SONA COLLEGE OF TECHNOLOGY, SALEM-5

(An Autonomous Institution)

B.Tech-Mechatronics Engineering

CURRICULUM and SYLLABI

[For students admitted in 2020-2021]

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: Mechatronics Engineering

S.No.	Course Code	Course Title	L	T	P	C	Category
Theory							
1	U19ENG101B	English for Engineers-I	1	0	2	2	HS
2	U19MAT102A	Linear Algebra and Calculus	3	1	0	4	BS
3	U19PHY103B	Engineering Physics	3	0	0	3	BS
4	U19CHE104G	Engineering Chemistry	3	0	0	3	BS
5	U19PPR105	Problem solving using Python Programming	3	0	0	3	ES
6	U19EGR106	Engineering Graphics **	2	0	2	3	ES
Practical							
7	U19PCL108B	Physics and Chemistry Laboratory#	0	0	2	1	BS
8	U19PPL111	Python Programming Laboratory	0	0	2	1	ES
9	U19GE101	Basic aptitude-I	0	0	2	0	EEC
Total Credits						**20**	
Optional Language Elective*							
10	U19OLE1101	French	0	0	2	1	HS
11	U19OLE1102	German					
12	U19OLE1103	Japanese					

*Students may opt for foreign languages viz., German/French/Japanese with additional one credit (Not accounted for CGPA calculation)
Laboratory classes on alternate weeks for physics and chemistry. The lab examination will be conducted separately for 50 marks each with 2 hours durations.
** The examination will be conducted for 3 hours through CAD software and manual drafting.

Approved By

Chairperson, Science and Humanities BoS	Chairperson, Mechatronics Engineering BoS	Member Secretary, Academic Council	Chairperson, Academic Council & Principal
Dr.M.Renuga	**Dr.P.Suresh**	**Dr.R.Shivakumar**	**Dr.S.R.R.Senthil Kumar**

Copy to:-
HOD/ Mechatronics Engineering, First Semester BE MCT 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: Mechatronics Engineering

S.N	Course Code	Course Title	L	T	P	C	Category	Total Contact Hours
Theory								
1	U19ENG201B	English for Engineers -II	1	0	2	2	HSMC	45 (15L+30P)
2	U19MAT202A	Differential Equations and Vector Calculus	3	1	0	4	BSC	60
3	U19PHY203F	Physics for electron devices	3	0	0	3	BSC	45
4	U19CHE204E	Modern materials	3	0	0	3	BSC	45
5	U19MCT201	Engineering Mechanics	3	0	0	3	ESC	45
6	U19MCT202	Basic Electrical Engineering	3	0	0	3	ESC	45
Practical								
7	U19WPL212	Workshop Practice	0	0	2	1	ESC	30
8	U19MCT203	Basic Electrical Engineering and Devices Laboratory	0	0	4	2	ESC	60
9	U19GE201	Basic Aptitude – II	0	0	2	0	EEC	30
Total Credits						**21**		
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, Mechatronics Engineering BoS**	**Member Secretary, Academic Council**	**Chairperson, Academic Council & Principal**
Dr. M. Renuga	**Dr. P. Suresh**	**Dr. R. Shivakumar**	**Dr. S. R. R. Senthil Kumar**

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

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit	Total Contact Hours
Theory							
1	U19MC301	Fluid Mechanics and Machinery	3	0	0	3	45
2	U19MC302	Strength of Materials	3	0	0	3	45
3	U19MC303	Manufacturing Technology	3	0	0	3	45
4	U19MC304	Electrical Drives and Control	3	0	0	3	45
5	U19MC305	Digital Electronics	3	0	0	3	45
6	U19GE304	**Mandatory course:** Constitution of India	2	0	0	0	30
Practical							
7	U19MC306	Fluid Mechanics and Strength of Materials Laboratory	0	0	4	2	60
8	U19MC307	Manufacturing Technology Laboratory	0	0	3	1.5	45
9	U19MC308	Electrical Drives and Control Laboratory	0	0	3	1.5	45
10	U19GE301	Soft Skill and Aptitude – I	0	0	2	1	30
					Total Credits	**21**	

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Chairperson, Academic Council & Principal
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HOD/ Mechatronics Engineering, Third Semester BE MCT 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: Mechatronics Engineering

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit	Total Contact Hours
Theory							
1	U19MAT401B	Probability and Statistical Methods	3	1	0	4	60
2	U19MC401	Fluid Power Systems	3	0	0	3	45
3	U19MC402	Thermodynamics and Heat Transfer	3	0	0	3	45
4	U19MC403	Microprocessors and Microcontroller	3	0	0	3	45
5	U19MC902	**Elective:** Sensors, Transducers and Instrumentation	3	0	2	4	75
6	U19GE402	**Mandatory course:** Environment and Climate science	2	0	0	0	30
Practical							
7	U19MC404	Fluid Power Systems Laboratory	0	0	4	2	60
8	U19MC405	Microprocessor and Microcontroller Laboratory	0	0	4	2	60
9	U19GE401	Soft Skill and Aptitude – II	0	0	2	1	30
					Total Credits	**22**	

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HOD/ Mechatronics Engineering, Fourth Semester BE MCT Students and Staff, COE

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

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit	Total Contact Hours
Theory							
1	U19MC501	CAD/CAM	3	0	0	3	45
2	U19MC502	Theory of machines	3	0	0	3	45
3	U19MC503	Data structure using python	3	0	2	4	75
4	U19MC504	Industrial Automation	3	0	0	3	45
5	noc22_me123	**NPTEL-** Automation in manufacturing	3	0	0	3	45
Practical							
6	U19MC505	CAD/CAM Laboratory	0	0	3	1.5	45
7	U19MC506	Industrial Automation Laboratory	0	0	3	1.5	45
8	U19MC507	Mini Project-I	0	0	2	1	30
9	U19GE501	Soft Skills and Aptitude – III	0	0	2	1	30
					Total Credits	**21**	

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HOD/ Mechatronics Engineering, Fifth Semester BE MCT Students and Staff, COE

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

S. No	Course Code	Course Title		Lecture	Tutorial	Practical	Credit	Total Contact Hours
Theory								
1	U19MC601	Artificial Intelligence and Machine Learning		3	0	0	3	45
2	U19MC602	Image Processing and Computer Vision		3	0	0	3	45
3	U19MC603	Robotics		3	0	0	3	45
4	U19MC904	**Professional Elective:**	Electric and Hybrid Vehicles	3	0	0	3	45
	U19MC905		Digital Manufacturing					
5	U19MC906	**Professional Elective:**	Drone Technology	3	0	0	3	45
	U19MC907		Design Thinking and Product Innovation					
6	U19CE1002	**Open Elective:**	Municipal Solid Waste Management	3	0	0	3	45
	U19CE1003		Energy Efficiency and Green Building					
	U19EC1006		Mobile Technology and its Applications					
	U19EE1002		Energy Conservation and Management					
	U19EE1003		Innovation, IPR and Entrepreneurship Development					
	U19EE1004		Renewable Energy Systems					
	U19FT1001		Fundamentals of Fashion Design					
	U19IT1001		Problem Solving Techniques using Java Programming					
	U19ME1004		Renewable Energy Sources					

Practical							
7	U19MC604	Image Processing Laboratory	0	0	2	1	30
8	U19MC605	3D Modelling and Analysis laboratory	0	0	2	1	30
9	U19GE601	Soft Skill and Aptitude – IV	0	0	2	1	30
10	U19MC606	Mini Project – II	0	0	2	1	30
					Total Credits	**22**	

Approved By

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Dr.P.Suresh	**Dr.R.Shivakumar**	**Dr.S.R.R.Senthil Kumar**

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HOD/ Mechatronics Engineering, Sixth Semester BE MCT Students and Staff, COE

MCT
VII

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

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit	Total Contact Hours
Theory							
1	U19GE701	Professional Ethics and Human Values	3	0	0	3	45
2	U19MC701	Total Quality Management	3	0	0	3	45
3	U19MC702	Robot Programming and Applications	3	0	0	3	45
4	U19MC909	**Professional Elective -** Agriculture Automation	3	0	0	3	45
5	U19MC922	**Professional Elective -** Automotive Mechatronics	3	0	0	3	45
6	U19BM1002	**Open Elective** Basic Life Support	3	0	0	3	45
	U19CE1001	Building Services and Safety Regulations					
	U19CE1004	Disaster Management					
	U19CS1002	Cloud Computing					
	U19CS1003	Internet of Things					
	U19EC1006	Mobile Technology and Its Applications					
	U19EC1007	CMOS VLSI Design					
	U19EE1003	Innovation, IPR and Entrepreneurship Development					
	U19EE1004	Renewable Energy Systems					
	U19FT1001	Fundamentals of Fashion Design					
	U19ME1002	Industrial Safety					

	U19ME1004		Renewable Energy Sources					
Practical								
7	U19MC703	Robotics Laboratory		0	0	3	1.5	45
8	U19MC704	Mini Project-III		0	0	3	1.5	45
Total Credits							**21**	**360**

Approved By

5/7/23

Chairperson, Mechatronics Engineering BoS
Dr.P.Suresh

Member Secretary, Academic Council
Dr.R.Shivakumar

13/7/23

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

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HOD/ Mechatronics Engineering, Seventh Semester B.E MCT Students and Staff, COE

MCT
VIII

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

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit	Total Contact Hours
Practical							
1	U19MC801	Project Work	0	0	24	12	360
					Total Credits	**12**	**360**

Approved By

Chairperson, Mechatronics Engineering BoS	**Member Secretary, Academic Council**	**Chairperson, Academic Council & Principal**
Dr.P.Suresh	**Dr.R.Shivakumar**	**Dr.S.R.R.Senthil Kumar**

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HOD/ Mechatronics Engineering, Eighth Semester BE MCT Students and Staff, COE

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

S.No.	Course Code	Course Title	L	T	P	C	Category
Theory							
1	U19ENG101B	English for Engineers-I	1	0	2	2	HS
2	U19MAT102A	Linear Algebra and Calculus	3	1	0	4	BS
3	U19PHY103B	Engineering Physics	3	0	0	3	BS
4	U19CHE104G	Engineering Chemistry	3	0	0	3	BS
5	U19PPR105	Problem solving using Python Programming	3	0	0	3	ES
6	U19EGR106	Engineering Graphics **	2	0	2	3	ES
Practical							
7	U19PCL108B	Physics and Chemistry Laboratory#	0	0	2	1	BS
8	U19PPL111	Python Programming Laboratory	0	0	2	1	ES
9	U19GE101	Basic aptitude-I	0	0	2	0	EEC
Total Credits						**20**	
Optional Language Elective*							
10	U19OLE1101	French	0	0	2	1	HS
11	U19OLE1102	German					
12	U19OLE1103	Japanese					

*Students may opt for foreign languages viz., German/French/Japanese with additional one credit (Not accounted for CGPA calculation)
Laboratory classes on alternate weeks for physics and chemistry. The lab examination will be conducted separately for 50 marks each with 2 hours durations.
** The examination will be conducted for 3 hours through CAD software and manual drafting.

Approved By

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Dr.M.Renuga	**Dr.P.Suresh**	**Dr.R.Shivakumar**	**Dr.S.R.R.Senthil Kumar**

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HOD/ Mechatronics Engineering, First Semester BE MCT Students and Staff, COE

U19ENG101B - ENGLISH FOR ENGINEERS – I
COMMON TO CSE, ECE, EEE, MCT, BME

L	T	P	C
1	0	2	2

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

1. Use grammatical components effectively in both written and spoken communication
2. Develop speaking skills for self-introduction, delivering speeches and technical presentation.
3. Speak effectively in real time and business situations
4. Write email, formal letters and descriptions of graphics
5. Develop skills for writing reports and proposals, and for general purpose and technical writing.

UNIT I

- General Vocabulary, Parts of speech
- Self-introduction - personal information, name, home background, study details, area of interest, hobbies, strengths and weaknesses, projects and paper presentations, likes and dislikes in food, travel, clothes, special features of home town.
- Instructions, Email - fixing an appointment, cancelling appointments, conference details, hotel accommodation, order for equipment, training programme details, paper submission for seminars and conferences
- Paragraph writing – Describing – defining – providing examples or evidences

UNIT II

- Tenses, active and passive voice
- Welcome address, vote of thanks, special address on specific topic.
- Checklists, letter writing - business communication, quotations, placing orders, complaints, replies to queries from business customers, inviting dignitaries, accepting and declining invitations

UNIT III

- Prefixes and Suffixes
- 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.
- Job application letter and resume, recommendations,

UNIT IV

- Modal verbs and probability, concord
- 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, receptionist and appointment seeker, new employee and manager, employee and employee, p.a. and manager, schedule for training
- Note making, Proposal

UNIT V

- If conditionals
- Situational Role Play - Asking for directions, seeking help with office equipment, clarifying an error in the bill, job details, buying a product, selling a product, designing a website, cancelling and fixing appointments, hotel accommodation, training facilities, dress code, conference facilities.
- Memo, technical report writing, feasibility reports, accident report, survey report

TOTAL: 45 hours

Speaking test will be conducted for 20 marks externally and evaluated along with English for Engineers – I in the End Semester Valuation.

TEXT BOOK:

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

Extensive Reading

- The Story of Amazon.com- Sara Gilbert, published by Jaico
- The Story of Google – Sara Gilbert, published by Jaico

Reference

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

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

- find the rank of the matrix and solve linear system of equations by direct and indirect methods
- apply the concepts of vector spaces and linear transformations in real world applications
- 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
- find the Taylor's series expansion, Jacobians and the maxima and minima of functions of two variables
- apply appropriate techniques of multiple integrals to find the area and volume.

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.

U19PHY103B - ENGINEERING PHYSICS
(For BE Mechatronics Engineering)

L	T	P	C
3	0	0	3

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

1. Discuss the dual nature of matter and radiation and the application of wave nature of particles.
2. Describe the basic components of lasers.
3. Analyse the relation between arrangement of atoms and material properties.
4. Deduce Maxwell's equations using the fundamentals of electromagnetism.
5. Elucidate the different modes of heat transfer.

UNIT I - QUANTUM PHYSICS **9**

Origin of quantum mechanics – Limitations of classical theory - Dual nature of matter and radiation.

Particle nature of radiation - Compton effect - Explanation based on quantum theory - Expression for Compton shift (no derivation).

Wave nature of matter - de Broglie waves - Schrödinger'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.

Application of wave nature of particles - Electron microscope - Comparison of optical and electron microscope - Scanning electron microscope - Limitations of electron microscope.

UNIT II - LASERS **9**

Basic terms - Energy level - normal population - induced absorption (pumping) - population inversion - meta stable state - spontaneous emission - stimulated emission.

Basic *components* of a laser - Active medium - pumping technique - optical resonator **Einstein's theory** - stimulated absorption - spontaneous emission and stimulated emission.

Types of lasers - Solid lasers (Nd:YAG) - Gas lasers (CO_2 laser) - semiconductor laser (homojunction and hetero junction laser)

Holography - Construction and reconstruction of hologram.

UNIT III - CRYSTAL PHYSICS **9**

Importance of crystals - Types of crystals - Basic definitions in crystallography (Lattice –space lattice - unit cell - lattice parameters – basis - crystallographic formula) - Seven crystal systems and fourteen Bravais lattices – Lattice planes and Miller indices – Interplanar distance - d spacing in cubic lattice - Calculation of number of atoms per

unit cell - Atomic radius - Coordination number and Atomic Packing factor for SC, BCC, FCC and HCP Structures - Polymorphism and allotropy.

Crystal imperfections - Point, line and surface defects - burger vector.

UNIT IV – ELECTROMAGNETISM **9**

Electrostatics - Electric field - Electric field intensity – Field due to discrete and continuous charges – Electric lines of forces – Electric flux – Gauss's law – Divergence of E – Applications of Gauss's law – Curl of E.

Magnetostatics – Magnetic fields – Magnetic Lorentz force – Force experienced by current carrying conductor in magnetic field **–** Steady currents – Magnetic field due to steady current - Biot - Savart Law - Straight line currents – Ampere's circuital law – Divergence and curl of B – Applications of Ampere's circuital law - Comparison of Magneto statics and Electrostatics.

UNIT V - THERMAL PHYSICS **9**

Heat and temperature - Modes of heat transfer (Conduction, convection and radiation) - Specific heat capacity - thermal capacity and coefficient of linear thermal expansion.

Thermal conductivity - Measurement of thermal conductivity of good conductor - Forbe's method - Measurement of thermal conductivity of bad conductor - Lee's disc method - Radial flow of heat - Cylindrical flow of heat - Practical applications of conduction of heat.

Thermal radiations - Properties of thermal radiations - Applications of thermal radiations.

TOTAL: 45 Hours

TEXT BOOKS

- M.N.Avadhanulu, 'Engineering Physics' S.Chand & Company Ltd, New Delhi (2015)
- D. K. Bhattacharya, Poonam Tandon "Engineering Physics" Oxford University Press 2017.

REFERENCES

- Engineering Physics, Sonaversity, Sona College of Technology, Salem (Revised Edition 2018).
- B. K. Pandey and S. Chaturvedi, Engineering Physics , Cengage Learning India Pvt. Ltd., Delhi, 2019
- Rajendran, V, and Marikani A, 'Materials science' TMH Publications, (2004) New Delhi.
- Palanisamy P.K, 'Materials science', SciTech Publications (India) Pvt. Ltd., Chennai, Second Edition (2007)

U19CHE104G - ENGINEERING CHEMISTRY
(For Mechatronics and Biomedical Engineering)

L	T	P	C
3	0	0	3

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

1. Analyze the impurities of water, their removal methods and explain the conditioning methods for industrial uses.
2. Outline the principles and applications of electrochemistry to engineering and technology.
3. Analyze the types of corrosion and describe the methods of corrosion control.
4. Discuss the principle and applications of surface chemistry and catalysis in engineering and technology.
5. Describe the basics of nano chemistry, synthesis, properties and applications of nano materials in engineering and technology.

UNIT I - WATER TECHNOLOGY 9

Introduction - Characteristics – hardness – estimation of hardness by EDTA method, alkalinity and its estimation - Boiler feed water – requirements – disadvantages of using hard water in boilers – internal conditioning (colloidal, phosphate, calgon and carbonate conditioning methods) – external conditioning – zeolite process, demineralization process, desalination of brackish water by reverse osmosis.

UNIT II - ELECTROCHEMISTRY 9

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).

UNIT III - CORROSION AND CORROSION CONTROL 9

Chemical corrosion - Pilling-Bedworth rule – electrochemical corrosion – mechanism - galvanic corrosion – differential aeration corrosion – factors influencing corrosion – corrosion control – sacrificial anode and impressed cathodic current methods – corrosion inhibitors – protective coatings – preliminary treatment - Paints constituents and their functions – surface conversion coatings – Galvanizing and Tinning.

UNIT IV - SURFACE CHEMISTRY AND CATALYSIS **9**

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 – 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 V - NANOCHEMISTRY **9**

Basics - distinction between molecules, nanoparticles and bulk materials – size-dependent properties – nanoparticles: nano cluster, nano rod, nanotube (CNT) and nanowire – Synthesis: precipitation – thermolysis – hydrothermal – solvothermal – electrodeposition - chemical vapour deposition - sol-gel technique – properties and applications of nano materials.

TOTAL: 45 hours

TEXT BOOKS

- P.C.Jain and Monica Jain, "Engineering Chemistry" Dhanpat Rai Pub, Co., New Delhi, 2010 (15^{th} Edition).
- T. Maruthavanan *et al.*, "Engineering Chemistry", Sonaversity, Sona College of Technology, Salem, Revised Edition 2019.

REFERENCE BOOKS

- H.K. Chopra, A. Parmer, "Chemistry for Engineers", Narosa Publishing House, New Delhi, 110 002, 2016.
- Kannan P., Ravikrishnan A., "Engineering Chemistry", Sri Krishna Hi-tech Publishing Company Pvt. Ltd., Chennai, 2009.
- B. Sivasankar "Engineering Chemistry" Tata McGraw-Hill Pub.Co.Ltd, New Delhi, 2008.
- Ozin G. A. and Arsenault A. C., "Nanochemistry: A Chemical Approach to Nanomaterials", RSC Publishing, 2005.

U19PPR105 - PROBLEM SOLVING USING PYTHON PROGRAMMING

L	T	P	C
3	0	0	3

Course Outcome: 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.

UNIT I - ALGORITHMIC PROBLEM SOLVING 9

Need for computer languages, 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 scope, global scope and recursion. 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

- Reema Thareja, "Problem Solving and Programming with Python", Oxford University Press, 2018.
- 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

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

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.

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 (CAD Software) L 12

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

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

REFERENCE BOOKS

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

U19PCL108B - PHYSICS AND CHEMISTRY LABORATORY

PHYSICS PART

(For Mechatronics Engineering)

L	T	P	C
0	0	2	1

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

1. Apply the principle of spectrometry to determine the properties of a given prism.
2. Study the change in properties of ultrasonic waves in a liquid medium and determine the characteristics of the liquid.
3. Demonstrate the applications of a diode laser to determine the characteristics of a given optical fibre.
4. Determine the specific resistance of the given wire using Carey – Fosters bridge.
5. Determine the band gap of a semiconductor diode.
6. Demonstrate by means of an appropriate experiment the poor thermal conductivity of a given bad conductor

LIST OF EXPERIMENTS (PHYSICS PART)

1. Determination of dispersive power of the prism for various pairs of colors in the mercury spectrum using a spectrometer.
2. Determination of velocity of ultrasonic waves and compressibility of the given liquid using ultrasonic interferometer.
3. Determination of laser wavelength, particle size (lycopodium powder), acceptance angle and numerical aperture of an optical fibre using diode laser.
4. Determination of specific resistance of a given wire using Carey Foster's bridge.
5. Determination of band gap of the given semiconductor diode.
6. Determination of the thermal conductivity of a bad conductor using Lee's Disc apparatus.

(Any five experiments may be conducted from the above list)

Total: 30 Hours

U19PCL108B - PHYSICS AND CHEMISTRY LABORATORY
CHEMISTRY PART

(For Mechatronics Engineering)

L	T	P	C
0	0	2	1

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

- Estimate the amount of total, temporary and permanent hardness in the given water sample
- Analyse the different types of alkalinity and determine their amount in the given water sample
- Estimate the amount of hydrochloric acid present in the given solution using conductivity meter.
- Estimate the amount of hydrochloric acid present in the given solution using pH metry.
- Describe the estimation of ferrous iron present in the given solution using potentiometer.
- Evaluate the iron content of the water by spectrophotometry.

List of Experiments (Chemistry part)

7. Estimation of hardness of water sample by EDTA method.
8. Estimation of alkalinity of water sample by indicator method.
9. Estimation of HCl by conductometry. (HCl vs NaOH)
10. Estimation of HCl by pH metry.
11. Estimation of ferrous ion by potentiometric titration.
12. Determination of iron content in water by spectrophotometric method

(Any five experiments may be conducted from the above list)

Total: 30 Hours

U19PPL111 - PYTHON PROGRAMMING LABORATORY

L	T	P	C
0	0	2	1

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

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

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

1. Solve fundamental problems in specific areas of quantitative aptitude
2. Solve basic problems in stated areas of logical reasoning
3. Demonstrate rudimentary verbal aptitude skills in English with regard to specific topics

1. Quantitative Aptitude and Logical Reasoning

Solving simple problems with reference to the following topics:

a. Numbers – HCF & LCM
b. Decimal fractions
c. Square roots & cube roots
d. Surds & Indices
e. Logarithms
f. Percentage
g. Averages
h. Coding and Decoding & Visual language

2. Verbal Aptitude

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

a. Synonyms
b. Antonyms
c. Verbal analogy
d. Editing passages
e. Sentence filler words

TOTAL: 30 hours

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
Theory							
1	U19CHE104E	Chemistry for Mechanical Engineering	3	1	0	4	BS
2	U19MAT102A	Linear Algebra and Calculus	3	1	0	4	BS
3	U19EE106	Electrical Drives and ARM Processor	3	0	0	3	ES
4	U19EGR106	Engineering Graphics**	2	0	2	3	ES
Practical							
5	U19CHL109	Chemistry Laboratory	0	0	3	1.5	BS
6	U19EEL114	Electrical Drives and ARM Processor Laboratory	0	0	4	2	ES
7	U19WPL112	Workshop Practice	0	0	2	1	ES
8	U19ENL115	Communication Skills in English - I	0	0	2	1	HS
9	U19GE101	Basic Aptitude - I	0	0	2	0	EEC
Total Credits						**19.5**	
Optional Language Elective*							
10	U19OLE1101	French	0	0	2	1	HS
11	U19OLE1102	German					
12	U19OLE1103	Japanese					

*Students may opt for foreign languages viz., German/French/Japanese with additional one credit (Not accounted for CGPA calculation)
** The examination will be conducted for 3 hours through CAD software and manual drafting.

