SONA COLLEGE OF TECHNOLOGY, SALEM-5

(An Autonomous Institution)

B.E-Mechatronics Engineering

CURRICULUM and SYLLABI

[For students admitted in 2019-2020]

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
(An Autonomous Institution)
Courses of Study for B.E/B.Tech. Semester II under Regulations 2019 (CBCS)
Branch: Mechatronics Engineering

S.No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit	Category
		Theory					
1	U19ENG201B	English for Engineers-II	1	0	2	2	HS
2	U19MAT202A	Differential equations and vector calculus	3	1	0	4	BS
3	U19PHY203F	Physics for electron devices	3	0	0	3	BS
4	U19CHE204E	Modern materials	3	0	0	3	BS
5	U19MCT201	Engineering Mechanics	3	0	0	3	ES
6	U19MCT202	Basic Electrical Engineering	3	0	0	3	ES
		Practical					
7	U19WPL212	Workshop Practice	0	0	2	1	ES
8	U19MCT203	Basic Electrical Engineering and Devices Laboratory	0	0	4	2	ES
9	U19GE201	Basic aptitude-II	0	0	2	0	EEC
					Total Credits	21	
		Optional Language Elective*					
10	U19OLE1201	French	0	0	2	1	HS
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 under Regulations 2019
Branch: Mechatronics Engineering

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

Approved By

Chairman, Fashion Technology 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, 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 under Regulations 2019
Branch: Mechatronics Engineering

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit
Theory						
1	U19MAT401B	Probability and Statistical Methods	3	1	0	4
2	U19MC401	Fluid Power Systems	3	0	0	3
3	U19MC402	Thermodynamics and Heat Transfer	3	0	0	3
4	U19MC403	Microprocessors and Microcontroller	3	0	0	3
5	U19MC901	**Professional Elective:** Sensors and Instrumentation	3	0	2	4
6	U19GE402	**Mandatory Course:** Environment and Climate science	2	0	0	0
Practical						
7	U19MC404	Fluid Power Systems Laboratory	0	0	4	2
8	U19MC405	Microprocessor and Microcontroller Laboratory	0	0	4	2
9	U19GE401	Soft Skill and Aptitude – II	0	0	2	1
					Total Credits	**22**

Approved By

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Chairperson, Academic Council & Principal
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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 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	noc21-ee67	**Elective-** (NPTEL course) Control Engineering	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 Skill 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	U19MC903	**Elective-** Embedded Systems and Internet of Things	3	0	0	3	45
	U19MC906	**Elective-** Drone Technology					
5	U19MC904	**Elective-** Electric and Hybrid Vehicles	3	0	0	3	45
	U19MC905	**Elective-** Digital Manufacturing					
	U19MC907	**Elective-** Design Thinking and Product Innovation					
Open Elective							
6	U19CE1003	Energy Efficiency and Green Building	3	0	0	3	45
	U19CS1001	Big Data Analytics					
	U19CS1002	Cloud Computing					
	U19CS1004	Mobile Application Development					
	U19CS1006	Data Science					
	U19EC1006	Mobile Technology and Its Applications					
	U19EE1001	Electric Mobility					
	U19EE1004	Renewable Energy Systems					
	U19IT1001	Problem Solving Techniques Using Java Programming					

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**	

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

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	U19MC908	**Professional Elective -** Virtual Instrumentation		3	0	0	3	45
5	U19MC909	**Professional Elective** - Agriculture Automation		3	0	0	3	45
6	U19CE1004	**Open Elective**	Disaster Management	3	0	0	3	45
	U19CS1001		Big Data Analytics					
	U19CS1002		Cloud Computing					
	U19CS1004		Mobile Application Development					
	U19EC1001		Biomedical Instrumentation and Measurements					
	U19EE1002		Energy Conservation and Management					
	U19EE1003		Innovation, IPR and Entrepreneurship Development					
	U19EE1004		Renewable Energy Systems					
	U19EE1005		Electrification in Building Construction					

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**	

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Dr.R.Shivakumar

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

Copy to: -

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

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**	

Approved By

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Dr.P.Suresh

Member Secretary, Academic Council
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Chairperson, Academic Council & Principal
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Copy to:-

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.

