

SCHEME OF EXAMINATION

and

SYLLABI

for

**Bachelor of Technology
Mechatronics**

Offered by

University School of Engineering and Technology

1st SEMESTER TO 8th SEMESTER



**Guru Gobind Singh Indraprastha University
Dwarka, Delhi – 110078 [INDIA]**

www.ipu.ac.in

**BACHELOR OF TECHNOLOGY
(COMMON TO ALL BRANCHES)
FIRST SEMESTER EXAMINATION**

Code No.	Paper ID	Paper	L	T/P	Credits	Status
THEORY PAPERS						
ETMA-101		Applied Mathematics-I	3	1	4	M
ETPH-103		Applied Physics-I	2	1	3	M
ETME-105		Manufacturing Processes	3	0	3	M
ETEE-107		Electrical Technology	3	0	3	M
ETHS-109		Human Values and Professional Ethics-I#	1	1	1	--
ETCS-111		Fundamentals of Computing	2	0	2	--
ETCH-113		Applied Chemistry	2	1	3	M
PRACTICAL/VIVA VOCE						
ETPH-151		Applied Physics Lab-I	-----	2	1	
ETEE-153		Electrical Technology Lab	-----	2	1	M
ETME-155		Workshop Practice	-----	3	2	M
ETME-157		Engineering Graphics Lab	-----	3	2	
ETCS-157		Fundamentals of Computing Lab	-----	2	1	--
ETCH-161		Applied Chemistry Lab	-----	2	1	--
		NCC/NSS*#	-----	-----	-----	--
TOTAL			16	18	27	

M: Mandatory for award of degree

#NUES (Non University Examination System)

*#NCC/NSS can be completed in any semester from Semester 1 – Semester 4. It will be evaluated internally by the respective institute. The credit for this will be given after fourth Semester for the students enrolled from the session 2014-15 onwards. The camps/classes will be held either during Weekends/Holidays or Winter/Summer Vacations.

**BACHELOR OF TECHNOLOGY
(COMMON TO ALL BRANCHES)
SECOND SEMESTER EXAMINATION**

Code No.	Paper ID	Paper	L	T/P	Credits	Status
THEORY PAPERS						
ETMA-102		Applied Mathematics-II	3	1	4	M
ETPH-104		Applied Physics-II	2	1	3	
ETEC-106		Electronic Devices	3	0	3	M
ETCS-108		Introduction to Programming	3	0	3	M
ETME-110		Engineering Mechanics	2	1	3	--
ETHS-112		Communication Skills	2	1	3	--
ETEN-114		Environmental Studies	2	1	3	--
PRACTICAL/VIVA VOCE						
ETPH-152		Applied Physics Lab-II	-----	2	1	
ETCS-154		Programming Lab	-----	2	1	M
ETEC-156		Electronic Devices Lab	-----	2	1	M
ETME-158		Engineering Mechanics Lab	-----	2	1	--
ETEN-160		Environmental Studies Lab	-----	2	1	--
		NCC/NSS*#	-----	-----	-----	--
TOTAL			17	15	27	

M: Mandatory for award of degree

#NUES (Non University Examination System)

*#NCC/NSS can be completed in any semester from Semester 1 – Semester 4. It will be evaluated internally by the respective institute. The credit for this will be given after fourth Semester for the students enrolled from the session 2014-15 onwards. The camps/classes will be held either during Weekends/Holidays or Winter/Summer Vacations.

**BACHELOR OF TECHNOLOGY
(MECHATRONICS)
THIRD SEMESTER EXAMINATION**

Code No.	Paper ID	Paper	L	T/P	Credits	Status
THEORY PAPERS						
ETEC-205		Switching Theory and Logic Design	3	1	4	M
ETMA-203		Numerical Analysis and Statistical Techniques	3	1	4	M
ETMT-205		Measurements and Instrumentation	3	0	3	
ETME-207		Material Science And Metallurgy	3	0	3	M
ETME-201		Fluid Mechanics	3	1	4	
ETTE-211		Mechanics of Solids	3	1	4	
PRACTICAL/VIVA VOCE						
ETEC-253		Switching Theory and Logic Design Lab	0	2	1	
ETMA-253		Numerical analysis and Statistical Techniques Lab	0	2	1	
ETMT-255		Measurements and Instrumentation Lab	0	2	1	
ETTE-257		Mechanics of Solids and Fluid Lab	0	2	1	
		NCC/NSS*	-	-	-	
TOTAL			18	12	26	

M: Mandatory for the award of degree.

