling procedure - mathematical modeling- Application to the continuum- Discretization - Matrix algebra - Gaussian elimination - Governing equations for continuum- Classical Techniques in FEM -Potential energy methods -Ritz method , Weighted residual methods, engineering applications of FEA.

Unit - III ONE DIMENSIONAL PROBLEMS

L 9

One dimensional element Coordinates and shapes functions- Potential energy approach -Galarkin approach- Assembly of stiffness matrix and load vector- linear 1D bar element - nodal

approximation- development of shape functions- quadratic shape functions - element matrices and vectors-. One dimensional heat transfer element – Assembly of stiffness matrix and load vector, one-dimensional heat transfer problems.

Unit – IV TWO DIMENSIONAL PROBLEMS

L 9

Scalar Variable Problems- Finite element modeling- CST element- Element equations, Load vectors and boundary conditions – Assembly - Vector Variable problems- Elasticity equations, Plane Stress, Plane Strain, Axisymmetric problems- Formulation- element matrices- Assembly - boundary conditions and solutions.

Unit – V ISOPARAMETRIC ELEMENT

L 9

Natural coordinates, Iso parametric elements, Four node quadrilateral element– Shape functions- Element stiffness matrix and force vector – Numerical integration – Gauss quadrature Application of python programming for 1D bar and heat transfer element.

Total Number of hours: 45

Learning Resources

Text Books

1. Ibrahim Zeid. & R. Sivasubramanian" CAD-CAM Theory and Practice", Tata McGraw-Hill Publishing Co. Ltd. 2nd edition, 2016. ISBN-13:978-0070151345
2. Chandrupatla & Belagundu, "Introduction to Finite Elements in Engineering", Prentice-Hall of India, Eastern Economy Editions, 4th Edition, 2015, ISBN-13: 978-9332551824.

Reference Books

1. David V.Hutton,"Fundamentals of Finite Element Analysis", Tata McGraw-Hill Edition, 2005, ISBN: 9780070601222.
2. J.N.Reddy, "An Introduction to the Finite Element Method", McGraw-Hill International Editions, 2006, 3rd Edition, ISBN: 9780070607415.
3. P.Seshu, "Text Book of Finite Element Analysis", Prentice-Hall of India Pvt. Ltd., NewDelhi, 2007. ISBN-978-203-2315-5
4. Mikell P. Groover and Emory W. Zimmers, Jr, "CAD/CAM Computer Aided and Manufacturing". Eastern Economy Edition, PHI publishers 2008.ISBN 13: 978-8120304024.
5. Rao S.S., "The Finite Element Method in Engineering", Fourth Edition, Published by Elsevier, 5th Edition, 2010, Hardcover ISBN: 9781856176613.
6. P.N. Rao, "CAD/CAM Principles and Applications". Tata McGraw Hill Publications, 3rd Edition 2010. ISBN-13 : 978-0070583733.
7. Logan D.L., "A First course in the Finite Element Method", Fourth Edition, Cengage Learning, 5th Edition, 2012, ISBN-13: 9788131517307.
8. Python - A Beginners Complete Reference Guide to Learn the Python Programming Language, Nexcod publishing, 2019.

COURSE CODE	noc23_cs82	LT P C
COURSE NAME	INTRODUCTION TO INDUSTRY 4.0 AND INDUSTRIAL INTERNET OF THINGS	3 0 0 3

Week 1 : Introduction: Sensing & actuation, Communication-Part I, Part II, Networking-Part I, Part II

Week 2 : Industry 4.0: Globalization and Emerging Issues, The Fourth Revolution, LEAN Production Systems, Smart and Connected Business Perspective, Smart Factories

Week 3 : Industry 4.0: Cyber Physical Systems and Next Generation Sensors, Collaborative Platform and Product Lifecycle Management, Augmented Reality and Virtual Reality, Artificial Intelligence, Big Data and Advanced Analysis

Week 4 : Cybersecurity in Industry 4.0, Basics of Industrial IoT: Industrial Processes-Part I, Part II, Industrial Sensing & Actuation, Industrial Internet Systems.

Week 5 : IIoT-Introduction, Industrial IoT: Business Model and Reference Architecture: IIoT-Business Models-Part I, Part II, IIoT Reference Architecture-Part I, Part II.

Week 6 : Industrial IoT- Layers: IIoT Sensing-Part I, Part II, IIoT Processing-Part I, Part II, IIoT Communication-Part I.

Week 7 : Industrial IoT- Layers: IIoT Communication-Part II, Part III, IIoT Networking-Part I, Part II, Part III.

Week 8 : Industrial IoT: Big Data Analytics and Software Defined Networks: IIoT Analytics - Introduction, Machine Learning and Data Science - Part I, Part II, R and Julia Programming, Data Management with Hadoop.

Week 9 : Industrial IoT: Big Data Analytics and Software Defined Networks: SDN in IIoT-Part I, Part II, Data Center Networks, Industrial IoT: Security and Fog Computing: Cloud Computing in IIoT-Part I, Part II.

Week 10 : Industrial IoT: Security and Fog Computing - Fog Computing in IIoT, Security in IIoT-Part I, Part II, Industrial IoT- Application Domains: Factories and Assembly Line, Food Industry.

Week 11 : Industrial IoT- Application Domains: Healthcare, Power Plants, Inventory Management & Quality Control, Plant Safety and Security (Including AR and VR safety applications), Facility Management.

Week 12 : Industrial IoT- Application Domains: Oil, chemical and pharmaceutical industry, Applications of UAVs in Industries, Real case studies :

Case study - I : Milk Processing and Packaging Industries

Case study - II: Manufacturing Industries - Part I

Case study - III : Manufacturing Industries - Part II

Case study - IV : Student Projects - Part I

Case study - V : Student Projects - Part II

Case study - VI : Virtual Reality Lab


Case study - VII : Steel Technology Lab

Total Number of hours: 45

Learning Resources

Books and References

1. "Industry 4.0: The Industrial Internet of Things", by Alasdair Gilchrist (Apress).
2. "Industrial Internet of Things: Cybermanufacturing Systems" by Sabina Jeschke, Christian Brecher, Houbing Song, Danda B. Rawat (Springer).
3. "Introduction to IoT", S. Misra, A. Mukherjee, and A. Roy, 2020. Cambridge University Press.
4. "Introduction to Industrial Internet of Things and Industry 4.0", S. Misra, C. Roy, and A. Mukherjee, 2020.


Dr. D. SENTHIL KUMAR, M.E., Ph.D
PROFESSOR & HEAD
DEPT. OF MECHANICAL ENGG.
SONA COLLEGE OF TECHNOLOGY
JUNCTION MAIN ROAD, SALEM-5.

COURSE CODE U19ME901

L T P C

COURSE NAME MACHINE LEARNING WITH PYTHON
PROGRAMMING

3 0 0 3

Prerequisites- subject: Problem solving in Python Programming**Course Outcomes**

Upon completion of this course the students will be able to

- CO1** Cognize the basic concepts and techniques of Machine Learning.
CO2 Develop data analytics and visualization skills for machine learning algorithms.
CO3 Analyze the various machine learning algorithms.
CO4 Assess the complexity of Machine Learning algorithms and their limitations.
CO5 Develop python programs for various machine learning algorithms.

CO / PO, PSO Mapping

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

Programme Outcomes (POs) and Programme Specific Outcome (PSOs)

COs, POs PSOs Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO - 1	3	3	3	3	2	1	2	2	1	2	3	2	3	2
CO - 2	3	3	3	2	1	-	-	-	1	3	3	1	2	2
CO - 3	2	1	3	3	2	2	2	1	-	3	3	3	3	3
CO - 4	-	2	3	3	3	2	-	1	2	3	2	3	3	3
CO - 5	1	2	2	3	3	1	1	2	2	3	3	3	2	3

Unit - I INTRODUCTION

L 9 T 0

History of Artificial Intelligence – overview of machine learning – Linear algebra – scalars, vectors and tensors – Matrix operations – special matrices – Matrix decomposition – labeled data – unlabeled data – supervised learning – unsupervised learning – semi-supervised learning – reinforced learning – data science & analytics – Artificial Intelligence and deep learning in Engineering applications.

Unit - II DATA ANALYTICS & VISUALIZATION

L 9 T 0

Data exploration (histograms, bar chart, box plot, line graph, scatter plot) - Qualitative and Quantitative Data - Measure of Central Tendency (Mean, Median and Mode) - Measure of Positions (Quartiles, Deciles, Percentiles and Quantiles) - Measure of Dispersion (Range, Median, Absolute deviation about median, Variance and Standard deviation) - Measure of Distribution (Skewness and Kurtosis), Box and Whisker Plot (Box Plot and its parts, Using Box Plots to compare distribution) and other statistical graphs – Burn charts.

Unit – III MACHINE LEARNING ALGORITHMS – I

L 9 T 0

Probability & Bayes' learning – Linear regression – Logistic regression – least squares gradient descent – goodness of fit – bias-variance tradeoff – multinomial regression – polynomial regression – ridge regression – lasso regression – k nearest neighbor (kNN) algorithm – Support vector machine. (Qualitative treatment only).

Unit – IV MACHINE LEARNING ALGORITHMS – II

L 9 T 0

Clustering – Hierarchical – divisive, agglomerative, dendrograms, K-means – identification of centroids and location near centroids – clustering large applications (CLARA) – dimension reduction – Density based spatial clustering of applications with noise (DBSCAN) – Decision tree – binary decision tree, recursive binary split, pruning – Introduction to Artificial neural networks (Qualitative treatment only).

Unit – V PYTHON PROGRAMMING FOR MACHINE LEARNING

L 9 T 0


Basic commands & syntax – packages and libraries – Construction of bar plots, line plot, scatter plot & histograms – Computation of mean, median & mode – construction of Box and Whisker Plot – development of machine learning programs using Scikit learn library– Linear regression – polynomial regression – kNN Algorithm – k-Means clustering – Support vector machine.

Total Number of hours: 45**Learning Resources****Text Books**

1. Alpaydin, Ethem. Introduction to machine learning. MIT press, 2017.
2. Harrington, Peter. Machine learning in action. Manning Publications Co., 2016.

Reference Books

1. Witten, Ian H., et al. Data Mining: Practical machine learning tools and techniques. Morgan Kaufmann, 2016.
2. Bengio, Yoshua, Ian Goodfellow, and Aaron Courville. Deep learning. Vol. 1. MIT press, 2017.
3. Hackeling, Gavin. Mastering Machine Learning with scikit-learn. Packt Publishing Ltd, 2017.
4. Kelleher, John D., Brian Mac Namee, and Aoife D'arcy. Fundamentals of machine learning for predictive data analytics: algorithms, worked examples, and case studies. MIT press, 2020.


Dr. D. SENTHIL KUMAR, M.E., Ph.D
PROFESSOR & HEAD
DEPT. OF MECHANICAL ENGG.
SONA COLLEGE OF TECHNOLOGY
JUNCTION MAIN ROAD, SALEM-5.

COURSE CODE **U19ME504** **L T P C**
COURSE NAME **HEAT AND MASS TRANSFER LABORATORY** **0 0 2 1**

Pre-requisites subject: Thermal engineering and Heat and mass transfer.

Course Outcomes

Upon completion of this course the students will be able to

- CO1** Apply the fundamental theory and equations of one-dimensional steady state heat conduction systems.
- CO2** Analyze the convective heat transfer in forced and free convection systems by applying the concepts of thermodynamics, heat transfer, and fluid mechanics.
- CO3** Compare the heat exchangers with LMTD method and Effectiveness NTU method.


CO / PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak Programme Outcomes (POs) and Programme Specific Outcome (PSOs)														
COs, POs PSOs Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO - 1	3	3	3	2	3	3	3	-	3	2	3	3	2	2
CO - 2	3	2	3	3	3	2	-	3	3	3	3	3	2	3
CO - 3	3	3	3	3	-	3	3	2	3	-	3	3	3	3

List of Experiments:

1. Thermal conductivity measurements by guarded plate method.
2. Thermal conductivity of metal bar.
3. Natural convection heat transfer from a vertical cylinder.
4. Forced convection inside tube.
5. Heat Transfer from Pin-fin (Natural & Forced convection modes).
6. Determination of Stefan- Boltzman constant.
7. Determination of Emissivity of a grey surface.
8. Effectiveness of parallel/ Counter flow heat Exchanger.
9. Thermal conductivity of insulating powder.
10. Thermal conductivity of composite wall material.

List of Equipment's: (for a batch of 30 students)

1. Heat transfer through guarded plate apparatus.
2. Heat transfer through metal bar apparatus.
3. Heat transfer through Natural convection apparatus.
4. Heat transfer through Forced convection apparatus.
5. Heat Transfer through Pin-fin apparatus.
6. Heat transfer through Stefan- Boltzman constant apparatus.
7. Heat transfer through Emissivity apparatus.
8. Heat transfer through parallel/ Counter flow heat Exchanger.
9. Thermal conductivity of insulating powder.
10. Thermal conductivity of composite wall material.

Total Number of hours: 30

Dr. D. SENTHIL KUMAR, M.E., Ph.D
PROFESSOR & HEAD
DEPT. OF MECHANICAL ENGG.
SONA COLLEGE OF TECHNOLOGY
JUNCTION MAIN ROAD, SALEM-5.

COURSE CODE U19ME505

L T P C

COURSE NAME DYNAMICS OF MACHINERY LABORATORY

0 0 2 1

Pre-requisites subject: Dynamics of Machinery.**Course Outcomes**

Upon completion of this course the students will be able to

- CO1** Demonstrate the kinematics of 4bar, Slider crank and Crank Rocker mechanisms, Universal joints and Gear trains.
- CO2** Determine the sensitivity, effort of Governors and determine the gyroscopic couple of Gyroscope and determination of Critical speed of shaft.
- CO3** Calculate the moment of Inertia by oscillation method and determine the damping coefficient of spring mass system.

CO / PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak Programme Outcomes (POs) and Programme Specific Outcome (PSOs)														
COs, POs PSOs Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO - 1	3	3	3	3	3	3	1	2	3	-	3	3	2	2
CO - 2	3	3	3	3	3	3	2	-	3	1	3	3	3	3
CO - 3	3	3	3	3	3	3	-	1	3	2	3	3	3	3

List of Experiments:


- Kinematics of 4 bar mechanisms – Slider crank and Crank Rocker Mechanism - Determination of velocity and acceleration.
- Kinematics of Universal Joints – Determination of velocity and acceleration
- Kinematics of Gear Trains – Simple, Compound and differential: Determination of velocity ratio and Torque
- Governors - Determination of sensitivity, effort, etc. for Watt, Porter, Proell, and spring controlled Governors
- Cam – Determination of jump speed and profile of the cam.
- Motorized Gyroscope-Verification of laws -Determination of gyroscopic couple.
- Whirling of shaft-Determination of critical speed of shaft with concentrated loads.
- Balancing of rotating and reciprocating masses.
- Determination of moment of inertia by Oscillation method for connecting rod and flywheel.
- Vibrating system - spring mass system - Determination of damping co-efficient of single degree of freedom system

11. Determination of torsional frequencies for compound pendulum and flywheel system with lumped Moment of inertia.
12. Transverse vibration –free- Beam. Determination of natural frequency and deflection of beam.

List of Equipment's: (for a batch of 30 students)

1. Four bar Mechanism
2. Slider Crank Mechanism
3. Universal Joint
4. Compound Gear Train
5. Universal Governor
6. Cam Analysis Machine
7. Motorized Gyroscope
8. Whirling of shafts
9. Balancing of rotating masses Apparatus.
10. Balancing of reciprocating masses Apparatus.
11. Moment of Inertia by Oscillation
12. Vibrating Table
13. Compound Pendulum
14. Transverse Vibration Apparatus

Total Number of hours: 30


Dr. D. SENTHIL KUMAR, M.E., Ph.D
PROFESSOR & HEAD
DEPT. OF MECHANICAL ENGG.
SONA COLLEGE OF TECHNOLOGY
JUNCTION MAIN ROAD, SALEM-5.

COURSE CODE U19ME506

L T P C

COURSE NAME COMPUTER AIDED DESIGN AND ANALYSIS LABORATORY 0 0 2 1**Pre-requisites subject:** Engineering Graphics, Computer aided drafting laboratory, Strength of material Laboratory.**Course Outcomes**

Upon completion of this course the students will be able to

CO1 Construct the 2D views of standard machine components.**CO2** Create 3D model for the engineering components using solid works software.**CO3** Solve real time analysis of 1D, 2D and 3D engineering problems using ANSYS.