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Copy to:-
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 II under Regulations 2019 (CBCS)
Branch: Mechatronics Engineering

S.No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit	Category
		Theory					
1	U19ENG201B	English for Engineers-II	1	0	2	2	HS
2	U19MAT202A	Differential equations and vector calculus	3	1	0	4	BS
3	U19PHY203F	Physics for electron devices	3	0	0	3	BS
4	U19CHE204E	Modern materials	3	0	0	3	BS
5	U19MCT201	Engineering Mechanics	3	0	0	3	ES
6	U19MCT202	Basic Electrical Engineering	3	0	0	3	ES
		Practical					
7	U19WPL212	Workshop Practice	0	0	2	1	ES
8	U19MCT203	Basic Electrical Engineering and Devices Laboratory	0	0	4	2	ES
9	U19GE201	Basic aptitude-II	0	0	2	0	EEC
					Total Credits	21	
		Optional Language Elective*					
10	U19OLE1201	French	0	0	2	1	HS
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, Second Semester BE MCT Students and Staff, COE

U19ENG201B - ENGLISH FOR ENGINEERS – II

L	T	P	C
1	0	2	2

Course Outcome: At the end of the 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.

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
- Short reading passages for sentence matching exercises, picking out specific information in a short text

TOTAL: 30 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.

TEXT BOOK

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

EXTENSIVE READING

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

REFERENCES

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.

U19MAT202A - DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS

L	T	P	C
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.

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.

TOTAL: 60 Hours

TEXTBOOKS

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.

REFERENCES

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.

U19PHY203F - PHYSICS FOR ELECTRON DEVICES

L	T	P	C
3	0	0	3

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

1. differentiate the electrical and thermal conductivity of metals.
2. elucidate the classification and theory of semiconducting materials.
3. discuss the applications of diode as rectifier, photodiode, LED and solar cell.
4. elucidate the application of bipolar transistor as amplifier
5. evaluate the novel properties of metallic glasses, shape memory alloys and nanomaterials.

UNIT I – 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 II – 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 III – 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 IV –- 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 V – 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.

TOTAL: 45 Hours

TEXT BOOKS

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).

U19CHE204E – MODERN MATERIALS

L	T	P	C
3	0	0	3

Course Outcomes: At the end of the course, the students 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.

UNIT I – POLYMER CHEMISTRY 9

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 9

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 9

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 9

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 9

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.

REFERENCES

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

1. analyse the forces in statically determinate structures using scalar and vector analytical techniques.
2. examine the condition for equilibrium of rigid body using free body diagram.
3. evaluate the effect of friction of bodies under equilibrium condition.
4. determine the centroid, moment of inertia and polar moment of inertia of simple and composite sections.
5. analyse the motion of a body with force and without force causing the motion.

UNIT I – BASICS & STATICS OF PARTICLES **9**

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 II – EQUILIBRIUM OF RIGID BODIES IN 2 DIMENSIONS **9**

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 III – FRICTION **9**

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

UNIT IV – PROPERTIES OF SURFACES AND SOLIDS **9**

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 V – DYNAMICS OF PARTICLES **9**

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.

TOTAL: 45 Hours

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

1. evaluate the behaviour of circuit elements in electric circuits.
2. explain the principles of operation of magnetics circuits and transformers
3. outline the construction and working principles of DC machines and synchronous machines.
4. evaluate the electromagnetic energy conversion and operating principle of three phase induction motors.
5. explain the principles of operations of single phase induction and stepper motors.