#NUES (Non University Examination System)

*#NCC/NSS can be completed in any semester from Semester 1 – Semester 4. It will be evaluated internally by the respective institute. The credit for this will be given after fourth Semester for the students enrolled from the session 2014-15 onwards.

**BACHELOR OF TECHNOLOGY
(MECHATRONICS)
FOURTH SEMESTER EXAMINATION**

Code No.	Paper ID	Paper	L	T/P	Credits	Status
THEORY PAPERS						
ETMT-202		Organizational Behaviour	3	0	3	
ETMT-204		Kinematics and Dynamics of Machinery	3	1	4	M
ETMT-206		Signals and Systems	3	1	4	M
ETEE-212		Control Systems	3	1	4	M
ETTE-210		Thermal science	3	1	4	
ETMT-212		Hydraulics and Pneumatics	3	1	4	M
PRACTICAL/VIVA VOCE						
ETMT-252		Kinematics and Dynamics of Machinery Lab	0	2	1	
ETMT-254		Signals and Systems Lab	0	2	1	
ETEE-260		Control Systems Lab	0	2	1	
ETMT-258		Hydraulics and Pneumatics Lab	0	2	1	
ETSS-250		NCC/NSS*	-	-	1	
TOTAL			18	13	28	

M: Mandatory for the award of degree.

**NCC/NSS can be completed in any semester from Semester 1 – Semester 4. It will be evaluated internally by the respective institute. The credit for this will be given after fourth Semester for the students enrolled from the session 2014-15 onwards.*

NOTE: 4 weeks Industrial / In-house Workshop will be held after fourth semester. However, Viva-Voce will be conducted in the fifth semester (ETMT 361).

**BACHELOR OF TECHNOLOGY
(MECHATRONICS)
FIFTH SEMESTER EXAMINATION**

Code No.	Paper ID	Paper	L	T/P	Credits	Status
THEORY PAPERS						
ETHS-301		Communication Skills for Professionals	2	0	1	
ETMT-303		Machine Element Design.	3	1	4	M
ETMT-305		Metrology And Quality Control	3	1	4	
ETMT-307		Digital Signal Processing	3	1	4	M
ETMT-309		Sensors and Transducers	3	1	4	M
ETMT-311		Power Electronics and Drives	3	0	3	M
PRACTICAL/VIVA VOCE						
ETHS-351		Communication Skills for Professionals Lab	0	2	1	
ETMT-353		Metrology And Quality Control Lab	0	2	1	
ETMT-355		Digital Signal Processing Lab	0	2	1	
ETMT-357		Sensors and Transducers Lab	0	2	1	
ETMT-359		Power Electronics and Drives Lab	0	2	1	
ETMT-361		Industrial Training*#	-	-	1	
TOTAL			17	14	26	

M: Mandatory for the award of degree.

#NUES (Non University Examination System)

**Viva-Voce for evaluation of Industrial Training / In-house Workshop will be conducted in this semester.*

Note: Minimum of 2 weeks of In-house training related to Mechatronics will be held after 5th semester; however, viva-voce will be conducted in 6th Semester (ETMT 360).

**BACHELOR OF TECHNOLOGY
(MECHATRONICS)
SIXTH SEMESTER EXAMINATION**

Code No.	Paper ID	Paper	L	T/P	Credits	Status
THEORY PAPERS						
ETMT-302		Management of Manufacturing System	3	1	4	
ETMT-304		Manufacturing Technology	3	1	4	
ETMT-306		Programmable Logic Controller and SCADA	3	1	4	M
ETMT-308		Computer Integrated Manufacturing	3	1	4	M
ETMT-310		Automotive Electronics	3	1	4	
ETMT-312		Microprocessors and Microcontrollers	3	1	4	M
PRACTICAL/VIVA VOCE						
ETMT-352		Programmable Logic Controller and SCADA Lab	0	2	1	
ETMT-354		Computer Integrated Manufacturing Lab	0	2	1	
ETMT-356		Automotive Electronics Lab	0	2	1	
ETMT-358		Microprocessors and Microcontrollers Lab	0	2	1	
ETMT-360		In house Training/Industrial Training	0	0	1	
TOTAL			18	14	29	

M: Mandatory for award of degree

Note: Minimum of 4-6 weeks of industrial training related to ME will be held after 6th semester; however, viva-voce will be conducted in 7th Semester (ETMT 459).