CO / PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak Programme Outcomes (POs) and Programme Specific Outcome (PSOs)														
COs, POs PSOs Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO - 1	1	3	1	-	3	1	-	2	-	3	3	3	2	3
CO - 2	2	3	3	3	3	2	-	-	2	3	3	3	3	2
CO - 3	3	3	3	3	3	3	2	3	1	3	3	2	3	3

List of Experiments:**PART-A-CAD****1. Introduction**

Introduction to Code of practice for Engineering Drawing, BIS specifications – Welding symbols, Riveted joints, keys, Fasteners – Reference to hand book for the selection of standard components like bolts, nuts, screws, keys etc. Introduction to Drafting Software, Editing, Dimensioning and Plotting Commands-Layering concepts-Limits, Fits and Tolerances.

2. Preparation of 2-D Drawings

Orthographic views of standard machine components:

Brackets, V Blocks, Stop Block, Screw threads and Threaded fasteners.

3. Assembly Drawing (Preparation of assembled view)

1. Solid Modeling & assembly
2. Surface modeling & assembly
3. Sheet metal & assembly
4. Weldments & assembly and BOM.
5. 3D printing of simple machine parts.

PART B – Finite Element Analysis using ANSYS Software:


6. Analysis of 1D element such as bar, rod and truss
7. Analysis of beams (cantilever, simply supported and fixed beam)
8. Analysis of an axis-symmetric element
9. Mode frequency analysis of beams (cantilever, simply supported and fixed beam)
10. 2D heat transfer analysis (conduction and convection)
11. Harmonic analysis
12. Analysis of 3D components

List of Equipment's:

1. Computer systems configuration: i7 – 7th GEN-8GB RAM-1TB HDD 22" LED DISPY
2. 3D printer

List of Equipment's: (for a batch of 30 students)

1. Solid Works 2019 -100 users.
2. ANSYS 12.00

Total Number of hours: 30

Dr. D. SENTHIL KUMAR, M.E., Ph.D
PROFESSOR & HEAD
DEPT. OF MECHANICAL ENGG.
SONA COLLEGE OF TECHNOLOGY
JUNCTION MAIN ROAD, SALEM-5.

COURSE CODE U19GE501 **LT P C**
COURSE NAME SOFT SKILLS AND APTITUDE – III **0 0 2 1**

Course Outcomes

Upon completion of this course the students will be able to

- CO1** Demonstrate capabilities in supplementary areas of soft-skills and job-related selection processes using hands-on and/or case-study approaches.
- CO2** Solve problems of advanced levels than those in SSA-II in specified areas of quantitative aptitude and logical reasoning and score 70-75% marks in company-specific internal tests.
- CO3** Demonstrate greater than SSA-II level of verbal aptitude skills in English with regard to given topics and score 70-75% marks in company-specific internal tests.

CO / PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
Programme Outcomes (POs) and Programme Specific Outcome (PSOs)														
COs, POs PSOs Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO – 1	1	1	2	1	1	3	3	3	3	1	1	3	2	2
CO – 2	3	3	1	1	2	3	2	2	3	2	2	3	2	2
CO – 3	1	2	1	2	1	1	1	1	3	3	1	3	2	3

List of Experiments:

1. SOFT SKILLS

Demonstrating Soft-Skill Capabilities With Reference to the following topics:

- a. **Career planning:** Importance; Exploring various career options, Field research, Social media management; Process, benefits and limitations of career planning; Mapping SWOT and GOALS to career planning; Self-evaluation.
- b. **Resume writing:** Build credentials and resume, Positioning yourself and your career, JD mapping, Video resume, Relevant resume phrases and components; Cover letter; Portfolio management and Social media cover.
- c. **Group discussion:** Skills needed for GD; Frequently Asked topics and Practice; Types of topics; Various framework and tools to handle GD; Practice and assessment.
- d. **Teamwork:** Definition and importance of team-building; Stages of team-building; Communication within a team; Various styles of teams and their analysis; Activities demonstrating a team.
- e. **Leadership skills:** Role of a leader; Difference between a manager and a leader; Various Leadership styles; Compelling qualities of a leader; Famous leaders and their impact to the world; Self-assessment.

- f. **Interview skills:** Process and types of interview; Appearance and grooming etiquette; Do's and Don'ts (Before – During interview); Brainstorming interview possible questions; Hot seat; Transactional Analysis for effective communication and handling interviewers; mock interviews and assessment parameters discussion.
- g. **Mock interviews:** Frequently Asked Questions practice and assessment; Discussion and demonstrations on Stress and Technical interviews; Group interview.
- h. **Mock GDs:** Frequently Asked Topics Practice; Assessment and feedback.

2. QUANTITATIVE APTITUDE AND LOGICAL REASONING

Solving problems with reference to the following topics:


- a. **Geometry:** 2D, 3D, Coordinate Geometry, and Height & Distance.
- b. **Permutation & Combinations:** Principles of counting, Circular Arrangements and Derangements.
- c. **Probability:** Addition & Multiplication Theorems, Conditional Probability and Bayes Theorem.
- d. **Statistics:** Mean Median, Mode, Range and Standard Deviation.
- e. **Interest Calculation:** Simple Interest and Compound Interest
- f. **Crypto arithmetic:** Addition and Multiplication based problem.
- g. **Logical Reasoning:** Blood Relations, Directions Test, Series, Odd man out, Analogy, Coding & Decoding, Problems and Input – Output Reasoning.
- h. Statement & Assumptions, Statements & Arguments, Inference.
- i. **Company Specific Pattern:** Infosys and TCS company specific problems.

3. VERBAL APTITUDE

Demonstrating English language skills with reference to the following topics:


- a. Subject verb agreement.
- b. Selecting the best alternative for the stated parts of given sentences.
- c. Reading comprehension.
- d. Contextual synonyms.
- e. Sentence fillers.
- f. Writing a story for a given picture.
- g. Company specific aptitude questions.

Total Number of hours: 30


Dr. D. SENTHIL KUMAR, M.E., Ph.D
PROFESSOR & HEAD
DEPT. OF MECHANICAL ENGG.
SONA COLLEGE OF TECHNOLOGY
JUNCTION MAIN ROAD, SALEM-5.

List of open electives offered to other departments by Mechanical**DEPARTMENT OF MECHANICAL ENGINEERING****2023-24 (ODD Semester)**

S.No.	Course Code	COURSE TITLE	L	T	P	C
1.	U19ME1002	Industrial Safety	3	0	0	3
2.	U19ME1004	Renewable Energy Sources	3	0	0	3


Dr. D. SENTHIL KUMAR, M.E., Ph.D
PROFESSOR & HEAD
DEPT. OF MECHANICAL ENGG.
SONA COLLEGE OF TECHNOLOGY
JUNCTION MAIN ROAD, SALEM-5.

COURSE CODE U19ME1002

L T P C

COURSE NAME INDUSTRIAL SAFETY

3 - - 3

Course Outcomes

Upon completion of this course the students will be able to

- CO1** Summarize various legal provisions available in safety regulation.
- CO2** Analyze industrial environment hygiene and develop precautionary measure to avert occupational diseases.
- CO3** Demonstrate the uses of different grades of fire protection systems related with different classes of fire.
- CO4** Develop Agronomical study of different work environment in industries.
- CO5** Discuss the importance of safety training and its impact on shop floor of factories.

CO / PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
Programme Outcomes (POs) and Programme Specific Outcome (PSOs)														
COs, POs PSOs Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO - 1	3	-	-	-	1	3	3	3	2	2	3	3	2	2
CO - 2	3	2	2	1	3	3	3	3	2	2	-	2	2	3
CO - 3	2	3	2	3	3	3	3	3	3	3	3	2	2	3
CO - 4	2	1	3	3	3	3	2	3	1	2	-	2	3	3
CO - 5	1	3	3	3	-	3	-	3	3	3	2	3	2	2

Unit I BASICS OF SAFETY ENGINEERING & ACTS

L 9 T 0

Evolution of modern safety concept –safety performance monitoring. Acts – factories act – 1948 – Statutory authorities – inspecting staff – Tamilnadu Factories Rules 1950 under Safety and health – environment act – 1986 – Air act 1981, water act 1974 – other acts. Safety in industries – General safety concepts, machine guarding, hazards in metal removing process, welding process, cold and hot working process.

Unit II OCCUPATIONAL HEALTH AND INDUSTRIAL HYGIENE

L 9 T 0

(Basic concepts, related hazards and exposure limits)

Physical Hazards – Noise, heat, radiation, vibration, recognition of chemical hazards-dust, fumes, mist, vapour, fog, gases. Biological and Ergonomical Hazards-Basic concepts. Occupational Health-Concept and spectrum of health – functional units and activities of occupational health services, pre-employment and post-employment medical examinations – occupational related diseases, levels of prevention of diseases, notifiable occupational diseases. Hazard assessment, procedure, methodology; safety audit, checklist analysis, what-if analysis, safety review, Preliminary Hazard Analysis (PHA), human error analysis, hazard operability studies (HAZOP), safety warning systems.

Unit III FIRE ENGINEERING AND EXPLOSIVE CONTROL

L 9 T 0

Fire properties of solid, liquid and gases – fire triangle – principles of fire extinguishing – active and passive fire protection systems – various classes of fires – A, B, C, D, E – types of fire extinguishers – Principles of explosion – Explosion Protection – Electrical Safety. Electrical Hazards – Primary and Secondary hazards – concept of earthing – protection systems – fuses, circuit breakers and over load relays – first aid cardiopulmonary resuscitation techniques.

Unit IV ERGONOMICS

L 9 T 0

Introduction to ergonomics: The focus of ergonomics, ergonomics and its areas of application in the work system, modern ergonomics, and future directions for ergonomics. Anatomy, Posture and Body Mechanics: anatomy of the spine and pelvis related to posture, posture stability and posture adaptation, low back pain, risk factors for musculoskeletal disorders in the workplace, effectiveness and cost effectiveness. Anthropometry and its uses in ergonomics, Applications of human factors engineering, man as a sensor, man as information processor, man as controller – Ergonomics in IT industries.

Unit V SAFETY EDUCATION AND TRAINING

L 9 T 0


Importance of training – identification of training needs – training methods – programs, seminars, conferences, competitions – motivation – communication – role of government agencies and private consulting agencies in safety training – creating awareness, awards, celebrations, safety posters, safety displays, safety pledge, safety incentive scheme, safety campaign – Domestic Safety Training.

Total Number of hours: 45**Learning Resources****Text Books**

1. Krishnan N.V., "Safety Management in Industry", Jaico Publishing House, Bombay, 1997.
2. Hand book of "Occupational Safety and Health", National Safety Council, Chicago, 1982.

Reference Books

1. Derek, James, "Fire Prevention Hand Book", Butter Worths and Company, London, 1986.
2. Guidelines for Hazard Evaluation Procedures Centre for Chemical Process Safety, AICHE 1992.
3. The factories Act 1948, Madras Book Agency, Chennai, 2000.
4. Introduction to Ergonomics, R.S. Bridger, Taylor & Francis.



Dr. D. SENTHIL KUMAR, M.E., Ph.D
PROFESSOR & HEAD
DEPT. OF MECHANICAL ENGG.
SONA COLLEGE OF TECHNOLOGY
JUNCTION MAIN ROAD, SALEM-5.

COURSE CODE U19ME1004

L T P C

COURSE NAME RENEWABLE ENERGY SOURCES

3 - - 3

Prerequisites- subject: Environmental Sciences.**Course Outcomes**

Upon completion of this course the students will be able to

- CO1** Discuss the power demand scenario in world level and impact of various renewable energy sources in satisfying power demand.
- CO2** Explain the different components and the principle of operation and the application of solar PV system and Bio Mass power generation system.
- CO3** Outline in the components and to find the suitability based on the performance of wind energy conversion system, geothermal and hydel power system.
- CO4** Describe the components of tidal power generation scheme and wave energy scheme and to discuss the performance of two schemes.
- CO5** Compare and contrast the various components and methods of Ocean Energy Conversion Systems.

CO / PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
Programme Outcomes (POs) and Programme Specific Outcome (PSOs)														
COs, POs PSOs Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO - 1	3	3	3	-	3	3	3	2	3	3	2	3	3	3
CO - 2	3	-	3	3	3	3	3	-	3	3	3	3	3	3
CO - 3	3	3	3	2	3	3	3	-	3	3	3	3	3	3
CO - 4	3	3	3	2	3	3	3	-	3	3	2	3	3	3
CO - 5	3	2	3	3	3	3	3	2	3	3	2	3	3	3

Unit I INTRODUCTION

L 9 T 0

World energy use – reserves of energy resources – energy cycle of the earth – environmental aspects of energy Utilization – renewable energy resources and their importance.

Unit II SOLAR & BIO ENERGY

L 9 T 0

Introduction – extra-terrestrial solar radiation – radiation at ground level – collectors – solar cells – applications of solar energy – Biomass Energy – Introduction – Biomass Conversion – Biogas Production – Ethanol Production – Pyrolysis and Gasification – Direct Combustion – Applications.

Unit III GEO THERMAL AND HYDRO ENERGY SOURCES

L 9 T 0

Geothermal energy – types of geothermal energy sites, site selection, and geothermal power plants, Hydro energy – Feasibility of small, mini and micro hydro plants: scheme, layout and economics.

Unit IV WIND AND TIDAL ENERGY

L 9 T 0

Introduction – Wind Energy – Wind speed and power relation – Power extracted from wind – wind distribution and wind speed predictions – types of Wind power systems.

Introduction – origin of tides – power generation schemes – Wave Energy – basic theory – wave power Devices.

Unit V OTHER RENEWABLE ENERGY SOURCES

L 9 T 0


Introduction – Open and Closed OTEC cycles – Ocean Currents – Salinity Gradient Devices – Potential impacts of harnessing the different renewable energy resources.

Total Number of hours: 45**Learning Resources****Text Books**

1. Twidell John; Weir, Tony, "Renewable energy resources", Taylor & Francis, 2010
2. Godfrey Boyle, "Renewable energy – power for a sustainable future", Oxford University Press, 2010
3. Kothari DP, Singal KC and Rakesh Ranjan, 'Renewable Energy Sources and Emerging Technologies' PHI Learning Pvt. Ltd.2011.
4. S.A. Abbasi and Naseema Abbasi, "Renewable energy sources and their environmental impact", Prentice- Hall of India, 2001.

Reference Books

1. T.N.Veziroglu, Alternative Energy Sources, Vol 5 and 6, McGraw Hill, 1978.
2. G D Rai, "Non-conventional sources of energy", Khanna Publishers, 2002.
3. G D Rai, "Solar energy utilization", Khanna Publishers, 2005.
4. MukundR.Patel, "Wind and Solar Power Systems", CRC Press, Taylor and Francis, 2005.
5. Yogi Goswami, 'Principles of Solar Engineering' CRC Press, 2015, ISBN 10: 1466563788


Dr. D. SENTHIL KUMAR, M.E., Ph.D
PROFESSOR & HEAD
DEPT. OF MECHANICAL ENGG.
SONA COLLEGE OF TECHNOLOGY
JUNCTION MAIN ROAD, SALEM-5.

V. Jem

Semester –V	U19GE501 : SOFT SKILLS AND APTITUDE - III	L	T	P	C	Marks
		0	0	2	1	100
Course Outcomes						
At the end of the course the student will be able to:						
1. Demonstrate capabilities in supplementary areas of soft-skills and job-related selection processes using hands-on and/or case-study approaches						
2. Solve problems of advanced levels than those in SSA-II in specified areas of quantitative aptitude and logical reasoning and score 70-75% marks in company-specific internal tests						
3. Display effective language knowledge to construct sentences with subject verb agreement and select the best alternative for the underlined parts of the sentences, and fill in the blanks in the given passages with suitable forms of words and their synonyms.						
1.SOFT SKILLS	Demonstrating soft-skill capabilities with reference to the following topics: <ol style="list-style-type: none"> Career planning Resume writing Group discussion Teamwork Leadership skills Interview skills Mock interviews Mock GDs 					
2.QUANTITATIVE APTITUDE AND LOGICAL REASONING	Solving problems with reference to the following topics : <ol style="list-style-type: none"> Geometry: 2D, 3D, Coordinate Geometry, and Height & Distance. Permutation&Combinations:Principles of counting, Circular Arrangements and Derangements. Probability: Addition & Multiplication Theorems, Conditional Probability and Bayes Theorem. Statistics : Mean Median, Mode, Range and Standard Deviation. Interest Calculation :Simple Interest and Compound Interest Crypto arithmetic: Addition and Multiplication based problem. Logical Reasoning :Blood Relations, Directions Test, Series, Odd man out, Analogy, Coding & Decoding, Problems and Input – Output Reasoning. Statement & Assumptions, Statements & Arguments, Inference. Company Specific Pattern :Infosys and TCS company specific problems 					
3. VERBAL APTITUDE	Demonstrating English language skills with reference to the following topics: <ol style="list-style-type: none"> Subject verb agreement Selecting the best alternative for the stated parts of given sentences Reading comprehension Contextual synonyms Sentence fillers Writing a story for a given picture Company specific aptitude questions 					

S. Anita
8/6/2023

Dr.S.Anita

Head/Training

Dr. S. ANITA

Professor and Head

Department of Training,

SONA COLLEGE OF TECHNOLOGY,

SALEM-636 005.