UNIT I – FUNDAMENTAL LAWS OF ELECTRICAL ENGINEERING AND CIRCUIT ELEMENTS 9

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

UNIT II – MAGNETIC CIRCUITS AND TRANSFORMERS 9

Ampere's Law – Basic Definition: Flux, Flux Density, Field Strength, Permeability, Reluctance, Permeance – Theory of Magnetism –Hysteresis and Eddy-Current Losses - Magnetic Circuits -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

DC Machines - DC Generator-construction–working principle- EMF equation -Types of DC Generators, DC motor-working principle –Types of DC Motors - 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

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

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

TOTAL: 45 Hours

TEXT BOOKS

1. B.L. Theraja and A. K. Theraja, “A Text Book of Electrical Technology”, S.Chand Publication, Vol 2, 2014.
2. 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	1	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- Practice

Making of Dust Pan and Funnel.

SECTION 3: WELDING

Tools and Equipment's – Practice

Arc welding of Butt joint and Lap Joint.

SECTION 4: CARPENTRY

Tools and Equipment's- Planning Practice

Making of Half Lap joint and Dovetail Joint.

TOTAL: 30 Hours

U19MCT203 - BASIC ELECTRICAL ENGINEERING AND DEVICES LABORATORY

L	T	P	C
0	0	4	2

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

1. understand the usage of common electrical measuring instruments and basic characteristics of transformers and electrical machines.
2. evaluate the characteristics of semiconductor devices.
3. interpret the solutions for real time applications of electrical machines and semiconductor devices.

List of Experiments

1. Measuring the steady-state and transient time-response of R-L, R-C, and RLC series 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 V - I Characteristics of PN diode
10. Verify the V - I Characteristics of Zener diode
11. Verify the V - I Characteristics of SCR.
12. Verify the V - I Characteristics of MOSFET.

TOTAL: 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 logical reasoning.

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

List of Experiments

1. QUANTITATIVE APTITUDE AND LOGICAL REASONING

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

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

2. VERBAL APTITUDE

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

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

TOTAL: 24 Hours

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

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

Approved By

Chairman, Fashion Technology 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, 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.

20.05.2020

B.E. / B.Tech. Regulations 2019

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

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit
Theory						
1	U19MAT401B	Probability and Statistical Methods	3	1	0	4
2	U19MC401	Fluid Power Systems	3	0	0	3
3	U19MC402	Thermodynamics and Heat Transfer	3	0	0	3
4	U19MC403	Microprocessors and Microcontroller	3	0	0	3
5	U19MC901	**Professional Elective:** Sensors and Instrumentation	3	0	2	4
6	U19GE402	**Mandatory Course:** Environment and Climate science	2	0	0	0
Practical						
7	U19MC404	Fluid Power Systems Laboratory	0	0	4	2
8	U19MC405	Microprocessor and Microcontroller Laboratory	0	0	4	2
9	U19GE401	Soft Skill and Aptitude – II	0	0	2	1
					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	PSO 1	PSO 2
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 (6) Internal test II (6) Internal test III (6) Assignment (5)	Seminar (5) Moodle (7) 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 like-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	PSO 1	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 (6) Internal test II (6) Internal test III (6) Assignment (5)	Seminar/ Assignment (5) Moodle test (7) Attendance (5) End semester Examination (60)	Course end survey

UNIT I LAWS OF THERMODYNAMICS **9 Hours**

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

UNIT II 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 III 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 IV CONVECTION **9 Hours**

Boundary Layer Concept -Heat Transfer Coefficient - Types of Convection - Forced Convection - External Flow and Internal Flow - Flow over Plates, Cylinders and Spheres-internal flow Introduction to free convection.

UNIT V RADIATION **9 Hours**

Laws of Radiation - Stefan Boltzmann Law, Kirchhoff's Law -Black Body Radiation- Radiation shield-radiation between surfaces.

Theory: 45 Hrs	Tutorial: --	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	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 (6) Internal test II (6) Internal test III (6) Assignment (5)	Seminar (5) Moodle (7) 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: -**	**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.		

U19MC901	Professional Elective-1 SENSORS 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:	Understand the units and standards, their conversions, characteristics and error analysis of measurement systems.
CO2:	Describe the different sensors available in mechanical measurements
CO3:	Classify the different types signal conditioning systems.
CO4:	Design a signal conditioning circuit and data acquisition system
CO5:	Develop the virtual instrumentation systems.