Imp:- Elective Paper will be floated in 7th Semester, if one-third of the total students opt for the same. It is advised that the decision about the elective subject for 7th Semester is done before the 15th April every year before end of 6th semester.

**BACHELOR OF TECHNOLOGY
(MECHATRONICS)
SEVENTH SEMESTER EXAMINATION**

Code No.	Paper ID	Paper	L	T/P	Credits
THEORY PAPERS					
ETAT-401		Computer Aided Design	3	1	4
ETMT-403		Micro Electro Mechanical System and Nano-Technology	3	1	4
ETMT-405		Mechatronics System Design	3	0	3
ELECTIVE – I (CHOOSE ANY ONE)					
ETMT-407		IC Engines	3	0	3
ETMT-409		Digital Image Processing	3	0	3
ETMT-411		Product Design and Costing	3	0	3
ETME-413		Non-Conventional manufacturing processes	3	0	3
ETMT-415		Process Modelling and Optimization Technique	3	0	3
ETME-401		Automobile Engineering	3	0	3
ETCS 425		Database Management Systems	3	0	3
ELECTIVE – II (CHOOSE ANY ONE)					
ETCS-429		Artificial Intelligence	3	0	3
ETMT-421		Waste and Heat Recovery Systems	3	0	3
ETME-421		Management Information System and ERP	3	0	3
ETMT-425		Fuzzy Logic and Neural Networks	3	0	3
ETMT-427		Operations Research	3	0	3
ETMT-429		Decision Science	3	0	3
ETEE-419		Renewable Energy Resources	3	0	3
ETME-423		Finite Element Method	3	0	3
ETHS-419		Sociology and Elements of Indian History for Engineers	3	0	3
PRACTICAL/VIVA VOCE					
ETAT-451		CAD Lab	0	2	1
ETMT-453		Lab based on Elective – I or II	0	2	1
ETMT-457		Seminar (topic should be linked to industrial training/ Soft skills learnt) [#]	0	2	1
ETMT-459		Industrial Training	0	0	1
ETMT-461		Minor Project+	0	6	3
TOTAL			15	14	24

Imp:- Elective Paper will be floated if one-third of the total students opt for the same. It is advised that the decision about the elective subject for 8th Semester is done before the 15th November every year before end of seventh semester. New Electives may be added as per requirement after getting it duly approved by BOS and AC respectively.

+ The student will submit a synopsis at the beginning of the semester for approval from the departmental committee in a specified format, thereafter he/she will have to present the progress of the work through seminars and progress reports.

#NUES (Non University Examination System)

**BACHELOR OF TECHNOLOGY
(MECHATRONICS)
EIGHTH SEMESTER EXAMINATION**

Code No.	Paper ID	Paper	L	T/P	Credits
THEORY PAPERS					
ETMT-402		Robotics	3	1	4
ETMT-404		Embedded System	3	1	4
ETHS-402		Human Values and Professional Ethics-II	1	0	1
#ELECTIVE – III (CHOOSE ANY ONE)					
ETME-402		Engineering System Modelling and Simulation	3	0	3
ETMT-410		Facility and Layout Planning	3	0	3
ETCS-412		Object Oriented Software Engineering	3	0	3
ETMT-414		Factory Automation	3	0	3
ETMT-416		Refrigeration And Air Conditioning	3	0	3
ETIC-414		VLSI Design	3	0	3
ETEC-420		Data Communication and Networks	3	0	3
#ELECTIVE – IV (CHOOSE ANY ONE)					
ETEC-408		Consumer Electronics	3	0	3
ETTE-424		Supply Chain Management – Planning	3	0	3
ETMT-424		Intelligent and Smart Instrumentation	3	0	3
ETMT-426		Reliability and Maintenance Management	3	0	3
ETMT-428		Flexible Manufacturing System	3	0	3
ETMT-430		Engineering Economics and Cost Analysis	3	0	3
PRACTICAL/VIVA VOCE					
ETMT-452		Robotics Lab	0	2	1
ETMT-454		Embedded System Lab	0	2	1
ETMT-456		Lab based on Elective – III or IV	0	2	1
ETMT-458		Major Project*	0	12	8
TOTAL			13	20	26