Syllabi for

**B.E/B.Tech Honours (Specialization in the
same Discipline)**

B.E/B.Tech Honours

B.E/B.Tech Minor

courses

COURSE OUTCOME:

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

1. Learn the foundations of data science and the primary areas of this discipline's research.
2. Demonstrate skill in Python sequence data structures, including strings, arrays, lists, tuples, sets, and dictionaries.
3. Apply aggregation functions such as finding the minimum, maximum, and mean values of arrays.
4. Apply various operations and transformations on data using Pandas methods and functions.
5. Analyse the need for data pre-processing and Web scrapping techniques.

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

UNIT I INTRODUCTION DATA SCIENCE AND PYTHON

9

What is data? what is data science? - Fundamentals of data science - Data science life cycle - Why data science is important? - Applications of data science -Basics of data: categories of data- Sources of data- data processing -Why Python is necessary for data science? - Jupyter/pycharm/spyder or any other python tool set up and installation.

UNIT II BASICS OF PYTHON AND DATA STRUCTURES

9

Data types - operators – variables – expressions - control structures using sample dataset-objects and functions -Python sequence data structures including String, Array, List, Tuple, Set, and Dictionary.

UNIT III INTRODUCTION TO NUMPY

9

Understanding Data Types in Python -The Basics of NumPy Arrays-Computation on NumPy Arrays: Universal Functions -Aggregations: Min, Max, and Everything In Between - Computation on Arrays: Broadcasting -Comparisons, Masks, and Boolean Logic- Fancy Indexing -Sorting Arrays-Structured Data: NumPy's Structured Arrays

UNIT IV DATA MANIPULATION WITH PANDAS

10

Introducing Pandas Objects - Data Indexing and Selection - Operating on Data in Pandas - Handling Missing Data - Hierarchical Indexing -Combining Datasets: Concat and Append - Combining Datasets: Merge and Join- Aggregation and Grouping - Pivot Tables - Vectorized String Operations - Working with Time Series -High-Performance Pandas: eval () and query()


DR. J. AKILANDESWARI
 PROFESSOR & HEAD
 Department of Information Technology
 SONA COLLEGE OF TECHNOLOGY
 SALEM - 636 005




Data pre-processing: data loading - dealing with missing values and outliers - data wrangling - filtering data - Data Normalization - Data Formatting -data cleaning - Web scraping with beautiful soup.

THEORY – 45 HRS

PRACTIAL: 30 HRS

TOTAL: 75 HOURS

LAB EXERCISES:

1. Write a python program to perform following operations.
 - a. Create a list, insert elements into the list and sort it in ascending order.
 - b. Create a dictionary of 10 elements, change/delete the values of few keys and display the dictionary before and after the updates.
 - c. Create a tuple and a list. Convert the list to tuple and display the elements of both. Write the program to remove the duplicate element of the list.
2. Write a python program to perform following task using NumPy
 - a. Develop a program to learn concept of array and NumPy module.
 - b. Convert a list of numeric value into a one-dimensional NumPy array. And perform all operations on that array.
 - c. Find the union of two arrays. Union will return the unique, sorted array of values that are in either of the two input arrays.
3. Perform the following task using pandas
 - a. Convert a NumPy array to a Pandas series. Also write a Pandas program to calculate the frequency counts of each unique value of a given series.
 - b. Read a dataset from diamonds DataFrame and modify the default columns values and print the first 6 rows. Also find the number of rows and columns and data type of each column of diamonds DataFrame.
4. Write a program to perform all basic data pre-processing steps on the given data set.
5. Write a program to perform exploratory data analysis on the given dataset.

TEXTBOOKS:

1. Python for data science for dummies 2nd Edition, John Paul Mueller, Luca Massaron, and Wiley.(Unit- 1,4,5)
2. Vasiliev, Y. (2022). Python for Data Science: A Hands-On Introduction. United Kingdom: No Starch Press. (Unit- 1,3,4)
3. Thareja, R. (2019). Python Programming: Using Problem Solving Approach. India: Oxford University Press. (Unit- 2)

REFERENCE BOOKS:

1. Pandas for everyone: Python Data Analysis, Daniel Y. Chen, Pearson
2. Introducing Data Science: Big Data, Machine Learning, and More, Using Python Tools, Davy Cielen, Arno D.B. Meysman, et al., Minning
3. Applied Data Science with Python and Jupyter: Use powerful industry-standard tools to unlock new, actionable insights from your data.




Dr. J. AKILANDESWARI
PROFESSOR & HEAD
Department of Information Technology
SONA COLLEGE OF TECHNOLOGY
SALEM - 636 005

COURSE OUTCOMES

At the end of the course, student will able to

1. Explain the life cycle of data analytics project
2. Apply Exploratory Data Analysis over the dataset
3. Explore data pre-processing and feature selection techniques over a dataset
4. Apply association rule mining to find the frequent item set in business data repository
5. Build different type of regression models for different business use cases

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

UNIT I INTRODUCTION

9

Need for data science – benefits and uses – facets of data – Data Analytics Lifecycle: Data Analytics Lifecycle Overview - Discovery – Data Preparation – Model Planning –Model Building – Communicate Results

UNIT II EXPLORATORY DATA ANALYTICS

9

Exploratory Data Analysis: Visualization before Analysis, Dirty Data, Examining Single and Multiple Variable, Data Exploration- Statistical Methods for Evaluation: Hypothesis Testing, Difference of Means, Wilcoxon Rank-Sum Test, Type I and Type II errors, Powers and Sample Size, ANOVA

UNIT III DATA PRE-PROCESSING AND FEATURE SELECTION

9

Data cleaning - Data integration - Data Reduction - Data Transformation and Data Discretization, Feature Generation and Feature Selection, Feature Selection algorithms: Filters-Wrappers, and Embedded

Dr. J. Akilandeswari
DR. J. AKILANDESWARI
 PROFESSOR & HEAD
 Department of Information Technology
 SONA COLLEGE OF TECHNOLOGY
 SALEM - 636 005

UNIT IV DATA ANALYTICS METHOD – ASSOCIATION RULE MINING 9

Association Rules: Apriori Algorithm, Evaluation of Candidate rules, Application of Association Rules, Frequent Pattern Growth Algorithm, Validation and Testing, Rule based Classifiers – Use case: Grocery Stores, Recommendation System

UNIT V REGRESSION MODELS 9

Regression Models – Use of Regression Analysis – Types of Regressions: Linear Regression, Logistic Regression, Polynomial Regression, Stepwise Regression, Ridge Regression, Lasso Regression, and ElasticNet Regression- Selection of Right Regression Model –Use Case: Sales Forecasting, Credit Card industry

TOTAL: 45 HOURS

TEXT BOOKS

1. David Dietrich, Barry Heller, Beibei Yang, “Data Science and Big data Analytics: Discovering, Analysing, Visualizing, and Presenting Data ”, Wiely 2015

REFERENCES

1. David Cielen, Arno D. B. Meysman, and Mohamed Ali, “Introducing Data Science”, Manning Publications, 2016.
2. Jiawei Han, Micheline Kamber and Jian Pei ,”Data Mining: Concepts and Techniques”, 3rd Edition , Morgan Kaufmann,2011
3. Jay Liebowitz, “Big Data and Business Analytics”, CRC Press, 2013
4. Cathy O'Neil and Rachel Schutt, “Doing Data Science”. O'Reilly, 2014.

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DR. J. AKILANDESWARI
PROFESSOR & HEAD
Department of Information Technology
SONA COLLEGE OF TECHNOLOGY
SALEM - 636 005


mech
VI

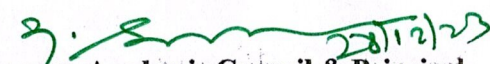
Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for B.E/B.Tech. Semester VI Regulations 2019
Branch: Mechanical Engineering

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit	Total Contact Hours
Theory							
1	U19ME601	Design of Machine Elements	3	1	0	4	60
2	U19ME602	Mechatronics System Design	3	0	0	3	45
3	U19ME603	Operations Research	3	1	0	4	60
4	U19ME910	Professional Elective – Robotics and Automation	3	0	0	3	45
	U19ME911	Professional Elective – Product Design and Development					
5	U19ME904	Professional Elective - Heating Ventilation and Air Conditioning Design	3	0	0	3	45
	U19ME905	Professional Elective - Modern Vehicle Technology and Automotive Testing					
6		*Open Elective – I	3	0	0	3	45
Practical							
7	U19ME604	Mechatronics and Simulation Laboratory	0	0	4	2	60
8	U19ME605	Computer Aided Manufacturing and Measurements Laboratory	0	0	4	2	60
9	U19GE601	Soft Skills and Aptitude – IV	0	0	2	1	30
Total Credits						25	

Approved By


Chairperson, Mechanical Engineering BoS
Dr. D. Senthilkumar


Member Secretary, Academic Council
Dr. R. Shivakumar


Chairperson, Academic Council & Principal
Dr. S.R.R. Senthil Kumar

Copy to:-
HOD/Mechanical Engineering, Sixth Semester BE Mechanical Students and Staff, COE,

22.12.2023


Regulations-2019

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S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit	Total Contact Hours
*Open Elective – I							
1	U19CS1001	Big Data Analytics	3	0	0	3	45
2	U19CS1002	Cloud Computing	3	0	0	3	45
3	U19EE1001	Electric Mobility	3	0	0	3	45
4	U19EE1002	Energy Conservation and Management	3	0	0	3	45
5	U19CE1003	Energy Efficiency and Green Building	3	0	0	3	45
6	U19FT1001	Fundamentals of Fashion Design	3	0	0	3	45
7	U19MC1004	Fundamentals of Robotics	3	0	0	3	45
8	U19FT1002	Garment Manufacturing Technology	3	0	0	3	45
9	U19EE1003	Innovation, IPR and Entrepreneurship Development	3	0	0	3	45
10	U19IT1004	Introduction to Database Technology	3	0	0	3	45
11	U19EC1006	Mobile Technology and its Applications	3	0	0	3	45
12	U19CE1002	Municipal Solid Waste Management	3	0	0	3	45
13	U19EE1004	Renewable Energy Systems	3	0	0	3	45

Approved By


Chairperson, Mechanical Engineering BoS
Dr.D.Senthilkumar


Member Secretary, Academic Council
Dr.R.Shivakumar 24/12/23


Chairperson, Academic Council & Principal
Dr.S.R.R.Senthil Kumar

Copy to:-
HOD/Mechanical Engineering, Sixth Semester BE Mechanical Students and Staff, COE

Pre-Requisites Subject: Engineering Mechanics, Kinematics of Machinery, Dynamics of Machinery and Strength of Materials

Course Outcomes

Upon completion of this course the students will be able to

- CO1** Select the materials based on Mechanical properties, different types of loading and explain simple, steady and variable stresses.
- CO2** Illustrate the design procedure for various types of shafts, keys and couplings.
- CO3** Design the threaded fasteners, bolted joints including eccentric loading & welded joints and riveted joints for pressure vessels and structures.
- CO4** Design the various types of springs like helical, leaf and torsional springs under constant loads and varying loads.
- CO5** Develop the design procedure for various types of bearings like sliding contact and rolling contact bearing.

CO / PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak Programme Outcomes (POs) and Programme Specific Outcome (PSOs)														
COs, POs PSOs Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO - 1	2	2	2			1				1			1	
CO - 2	2	2	2			1				1			2	
CO - 3	3	3	3			1	1	1		1		2	2	
CO - 4	3	3	3			1	2	1		1		2	2	
CO - 5	3	3	3			1	2	1		1		2	2	

Unit I STEADY AND VARIABLE STRESSES

L 9 T 3

Fundamentals of machine design - Introduction to the design process - Factor influencing machine design, selection of materials based on mechanical properties, fits and tolerances - Direct, bending and torsional stress equations - Role of factor of safety - Theories of failure - Design for variable loading - Soderberg, Goodman and Gerber relations - Design of curved beams.

Unit II DESIGN OF SHAFTS AND COUPLINGS

L 9 T 3

Design of solid and hollow shafts based on strength and rigidity - Design of rigid couplings - Flange, Box and clamp - Introduction of flexible couplings - Bushed pin type.

Unit III DESIGN OF FASTENERS AND WELDED JOINTS

L 9 T 3

Threaded fasteners - Design of bolted joints including eccentric loading - Design of welded joints - Eccentric loaded welded joints- Introduction of riveted joints-Types of failure of riveted joints for structures and pressure vessel/cylinders.

Unit IV DESIGN OF SPRINGS AND ENGINE COMPONENTS L 9 T 3

Design of helical, leaf and torsional springs under constant loads and varying loads - Introduction of concentric springs - Design of Flywheels for engines and punching machines.

Unit V DESIGN OF BEARINGS L 9 T 3

Design and Selection of sliding and rolling contact bearings - Cubic mean load - Design of journal bearings - McKees equation - Lubrication in journal bearings - Bearing materials for various applications.

Total Number of hours: 60

Note: Use of P S G Design Data Book is permitted


Learning Resources

Text Books

1. Joseph Shigley, Charles Mischke, Richard Budynas and Keith Nisbett "Mechanical Engineering Design", 9th Edition, Tata McGraw-Hill, 2020.
2. R.S.Khurmi, "Machine Design", 25th edition, S Chand Publisher, 2020.
3. Bhandari V, "Design of Machine Elements", 3rd Edition, Tata McGraw-Hill Book Co, 2021.

Reference Books

1. Ansel Ugural, "Mechanical Design - An Integral Approach", First Edition, Tata McGraw-Hill Book Co, 2010.
2. Merhyle F. Spotts, Terry E. Shoup and Lee E. Hornberger, "Design of Machine Elements" Eight Edition, Printice Hall, 2012.
3. Orthwein W, "Machine Component Design", Jaico Publishing Co, 2015.
4. Bernard Hamrock, Steven Schmid, Bo Jacobson, "Fundamentals of Machine Elements", Second Edition, Tata McGraw-Hill Book Co., 2017.
5. Alfred Hall, Halowenko, A and Laughlin, H., "Machine Design", Tata McGraw-Hill Book Co. (Schaum's Outline), 2018.
6. Sundararamoorthy T. V. Shanmugam .N, "Machine Design", Anuradha Publications, Chennai, 2019.
7. Robert C. Juvinall and Kurt M. Marshek, "Fundamentals of Machine Design", Fourth Edition, Wiley, 2020.


Dr. D. SENTHIL KUMAR, M.E., Ph.D
PROFESSOR & HEAD
DEPT. OF MECHANICAL ENGG.
SONA COLLEGE OF TECHNOLOGY
JUNCTION MAIN ROAD, SALEM-5.

COURSE CODE U19ME602

L T P C

COURSE NAME MECHATRONICS SYSTEM DESIGN

3 0 0 3

Pre-Requisites Subject: Electrical Drives and ARM processor, Instrumentation and Control Systems.

Course Outcomes

Upon completion of this course the students will be able to

- CO1** Analyze open loop and closed loop system in Mechatronics system.
- CO2** Select the suitable actuator for Mechatronics system Product.
- CO3** Design the hydraulic and pneumatic circuit for the given application.
- CO4** Identify the controller and construct a PLC ladder program for the given application.
- CO5** Apply the concepts of AI in mechatronics and suggest suitable solution for the industrial requirement.

CO / PO, PSO Mapping														
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
Programme Outcomes (POs) and Programme Specific Outcome (PSOs)														
COs, POs PSOs Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO - 1			2							2		2		2
CO - 2	1											2		2
CO - 3			2			2		2		2			2	2
CO - 4					2				2				1	3
CO - 5		2			2					2		2	2	3

Unit I INTRODUCTION TO MECHATRONICS SYSTEMS

L 9

Introduction to Mechatronics: Mechatronics- elements – mechatronics approach to modern engineering. Mechatronics system – Measurement systems – control systems- automatic control, sequential controllers - Microprocessor based controllers-examples.

Advanced Sensors: Performance terminology and Characteristics of Sensors-Advanced sensors-RFID sensor, Sniff Sensor, Smart sensor-types and Properties.

Unit II ACTUATION SYSTEM FOR MECHATRONICS

L 9

Hydraulic and Pneumatic Actuation Systems: linear and rotary actuator –hydraulic and pneumatic motors, control valves -Directional control valves, flow control, Mechanical Actuation systems – Cams- Gear Trains – Ratchet and pawl.

Electrical actuation- Solenoids, BLDC motor, stepper motor and servomotors-application and selection of motor.

Unit III HYDRAULIC AND PNEUMATIC CIRCUIT DESIGN

L 9

Hydraulic circuits design- Symbol, Reciprocating–quick return–pressure sequencing circuit, regeneration and synchronizing circuit, speed control–meter in, meter out and bleed off circuit, accumulator and safety circuits, clamping and drilling circuit.