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	PO7	PO8	P09	PO10	PO11	PO 12	PSO 1	PSO 2
CO1	3		3	2			2			2			3	2
CO2	3		3	2			2			2			3	2
CO3	3		3	2			2			2			3	2
CO4	3		3	2			2			2			3	2
CO5	3		3	2			2			2			3	2

Course Assessment methods

Direct		Indirect
Internal test I (6) Internal test II (6) Internal test III (6) Assignment (5)	Seminar (5) Moodle (7) Attendance (5) End semester Examination (60)	Course end survey

Unit 01: GENERAL CONCEPTS OF MEASUREMENT	**09 +06 Hours**

Generalized Measurement System – Performance Characteristics – Static and Dynamic Characteristics – Errors in Measurements – Generalized Performance of Zero Order, First Order and Second Order Systems – Classifications of Transducers

Unit 02: SENSORS	**09 +06 Hours**

Introduction -Sensor Characteristics - Fundamentals of Time and Frequency- Linear and Rotational Sensors-Acceleration Sensors-Force Measurement-Torque and Power Measurement-Flow Measurement-Temperature Measurements-Distance Measuring and Proximity Sensors-Light sensor.

Unit 03: **SIGNALCONDITIONING**	**09 +06 Hours**

Instrumentation amplifier characteristics, OP-Amp- characteristics- OP-Amp circuits used in instrumentation- A/D and D/A conversion, Clipper and clamper, Frequency to voltage, voltage to frequency Conversion concept and methods.

Unit 04: **DATA ACQUISITION**	**09 +06 Hours**
Real-time interfacing – Introduction - Elements of data acquisition and control - Overview of I/O process, Data Acquisition Conversion-General configuration-single channel and multichannel data acquisition – Data conversion – Introduction to Digital Transmission system.	
Unit 05 VIRTUAL INSTRUMENTATION	**09 +06 Hours**
Block diagram and architecture of the virtual instrumentation - VIs and sub VIs, loops and charts, arrays, clusters and graphs, case and sequence structures, formula nodes, local and global variables, string and file I/O.	

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

Text Books

1. John G. Webster, "Measurement, Instrumentation, and Sensors Handbook", CRC Press. 2014.
2. Brian Morriss, "Automated Manufacturing Systems - Actuators, Controls, Sensors and Robotics", McGraw Hill International Edition, 1995.

REFERENCES

1. Sawney A K and Puneet Sawney, "Measurements and Instrumentation and control", 12th edition, Dhanpat Rai and Co, New Delhi, 2013.
2. Patranabis, D, "Sensors and Transducers", Wheeler Publishing Co, Ltd., New Delhi, 2003.
3. Holeman . J, "Experimental Methods for Engineers", Mc Graw Hill, 10th Edition, 2010.
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)													
	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	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
Mean of 1st half of Experiment (10) Quiz on 1st half (5) Internal test I (10) Mean of 2nd half of Experiment (10)	Quiz on 2nd half (5) Internal test II (10) 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 using 8085 Microprocessor instructions.
CO2:	Write an assembly language program to interface various devices using 8085 instructions.
CO3:	Write an assembly language program to perform some basic arithmetic operations using 8086 Microprocessor instructions.

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	PO10	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
Mean of 1st half of Experiment (10) Quiz on 1st half (5) Internal test I (10) Mean of 2nd half of Experiment (10)	Quiz on 2nd half (5) Internal test II (10) RTPS (10) End semester Examination (40)	Course end survey

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

U19MAT401B PROBABILITY AND STATISTICAL METHODS 3 1 0 4

COURSE OUTCOMES

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

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

UNIT – I BASIC STATISTICS 12

Measures of central tendency (simple arithmetic mean, median, mode) – quartile's – measures of dispersion (range, inter-quartile range, quartile deviation, mean deviation, standard deviation, coefficient of variation) – simple correlation – curve fitting (straight line and parabola).