*The student will submit a synopsis at the beginning of the semester for approval from the departmental committee in a specified format, thereafter he/she will have to present the progress of the work through seminars and progress reports. Seminar related to major project should be delivered one month after starting of Semester. The progress will be monitored through seminars and progress reports.

#Elective Paper will be floated if one-third of the total students opt for the same. It is advised that the decision about the elective subject is done before 15th November every year before end of seventh semester. New Electives may be added as per requirement after getting it duly approved by BOS and AC respectively.

NOTE:

1. The total number of the credits of (Mechtronics) Programme = 213.
2. Each student shall be required to appear for examinations in all courses. However, for the award of the degree a student shall be required to earn minimum of 200 credits including Mandatory papers (M).

FOR LATERAL ENTRY STUDENTS:

1. The total number of the credits of the B.Tech. (Mechtronics) Programme = 159.
2. Each student shall be required to appear for examinations in all courses Third Semester onwards. However, for the award of the degree a student shall be required to earn the minimum of 150 credits, including mandatory papers (M).

NOMENCLATURE OF CODES GIVEN IN THE SCHEME OF

Modified Scheme and Syllabus of B. Tech-Mechatronics (1st Semester to 8th Semester) implemented from Academic Session w.e.f. 2015-16, approved in the 23rd BOS and 40th AC meeting of USET.

B.TECH AND M.TECH

1. **ET** stands for Engineering and Technology.
2. **PE** stands for Power Engineering.
3. **ME** stands for Mechanical Engineering.
4. **MT** stands for Mechatronics.
5. **AT** stands for Mechanical and Automation Engineering.
6. **EE** stands for Electrical and Electronics Engineering.
7. **EL** stands for Electrical Engineering.
8. **IT** stands for Information Technology
9. **CS** stands for Computer Science and Engineering
10. **CE** stands for Civil Engineering
11. **EC** stands for Electronics and Communications Engineering.
12. **EN** stands for Environmental Engineering
13. **TE** stands for Tool Engineering
14. **MA** stands for Mathematics
15. **HS** stands for Humanities and Social Sciences
16. **SS** stands for Social Services

APPLIED MATHEMATICS-I

Paper Code : ETMA-101
Paper : Applied Mathematics-I

L	T	C
3	1	4

INSTRUCTIONS TO PAPER SETTERS:**MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

Objective: The objective of the paper is to facilitate the student with the basics of Applied Mathematics that are required for an engineering student.

UNIT- I

Successive differentiation: Leibnitz theorem for n^{th} derivative (without proof). Infinite series: Convergence and divergence of infinite series, positive terms infinite series, necessary condition, comparison test (Limit test), D'Alembert ratio test, Integral Test, Cauchy's root test, Raabe's test and Logarithmic test (without proof). Alternating series, Leibnitz test, conditional and absolutely convergence. Taylor's and Maclaurin's expansion (without proof) of function (e^x , $\log(1+x)$, $\cos x$, $\sin x$) with remainder terms, Taylor's and Maclaurin's series, Error and approximation.

[T1], [T2][No. of hrs. 12]

UNIT- II

Asymptotes to Cartesian curves. Radius of curvature and curve tracing for Cartesian, parametric and polar

curves. Integration: integration using reduction formula for $\int_0^{\pi} \sin^n \theta d\theta$, $\int_0^{\pi} \cos^n \theta d\theta$, $\int_0^{\pi} \sin^n \theta \cos^m \theta d\theta$. Application of integration : Area under the curve, length of the curve, volumes and surface area of solids of revolution about axis only. Gamma and Beta functions.