Pneumatic circuits design: pneumatic circuits- hydro pneumatic circuits - logic circuits, cylinder sequencing circuit-cascade circuit and its applications.

Unit IV CONTROLLERS AND PROGRAMMABLE LOGIC CONTROLLERS

L 9

Controller : Modes of Controller- On – Off mode, Proportional mode, Derivative mode, Integral Mode, PI Mode, PD mode –PID Controllers.

Programmable Logic Controllers: Introduction -basic structure, Relay logic, Input/output processing, ladder diagram and programming - timers, counters, latching, internal relays and shift registers, data handling, selection of a PLC, I/O interfacing, simple ladder programming applications for the industrial requirements.

Unit V ARTIFICIAL INTELLIGENCE IN MECHATRONICS AND CASE STUDIES

L 9

AI concepts in mechatronics –Perception and Cognition, Neural Networks, Reasoning- Fuzzy logic –Application of AI in mechatronics.

Case studies: Control of Washing machine –Autofocus Camera, exposure control, Engine management systems – Controlling temperature of a hot/cold reservoir using PID – Control of pick and place robot – Part identification and tracking using RFID.

Total Number of hours: 45


Learning Resources

Text Books

1. Nitaigour Premchand Mahalik., "Mechatronics: Principles, Concepts and Applications", Tata Mc Graw Hill, 2003.
2. Bolton, N., "Mechatronics: A Multidisciplinary Approach", 4th edition, Pearson Education, 2013.

Reference Books

1. Ernest O. Doebelin, "Measurement system, Application and design", Tata McGraw Hill Publishing Company Ltd., Fiftieth Edition, 2004.
2. Patranabis D., "Sensor and Actuators", Prentice Hall of India (Pvt) Ltd., 2005.
3. Bradley, D.Dawson, N.C. Burd and A.J. Loader, "Mechatronics: Electronics in Products and Processes", CRC Press 1991, First Indian print 2010.
4. Devdas shetty, Richard A. Kolk, "Mechatronics System Design", 2nd Edition, Cengage Learning 2011.
5. De Silva, "Mechatronics: A Foundation Course", Taylor & Francis, Indian Reprint, 2013.
6. David Allan Bradley, Derek Seward, David Dawson, "Mechatronics and the Design of Intelligent Machines and Systems" CRC press, 2018.
7. Jeremy Blum, "Exploring Arduino: Tools and Techniques for Engineering Wizardry. Wiley publisher, 2019.



Dr. D. SENTHIL KUMAR, M.E., Ph.D
PROFESSOR & HEAD
DEPT. OF MECHANICAL ENGG.
SONA COLLEGE OF TECHNOLOGY
JUNCTION MAIN ROAD, SALEM-6.

Pre-Requisites Subject: Probability and statistics, Multivariable Calculus.

Course Outcomes

Upon completion of this course the students will be able to

- CO1** Formulate real life situations into linear programming problems and solve using the algorithms.
- CO2** Construct and solve industrial problems using transportation and assignment modeling.
- CO3** Analyze various routing issues using network models to solve them and understand game theory.
- CO4** Design inventory models to help decision making of purchase and production department.
- CO5** Formulate queuing models for service systems and solve them optimally. Simulate exponential and Poisson models and suggest realistic solutions.

CO / PO, PSO Mapping														
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
Programme Outcomes (POs) and Programme Specific Outcome (PSOs)														
COs, POs PSOs Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO - 1	3	2										2		
CO - 2	3	3										2	2	
CO - 3	3	3										2	2	
CO - 4	3	3										2	2	
CO - 5	3	3										2	2	

Unit I LINEAR PROGRAMMING

L 9 T 3

Introduction to operations research- Linear programming, Mathematical formulation of real life problems- Graphical solution - Mathematical formulation of a problem -Simplex Algorithm: Algebraic form, Tabular form, BIG-M, Two phase method. Introduction to dual simplex method, writing the dual of an LP, simple problems.

Unit II TRANSPORTATION AND ASSIGNMENT MODELS

L 9 T 3

Transportation problems - Introduction - Problem formulation, balancing the transportation problem - North West Corner method - Least cost method - Vogel's method, Assignment problems, Algorithm - Hungarian method, travelling salesman problem, real life problems in finding optimal number of delivery points and the capacity level of service outlets.

Unit III NETWORK MODELS AND GAME THEORY

L 9 T 3

Network models - Shortest route algorithm - Minimal spanning tree - Maximum flow algorithm - Designing different types of sales networks to minimize resource uses and improve efficiency. Critical path method - PERT networks. Introduction to game theory, two person zero sum games, problem formulation, graphical solutions.

Unit IV INVENTORY MODELS

L 9 T 3

Introduction to deterministic inventory models - Economic order quantity models - EOQ with price breaks, Quantity discount models - Probabilistic Inventory models - single period models, Multi period models.

Unit V QUEUEING THEORY AND SIMULATION MODELING

L 9 T 3


Elements of Queuing models - role of exponential and poisson distribution, - Single Server and multi-server models - Poisson input - Exponential service - Constant rate service. Monte carlo simulation, Discrete event simulation, Generation of random numbers and manual simulation of single server model.

Total Number of hours: 60**Learning Resources****Text Books**

1. H.A.Taha, "Operations Research ", Prentice Hall of India, 2011, Ninth Edition.
2. Panneerselvam.R , "Operations Research " , Prentice Hall of India, 2009, 2nd edition.
3. Hira and Gupta, "Introduction to Operations Research", S.Chand and Co., 2002.

Reference Books

1. Shenoy,G.V; Srivastava,U.K; Sharma,S.C, "Operation Research for Management " , New Age International (P) Ltd, 2005.
2. Sherali,Hanif.D ; Jarvis,John.J ; Bazaraa,Mokhtar.S, "Linear Programming and Network Flows " , Wiley-Interscience, 2005.
3. Ravindran.A; Phillips,Dow.T; Solberg,James,"Operations Research Principles & Practice " , John Wiley, 2004.



Dr. D.SENTHIL KUMAR, M.E., Ph.D
PROFESSOR & HEAD
DEPT. OF MECHANICAL ENGG.
SONA COLLEGE OF TECHNOLOGY
JUNCTION MAIN ROAD, SALEM-5.

Prerequisites- subject: Kinematics of machinery, Computer Aided Design and Analysis

Course Outcomes

Upon completion of this course the students will be able to

- CO1** Classify robot configuration and end effectors and state kinematics of robot.
- CO2** Analyze hydraulic, pneumatic and electrical drives of robot.
- CO3** Identify robot cell layout and write robot program for industrial application.
- CO4** Apply mechatronics design process for industrial automation and discuss industry 4.0.
- CO5** Recognize various transport system for automation and parts delivery system.

CO / PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak Programme Outcomes (POs) and Programme Specific Outcome (PSOs)														
COs, POs PSOs Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO - 1	3	3	3	2		3							1	3
CO - 2	3	2	3	3										3
CO - 3	3	3	3	3		3				3				2
CO - 4						2						3	3	3
CO - 5						3	3					3		2

Unit I INTRODUCTION AND ROBOT KINEMATICS

L 9

Definition need and scope of industrial robots – Robot anatomy – Work volume – Precision movement – Classification of robots. Robot Kinematics – Direct and inverse kinematics – Coordinate transformation, Types of end effectors - Grippers - Tools as end effectors - Robot/End - effort interface.

Unit II ROBOT DRIVES AND CONTROL

L 9

Hydraulic and pneumatic drives – Linear and rotary actuators and control valves –Electro hydraulic servo valves, electric drives – Motors, Design of drive systems controlling the robot motion –robot control - open loop and closed loop system- Position and velocity sensing devices

Unit III ROBOT CELL DESIGN AND INDUSTRIAL APPLICATION

L 9

Robot work cell design and control – safety in robotics – Robot cell layouts – Multiple Robots and machine interference – Robot cycle time analysis. Industrial application of robots in Welding - Assembly – inspection-Material handling –pick and place- Loading and unloading. Simple robot programming language for pick and place and loading and unloading.

Unit IV INTRODUCTION TO AUTOMATION

L 9

Introduction, Integrated design issues in automation systems, the Mechatronics design process- benefits, Architecture of industrial automation system, building blocks of automation systems, Automation in production system, classification of automated manufacturing system- fixed, programmable and flexible automation ,Automation principle and strategies - Fundamentals of industry 4.0

Unit V TRANSPORT SYSTEM AND ASSEMBLY AUTOMATION

L 9

Material transport system - Principles of material handling, overview of material handling equipment, AGVs, RGVs ASRS-Conveyor system-Types of conveyor system, belt conveyor elements, conveyor operation and features, Assembly automation Equipments-parts delivery system-Hopper Feeders.

Total Number of hours: 45


Learning Resources

Text Books

1. Mikell, P.Groover, Mitchell Weis, Roger, N.Nagel, Nicholas G.Odrey, "Industrial robotics Technology, Programming and applications" Mc Graw-Hill 2012.
2. K.S.Fu, R.C.Gonzalez and C.S.G lee, "Robotics control, Sensing, Vision and Intelligence" Mc Graw-Hill, 2008.

Reference Books

1. Mikell, P.Groover "Automation, Production system and Computer Integrated Manufacturing, Pearson Education. Asia 2001
2. Yoram Koren, "Robotics for Engineers" Mc Graw-Hill, 1987.
3. Kozyrey, Yu. "Industrial Robotics", MIR Publishers Moscow 1985.
4. Richard D, Klafter, Thomas A, Chmielewski, MichealNegin, "Robotics Engineering – An integrated Approach", Prentice-Hall of India Pvt Ltd 1984.
5. Deb S.R, "Robotics Technology and Flexible Automation", Tata Mc Graw-Hill, 1994
6. Ashitava Ghosal," Robotics fundamental concepts and Analysis," oxford university press, 11th compression 2015.
7. Khushdeep goyal Deepak Bhandari Industrial automation and robotics S.K.Kataria & Sons. Fifth Edition 2015


DR. D. SENTHIL KUMAR, M.E., Ph.D
PROFESSOR & HEAD
DEPT. OF MECHANICAL ENGG.
SONA COLLEGE OF TECHNOLOGY
JUNCTION MAIN ROAD, SALEM-5.

COURSE CODE U19ME911

L T P C

COURSE NAME PRODUCT DESIGN AND DEVELOPMENT

3 0 0 3

Course Outcomes

Upon completion of this course the students will be able to:

- CO1** Apply the fundamental principles of product design and development for new product development.
- CO2** Perform concept generation and select the best one by structured approaches.
- CO3** Test the selected concept and develop product architecture.
- CO4** Assess the importance of industrial design.
- CO5** Apply the principles of design for environment and manufacturing.

CO / PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
Programme Outcomes (POs) and Programme Specific Outcome (PSOs)														
COs, POs PSOs Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO - 1			3						2	2			3	
CO - 2			3						2	2			3	
CO - 3			3						2	2			3	
CO - 4			2			2			2	2			3	
CO - 5							2	2	2	2			3	

Unit I INTRODUCTION TO PRODUCT DESIGN AND DEVELOPMENT

L 9

Characteristics of successful product development - Challenges of Product development - phases of generic product development process - opportunity identification process - Identification of customer needs - Establishing product specifications - case study on developing product specification for mountain bike with suspension fork.

Unit II CONCEPT GENERATION AND SELECTION

L 9

Phases of concept generation process - Structured approaches - clarification - search externally and internally-Explore systematically - reflect on the solutions and processes - concept selection - phases - concept screening - concept scoring - case studies on concept generation and selection.

Unit III CONCEPT TESTING AND PRODUCT ARCHITECTURE

L 9

Seven step method for concept testing - product architecture - types of modularity - product change - product variety - component standardization - product performance - product development management - Steps involved in establishing product architecture - case study on establishing product architecture of a Deskjet printer - platform planning.

Unit IV INDUSTRIAL DESIGN

L 9

Need for industrial design – critical goals of industrial designers – Ergonomic needs – Aesthetic needs – case study on assessing the importance of industrial design for a mobile phone – industrial design and corporate identity – Industrial design process – case studies on assessing the Quality of Industrial Design.

Unit V DESIGN FOR ENVIRONMENT & MANUFACTURING

L 9

Stages in natural and product life cycle management – Environmental impacts - The Design for Environment Process – Introduction to Design for manufacturing (DFM) – The five-step process involved in DFM – Case studies – Ethical principles in product design.

Total Number of hours: 45


Learning Resources

Text Books

1. Karl Ulrich, Steven Eppinger, Maria C. Yang, Product Design And Development, 7th Edition, McGraw Hill, 2020

Reference Books

1. Mattson, Christopher A., and Carl D. Sorensen. Product Development: Principles and Tools for Creating Desirable and Transferable Designs. Springer Nature, 2019.
2. Jamnia, Ali. Introduction to product design and development for engineers. CRC Press, 2018.
3. Desai, Anoop, and Anil Mital. Sustainable Product Design and Development. CRC Press, 2020.
4. Boothroyd, Geoffrey, Peter Dewhurst, and Winston A. Knight. Product design for manufacture and assembly. CRC press, 2010.
5. Morris, Richard. The fundamentals of product design. Bloomsbury Publishing, 2016.


Dr. D. SENTHIL KUMAR, M.E., Ph.D
PROFESSOR & HEAD
DEPT. OF MECHANICAL ENGG.
SONA COLLEGE OF TECHNOLOGY
JUNCTION MAIN ROAD, SALEM-5.

Pre-Requisites Subject: Engineering Thermodynamics, Thermal Engineering, Heat and Mass Transfer.

Course Outcomes

Upon completion of this course the students will be able to

- CO1** Develop an understanding of basic physical principles of refrigerants, air and efforts of heat transfer through materials.
- CO2** Estimate the heating and cooling load for various buildings.
- CO3** Design simple duct layouts and estimate the pressure drop in simple duct layouts.
- CO4** Select the suitable fan for the air distribution systems.
- CO5** Suggest an appropriate Air Conditioning system for specific applications.

CO / PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
Programme Outcomes (POs) and Programme Specific Outcome (PSOs)														
COs, POs PSOs Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO - 1	3	3	3					2					3	2
CO - 2	3	3	3		3							2	2	3
CO - 3	3	3	3										3	3
CO - 4	3	3	3										3	3
CO - 5	3	3	3								3	2	2	3

Unit I INTRODUCTION

L 9

Introduction to HVAC- scope - modes of Heat transfer in building - Refrigerants- types properties of refrigerants, properties of air, psychrometric processes, psychrometric chart - basic components of air conditioning - RTU, AHU etc. - functions of HVAC systems - Codes and standards - ASHRAE, ISHRAE, IMC.

Unit II LOAD CALCULATIONS

L 9

Heating and Cooling Load calculation - Room types - load sources - internal and external - infiltration, ventilation (Restaurant, kitchen, parking area and Toilet)- case study of various buildings.

Unit III DUCT DESIGN

L 9

Ducts and its types, Duct materials, fittings, dampers, Pressure losses in ducts, Equivalent diameter, Duct designing methods (manual calculations) using Equal friction/Velocity reduction method.

Unit IV AIR DISTRIBUTION SYSTEMS

L 9

Principles of air distribution systems – types, Diffusers – grills – selection – fans – types – performance characteristics.

Unit V AIR CONDITIONING SYSTEMS & HVAC COMMISSIONING

L 9

Air conditioning systems – Unitary Air Conditioning Systems - Central Air Conditioning Systems - Chilled water system.

HVAC Commissioning- Cost / Benefit Analysis - Testing and Commissioning Procedures for HVAC Systems.

Total Number of hours: 45

Note: (Use of "Refrigeration and Air-Conditioning" data book, Domkundwar, Dhanpat Rai & co, and Approved HVAC data book are permitted in the University examination).

Learning Resources**Text Books**

6. R.K.Rajput, "A Textbook of Refrigeration and Air-Conditioning", S.K. Kataria & Sons, 2014.
7. Faye C. McQuiston, Jerald D. Parker & Jeffrey D. Spitler "Heating, Ventilating, and Air Conditioning analysis and Design", sixth edition, Wiley, Reprint 2016.

Reference Books

1. Ali vedavarz, Sunil kumar and Muhammed iqbal hussain, "The Handbook of Heating, Ventilation and Air Conditioning for Design and Implementation", Industrial press inc, new york, 2007.
2. Edward G. Pita "Air conditioning Principles and systems", PHI learning Private Limited, Fourth edition, Reprint 2012.
3. P.L. Ballaney, "Refrigeration and Air Conditioning", Khanna Publishers, 2013.
4. Shan K. Wang, "Handbook Of Air Conditioning And Refrigeration", Second Edition, McGraw-Hill
5. Arthur A. Bell Jr, "HVAC Equations, Data, and Rules of Thumb", McGraw-Hill.