UNIT – II RANDOM VARIABLES 12

Discrete and continuous random variables – probability mass function, probability density function, moments, moment generating function and their properties.

UNIT – III THEORETICAL DISTRIBUTIONS 12

Binomial, Poisson, geometric, uniform, exponential and normal distributions and their properties – applications.

UNIT – IV TWO DIMENSIONAL RANDOM VARIABLES 12

Joint distributions, marginal and conditional distributions – covariance – correlation – central limit theorem.

UNIT – V TESTING OF HYPOTHESIS 12

Sampling distributions – testing of hypothesis for proportion, mean, standard deviation and differences using normal distribution– t-test for single mean and difference between means - χ^2- tests for independence of attributes and goodness of fit and F-test for equality of two variances.

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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

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. h. 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

Department of Placement 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 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	noc21-ee67	**Elective-** (NPTEL course) Control Engineering	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 Skill and Aptitude – III	0	0	2	1	30
					Total Credits	**21**	

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, 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)													
	PO 1	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. Sensors and Instrumentation
2. 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	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.

noc21-ee67	CONTROL ENGINEERING	L	T	P	C
		3	0	0	3

Course Outline :

This course shall introduce the fundamentals of modeling and control of linear time invariant systems; primarily from the classical viewpoint of Laplace transforms and a brief emphasis on the state space formulation as well. The course will be useful for students from major streams of engineering to build foundations of time/frequency analysis of systems as well as the feedback control of such systems. The 11th module of the course will cover a detailed application of filter design in the field of navigation and human movement (gait). Students will be able to design their very own basic navigational system using inertial sensors and microcontrollers. Any industry into Industrial Automation

Intended audience :

Undergraduate students taking course on Control Engineering

Pre requisites : Network and Circuits,
Basic Engineering Mathematics.

Course layout:

Week 1: Mathematical Modelling of Systems

Week 2: Laplace Transforms, transfer functions, block diagram representation.

Week 3: Block diagram reduction, Time response characteristics.

Week 4: Introduction to stability, Routh Hurwitz stability criterion.

Week 5: Root locus plots, stability margins.

Week 6: Frequency response analysis: Nyquist stability criterion, Bode plots and stability margins in frequency domain.

Week 7: Basics of control design, the proportional, derivative and integral actions.

Week 8: Design using Root Locus

Week 9: Design using Bode plots

Week 10: Effects of zeros, minimum and non-minimum phase systems.

Week 11: State space analysis

Week 12: Design using State space

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

Text Books	
1.	Control Systems Engineering, Norman S. Nise, Wiley, 6th edition.
2.	Modern Control Engineering, Katsuhiko Ogata, Pearson Education Inc.

References Books	
1.	Modern Control Systems, Richard C. Dorf, Robert H. Bishop, 12th Edition
2.	Automatic Control Systems, Farid Golnaraghi and Benjamin C Kuo, 9th Edition, John Wiley and Sons
3.	Feedback Systems: An Introduction for Scientists and Engineers, by Karl Astrom and Richard
4.	M.Murray.(http://www.cds.caltech.edu/~murray/books/AM05/pdf/am08 complete_22Feb09.pdf)
5.	MATLAB Tutorials

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
CO 1	3	3	2	2			2			2			3	2
CO 2	3	2	3	2			2			2			3	2
CO 3	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) Real Time Problem Solving (10) End semester Examination (40)	Course end survey

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

B-E-V Sem
2019-Batch

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. Demonstrate greater than SSA-II level of verbal aptitude skills in English with regard to given topics and score 70-75% marks in company-specific internal tests