[T1],[T2][No. of hrs. 12]

UNIT- III

Matrices: Orthogonal matrix, Hermitian matrix, Skew-Hermitian matrix and Unitary matrix. Inverse of matrix by Gauss-Jordan Method (without proof). Rank of matrix by echelon and Normal (canonical) form. Linear dependence and linear independence of vectors. Consistency and inconsistency of linear system of homogeneous and non homogeneous equations. Eigen values and Eigen vectors. Properties of Eigen values (without proof). Cayley-Hamilton theorem (without proof). Diagonalization of matrix. Quadratic form, reduction of quadratic form to canonical form.

[T1], [T2][No. of hrs. 12]

UNIT-IV

Ordinary differential equations: First order linear differential equations, Leibnitz and Bernoulli's equation. Exact differential equations, Equations reducible to exact differential equations. Linear differential equation of higher order with constant coefficients, Homogeneous and non homogeneous differential equations reducible to linear differential equations with constant coefficients. Method of variation of parameters. Bessel's and Legendre's equations (without series solutions), Bessel's and Legendre's functions and their properties.

[T1],[T2][No. of hrs. 12]

Text:

[T1] B. S. Grewal, "Higher Engineering Mathematics" Khanna Publications.

[T2]. R. K. Jain and S.R.K. Iyengar, "Advanced Engineering Mathematics" Narosa Publications.

References:

[R1] E. kresyzig, "Advance Engineering Mathematics", Wiley publications

[R2] G.Hadley, "Linear Algebra" Narosa Publication

[R3] N.M. Kapoor, "A Text Book of Differential Equations", Pitambar publication.

[R4] Wylie R, "Advance Engineering mathematics", McGraw-Hill

[R5] Schaum's Outline on Linear Algebra, Tata McGraw-Hill

[R6] Polking and Arnold, "Ordinary Differential Equation using MatLab" Pearson.

APPLIED PHYSICS – I

Modified Scheme and Syllabus of B. Tech-Mechatronics (1st Semester to 8th Semester) implemented from Academic Session w.e.f. 2015-16, approved in the 23rd BOS and 40th AC meeting of USET.

Paper Code: ETPH – 103
Paper: Applied Physics – I

L	T	C
2	1	3

INSTRUCTIONS TO PAPER SETTERS:

MAXIMUM MARKS: 75

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

Objective: The objective of the paper is to facilitate the student with the basics of Applied Physics aspects that are required for his understanding of basic physics.

UNIT I

Interference: Introduction, Interference due to division of wave front: Fresnel's Biprism, Interference due to division of amplitude: wedge shaped film, Newton's rings.

Diffraction: Introduction, Difference between Fresnel and Fraunhofer diffraction, Single slit diffraction, Transmission diffraction grating, Absent spectra.

[T1], [T2](No. of Hrs. 8)

UNIT II

Polarization: Introduction, Uniaxial crystals, Double refraction, Nicol prism, Quarter and half wave plates, Theory of production of plane, circularly and elliptically polarized lights, Specific rotation, Laurents half shade polarimeter.

Laser: Spontaneous and stimulated emissions, Einstein's coefficients, Laser and its principle, He-Ne laser.

Fibre optics: Introduction, Single mode fibre, Step index and graded index multimode fibres, Acceptance angle and numerical aperture.

[T1], [T2](No. of Hrs. 8)

UNIT III

Theory of Relativity: Introduction, Frame of reference, Galilean transformation, Michelson-Morley experiment, Postulates of special theory of relativity, Lorentz transformations, Length contraction, Time dilation, Mass energy relation

Ultrasonics: Introduction, Production of ultrasonics by magnetostriction and Piezoelectric methods, Applications.

[T1], [T2](No. of Hrs. 8)

UNIT IV

Nuclear Physics: Introduction, Radioactivity, Alpha decay, Beta decay, Gamma decay, Q value, Threshold energy, Nuclear reactions, Nuclear fission: Liquid drop model, Nuclear fusion, Particle accelerators: Linear accelerator, Cyclotron, Radiation detectors: Ionization chamber, Geiger Mueller Counter.