Course Outcomes

Upon completion of this course the students will be able to

- CO1** Discuss the vehicle control, geographical information and autonomous safety systems.
- CO2** Design and implement the comfort and security systems for autonomous vehicles.
- CO3** Discuss the various vibration measurement test, Vehicle roof strength test and Fuel consumption test for autonomous vehicles.
- CO4** Analysis the performance of suspension, shock absorber and Steering control system.
- CO5** Evaluate the performance of wheels and braking system.

CO / PO, PSO Mapping														
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
Programme Outcomes (POs) and Programme Specific Outcome (PSOs)														
COs, POs PSOs Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO - 1						2	3							
CO - 2						2	3							
CO - 3	3		3			2							3	
CO - 4	3	3	3			2							3	
CO - 5	3	3	3				3						3	

Unit I DRIVER ASSISTANCE, TELEMATICS AND SAFETY SYSTEM L 9

Driver information - driver perception - driver monitoring, general vehicle control - longitudinal and lateral control, collision avoidance, vehicle monitoring. Global positioning system, geographical information systems, navigation system, automotive vision system, road recognition. Active and passive safety, forward collision warning systems, Autonomous Vehicle System, Lane departure warning system, Adaptive headlight system, Day time running lights (DRL), Automatic wiper system, Traffic Sign Identification.

Unit II COMFORT SYSTEMS AND SECURITY SYSTEMS L 9

Adaptive cruise control system - Active suspension system- collapsible and climate control system. Anti-theft technologies - mechanical, electromechanical and electronic immobilizers, alarm system, stolen vehicle tracking system, remote keyless entry, smart card system, number plate coding, Bio metric systems.

Unit III RIDE VIBRATION AND BODY TEST

L 9

Vibration measurement instrument - accelerometer and signal conditioning. Dynamic simulation sled testing, vehicle acceleration measurement. Dolly roll over test - dolly roll over fixture, Vehicle roof strength test - test procedure and test measurements. Door system crush test - procedure and measurements. Fuel consumption test - test route selection, vehicle test speeds, cargo weights, driver selection, simple calculations.

Unit IV SUSPENSION AND STABILITY FOR**DIRECTIONAL CONTROL TEST**

L 9

Measurement of dimensional and geometric characteristics - measurement of centre of gravity position, suspension elastic and coulomb friction characteristics, measurement of shock absorber characteristics. Steering control system directional control test - Analysis of constant radius test, constant steer angle test, constant speed variable radius test, constant speed variable steer angle test, response gain test and simple design calculation.

Unit V WHEELS AND BRAKING PERFORMANCE TEST

L 9

Dynamic cornering fatigue, dynamic radial fatigue tests - procedure, bending moment and radial load calculations. Impact test - road hazard impact test for wheel and tyre assemblies, test procedures, failure criteria and performance criteria. Bumpers - types of tests, fixed collision barrier test, procedure, performance criteria. Air and hydraulic brake test, air brake actuator, valves test, performance requirements. Parking brake - drawbar pull test, grade holding test and performance calculations.

Total Number of hours: 45**Learning Resources****Text Books**

1. Crouse W.H. and Anglin D.L., "Automotive Mechanics" Tata McGraw Hill Publishing Company, 2004.
2. Rangan, Mani and Sharma, "Instrumentation", Tata McGraw Hill Publishers, New Delhi, 2004.
3. Ronald K Jurgen, "Navigation and Intelligent Transportation Systems - Progress in Technology", Automotive Electronics Series. SAE, USA, 2001.

Reference Books

1. Beckwith TG. and Buck N L., "Mechanical Measurements", Addison Wesley Publishing Company Limited, 2004.
2. Tim Gilles, "Automotive Service" Delmar Publishers, 2005.
3. Jain R K. "Mechanical and Industrial Measurements", Khanna Publishers, Delhi, 2004.
4. LjuboVlacic, Michel Parent and Fumio Harashima, "Intelligent Vehicle Technologies", Butterworth-Heinemann Publications, Oxford, 2001.
5. Robert Bosch GmbH, "Safety, Comfort and Convenience Systems", Wiley, 2007.

Pre-requisites Subject: Electrical Drives and ARM processor Laboratory

Course Outcomes

Upon completion of this course the students will be able to

- CO1** Design the fluid power circuits to control the direction and speed of actuators.
- CO2** Analyze the performance of ON-OFF/P/PI/PD/PID controllers on Temperature Process, Flow Process and Pressure Process.
- CO3** Solve the real-time problem using fluid sim, Lab view and MATLAB in automation industry.

CO / PO, PSO Mapping														
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
Programme Outcomes (POs) and Programme Specific Outcome (PSOs)														
COs, POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO - 1	1				2				2	2		2	1	1
CO - 2				2	1				2	2		2	1	2
CO - 3	1			2	2				2	2		2	1	2

LIST OF EXPERIMENTS

1. Design the fluid power circuits to control the direction and speed of actuators.
2. Design of fluid power circuits to control the speed of actuators.
 - a. Meter in circuit
 - b. Meter out circuit
3. Design of circuits for the logic sequence using Electro pneumatic trainer kits.
4. Simulation of basic Hydraulic and Pneumatic circuits using software.
5. Design of circuits with Programmable logic controller in Electro pneumatic trainer.
6. Servo controller interfacing for open loop and closed loop.
7. PID controller interfacing of DC motor for the speed control.
8. Stepper motor interfacing with 8051 Micro controllers
 - a. Full step resolution
 - b. Half step resolution
9. Analyzing the performance of ON-OFF/P/PI/PD/PID controllers on Temperature Process, Flow Process and Pressure Process.
10. Simulation using LabVIEW and Data acquisition using NI Hardware
11. Simulation using MATLAB software
 - a. Simulation of Cam and follower mechanism to find the displacement

- b. Simulation of air conditioning with condenser and evaporator temperatures as input to estimate the COP
- c. Simulation of heat exchanger to find the LMTD
- d. Simulation of spring mass system by varying mass to find the frequency

List of Equipment (for a batch of 30 students)

- 1. Basic Pneumatic Trainer Kit with manual and electrical controls - 1 each
- 2. Basic Pneumatic Trainer Kit with PLC controls - 1 No.
- 3. Fluid sim- hydro & Pneumo Software - 2 sets.
- 4. LabVIEW software - 40 users.
- 5. Data acquisition setup - 1 each.
- 6. MATLAB Software- 20 users.

Total Number of Hours: 60

Dr. D. SENTHIL KUMAR, M.E., Ph.D
PROFESSOR & HEAD
DEPT. OF MECHANICAL ENGG.
SONA COLLEGE OF TECHNOLOGY
JUNCTION MAIN ROAD, SALEM-5.

COURSE CODE U19ME605

L T P C

COURSE NAME COMPUTER AIDED MANUFACTURING AND MEASUREMENTS LABORATORY

0 0 4 2

Pre-requisites subject: Manufacturing process, Instrumentation and Control Systems.

Course Outcomes

Upon completion of this course the students will be able to

- CO1 Write a CNC part program by using G & M Codes for turning machine.
- CO2 Measure the taper angle, cutting tool parameters, temperature, straightness, flatness, and gear tooth parameters.
- CO3 Simulate a CNC part program for manufacturing real time component applications.

CO / PO, PSO Mapping														
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
Programme Outcomes (POs) and Programme Specific Outcome (PSOs)														
COs, POs PSOs Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO - 1	2			2	2								2	
CO - 2	2	2		2									2	
CO - 3	2		2	2	2				2				2	

LIST OF EXPERIMENTS

PART-A- CAM

1. CNC lathe - Introduction to G-Code and M- code programming & operations.
2. CNC Part Programming for facing cycle.
3. CNC Part Programming for turning cycle.
4. CNC Part Programming for threading cycle.
5. CNC Part Programming for Taper Turning operation.
6. Circular Interpolation - CCW & CW operations.
7. Part Programming for Grooving, Drilling and Boring operations.
8. Multiple profile turning & boring canned cycle.
9. manufacturing of tapered nozzle for hydraulic and pneumatic systems.

PART-B-Measurements


1. Checking Linear dimensions of a part using slip gauges.
2. Measurement of Taper Angle using sine bar / bevel protractor.
3. Measurement of cutting tool parameters using tool makers microscope.
4. Measurement of straightness and flatness using auto-collimator.

5. Measurement of thread parameters using Profile projector / Floating carriage micrometer.
6. Checking the limits of dimensional tolerances using comparators (Mechanical / Pneumatic).
7. Measurement of Temperature using Thermocouple system.
8. Measurement of Force using load cell.
9. Measurement of Gear tooth dimensions using Gear Tooth Vernier.

List of Equipment's (for a batch of 30 students)

1. CNC Lathe
2. Simulation software - CADEM
3. Micrometer and Dial Gauge
4. Vernier Caliper, Vernier Height Gauge, Vernier Depth Gauge
5. Sine Bar and Slip Gauge Set
6. Bevel Protractor
7. Tool Makers Microscope
8. Autocollimator
9. Profile Projector
10. Floating Carriage Micrometer
11. Mechanical and Pneumatic Comparator
12. Temperature Measuring Setup
13. LVDT-Displacement Measuring Setup
14. Load cell -Force Measuring Setup
15. Gear Teeth Vernier

Total Number of Hours: 60


Dr. D. SENTHIL KUMAR, M.E., Ph.D
PROFESSOR & HEAD
DEPT. OF MECHANICAL ENGG.
SONA COLLEGE OF TECHNOLOGY
JUNCTION MAIN ROAD, SALEM-5.

Semester –VI	U19GE601: SOFT SKILLS AND APTITUDE – IV (Common to all dept except Civil)	L	T	P	C	Marks
Course Outcomes At the end of the course the student will be able to:						
1. Demonstrate capabilities in job-oriented company selection processes using the hands-on approach						
2. Solve problems of any given level of complexity in all areas of quantitative aptitude and logical reasoning and score 70-75% marks in company-specific internal tests						
3. Demonstrate advanced-level verbal aptitude skills in English and score 70-75% marks in company-specific internal tests						
1. Soft Skills	Demonstrating Soft -Skills capabilities with reference to the following topics: a. Mock group discussions b. Mock interviews c. Mock stress interviews					
2. Quantitative Aptitude and Logical Reasoning	Solving problems with reference to the following topics: a. Functions and Polynomials b. Clocks and Calendars c. Data Sufficiency: Introductions, 3 Options Data Sufficiency, 4 Options Data Sufficiency and 5 Options Data Sufficiency. d. Logical reasoning: Cubes, Non Verbal reasoning and Symbol based Reasoning. e. Decision making table and Flowchart Campus recruitment papers: Solving of previous year questions paper of all major recruiters f. Miscellaneous: Cognitive gaming Puzzles-(Picture, Word and Number based), IQ Puzzles, Calculation Techniques and Time Management Strategies. g. Trigonometry.- Concepts					
3. Verbal Aptitude	Demonstrating English language skills with reference to the following topics: a. Writing captions for given pictures b. Reading comprehension c. Critical reasoning d. Theme detection e. Jumbled sentences f. Writing a story on given pictures g. Company specific verbal questions					

30 Hours

S. Anita
18/12/2023

Dr.S.Anita
Professor and Head
Department of Training
Dr. S. ANITA
Professor and Head
Department of Training,
SONA COLLEGE OF TECHNOLOGY,
SALEM-636 005.

COURSE OUTCOMES:**At the end of the course the students will be able to**

- Compare and analyze different types of digital data characteristics of Big Data
- Implement programs using Hadoop open source software framework
- Design and develop programs using NoSQL Databases like Mongo DB and Cassandra
- Apply MapReduce programming for various big data based problems
- Implement programs using Hive and Pig Databases

CO / PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	Programme Outcomes (POs) and Programme Specific Outcome (PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	P09	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	2	1	2	0	1	0	2	1	2	2	2
CO2	2	1	2	2	3	2	0	1	1	2	2	2	2	2
CO3	2	1	2	3	3	2	1	1	1	2	3	2	2	3
CO4	3	1	2	3	3	2	0	1	0	2	3	2	2	3
CO5	2	2	3	3	3	1	0	1	0	2	3	2	3	3

UNIT I INTRODUCTION TO BIG DATA**9**

Types of Digital Data: Classification of Digital Data Characteristics of Data, Evolution of Big Data, Definition of Big Data, Challenges with Big Data, Characteristics of Big Data ,Traditional Business Intelligence (BI) versus Big Data, A Typical Data Warehouse Environment , A Typical Hadoop Environment.

UNIT II BIG DATA ANALYTICS**9**

Introduction -Big Data Analytics, Classification of Analytics, Challenges in Big Data, Technologies to handle Challenges Posed by Big Data- Data Science- Data Scientist, Terminologies Used in Big Data Environments, Basically Available Soft State Eventual Consistency (BASE), Few Top Analytics Tools.

UNIT III HADOOP**9**

Introduction Hadoop, RDBMS versus Hadoop, Distributed Computing Challenges ,History of Hadoop , Hadoop Overview, Use Case of Hadoop ,Hadoop Distributors ,HDFS (Hadoop Distributed File System),Processing Data with Hadoop, Managing Resources and Applications with Hadoop YARN (Yet another Resource Negotiator),Interacting with Hadoop Ecosystem, MapReduce Programming -Mapper, Reducer, Combiner, Partitioner, Searching, Sorting, Compression

UNIT IV NO SQL DATABASES

9

Cassandra :Apache Cassandra - An Introduction , Features of Cassandra, CQL Data types, CQLSH, Keyspaces, CRUD (Create, Read, Update and Delete) Operations, Collections, Using a Counter, Time to Live (TTL), Alter Commands, Import and Export, Querying System Tables, Practice Examples- MongoDB, Terms Used in RDBMS and MongoDB, Data Types in MongoDB , MongoDB Query Language

UNIT V HIVE AND PIG

9

Hive: Introduction to Hive, Hive Architecture, Hive Data Types, Hive File Format, Hive Query Language (HQL), RCFile Implementation, SerDe, User-defined Function(UDF).

Pig: Introduction to Pig, The Anatomy of Pig, Pig on Hadoop , Pig Philosophy, Use Case for Pig: ETL Processing, Pig Latin Overview , Data Types in Pig ,Running Pig , Execution Modes of Pig ,HDFS Commands ,Relational Operators ,Eval Function ,Complex Data Types ,Piggy Bank, User-Defined Functions (UDF) ,Parameter Substitution , Diagnostic Operator , Word Count Example using Pig,Pig versus Hive


Total: 45 hours

TEXT BOOKS:

1. **Big Data and Analytics**, Seema Acharya, Subhashini Chellappan, Infosys Limited, Publication: Wiley India Private Limited,1st Edition 2015(Chapters 1,2,3,4,5,6,7,8,9,10)

REFERENCE BOOKS:

1. **Hadoop in Practice**, Alex Holmes, Manning Publications Co., September 2014, Second Edition.
2. **Programming Pig**, Alan Gates, O'Reilly, Kindle Publication.
3. **Programming Hive**, Dean Wampler, O'Reilly, Kindle Publication.


Dr. B. SATHIYABHAMA, B.E., M.Tech., Ph.D.
PROFESSOR & HEAD,
Dept. of Computer Science and Engineering
SONA COLLEGE OF TECHNOLOGY
SALEM - 636 005

COURSE OUTCOMES:

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

1. Provide an overview of cloud computing
2. Explain the various tasks in developing cloud services
3. Analyze the provision of cloud computing services to different users
4. Configure the various cloud services according to the environment.
5. Analyze various ways to collaborate online

CO / PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	Programme Outcomes (POs) and Programme Specific Outcome (PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	2	1	2	0	1	0	2	1	2	2	2
CO2	2	1	2	3	3	2	0	1	1	2	2	3	3	3
CO3	2	1	3	3	3	2	0	1	0	3	3	2	3	3
CO4	2	1	2	3	3	2	0	1	0	2	3	3	3	3
CO5	2	2	3	3	3	1	0	1	0	2	3	2	3	3

UNIT I Understanding Cloud Computing**6**

Cloud Computing – History of Cloud Computing – Cloud Architecture – Cloud Storage – Why Cloud Computing Matters – Advantages of Cloud Computing – Disadvantages of Cloud Computing – Companies in the Cloud Today – Cloud Services

UNIT II Developing Cloud Services**10**

Web-Based Application – Pros and Cons of Cloud Service Development – Types of Cloud Service Development – Software as a Service – Platform as a Service – Web Services – On-Demand Computing – Discovering Cloud Services Development Services and Tools – Amazon – Google App Engine – IBM Clouds

UNIT III Cloud Computing for Everyone**10**

Centralizing Email Communications – Collaborating on Schedules – Collaborating on To-Do Lists – Collaborating Contact Lists – Cloud Computing for the Community – Collaborating on Group Projects and Events – Cloud Computing for the Corporation

UNIT IV Using Cloud Services**10**

Collaborating on Calendars, Schedules and Task Management – Exploring Online Calendar Applications- Collaborating on Contact Management – Collaborating on Project Management – Collaborating on Word Processing - Collaborating on Spread sheets- Collaborating on Databases – Storing and Sharing Files

Collaborating via Web-Based Communication Tools – Evaluating Web Mail Services –
Evaluating Web Conference Tools – Collaborating via Social Networks and Groupware –
Collaborating via Blogs and Wikis

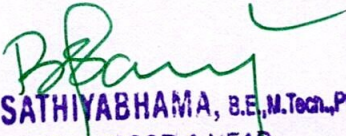
Total:45 hours

TEXT BOOK:

1. Michael Miller, Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online, Que Publishing, August 2008.

REFERENCE BOOK:

1. Haley Beard, Cloud Computing Best Practices for Managing and Measuring Processes for On-demand Computing, Applications and Data Centers in the Cloud with SLAs, Emereo Pty Limited, July 2008.