1.SOFT SKILLS

Demonstrating soft-skill capabilities with reference to the following topics:

a. **Career planning:** Importance; Exploring various career options, Field research, Social media management; Process, benefits and limitations of career planning; Mapping SWOT and GOALS to career planning; Self-evaluation

b. **Resume writing :** Build credentials and resume, Positioning yourself and your career, JD mapping, Video resume, Relevant resume phrases and components; Cover letter; Portfolio management and Social media cover

c. **Group discussion :** Skills needed for GD; Frequently Asked topics and Practice; Types of topics; Various framework and tools to handle GD; Practice and assessment

d. **Teamwork :** Definition and importance of team-building; Stages of team-building; Communication within a team; Various styles of teams and their analysis; Activities demonstrating a team

e. **Leadership skills :** Role of a leader; Difference between a manager and a leader; Various Leadership styles; Compelling qualities of a leader; Famous leaders and their impact to the world; Self-assessment

f. **Interview skills :** Process and types of interview; Appearance and grooming etiquette; Do's and Don'ts (Before – During interview); Brainstorming interview possible questions; Hot seat; Transactional Analysis for effective communication and handling interviewers; mock interviews and assessment parameters discussion

g. **Mock interviews :** Frequently Asked Questions practice and assessment; Discussion and demonstrations on Stress and Technical interviews; Group interview

h. **Mock GDs :** Frequently Asked Topics Practice; Assessment and feedback

2.QUANTITATIVE APTITUDE AND LOGICAL REASONING	**Solving problems with reference to the following topics :** a. **Geometry:** 2D, 3D, Coordinate Geometry, and Height & Distance. b. **Permutation & Combinations :** Principles of counting, Circular Arrangements and Derangements. c. **Probability:** Addition & Multiplication Theorems, Conditional Probability and Bayes Theorem. d. **Statistics :** Mean Median, Mode, Range and Standard Deviation. e. **Interest Calculation :**Simple Interest and Compound Interest f. **Crypto arithmetic:** Addition and Multiplication based problem. g. **Logical Reasoning :**Blood Relations, Directions Test, Series, Odd man out, Analogy, Coding & Decoding, Problems and Input – Output Reasoning. h. Statement & Assumptions, Statements & Arguments, Inference. i. **Company Specific Pattern :**Infosys and TCS company specific problems
3. VERBAL APTITUDE	**Demonstrating English language skills with reference to the following topics:** a. Subject verb agreement b. Selecting the best alternative for the stated parts of given sentences c. Reading comprehension d. Contextual synonyms e. Sentence fillers f. Writing a story for a given picture g. Company specific aptitude questions

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	U19MC903	**Elective-** Embedded Systems and Internet of Things	3	0	0	3	45
	U19MC906	**Elective-** Drone Technology					
5	U19MC904	**Elective-** Electric and Hybrid Vehicles	3	0	0	3	45
	U19MC905	**Elective-** Digital Manufacturing					
	U19MC907	**Elective-** Design Thinking and Product Innovation					
Open Elective							
6	U19CE1003	Energy Efficiency and Green Building	3	0	0	3	45
	U19CS1001	Big Data Analytics					
	U19CS1002	Cloud Computing					
	U19CS1004	Mobile Application Development					
	U19CS1006	Data Science					
	U19EC1006	Mobile Technology and Its Applications					
	U19EE1001	Electric Mobility					
	U19EE1004	Renewable Energy Systems					
	U19IT1001	Problem Solving Techniques Using Java Programming					

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
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, 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	PO2	PO3	PO4	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	PO2	PO3	PO4	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.

U19MC903	Elective: EMBEDDED SYSTEMS AND INTERNET OF THINGS	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 embedded system hardware capabilities and embedded design process.
CO2:	Select the communication devices and Buses for real time embedded design.
CO3:	Illustrate the concepts of real time operating systems.
CO4:	Outline the basic architecture of Internet of Things.
CO5:	Develop the real time IOT applications through programming.

Pre-requisite

1. Digital Electronics
2. Microprocessors and Microcontroller

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	3	2
CO2	3	2	2			2	2					2	3	2
CO3	3	2	2		2	2	3					2	3	2
CO4	3	2	2		2	2	3					2	3	3
CO5	3	3	2		2	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: EMBEDDED SYSTEMS — **9 Hours**

Introduction to embedded systems – Hardware and software components – Classifications – Characteristics – Embedded system on chip – Design process in embedded system – Challenges in embedded computing system design

Unit 02: COMMUNICATION DEVICES AND BUSES — **9 Hours**

Serial and parallel communication devices – Wireless devices – Timer and Counting devices – Distributed network embedded systems – Serial communication using I^2C, CAN and USB buses – Parallel communication using ISA, PCI and PCI/X buses-Wireless and mobile system protocol.