[T1](No. of Hrs. 8)

Text Books:

- [T1]. Arthur Beiser, 'Concepts of Modern Physics', [McGraw-Hill], 6th Edition 2009
 [T2]. A. S. Vasudeva, 'Modern Engineering Physics', S. Chand, 6th Edition, 2013.

Reference Books

- [R1]. A. Ghatak 'Optics', TMH, 5th Edition, 2013
 [R2]. G. Aruldhas 'Engineering Physics' PHI 1st Edition, 2010.
 [R3]. Fundamentals of Optics : Jenkins and White , Latest Edition
 [R4]. C. Kittel, "Mechanics", Berkeley Physics Course, Vol.- I.
 [R5]. Feynman " The Feynman lectures on Physics Pearson Volume 3 Millennium Edition, 2013
 [R6]. Uma Mukhrji 'Engineering Physics' Narosa, 3rd Edition, 2010.
 [R7]. H.K. Malik & A. K. Singh 'Engineering Physics' [McGraw-Hill], 1st Edition, 2009.

MANUFACTURING PROCESSES

Paper Code: ETME-105

Paper: Manufacturing Processes

L	T	C
3	0	3

INSTRUCTIONS TO PAPER SETTERS:

MAXIMUM MARKS: 75

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

Objective: The Objective of the paper is to facilitate the student with the basic Manufacturing processes.

Unit-I

Introduction: Introduction of Manufacturing processes and their classification, Basic Metals & Alloys : Properties and Applications. Properties of Materials: Strength, elasticity, stiffness, malleability, ductility, brittleness, toughness and hardness. Ferrous Materials: Carbon steels, its classification based on % carbon as low, mild, medium & high carbon steel, its properties & applications. Wrought iron. Cast iron. Alloy steels: stainless steel, tool steel. Elementary introduction to Heat- treatment of carbon steels: annealing, normalizing, quenching & tempering and case- hardening.

Non-Ferrous metals & alloys: Properties and uses of various non-ferrous metals & alloys and its composition such as Cu-alloys: Brass, Bronze, Al-alloys such as Duralumin.

Casting Processes:

Principles of metal casting, Pattern materials, types and allowance, composition and properties of moulding sand, foundry tools, concept of cores and core print, elements of gating system, description and operation of cupola, special casting processes e.g. die-casting; permanent mould casting; centrifugal casting; investment casting; casting defects.

(T₁, T₂, R₁, R₂, R₃, R₄, R₅) [No. of Hrs.12]

UNIT-II

Smithy and Forging:

Hot working and cold working, Forging tools and equipments, Forging operations, Forging types: Smith forging, Drop forging, Press forging, Machine forging; Forging defects; Extrusion, wire drawing, swaging.

BENCH WORK AND FITTING:

Fitting shop tools, operation: Fitting; sawing; chipping; thread cutting (with taps and dies); Marking and marking tools.

(T₁, T₂, R₁, R₂, R₃, R₄, R₅) [No. of Hrs. 12]

Unit-III

Metal joining: Welding principles, classification of welding techniques, Oxyacetylene Gas welding, equipment and field of application, Arc-welding, metal arc, Carbon arc welding, submerged arc welding and atomic hydrogen welding, TIG and MIG welding, Electric resistance welding: spot; seam; flash; butt and percussion welding, Flux: composition; properties and function, Electrodes, Types of joints and edge preparation, Brazing and soldering, welding defects.

(T₁, T₂, R₁, R₂, R₃, R₄, R₅)[No. of Hrs. 12]

Unit-IV

Sheet Metal Work:

Tools and equipments used in sheet metal work, metals used for sheets, standard specification for sheets, Types of sheet metal operations: shearing, drawing, bending. Other operations like spinning, stretch forming, embossing and coining.

Powder Metallurgy: Introduction of powder metallurgy process: powder production, blending, compaction, sintering.

(T₁, T₂, R₁, R₂, R₃, R₄, R₅)[No. of Hrs. 12]

Text Books:

[T1]. Manufacturing Process by Raghuvanshi.(Dhanpat Rai and Co.)

[T2]. Manufacturing Technology by P.N.Rao (TMH publications)

Reference Books:

[R1]. Workshop Technology by Hazra-Chowdhary (Media Promoters and Publishers Pvt. Ltd.)