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, First Semester BE Mechanical 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: Mechatronics Engineering

S.N	Course Code	Course Title	L	T	P	C	Category	Total Contact Hours
Theory								
1	U19ENG201B	English for Engineers -II	1	0	2	2	HSMC	45 (15L+30P)
2	U19MAT202A	Differential Equations and Vector Calculus	3	1	0	4	BSC	60
3	U19PHY203F	Physics for electron devices	3	0	0	3	BSC	45
4	U19CHE204E	Modern materials	3	0	0	3	BSC	45
5	U19MCT201	Engineering Mechanics	3	0	0	3	ESC	45
6	U19MCT202	Basic Electrical Engineering	3	0	0	3	ESC	45
Practical								
7	U19WPL212	Workshop Practice	0	0	2	1	ESC	30
8	U19MCT203	Basic Electrical Engineering and Devices Laboratory	0	0	4	2	ESC	60
9	U19GE201	Basic Aptitude – II	0	0	2	0	EEC	30
Total Credits						**21**		
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, Mechatronics Engineering BoS**	**Member Secretary, Academic Council**	**Chairperson, Academic Council & Principal**
Dr. M. Renuga	**Dr. P. Suresh**	**Dr. R. Shivakumar**	**Dr. S. R. R. Senthil Kumar**

Copy to:-
HOD/ Mechatronics Engineering, First Semester BE MCT Students and Staff, COE

U19ENG201B- English for Engineers – II

First year II semester

MCT

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

1. Frame sentences correctly, both in written and spoken forms of language with accuracy and fluency.
2. Develop and demonstrate listening skills for academic and professional purposes.
3. Draw conclusions on explicit and implicit oral information.
4. Develop effective reading skills and reinforce language skills required for using grammar and building vocabulary.
5. Read for gathering and understanding information, following directions and giving responses.

	COURSE OUTCOMES	PROGRAMME OUTCOMES													
		1	2	3	4	5	6	7	8	9	10	11	12	Pso1	Pso2
1	Frame sentences correctly, both in written and spoken forms of language with accuracy and fluency	2	1	2	3	2	3	3	3	3	3	3	3	3	3
2	Develop and demonstrate listening skills for academic and professional purposes	2	2	2	3	2	3	3	3	3	3	3	3	3	3
3	Draw conclusions on explicit and implicit oral information	3	2	2	3	2	3	3	3	3	3	3	3	3	3
4	Develop effective reading skills and reinforce language skills required for using grammar and building vocabulary	3	3	2	3	2	3	3	3	3	3	3	3	3	3
5	Read for gathering and understanding information, following directions and giving responses.	3	3	2	3	2	3	3	3	3	3	3	3	3	3

UNIT –I

- Cause and effect expressions, adjectives, comparative adjectives
- Listening to conversations, welcome speeches, lectures and description of equipment
- Listening to different kinds of interviews (face-to-face, radio, TV and telephone interviews)
- Understanding notices, messages, timetables, advertisements, graphs, etc.
- Reading passages for specific information transfer

UNIT – II

- Prepositions and dependent prepositions
- Understanding short conversations or monologues
- Taking down phone messages, orders, notes etc
- Listening for gist, identifying topic, context or function
- Reading documents for business and general contexts and interpreting graphical representations

UNIT – III

- Collocations
- Listening comprehension, entering information in tabular form
- Error correction, editing mistakes in grammar, vocabulary, spelling, etc.
- Reading passage with multiple choice questions, reading for gist and reading for specific information, skimming for comprehending the general idea and meaning and contents of the whole text

UNIT – IV

- Articles, adverbs
- Intensive listening exercises and completing the steps of a process.
- Listening exercises to categorise data in tables.
- Short reading passage: gap-filling exercise related to grammar, testing the understanding of prepositions, articles, auxiliary verbs, modal verbs, pronouns, relative pronouns and adverbs, short reading passage with multiple choice questions.

UNIT – V

- Pronouns
- Listening to extended speech for detail and inference
- Listening and developing hints
- gap-filling exercise testing the knowledge of vocabulary, collocations, dependent prepositions, grammatical structures
- Short reading passages for sentence matching exercises, picking out specific information in a short text

TOTAL: 45 hours

The listening test will be conducted for 20 marks and reading for 20 marks internally and evaluated along with English for Engineers – II in the End Semester Valuation.

Textbook:

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.

B. E. / MECHATRONICS ENGINEERING

SEMESTER – II	DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS	L	T	P	C
U19MAT202A		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	P09	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3		3	2						3	2	3	3
CO2	3	3		3	2						3	2	3	3
CO3	3	3		3	2						3	2	3	3
CO4	3	3		3	2						3	2	3	3
CO5	3	3		3	2						3	2	3	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 parallelopiped.

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

Course Code:	**U19PHY203F**	**L T P C**
Course Name:	**Physics for Electron Devices**	**3 0 0 3 100**

(for Mechatronics Engineering)

COURSE OUTCOMES:

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

CO1 Differentiate the electrical and thermal conductivity of metals.

CO2 Elucidate the classification and theory of semiconducting materials.

CO3 Discuss the applications of diode as rectifier, photodiode, LED and solar cell.

CO4 Elucidate the application of bipolar transistor as amplifier.

CO5 Evaluate the novel properties of metallic glasses, shape memory alloys and nanomaterials.

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 Conducting materials **9**

Usage of conducting materials - basic definitions (electrical resistance - conductance -resistivity - conductivity).

Classical free electron theory of metals - postulates of classical free electron theory - microscopic form of Ohm's law - Electrical conductivity - definition and expression for electrical conductivity - thermal conductivity - definition and expression for thermal conductivity - Wiedemann - Franz law and Lorentz number - Success and failure of classical free electron theory.

Quantum free electron theory - Drawbacks of quantum free electron theory - origin of energy bands - band theory of solids (qualitative treatment only) - Fermi energy and Fermi distribution function - Effect of temperature on Fermi function - Density of energy states - carrier concentration in metals.

Unit 2 Semiconducting Materials 9

Properties of semiconductors - Classification of semiconductors - Intrinsic and extrinsic semiconductors - Elemental and compound semiconductors.

Intrinsic semiconductor - two types of charge carriers - Energy band diagram of intrinsic semiconductors (at T= 0 K and T > 0 K) - Expression for number of electrons in conduction band - Expression for number of holes in valence band - Law of mass action and intrinsic carrier concentration - Fermi level - Variation of Fermi level with temperature - electrical conductivity - band gap determination.

Extrinsic semiconductors - Draw backs of intrinsic semiconductors – Types of extrinsic semiconductors – 'n'-type and 'p'-type semiconductors – Energy band diagram of 'n' type and 'p' type semiconductors (at T= 0 K and T > 0 K) – Carrier concentration of extrinsic semiconductors (Qualitative Treatment only) – Hall effect –Determination of Hall coefficient – Applications.

Unit 3 PN junction diode and optoelectronic devices **9**

PN junction diode - Formation of p-n junction - p-n junction diode- p-n junction diode under forward bias- p-n junction diode under reverse bias-Application of junction diode as rectifier- Half wave rectifier- full wave rectifier- bridge rectifier-Zener diode- Zener diode as voltage regulator.

Optoelectronic devices - Photo diodes- types of photo diodes- Photo detector-PIN diode- Avalanche photo diode-Light emitting diode (LED) - LED- principle –construction- working- Solar cell- principle –construction- working.

Unit 4 Bipolar junction transistors and amplifiers **9**

Bipolar junction transistors - npn and pnp transistors- Unbiased npn transistor – Biased npn transistor –Transistor currents-Transistor configuration- common base configuration-common emitter configuration-common collector configuration.

Amplifiers - Transistor as amplifier-introduction to Field effect transistors (FET) - Types of field effect transistors- Junction field effect transistor (JFET) –Metal oxide field effect transistor (MOSFET).

Unit 5 New Engineering Materials: **9**

Metallic glasses -Preparation, properties and applications.

Shape memory alloys (SMA) - Characteristics, properties of NiTi alloy, application, advantages and disadvantages of SMA.

Nanoscience and Nanotechnology - Significance of nanoscale - different types of nanostructures (0-D, 1-D, 2-D and 3-D) – Fabrication of nanomaterials - Ball milling and Chemical vapour deposition technique (CVD).

Carbon nanotubes – structure - properties and applications – fabrication - pulsed laser deposition method.

Lecture: 45, Tutorial: 00, Total: 45 Hours

Text Book:

1. M.N.Avadhanulu, 'Engineering Physics' S.Chand &Company Ltd, New Delhi (2015)
2. B. K. Pandey and S. Chaturvedi, Engineering Physics, Cengage Learning India Pvt. Ltd., Delhi, 2012.

References:

1. Physics for Electrical and Electronics Engineering, Sonaversity, Sona College of Technology, Salem (Revised Edition 2016).
2. Rajendran, V, and Marikani A, 'Materials science' TMH Publications, (2004) New Delhi.
3. Palanisamy P.K, 'Materials science', SciTech Publications (India) Pvt. Ltd., Chennai, Second Edition (2007)
4. M. Arumugam, 'Materials Science' Anuradha Publications, Kumbakonam, (2006).

COURSE CODE	U19CHE204E	L T P C
COURSE NAME	MODERN MATERIALS	3 0 0 3

COURSE OUTCOMES

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

CO1: Analyze the types of polymers, polymerization reactions, polymerization techniques and fabrication methods of polymers for engineering applications.

CO2: Analyze the types and methods of preparing conducting polymers.

CO3: Explore different methodologies to synthesize nanostructured composites materials.

CO4: Analyze the different types of electrochemical processes carried out in electronic industries.

CO5: Compare the working principles of various organic electronic devices.

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
CO – 2	3	3												3
CO – 3	3	3												3
CO – 4	3	3												3
CO - 5	3	3												3

UNIT I: POLYMER CHEMISTRY **09**

Nomenclature of Polymers – Functionality – Types of Polymerization-addition-condensation and copolymerization – Classification of Polymers – Free Radical mechanism of addition polymerization – Properties of Polymers- Tg – tacticity - Methods of Polymerization: emulsion and suspension – Plastics: Moulding constituents of plastic – Moulding of plastics into articles-Injection-Compression and Blow moulding – Thermoplastic and Thermosetting Resins.

UNIT II: CONDUCTING POLYMERS **09**

Introduction – Structural characteristics and doping concept in metals and metal oxide nanoparticles - Charge carriers and conducting mechanism – Classification of conducting polymers: Intrinsic and extrinsic conducting polymers – Synthesis of conducting polymers - bulk and solution polymerization – Applications of conducting polymers in corrosion protection and sensors.

UNIT III: NANOSTRUCTURED COMPOSITES **09**

Definition of nanocomposites – Nanofillers: Classification of nanofillers, Synthesis and properties of nanofillers – Synthesis of nanocomposites by physical methods - direct mixing and solution mixing - Chemical methods - Microemulsion synthesis, Microwave assisted synthesis and Sonochemical assisted synthesis - Types of nanocomposites - Core-Shell nanostructure, Organic-Inorganic hybrid nanocomposites, Quantum dot (QDs) synthesis.

UNIT IV: ELECTROCHEMICAL PROCESSES IN THE FABRICATION OF ELECTRONIC DEVICES 09

Electroplating – Principle and process - plating parameters- current and energy efficiency - Electroplating of Nickel - Fundamentals of electro less deposition – electro less plating of Nickel, fabrication of PCB's - Electrochemical etching of copper from PCBs - Anodizing - definition, principle and working methodology of anodized aluminium - Chemical sensors - optical and heat sensors – definitions and applications.

UNIT V: ORGANIC ELECTRONIC MATERIALS 09

Organic semiconducting materials – working principle and advantages over inorganic semiconducting materials - p-type and n-type organic semiconducting materials - Pentacene Fullerenes-C-60 – Organic dielectric material – definition - working principle and examples - Polystyrene – PMMA – Organic Light Emitting Diodes (OLEDs): construction, working principle and applications – Organic transistors: construction, working principle and applications in electronic industries.

TOTAL: 45 HOURS

Text Books

1. Hagen Klauk, Organic Electronics: Materials, Manufacturing and Applications, Wiley – VCH. 2006.
2. A.P. Uthirakumar et.al, "Modern Materials", Sonaversity, Sona College of Technology, 2019.

Reference Books

1. H.K. Chopra, A. Parmer, "Chemistry for Engineers", Narosa Publishing House, New Delhi, 110 002, 2016.
2. Nanostructured Materials and Nanotechnology – II, Eds. Sanjay Mathur and Mrityunjay Singh, Willey, 2008.
3. Gowariker V.R, Viswanathan N.V. and Jayadev Sreedhar, Polymer Scinece, New age International P (Ltd), Chennai, 2006.
4. Nanostructured Materials and Nanotechnology – II, Eds. Sanjay Mathur and Mrityunjay Singh, Willey, 2008.

U19MCT201	ENGINEERING MECHANICS	L	T	P	C
		3	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1:	Analyse the forces in statically determinate structures using scalar and vector analytical techniques.
CO2:	Examine the condition for equilibrium of rigid body using free body diagram.
CO3:	Evaluate the effect of friction of bodies under equilibrium condition.
CO4:	Determine the centroid, moment of inertia and polar moment of inertia of simple and composite sections.
CO5:	Analyse the motion of a body with force and without force causing the motion.

Pre-requisite

Engineering Physics

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	2		2	2			1		1	3	2
CO2	3	3	3	2		2	2			1		2	3	2
CO3	3	3	3	2		2	2			1		2	3	2
CO4	3	3	3	2		2	2			1		1	3	2
CO5	3	3	3	2		2	2			1		2	3	2

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: BASICS & STATICS OF PARTICLES	**9 Hours**

Introduction – Units and Dimensions – Laws of Mechanics – Lame's theorem, Parallelogram and triangular Law of forces – Vectors – Vectorial representation of forces and moments – Coplanar Forces – Resolution and Composition of forces – Equilibrium of a particle - Forces in space – Equilibrium of a particle in space – Equivalent systems of forces – Principle of transmissibility – Single equivalent force.

Unit 02: EQUILIBRIUM OF RIGID BODIES IN 2 DIMENSIONS	**9 Hours**

Free body diagram – Types of supports and their reactions – requirements of stable equilibrium – Moments and Couples – Moment of a force about a point – Varignon's theorem – Equilibrium of Rigid

bodies in two dimensions.

Unit 03: FRICTION	**9 Hours**

Frictional force – Laws of Coulomb friction – Angle of friction – cone of friction – Equilibrium of bodies on inclined plane.

Unit 04: PROPERTIES OF SURFACES AND SOLIDS	**9 Hours**

Determination of Areas and Volumes – First moment of area and the Centroid of sections – Rectangle, circle, triangle from integration – T section, I section, Hollow section by using standard formula. Second and product moments of plane area – Rectangle, triangle, circle from integration – T section, I section by using standard formula – Parallel axis theorem and perpendicular axis theorem – Polar moment of inertia.

Unit 05: DYNAMICS OF PARTICLES	**9 Hours**

Displacements, Velocity and acceleration, their relationship – Rectilinear and Curvilinear motion – Newton's law – Work Energy Equation of particles – Impulse and Momentum– Impact of elastic bodies.

Theory: 45 Hrs	**Tutorial: --**	**Practical: --**	**Total Hours: 45 Hrs**

TEXT BOOKS

1. Beer, F.P and Johnson Jr. E.R. "Vector Mechanics for Engineers: Statics and Dynamics", McGraw–Hill International 10th Edition, 2013.
2. Dr. N. Kottiswaran, "Engineering Mechanics (Statics and Dynamics)" ,Sri Balaji Publications 10th edition 2010.

REFERENCES

1. Rajasekaran, S, Sankarasubramanian, G., "Fundamentals of Engineering Mechanics", Vikas Publishing House Pvt. Ltd., (2011).
2. Hibbeller, R.C., "Engineering Mechanics", Vol. 1 Statics, Vol. 2 Dynamics, Pearson Education Asia Pvt. Ltd., (2015).
3. Palanichamy, M.S., Nagam, S., "Engineering Mechanics – Statics & Dynamics", Tata McGraw–Hill, (2004).
4. MeriamJ.L,KraigeL.G,"Engineering Mechanics-Statics"6th Edition, Wiley, 2017.
5. Irving H. Shames, "Engineering Mechanics – Statics and Dynamics", IV Edition– Pearson Education Asia Pvt. Ltd., (2006).
6. Kumar, K.L., "Engineering Mechanics", 3rd Revised Edition, Tata McGraw-Hill Publishing company, New Delhi (2008)

U19MCT202	BASIC ELECTRICAL ENGINEERING	L	T	P	C
		3	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1:	Evaluate the behaviour of circuit elements in electric circuits.
CO2:	Explain the principles of operation of magnetics circuits and transformers
CO3:	Outline the construction and working principles of DC machines and synchronous machines.
CO4:	Evaluate the electromagnetic energy conversion and operating principle of three phase induction motors.
CO5:	Explain the principles of operations of single-phase induction and stepper motors.

Pre-requisite

Engineering Physics

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	2			2			2			3	2
CO2	3	3	3	2			2			2			3	2
CO3	3	3	3	2			2			2			3	2
CO4	3	3	3	2			2			2			3	2
CO5	3	3	3	2			2			2			3	2

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 I FUNDAMENTAL LAWS OF ELECTRICAL ENGINEERING AND CIRCUIT ELEMENTS	9 Hours

Electric Current – Coulomb's Law – Ohm's Law – Faraday's Law of Electromagnetic Induction – Kirchhoff's Laws–Energy and Power – Resistance Parameter – Inductance Parameter –Capacitance Parameter – Series and Parallel Combinations of Resistances —RLC Series-Parallel Circuits – Resonance

UNIT II MAGNETIC CIRCUITS AND TRANSFORMERS	**9 Hours**

Ampere's Law – Basic Definition: Flux, Flux Density, Field Strength, Permeability, Reluctance, Permeance – Theory of Magnetism –Hysteresis and Eddy-Current Losses - Magnetic Circuit -Self Inductance, Mutual inductance, Co-efficient of Coupling- Transformers – Equivalent Circuit–Parameters from No-Load Tests – Efficiency and Voltage Regulation.

UNIT III DC MACHINES AND THREE PHASE SYNCHRONOUS MACHINES	**9 Hours**

DC Machines- DC Generator-construction–working principle- EMF equation-Types of DC Generator, DC motor-working principle –Types of DC Motor-Motor Speed torque Characteristics-starters for DC Motors -Generation of a Three Phase Voltage– Synchronous Generator-construction and working principle.

UNIT IV ELECTROMAGNETIC ENERGY CONVERSION AND THREE PHASE INDUCTION MOTOR	**9 Hours**

Introduction-Basic Analysis of Electromagnetic Torque - Three Phase Induction Motor – Revolving Magnetic Field – Construction- Working Principle- Types- Speed-Torque Characteristic – Parameters from No Load and Blocked rotor Tests – Equivalent Circuit – Applications of Three phase Induction Motors.

UNIT V SINGLE PHASE INDUCTION MOTORS AND SPECIAL MACHINES	**9 Hours**

Single Phase Induction Motor-Construction-working principle- Switched reluctance motor- Stepper Motors –working principle- Stepper Motors -PM Brushless DC motors - Servo motor- Applications

Theory: 45 Hrs	**Tutorial: --**	**Practical: -- Hr**	**Total Hours: 45 Hrs**

Text Books

1. B.L. Theraja and A. K. Theraja, "A Text Book of Electrical Technology", S.Chand Publication, Vol 2, 2014.
2. A. Sudhakar and S.P Shyam Mohan, "Circuits, Network Analysis and Synthesis", Tata McGraw Hill, Fifth Edition, 2015.

REFERENCES

1. D.P. Kothari and I.J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, Fourth Edition, 2011.
2. V.K.Metha, Rohit Metha, "Principles of Electrical Engineering and Electronics", Second edition, S.Chand Publication, 2015.
3. S.K.Bhattacharya "Basic Electrical and Electronics Engineering" Pearson Education India, 2012.
4. V.N. Mittle and Aravind Mittal "Basic Electrical Engineering", Tata McGraw Hill, Second edition, 2005.

U19WPL212 – WORKSHOP PRACTICE

L	T	P	C
0	0	2	1

Course Outcomes: At the end of the 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.

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- PracticeMaking 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

U19MCT203	BASIC ELECTRICAL ENGINEERING AND DEVICES LABORATORY	L	T	P	C
		0	0	4	2

Course Outcomes

After successful completion of this course, the students should be able to

CO1:	Understand the usage of common electrical measuring instruments and basic characteristics of transformers and electrical machines.
CO2:	Evaluate the characteristics of semiconductor devices.
CO3:	Interpret the solutions for real time applications of electrical machines and semiconductor devices.

Pre-requisite

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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	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	3						2			3	2
CO2	3	3	3	3						2			3	2
CO3	3	3	3	3						2			3	2

Course Assessment methods

Direct		Indirect
CIE TEST-I (20) Quiz-I (5) CIE TEST-II (20)	Quiz-II (5) RTPS (10) End semester Examination (40)	Course end survey

List of Experiments

1. Measuring the steady-state and transient time-response of R-L, R-C, and RLC circuits.
2. Sinusoidal steady state response of R-L, and R-C circuits impedance
3. Calculation and verification. Observation of phase differences between current and voltage. Resonance in R-L-C circuits.
4. Loading of a transformer: measurement of primary and secondary voltages and currents, and power.
5. Three-phase transformers: Star and Delta connections.
6. Torque Speed Characteristic of dc shunt motor.
7. Synchronous speed of two and four-pole, three-phase induction motors.
8. Torque-Slip Characteristic of an induction motor.
9. Verify the VI Characteristics of PN diode
10. Verify the VI Characteristics of Zener diode
11. Verify the VI Characteristics of SCR.
12. Verify the VI Characteristics of MOSFET.

Total Hours: 60 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 logicalreasoning.

CO3 demonstrate higher than BA-I level verbal aptitude skills in English with regardto 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 Regulations 2019
Branch: Mechatronics Engineering

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit	Total Contact Hours
Theory							
1	U19MC301	Fluid Mechanics and Machinery	3	0	0	3	45
2	U19MC302	Strength of Materials	3	0	0	3	45
3	U19MC303	Manufacturing Technology	3	0	0	3	45
4	U19MC304	Electrical Drives and Control	3	0	0	3	45
5	U19MC305	Digital Electronics	3	0	0	3	45
6	U19GE304	**Mandatory course:** Constitution of India	2	0	0	0	30
Practical							
7	U19MC306	Fluid Mechanics and Strength of Materials Laboratory	0	0	4	2	60
8	U19MC307	Manufacturing Technology Laboratory	0	0	3	1.5	45
9	U19MC308	Electrical Drives and Control Laboratory	0	0	3	1.5	45
10	U19GE301	Soft Skill and Aptitude – I	0	0	2	1	30
					Total Credits	**21**	

Approved By

Chairperson, Mechatronics Engineering BoS
Dr.P.Suresh

Member Secretary, Academic Council
Dr.R.Shivakumar

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

Copy to:-

HOD/ Mechatronics Engineering, Third Semester BE MCT Students and Staff, COE

U19MC301	FLUID MECHANICS AND MACHINERY	L	T	P	C
		3	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1:	Apply mathematical knowledge to predict the properties of fluid and analyse the pressure measurement.
CO2:	Evaluate the fluid flow problems using continuity equation and Bernoulli's equation with their applications. Distinguish laminar and turbulent flow through circular pipes.
CO3:	Perform the dimensional analysis by using Buckingham's ∏ theorem.
CO4:	Analyze the performances of the hydraulic turbines.
CO5:	Describe the working principle of centrifugal pumps & reciprocating pumps and analyze their performances.