Unit 03: REAL TIME OPERATING SYSTEMS	9 Hours
Multiple processes – Multiple threads – Tasks and Thread states – Inter process communication and synchronisation – Signals – Concept of Semaphores – Queues and Mailboxes – Shared data problem.	
Unit 04: IOT ARCHITECTURES	**9 Hours**
Introduction and features of IOT – Physical design – Logical design – IOT enabled technology – simplified IoT Architecture – Core IoT functional Stack – Architecture for IoT using mobile technologies – Mobile technologies for supporting IoT ecosystem	
Unit 05: IOT PROGRAMMING AND DATA ANALYTICS	**9 Hours**
Raspberry Pi board – Raspberry Pi interfaces – Programming Raspberry Pi with Python – Developing code for writing to actuators, blinking Led, reading from sensors – Data standards – IoT information Security and challenges – Data analytics for IoT : Role of machine learning – Big Data analytics tools and technology	

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

TEXT BOOKS

1.	Rajkamal, "Embedded system-Architecture, Programming and Design", Third edition Tata McGraw-Hill, 2015.
2.	Arshdeep Bahga, Vijay Madisetti , "Internet of Things: A Hands-on Approach", Universities press, 2014.
3.	Frank Vahid, "Embedded System Design–A Unified Hardware & Software Introduction", Third Edition, Wiley Publishers, 2009.

REFERENCES

1.	Daniel W. Lewis, "Fundamentals of Embedded Software", First Edition, Prentice Hall of India, 2013.
2.	Wayne Wolf , "Computers as components: Principles of Embedded Computing System Design", Third Edition, Elsevier, 2013.
3.	David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton, Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things", Cisco Press, 2017.
4.	Pethuru Raj, Anupama C. Raman , "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC, 2017

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

Course Outcomes

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

CO1:	Explain the basic knowledge about the development and potential of UAV in professional activities
CO2:	Illustrate the features and characteristics of an Unmanned Aerial System
CO3:	Demonstrate the basic concepts and features of flight
CO4:	Utilize the drone equipment maintenance and repair
CO5:	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 method. Contemporary applications like military, government and civil areas – Operational considerations like liability / legal issues, Ethical implications LOS / BLOS.

Unit 02: UNMANNED AERIAL SYSTEM (UAS) COMPONENTS	9 Hours
Platforms – Configurations – Characteristics – Applications – Propulsion: Internal combustion engines, Turbine engines, Electric systems – On-board flight control – Payloads: Sensing/Surveillance, Weaponized UAS and delivery – 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 – Emergency identification and handling – Fixed wing operations: Types of fixed wing drones, Make, Parts, Terminology and Operation	
Unit 04: DRONE EQUIPMENT MAINTENANCE	**9 Hours**
Maintenance of drone: Flight control box – Maintenance of ground equipment – Batteries – Scheduled servicing – Repair of equipment – Fault finding and rectification –Weather and meteorology.	
Unit 05: REGULATORIES AND REGULATIONS	**9 Hours**
Homeland Regulatories: FCC, FAA and Foreign regulatory – Regulations: FCC compliance, UAS registration, Federal Aircraft Regulations (FARs) - Safety considerations	

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

TEXT BOOKS

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

REFERENCES

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

U19MC904	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	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.