[R2]. Production Engineering by R.K.Jain (Khanna Publishers)

[R3]. Workshop Technology by Chapman (Elsevier Butterworth-Heinemann)

[R4]. Fundamentals of Modern Manufacturing by Mikell P. Groover (Wiley India Edition)

[R5]. Manufacturing Processes for Engineering Materials by Kalpakjian and Schmid (Pearson)

ELECTRICAL TECHNOLOGY**Paper Code: ETEE-107****Paper : Electrical Technology**

L	T	C
3	0	3

INSTRUCTIONS TO PAPER SETTERS:**Maximum Marks: 75**

1. This is first introductory course in electrical technology to the students of all the branches of engineering in first year.
2. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
3. Apart from question no. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

Objective: To provide exposure to the students in respects of the basics of different aspects of electrical engineering with emphasis on constructional, measurement and applications of various types of instruments and equipments.

UNIT – I: DC Circuits

Introduction of Circuit parameters and energy sources (Dependent and Independent), Mesh and Nodal Analysis, Superposition, Thevenin's, Norton's, Reciprocity, Maximum Power Transfer and Millman's Theorems, Star-Delta Transformation and their Applications to the Analysis of DC circuits.

[T1],[T2][No. of Hrs. 11]**UNIT – II: A.C.Circuits**

A.C. Fundamentals, Phasor representation, Steady State Response of Series and Parallel R-L, R-C and R-L-C circuits using j-notation, Series and Parallel resonance of RLC Circuits, Quality factor, Bandwidth, Complex Power, Introduction to balanced 3-phase circuits with Star- Delta Connections.

[T1],[T2][No. of Hrs. 14]**UNIT – III: Measuring Instruments**

Basics of measuring instruments and their types ,Working principles and applications of moving coil, moving iron (ammeter & voltmeter) and Extension of their ranges, dynamometer- type Wattmeter , induction-type Energy Meter , Two-wattmeter method for the measurement of power in three phase circuits, Introduction to digital voltmeter, digital Multimeter and Electronic Energy Meter.

[T1],[T2],[R2][No. of Hrs. 11]**UNIT – IV: Transformer and Rotating Machines**

Fundamentals of Magnetic Circuits, Hysteresis and Eddy current losses, working principle, equivalent circuit, efficiency and voltage regulation of single phase transformer and its applications. Introduction to DC and Induction motors (both three phase and single phase), Stepper Motor and Permanent Magnet Brushless DC Motor.

[T1],[T2],[R2][No. of Hrs. 12]**Text Books:**

[T1] S.N Singh, "Basic Electrical Engineering" PHI India Ed 2012

[T2] Chakrabarti, Chanda,Nath "Basic Electrical Engineering" TMH India", Ed 2012.

Reference Books:

[R1] William Hayt "Engineering Circuit Analysis" TMH India Ed 2012

[R2] Giorgio Rizzoni "Principles and Application of Electrical Engineering" Fifth Edition TMH India.

HUMAN VALUES & PROFESSIONAL ETHICS**Paper Code: ETHS-109****Paper : Human Values & Professional Ethics**

L	T	C
1	1	1

Non-University Examination Scheme (NUES)

Note: There will be no End-Term External University Examination. Marks are to be given on the basis of two internal sessional test of 30 marks each and one final Viva-voce project report Examination of 40 marks

Objectives:

This introductory course input is intended

- To help the students appreciate the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
- To facilitate the development of a holistic perspective among students towards life, profession and happiness, based on the correct understanding of the Human reality and the rest of the Existence. Such a Holistic perspective forms the basis of value-based living in a natural way.
- To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually satisfying human behaviour and mutually enriching interaction with Nature.

UNIT-1: Introduction to Value Education**No. of lectures: 03+1**

- Understanding the need, basic guidelines, content and process for value education.
- Basic Human Aspirations: Prosperity and happiness
- Methods to fulfil the human aspirations – understanding and living in harmony at various levels.
- Practice Session – 1.