Pre-requisite

1. Engineering Physics
2. Transforms & Partial differential equations

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	2	2	1	1				1			3	2
CO2	3	3	2	2		2				1			3	2
CO3	3	3	3	2	1	1				1			3	2
CO4	3	3	3	2		2	1	1		1		1	3	2
CO5	3	3	3	2		2	1	1		1		1	3	2

Course Assessment methods

Direct		Indirect
Internal test I (8) Internal test II (8) Internal test III (8) Moodle (6)	Assignment/Seminar (5) Attendance (5) End semester Examination (60)	Course end survey

Unit 01: FLUID PROPERTIES AND PRESSURE MEASUREMENT	**09 Hours**

Units & Dimensions. Properties of fluids – mass density, specific weight, specific volume, viscosity, capillarity and surface tension, compressibility, vapor pressure and cavitation. Pressure Measurement- Pascal law-measurement of pressure through simple and differential manometers

Unit 02: FLOW CHARACTERISTICS AND FLOW THROUGH PIPES	**09 Hours**

Types of fluid flow- application of continuity equation, Euler's equation-Bernoulli's equation-Orifice meter, Venturi meter.

Boundary layer concept-Laminar flow though circular pipes -Hagen-Poiseuille equation- Turbulent flow though circular pipes- Darcy Weisbach equation –friction factor-Energy losses in flow through pipes (description only)-Power transmission through pipes.

Unit 03: DIMENSIONAL ANALYSIS	**09 Hours**

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

Unit 04: HYDRAULIC TURBINES	**09 Hours**
Turbines: definition and classification – impulse and reaction- Pelton turbine - Francis turbine - Kaplan turbine - working principles - velocity triangles - work done - efficiencies and performance calculations-specific speed.	
Unit 05: HYDRAULIC PUMPS	**09 Hours**
Pumps: Definition and classifications. Centrifugal pump- working principle, velocity triangle, head and efficiencies, performance calculations. Reciprocating pump – classification, working principle-performance calculations, function of air vessel-Rotary pumps- gear and vane pump- working principle.	

Theory: 45Hrs	**Tutorial: -**	**Total Hours: 45 Hrs**

Text Books

1. Bansal, R.K., Fluid Mechanics and Hydraulics Machines, (9th edition), Laxmi publications (P) Ltd, New Delhi, 2015

REFERENCES

1. Sukumar Pati., "Fluid Mechanics and Hydraulics Machines", Tata McGraw Hill publications (P) Ltd, New Delhi, 2012.
2. C.S.P.Ojha, R.Berndtsson, P.N.Chandramouli., Fluid Mechanics and Machinery, Oxford University Press, New Delhi, 2010.
3. Modi P.N. and Seth, S.M. "Hydraulics and Fluid Mechanics", Standard Book House, New Delhi 2004
4. Streeter, V. L. and Wylie E. B., "Fluid Mechanics", McGraw Hill Publishing Co. 2010
5. Ramamritham. S, Fluid Mechanics, Hydraulics and Fluid Machines, Dhanpat Rai & Sons, Delhi, 2011

U19MC302	STRENGTH OF MATERIALS	L	T	P	C
		3	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1:	Analyse the state of stresses and strains in engineering components as a result of different loading conditions in the machine members and structures.
CO2:	Investigate the effect of various loading combinations by determining the principal stresses, principal planes and maximum shear stress u on machine and structural parts using Mohr's circle.
CO3:	Apply the principles and equations, necessary tools to analyze structural members under axial loads, bending, shear, and torsion.
CO4:	Evaluate the material behaviour under pure torsion on circular shafts.
CO5:	Design the structural beams, columns, long mechanical members under compression and different loading condition.

Pre-requisite

1.Engineering Mechanics

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	2	1	2				1			3	2
CO2	3	3	3	2	1	2				1			3	2
CO3	3	3	3	2	1	2	1	1		1		1	3	2
CO4	3	3	3	2	1	2	1			1			3	2
CO5	3	3	3	2	1	2	1	1		1		1	3	2

Course Assessment methods

Direct		Indirect
Internal test I (8) Internal test II (8) Internal test III (8) Moodle (6)	Assignment/Seminar (5) Attendance (5) End semester Examination (60)	Course end survey

Unit 01: Stress, Strain and Deformation of Solids — **09 Hours**

Simple stress and strain – Stresses and strains due to axial force - Mechanical properties of materials – Stress-strain curve –- Hooke's law - Factor of safety – Stepped shafts – Uniformly varying sections – Stresses in composite sections - Temperature stresses – Poisson's ratio - shear modulus, bulk modulus, relationship between elastic constants.

Unit 02: Analysis of Stresses in Two Dimensions — **09 Hours**

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 03: Beams - Loads and Stresses — **09 Hours**

Beams – types of supports – simple and fixed, types of load – concentrated, uniformly

distributed, varying distributed load, combination of above loading – relationship between bending moment and shear force – bending moment, shear force diagram for simply supported, cantilever and over hanging beams – Point of contra flexure. Introduction to Theory of simple bending.	
Unit 04: Torsion in Shafts and springs	**09 Hours**
Analysis of torsion of circular bars – Shear stress distribution – Bars of Solid and hollow circular section – Stepped shaft – Twist and torsion stiffness – Compound shafts 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 05: columns and Deflection of Beams	**09 Hours**
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 Deflection of beams – double integration method – Macaulay's method – slope and deflection using moment area method.	

Theory: 45 Hrs	**Tutorial: -**	**Total Hours: 45 Hrs**

Text Books

1. R K Bansal, "A text book of Strength of Materials", Lakshmi Publications (P) Limited, New Delhi, 2007.
2. R K Rajput, "Strength of Materials", S Chand & Co., New Delhi, 2006.

REFERENCES

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, 1997.

U19MC303	MANUFACTURING TECHNOLOGY	L	T	P	C
		3	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1:	Elaborate the sand casting, pattern materials and welding, different welding processes.
CO2:	Describe the various bulk deformation processes, different sheet metal operations and shaping of plastics using different moulding methods.
CO3:	Identify the cutting tool materials and its specific purpose and explain about lathe details, main dissimilarity of capstan and turret lathes.
CO4:	Illustrate the principle of reciprocating machine tools.
CO5:	Explain the working principle of milling and grinding processes.

Pre-requisite

1. Engineering Physics

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	1	1	2	1	1		1		1	3	2
CO2	3	3	3	1	1	2	1	1		1		1	3	2
CO3	3	3	3	2	1	2	1	1		1		1	3	2
CO4	3	3	3	2	1	2	1	1		1		1	3	2
CO5	3	3	3	2	1	2	1	1		1		1	3	2

Course Assessment methods

Direct		Indirect
Internal test I (8) Internal test II (8) Internal test III (8) Moodle (6)	Assignment/Seminar (5) Attendance (5) End semester Examination (60)	Course end survey

Unit 01: METAL CASTING AND METAL JOINING PROCESS — **09 Hours**

Sand Casting- Moulding Tools- Types of Patterns- Pattern Materials- Moulding Sand- Properties- Melting Furnaces: Cupola, Crucible and Electric arc furnace- Special Casting Process: Shell, Investment Casting - Lost Wax Process- Gas welding- Arc welding -TIG welding- MIG welding.

Unit 02: SHEET METAL AND PLASTIC COMPONENTS — **09 Hours**

Drawing Process: Wire drawing, Tube drawing, Metal Spinning, Rolling: Type of rolling mills- Extrusion: Principles of Extrusion – Types – Hot and Cold extrusion, Sheet metal: Rubber pad forming- Explosive forming. Moulding of thermoplastics- injection moulding- blow moulding – Rotational moulding

Unit 03: CENTRE LATHE — **09 Hours**

Centre lathe: constructional features- various operations, tool and work holding devices- taper turning methods, thread cutting, special attachments. Special Purpose Lathe: Capstan and

turret lathes – automats – single spindle- Swiss type- automatic screw type, multi spindle, Bar feed mechanism	
Unit 04: SPECIAL MACHINE TOOLS	**09 Hours**
Construction, Types, Operations and mechanisms of Shaper, Planner and Slotter. Hole making: drilling – Reaming, Boring- Tapping operations. Broaching machines: broach construction – push, pull, surface and continuous broaching machines.	
Unit 05: MILLING AND GEAR PROCESS	**09 Hours**
Milling operations-types of milling cutter. Gear cutting – forming and generation principle and construction of gear milling, hobbing and gear shaping processes –finishing of gears. Grinding: types of grinding process- types of grinding wheel – Abrasives - cylindrical grinding, surface grinding, centreless grinding – honing, lapping and buffing.	

Theory: 45Hrs	**Tutorial: -**	**Total Hours: 45 Hrs**

Text Books

1. Hajra Choudhury, "Elements of Workshop Technology, Vol. I and II", Media promoters Pvt Ltd., Mumbai, 2001.
2. Mikell P Groover, " Principles of Modern Manufacturing" Wiley India Pvt Ltd. 2014.

REFERENCES

1. B.S. Magendran parashar & 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, 2002.
3. J.P .Kaushish "Manufacturing Processes" PHI Learning Private limited, second edition 2010.
4. P. C. Sharma, "A text book of production technology", S. Chand and company, IV Edition, 2003.
5. Begma, 'Manufacturing process", John Wilely & sons, VII Edition, 2005.
6. Serope Kalpajian, Steven R.Schmid, Manufacturing Engineering and Technology, Pearson Education, Inc. 2002 (Second Indian Reprint)
7. Beddoes. J and Bibby M.J. 'Principles of Metal Manufacturing Processes', Elsevier, 2006.
8. Rajput R.K, 'A text book of Manufacturing Technology', Lakshmi Publications, 2007.

U19MC304	ELECTRICAL DRIVES AND CONTROL	L	T	P	C
		3	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1:	To learn the General characteristics of different types of electrical AC & DC Motors with respect to the applications.
CO2:	Explain the nature of speed torque characteristic of various types of loads and drive motor
CO3:	Describe the different starting methods of AC & DC motors.
CO4:	Explain various solid-state speed controls of single and three phase DC drives.
CO5:	Explain the working of various 3 phase induction motor drives for precise variable speed control.

Pre-requisite

1. Basic Electrical Engineering

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	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	3	3	3	2	1	1	2	1	1	2			3	2
CO2	3	3	3	2	1	1	2	1	1	2			3	2
CO3	3	3	3	2	1	1	2	1	1	2			3	2
CO4	3	3	3	2	1	1	2	1	1	2			3	2
CO5	3	3	3	2	1	1	2	1	1	2			3	2

Course Assessment methods

Direct		Indirect
Internal test I (8) Internal test II (8) Internal test III (8) Moodle (6)	Assignment/Seminar (5) Attendance (5) End semester Examination (60)	Course end survey

Unit 01: INTRODUCTION OF ELECTRIC DRIVES — **9 Hours**

Basic Elements – Types of Electric Drives – factors influencing the choice of electrical drives – heating and cooling curves – Loading conditions and classes of duty – Selection of power rating for drive motors with regard to thermal overloading and Load variation factors. Drive consideration for Textile mills, Steel rolling mills, Cement mills, Paper mills

Unit 02: Starting and speed Control of Drives — **9 Hours**

Types of D.C Motor starters – Braking of Electrical motors –Induction Motor starters- Speed control of DC series and shunt motors – Armature and field control, Ward- Leonard control system applications. Conventional Speed Control of Induction Motors: Stator Voltage Control, Stator Frequency Control, Rotor Resistance Control.

Unit 03: CONVENTIONAL AND SOLID-STATE SPEED CONTROL OF DC DRIVES — **9 Hours**

Single Phase and Three Phase Fully Controlled Converter: Principle of operation and waveforms of single phase and three phase fully controlled converter fed DC drive – Choppers Fed DC Motor Drive – Applications.

Unit 04: CONVENTIONAL AND SOLID-STATE SPEED CONTROL OF AC DRIVES — **9 Hours**

Speed control of three phase induction motor-Voltage control, Voltage/ frequency

control, Slip power recovery scheme- VSI fed Three Phase Induction Motors–CSI Fed Three Phase Induction Motors- and AC voltage regulators-Applications.			
Unit 05: SPECIAL MOTOR DRIVES			**9 Hours**
Speed control of Stepper motors – Permanent magnet, Variable reluctance, Single and multi-stack configurations, Hybrid motor. Speed control of Switched reluctance motor – AC & DC Servo motors – Brushless DC motors			
Theory: 45 Hrs	**Tutorial: --**	**Practical: -- Hr**	**Total Hours: 45 Hrs**
Text Books			
1. U.A.Bakshi, M.V.Bakshi, "Electrical Drives and Control", Technical Publications, 2009.			
2. G.K dubey , "Fundamentals of Electrical Drives ",Narosa Publishing House, New Delhi ,2 nd Edition, 2001			
REFERENCES			
1. M. D. Singh, "Power electronics", Tata McGraw-Hill Education, 2011.			
2. Bimbhra, P.S., "Power Electronics", Second edition, Khanna Publishers, New Delhi 5 th Edition, 2015.			
3. P.C.Sen "Principles of Electric Machines and Power Electronics" John Wiley & Sons, 2007.			
4. VEDAM SUBRAMANIAM "Electric drives", Tata McGraw-Hill.2001.			

U19MC305	DIGITAL ELECTRONICS	L	T	P	C
		3	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1:	Discuss the different number systems, error correcting codes and implement Boolean functions using logic gates
CO2:	Design and analyse the combinational logic circuits
CO3:	Design and analyse synchronous sequential circuits using flip flops
CO4:	Design and implement various logic functions using ROM, PLA and PAL
CO5:	Discuss the different types of basic electronics circuits.

Pre-requisite

Physics for Electron devices

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**	**PO 7**	**PO 8**	**P0 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	3	3	2	2				2				3	2
CO2	3	3	3	2	2				2				3	2
CO3	3	2	3	2	2				2				3	2
CO4	3	3	3	2	2				2				3	2
CO5	3	3	3	2	2				2				3	2

Course Assessment methods

Direct		Indirect
Internal test I (8) Internal test II (8) Internal test III (8) Moodle (6)	Assignment/Seminar (5) Attendance (5) End semester Examination (60)	Course end survey

Unit 01: BINARY SYSTEMS AND BOOLEAN ALGEBRA — **09 Hours**

Number systems – Base conversion – Binary codes – Parity and hamming code – Logic gates – Boolean laws and theorems – Minimization of Boolean expressions – SOP and POS forms, minterms and maxterms – Karnaugh map minimization (up to 5 variables) – Realization of circuits using logic gates.

Unit 02: COMBINATIONAL CIRCUITS — **09 Hours**

Design of Half and Full Adder, Half and Full Subtractor, Parallel Adder / Subtractor, Comparator, Parity generator and checker – Priority Encoder, Decoder, Demultiplexer and Multiplexer – Implementation of combinational logic circuits using decoder, de-multiplexer and multiplexer.

Unit 03: **DESIGN OF SYNCHRONOUS SEQUENTIAL CIRCUITS** — **09 Hours**

Flip flops – SR, JK, D and T – Master-Slave flip-flop – Realization of one flip flop using other flip flops – Analysis and Design of synchronous sequential circuits – Asynchronous Up / Down counter – Design of synchronous counters – Shift registers.

Unit 04: **MEMORIES AND PLDs** — **09 Hours**

Classification of memories – Random Access Memory (RAM) – Read Only Memory (ROM) – Memory decoding– Programmable Array Logic (PAL) – Programmable Logic Array (PLA) – Field Programmable Gate Arrays (FPGA) – Implementation of logic functions with PROM, PLA and PAL.

Unit 05: DIGITAL CIRCUIT APPLICATIONS — **09 Hours**

Digital to analog and Analog to digital convertors – R-2R Ladder and Successive approximation techniques – Multivibrators – Logic gates in timing circuits – Operational amplifier – Schmitt trigger – 555 timer – Introduction to Arduino and Raspberry Pi boards.

Theory: 45 Hours	Tutorial: -	Total Hours: 45 Hours

TEXT BOOKS
M. Morris Mano and Michael D. Ciletti, "Digital Design: With an Introduction to the Verilog HDL, VHDL, and System Verilog", Pearson Education, 6th edition, 2018.
D.P. Kothari and J.S. Dhillon, "Digital Circuits and Design", Pearson Education, 2015.
REFERENCES
A. Anand Kumar, "Fundamentals of Digital Circuits", PHI India, 4th edition, 2016.
Charles H.Roth and Larry L. Kinney "Fundamentals of Logic Design", 7th Edition, Cengage Learning, 2014.
Donald D. Givone, "Digital Principles and Design", McGraw Hill Education, 2016

U19MC306	FLUID MECHANICS AND STRENGTH OF MATERIALS LABORATORY	L	T	P	C
		0	0	4	2

Course Outcomes

After successful completion of this course, the students should be able to

CO1:	Understand the working principles of flow measuring instruments, determine the Coefficient of discharge of orifice/venturi meters and evaluate the fluid machines performance.
CO2:	Investigate the mechanical properties of materials.
CO3:	Evaluate the real time problems in the fluid flow and material strength analysis.

Pre-requisite

Engineering Physics

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	2	2			1	3	2	1	2	3	2
CO2	3	3	3	2	2			1	3	2	1	2	3	2
CO3	3	3	3	2				1	3	2			3	2

Course Assessment methods

Direct		Indirect
CIE TEST-I (20) Quiz-I (5) CIE TEST-II (20) Quiz-II (5)	RTPS (10) End semester Examination (40)	Course end survey

List of Experiments

Part-A: Fluid Mechanics laboratory

1. Determination of the Coefficient of discharge of given Orifice meter / Venturi meter.
2. Conducting experiments and drawing the characteristic curves of centrifugal pump / submersible pump
3. Conducting experiments and drawing the characteristic curves of reciprocating pump / Gear pump.
4. Conducting experiments and drawing the characteristic curves of Pelton wheel.
5. Conducting experiments and drawing the characteristics curves of Francis turbine.
6. Conducting experiments and drawing the characteristic curves of Kaplan turbine.

Part-B: Strength of Materials laboratory

1. Tension Test on MS Steel.
2. Compression test – MS Steel.
3. Double shear test in UTM.
4. Tests on spring – Tension and Compression.
5. Hardness test on various machines.
6. Impact test – Charpy and Izod.

Total Hours: 60 Hrs

U19MC307	MANUFACTURING TECHNOLOGY 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:	Demonstrate the working of general purpose machine tools and do turning process for a given job
CO2:	Work on drilling machine and make drilling on steel plate.
CO3:	Perform an ARC welding equipment and make various joints

Pre-requisite

1. Workshop practice laboratory

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	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	3						2			3	2
CO2	3	3	3	3						2			3	2
CO3	3	3	3	3						2			3	2

Course Assessment methods

Direct		Indirect
CIE TEST-I (20) Quiz-I (5) CIE TEST-II (20) Quiz-II (5)	RTPS (10) End semester Examination (40)	Course end survey

List of Experiments

1. Exercise on simple facing & Turning.
2. Exercise on Step turning.
3. Exercise on taper turning.
4. Exercise on thread cutting operation.
5. Exercise on Knurling and Grooving.
6. Exercise on Drilling, Boring and Chamfering.
7. Exercise on radial drilling (Drilling, Tapping, Reaming and Counter Sink).
8. Exercise on surface machining using shaper.
9. Exercise on Gear milling.
10. Exercise on cylindrical grinding.

Total Hours: 45 Hrs

U19MC308	ELECTRICAL DRIVES AND CONTROL 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:	Understand the concept of starters and starting of motor and experiment the Controlling of DC and AC motors.
CO2:	Test the motors and generators and draw the speed torque performance curves. Discuss the Speed and torque control of DC motors and AC motors.
CO3:	Give the solution for real time problems in electrical machines.

Pre-requisite

1.Basic Electrical Engineering Laboratory

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	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	3						2			3	2
CO2	3	3	3	3						2			3	2
CO3	3	3	3	3						2			3	2

Course Assessment methods

Direct		Indirect
CIE TEST-I (20) Quiz-I (5) CIE TEST-II (20) Quiz-II (5)	RTPS (10) End semester Examination (40)	Course end survey

List of Experiments

1. Speed control of DC shunt motor (Armature, Field control).
2. Study of V/f control operation of induction motor drive.
3. Speed control of three phase slip ring Induction Motor.
4. Speed control of chopper-controlled DC series motor.
5. Speed control of Chopper controlled DC shunt motor.
6. Speed control of PWM inverter-based induction motor drive.
7. PLC based Speed control of induction motor.
8. Speed control steeper motor.
9. DSP controller-based speed control of induction motor drive.
10. Speed control of controlled rectifier-based DC motor drive.
11. Speed control of Brushless Dc Motor.

Total Hours: 45 Hrs

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:** 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:** 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:** a. Verbal analogy b. Tenses c. Prepositions d. Reading comprehension e. Choosing correct / incorrect sentences f. Describing pictures g. Error spotting	

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

SEMESTER – III

MANDATORY COURSE

U19GE304- CONSTITUTION OF INDIA

(Common for MCT and FT)

L	T	P	C
2	0	0	0

Course Outcomes

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

1. demonstrate a capacity to work efficiently and with critical engagement with complex and sophisticated primary constitutional law texts
2. exhibit the capacity to craft coherent and persuasive constitutional law arguments in an adversarial context ,also recognizing the limitations of such argumentation
3. apply a contextual understanding of (i) the function of the High Court as the final arbiter of constitutionality and (ii) the techniques of judicial review as applied
4. practice a thorough and contextual knowledge of constitutional law doctrine particularly in its application to real or hypothetical constitutional law problems
5. demonstrate a high level of skill on academic and professional legal writing

UNIT – I Introduction to Constitution of India 6

Constitutional law – meaning – importance
Constitutionalism – features – elements
Constitution of India – concept – importance – historical perspective – characteristics

UNIT – II Fundamental Rights and Equality 6

Fundamental rights – scheme – benefits
Fundamentals duties – importance – and its legal status

UNIT – III Structure, Policies, Principles 6

State policy – the directive principles and its importance-The implementation of directive principles- Parliamentary form of government in India- Constitution power and status of the President- Federal structure and distribution of legislative

UNIT –IV Emergency rule 6

Financial powers between the union and the states- Amendment of the constitutional powers – procedure- Emergency provisions : articles of Indian constitution that has provisions to proclaim emergency- Emergency powers of President – national emergency President rule, financial emergency

UNIT – V Types and Concepts of Local Self Government 6

The concept of local self –government and its types
Comparison of the Indian constitutional scheme

Directive principles of state policy and fundamental duties noted in the Indian constitution

Scheme of the fundamental rights to certain freedom under Article 19
Scope of the right to life and personal liberty under Article 21

References:

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

Total: 30 HOURS

20/5/20
Dr. M. Raja
Course Coordinator / Sciences

20.5.2020
Dr. C. Shanthi
HOD / Sciences

20/5
Dr. M. Renuga
Chairperson B.O.S,
Science and Humanities.

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

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit	Total Contact Hours
Theory							
1	U19MAT401B	Probability and Statistical Methods	3	1	0	4	60
2	U19MC401	Fluid Power Systems	3	0	0	3	45
3	U19MC402	Thermodynamics and Heat Transfer	3	0	0	3	45
4	U19MC403	Microprocessors and Microcontroller	3	0	0	3	45
5	U19MC902	**Elective:** Sensors, Transducers and Instrumentation	3	0	2	4	75
6	U19GE402	**Mandatory course:** Environment and Climate science	2	0	0	0	30
Practical							
7	U19MC404	Fluid Power Systems Laboratory	0	0	4	2	60
8	U19MC405	Microprocessor and Microcontroller Laboratory	0	0	4	2	60
9	U19GE401	Soft Skill and Aptitude – II	0	0	2	1	30
					Total Credits	**22**	

Approved By

Chairperson, Mechatronics Engineering BoS
Dr.P.Suresh

Member Secretary, Academic Council
Dr.R.Shivakumar

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

Copy to:-

HOD/ Mechatronics Engineering, Fourth Semester BE MCT Students and Staff, COE

U19MC401	FLUID POWER SYSTEMS	L	T	P	C
		3	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1:	Apply the pump theory and classifications and able to use the fluid power in his/her professional career.
CO2:	Demonstrate the principle of hydraulic cylinders and fluid motors, Gear, Vane and Piston motors.
CO3:	Compare accumulators and intensifiers and justify the usage of accumulators on real time feedback circuits in their professional career.
CO4:	Differentiate the different Pneumatic approaches for simple applications and able to synthesis the new approach specific to their application.
CO5:	Define fluidic devices applications with basic trouble shooting methodologies and types of Servo systems.