Dr. B. SATHIYABHAMA, B.E., M.Tech., Ph.D.
PROFESSOR & HEAD,
Dept. of Computer Science and Engineering
SONA COLLEGE OF TECHNOLOGY
SALEM-636 005

O.E

EEF
VI

U19EE1001

ELECTRIC MOBILITY

3 0 0 3

COURSE OUTCOMES

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

- Explain the need for electric and hybrid vehicles fundamentals.
- Describe the energy sources of types of batteries and fuel cells.
- Discuss the various types of motor control design features of Electric vehicle.
- Illustrate the design of various considerations of electric vehicle.
- Explain the hybrid design vehicle technology.

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

UNIT I INTRODUCTION 9

Need for electric and hybrid vehicles-Comparative study of electric and hybrid vehicles- Limitations of electric vehicles- Petroleum resources- Global warming-Fuel cell vehicles- Optimum solutions for motor, drives and batteries.

UNIT II ENERGY SOURCES 9

Battery Parameters-Power requirement of electric vehicles- Different types of batteries - Lead acid- Nickel based-Sodium based-Lithium based- Metal Air based. Battery charging- Charger design- Quick charging devices- Battery Modeling. Different type of energy storage – Solar, wind, compressed fluid. Fuel Cell- Fuel cell characteristics- Fuel cell types-Hydrogen fuel cell- Connecting cell in series.

UNIT III PROPULSION MOTORS AND CONTROLLERS 9

Characteristic of permanent magnet and separately excited DC motors.–Basic Principles of BLDC Motor Drives-Performance Analysis and Control of BLDC Machines- Inverters – DC and AC motor speed controllers.

S. Padma
23.12.23
Dr.S.PADMA, M.E., Ph.D.,
Professor and Head,
Department of EEE,
Sona College of Technology
Tamil Nadu-636 005.

UNIT IV DESIGN OF ELECTRIC VEHICLES FUNDAMENTALS 9

Aerodynamic-Rolling resistance- Transmission efficiency- Grading Resistance -Vehicle mass- Electric vehicle chassis and Body design considerations- Heating and cooling systems- Controllers- Power steering-Vehicle Performance.

UNIT V HYBRID VEHICLES 9

Types of Hybrid- Series, parallel, parallel - Advantages and Disadvantages-Hybrid drive prospects-Hybrid technology case studies - Production hybrid-drive cars -Hybrid passenger and goods vehicles.

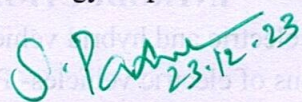
Lecture: 45; Tutorial: 0; Total: 45 Hrs

TEXT BOOKS:

1. Mehrdad Ehsani, "Modern Electric, Hybrid Electric and Fuel Cell Vehicles", CRC Press, 2009.
2. Ron HodKinson, "Light Weight Electric/Hybrid Vehicle Design", Butterworth Heinemann Publication, 2005.

REFERENCE BOOKS

1. Iqbal Husain, "Electric and Hybrid Vehicles-Design Fundamentals", CRC Press, 2003.
2. Jack Erjavec, "Hybrid, Electric & Fuel-Cell Vehicles", Delmar, Cengage Learning, 2013.
3. James Larminie and John Lowry, "Electric Vehicle Technology Explained" John Wiley & Sons, 2003.


Dr. S. PADMA, M.E., F
Professor and Head,
Department of EEE,
Sona College of Technology
Salem-636 005. Tamil Nadu.

COURSE OUTCOMES

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

1. Assess role of energy in global economic development.
2. Explain methodology of energy audit and concept of instruments used.
3. Discuss various lamps and design energy efficient illumination schemes.
4. Apply energy conservation concepts in buildings.
5. Identify the energy conserving opportunities in utilities.

CO / PO, PSO Mapping

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

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

UNIT- I ENERGY SCENARIO AND BASICS

9

Classification of Energy – Purchasing Power Parity – Energy Security – Strategy to meet future energy requirements – Objectives and features for electricity act 2003 – Energy efficiency standards and labeling – Study of Global and Indian primary energy reserves – Study of energy scenario for India – Energy and environment – Global environmental issues – Types of Energy – Electrical and Thermal energy basics – Energy units and conversions.

UNIT- II ENERGY MANAGEMENT AND AUDIT

9

Definition and objectives of energy management and audit – Need for energy audit – Types of energy audit – Methodology for conducting detailed energy audit – ENCON opportunities and measures – Energy audit report. Energy costs – Benchmarking – Energy performance – Fuel and Energy substitution – Instruments and metering for energy audit – Basic principles, components of material and energy balance – Sankey diagram – Financial analysis terms – Payback period, ROI, NPV, IRR.

UNIT- III LIGHTING SYSTEMS

9

Introduction – Terms in Lighting and Illumination – Light sources - Lamp types – Arc Lamps, Vapour lamps = Incandescent lamp, Fluorescent lamp = Energy saving lamps = CFL, LED = Lighting design for interiors – Indoor and outdoor lighting schemes – Energy saving opportunities – Energy efficient lighting controls.

UNIT- IV ENERGY CONSERVATION IN BUILDINGS

9

Energy conservation building code (ECBC) – Compliance approaches – ECBC guidelines on Building envelope, HVAC system, Service hot water, Water pumps – Energy consumption in Escalators and Elevators – Building Energy Management Systems – Star ratings – Energy Efficiency Measures in AC and Lighting system.

S. Padma
Dr.S.PADMA, M.E., Ph.D.
 Professor and Head,
 Department of EEE,
 Sona College of Technology
 Salem-636 005. Tamil Nadu.

UNIT-V ENERGY EFFICIENT OPPORTUNITIES IN UTILITIES

9

Introduction to Compressed air system components – Heat transfer loops in refrigeration systems – Standards and labelling of room air conditioners – Introduction to Fans, Blowers and Compressors – Types of pumps, Pump curves – Efficient operation of pumps – Components of cooling towers and its efficient operation - Introduction to DG set system.

Energy Efficiency and energy savings in Compressed Air System, HVAC system, Fans and Blowers, Pumping system, Cooling towers, and DG sets.

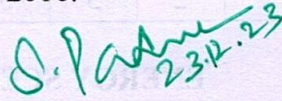
Lecture: 45; Tutorial: 00; Total: 45

TEXT BOOKS:

1. "General Aspects of Energy Management and Energy Audit", Bureau of Energy Efficiency, Fourth Edition, 2015.
2. "Energy Efficiency in Electrical Utilities", Bureau of Energy Efficiency, Fourth Edition, 2015.

REFERENCE BOOKS:

1. Chakrabarti A, "Energy Engineering and Management", PHI, 2011.
2. Murphy W R, McKay G, "Energy management", Elsevier, 2009.
3. Rajput R K, "Utilization of Electrical Power", Lakshmi Publications, 2006.


Dr. S. PADMA, M.E., Ph.D.,
Professor and Head,
Department of EEE,
Sona College of Technology
Salem-636 005. Tamil Nadu.

PREAMBLE**To
Energy Efficiency and Green Building**

- Green building, or sustainable design, is the practice of increasing the efficiency with which buildings and their sites use energy, water, and materials, and of reducing impacts on human health and the environment for the entire lifecycle of a building.
- A sustainable building or green building is an outcome of a design philosophy which focuses on increasing the efficiency of resource use-energy, water, and materials-while reducing building impacts on human health and the environment during the building's lifecycle, through better siting, design and construction.
- Solar water heating further reduces energy costs. Onsite generation of renewable energy through solar power, wind power, hydro power, or biomass can significantly reduce the environmental impact of the building. Power generation is generally the most expensive feature to add to a building.

Green buildings are designed in such a way to reduce overall impact on environment and human health by:

- Reducing trash, pollution and degradation of environment.
- Efficiently using energy, water and other resources.
- Protecting occupant health and improving productivity.

COURSE CODE	COURSE NAME												L	T	P	C
U19CE1003	ENERGY EFFICIENCY AND GREEN BUILDING												3	0	0	3
Course Objective (s): The Purpose of learning this course is to:																
1.	To describe the importance of energy resources, its availability and conservation for sustainability goals.															
2.	To study and identify the methods adopted to make the building as energy efficient.															
3.	To gain knowledge about use of construction materials based on embodied energy values															
4.	To study about different green building rating systems with real time examples.															
5.	To create awareness about clean development mechanism and the role of UNFCCC in sustainability															
Course Outcome (s) (COs): At the end of this course, the students will be able to:																
CO1	Acquire the basics understanding of green building concept and associated resources. (K1)															
CO2	Analyze the various methods to design green building parameters. (K3)															
CO3	Understand the availability of construction materials for energy efficient construction (K4)															
CO4	Aware about the various green building rating systems prevail in the country (K3)															
CO5	Understand the role of UNFCCC and know about clean development mechanism (K2)															
Knowledge Level: K1 – Remember: K2 – Understand: K3 – Apply: K4 – Analyze: K5 – Evaluate:																
CO – PO Mapping																
COs	Pos												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	POS		
CO1	3	1	3	1	2	1	3	1	1	-	-	3	2	2		
CO2	3	1	3	1	2	1	3	1	1	-	-	3	2	2		
CO3	3	1	3	1	1	1	3	1	1	-	-	2	2	2		
CO4	2	2	3	1	1	1	3	2	1	-	-	2	2	1		
CO5	2	2	3	1	1	1	3	2	1	-	-	2	2	1		
CO (Avg)	2.6	1.4	3	1	1.4	1	3	1.4	1	-	-	2.4	2	1.6		
Correlation Level: 1:Slight (Low) 2:Moderate (Medium) 3:Substantial (High)																

UNIT-I	INTRODUCTION	9 Hours
Definition and concepts, Energy and water as a resource - Criticality of resources - Needs of modern living - Heat loss and heat gain in buildings- thermal comfort improvement methods - other building comforts -indoor air quality requirements - electrical energy conservation.		
UNIT-II	ENERGY EFFICIENT BUILDINGS	9 Hours
Zero Energy Building (ZEB) - Nearly Zero Energy Building (NZEB) - energy consumption - defining low energy buildings- opportunities and techniques for energy conservation in buildings - water conservation - water management system - water efficient landscaping - green roofing - rainwater harvesting - sanitary fixtures and plumbing systems - wastewater treatment and reuse - process water strategies - adoption to sustainable resources, process and technologies- Energy Conservation Opportunities in Public and Private Buildings.		
UNIT-III	CONSTRUCTION MATERIALS AND PRACTICES	9 Hours
Construction materials - Embodied energy, carbon content, and emission of CO ₂ , SO ₂ and NO _x of building materials, elements and construction process- Current practice and low environmental impact alternatives.		
UNIT-IV	BUILDING ASSESSMENT SCHEMES	9 Hours
Energy efficiency ratings & ECBC - 2007 - Various energy efficiency rating systems for buildings - LEED, BEE, & GRIHA - case studies.		
UNIT-V	CLEAN DEVELOPMENT MECHANISM	9 Hours
Clean Development Mechanism - CDM Benefits for energy conservation methodology and procedure - Eligibility Criteria - UNFCCC - role of UNFCCC and Government of India.		
		TOTAL: 45 Hours
TEXT BOOKS:		
1.	Sustainable Building, Design Manual: Published by The Energy and Resources Institute, Darbari Seth block, IHC Complex, Lodhi Road, New Delhi-110003.	
2.	KILBERT, Charles , (2008) Sustainable construction : Green Building Design and Delivery John Wiley and Sons..	
3.	BROWN, G.Z. and DEKAY, Mark, 2001. Sun, Wind & Light - Architectural Design Strategies, Second Edition , John Wiley & sons, Inc.	
REFERENCES:		
1.	ECBC Code 2007 (Edition 2008) published by Bureau of Energy Efficiency, New Delhi	
2.	Bureau of Energy Efficiency Publications - rating System, TERI PUBLICATIONS .	
3.	GRIHA Rating System, LEED Publications	


Dr. R. MALATHY
 Head Of The Department.
 Dean (R&D) of Civil Engg.
 Sona College of Technology,
 SALEM-636 005.

COURSE OUTCOMES

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

1. Define and discuss the fashion and related terms and reason for change in fashion and the classification
2. Describe clothing and its purpose, Role of clothing and its status.
3. Describe the selection of clothing for various age groups, Fashion apparel and wardrobe planning.
4. Explain the elements and principles of the design, with the effects in the apparel
5. Bounce out the theme and development of portfolio.

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

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

UNIT I Introduction to Fashion 9
Origin of fashion - terms and definitions - reasons for change in fashion - classification of fashion – Style, Classic, FAD, Trend – theories of fashion – movement of fashion - fashion cycle.

UNIT II Introduction to Clothing 9
Understanding clothing - Purpose of clothing: protection, modesty, attraction etc - Importance of clothing - Clothing Culture, Men and Women clothing and ornamentation - Role and status of clothing - Clothing according to climatic conditions – factors to be considered in the selection of clothing

UNIT III Selection of clothes 9
Clothes for children, middle-aged and adults. Types of clothes according to different types of human figure, Different materials for different clothes, Fabrics and colours suitable for different garments.

Planning for clothing needs: Formal clothing, Clothes for parties, Clothes for sports, Casual Clothes for casualwear. **Wardrobe Planning:** Wardrobe for men and women

UNIT IV Elements and Principles of Design 9

22.12.2023

Regulations-2019


Dr. D. RAJA, M.Tech., Ph.D.,
Professor & Head
Department of Fashion Technology
Sona College of Technology
Salem - 636 005. Tamil Nadu

Elements of Design: Introduction on basics Elements of design - Silhouette, Details, Texture, Color, Lines,

Principle of design: Introduction to principles of Elements of design - Proportion, Balance, Rhythm, Center of Interest, Harmony

UNIT 5 Design and Development

9

Boards: Mood board, fabric board, colour board, accessory board. Fashion illustration – head theories, Illustration techniques – strokes, hatching, shading; Colouring techniques – Medias for colouring. Portfolio presentation – styles of presentation - Fashion shows.

Dr. D. RAJA, M.Tech., Ph.D.,

Professor & Head

Department of Fashion Technology

Sona College of Technology

Salem - 686 005, Tamil Nadu

TOTAL: 45 hours

TEXT BOOKS

1. Munslow, Janine, McKelvey, Kathryn “**Fashion Design Process Innovation and Practice**”, 2nd Edition, wiley, 2012.
2. Nicola White, Ian Griffiths, “**The Fashion Business Theory, Practice, Image**”, Berg, 2000.

REFERENCE

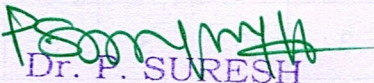
1. Sumathi, G. J. **Elements of fashion and apparel design**. New Age International, 2007.
2. Kathryn McKelvey “**Fashion Source Book**” Balckwell Publishing New Delhi.
3. Mills, Jane, and Janet K. Smith. **Design concepts**. Fairchild Books, 1985.
4. Rasband J. **Wardrobe strategies for women**. Fairchild Publications; 2002.
5. Jarnow JA, Judelle B, Guerreiro M. **Inside the fashion business**. Wiley; 1981.

Department of Mechatronics Engineering

Open Elective

U19MC1004		FUNDAMENTALS OF ROBOTICS								L	T	P	C	
										3	0	0	3	
Course Outcomes														
After successful completion of this course, the students should be able to														
CO1:	Understand the basic robotic concepts													
CO2:	Select the suitable drive system for robot application													
CO3:	Select the suitable sensors and grippers for the respective application													
CO4:	Develop VAL Programming for simple applications													
CO5:	Illustrate the robotic application in various sectors													
Pre-requisite														
NIL														
CO/PO, PSO Mapping														
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	Programme Outcomes (POs) and Programme Specific Outcome (PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3		2			3	2		3		3	3	3	3
CO2	2	2	2		3				3		2	3	2	3
CO3	3	2	2		3				3		2	3	3	3
CO4	3	3	3	3	3				3		2	3	3	2
CO5	3	3	3	3	3	3	3		3			2	3	3
Course Assessment methods														
Direct							Indirect							
Internal test I (8) Internal test II (8) Internal test III (8) Assignment/seminar/Quiz (5)							Online test (6) Attendance (5) End semester Examination (60) Course end survey							
Unit 01: INTRODUCTION TO ROBOTICS												9 Hours		
Introduction to Robotics – History of Robotics – Laws of Robotics - Anatomy of a Robot – Classification of Robots – Robot Configurations - Robot subsystems: Motion subsystem, Recognition subsystem, Control subsystem – Robot Links – Joints in robot –Robot Specifications.														