U19MC907	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	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-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)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	P09	PO10	PO 11	PO12	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

Dr.S.Anita

Head/Training

Department of Placement Training

MCT

U19MC1001	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

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	U19MC908	**Professional Elective -** Virtual Instrumentation		3	0	0	3	45
5	U19MC909	**Professional Elective** - Agriculture Automation		3	0	0	3	45
6	U19CE1004	**Open Elective**	Disaster Management	3	0	0	3	45
	U19CS1001		Big Data Analytics					
	U19CS1002		Cloud Computing					
	U19CS1004		Mobile Application Development					
	U19EC1001		Biomedical Instrumentation and Measurements					
	U19EE1002		Energy Conservation and Management					
	U19EE1003		Innovation, IPR and Entrepreneurship Development					
	U19EE1004		Renewable Energy Systems					
	U19EE1005		Electrification in Building Construction					

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**	

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, 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)	Online 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.

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)	Online 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.

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)	Online 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.

U19MC908	Professional Elective VIRTUAL INSTRUMENTATION	L	T	P	C
		3	0	0	3

Course Outcomes

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

CO1:	Identify Virtual Instrument concepts.
CO2:	Create a Virtual Instrument using graphical programming.
CO3:	Develop systems for real-time signal acquisition and analysis.
CO4:	Apply concepts of network interface for data communication.
CO5:	Suggest solutions for automation and control applications using virtual instrumentation.

Pre-requisite

1. Problem solving using Python programming
2. 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	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: INTRODUCTION TO VIRTUAL INSTRUMENTATION	9 Hours
Historical perspective – advantages – Block diagram – Architecture of a Virtual Instrument – Data Flow Techniques – Graphical programming in data flow – comparison with Conventional programming.	
Unit 02: LABVIEW FUNTAMENTALS	**9 Hours**
Advantages of LabVIEW Software Environment – Creating and Saving VI – Controls and Indicators – Data types. Sub VI: Creating – Opening – Editing – Placing a Sub VI in a block – Creating a Stand Alone Application.	
Unit 03: PROGRAMMING TECHNIQUES	**9 Hours**
Loops and charts – arrays – clusters and graphs – case and sequence structures – formula nodes – local and global variables – string and file I/O.	
Unit 04: DATA ACQUISITION AND INSTRUMENT INTERFACES	**9 Hours**
Signals Handling and Classification – Signal Conditioning – Analog Interfacing (I/O) – Counters & Timers – Digital (I/O) – DAQ Hardware – DAQ Software Architecture – DAQ Assist. GPIB-RS232 – Handshaking – RS232/RS485 interfacing – VISA – IVI – PCMCIA – SCXI – VXI.	
Unit 05: APPLICATIONS	**9 Hours**
Motion Control - Virtual Instrumentation and CAD Tool, Remote Front Panel LabVIEW Applications, Timed Loop Applications Client – Server Applications – Case Studies.	

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

TEXT BOOKS

1.	Sumathi. S and Surekha. P, "LabVIEW Based Advanced Instrumentation Systems", 2nd edition, 2007.
2.	Jovitha Jerome, "Virtual Instrumentation using LabVIEW", PHI Learning Pvt. Ltd, New Delhi, 2010.

REFERENCES

1.	Lisa .K, Wells and Jeffrey Travis, "LABVIEW for Everyone", Prentice Hall, 2009.
2.	Skolkoff, "Basic concepts of LABVIEW 4", PHI, 1998.
3.	Gupta. S, Gupta. J.P, "PC Interfacing for Data Acquisition and Process Control", ISA, 1994.

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

CO6:	Explain the basic principle of smart agriculture
CO7:	Demonstrate various Sensors and actuators for farming tools
CO8:	Illustrate the Telemetry and Plant health monitoring used in Agriculture automation
CO9:	Construct the advanced technologies for smart farming
CO10:	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)	Online 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

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

19MC704	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 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 (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 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

MCT

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

CO6:	Understand the basic automation concepts
CO7:	Identify the components for automation
CO8:	Know the home and smart city automation concepts
CO9:	Apply the concepts of automation in agriculture
CO10:	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

CO11:	Understand the basic robotic concepts
CO12:	Select the suitable drive system for robot application
CO13:	Select the suitable sensors and grippers for the respective application
CO14:	Develop VAL Programming for simple applications
CO15:	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

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.

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.

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**	

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, Eighth Semester BE MCT Students and Staff, COE