Pre-requisite

Fluid Mechanics and machinery

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	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	3	2	3	3	3	1							3	3
CO2	3	3	3										3	3
CO3	2	3	1	3	2							3	3	3
CO4	3	3	3	3		3							3	3
CO5	3	2	3	3	3	3		3				3	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 FLUID POWER — **09 Hours**

Introduction to fluid power, Advantages of fluid power, Application of fluid power system. Types of fluid power systems, Fluid power symbols.

Sources of Hydraulic Power: Pumping theory – Pump classification – Gear pump, Vane Pump, piston pump, construction and working of pumps – pump performance – Variable displacement pumps

Unit 02: CONTROL AND ACTUATION ELEMENTS	**09 Hours**
Construction of Control Components: Direction control valves – 3/2 way valve – 4/2 way valve –4/3 valve-5/3 valve- Shuttle valve – check valve – pressure control valve – pressure reducing valve, sequence valve, Flow control valve – Fixed and adjustable - electrical control solenoid valves, Relays. Fluid Power Actuators: Linear hydraulic actuators – Types of hydraulic cylinders – Single acting, Double acting -special cylinders: tandem, rod-less, telescopic, cylinder cushioning mechanism-construction of double acting cylinder - Rotary actuators: fluid motors-gear, vane and piston motors.	
Unit 03: HYDRAULIC CIRCUITS	**09 Hours**
Hydraulic circuits-reciprocating–quick return-pressure sequencing circuit- Regeneration circuit Drilling circuit, synchronizing circuit, speed control-meter in, meter out and bleed off circuit, safety circuits Accumulators and Intensifiers: Types of accumulators – Accumulators circuits, intensifier – Applications of Intensifier – Intensifier circuit.	
Unit 04: PNEUMATIC SYSTEMS AND CIRCUITS	**09 Hours**
Pneumatic Components: Properties of air – Compressors – Filter, Regulator, and Lubricator Unit – Air control valves, Quick exhaust valves, and pneumatic actuators. Fluid Power Circuit Design, Pneumo-hydraulic circuit, Sequential circuit design for simple applications using cascade method.	
Unit 05: SPECIAL SYSTEM AND MAINTENANCE	**09 Hours**
Servo systems – Hydro Mechanical servo systems, Electro-hydraulic servo systems and hydro pneumatic circuits -Introduction to logic circuits. Introduction to fluidic devices, simple circuits, ladder diagrams, PLC applications in fluid power control circuit –fault finding -Failure and troubleshooting. Low cost automation.	

Theory: 45 Hrs	**Tutorial: -**	**Total Hours: 45 Hrs**

Text Books

1. Anthony Esposito, "Fluid Power with Applications", Pearson Education,7th edition, 2013.
2. Majumdar S.R., "Oil Hydraulics Systems- Principles and Maintenance", Tata McGraw-Hill, 2011.

REFERENCES

1. Dudelyt, A. Pease and John T. Pippenger, "Basic Fluid Power", Prentice Hall, 2007
2. Michael J, Prinches and Ashby J. G, "Power Hydraulics", Prentice Hall, 2009.
3. Anthony Lal, "Oil hydraulics in the service of industry", Allied publishers, 2002.
4. Shanmugasundaram.K, "Hydraulic and Pneumatic controls", Chand & Co, 2006.

U19MC402	THERMODYNAMICS AND HEAT TRANSFER	L	T	P	C
		3	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1:	Express the basic concepts and laws of thermodynamics
CO2:	Perform the analysis of air standard cycles
CO3:	Evaluate the conduction heat transfer for a given system
CO4:	Demonstrate the types of convection and determine heat transfer coefficient
CO5:	Investigate the radiation effect among different surfaces

Pre-requisite

1.Engineering Physics

2.Fluid Mechanics and machinery

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	PO 10	PO 11	PO 12	PSO1	PSO 2
CO1	3	3	3	2	1	1	2	1	1	2	1	1	3	2
CO2	3	3	3	2	1	1	2	1	1	2	1	1	3	2
CO3	3	3	3	2	1	1	2	1	1	2	1	1	3	2
CO4	3	3	3	2	1	1	2	1	1	2	1	1	3	2
CO5	3	3	3	2	1	1	2	1	1	2	1	1	3	2

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: LAWS OF THERMODYNAMICS **9 Hours**

Systems-closed and open systems - properties, processes, cycles- equilibrium- work and heat transfers - zeroth law - first law for a closed system and flow process - enthalpy - second law – entropy.

Unit 02: AIR STANDARD CYCLES AND VAPOUR POWER CYCLE **9 Hours**

Air standard cycles: Carnot cycle - Otto cycle - Diesel cycle - Brayton cycle - vapour power cycle: Rankine cycle- cycle efficiency

Unit 03: INTRODUCTION TO HEAT TRANSFER AND CONDUCTION **9 Hours**

Basic Concepts- mechanism of heat transfer – conduction: Fourier Law of conduction - general differential equation of heat conduction - Cartesian and cylindrical coordinates - one dimensional steady state heat conduction-introduction to transient heat conduction.

Unit 04: CONVECTION	9 Hours
Boundary layer concept - heat transfer coefficient - types of convection - forced convection - external flow: flow over plates, cylinders and spheres - internal flow introduction to free convection.	
Unit 05: RADIATION	**9 Hours**
Laws of Radiation - Stefan Boltzmann Law, Kirchhoff's Law -black body radiation- radiation shield-radiation between surfaces.	

Theory: 45 Hrs	Tutorial: --	Practical: --	Total Hours: 45 Hrs

TEXT BOOKS

1. P. K. Nag, Engineering Thermodynamics, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2013
2. R.C Sachdeva, Fundamentals of Engineering Heat and Mass Transfer, New Age International Publishers, New Delhi, 2017

REFERENCES

1. P. K. Nag, Applied Thermodynamics, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2nd edition ISBN: 9780070151314, 0070151318
2. Yunus A. Cengel and Michael A. Boles, Thermodynamics - An Engineering Approach in SI Units, Tata McGraw Hill Publishing Company, New Delhi, 2010
3. Frank P. Incropera and David P. DeWitt, Fundamentals of Heat and Mass Transfer, John Wiley and Sons Pvt. Ltd., Singapore, 2006.
4. T. D. Eastop and Mc Conkey, Applied Thermodynamics for Engineering Technologists, Pearson, New Delhi, 2004.
5. C. P. Kothandaraman, S. Domkundwar and A. V. Domkundwar, A course in Thermal Engineering, Dhanpatrai and Co. Pvt. Ltd., New Delhi, 2012

U19MC403	MICROPROCESSORS AND MICROCONTROLLER	L	T	P	C
		3	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1:	Outline the architecture, discuss the addressing modes, instruction set interrupt structure and develop skill in simple program writing of Intel 8085 microprocessor
CO2:	Discuss various Peripheral Interfacing function and interface with 8085 processor
CO3:	Outline the architecture, discuss the addressing modes, instruction set interrupt structure and develop skill in simple program writing of Intel 8086 microprocessor
CO4:	Explain the architecture, discuss the addressing modes, instruction set interrupt structure and develop skill in simple program writing of Intel 8051 microcontroller
CO5:	Apply the interfacing techniques in motors and traffic light controller for microcontroller based simple applications

Pre-requisite

Digital electronics

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	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	2	2				2				3	2
CO2	3	3	3	2	2				2				3	2
CO3	3	2	3	2	2				2				3	2
CO4	3	3	3	2	2				2				3	2
CO5	3	3	3	2	2				2				3	2

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: 8085 MICROPROCESSOR	**09 Hours**

8085 architecture – instruction set – addressing modes– machine cycles and timing diagrams – interrupts - memory interfacing, typical EPROM and RAM Interfacing.

Unit 02: PERIPHERALS INTERFACING OF 8085	**09 Hours**

Architecture and programming of ICs: 8255 PPI, 8259 PIC, 8251 USART, 8279 keyboard display controller ,8254 timer/ counter.

Unit 03: **8086 MICROPROCESSOR**	**09 Hours**
8086 architecture – 8086 addressing modes – memory organization instruction set – 8086 assembly language programming – interrupts.	
Unit 04: **MICROCONTROLLER**	**09 Hours**
8051: Architecture, I/O pins – ports and circuits – memory organization (internal and external) – counters and timers – serial data I/O – interrupts. PIC18F: Architecture, I/O pins – ports and circuits	
Unit 05: 8051 PROGRAMMING AND APPLICATIONS	**09 Hours**
8051 addressing modes – instruction set –Interfacing of stepper motor, speed control of DC motor, Introduction to raspberry and arduino boards.	

Theory: 45 Hrs	**Tutorial: -**	**Practical: -**	**Total Hours: 45 Hrs**

Text Books

1. Krishna Kant, "Microprocessor and Microcontrollers", Eastern Company Edition, Prentice Hall of India, New Delhi, 2007.
2. R.S. Gaonkar, 'Microprocessor Architecture Programming and Application', with 8085, Wiley Eastern Ltd., New Delhi, 2013.
3. Soumitra Kumar Mandal, Microprocessor & Microcontroller Architecture, Programming & Interfacing using 8085,8086,8051, McGraw Hill Edu,2013.

REFERENCES

1. Muhammad Ali Mazidi & Janice Gilli Mazidi, R.D.Kinely 'The 8051 Micro Controller and Embedded Systems', PHI Pearson Education, 5th Indian reprint, 2003.
2. N.Senthil Kumar, M.Saravanan, S.Jeevananthan, 'Microprocessors and Microcontrollers', Oxford University Press, 2010.

U19MC902	Elective: SENSORS, TRANSDUCERS AND INSTRUMENTATION	L	T	P	C
		3	0	2	4

Course Outcomes

After successful completion of this course, the students should be able to

CO1:	Analyse the characteristics of a sensor or transducer.
CO2:	Identify the different types of mechanical sensors.
CO3:	Predict the different types of sensors for Industrial variables.
CO4:	Design a signal conditioning circuit and data acquisition system
CO5:	Implement smart sensors in digital Industries.

Pre-requisite

1. Basic Electrical and Electronics Engineering

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	2			2			2			3	2
CO2	3	2	3	2			2			2			3	2
CO3	3	2	3	2			2			2			3	2
CO4	3	3	2	2			2			2			3	2
CO5	3	3	3	2			2			2			3	2

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 MEASUREMENT SYSTEMS — **09 + 06 Hours**

Sensors & Transducer: Definition – Classification – selection of sensors – Static and Dynamic Characteristics – Errors in Measurements – Problems on error measurements – Transduction principles: Resistive, Inductive and Capacitive.

Unit 02: SENSORS FOR AUTOMATION I — **09 + 06 Hours**

Measurement of displacement using Potentiometer, LVDT & Optical Encoder – Measurement of force using strain gauge – Measurement of pressure using LVDT based on diaphragm & piezoelectric sensor – Position sensors – Angular rate sensors.

Unit 03: SENSORS FOR AUTOMATION II — **09 +06 Hours**

Measurement of temperature using Thermistor, Thermocouple & RTD – Concept of thermal imaging – Measurement of position using Hall effect sensors – Proximity sensors: Inductive &

Capacitive, Inertial sensors – Flow Sensors: Ultrasonic & LASER – Level Sensors: Ultrasonic & Capacitive.	
Unit 04: **SIGNAL CONDITIONING AND DATA ACQUISITION**	**09 +06 Hours**
Signal Conditioning: Basic block diagram of Signal conditioning Analog and Digital IO – Types of ADC: successive approximation and sigma-delta – Types of DAC: Weighted Resistor and R-2R Ladder type – Data acquisition: Elements of data acquisition and control - Overview of I/O process - single channel & multichannel data acquisition.	
Unit 05: INTELLIGENT SENSORS	**09 +06 Hours**
Intelligent Sensors: General Structure of smart sensors & its components – Characteristic of smart sensors: Self calibration, Self-testing & self-communicating – Application of smart sensors: Automatic robot control, automobile engine control & Digital industries.	

Theory: 45 Hrs	**Tutorial: --**	**Practical: 30Hrs**	**Total Hours: 75 Hrs**

TEXT BOOKS

1. D Patranabis, "Sensors and Transducers", PHI 2nd Edition, 2015.
2. DVS Murthy, "Transducers and Instrumentation", PHI 2nd Edition 2013.

REFERENCES

1. Sawney A K and Puneet Sawney, "Measurements and Instrumentation and control", 12th edition, Dhanpat Rai and Co, New Delhi, 2013.
2. S. Gupta, J.P. Gupta "PC interfacing for Data Acquisition & Process Control", 2nd ED Instrument Society of America, 1994.
3. A.D. Helfrick and W.D. Cooper, "Modern Electronic Instrumentation & Measurement Techniques", PHI, 2001.
4. Deoblin E.O. "Measurement Systems - Application and Design", McGraw Hill, 4th Edition, 2005.

U19MC404	FLUID POWER SYSTEMS LABORATORY	L	T	P	C
		0	0	4	2

Course Outcomes

After successful completion of this course, the students should be able to

CO1:	Demonstrate the working principles of Hydraulic, Pneumatic pump and various actuators.
CO2:	Construct various hydraulic and, Pneumatic circuits using valves.
CO3:	Perform Industrial based circuit operations.

Pre-requisite:

1.Fluid Mechanics and fluid machinery

2.Fluid Mechanics and fluid machinery laboratory

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)													
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	P09	PO 10	PO 11	PO 12	PS O1	PSO 2
CO1	3	3	3		3		2			3		2	2	2
CO2	3	3	3		3		2			2		2	2	2
CO3	3	3	3		3		3			2		2	3	3

Course Assessment methods

Direct		Indirect
CIE TEST-I (20) Quiz-I (5) CIE TEST-II (20)	Quiz-II (5) RTPS (10) End semester Examination (40)	Course end survey

List of Experiments

1. [A] Study of Construction and working of Hydraulic equipments
   [B] Study of Construction and working Pneumatic equipments
2. Design and testing of hydraulic circuit for pressure control using pressure relief valve
3. Design and testing of hydraulic circuit for flow control using pressure /non-pressure compensated flow control valve.
4. Design and testing of hydraulic circuit for direction control using two-way valves
5. Design and testing of pneumatic circuit for single acting cylinder.
6. Design and testing of pneumatic circuit for double acting cylinder.
7. Design and testing of pneumatic circuit for flow control using meter in circuit.
8. Design and testing of pneumatic circuit for flow control using meter out circuit
9. Design and testing of pneumatic circuit for logic controls
10. Design and testing of pneumatic circuit for with multiple cylinder sequences
11. Modelling and analysis of hydraulic and pneumatic system using software

Total Hours: 60 Hrs

U19MC405	MICROPROCESSOR AND MICROCONTROLLER LABORATORY	L	T	P	C
		0	0	4	2

Course Outcomes

After successful completion of this course, the students should be able to

CO1:	Write an assembly language program to perform some basic arithmetic operations and to interface various devices using 8085 instructions.
CO2:	Write an assembly language program to execute basic arithmetic operations using 8086 processor and 8051 microcontroller.
CO3:	Solve the real time problems using microprocessor and microcontroller.

Pre-requisite

1. Electron devices and circuits
2. Electron devices and circuits Laboratory

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	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	3						2		2	3	2
CO2	3	3	3	3						2		2	3	2
CO3	3	3	3	3						2		2	3	2

Course Assessment methods

Direct		Indirect
CIE TEST-I (20)	Quiz-II (5)	Course end survey
Quiz-I (5)	RTPS (10)	
CIE TEST-II (20)	End semester Examination (40)	

List of Experiments

1. Assembly Language Programming of 8-bit binary addition and subtraction using 8085 processor.
2. Assembly Language Programming of 8-bit binary multiplication and division using 8085 processor.
3. Assembly Language Programming of 16-bit addition and multiplication using 8085 processor.
4. Assembly Language Programming of 8-bit Minimum / Maximum number, Ascending / Descending order using 8085 processor.
5. Assembly Language Programming of Code converter (BCD to Binary and Binary to BCD) using 8085 processor.
6. Assembly Language Programming of Interface Experiments (A/D and D/A interface) using 8085 processor.

7.	Interfacing and Programming of Stepper Motor control using 8085 processor.
8.	Assembly Language Programming of 16-bit binary addition and subtraction using 8086 processor.
9.	Assembly Language Programming of 16-bit binary multiplication and division using 8086 processor.
10.	Assembly Language Programming of 8-bit binary addition and subtraction using 8051 microcontrollers.
11.	Study and Interface of Arduino board.
12.	Study and Interface of raspberry board.
	Total Hours: 60 Hrs

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

Dr.S.Anita

Head/Training

Sona College of Technology, Salem **Department of Sciences (Chemistry)**

SEMESTER – IV

MANDATORY COURSE

U19GE402 - ENVIRONMENT AND CLIMATE SCIENCE

(Common for MCT, IT,FT,ECE and BME)

L	T	P	C
2	0	0	0

Course Outcomes:

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

1. state the importance of the acute need for environmental awareness and discuss significant aspects of natural resources like forests, water and food resources.
2. explain the concepts of an ecosystem and provide an overview of biodiversity and its conservation.
3. explain environmental based pollution their causes, effects and their remedial measures
4. discuss their causes, effects and the control measures of Global Warming, Acid Rain, Ozone Layer Depletion
5. describe the effect of climate change due to pollution

UNIT I INTRODUCTION TO ENVIRONMENTAL STUDIES AND NATURAL RESOURCES 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 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 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..

23.01.2021 **B.E. / B.Tech. Regulations 2019**

UNIT IV CLIMATE CHANGE ON THE ENVIRONMENT 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 ON POLLUTION 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: 30 HOURS

Text Books:

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.

References:

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. Erach Bharucha, "Textbook of Environmental Studies for Undergraduate Courses", 2005, University Grands Commission, Universities Press India Private Limited, Hyderguda, Hyderabad – 500029.

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

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 under Regulations 2019
Branch: Mechatronics Engineering

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit	Total Contact Hours
Theory							
1	U19MC501	CAD/CAM	3	0	0	3	45
2	U19MC502	Theory of machines	3	0	0	3	45
3	U19MC503	Data structure using python	3	0	2	4	75
4	U19MC504	Industrial Automation	3	0	0	3	45
5	noc22_me123	**NPTEL-** Automation in manufacturing	3	0	0	3	45
Practical							
6	U19MC505	CAD/CAM Laboratory	0	0	3	1.5	45
7	U19MC506	Industrial Automation Laboratory	0	0	3	1.5	45
8	U19MC507	Mini Project-I	0	0	2	1	30
9	U19GE501	Soft Skills and Aptitude – III	0	0	2	1	30
					Total Credits	**21**	

Approved By

Chairperson, Mechatronics Engineering BoS
Dr.P.Suresh

Member Secretary, Academic Council
Dr.R.Shivakumar

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

Copy to:-

HOD/ Mechatronics Engineering, Fifth Semester BE MCT Students and Staff, COE

U19MC501	CAD/CAM	L	T	P	C
		3	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1:	State fundamental concepts of Computer aided design and Modeling Techniques.
CO2:	Explain construction and development of modern CNC machine and give the details of Automatic Tool changers (ATC).
CO3:	Write a CNC part program for manufacturing real time component applications.
CO4:	Explain and describe the process planning and group technology in CIM environment.
CO5:	Explain about the computer aided quality control systems based CMM testing and explain flexible manufacturing systems.

Pre-requisite

1. Engineering graphics
2. Manufacturing 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	P09	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2						3					3	3
CO2	3	3	3	3			3						3	3
CO3	3	2	3	3	3		3					3	3	3
CO4	3	2	3		3		3	3	3	3	3		3	3
CO5	3		3		3		3	3	3	2	3		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: COMPUTER AIDED DESIGN — **9 Hours**

Introduction to CAD, Interactive display devices, Operator input/output devices, Graphic standards, 2D Transformation- Scaling, Translation and Rotation. Geometric Modeling- Wire Frame Modeling, Surface Modeling, Solid Modeling-Constructive solid geometry (CSG), Boundary Representation (B-Rep).

Unit 02: COMPUTER AIDED MANUFACTURING — **9 Hours**

CNC Technology-Classification of CNC systems-Contouring System-Interpolators, open loop and closed loop CNC systems, Hardware features-Direct Numerical Control. Construction features - Structural members-Slide ways-Sides linear bearings-Ball screws-Spindle drives and feed drives - work holding devices and tool holding devices-Automatic Tool changers

Unit 03: CNC – PROGRAMMING — **9 Hours**

Computer Numerical Control codes- Punched tapes, G,M Code, Standards, Types of dimensioning, Manual Part programming for point to point- Linear, Circular interpolation. - Canned cycles and subroutines. CNC programming practices for Turning and Milling

Operations.			
Unit 04: GROUP TECHNOLOGY AND CAPP			**9 Hours**
Introduction to CIM, Role of Elements, CIM Networking, Group Technology, Part Families, parts Classification & Coding, GT Machine cells, Shop floor phases, Benefits of GT. Computer Aided Process Planning (CAPP), Retrieval type, Generative type Process Planning Systems, Benefits of CAPP.			
Unit 05: COMPUTER AIDED QUALITY CONTROL AND FMS			**9 Hours**
Computer Aided Quality Control (CAQC)- Introduction, Contact Inspection methods, Non-Contact Inspection methods, Co-ordinate Measuring Machine. Flexible manufacturing Systems-Introduction, Scope, Types, Elements and Benefits of FMS.			
Theory: 45 Hrs	**Tutorial: --**	**Practical:--**	**Total Hours: 45 Hrs**

TEXT BOOKS

1. Ibrahim Zeid." CAD-CAM Theory and Practice", Tata McGraw-Hill Publishing Co. Ltd. 2nd edition.
2. P.Radhakrishan, S.Subramanyan, V. Raju, "CAD/CAM/CIM". New Age International Publishers, 3rd Edition 2012.
3. Mikell P. Groover and Emory W. Zimmers, Jr, "CAD/CAM Computer Aided and Manufacturing".
4. Eastern Economy Edition, PHI publishers 2007.

REFERENCES

1. Mikell.P.Groover "Automation, Production Systems and computer integrated and manufacturing", Pearson Education 2016.
2. P.N. Rao, "CAD/CAM Principles and Applications". Tata McGraw Hill Publications, 2010.
3. William .M. Neumann and Robert .F. Sproul, "Principle of Interactive Computer Graphics" McGraw Hill Book Co. Singapore, 2001.
4. Paul G. Ranky, "Computer Integrated Manufacturing- An Introduction with Case Studies" Prentice Hall International, 2004.

U19MC502	THEORY OF MACHINES	L	T	P	C
		3	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1: Identify and enumerate different link-based mechanisms with a force-motion relationship in components subjected to external forces.

CO2: Design and evaluate the performance of different cams and followers.

CO3: Interpret the force analysis of simple mechanisms.

CO4: Design and evaluate the performance of rotating & reciprocating masses.

CO5: Value the principles in mechanisms used for governing of machines

Pre-requisite

Engineering Mechanics

CO/PO, PSO Mapping

(3/2/1 indicates the 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	PO 10	PO11	PO 12	PSO1	PSO2
CO1	3	3	3	3			3			3		3	3	3
CO2	3	3	3	3			3			2			3	3
CO3	3	3	3	3						2		2	3	3
CO4	3	3	3	3						2			3	3
CO5	3	3	3	3			3						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 MECHANISMS — **9 Hours**

Definitions Link or Element, Kinematic Pairs, Kinematic chain, Degrees of Freedom, Grubler's Criterion (without derivation), Kinematic Chain, Mechanism, Structure, Mobility of Mechanism, Mechanical Advantage, Transmission angle. Inversions of Kinematic Chains: Four bar chain, Single slider and Double slider. Common Mechanisms, Straight line Mechanisms (Exact & Approximate Straight line).