Unit 02: ROBOT MOTIONS AND DRIVE SYSTEMS			9 Hours
Degrees of freedom – DOF associated with arm and body - DOF associated with wrist –Joint Notation scheme- Robot Kinematics – Robot Drive systems – Hydraulic Actuators – Pneumatic actuators – Electrical actuators: Stepper motors, DC motors, Servomotor.			
Unit 03: ROBOT SENSORS AND END EFFECTORS			9 Hours
Classification of Robotic sensors and their functions – Tactile sensors – Inductive Proximity sensor – Hall effect sensor – Range sensor –Force ant Torque sensors- Types of end effectors – Mechanical grippers – Vacuum cups – Magnetic grippers – Adhesive grippers – Tools as end effectors.			
Unit 04: ROBOT PROGRAMMING			9 Hours
Methods of Robot Programming: Lead through methods, Textual robot Languages – Robot language structure – First generation Languages – Second generation Languages – VAL Programming – Simple Programming examples.			
Unit 05: ROBOT APPLICATIONS			9 Hours
Robotics Applications in Manufacturing: Welding Robot, AGVs– Healthcare: Surgery Robot, Therapeutic Robot – Agriculture: Crop Harvesting & Fruit Picking Robot – Defence & Space: Exoskeleton Robot, Telerobotics.			
Theory: 45 Hrs	Tutorial: --	Practical: --	Total Hours: 45 Hrs
TEXT BOOKS			
1.	M.P.Groover, M.Weiss,R.N. Nagal,N.G.Odrey, "Industrial Robotics - Technology, programming and Applications" Tata McGraw-Hill Publication, 2012.		
REFERENCES			
1.	Richard D.Klafter, "Robotics Engineering" PHI Learning Private Limited, 2009.		
2.	Ganesh S.Hedge, "A text book in Industrial Robotics", Laxmi Publications, 2006.		
3.	S K Saha, "Introduction to Robotics", Tata McGraw-Hill Publication, 2012.		
4.	Sathya Ranjan Deb, "Robotics Technology & flexible Automation" Second edition, Tata McGraw-Hill Publication, 2009.		


Dr. P. SURESH

Professor and Head
Department of Mechatronics Engineering
SONA COLLEGE OF TECHNOLOGY
Junction Main Road, SALEM - 636 005.
Ph:0427-4099999

COURSE OUTCOMES

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

1. Explain the basics of garment technology.
2. Explain in detail about the various seams, stitches, needle type, sewing thread and types of sewing machines.
3. Explain in detail about the various garment accessories.
4. Explain the sewing quality parameters and method of garment laundering.
5. Discuss the quality standards of apparel industry and finishing of garments.

CO/PO, PSO Mapping														
<i>(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak</i>														
COs	Programme Outcomes (POs) and Programme Specific Outcome (PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	P09	PO10	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	2						3	3	2
CO2	3	3	3	3	3	3	1					3	3	2
CO3	2	3	3	3	3	3	3					3	3	3
CO4	3	3	3	3	3	3	3	3				3	3	2
CO5	2	3	2	3	3		3	2				3	3	2

UNIT-I Basics of apparel industry - lay out, process sequence 9

Introduction: Apparel industry in world, types of workers in apparel industry, typical layout of apparel industry.

Garment Production Sequence: Fabric selection, pattern making, grading, marker planning, spreading, cutting and sewing, finishing and packing.

UNIT II Seams, Stitches, Needle and Sewing Threads, Types of sewing Machines 9

Seam and Stitches: Classification of seams and stitches, single needle lock stitch machine, parts and functions.

Needle and Sewing Thread: Needle, functions, special needles, needle size, numbering, needlepoint, sewing thread construction, material, thread size, sewing thread packages.

Basics of sewing machines: Single needle Lock stitch, Double needle lock stitch, Over lock, Flat lock, Feed of the arm, Button Attaching, Button hole machine.

Unit III Garment Accessories 9

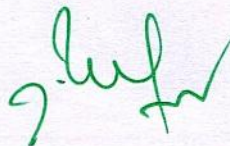
Garment add-on: Labels, linings, interlinings, wadding, lace, braid, elastic, hook and loop fastening, shoulder pads, eyelets and laces, zip fasteners, buttons, Tapes, Tags.

UNIT IV Overview of garment making and care labelling of garment 9

Sewing Process: Garment basic components and assembly process.

Alternative sewing process: Fusing, welding, adhesive, seamless garments, moulding, robotics in sewing.

Basic sizes of mens wear, women's wear, childrens wear and its description.



Types of labels: Size label, brand label, wash care label, designer label.

UNIT V Defects in garment, pressing and Packing

9

Defects: Common defects in woven fabric, knitted fabric and garment.

Garment pressing: Pressing types and pressing equipments.

Packing: Types of packing and different types of packing materials.

TEXT BOOKS

1. Rajkishore Nayak Rajiv Padhye, "**Garment Manufacturing Technology**", woodhead publication, 2015.
2. Ganesan, P., Gopalakrishnan, D., Karthik, T, "**Apparel manufacturing technology**", CRC Publication, 2016.
3. Gerry Cooklin, Steven George Hayes, John McLoughlin, Dorothy Fairclough. "**Cooklin's Garment Technology for Fashion Designers**", John Wiley & Sons, 2011.

Dr. D. RAJA, M.Tech., Ph.D.,
Professor & **FOCAL: 45 hours**
Department of Fashion Technology
Sona College of Technology, Est. Edition,
Salem - 636 005. Tamil Nadu

REFERENCE

1. EIRI Consultants and Engineers, "**Hand book of garment manufacturing technology**", 2017.
2. Janace E. Bubonia, "**Apparel production terms and processes**", 2017.
3. Harold Carr, Barbara Latham, "**The Technology of Clothing Manufacture**", Wiley, 1994.

COURSE OUTCOMES

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

1. Acquire the knowledge for establishment of an enterprise and management,
2. Derive innovative ideas, right approach to the problem and arrive solution for problem with IPR and its legal aspects.
3. Prepare the project report preparation and assessment of Business.
4. Acquire the knowledge on costing, Techno-economic aspects, find out the sources of finance and opportunities in business.
5. Identify the support system for Entrepreneurs by Government and venture capitals.

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

UNIT I ENTREPRENEURSHIP & MOTIVATION 9
 Entrepreneur – Types of Entrepreneurs – Difference between Entrepreneur and Intrapreneur
 Entrepreneurship in Economic Growth, Factors Affecting Entrepreneurial Growth. Major Motives
 Influencing an Entrepreneur – Achievement Motivation Training, Self-Rating, Business Games, Thematic
 Apperception Test – Stress Management, Entrepreneurship Development Programs – Need, Objectives.

UNIT II INNOVATION, CREATIVITY, DEVELOPMENT PROCESS AND LEGAL ASPECTS 9
 Innovation and Creativity- An Introduction, Innovation in Current Environment, Types of Innovation
 Sources of new Ideas, Methods of generating innovative ideas, creating problem solving, product
 planning and development process. Legal aspects of business (IPR, Labor law).

UNIT III BUSINESS 9
 Small Enterprises – Definition, Classification – Characteristics, Ownership Structures – Project
 Formulation – Steps involved in setting up a Business – identifying, selecting a Good Business
 opportunity, Market Survey and Research, Techno Economic Feasibility Assessment – Preparation of
 Preliminary Project Reports – Project Appraisal – Sources of Information – Classification of Needs and
 Agencies.

UNIT IV FINANCING AND ACCOUNTING 9
 Need – Sources of Finance, Term Loans, Capital Structure, Financial Institution, Management of working
 Capital, Costing, Break Even Analysis, Taxation – Income Tax, GST.

S.P. Padma
23.12.23

Dr.S.PADMA, M.E., Ph.D.,
Professor and Head,
Department of EEE,
Sona College of Technology
Salem-636 005. Tamil Nadu.

UNIT V SUPPORT TO ENTREPRENEURS

9

Sickness in small Business – Concept, Magnitude, Causes and Consequences, Corrective Measures - Business Incubators – Government Policy for Small Scale Enterprises – Growth Strategies in small industry – Expansion, Diversification, Joint Venture, Merger and Sub Contracting.

Lecture: 45; Tutorial: 0; Total: 45 Hrs

TEXT BOOKS:

1. Khanka. S.S., “Entrepreneurial Development” S.Chand& Co. Ltd., Ram Nagar, New Delhi, 2013. 99
2. Donald F Kuratko, “Entrepreneurship – Theory, Process and Practice”, 9 th Edition, Cengage Learning, 2014.

REFERENCES:

1. Hisrich R D, Peters M P, “Entrepreneurship” 8th Edition, Tata McGraw-Hill, 2013.
2. Mathew J Manimala, "Entrepreneurship theory at cross roads: paradigms and praxis" 2 nd Edition Dream tech, 2005.
3. Rajeev Roy, "Entrepreneurship" 2 nd Edition, Oxford University Press, 2011.
4. EDII “Faulty and External Experts – A Hand Book for New Entrepreneurs Publishers: Entrepreneurship Development”, Institute of India, Ahmadabad, 1986.
5. Innovation and Entrepreneurship Book by Peter Drucker,
6. James Larminie and John Lowry, “Electric Vehicle Technology Explained “ John Wiley & Sons, 2003.

S.Padma
23.12.23
Dr.S.PADMA, M.E., Ph.D.
Professor and Head,
Department of EEE,
Sona College of Technology
Salem-636 005. Tamil Nadu.

PREAMBLE

The objective of this course is to introduce the concepts of database systems. Any of the digital applications used by the people be it web applications or mobile applications run with the database in the background. For any e-commerce application like flipkart or amazon, database is the core requirement. Social media sites like Facebook or Twitter stores all the content such as user profiles, likes, shares, and messages in the database. All the organizations maintain their data in the database with lots of security features. Working with a database system is the most important skill needed by the IT industry.

The course is designed in such a way that the students will acquire necessary skills to store, manipulate and retrieve data. The students will learn the fundamental concepts of database systems and write queries to manipulate the database. The students will have hands on experience in working with an open source database management system. This course is designed for the students of both circuit (EEE, ECE) and non-circuit branches (Mechanical, Civil and Fashion Technology).

COURSE OUTCOMES

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

1. Comprehend the need, background, architecture and evolution of database management system
2. Construct ER diagrams that capture the requirements of an application and map the ER diagram to relational databases
3. Write SQL queries to create, maintain, retrieve, manipulate and provide security to databases.
4. Design and evaluate the normality of a logical data model, and correct any anomalies.
5. Summarize the general ideas behind indexing techniques

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

UNIT I

INTRODUCTION

Database and Database Users: Characteristics of database approach, Advantages of DBMS Approach, Database Applications

Database system concepts and architecture: Data models, Schemas, Instance, Three schema architecture and data independence, DBMS languages, DBMS interfaces, database system Environment

UNIT II ENTITY RELATIONSHIP AND RELATIONAL MODEL 9

ER model: Entity types, attributes, keys,, relationship types, constraints, weak entity, ER diagrams, EER concepts

Relational data model, relational constraints and relational Algebra: Relational model concepts, Relational constraints and Relational data base schema, update operations, basic Relational algebra operations, additional relational operations, ER to relational mapping

UNIT III QUERY LANGUAGE 9

SQL: Data definition and constraints, Basic queries, insert, delete, update, Joins, complex queries, views, assertions and triggers

Database security and Authorization: security issues, grant/revoke privileges, SQL injections

UNIT IV RELATIONAL DATABASE DESIGN 9

Functional dependencies and normalization: Functional dependencies, Normal forms: 1NF, 2NF, 3NF, Boyce Codd NF, decomposition

UNIT V STORAGE STRUCTURES AND INDEXING 9

Secondary Storage Devices – Placing file records – Operations on files – unordered files – ordered files - hashing – RAID - **Indexing Structures:** Types of Single-Level Ordered Indexes, Multilevel Indexes

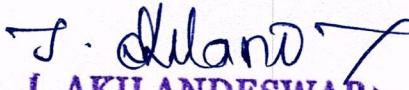
Total: 45 hours

TEXT BOOK

1. Ramez Elmasri and Shamkant Navathe, “Fundamentals of Database Systems ”, 6th Edition, Addison-Wesley, 2014.

REFERENCES

1. Abraham Silberschatz, Henry F. Korth and Sudarshan. S, “Database System Concepts”, 6th Edition, McGraw-Hill, 2016
2. Raghu Ramakrishnan, “Database Management System”, Tata McGraw-Hill Publishing Company, 2003
3. Date. C. J, Kannan. A, Swamynathan. S, “An Introduction to Database Systems”, 8th Edition, Pearson Education, 2012
4. Rajesh Narang, “Database Management systems”, PHI Learning pvt. Ltd, New Delhi, 2011


Dr. J. AKILANDESWARI
PROFESSOR & HEAD
Department of Information Technology
SONA COLLEGE OF TECHNOLOGY
SALEM - 636 005

Course Outcomes

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

- 1) Analyze the 1G and 2G Technologies.
- 2) Explain the 2.5G evolutions
- 3) Analyze the principles of 3G and UMTS
- 4) Analyze the evolutions of 4G.
- 5) Summarize the various wireless security applications and solve the mobile phone faults.

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

COs	Programme Outcomes (POs) and Programme Specific Outcome (PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	P09	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	3		1		1	1	3		
CO2	3	3	3	3	3	3		1		1	1	3		
CO3	3	3	3	3	3	3		1		1	1	3		
CO4	3	3	3	3	3	3		1		1	1	3		
CO5	3	3	3	3	3	3		1		1	1	3		

Unit I 1G and 2G

9

First Generation (1G): 1G Systems – General 1G System Architecture – Generic MTSSO Configuration – Generic Cell Site Configuration – Call Setup Scenarios – Handoff – Frequency Reuse – Spectrum Allocation – Channel Band Plan

Second generation (2G): Enhancements over 1G Systems – Integration with Existing 1G Systems – GSM - iDEN – CDPD

Unit II 2.5G Generation

9

Enhancements over 2G – Technology Platforms – General Packet Radio Service (GPRS) – Enhanced Data Rates for Global Evolution (EDGE) – High-Speed Circuit Switched Data (HSCSD) – CDMA2000 (1XRTT) – WAP-Migration Path from 2G to 2.5G to 3G..

Dr. R.S. SABEENIAN

Dr. R.S. SABEENIAN, M.E., MBA, Ph.D.
Professor and Head of Department
Electronics and Communication Engineering,
SONA COLLEGE OF TECHNOLOGY,
Salem - 636 005, Tamilnadu, India.

Unit III 3G Generation

9

Introduction – Universal Mobile Telecommunications Service (UMTS), UMTS Basics, The UTRAN Architecture, Handover, UMTS Services – The UMTS Air Interface – Overview of the 3GPP Network Architecture – Overview CDMA2000 – Commonality Between WCDMA/CDMA2000/CDM

Unit IV 4G and Beyond

9

Introduction to LTE - Network architectures – EPC – E-UTRAN architecture – Mobility management – Resource management – Services – Channel – logical and transport channel mapping – downlink/uplink data transfer – MAC control element – PDU packet formats – scheduling services – random access procedure – Objectives of 5G-Architecture – Features and benefits.

Unit V Wireless Security and Mobile Phone service

9

Introduction – Fingerprint – Classification of major security attacks against RFID systems – GSM Security – Barcode scanner technology features and applications – QR code – BAR code – OTP – AirDrop.
Mobile phone Service: Parts in the mobile phones -Mobile phones assembling and disassembling –motherboard - Mobile Operating Systems - Fault finding - Advanced troubleshooting techniques.

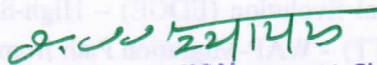
TOTAL : 45 HOURS

Text Book

- 1) Clint Smith,P.E, Dannel Collins, “3G Wireless Networks” 2nd edition, Tata McGraw-Hill, 2008.
- 2) Vijay K.Garg, “Wireless Network Evolution- 2G & 3G” Pearson, 2013.