Unit 02: KINEMATICS OF CAM — **9 Hours**

Cams: Types of cams, Types of followers. Displacement, Velocity & Acceleration Time curves for cam Profiles. Disc cam with Reciprocating follower having Knife- Edge, Roller & Flat-face follower, Disc cam with oscillating roller follower. Follower motions including, SHM, Uniform velocity, Uniform acceleration & retardation and Cycloidal motion.

UNIT 03: FORCE ANALYSIS	9 Hours
Static force analysis: Static equilibrium. Equilibrium of two and three force members. Members with two forces and torque, free body diagrams. Static force analysis of four-bar mechanism and slider-crank mechanism with and without friction. Dynamics force analysis: Alembert's principle, Inertia force, inertia torque, Dynamic force analysis of reciprocating engine (Analytical method).Introduction to vibration.	
Unit 04: BALANCING OF ROTATING & RECIPROCATING MASSES	**9 Hours**
Balancing of Rotating Masses: Static and dynamic balancing, balancing of single rotating mass by balancing masses in same plane and in different planes. Balancing of several rotating masses by balancing masses in same plane and in different planes. Balancing of Reciprocating Masses: Balancing of Locomotives, Multi cylinder engine, partial balancing of locomotive engines.	
Unit 05: GYROSCOPE & GOVERNORS	**9 Hours**
Governors: Types of governors; force analysis of Watt, Porter (Problem alone) and Hartnell governors (Theory). Controlling force, stability, sensitiveness, isochronism, effort and power. Gyroscope: Gyroscopic couple, Effect of gyroscopic couple on ship, aeroplane, stability of two-wheelers.	

Theory: 45Hrs	Tutorial: --	Practical:--	Total Hours: 45 Hrs

TEXT BOOKS

1. Ratan, S.S., "Theory of Machines", Tata McGraw Hill Publishing company Ltd., 4th Edition, 2014.
2. Sadhu Singh., "Theory of Machines", Pearson Education India, 2nd Edition 2013.
3. Thomas Bevan, "Theory of Machines", Pearson Education India, 1948, 3rd Edition, 2010.

REFERENCES

1. R. S. Khurmi, J. K. Gupta. "Theory of Machines" Eurasia Publishing House, 2008.
2. B.L. Balleney, "Theory of Machines", Khanna Pub. Delhi, 2012.
3. Shigley J.E and Uicker J.J "Theory of Machines and Mechanisms," McGraw Hill ISE, 2011.
4. Rao J.S and Dukkipati R.V, "Mechanism and Machine Theory", New Age Intl.,New Delhi, 2nd Edition, 2012.
5. Ambekar A. G, "Mechanism and machine theory", PHI Learning Pvt. Ltd, New Delhi, 2007.

U19MC503	DATA STRUCTURE USING PYTHON	L	T	P	C
		3	0	2	4

Course Outcomes

After successful completion of this course, the students should be able to

CO1:	Implement Class using python.
CO2:	Implement abstract data types for linear data structures and Solve real world problems using stack and queue linear data structures.
CO3:	Design algorithms to solve common graph problems.
CO4:	Apply various non-linear tree data structures in real time applications.
CO5:	Analyze various sorting, searching and hashing techniques.

Pre-requisite

Python programming

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	2	1	1			2	2	1	3	3	2
CO2	3	3	2	2	2	1			3	1	1	3	3	2
CO3	3	3	3	2	2	1			3	2	1	3	3	2
CO4	3	3	3	2	2	1			3	2	1	3	3	2
CO5	3	3	3	2	2	1			3	2	1	3	3	2

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: ABSTRACT DATA TYPES — **9+6 Hours**

Introduction to programming, algorithms and data structures - Abstract Data Types (ADTs) – ADTs and classes – Introduction to OOP – classes in Python - Basic algorithmic analysis: input size, asymptotic notations.

Suggested Activities for practical:

- Implement Class using python

Unit 02: LINEAR DATA STRUCTURES — **9+6 Hours**

List ADT – array-based implementation – linked list implementation - Applications of lists - Stack ADT – Queue ADT - Applications of Stacks and queues.

Suggested Activities for practical:

- Implementation of Lists
- Implementation of Stacks
- Implementation of Queues

Unit 03: NON LINEAR DATA STRUCTURES - 1	9+6 Hours

Introduction to Non Linear Data Structures - Tree ADT – Binary Tree ADT – Tree traversals - Expression trees - Binary search trees - Heap – Applications of heap

Suggested Activities for practical:

- Implementation of Binary Trees
- Implementation of Tree Traversal
- Implementation of Binary Search Trees
- Implementation of Heap

Unit 04: NON LINEAR DATA STRUCTURES - 2	9+6 Hours

Graph ADT: representations of graph – graph traversals: BFS - DFS - shortest paths – Minimum Spanning Trees: Prim's algorithm, Kruskal's algorithm - – Shortest path algorithms: Dijkstra's algorithm - Applications of Graphs.

Suggested Activities for practical:

- Implementation of graphs using BFS and DFS
- Implementation of Prim's algorithm
- Implementation of Kruskal's algorithm
- Implementation of Dijkstra's algorithm

Unit 05: SORTING, SEARCHING AND HASHING	9+6 Hours

Sorting: Selection Sort - Bubble Sort – Insertion Sort - Merge Sort - Quick Sort – Searching: Linear Search - Binary Search – Hashing.

Suggested Activities for practical:

- Implementation of Sorting Techniques
- Implementation of Searching Techniques
- Implementation of Hashing and Collision Resolution Technique

Theory: 45 Hrs	Tutorial:--	Practical: 30 Hrs	Total Hours: 75 Hrs

TEXT BOOKS

1.	Michael T. Goodrich, Roberto Tamassia, and Michael H. Goldwasser, "Data Structures & Algorithms in Python", John Wiley & Sons Inc., 2013.
2.	Lee, Kent D., Hubbard, Steve, "Data Structures and Algorithms with Python" Springer Edition 2015.

REFERENCES

1.	https://infosysheadstart.onwingspan.com/
2.	Rance D. Necaise, "Data Structures and Algorithms Using Python", John Wiley & Sons, 2011.

U19MC504	INDUSTRIAL AUTOMATION	L	T	P	C
		3	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1:	Acquire an adequate knowledge about PLC and working of its components.
CO2:	Understanding the concepts of various instructions in PLC programming language.
CO3:	Identify the sensors and actuators for the various Industrial applications.
CO4:	Understand the communication requirements and programming for real time applications.
CO5:	The need of SCADA, DCS and its advantages with PLC.

Pre-requisite

1. Basic Electrical Engineering
2. Sensors, Transducers and Instrumentation

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	2		3			2			2		3	2
CO2	2	3	3		2		3		3			2	2	3
CO3	3	2	3		3		2				2		3	3
CO4	3	2	3		3					3			3	2
CO5	3	3	2		2			2				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 INDUSTRIAL AUTOMATION — **9 Hours**

Programmable Logic Controllers: Introduction, Relay based automation, Evolution of PLC's, Parts of PLC, Principles of operation, Advantages over relay logic, PLC sizes, PLC hardware components, I/O section, Discrete and Analog Module, CPU processor and memory module, Programming devices, PLC Programming Languages, Ladder diagram, Function Block Diagram, Latching relays, Converting simple relay ladder diagram in to PLC relay ladder diagram.

Unit 02: PLC INSTRUCTIONS	9 Hours
Timer Instructions: On Delay, Off Delay And Retentive Timers, Up Counter, Down Counter And Up Down Counters, Relay – Type Instructions, Data Manipulating Program, Data Handling Instructions - Control Instruction, Math Instructions - Sequencer And Shift Register Instructions.	
Unit 03: PLC I/O DEVICES	**9 Hours**
Input devices: Manually Operated Switches – Mechanically Operated Switches, Analog and discrete temperature switches, proximity switches, pressure switches NO and NC Push buttons and interlocking concepts. Ouput devices: Contactor for motors, Stepper and servo motors, starters, VFD, hydraulic and pneumatic cylinders, Analog valves.	
Unit 04: PLC COMMUNICATION DEVICES AND APPLICATIONS	**9 Hours**
Networking of PLC, Fieldbus, PROFI bus, and Mod bus, mechatrolink, ControlNet, DeviceNet and Profinet protocols. Controlling a Robot with PLC, Conveyor belt motor control, Automatic car washing machine, PLC in quality inspection, Traffic light control system, Application of PLC in power plants.	
Unit 05: SUPERVISORY CONTROL AND DATA ACQUISITION	**9 Hours**
Introduction, Evolution of SCADA, Interfacing PLC with SCADA, features of SCADA, SCADA Architecture, Components of SCADA, Master Terminal Unit, Remote terminal Unit, alarm logging, Trend on line, off line, HMI and Introduction to DCS.	

Theory: 45 Hrs	Tutorial: --	Practical:--	Total Hours: 45 Hrs

TEXT BOOKS

1.	F.D. Petruzella, Programmable Logic Controllers, Tata Mc-Graw Hill, Third edition, 2010
2.	Stuart A Boyer, “SCADA supervisory control and data acquisition”2010.

REFERENCES

1.	K. L.S. Sharma, Overview of Industrial Process Automation, Elsevier, Batten G. L., “Programmable Controllers”, McGraw Hill Inc., Second Edition, 2011.
2.	Hughes .T, “Programmable Logic Controllers”, ISA Press, 1989.
3.	Mdhuchhanda Mitra, Samarjit Sen Gupta, “Programmable Logic Controllers and Industrial Automation, An Introduction” Penram International Publishing Limited,2012.

noc22_me123	AUTOMATION IN MANUFACTURING	L	T	P	C
		3	0	0	3

Course Outline :

Manufacturing industry contributes a major share in the GDP of our country. Application of automated systems is certainly improving the productivity of the manufacturing industry. In view of this, a course on "Automation in Manufacturing" is designed with the primary focus on the design and development of automated systems in the manufacturing. Initially the course introduces various automated systems being used in the manufacturing industry. Then the building blocks of a typical automated system are described. It presents a study on the principle of operation and construction details of sensors/transducers, actuators, drives and mechanisms, hydraulic and pneumatic systems. It also covers up the microprocessor technology, programming and CNC technology. The contents are lucidly presented with real-life examples. Case studies based on manufacturing industry applications are presented.

Intended audience :

UG, PG students of Mechanical, Production, Industrial Engineering, Mechatronics Engineering. Practicing engineers.

Pre requisites: Knowledge of basic electronics and electrical engineering.

Course layout:

Week 1: Introduction: Importance of automation in the manufacturing industry. Use of mechatronics. Systems required.

Week 2: Design of an automated system: Building blocks of an automated system, working principle and examples.

Week 3: Fabrication: Fabrication or selection of various components of an automated system. Specifications of various elements. Use of design data books and catalogues.

Week 4: Sensors: study of various sensors required in a typical automated system for manufacturing. Construction and principle of operation of sensors

Week 5: Microprocessor Technology: signal conditioning and data acquisition, use of microprocessor or micro controllers. Configurations. Working.

Week 6: Drives: electrical drives – types, selection criteria, construction and operating principle.

Week 7: Mechanisms: Ball screws, linear motion bearings, cams, systems controlled by camshafts.

Week 8: Mechanisms: Electronic cams, indexing mechanisms, tool magazines, and transfer systems.

Week 9: Hydraulic systems: hydraulic power pack, pumps, valves.

Week 10: Hydraulic systems: designing of hydraulic circuits.

Week 11: Pneumatic systems: configurations, compressors, valves, distribution and conditioning.

Week 12: CNC technology: basic elements, interpolators and programming

Theory: 45 Hrs	Tutorial: --	Practical: --	Total Hours: 45 Hrs

TEXT BOOKS	
1.	HMT Ltd. Mechatronics, Tata McGraw-Hill, New Delhi, 1988.
2.	Boltan, W., Mechatronics: electronic control systems in mechanical and electrical engineering, Longman, Singapore,1999.
REFERENCES	
1.	Regtien, P. P. L., Sensors for mechatronics, Elesevier, USA,2012
2.	Tonshoff, H.K. and I. Inasaki, Sensors in manufacturing,Wiley-VCH, 2001.
3.	Gaonkar, R. S., Microprocessor architecture, programming,and applications with the 8085, Penram International Publishing (India), Delhi, 2000
4.	Bradley, D. A., Dawson D., Burd, N. C. and Loader A. J.,Mechatronics: Electronics in products and processes, CRC Press, Florida, USA, 2010.
5.	Rothbart, H. A., CAM Design Handbook, McGraw-Hill, 2004.
6.	Norton, R. L., Cam Design and Manufacturing Handbook,Industrial press Inc, 2002.

U19MC505	CAD/CAM 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:	Perceive working knowledge in Computer Aided Design methods and procedures.
CO2:	Construct solid modelling using 3D modelling standard software.
CO3:	Interpret simple CNC programs.

Pre-requisite:

Engineering Graphics

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	PO12	PSO1	PSO2
CO1	3	3	3		3		2					2	2
CO2	3	3	3		3		2					2	2
CO3	3	3	3		3		3					3	3

Course Assessment methods

Direct		Indirect
CIE Test-I (20) Quiz-I (5) CIE Test-II (20)	Quiz-II (5) Real Time Problem Solving (10) End semester Examination (40)	Course end survey

List of Experiments

1. Drawing Standards Code of practice for Engineering Drawing, BIS specifications. Drawing, Editing, Dimensioning and Plotting Commands-Layering concepts-Limits, Fits and Tolerances.
2. Orthographic views of standard machine components: Brackets, V Blocks, Stop Block, Screw threads and Threaded fasteners.
3. [A] Solid modelling & assembly
   [B] Surface modelling & assembly & BOM.
4. CNC lathe introduction to basic programming & operations.
5. Part Programming of facing operation.
6. Part Programming of turning operation.
7. Part Programming of thread cutting operation. (Internal/External)
8. Part Programming of Grooving operation.
9. Part Programming of Drilling and Boring operation. (Internal/External)
10. Part programming using Canned Cycle operations.

Total Hours: 45 Hrs

U19MC506	INDUSTRIAL AUTOMATION 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:	Develop the PLC program for the implementation of logic gates
CO2:	Develop the PLC program for controlling the parameters like Pressure, Level and Flow
CO3:	Design the real time PLC program for various applications like bottle filling, cylinder actuation and elevator control

Pre-requisite

1.Electronic Devices and circuits laboratory

2.Hydraulics and pneumatics laboratory

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	2	2			2			2			3	2
CO2	3	2	3	2			2			2			3	2
CO3	3	3	2	2			2			2			3	2

Course Assessment methods

Direct		Indirect
CIE Test-I (20)	Quiz-II (5)	Course end survey
Quiz-I (5)	Real Time Problem Solving (10)	
CIE Test-II (20)	End semester Examination (40)	

List of experiments/demonstrations:

1. Write ladder logic program for AND and OR gate.
2. Write ladder logic program for NAND and NOR gate.
3. Write ladder logic program for NOT and EX-OR gate.
4. Automate the level and flow control using PLC.
5. Conduct the temperature control using PLC
6. Conduct the pressure and flow control using PLC.
7. Conduct the control of elevator using PLC
8. Study the Bottle filling process using PLC
9. Conduct the cylinder sequencing using simple pneumatic direct control valve.
10. Write ladder logic program for the traffic light controller using PLC
11. Conduct the special I/O for speed control of DC motor using PLC.
12. Programming in HMI and SCADA.

Total Hours: 45 Hrs

U19MC507	MINI PROJECT-I	L	T	P	C
		0	0	2	1

Course Outcomes

After successful completion of this course, the students should be able to

CO1:	Frame a real world problem, identify the requirement and develop the design solutions. Express the technical ideas, strategies and methodologies.
CO2:	Apply the new tools, algorithms, techniques that contribute to obtain the solution of the project. Examine and validate through conformance of the developed prototype and analysis the cost effectiveness.
CO3:	Prepare report and present the oral demonstrations.

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	2	1	2	2	2	2	2	1	1	3	2
CO2	3	3	3	3	3	2	2	2	2	2	3	3	3	2
CO3	3	2	2	2	2	2	3	3	3	3	1	1	3	2

Course Assessment methods

Direct		Indirect
Review- I (10 marks) Review- II (10 marks) Review- III (10 marks) Project & report (30 marks)	End semester Examination (40 marks)	Course end survey

1. The students formed into a team of convenient groups of not more than 4 members on a project are not allowed to change their team members.
2. Every project team should report to their faculty guide for discussion from the day of beginning of 5th semester.
3. The group has to analyze the selected problem addressed in their project work to draw solution.
4. A project report has to be submitted by each student group at the end of the 5th semester.
5. Three reviews have to be conducted by a team of faculty (minimum of 1 and maximum of 2) along with their faculty guide as a member of faculty team (for monitoring the progress of project planning and implementation).

Total Hours: 30 Hrs

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:** a. Career planning b. Resume writing c. Group discussion d. Teamwork e. Leadership skills f. Interview skills g. Mock interviews h. Mock GDs
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

S. Anita

Dr.S.Anita

Head/Training

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

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

S. No	Course Code	Course Title		Lecture	Tutorial	Practical	Credit	Total Contact Hours
Theory								
1	U19MC601	Artificial Intelligence and Machine Learning		3	0	0	3	45
2	U19MC602	Image Processing and Computer Vision		3	0	0	3	45
3	U19MC603	Robotics		3	0	0	3	45
4	U19MC904	**Professional Elective:**	Electric and Hybrid Vehicles	3	0	0	3	45
	U19MC905		Digital Manufacturing					
5	U19MC906	**Professional Elective:**	Drone Technology	3	0	0	3	45
	U19MC907		Design Thinking and Product Innovation					
6	U19CE1002	**Open Elective:**	Municipal Solid Waste Management	3	0	0	3	45
	U19CE1003		Energy Efficiency and Green Building					
	U19EC1006		Mobile Technology and its Applications					
	U19EE1002		Energy Conservation and Management					
	U19EE1003		Innovation, IPR and Entrepreneurship Development					
	U19EE1004		Renewable Energy Systems					
	U19FT1001		Fundamentals of Fashion Design					
	U19IT1001		Problem Solving Techniques using Java Programming					
	U19ME1004		Renewable Energy Sources					

Practical							
7	U19MC604	Image Processing Laboratory	0	0	2	1	30
8	U19MC605	3D Modelling and Analysis laboratory	0	0	2	1	30
9	U19GE601	Soft Skill and Aptitude – IV	0	0	2	1	30
10	U19MC606	Mini Project – II	0	0	2	1	30
					Total Credits	**22**	

Approved By

Chairperson, Mechatronics Engineering BoS	**Member Secretary, Academic Council**	**Chairperson, Academic Council & Principal**
Dr.P.Suresh	**Dr.R.Shivakumar**	**Dr.S.R.R.Senthil Kumar**

Copy to:-

HOD/ Mechatronics Engineering, Sixth Semester BE MCT Students and Staff, COE

U19MC601	ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING	L	T	P	C
		3	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1:	Identify suitable Artificial Intelligent agent for the real time problem.
CO2:	Solve real time design problems using heuristic based algorithms.
CO3:	Construct knowledge base through various inference rules.
CO4:	Outline the machine learning concepts.
CO5:	Apply supervised learning algorithms to various classification problems.

Pre-requisite

1. Probability and statistics

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	2		2	2						2	3	2
CO2	3	3	2		2	2	2					2	3	2
CO3	3	3	2		2	2	2					2	3	2
CO4	3	3	3		2		2					2	3	3
CO5	3	3	3		2		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 OF AI — **9 Hours**

Foundations of AI – History of AI – Applications – Components of AI – Intelligent agents: Terminology, Structure, Attributes – Types of agents – Problem solving – Problem formulation: Examples – Searching techniques: Types – Uniformed search strategies: Breadth first search , Depth first search – Iterative deepening – Bi-directional search – Comparing search strategies

Unit 02: PROBLEM SOLVING STRATEGIES — **9 Hours**

Informed/Heuristic search: Hill climbing search, A* search, Branch and Bound search – Adversarial search: Optimal strategies, Minimax algorithm, Alpha-Beta pruning – Constrained satisfaction problems: Crypto arithmetic problem

Unit 03: KNOWLEDGE REPRESENTATION AND REASONING	9 Hours
Agent – knowledge representation issues – Predicate logic: Representation, Unification and resolution – Representation knowledge using rules: Propositional logic – First order logic – Inference – Forward and backward chaining	
Unit 04: MACHINE LEARNING	**9 Hours**
Introduction – Classification – Regression – Types of Learning: Supervised, Unsupervised, Reinforcement learning – Machine learning applications – Dimensionality reduction: Subset selection, Principle Component Analysis (PCA), Linear discriminate analysis – Clustering: Iterative distance based clustering, k-Means clustering	
Unit 05: CLASSIFICATION ALGORITHMS	**9 Hours**
Decision Tree: Introduction, Basic learning tree learning algorithm, steps, issues in decision trees – Support Vector Machine (SVM) – Bayesian classification: Naive Bayes classifier, K-Nearest Neighbor (KNN)	

Theory: 45 Hrs	Tutorial: --	Practical: --	Total Hours: 45 Hrs

TEXT BOOKS

1.	Nilakshi Jain, "Artificial Intelligence - Making a system intelligent", First Edition, Wiley Publisher, 2019.
2.	Anuradha Srinivasaraghavan, Vincy Joseph ,"Machine learning", First Edition , Wiley publisher , 2019.
3.	Rajiv Chopra, "Artificial Intelligence", Second Edition ,S.Chand publisher, 2016

REFERENCES

1.	Elaine Rich, Kevin Knight and S B Nair," Artificial Intelligence", Third Edition, Tata McGraw Hill , 2019
2.	Masashi Sugiyama, Introduction to Statistical Machine Learning, Morgan Kaufmann Publishers, 2016.
3.	David Pool and Alan Mackworth, "Artificial Intelligence: Foundations of Computational agents", Cambridge University, 2011.

U19MC602	IMAGE PROCESSING AND COMPUTER VISION	L	T	P	C
		3	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1:	Familiarize the fundamental concepts of digital image processing.
CO2:	Apply Image enhancement techniques in spatial domain.
CO3:	Identify the features and region of interest for a given image using segmentation approaches.
CO4:	Implement different compression techniques.
CO5:	Develop algorithms for computer vision problems with focus on Robotics.

Pre-requisite

1. Linear algebra and calculus

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	PO 2	PO 3	PO 4	PO5	PO6	PO7	PO8	P09	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	2		3			2			3		3	2
CO2	2	3	3		2		3		3			2	3	2
CO3	3	3	2		3		2				2	2	3	2
CO4	2	2	3		2					3		2	3	2
CO5	3	3	2		2			2				2	3	2

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: IMAGE PROCESSING FUNDAMENTALS — **9 Hours**

Fundamental Steps in Digital Image Processing – Elements of Visual Perception – Some Basic Relationship Between Pixels – Connectivity – Distance Measure – Brightness – Contrast – Hue – Saturation – Mach Band Effect – Types of Image – Image sampling – Quantization – False Contouring – Colour Image Fundamentals RGB – HSI Models – Conversion from RGB to HSI.

Unit 02: IMAGE ENHANCEMENT	9 Hours
Spatial domain filtering: Image negative, Contrast stretching, Gray level slicing – Histogram equalization – Smoothing filters – Sharpening filters – Maximum filter – Minimum filter – Median filter – Bit Plane Slicing – Frequency domain filtering: Low-pass filter, High-pass filter, Butterworth High-pass filter, Low-pass and High-pass Gaussian filter	
Unit 03: IMAGE SEGMENTATION	**9 Hours**
Image segmentation: Point, line and edge detection – Basics of intensity thresholding – Region based segmentation : Region growing, Region splitting and merging – Thresholding – Standard Binary Morphological Operations – Dilation and Erosion based Operations	
Unit 04: IMAGE COMPRESSION	**9 Hours**
Image Compression – Lossless Compression – Huffman Coding –Arithmetic Coding – LZW Coding – Lossy Compression – Compression Standards: JPEG Image Compression Standards and MPEG Video Compression Standards – H.244 Compression Standards	
Unit 05: COMPUTER VISION	**9 Hours**
Feature extraction: Markov Random Field Matrix, Gray Level Co – occurrence Matrix, Gray Level Weight Matrix, Multi Resolution Combined Statistical and Spatial Frequency method, Character Recognition – Zoning approaches – Computer vision for Autonomous Robots	

Theory: 45 Hrs	Tutorial: --	Practical: --	Total Hours: 45 Hrs

TEXT BOOKS

1.	Jayaraman S., Esakkirajan and Verrakumar, "Digital Image Processing", TMH New Delhi, 2nd edition, 2020.
2.	Anil K.Jain, "Fundamentals of Digital Image Processing", Prentice Hall of India, 2004.

REFERENCES

1.	Richard Szeliski, "Computer Vision Algorithms and Applications", Springer Verlag London Limited, 2011.
2.	Sabeenian R.S., "Digital Image Processing", Sonaversity publication, Second Edition, 2010.
3.	Annadurai S., R. Shanmugalakshmi, "Fundamentals of Digital Image Processing", Pearson Education India, 2007.
4.	Sridhar.S, "Digital Image Processing", Oxford University Press, First Edition, 2011.
5.	Rafael C.Gonzalex, Richard E.Woods, "Digital Image Processing", Pearson Education, Forth Edition, 2018.

U19MC603	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 fundamentals of Robotics.
CO2:	Illustrate the kinematic relationships in robot motion.
CO3:	Compute Lagrange formulation of Robot dynamics
CO4:	Learn the types of grippers and its functions.
CO5:	Understand the economic and social implications of Robotics.

Pre-requisite :

1. Theory of Machines
2. Engineering Mechanics

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	PO 2	PO 3	PO 4	PO5	PO6	PO7	PO8	P09	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2		3			2		2			3	2
CO2	3	3	3		3					2			3	2
CO3	3	3	3		3					2			3	2
CO4	3	2	3		2					3		2	3	2
CO5	2	3	3	2	2			2	3	2	2	3	3	2

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: FUNDAMENTALS OF ROBOTICS **9 Hours**

Introduction – Automation and Robotics – History of Robotics – Robot anatomy - Major components of a robot – Robot subsystems: Motion subsystem, Recognition subsystem, Control subsystem – Classification of robots: Classification by coordinate system, Classification by control method, Classification by actuation method – Joint notation scheme

Unit 02: ROBOT MOTION ANALYSIS	9 Hours
Links and Joints: Types of Joints – Kinematic chain – Degree of freedom – Robot kinematics –Position representation - Forward transformation of 2 DOF arm – Reverse transformation of 2 DOF arm – Adding orientation – Homogeneous transformations – D-H conventions	
Unit 03: ROBOT DYNAMICS	**9 Hours**
Introduction – Manipulator path control - Static analysis – Compensating for gravity – Robot arm dynamics: Joint velocities, Kinetic energy, Potential energy – Lagrange formulation of Robot dynamics - Configuration of a Robot controller	
Unit 04: ROBOT END EFFECTORS	**9 Hours**
Introduction – Types of end effectors – Mechanical grippers: Types of gripper mechanisms ,Gripper force analysis – Vacuum cups – Magnetic grippers – Adhesive grippers – Tools as end effectors – End effector interface – Remote Center Compliance – Considerations in gripper selection and design	
Unit 05: ECONOMIC ANALYSIS AND SOCIAL IMPLICATIONS	**9 Hours**
Type of Robot Installation – Cost data required for analysis – Methods of economic analysis – Subsequent use of the robot – Differences in production rate – Factors more difficult to quantify – Robot project analysis form – Sociological consequences of robot	

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.

U19MC904	Professional Elective: ELECTRIC AND HYBRID VEHICLES	L	T	P	C
		3	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1:	Classify the precise battery types for electric vehicles.
CO2:	Discuss the working concepts of various motors used in electric vehicles.
CO3:	Choose the proper control methods for electric vehicles.
CO4:	Identify the different types of hybrid vehicles for commercial applications.
CO5:	Examine the performance characteristics of fuel cell.

Pre-requisite

1. Electrical Drives and Control

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	2			2	3					2	3	2
CO2	3	3	2			2	3					2	3	2
CO3	3	3	2			2	3					2	3	3
CO4	3	3	2			2	3					3	3	3
CO5	3	3	2			2	3					3	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 ELECTRIC VEHICLES — **9 Hours**

Electric vehicle: Need, Types, Cost and Emissions, End of life – Electric vehicle technology: Layouts, Cables, Components, Controls – Batteries: Overview, Types, Battery plug-in and life, Ultra-capacitor charging – Methods and standards – Alternate charging sources : Wireless and Solar

Unit 02: ELECTRIC VEHICLE MOTORS — **9 Hours**

Motors (DC, BLDC): Types, Principle, Construction, Control – Electric Drive Trains (EDT) – Series HEDT (Electrical Coupling): Power rating design, Peak Power Source (PPS) – Parallel HEDT (Mechanical Coupling) – Torque coupling and speed coupling - Switched Reluctance Motors (SRM) drives: Basic structure, Drive convertor, Design

Unit 03: CONTROL METHODS IN ELECTRIC VEHICLES — **9 Hours**

Sensors: Autonomous EV cars, Self-Drive Cars – Sensor less control methods: Phase flux linkage method, Phase inductance method, Modulated signal injection, Mutually induced voltage, Observer method – Safety: Risks and Guidance, Precautions, High voltage safety, Hazard management

Unit 04: HYBRID VEHICLES	9 Hours
Hybrid electric vehicles classification: Micro, Mild, Full – EV Layout and Architecture: Series, Parallel and Series-Parallel, Hybrid-Propulsion systems and components – Regenerative braking – Economy, Vibration and Noise reduction – Hybrid electric vehicles system: Analysis and its types, Controls	
Unit 05: FUEL CELLS FOR ELECTRIC VEHICLES	**9 Hours**
Fuel cell : Introduction, Technologies and Types, Obstacles, Operation principles, Potential and I-V curve, Fuel and oxidation consumption – Fuel cell characteristics: Efficiency, Durability, Specific power, Power design of fuel cell vehicle and freeze capacity – Lifetime cost of fuel cell vehicle	

Theory: 45 Hrs	Tutorial: --	Practical: --	Total Hours: 45 Hrs

TEXT BOOKS

1.	Wei Liu ,"Hybrid Electric Vehicle System Modeling and Control", Second Edition, John Wiley & Sons, Inc., 2017.
2.	Tom Denton,"Electric and Hybrid Vehicles",CRC Press, Second Edition, 2020.

REFERENCES

1.	Gianfranco Pistoia ,"Electric and Hybrid Vehicles Power Sources, Models, Sustainability, Infrastructure and the Market", Elsevier Publications, 2010.
2.	Mehrdad Ehsani,Yimin Gao, Stefano Longo and Kambiz Ebrahimi ,"Modern Electric, Hybrid Electric, and Fuel Cell Vehicles", Third Edition, CRC Press,2018.
3.	Simona ,"Hybrid Electric Vehicles", First Edition, Springer India , 2019
4.	Teresa Donateo,"Hybrid Electric Vehicles",First Edition, Intech Open Limited ,2017

U19MC905	Professional Elective: DIGITAL MANUFACTURING	L	T	P	C
		3	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1:	Explain steps involved in Rapid tooling and Addictive manufacturing.
CO2:	Discuss various fabrication & modelling techniques.
CO3:	State fundamental concepts of Automation and adaptive control Techniques.
CO4:	Interpret the types and function of robots and Automated guided vehicles.
CO5:	Discuss various applications of Industrial IoT.

Pre-requisite

1. Manufacturing Technology
2. Computer Aided Design and Manufacturing

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	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3		3								3	3
CO2	3	3	3		3								3	3
CO3	3	3	3	3			3			3		3	3	3
CO4	3	3	3	3						3			3	3
CO5	3	2	3	2	3	3		2		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 ADDITIVE ENGINEERING — **9 Hours**

Needs, Impact of AM and Rapid Tooling on product development, Distinction between AM and CNC machining, The Generalized AM Process chain - CAD Model: Input file formats, Generation and conversion of STL file, File verification and repair, Build file creation - Part construction: Part cleaning and finishing - RP benefits and classification of RP systems.

Unit 02: LIQUID POLYMER AND SOLID BASED SYSTEMS	9 Hours
Stereo lithography apparatus (SLA), Fused deposition modeling (FDM), Laminated object manufacturing (LOM), Selective laser sintering (SLS), Ballistic particle manufacturing (BPM), Working principle, Construction, Materials and applications.	
Unit 03: INTRODUCTION TO MANUFACTURING PROCESS AUTOMATION	**9 Hours**
Introduction: Automation, Numerical control, Programming, Adaptive control – Material handling and movement – Sensor technology – Flexible fixturing.	
Unit 04: INDUSTRIAL ROBOTS AND AUTOMATED GUIDED VEHICLE SYSTEMS	**9 Hours**
Introduction: Structure and operation of robots, Robot anatomy, Types, Programming, Applications; Industrial – Non-industrial – Automated guided vehicle systems: Types, Applications and functions.	
Unit 05: INDUSTRIAL INTERNET OF THINGS	**9 Hours**
Introduction: Understanding the Industrial IoT Process - Industrial data flow and devices - Security management of an IoT ecosystem - Case studies: Manufacturing, Oil and gas, Power utility industry.	

Theory: 45Hrs	Tutorial: --	Practical: --	Total Hours: 45Hrs

TEXT BOOKS

1.	C. K. Chua, K. F. Leong and C. S. Lim, "Rapid prototyping: Principles and applications", Cambridge University Press, 2010.
2.	Serope Kalpakjian, "Manufacturing Engineering and Technology", Pearson , Fourth edition.

REFERENCES

1.	I. Gibson, D. W. Rosen, and B. Stucker, "Additive Manufacturing Methodologies: Rapid Prototyping to Direct Digital Manufacturing", Springer, 2010
2.	Barrenechea, Mark j. Jenkins, Tom "Digital Manufacturing", First published in Canada 2018.
3.	Zongwei Luo, Robotics, ""Automation and control in Industrial and service settings", published in the United States of America by Engineering science.

U19MC906	Professional Elective: DRONE TECHNOLOGY	L	T	P	C
		3	-	-	3

Course Outcomes

After successful completion of this course, the students should be able to

CO6:	Explain the basic knowledge about the development and potential of UAV in professional activities
CO7:	Illustrate the features and characteristics of an Unmanned Aerial System
CO8:	Demonstrate the basic concepts and features of flight
CO9:	Utilize the drone equipment maintenance and repair
CO10:	Develop the Regulatory measures and regulations

Pre-requisite

1. Electrical Drives and Controls
2. Digital Electronics

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	2	3	2	3	3	-	-	-	-	-	2	3	3	3
CO2	2	3	2	3	3	-	-	-	-	-	2	3	3	3
CO3	2	3	2	3	3	-	-	-	-	-	2	3	3	3
CO4	2	3	2	3	3	-	-	-	-	-	2	3	3	3
CO5	2	3	2	3	3	2	2	2	-	-	3	3	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 UNMANNED AERIAL VEHICLES (UAV) — **9 Hours**

Overview and background: History of UAVs, Classifications of UAVs, Lift generation and thrust generation method, working of an UAV, Contemporary applications like military and civil areas –Ethical implications LOS / BLOS, Advantages and disadvantages of an UAV.

Unit 02: UNMANNED AERIAL SYSTEM (UAS) COMPONENTS — **9 Hours**

Platforms – Configurations – Characteristics – Propulsion: Internal combustion engines, Turbine engines, Electric systems – On-board flight control – Payloads: Sensing/Surveillance. Communications: Command/Control, Telemetry, Launch/recovery systems – Ground control stations

Unit 03: BASIC CONCEPTS OF FLIGHT — **9 Hours**

Aerodynamics: Lift, weight, Thrust and drag – Flight performance: Climbing vs. Gliding flight, Range / Endurance – Stability and control: Flight axes, Flight controls, Autopilots – Fixed wing operations: Types of fixed wing drones, Make, Parts, Terminology and Operation.

Unit 04: DRONE EQUIPMENT MAINTENANCE AND APPLICATIONS			9 Hours
Maintenance of drone: Flight control box – Maintenance of ground equipment – Batteries – Fault finding and rectification –Weather and meteorology, Surveying & mapping, construction & Agriculture sector.			
Unit 05: REGULATORIES AND REGULATIONS			**9 Hours**
Homeland Regulatories: FCC, FAA and Foreign regulatory – Regulations: FCC compliance, European union regulations, UAS registration, Federal Aircraft Regulations (FARs) - Safety considerations			
Theory: 45 Hrs	**Tutorial: --**	**Practical: --**	**Total Hours: 45Hrs**

TEXT BOOKS

4. Reg Austin, "Unmanned Aircraft Systems UAV design, development and deployment", Wiley, 2010.
5. Paul Fahlstrom, Thomas Gleason, "Introduction to UAV Systems", 4th Edition, John Wiley & Sons, NA, 2016.

REFERENCES

4. **P K Garg, "Introduction to Unmanned Aerial Vehicles", New Age International Private Limited, 2020**
5. **Garvit Pandya, "Basics of Unmanned Aerial Vehicles", Notion press, 2021**
6. **Jha, "Theory, Design, and Applications of Unmanned Aerial Vehicles", 1st Edition, CRC press, Florida, 2017.**
7. **Randal W. Beard & Timothy W. McLain, "Small Unmanned Aircraft: Theory and Practice", Princeton University Press, Newjersy, 2010.**

U19MC907	Professional Elective: DESIGN THINKING AND PRODUCT INNOVATION	L	T	P	C
		3	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1:	Relate the various systematic approach for innovative designs.
CO2:	Describe the product development process.
CO3:	Explain the need for product specification and concepts generation.
CO4:	Design principles to develop new products.
CO5:	Familiarize the concepts of Intellectual Property rights.

Pre-requisite

1. Basic Electrical Engineering

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	2			2	2	2	2			2	3	2
CO2	3	2	2			3	2	2	3		2	2	3	2
CO3	3	3	2			3	2	2	3		2	2	3	2
CO4	3	3	2			2	2	2	3		3	3	3	2
CO5	3	3	2			2	2	2				3	3	2

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: DESIGN THINKING — **9 Hours**

Design thinking: Introduction, Principles, Process, Innovation in design thinking, benefits of design thinking – Idea generation: Introduction, Techniques, Conventional methods, Intuitive methods, Brainstorming – Methods for combining solution – Decision making for new design

Unit 02: PRODUCT DEVELOPMENT PROCESS — **9 Hours**

Introduction to design – Fundamentals of systematic approach – Product planning – Product development process – Opportunity identification – Innovation in product development – Cost estimation

Unit 03: PRODUCT SPECIFICATION AND CONCEPTS GENERATION — **9 Hours**

Product Specification – Concepts generation – Concepts selection: Methods, Concept screening, Concept Scoring – Concept testing – Prototyping: Types and Principles

Unit 04: CASE STUDY IN PRODUCT DEVELOPMENT — **9 Hours**

Agriculture: Development of machines for separation of corn seeds, Peeling of groundnut shells, Husk removing from paddy – Electrical: Design of burglar alarm, Speedometer, Water level indicator, Smart gates, and Smart lights – Design of electrical vehicles – Unmanned vehicles – Design principles in drones

Unit 05: INTELLECTUAL PROPERTY RIGHTS (IPR)			9 Hours
Basic concepts and need for Intellectual Property – Patents: Patent search, Patent applications, International code for Patents – Copyrights – Geographical Indications – Trademark – Preparing a disclosure			
Theory: 45 Hrs	**Tutorial: --**	**Practical: --**	**Total Hours: 45 Hrs**

TEXT BOOKS	
1.	Karl T. Ulrich, Steven D. Eppinger," Product Design and Development",Sixth Edition, Tata Mcgraw Hill Education,2016
2.	Hasso Plattner,Christoph Meinel and Larry Leifer,"Design Thinking",First Edition, Springer, 2011
REFERENCES	
1.	Philip Kosky, Robert T. Balmer, William D. Keat, George Wise, "Exploring Engineering: An Introduction to Engineering and Design", Fouth edition, Elsevier, 2016
2.	G. Pahl, W.Beitz, J. Feldhusen, KH Grote, "Engineering Design: A Systematic Approach", Third Edition, Springer, 2007
3.	Gavin Ambrose , Paul Harris, "Basics Design - Design Thinking", First Edition, Bloomsbury Publishing India Private Limited,2009.
4.	Tom Kelley, Jonathan Littman, "Ten Faces in Innovation", Currency Books, 2006.

U19MC604	IMAGE PROCESSING LABORATORY	L	T	P	C
		0	0	2	1

Course Outcomes

After successful completion of this course, the students should be able to

CO1:	Write a MATLAB code to demonstrate and perform various operations on a given text image.
CO2:	Write a MATLAB code to extract features from text images ,image segmentation and compression.
CO3:	Write a MATLAB code to image processing applications

Pre-requisite

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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	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	P09	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2			2			2			3	2
CO2	3	2	3	2			2			2			3	2
CO3	3	3	2	2			2			2			3	2

Course Assessment methods

Direct		Indirect
CIE TEST-I (20) Quiz-I (5) CIE TEST-II (20) Quiz-II (5)	RTPS (10) End semester Examination (40)	Course end survey

List of Experiments

Using MATLAB

1.	Demonstrating False Contour Effect.
2.	Extraction and display of each bits as an image for a given 8 bit gray scale image.
3.	RGB Plane extraction
4.	Conversion from RGB to HSI
5.	Histogram Mapping and Equalization
6.	Spatial Domain Image Enhancement.
7.	Edge Detection Algorithms.
8.	Pseudo Coloring.
9.	Morphological Operations on Binary Images.
10.	Computing the DWT of an image and displaying the LL, LH, HL and HL images.
	Total Hours: 30 Hrs

U19MC605	3D MODELLING AND ANALYSIS LABORATORY	L	T	P	C
		0	0	2	1

Course Outcomes

After successful completion of this course, the students should be able to

CO1:	Construct the 2D views of standard machine components
CO2:	Create 3D model, assembling and detailing for the engineering components using solid works software.
CO3:	Analysis the structural components (Beams) using ANSYS software.

Pre-requisite

Engineering graphics

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)													
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	P09	PO10	PO 11	PO1 2	PSO 1	PSO 2
CO1	1	3	1		3	1		2		3	3	3	2	3
CO2	2	3	3	3	3	2			2	3	3	3	3	2
CO3	3	3	3	3	3	3	2	3	1	3	3	3	2	3

Course Assessment methods

Direct		Indirect
CIE TEST-I (20) Quiz-I (5) CIE TEST-II (20) Quiz-II (5)	RTPS (10) End semester Examination (40)	Course end survey

List of Experiments

1. Introduction of 3D Modelling software
2. Creation of 3D assembly model of Flange Coupling.
3. Creation of 3D assembly model of Plummer Block.
4. Creation of 3D assembly model of Screw Jack.
5. Creation of 3D assembly model of Universal Joint.
6. Creation of 3D assembly model of Machine Vice.
7. Creation of 3D assembly model of Safety Valves.
8. Creation of 3D assembly model of Non-return valves.
9. Structural analysis 2D components of Beam (Cantilever) with point load and torque.
10. Structural analysis 2D components of Beams (Simply supported) with UDL load.
11. Thermal analysis 2D components.

Total Hours: 30 Hrs

U19MC606	MINI PROJECT-II	L	T	P	C
		0	0	2	1

Course Outcomes

After successful completion of this course, the students should be able to

CO1:	Frame a real world problem, identify the requirement and develop the design solutions. Express the technical ideas, strategies and methodologies.
CO2:	Apply the new tools, algorithms, techniques that contribute to obtain the solution of the project. Examine and validate through conformance of the developed prototype and analyse the cost effectiveness.
CO3:	Prepare report and present the oral demonstrations.

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	2	1	2	2	2	2	2	1	1	3	2
CO2	3	3	3	3	3	2	2	2	2	2	3	3	3	2
CO3	3	2	2	2	2	2	3	3	3	3	1	1	3	2

Course Assessment methods

Direct		Indirect
Review- I (10 marks) Review- II (10 marks) Review- III (10 marks) Project & report (30 marks)	End semester Examination (40 marks)	Course end survey

1. The students formed into a team of convenient groups of not more than 3 members on a project are not allowed to change their team members.
2. Every project team should report to their faculty guide for discussion from the day of beginning of 6th semester.
3. The group has to analyze the selected problem addressed in their project work to draw solution.
4. A project report has to be submitted by each student group at the end of the 6th semester.
5. Three reviews have to be conducted by a team of faculty (minimum of 1 and maximum of 2) along with their faculty guide as a member of faculty team (for monitoring the progress of project planning and implementation).

Total Hours: 30 Hrs

Semester –VI	U19GE601-SOFT SKILLS AND APTITUDE – IV (Common to All except Civil)	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 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

06/01/2023

Dr.S.Anita

Head/Training

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

U19MC1003	SMART AUTOMATION	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 automation concepts
CO2:	Identify the components for automation
CO3:	Know the home and smart city automation concepts
CO4:	Apply the concepts of automation in agriculture
CO5:	Suggest solutions for automation and control applications in textile and medical industry

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	P09	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2		3			2			3		3	3
CO2	2	3	3		3		3		3			2	2	3
CO3	3	3	3		3		2				2		3	3
CO4	3	2	3		2					3			3	2
CO5	3	3	3		2			2				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: BASICS OF AUTOMATION — **9 Hours**

Introduction – Drawbacks of manual process – Need of automation in current era – Advantages of automation system – Industry 1.0 to 4.0 – Automation required areas: Heavy Industries – Home – Agriculture – Health care – Defence – Automotive Industries

Unit 02: COMPONENTS FOR AUTOMATION — **9 Hours**

Sensing: Sensors – Transducers – transduction principle: resistive, Inductive and capacitive type – sensors for detecting temperature, pressure, flow and objects – Decision making: Diode – Transistor – Microprocessor and microcontroller, Raspberry Pi- Relay and PLC – Actuation: Hydraulic and pneumatic cylinders, stepper and servo motors – Lights and buzzers – Analog valves – Bluetooth, Zigbee and Wifi for communication.

Unit 03: HOME AND SMART CITY AUTOMATION	9 Hours
Need of Home automation – Home automation using IoT – Automated gate unlock system – smart domestic appliances – Wifi camera – object detection (dark mode) – biometric based door opening system - Smart Building using IoT – Automatic Solar Tracker - GPS & GSM based Tracker – Automated Street Lighting - Automated Railway Crossing – Smart Traffic Lighting System.	
Unit 04: AGRICULTURE AUTOMATION	**9 Hours**
Standards for agriculture – Need for agriculture digitalization – Dielectric Soil Moisture Sensors – Weather sensors – Measurement of leaf health, chlorophyll detection, crop mapping, fertilizing, seeding and weeding machine, ripeness level detection, fruit picking robot, smart sorting system.	
Unit 05: MEDICAL AND TEXTILE AUTOMATION	**9 Hours**
Types of medical robots – State of art of robotics in the field of healthcare – Assistive robots – Types of assistive robots – Yarn clearer controls – Knotter /splicer carriage controls – Pre-set length/full cone monitors – Warping machine monitors and controls – Humidification system	

Theory: 45 Hrs	Tutorial: --	Practical: --	Total Hours: 45 Hrs

TEXT BOOKS

1.	D. Patranabis, “Sensors and Transducers”, PHI Learning pvt ltd., 2004
2.	Dwight Spivey, “Home Automation For Dummies”, Wiley, 2015

REFERENCES

1.	Diego Galar, Pascual Pasquale and Daponte Uday Kumar, “Handbook of Industry 4.0 and SMART Systems”, CRC Press, 2021
2.	Shimon Y. Nof, “Springer Handbook of Automation”, Springer, 2009
3.	Pradeep Tomar and Gurjit Kaur, “Artificial Intelligence and IoT-Based Technologies for Sustainable Farming and Smart Agriculture”, IGI Global, 2021
4.	Ramesh C. Poonia, Xiao-Zhi Gao, Linesh Raja, Sugam Sharma and Sonali Vyas, “Smart Farming Technologies for Sustainable Agricultural Development”, IGI Global, 2018
5.	Achim Schweikard, Floris Ernst, “Medical Robotics”, Springer, 2015
6.	George stylios, “Textile objective measurement and automation in garment manufacture”, E.Horwood, 1991.