References

- 1) T.S Rapp port, “Wireless Communications” Principles and Practice, Second Edition, Pearson Education/ Prentice Hall of India, Third Indian Reprint, 2013.
- 2) JochenH.Schiller, “Mobile Communications”, 2/e, Pearson, 2014
- 3) SassanAhmadi, “LTE-Advanced – A practical systems approach to understanding the 3GPP LTE Releases 10 and 11 radio access technologies”, Elsevier, 2014


Dr. R. S. SABEENIAN, M.E., MBA, Ph.D., FIETE,
Professor and Head of Department
Electronics and Communication Engineering
SONA COLLEGE OF TECHNOLOGY,
Salem - 636 005. Tamilnadu, India.

PREAMBLE**To****Municipal Solid Waste Management**


Solid wastes represent one of the main environmental problems in India that needs to be dealt with. In order to minimize environmental impacts and pave the way for a sustainable development, integrated and specific actions need to be adopted and implemented. Due to rapid increase in the production and consumption processes, societies generate as well as reject solid materials regularly from various sectors – agricultural, commercial, domestic, industrial and institutional. The present course covers evaluation on the type and nature of wastes, estimation of total volumes and assessment of handling, storage, transportation and disposal methods to be adopted and the potential environmental impacts.

The overall objectives of the course:

- To assess the activities involved for the proposed and determine the type, nature and estimated volumes of waste to be generated.
- To identify any potential environmental impacts from the generation of waste at the site;
- To recommend appropriate waste handling and disposal measures / routings in accordance with the current legislative and administrative requirements; and
- To categories waste material where practicable (inert material / waste fractions) for disposal considerations i.e. public filling areas / landfill.

COURSE CODE	COURSE NAME												L	T	P	C
U19CE1002	MUNICIPAL SOLID WASTE MANAGEMENT												3	0	0	3
Course Objective (s): The Purpose of learning this course is to:																
1.	Provide a broader understanding on various aspects of sources and solid waste management.															
2.	Impart the basic knowledge in the methods and processing of on-site storage.															
3.	Provide the basic knowledge of types of collection vehicles and transfer stations.															
4.	Aware the students about different techniques involved in off-site processing.															
5.	Awareness to be given on disposing the wastes using sanitary landfills.															
Course Outcome (s) (COs): At the end of this course, the students will be able to:																
CO1	Identify the sources, types and characteristics of solid wastes. (K1)															
CO2	Choose the on-site storage methods and processing techniques. (K2)															
CO3	Summarize the methods of collection and its components. (K2)															
CO4	Outline the off-site processing techniques & equipment's and resource recovery from solid wastes. (K3)															
CO5	Evaluate the processing techniques and disposal methods for managing the municipal solid wastes. (K4)															
Knowledge Level: K1 – Remember: K2 – Understand: K3 – Apply: K4 – Analyze: K5 – Evaluate:																
CO – PO Mapping																
Cos	Pos												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	POS		
CO1	3	2	-	-	-	2	2	1	-	-	-	-	2	-		
CO2	3	-	-	-	-	3	2	-	-	-	-	-	2	-		
CO3	3	-	-	-	-	2	2	1	-	-	-	3	2	-		
CO4	3	-	-	-	3	3	2	1	-	-	-	3	2	3		
CO5	3	3	3	-	3	3	2	1	-	-	-	3	2	3		
CO (Avg)	3	1	0.6	-	1.2	2.6	2	0.8	-	-	-	1.8	2	1.2		

Correlation Level:		1:Slight (Low)	2:Moderate (Medium)	3:Substantial (High)
UNIT-I	SOURCES AND TYPES			9 Hours
Sources and types of solid wastes - Quantity - factors affecting generation of solid wastes; characteristics - methods of sampling and characterization; Effects of improper disposal of solid wastes - public health effects. Principle of solid waste management –IOT Applications in Waste management; Public awareness; Role of NGOs; Solid waste management rules 2016 - Construction and demolition Wastes				
UNIT-II	ON-SITE STORAGE AND PROCESSING			9 Hours
On-site storage methods - Materials used for containers - on-site segregation of solid wastes - public health & economic aspects of storage - options under Indian conditions - Critical evaluation of options.				
UNIT-III	COLLECTION AND TRANSFER			9 Hours
Methods of Residential and commercial waste collection - Collection vehicles - Manpower- collection routes - Analysis of collection systems; Transfer stations - Selection of location, operation & maintenance; options under Indian conditions - Field problems- solving				
UNIT-IV	OFF-SITE PROCESSING			9 Hours
Processing techniques and equipment; Resource recovery from solid wastes - Composting, incineration, Pyrolysis - Options under Indian conditions - Case studies.				
UNIT-V	DISPOSAL			9 Hours
Dumping of solid waste; Sanitary landfills - Site selection, design and operation of sanitary landfills -Leachate collection and treatment, Land fill bio reactor, Landfill capping, Landfill mining.				
				TOTAL: 45 Hours
TEXT BOOKS:				
1.	George Tchobanoglous, “Integrated Solid Waste Management”, McGraw-Hill Publishers,2003.			
2.	Vesilind P.A. and Rimer A.E, “Unit Operations in Resource Recovery Engineering”, Prentice Hall, Inc., 1981			
REFERENCES:				
1.	Manual on Municipal Solid Waste Management, CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 2000.			
2.	Landreth R.E, and P.A and Rebers, “Municipal Solid Wastes –problems and Solutions”, Lewis Publishers, 2000.			
3.	Ramachandra T.V, “Management of Municipal Solid Waste”, TERI press, New Delhi, 2009.			
4.	Paul T Willams, “Waste Treatment and Disposal”, John Wiley and Sons, 2000			
5.	http://nptel.iitm.ac.in			


Dr. R. MALATHY
 Head Of The Department.
 Dean (R&D) of Civil Engg.
 Sona College of Technology,
 SALEM-636 005.

COURSE OUTCOMES

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

1. Describe the power demand scenario in world level and impact of various renewable energy sources in satisfying power demand.
2. Explain the principle of operation and the application of solar system.
3. Outline in the components and to find the suitability based on the performance of wind energy and Conversion system, biomass energy system
4. Describe the principle of operation and the application of geo thermal power tidal power generation scheme, wave energy and OTEC scheme.
5. Illustrate the emerging energy generation systems of MHD, Thermal and fuel cells applications.

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

UNIT I INTRODUCTION

9

World energy futures–Energy sources and their availability – Energy cycle of the earth – environmental aspects of energyutilization – Energy plantation- Renewable energy resources and their importance-Prospects of Renewable energy sources.

UNIT II SOLARENERGY SYSTEMS

9

Introduction –Solar radiation and measurements-Solar energy collectors-solar energy storage systems- Solar pond and applications- Applications of solar energy: solar pumping, solar cooking, solar distillation and solar greenhouse.

UNIT III WIND AND BIOMASS ENERGY SYSTEMS

9

Introduction – Wind Energy conversion- Wind speed and power relation – Power extracted from wind – wind distributionand wind speed predictions – types of Wind power systems.

Bio mass conversion technologies-Biogas generation-Types of biogas plants-Bio gas from plant wastes-Utilization of Bio gas and applications.

UNIT IV GEOTHERMAL, TIDAL AND OCEAN ENERGY SYSTEMS

9

Geothermal energy – Estimates of Geothermal power- site selection for geothermal power plant-Applications of Geothermal energy.

Origin of tides – Basic principle of Tidal power- Operation of a Tidal power plant. Ocean Thermal Energy conversion system- Open and closed OTEC cycles- Prospects of ocean thermal energy conversion in India.

S. Padma
23.12.23
Dr. S. PADMA, M.E., Ph.D.,
Professor and Head,
Department of EEE,
Sona College of Technology
Salem-636 005. Tamil Nadu.

UNIT V EMERGING ENERGY SYSTEMS

Magneto Hydro Dynamic (MHD) Power Generation- MHD systems and its operation. Thermo Electric power generation- Basic principle- Thermo electric power generator.

Thermonuclear fusion energy-Nuclear fusion and reactions- Advantages. Fuel cell- classification of fuel cells- Fuel cell based electrical power generation scheme- Applications.

Lecture: 45; Tutorial: 0; Total: 45 Hours

TEXT BOOKS:

1. Rai, G.D., "Non-Conventional Energy Sources", Khanna Publishers, Sixth Edition 2017.
2. Khan, B.H, Non- Conventional Energy Resources", Mc. Graw Hill Education Ltd, third reprint 2017.

REFERENCE BOOK

1. Rao S. Paruklekar, B.B, "Energy Technology – Non Conventional, Renewable and Conventional", Khanna Publishers, 1994.
2. F.Kreith and J.F.Kreider, "Principles of Solar Engineering", McGraw Hill.
3. T.N.Veziroglu, "Alternative Energy Sources", Vol 5 and 6, McGraw Hill.
4. MukundR.Patel, "Wind and Solar Power Systems", CRC Press LLC.

S. Padma
23.12.23
Dr. S. PADMA, M.E., Ph.D.,
* Professor and Head,
* Department of EEE,
Sona College of Technology
Salem-636 005, Tamil Nadu.

Syllabi for

**B.E/B.Tech Honours (Specialization in the
same Discipline)**

B.E/B.Tech Honours

B.E/B.Tech Minor

courses

COURSE OUTCOMES

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

1. Explain the fundamentals of Exploratory Data Analysis.
2. Explore the significance of different data transformation techniques.
3. Implement correlation and time series data analysis.
4. Evaluate different datasets with NumPy and Pandas.
5. Apply data exploration and visualization techniques with Matplotlib on different datasets.

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

UNIT I INTRODUCTION TO DATA VISUALIZATION IN EDA 9

Exploratory Data Analysis (EDA) fundamentals – Understanding data science – Significance of EDA – Making sense of data – Comparing EDA with classical and Bayesian analysis – Software tools for EDA - Visual Aids for EDA.

UNIT II DATA TRANSFORMATION TECHNIQUES 9

Technical requirements - merging database, reshaping and pivoting, Transformation techniques - Grouping Datasets - data aggregation – Pivot tables and cross-tabulations.

UNIT III CORRELATION AND TIME SERIES ANALYSIS 9

Introducing Correlation – Types of analysis – Discuss multivariate analysis using the Titanic dataset – Outline Simpson's paradox – Understand the time series dataset – TSA with open power system data.

UNIT IV BUILDING VISUALIZATIONS 9

Chart your data - Chart design principles, Google sheet charts, Bar and Column charts, Histograms, Pie, Line and Area charts, Data wrapper charts, Annotated charts, Range charts, Scatter and Bubble charts, Tableau public charts, Filtered Line chart – Map your data – Table your data.

UNIT V CODE TEMPLATES AND ADVANCED TOOLS 9

Edit and Host code with GitHub – Chart.js and Highcharts templates – Leaflet map templates – Transform your map data – Geospatial data and GeoJSON, Find GeoJSON Boundary files, Draw and edit GeoJson.io, Edit and join with Mapshaper.

THEORY: 45 HRS

PRACTICALS: 30 HRS

TOTAL: 75 HOURS

TEXT BOOKS:


1. Suresh Kumar Mukhiya, Usman Ahmed, "Hands-On Exploratory Data Analysis with Python", Packt Publishing, 2020. (Unit 1, 2 and 3)
2. Jack Dougherty, Ilya Ilyankou, "Hands-On Data Visualization", O'Reilly Media, Apr 2021. (Unit 4 and 5)

REFERENCES:

1. Eric Pimpler, Data Visualization and Exploration with R, GeoSpatial Training service, 2018.
2. Claus O. Wilke, "Fundamentals of Data Visualization", O'reilly publications, 2019.
3. Matthew O. Ward, Georges Grinstein, Daniel Keim, "Interactive Data Visualization: Foundations, Techniques, and Applications", 2nd Edition, CRC press, 2015.
4. Fabio Nelli, "Python Data Analytics with Pandas, Numpy and Matplotlib", Apress, 2nd Edition, 2018.

LIST OF EXPERIMENTS:

1. Perform exploratory data analysis (EDA) on with datasets like email data set. Export all your emails as a dataset, import them inside a pandas data frame, visualize them and get different insights from the data.
2. Perform Time Series Analysis and apply the various visualization techniques.
3. Perform Data Analysis and representation on a Map using various Map data sets with Mouse Rollover effect and user interaction.
4. Build cartographic visualization for multiple datasets involving various countries of the world, states, and districts in India etc.
5. Perform EDA on Wine Quality Data Set and Map data transformation using advanced tools.



Dr. J. AKILANDESWARI
PROFESSOR & HEAD
Department of Information Technology
SONA COLLEGE OF TECHNOLOGY
SALEM - 636 005



COURSE OUTCOMES

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

1. Explain the basic concepts of Deep Learning.
2. Design and implement Feed Forward Neural Networks along with regularization and optimization techniques.
3. Design and implement Convolutional Neural Networks.
4. Design and implement Recurrent Neural Networks.
5. Apply Deep Learning models in various applications.

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

UNIT I FUNDAMENTALS OF NEURAL NETWORKS 9

Introduction to Deep Learning: Basics: Biological Neuron, Idea of Computational Units, McCulloch – Pitts Unit and Thresholding Logic – Linear Perceptron, Perceptron Learning Algorithm – Linear Separability, Convergence Theorem for Perceptron Learning Algorithm.

UNIT II FEED FORWARD NEURAL NETWORKS 9

Feed Forward Neural Networks – Gradient Descent – Back Propagation Algorithm – Training Deep Neural Networks: The Vanishing/Exploding Gradients Problems- Reusing Pretrained Layers- Faster Optimizers: Momentum Optimization, Nesterov Accelerated Gradient, AdaGrad, RMSProp, Adam and Nadm, Learning Rate Scheduling - Avoiding Overfitting Through Regularization: L1 and L2 ,Dropout.

UNIT III CONVOLUTIONAL NEURAL NETWORKS 9

CNN Architectures – Convolution Operation – Variants of the Basic Convolution Function – Structured Outputs – Data Types – Efficient Convolution Algorithm – Random or Unsupervised Features – LeNet, AlexNet.

UNIT IV RECURRENT NEURAL NETWORKS AND OTHER DEEP LEARNING ARCHITECTURES 9

Recurrent Neural Networks – Bidirectional RNNs – Deep Recurrent Networks – Recursive Neural Networks – LSTM and Other Gated RNNs – Autoencoders – Stochastic Encoders and

Decoders, Denoising Autoencoders, Contractive Autoencoders, Applications of Autoencoders.

UNIT V DEEP LEARNING APPLICATIONS

9

Large Scale Deep Learning – Object detection -one stage algorithm: yolo-two stage algorithm: RCNN- image segmentation – Speech Recognition – Natural Language Processing.

THEORY: 45 HOURS

PRACTICAL: 30 HOURS

TOTAL: 75 HOURS

LAB EXERCISES


1. Write a program to generate following logic functions using McCulloch-Pitts neuron and appropriate values for weights, bias and threshold.
 - a. AND logic function.
 - b. OR logic function.
 - c. NOT logic function.
 - d. NOR logic function.
 - e. XOR logic function.
2. Write a program to build a logistic regression classifier with a Neural Network mindset. Consider following guidelines.
 - a. Consider any convenient dataset (Cats dataset etc.) and pre-process the dataset.
 - b. Define the appropriate model structure.
 - c. Evaluate the model performance.
 - d. Analyse the obtained results.
3. Build a Multiclass classifier using the CNN model. Use MNIST or any other suitable dataset.
 - a. Perform Data Pre-processing
 - b. Define Model and perform training
 - c. Evaluate Results using confusion matrix
4. Design and implement a CNN for Image Classification
 - a) Select a suitable image classification dataset (medical imaging, agricultural, etc.).
 - b) Optimized with different hyper-parameters including learning rate, filter size, no. of layers, optimizers, dropouts, etc
5. Apply a pre-trained network and apply it to a new task using transfer learning
 - a) Use any three pre-trained models including AlexNet, GoogleNet, VGGNet, MobileNet, ResNet, DenseNet, etc.
 - b) Fine-tune the hyper-parameters and compare their performance for a suitable application.

TEXT BOOKS

1. Goodfellow I., Bengio Y., and Courville A., "Deep Learning", MIT Press, 2016. (Units 1, 2, 3, 4)
2. Aurélien Géron, Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, 2nd Edition. O'Reilly, 2019. (Unit 2)
3. Yunji Chen, Ling Li, AI Computing Systems An Application-Driven Perspective, MK publishers (Elsevier), 2023. (Units 1,2,3,5)

REFERENCE BOOKS

1. Francois Chollet, "Deep Learning with Python", Manning Publications, 2018.
2. Nithin Buduma, Nikhil Buduma, Fundamentals of Deep Learning Designing Next-Generation Machine Intelligence Algorithms, 2nd Edition, O'Reilly, 2022
3. Ragav Venkatesan, Baoxin Li, "Convolutional Neural Networks in Visual Computing", CRC Press, 2018.
4. Navin Kumar Manaswi, "Deep Learning with Applications Using Python", Apress, 2018.
5. Pablo Rivas, Deep Learning for Beginners, Packt Publishing, 2022


Dr. J. AKILANDESWARI
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