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

CO6:	Understand the basic robotic concepts
CO7:	Select the suitable drive system for robot application
CO8:	Select the suitable sensors and grippers for the respective application
CO9:	Develop VAL Programming for simple applications
CO10:	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	P09	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

3.	M.P.Groover, M.Weiss,R.N. Nagal,N.G.Odrey, "Industrial Robotics - Technology, programming and Applications" Tata McGraw-Hill Publication, 2012.

REFERENCES

7.	Richard D.Klafter, “Robotics Engineering" PHI Learning Private Limited, 2009.
8.	Ganesh S.Hedge, "A text book in Industrial Robotics", Laxmi Publications, 2006.
9.	S K Saha, "Introduction to Robotics", Tata McGraw-Hill Publication, 2012.
10	Sathya Ranjan Deb, "Robotics Technology & flexible Automation" Second edition, Tata McGraw-Hill Publication, 2009.

MCT
VII

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

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit	Total Contact Hours
Theory							
1	U19GE701	Professional Ethics and Human Values	3	0	0	3	45
2	U19MC701	Total Quality Management	3	0	0	3	45
3	U19MC702	Robot Programming and Applications	3	0	0	3	45
4	U19MC909	**Professional Elective -** Agriculture Automation	3	0	0	3	45
5	U19MC922	**Professional Elective -** Automotive Mechatronics	3	0	0	3	45
6	U19BM1002	**Open Elective** Basic Life Support	3	0	0	3	45
	U19CE1001	Building Services and Safety Regulations					
	U19CE1004	Disaster Management					
	U19CS1002	Cloud Computing					
	U19CS1003	Internet of Things					
	U19EC1006	Mobile Technology and Its Applications					
	U19EC1007	CMOS VLSI Design					
	U19EE1003	Innovation, IPR and Entrepreneurship Development					
	U19EE1004	Renewable Energy Systems					
	U19FT1001	Fundamentals of Fashion Design					
	U19ME1002	Industrial Safety					

	U19ME1004		Renewable Energy Sources					
Practical								
7	U19MC703	Robotics Laboratory		0	0	3	1.5	45
8	U19MC704	Mini Project-III		0	0	3	1.5	45
Total Credits							**21**	**360**

Approved By

5/7/23

Chairperson, Mechatronics Engineering BoS
Dr.P.Suresh

Member Secretary, Academic Council
Dr.R.Shivakumar

13/7/23

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

Copy to: -

HOD/ Mechatronics Engineering, Seventh Semester B.E MCT Students and Staff, COE

U19GE701	PROFESSIONAL ETHICS AND HUMAN VALUES	L	T	P	C
		3	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1:	Identify the core values that shape the ethical behavior of an engineer.
CO2:	Analyze and practice engineering ethics in their profession.
CO3:	Apply codes of ethics in the context of social experimentation.
CO4:	Explore various safety issues and ethical responsibilities of an engineer.
CO5:	Adopt ethical practices pertaining to global issues.

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	P09	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	1	1	2	3	3	3	2	2	3	2	2
CO2	2	1	1	1	2	2	3	3	3	3	3	3	2	2
CO3	2	1	3	1	2	3	3	3	3	3	3	3	2	2
CO4	2	1	3	1	1	3	3	3	3	2	3	3	2	2
CO5	2	1	3	1	1	3	3	3	3	3	3	3	2	2

Course Assessment methods

Direct		Indirect
Internal test I (8) Internal test II (8) Internal test III (8) Assignment/seminar/Quiz (5)	Objective test (6) Attendance (5) End semester Examination (60)	Course end survey

Unit 01: HUMAN VALUES — **9 Hours**

Morals, Values and Ethics – Integrity – Work Ethics – Service Learning – Civic Virtue – Respect for Others – Living Peacefully – Caring – Sharing – Honesty – Courage – Valuing Time – Co-operation – Commitment – Empathy – Self-Confidence – Character – Introduction to Yoga and meditation for professional excellence and stress management.

Unit 02: ENGINEERING ETHICS	9 Hours
Senses of Engineering Ethics – Variety of moral issues – Types of inquiry – Moral Dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Profession and Professionalism – Professional Ideals and Virtues –Theories of Right action- Self Interest- Customs and Religion-Uses of Ethical Theories.	
Unit 03: ENGINEERING AS SOCIAL EXPERIMENTATION	**9 Hours**
Engineering as Experimentation – Contrasts with standard experiments- Engineers as Responsible Experimenters – Importance and limitations of Codes of Ethics - Industrial Standards - A Balanced Outlook on Law – Industrial Standards- Case Study: Space shuttle challenger disaster.	
Unit 04: SAFETY, RESPONSIBILITIES AND RIGHTS	**9 Hours**
Safety and Risk – Types of risk - Assessment of Safety and Risk – Risk Benefit analysis-Reducing Risk – Case Studies - Chernobyl and Bhopal plant disaster. Collegiality and Loyalty –Respect for Authority- Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Importance and consequences of whistle blowing - Professional Rights – Employee Rights – Intellectual Property Rights (IPR) and its components– Discrimination.	
Unit 05: GLOBAL ISSUES	**9 Hours**
Multinational Corporations – Environmental Ethics – Computer Ethics and Internet- Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership – Participation in professional societies- –Code of Conduct – Corporate Social Responsibility.	

Theory: 45 Hrs	Tutorial: --	Practical: --	Total Hours: 45 Hrs

TEXT BOOKS

1.	Mike Martin and Roland Schinzinger, "Ethics in Engineering", McGraw Hill, Indian Edition, Tenth reprint, 2017.
2.	Professional Ethics and Human values- Sonaversity, Edition 2018.

REFERENCES

1.	Charles D Fleddermann, "Engineering Ethics", Prentice Hall, New Mexico, 2012.
2.	Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2016.
3.	Charles E Harris, Michael S Pritchard and Michael J Rabins, "Engineering Ethics – Concepts and Cases", Cengage Learning, 2009.
4.	R.Subramanian, "Professional Ethics ",Oxford University Press , Second Edition, 2017.

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U19MC701	TOTAL QUALITY MANAGEMENT	L	T	P	C
		3	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1:	Outline the Dimensions and Barriers regarding with Quality.
CO2:	Discuss the TQM Principles and quality improvement teams.
CO3:	Justify the concept of Six Sigma and four levels of benchmarking.
CO4:	Explain the various types of Techniques are used to measure Quality.
CO5:	Apply various Quality Systems and Auditing on implementation of TQM.

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	P09	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3		3				3	3			3	3	3
CO2		3	3	3			3	3					3	3
CO3			3	3		3		3	3			3	3	3
CO4	3	3	3		3								3	3
CO5	3	2	3		3								3	3

Course Assessment methods

Direct		Indirect
Internal test I (8) Internal test II (8) Internal test III (8) Assignment/Seminar/Quiz (5)	Objective test (6) Attendance (5) End Semester Examination (60)	Course end survey

Unit 01: INTRODUCTION — **9 Hours**

Introduction - Need for quality - Evolution of quality - Definitions of quality - Dimensions of product and service quality - Basic concepts of TQM - TQM Framework - Contributions of Deming, Juran and Crosby - Barriers to TQM - Customer focus - Customer orientation, Customer satisfaction, Customer complaints, Customer retention.

Unit 02: TQM PRINCIPLES — **9 Hours**

Leadership: Quality Statements, Strategic quality planning, Quality Councils - Employee involvement: Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal - Continuous process improvement: PDCA cycle, 5S, Kaizen - Supplier partnership: Partnering, Supplier selection, Supplier Rating.

Unit 03: TQM PRACTICES	9 Hours
The seven traditional tools of quality - New management tools - Six sigma: Concepts, Methodology, applications to manufacturing, service sector including IT - Bench marking: Reason to bench mark, Bench marking process – FMEA: Stages, Types.	
Unit 04: TQM TOOLS AND TECHNIQUES	**9 Hours**
Quality Circles - Cost of Quality - Quality Function Deployment (QFD) - Taguchi quality loss function - TPM: Concepts, improvement needs - Performance measures.	
Unit 05: QUALITY SYSTEMS	**9 Hours**
Need for ISO 9000 - ISO 9001-2008 - Quality System: Elements, Documentation, Quality Auditing - QS 9000 - ISO 14000: Concepts, Requirements and Benefits - TQM Implementation in manufacturing and service sectors.	

Theory: 45 Hrs	Tutorial: --	Practical: --	Total Hours: 45 Hrs

TEXT BOOKS

1.	Dale H.Besterfiled et al, "Total Quality Management", Pearson Education Asia, Revised Third Edition, Indian Reprint, Sixth Impression, 2013.

REFERENCES

1.	James R. Evans and William M. Lindsay, "The Management and Control of Quality", 8th Edition, First Indian Edition, Cengage Learning, 2012.
2.	Suganthi.L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2006.
3.	Janakiraman. B and Gopal. R.K., "Total Quality Management - Text and Cases", Prentice Hall (India) Pvt. Ltd., 2006.

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U19MC702	ROBOT PROGRAMMING AND APPLICATIONS	L	T	P	C
		3	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1:	Outline the various methods to implement the robot programming
CO2:	Illustrate the different methods of execution of robot program
CO3:	Apply the VAL Language to develop robot programming for industrial applications
CO4:	Develop the RAIL and AML language for robot programming
CO5:	Apply the robot programming skills to control industrial applications

Pre-requisite

1. Robotics
2. Theory of Machines

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	2	1	1	2	2		2	2		2	3	2
CO2	3	2	2	2	1	2	2		2	1		2	3	2
CO3	3	2	2	2	2	2	3		2	1		2	3	2
CO4	3	2	2	1	2	2	3		1	1		2	3	3
CO5	3	3	2	1	2	2	3		1	1		2	3	3

Course Assessment methods

Direct		Indirect
Internal test I (8) Internal test II (8) Internal test III (8) Assignment/seminar/Quiz (5)	Objective test (6) Attendance (5) End semester Examination (60)	Course end survey

Unit 01: INTRODUCTION TO ROBOT PROGRAMMING — **9 Hours**

Programming of Robots-Methods of Robot programming-Teach method Generation of Robot programming language- Robot Language structure: Operating System, Elements and functions- High level computer language- VAL-Machine Control Language.

Unit 02: ROBOT PROGRAMMING METHODOLOGY — **9 Hours**

Robot Task function- Motion interpolation-Constant, Variables and other data objects, Robot specifications- Motion commands, end effectors and sensors commands-computations and operations-program control and subroutines-communications and data processing-monitor mode commands.

Unit 03: VAL LANGUAGE — **9 Hours**

Introduction to VAL language – Monitor commands - Hand control - Configuration control- Hand control - input/output control-palletizing applications using VAL, Robot welding application using VAL program.

Unit 04: RAIL AND AML	9 Hours
RAIL General description features- Locations- Robot motion statements- Learn Statement-I/O- Operator I/O and file system- program control. AML Language-elements and functions, Statements, constants and variables-Program control statements- Operating systems, Motion, Sensor commands-Data processing.	
Unit 05: REAL TIME APPLICATION AND PROGRAMMING	**9 Hours**
Robotic welding: automated single pass welding, automated multi pass welding, welding robot with computer vison VAL program for weld path generation-Spray painting robots and programming method-Joystick technology and tele operated robots-obstacle avoidance robot.	

Theory: 45Hrs	Tutorial: --	Practical: --	Total Hours: 45 Hrs

TEXT BOOKS

1.	Deb. S. R. "Robotics Technology and Flexible Automation", Tata McGraw Hill publishing company limited, 2013.
2.	Mikell. P. Groover, "Industrial Robotics Technology", Programming and Applications, McGraw Hill Co, 2016.

REFERENCES

1.	Klafter. R.D, Chmielewski.T.A and Noggin's, "Robot Engineering : An Integrated Approach", Prentice Hall of India Pvt. Ltd.,2011.
2.	Fu .K. S, Gonzalez .R. C. & Lee .C.S.G, "Robotics Control, Sensing, Vision and Intelligence", McGraw Hill Book co, 2011.
3.	Craig .J. J, "Introduction to Robotics Mechanics and Control", Addison- Wesley, 2009.
4.	Robert J. Schilling, "Fundamentals of Robotics Analysis and Control", PHI Learning., 2009.

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U19MC703	ROBOTICS 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 fundamentals of assembly level programming in robot.
CO2:	Create the various path planning techniques by briefing about the robot's environment.
CO3:	Analysis the applications of robots in various industrial application.

Pre-requisite

Robotics

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	PO 11	PO12	PSO1	PSO2
CO1	1	3	1		3	1		2		3	3	3	2	3
CO2	2	3	3	3	3	2			2	3	3	3	3	2
CO3	3	3	3	3	3	3	2	3	1	3	3	3	2	3

Course Assessment methods

Direct		Indirect
CIE TEST-I (20) Quiz-I (5) CIE TEST-II (20)	Quiz-II (5) RTPS (10) End semester Examination (40)	Course end survey

List of Experiments

1. Introduction of Robot Programming.
2. External Input/output wiring.
3. Linear Interpolation Programming.
4. Linear Interpolation with Continuous Path Programming.
5. Circular Interpolation Programming.
6. Conditional Loop Using IF Statement.
7. Conditional Loop using FOR Loop.
8. Programming Robot Path Using Precision Function.
9. Programming for Pick and Place with TCP.
10. Programming for Pick and Place by Pallet Command.
11. Programmming for palletize the colorbox using image processing Technique.
12. Programmming for palletize the different geometric shapes.

Total Hours: 45 Hrs

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U19MC704	MINI PROJECT-III	L	T	P	C
		0	0	3	1.5

Course Outcomes

After successful completion of this course, the students should be able to

CO1:	Identify a real time problem and develop the methods to find the solutions through a systematic approach.
CO2:	Analyse the new techniques to obtain the optimum solution to carry out the project.
CO3:	Prepare report and present the oral demonstrations.

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	2	1	2	2	2	2	2	1	1	3	2
CO2	3	3	3	3	3	2	2	2	2	2	3	3	3	2
CO3	3	2	2	2	2	2	3	3	3	3	1	1	3	2

Course Assessment methods

Direct		Indirect
Review- I (10 marks) Review- II (10 marks) Review- III (10 marks) Project report (10 marks)	End semester Examination (60 marks)	Course end survey

1. The students formed into a team of convenient groups of not more than 3 members on a project are not allowed to change their team members.
2. Every project team should report to their faculty guide for discussion from the day of beginning of 7th semester.
3. The group has to analyze the selected problem addressed in their project work to draw solution.
4. A project report has to be submitted by each student group at the end of the 7th semester.
5. Three reviews have to be conducted by a team of faculty (minimum of 1 and maximum of 2) along with their faculty guide as a member of faculty team (for monitoring the progress of project planning and implementation).

Total Hours: 45 Hrs

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U19MC909	AGRICULTURE AUTOMATION	L	T	P	C
		3	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1:	Explain the basic principle of smart agriculture
CO2:	Demonstrate various Sensors and actuators for farming tools
CO3:	Illustrate the Telemetry and Plant health monitoring used in Agriculture automation
CO4:	Construct the advanced technologies for smart farming
CO5:	Develop a machine for smart irrigation system

Pre-requisite

1. Sensors and Instrumentation

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	2	2	2	-	-	2	2	3	3	3
CO2	3	3	3	3	1	2	2	-	-	2	2	3	3	3
CO3	2	3	3	3	1	2	2	-	-	2	2	3	3	3
CO4	3	3	3	3	1	2	3	-	-	2	2	3	3	3
CO5	3	3	2	3	1	3	3	-	-	3	2	3	3	3

Course Assessment methods

Direct		Indirect
Internal test I (8) Internal test II (8) Internal test III (8) Assignment/seminar/Quiz (5)	Objective test (6) Attendance (5) End semester Examination (60)	Course end survey

Unit 01: INTRODUCTION **9 Hours**

Overview of smart agriculture: Nature and origin of soil, Soil minerals, Classification and composition, soil properties including structure, PH, Surface tension and Soil nutrients – Standards for agriculture – Need for agriculture digitalization

Unit 02: SENSORS, ACTUATORS AND CONTROLS IN AGRICULTURE	9 Hours
Sensors: Smart sensors, Colorimetry based detection, MEMS Electrochemical Sensors, Dielectric Soil Moisture Sensors, ISFET, Weather sensors, Proximity Sensors, Air flow sensors, Thermal camera, Image processing – Actuators and Controls: AC & DC Motors, Stepper motor, Solenoid actuators, Piezoelectric motors, Electric drives, Hydraulic and Pneumatic actuators	
Unit 03: TELEMETRY AND PLANT HEALTH MONITORING	**9 Hours**
Wireless communication modules and topology – Zig-bee – Bluetooth – LORA – Zero power devices – Energy Harvesting technology – GIS enabled smart technology – Measurement of leaf health – Chlorophyll detection = Ripeness level – Crop mapping –Fertilizing	
Unit 04: TECHNOLOGIES FOR FARMING	**9 Hours**
Water quality monitoring – Smart water management – Micro-irrigation system – Solar pump and lighting system – Fencing – Android based automation – AI and IOT in farming – Drone technology for soil field analysis and Assistive operations	
Unit 05: APPLICATIONS OF AGRICULTURE AUTOMATION	**9 Hours**
Case studies: Sorting, Seeding and Weeding machine, Fruit picking robots, Autonomous unmanned ground vehicles and Drones	

Theory: 45 Hrs	Tutorial: --	Practical: --	Total Hours: 45Hrs

TEXT BOOKS

1.	Ramesh C. Poonia, Xiao-Zhi Gao, Linesh Raja, Sugam Sharma and Sonali Vyas, "Smart Farming Technologies for Sustainable Agricultural Development", IGI Global, 2018
2.	Pradeep Tomar and Gurjit Kaur, "Artificial Intelligence and IoT-Based Technologies for Sustainable Farming and Smart Agriculture", IGI Global, 2021

REFERENCES

1.	Annamaria Castrignano, Gabriele Buttafuoco, Raj Khosla, Abdul Mouazen, Dimitrios Moshou and Olivier Naud, "Agricultural internet of things and decision support for precision smart farming", Elsevier, 2020
2.	Manoj Karkee, Qin Zhang, "Fundamentals of Agricultural and Field Robotics", Springer, 2021
3.	Yong He, Pengcheng Nie, Qin Zhang, Fei Liu, "Agricultural Internet of Things Technologies and Applications", Springer, 2021
4.	Hazem Shawky Fouda, "Agricultural Automation: Fundamentals and Practices", Arcler Education Inc, 2019

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U19MC922	AUTOMOTIVE MECHATRONICS	L	T	P	C
		3	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1:	Deliberate the various types of sensors and microprocessor application in automobiles.
CO2:	Demonstrate the engine control systems.
CO3:	Analyze the electronic management systems used in auto motives.
CO4:	Investigate the hydraulic actuation system, Vehicles lighting Circuits and electric windows systems.
CO5:	Examine the various applications electronic control systems used in auto motives.

Pre-requisite

Digital electronics, Electrical drives and control

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	2		2	2	2				2	3	3
CO2	3	3	3	2		2	2	2				2	3	3
CO3	3	3	3	2		3	2	3				2	3	3
CO4	3	3	3	2		3	2	3				2	3	3
CO5	3	3	3	2		3	2	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)	Objective test (6) Attendance (5) End semester Examination (60)	Course end survey

Unit 01: Fundamentals of Automotive Electronics — **9 Hours**

Basic sensor arrangement – Types of sensors. Oxygen Sensor – Cranking Sensor – Position Sensors – Engine cooling water temperature Sensor – Engine oil pressure Sensor – Fuel metering – Vehicle speed sensor and detonation sensor – Stepper motors – Relays, solenoids - Microprocessor and Micro Computer applications in automobiles.

Unit 02: Engine Management Systems — **9 Hours**

Introduction - components for engine management system - Open loop and closed loop control system – Engine cranking and warm up control – Acceleration, deceleration and idle speed control- Feedback

carburetor system – Single point injection and multi point fuel injection system – Advantage of electronic ignition systems – Types of solid state ignition systems and their principles of operation – Electronic spark timing control.

Unit 03: Electronic Management Systems	**9 Hours**
Introduction-Electronic management of chassis systems, anti - lock braking system, Tyre pressure monitoring system, Collision avoidance system, Traction control system, Active suspension system, Key less entry system and Electronic power steering system.	

Unit 04: Electronic Actuators	**9 Hours**
Wiper system, flasher, electronic fuel pump, Brake Actuation Warning System. Traficators, Windshield Wiper, Starting Systems – Charging Systems –climate control, Vehicles lighting Circuits Signaling Circuit, electric windows systems, seat belt tensioners.	

Unit 05: Electronics Control Systems	**9 Hours**
Introduction of Control Systems - Automatic Cruise Control, Air Bag Control, Automatic Transmission Control, Automatic gear control, Electronic Distributor-less ignition control, Electronic Fuel Control, Exhaust emission control, Electronic Clutch Control, Automotive central locking and anti-theft system control.	

Theory: 45 Hrs	**Tutorial: --**	**Practical: -- Hr**	**Total Hours: 45 Hrs**

Text Books

1.	William Ribbens, Understanding Automotive Electronics, Newnes Publishers, India, 2013.
2.	Tom Denton, "Automobile electrical and electronic systems", Routledge, 5th edition, 2017.

REFERENCES

1.	Robert Bosch, "Automotive Handbook" SAE, 2003.
2.	W.F. Walter, Electronic Measurements", Macmillan Press Ltd., London.
3.	E.Dushin, Basic Metrology and Electrical Measurements", MIR Publishers, Moscow, 1989.
4.	Sonde.B.S. "Transducers and Display System", Tata McGraw Hill Publishing Co. Ltd.New Delhi

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U19BM1002 **BASIC LIFE SUPPORT** **L T P C**
3 0 0 3

COURSE OUTCOMES:

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

- Analyze Various BLS and First Aid Techniques
- Understand the Essentials of Anatomy and Physiology
- Analyze Various BLS techniques for adults.
- Analyze Various BLS techniques for children and infants
- Apply Respiratory techniques and AED in critical conditions

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**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	-	-	-	-	3	1	1	1	-	-	1	-	-	-
CO2	3	-	-	-	-	1	2	1	-	-	-	1	1	-	-
CO3	3	-	-	-	-	1	1	1	1	-	-	1	-	-	-
CO4	3	-	-	-	-	3	2	1	-	-	-	1	-	-	1
CO5	3	-	-	-	-	2	1	1	1	-	-	1	1	-	1

UNIT I INTRODUCTION TO BASIC LIFE SUPPORT **9**

General Concepts of Basic Life Support (BLS)-Chain of survival. BLS Algorithm, First Aid: Basic First Aid techniques- first aid kit, Law, Resuscitation, Top to Toe Assessment, Hygiene and Hand Washing.

UNIT II ESSENTIALS OF ANATOMY AND PHYSIOLOGY OF HUMAN BODY **9**

Levels of Organization-Chemicals-Cells-Tissues-Organs-Organ Systems, Metabolism and Homeostasis, Terminology and General Plan of the Body-Case Studies.

UNIT III ADULT BASIC LIFE SUPPORT **9**

BLS for adults: Adult BLS Algorithm, CPR, One Rescuer and Two Rescuer BLS for Adults- Adult Mouth-to-Mask Ventilation, Adult Bag-Mask Ventilation, Self-Assessment for Adult BLS

UNIT IV PAEDIATRIC BASIC LIFE SUPPORT **9**

BLS for children: BLS Algorithm children, One Rescuer and Two Rescuer BLS for children, Child Ventilation. BLS for Infants: One Rescuer and Two Rescuer BLS for infants-Case Studies.

UNIT V AUTOMATED EXTERNAL DEFIBRILLATOR AND FOREIGN BODY AIRWAY OBSTRUCTION **9**

AED for Adults, AED for Children and Infant, Self-Assessment for AED, FBAO- Respiration, Difficult Breathing, Drowning, Strangulation and Hanging, Chocking, Suffocation - Airway Management-Chest Discomforts-Case Studies.

TOTAL PERIODS:45

REFERENCES:

1. Dr. Karl Disque, Basic Life Support Provider Handbook, Satori Continuum Publishing, USA, 2021.
2. INDIAN FIRST AID MANUAL – 7th Edition, St. John Ambulance Association (India) – Indian Red Cross Society National Headquarters, New Delhi, 2016.
3. Basic Life Support Training Manual, 1st Edition, Published by in Medical Development Division, Ministry of Health Malaysia, Malaysia in December 2017.
4. Valerie C. Scanlon, Tina Sanders,Essentials of Anatomy and Physiology,5th Edition, F. A. Davis Company.

Chairperson
BOS-BME

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O.E

Civil VII

PREAMBLE
To
Building Services and Safety Regulations

- Building services engineers are responsible for the design, installation, operation and monitoring of the mechanical, electrical and public health systems required for the safe, comfortable and environmentally friendly operation of modern buildings.
- Building services engineers work closely with other construction professionals such as architects, structural engineers and quantity surveyors. They influence the architecture of a building and play a significant role on the sustainability and energy demand of a building.
- Within building services engineering, new roles are emerging, for example in the areas of renewable energy, sustainability, low carbon technologies and energy management.
- With buildings accounting for around 50% of all carbon emissions, building services engineers play a significant role in combating climate change.

COURSE CODE	COURSE NAME	L	T	P	C
U19CE1001	BUILDING SERVICES AND SAFETY REGULATIONS	3	0	0	3

Course Objective (s): The Purpose of learning this course is to:

1.	Provide knowledge on the building electrification systems.
2.	Impart the basic knowledge in the design of lighting systems in the buildings.
3.	Provide the basic knowledge of providing air conditioning systems in the various types of buildings.
4.	Aware the students about fire safety regulations and installation systems in the building.
5.	Provide basic knowledge in the water supply and sewerage systems for the buildings.

Course Outcome (s) (COs): At the end of this course, the students will be able to:

CO1	Acquire the basics knowledge in electrical and wiring systems for the buildings. **(K1)**
CO2	Design the lighting system for the various buildings and disabled peoples. **(K3)**
CO3	Know the basic provisions for air conditioning systems for various types of buildings. **(K4)**
CO4	Plan to install the fire safety equipment system in the buildings by obeying the regulations. **(K3)**
CO5	Explain the various plumbing fittings in the water supply and rainwater harvesting system for buildings. **(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	PO5
CO1	3	1	3	1	1	1	3	1	1	-	-	2	1	2
CO2	3	2	3	1	2	1	3	-	1	-	-	2	1	2
CO3	3	2	3	1	2	1	3	-	1	-	-	2	1	2
CO4	1	2	3	2	2	2	3	3	2	-	-	2	2	2
CO5	1	3	3	2	2	2	3	1	2	-	-	2	2	2
CO (Avg)	2.2	2	3	1.4	1.8	1.4	3	1	1.4	-	-	2	1.4	2

Correlation Level: 1:Slight (Low) 2:Moderate (Medium) 3:Substantial (High)

UNIT-I	ELECTRICAL SYSTEMS IN BUILDINGS	9 Hours

Basics of electricity- Single / Three-phase supply- Protective devices in electrical installations- Earthing for safety- Types of earthing- ISI specifications- Types of wires, wiring systems, and their choice- Planning electrical wiring for building- Main and distribution boards- Transformers and switch-gears- Layout of substations.

UNIT-II	PRINCIPLES OF ILLUMINATION & DESIGN	9 Hours

Visual tasks- Factors affecting visual tasks- Modern theory of light and colour- Synthesis of light- Additive and subtractive synthesis of colour- Luminous flux- Candela- Solid angle illumination- Utilisation factor- Depreciation factor- MSCP- MHCP- Lans of illumination- Classification of lighting- Artificial light sources- Spectral energy distribution- Luminous efficiency- Colour temperature- Colour rendering. Design of modern lighting- Lighting for stores, offices, schools, hospitals, and house lighting. Elementary idea of special features required and minimum level of illumination required for

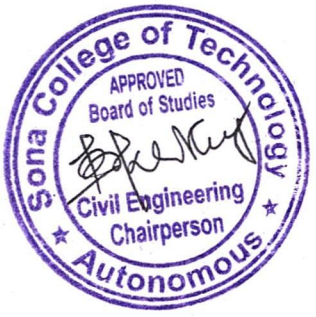
physically handicapped and elderly in building types.		
UNIT-III	**REFRIGERATION PRINCIPLES & APPLICATIONS**	**9 Hours**
Thermodynamics- Heat- Temperature, measurement transfer- Change of state- Sensible heat- Latent heat of fusion, evaporation, sublimation- saturation temperature- Superheated vapour- Subcooled liquid- Pressure temperature relationship for liquids- Refrigerants- Vapour compression cycle- Compressors- Evaporators- Refrigerant control devices- Electric motors- Starters- Air handling units- Cooling towers- Window type and packaged air-conditioners- Chilled water plant- Fan coil systems- Water piping- Cooling load- Air conditioning systems for different types of buildings- Protection against fire to be caused by A.C. Systems		
UNIT-IV	**FIRE SAFETY REGULATIONS AND INSTALLATION**	**9 Hours**
Causes of fire in buildings- Safety regulations- NBC- Planning considerations in buildings like non-combustible materials, construction, staircases and lift lobbies, fire escapes, and A.C. systems. Special features required for physically handicapped and elderly in building types- Heat and smoke detectors- Fire alarm system, snorkel ladder- Fire lighting pump and water storage- Dry and wet risers- Automatic sprinklers		
UNIT-V	**WATER SUPPLY AND SEWERAGE SYSTEM FOR BUILDINGS**	**9 Hours**
Plumbing fixtures and fixture fittings- Water-conserving fittings- Overflows- Strainers and connectors- Prohibited fixtures- Special fixtures- Installation of water closet- Urinals - Flushing devices- Floor drains- Shower stall- Bathtub- Bidets- Minimum plumbing facilities- Rainwater harvesting systems- Necessity- Construction- Different types		
		TOTAL: 45 Hours

TEXT BOOKS:

1.	R. Udaykumar, "A text book on Building Services", Eswar Press, Chennai, ISBN13, 9788178740638. ISBN-10, 817874063X
2.	David V. Chadderton , Building Services Engineering Taylor & Francis, 2000.

REFERENCES:

1.	Handbook for Building Engineers in Metric systems, NBC, New Delhi, 2011.
2.	Philips Lighting in Architectural Design, McGraw-Hill, New York, Latest edition.
3.	R.G.Hopkinson and J.D.Kay, "The Lighting of buildings", Faber and Faber, London, 1972.
4.	William H.Severns and Julian R.Fellows, "Air-conditioning and Refrigeration", John Wiley and Sons, London, 1988.
5.	A.F.C. Sherratt, "Air-conditioning and Energy Conservation", The Architectural Press, London, 2007.



PREAMBLE
To
Disaster Management

We observe that during the last three decades, disaster both natural and man-made occur frequently and their impact on life, live hoods, natural resources, property, infrastructure and facilities is very severe. Though hazards and disasters could not be prevents, by taking preparedness activities, we can minimize their harmful effects.

This course on disaster management emphasizes the need for disaster preparedness rather than emergency response. It throws light on risk assessments, risk resolution and risk sharing and transfer. The importance of community participation, building self-reliant resilient communities and awareness creation is highlights in this course. Application of modern communication tools, remote sensing and GIS technologies in search and resource operations and stream lining activities is elaborated. Way and means of financial arrangements to carry out disaster management activities are discussed.

The physics of earthquake and tsunamis is explained. Safety measures against tsunamis are described. The functioning and tsunamis warning system is described.

COURSE CODE	COURSE NAME	L	T	P	C
U19CE1004	DISASTER MANAGEMENT	3	0	0	3

Course Objective (s): The Purpose of learning this course is to:	
1.	Provide knowledge on the types and effects of disasters.
2.	Impart basic knowledge to reduce the impact of disasters.
3.	Understand the relationship and impact of development projects on environment and society.
4.	Disseminate the National policy and role played by our country during disasters.
5.	Provide basic knowledge in assessment of disasters with case study.

Course Outcome (s) (COs): At the end of this course, the students will be able to:	
CO1	Distinguish various types of disasters, their causes and impacts on environment and society (K2)
CO2	Explain different phases of disaster management cycle (K3)
CO3	Assess vulnerability and prepare disaster risk reduction measures (K4)
CO4	Explain the vulnerability profile of India(K5)
CO5	Prepare hazard zonation maps for all types of hazards (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	3	3	1	2	3	3	3	3	2	3	2	2
CO2	3	2	3	2	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	2	3	3	3	2	2	2	3	3	3	3
CO (Avg)	3	2.6	3	2.6	2.6	2.8	3	2.8	2.8	2.8	2.8	3	2.8	2.8

Correlation Level: 1:Slight (Low) 2:Moderate (Medium) 3:Substantial (High)

UNIT-I	INTRODUCTION TO DISASTERS	9 Hours

Definitions: Disaster, Hazard, Vulnerability, Resilience, Disaster Preparedness - Classification of Disasters - Causes for Disasters - Impacts of Disasters on Society, Environment, Economics, Politics, Health, etc. - Types of Vulnerability - The Sphere Project

UNIT-II	APPROACHES TO DISASTER RISK REDUCTION	9 Hours

Phases of Disaster Management Cycle - Culture of safety, prevention, mitigation, and preparedness - Community-based Disaster Risk Reduction - Structural and Non-structural mitigation measures

UNIT-III	INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT	9 Hours
Linkage between Development and Disasters -Impact of Development Projects on Environment and Society - Climate Change Adaptation - IPCC - India's Participation - Relevance of Indigenous Knowledge, Appropriate Technology, and Local Resources		
UNIT-IV	**DISASTER RISK MANAGEMENT IN INDIA**	**9 Hours**
Hazards-Vulnerability Profile of India - Components of Disaster Relief: Water, Sanitation, Food, Shelter, Health, etc. - National Policy and Disaster Management - Institutional Framework for Disaster Management in India - Role of NGOs in Disaster Risk Reduction - Role of Armed Forces during Disasters		
UNIT-V	**DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD WORKS**	**9 Hours**
Application of Information Technology, Remote Sensing Technology, and Geographic Information System in Disaster Risk Reduction - Case Studies on Landslide Hazard Zonation, Seismic Assessment of Buildings and Infrastructures, Drought Assessment, Coastal Flooding Assessment, Storm Surge Assessment, Fluvial and Pluvial Floods Assessment, Forest Fires Assessment		
		TOTAL: 45 Hours

TEXT BOOKS:

1.	Singhal J.P. "Disaster Management", Laxmi Publications, 2010.
2.	Tushar Bhattacharya, "Disaster Science and Management", McGraw Hill India Education Pvt. Ltd., 2012.
3.	Pardeep Sahni and Madhavi Malalgoda Ariyabandu, "Disaster Risk Reduction in South Asia", PHI Learning Private Limited, Delhi- 110092, 2017
4.	Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011
5.	Kapur Anu Vulnerable India: A Geographical Study of Disasters, IIAS and Sage Publishers, New Delhi, 2010.

REFERENCES:

1.	Govt. of India: Disaster Management Act, Government of India, New Delhi, 2005
2.	Government of India, National Disaster Management Policy,2009.

U19CS1003	INTERNET OF THINGS	3 0 0 3

PREAMBLE

The "Internet of Things" (IoT) is the network of physical objects or "things" embedded with sensors, actuators, software, electronics and network connectivity to enable it to achieve greater value and service by exchanging data between the physical world and computer systems over existing network infrastructure. By connecting everyday real world objects such as transports, buildings and industrial equipments, IoT guarantees to revolutionize how we live and work. In the year 2020, it is estimated that approximately 30 billion devices will be connected in IoT. IoT will drive new consumer and business behavior that will demand increasingly intelligent industry solutions. It can also help various industries like agriculture, health services, energy, security, disaster management etc., which need to automate solutions to problems faced through remotely connected devices.

The Internet of Things involves three distinct stages:

1. The sensors which collect data (including identification and addressing the sensor/device)

2. An application which collects and analyzes this data for further consolidation

3. Decision making and the transmission of data to the decision-making server. Analytical engines, actuators and Big data may be used for the decision making process.

After completing the course the students will attain the following,

- Ability to build real time IoT applications by interfacing the sensors with minimal programming.
- Ability to associate sensor networks and communication modules for building IoT systems.

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U19CS1003 INTERNET OF THINGS 3 0 0 3

COURSE OUTCOMES:

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

- Recall characteristics, physical and logical designs, domains.
- Differentiate IoT and M2M and explain IoT design methodology.
- Describe the various IoT components.
- Design a portable IoT system using Arduino/Raspberry Pi.
- Discuss the various applications of IoT.

UNIT I FUNDAMENTALS OF IOT **9**

Introduction-Definition and Characteristics of IoT- Physical design- IoT Protocols-Logical design - IoT communication models, Iot Communication APIs- Enabling technologies - Wireless Sensor Networks, Cloud Computing, Big data analytics, Communication protocols, Embedded Systems, IoT Levels and Templates - Domain specific IoTs.

UNIT II M2M AND IOT DESIGN METHODOLOGY **9**

IoT and M2M- difference between IoT and M2M - Software defined networks, network function virtualization– Needs- IoT design methodology

UNIT III IOT COMPONENTS **9**

Sensors and actuators - Communication modules - Zigbee- RFID-Wi-Fi-Power sources.

UNIT IV BUILDING IOT WITH HARDWARE PLATFORMS **9**

Platform - Arduino/Raspberry Pi- Physical devices - Interfaces - Programming - APIs/Packages

UNIT V CASE STUDY **9**

Various Real time applications of IoT- Home automation-Automatic lighting-Home intrusion detection- Cities-Smart parking-Environment-Weather monitoring system- Agriculture-Smart irrigation.

TOTAL: 45 PERIODS

TEXT BOOK:

1. Arshdeep Bahga, Vijay Madisetti, "Internet of Things-A hands-on approach", Universities Press, 2015.

REFERENCES:

1. Manoel Carlos Ramon, —Intel® Galileo and Intel® Galileo Gen 2: API Features and Arduino Projects for Linux Programmersl, Apress, 2014.

2. Marco Schwartz, —Internet of Things with the Arduino Yunl, Packt Publishing, 2014.

3. Adrian McEwen, Hakim Cassimally, "Designing the Internet of Things", Wiley Publications, 2012.

4. Olivier Hersent, David Boswarthick, Omar Elloumi, "The Internet of Things: Key applications and Protocols", Wiley Publications 2nd edition , 2013.

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U19CS1002 CLOUD COMPUTING 3 0 0 3

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	P09	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

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UNIT V Other Ways to Collaborate Online 9

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.

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U19EC1006 MOBILE TECHNOLOGY AND ITS APPLICATIONS 3 0 0 3

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 MTSO 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..

05/07/23
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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

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U19EC1007 CMOS VLSI DESIGN 3 0 0 3

Course Outcomes

After successful completion of this course, the students should be able to

1) Design HDL code for combinational circuits and sequential circuits
2) Analyze MOS transistor theory
3) Illustrate the fabrication processes of CMOS
4) Design combinational circuit design.
5) Architectural choices and performance tradeoffs involved in designing

Pre-requisite

Digital Electronics

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	2	2	1	2	3	1	3	3	1	1	2	1	3	3
CO2	1	2	2	2	2		2	3		1	2	1	3	3
CO3	2	2	3	3	2		2	2		2	1	1	3	3
CO4	2	2	2	3	2		2	3		2	2	1	3	3
CO5	1	2	3	3	2	1	3	2	1	2	1	2	3	3

Unit I VERILOG HDL 9

Overview of Digital Design with Verilog HDL – Hierarchical Modeling Concepts – Basic Concepts –Modules and Ports – Gate-Level Modeling – Dataflow Modeling – Behavioral Modeling – Test Benches

Unit II MOS TRANSISTOR THEORY 9

Introduction – MOS Transistors – CMOS Logic – Inverter – NAND gate – CMOS Logic Gates – Compound - MOS Transistor Theory – MOS Structure - nMOS and pMOS Transistor Operation –Long Channel V-I Characteristics – C-V Characteristics – Non-ideal I-V Effects

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Unit III **CMOS INVERTER AND ITS TECHNOLOGY** **9**

DC Transfer Characteristics CMOS Inverter – CMOS Technologies – nMOS Fabrication – n-well Process – SOI – Twin Well Process - Layout Design Rules – CMOS Process Enhancement - Stick Diagram – Inverter – CMOS NAND – CMOS NOR.

Unit IV **COMBINATIONAL CIRCUIT DESIGN** **9**

Static CMOS – Pseudo logic– Dynamic Circuits – Pass-Transistor Circuits – CMOS with Transmission Gates – Source of Power Dissipation.

Unit V **DESIGNING ARITHMETIC BUILDING BLOCKS AND FPGA** **9**

Data path circuits, architectures for ripple carry adders (RCA), high speed adders, carry look ahead adder (CLA), Accumulators, Multipliers, Barrel shifters – Introduction to FPGA - FPGA Architecture – FPGA implementation

TOTAL : 45 HOURS

Text Book

1) Neil H. E Weste and David Money Harris, "CMOS VLSI Design a circuits and systems perspective", 4th Edition, Pearson, 2015..
2) Ciletti, "Advanced Digital Design with the Verilog HDL, 2nd Edition ", Pearson Education, Second Edition, 2011

References

1) Jan M. Rabaey, Anantha Chandrakasan ,Borivoje Nikolic, "Digital Integrated Circuits a design perspective", Pearson Education, 2nd edition, 2016
2) Charles H. Roth, Jr., Lizy Kurian John,"Digital System Design using VHDL", Cengage, 3rd edition, 2018
3) Pucknell D.A and Eshraghian K., "Basic VLSI Design", Third Edition, PHI, 2003.

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PREAMBLE
TO
RENEWABLE ENERGY SYSTEMS

Energy is an important source of all technological developments as well as for all basic needs. The usage of renewable energy sources are the only way for sustainable development and future energy requirements. Renewable energy encourages the generation of electricity without any environmental impact and improves the economic growth of the country.

By choosing this elective the students will be able to know the importance of renewable energy sources for power generation. And also they could understand how the fossil fuels are made an impact on environmental issues. They will be familiar with the following

1. Concept of solar energy power production and solar photovoltaic cells and the application of solar PV system and Bio Mass power generation system.
2. Principle of conversion of wind energy in to electric energy
3. Working of geothermal and hydro power stations.
4. Principle of the conversion of tidal and wave energy in to electric energy.
5. The emerging technology of power generation.

After completion of this subject students will know how the energy can be produced locally. This knowledge would provide an opportunity to install small capacity power generation units independently for their needs.

S. Padma 15.7.23
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U19EE1004 **RENEWABLE ENERGY SYSTEMS** **3 0 0 3**

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	P09	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 energy utilization – Energy plantation- Renewable energy resources and their importance-Prospects of Renewable energy sources.

UNIT II SOLAR ENERGY 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 distribution and 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 GEO THERMAL, 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.

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UNIT V EMERGING ENERGY SYSTEMS 9

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", KhannaPublishers,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. Mukund R.Patel, "Wind and Solar Power Systems", CRC Press LLC.

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PREAMBLE
TO
Innovation, IPR and Entrepreneurship Development

The open elective course syllabus has been framed by Entrepreneurship Development Cell of Sona College of Technology on above mentioned title for even semester. The course covers a wide range of topics from Innovation, Intellectual Property Right and entrepreneurial Competitiveness and competency, basic requirements of setting of an enterprise/startups, factors influencing entrepreneurship, Barriers to Entrepreneurship & Concepts, Issues of Entrepreneurship Failure, Idea selection, Innovation & creativity, design thinking.

The course also covers identifying and selecting a good business opportunity, market survey & research, techno-economic feasibility assessment and preparation of preliminary project reports, management of working capital, costing, break even analysis, taxation, income tax, GST, provision of incentives, subsidies & concessions, entrepreneurship finance and angels & ventures capital fund etc. Benefit out of Government policies to small scale industries and business incubators.

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U19EE1003 INNOVATION, IPR AND ENTREPRENEURSHIP DEVELOPMENT 3 0 0 3

COURSE OUTCOMES

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

- Acquire the knowledge for establishment of an enterprise and management,
- Derive the innovative ideas, right approach to the problem and arrive solution for problem with IPR and its legal aspects.
- Prepare the project report preparation and assessment of Business.
- Acquire the knowledge on costing, Techno-economic aspects, find out the sources of finance and opportunities in business.
- 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	P09	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.

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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, "Entreprenuership – 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, "Enterprenuership 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.

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U19FT1001 FUNDAMENTALS OF FASHION DESIGN 3 0 0 3

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	P09	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**

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

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Sona College of Technology
Salem - 636 005. Tamil Nadu

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.

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.

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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 sprine 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.

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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

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U19GE701 PROFESSIONAL ETHICS AND HUMAN VALUES 3 0 0 3

COURSE OUTCOMES:

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

- Identify the core values that shape the ethical behavior of an engineer.
- Analyze and practice engineering ethics in their profession.
- Apply codes of ethics in the context of social experimentation.
- Explore various safety issues and ethical responsibilities of an engineer.
- Adopt ethical practices pertaining to global issues.

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

UNIT-I HUMAN VALUES **9**

Morals, Values and Ethics – Integrity – Work Ethics – Service Learning – Civic Virtue – Respect for Others – Living Peacefully – Caring – Sharing – Honesty – Courage – Valuing Time – Co-operation – Commitment – Empathy – Self-Confidence – Character – Introduction to Yoga and meditation for professional excellence and stress management.

UNIT -II ENGINEERING ETHICS **9**

Senses of Engineering Ethics – Variety of moral issues – Types of inquiry – Moral Dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Profession and Professionalism – Professional Ideals and Virtues –Theories of Right action- Self Interest- Customs and Religion-Uses of Ethical Theories.

UNIT-III ENGINEERING AS SOCIAL EXPERIMENTATION **9**

Engineering as Experimentation – Contrasts with standard experiments- Engineers as Responsible Experimenters – Importance and limitations of Codes of Ethics - Industrial Standards - A Balanced Outlook on Law – Industrial Standards- Case Study: Space shuttle challenger disaster.

UNIT-IV SAFETY, RESPONSIBILITIES AND RIGHTS **9**

Safety and Risk – Types of risk - Assessment of Safety and Risk – Risk Benefit analysis-Reducing Risk – Case Studies - Chernobyl and Bhopal plant disaster.

Collegiality and Loyalty –Respect for Authority- Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Importance and consequences of whistle blowing - Professional Rights – Employee Rights – Intellectual Property Rights (IPR) and its components– Discrimination.

UNIT-V GLOBAL ISSUES **9**

Multinational Corporations – Environmental Ethics – Computer Ethics and Internet- Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership – Participation in professional societies- –Code of Conduct – Corporate Social Responsibility.

Lecture: 45, Tutorial: 0, TOTAL: 45 Hours

TEXT BOOKS

1. Mike Martin and Roland Schinzinger, "Ethics in Engineering", McGraw Hill, Indian Edition, Tenth reprint, 2017.
2. Professional Ethics and Human values- Sonaversity, Edition 2018.

REFERENCES

1. Charles D Fleddermann, "Engineering Ethics", Prentice Hall, New Mexico, 2012.
2. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2016.
3. Charles E Harris, Michael S Pritchard and Michael J Rabins, "Engineering Ethics – Concepts and Cases", Cengage Learning, 2009.
4. R.Subramanian, "Professional Ethics ",Oxford University Press , Second Edition, 2017.

5/7/2022

Member Secretary-Academic Council
SONA COLLEGE OF TECHNOLOGY
SALEM - 636 005.

MCT
VIII

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

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit	Total Contact Hours
Practical							
1	U19MC801	Project Work	0	0	24	12	360
					Total Credits	**12**	**360**

Approved By

Chairperson, Mechatronics Engineering BoS	**Member Secretary, Academic Council**	**Chairperson, Academic Council & Principal**
Dr.P.Suresh	**Dr.R.Shivakumar**	**Dr.S.R.R.Senthil Kumar**

Copy to:-

HOD/ Mechatronics Engineering, Eighth Semester BE MCT Students and Staff, COE