[T1], [R1], [R4]**UNIT-2: Harmony in the Human Being****No. of lectures: 05+1**

- Co-existence of the sentient "I" and the material body – understanding their needs – Happiness & Conveniences.
- Understanding the Harmony of "I" with the body – Correct appraisal of physical needs and the meaning of prosperity.
- Programme to ensure harmony of "I" and Body-Mental and Physical health and happiness.
- Harmony in family and society: Understanding Human-human relationship in terms of mutual trust and respect.
- Understanding society and nation as extensions of family and society respectively.
- Practice Session – 02

[T2], [R1], [R2]**UNIT-3: Basics of Professional Ethics****No. of lectures: 04+1**

- Ethical Human Conduct** – based on acceptance of basic human values.
- Humanistic Constitution and universal human order** – skills, sincerity and fidelity.
- To identify the scope and characteristics of people** – friendly and eco-friendly production system, Technologies and management systems.
- Practice Session – 03.

[T1],[R4]**UNIT-4: Professional Ethics in practice****No. of lectures: 04+1**

- Profession and Professionalism** – Professional Accountability, Roles of a professional, Ethics and image of profession.
- Engineering Profession and Ethics** - Technology and society, Ethical obligations of Engineering professionals, Roles of Engineers in industry, society, nation and the world.
- Professional Responsibilities** – Collegiality, Loyalty, Confidentiality, Conflict of Interest, Whistle Blowing
- Practice Session – 04

[T1], [T2], [T3], [R3]**Text Books:**

[T1] Professional Ethics, R. Subramanian, Oxford University Press.

[T2] Professional Ethics & Human Values: S.B. Srivasthva, SciTech Publications (India) Pvt. Ltd. New Delhi.

[T3] Professional Ethics & Human Values: Prof. D.R. Kiran, TATA Mc Graw Hill Education.

References:

Modified Scheme and Syllabus of B. Tech-Mechatronics (1st Semester to 8th Semester) implemented from Academic Session w.e.f. 2015-16, approved in the 23rd BOS and 40th AC meeting of USET.

- [R1] Success Secrets for Engineering Students: Prof. K.V. SubbaRaju, Ph.D., Published by SMARTstudent.
 [R2] Ethics in Engineering Mike W. Martin, Department of Philosophy, Chapman University and Roland Schinzinger, School of Engineering, University of California, Irvine.
 [R3] Human Values: A. N. Tripathy (2003, New Age International Publishers)
 [R4] Value Education website, <http://www.universalhumanvalues.info>[16]
 [R5] Fundamentals of Ethics, Edmond G. Seebauer & Robert L. Barry, Oxford University Press.
 [R6] Human Values and Professional Ethics: R. R. Gaur, R. Sangal and G. P. Bagaria, Eecel Books (2010, New Delhi). Also, the Teachers' Manual by the same author.

***PRACTICAL SESSIONS OF 14 HOME ASSIGNMENTS** will be followed by the students pursuing this paper. (Ref: Professional Ethics & Human Values: S.B. Srivastava, SciTech Publications (India) Pvt. Ltd. New Delhi.)

CONTENT OF PRACTICE SESSION

Module 1: Course Introduction – Needs, Basic Guidelines, Content and Process of Value Education

PS-1: Imagine yourself in detail. What are the goals of your life? How do you set your goals in your life? How do you differentiate between right and wrong? What have been your achievements and shortcoming in your life? Observe and analyze them.

Expected Outcome:

The students start exploring themselves; get comfortable to each other and to the teacher and start finding the need and relevance for the course.

PS-2: Now a days there is lot of voice about techno-genie maladies such as energy and natural resource depletion, environmental Pollution, Global Warming, Ozone depletion, Deforestation, etc. – all these scenes are man-made problems threatening the survival of life on the earth – what is root cause of these maladies and what is the way out in your opinion?

On the other hand there is rapidly growing danger because of nuclear proliferation, arm race, terrorism, criminalization of politics, large scale corruption, scams, breakdown of relationships, generation gap, depression and suicidal attempts, etc - what do you think the root cause of these threats to human happiness and peace – what could be the way out in your opinion?

Expected Outcome:

The students start finding out that technical education with study of human values can generate more problems than solutions. They also start feeling that lack of understanding of human values is the root cause of all the problems and the sustained solution could emerge only through understanding of human values and value based living. Any solutions brought out through fear, temptation or dogma will not be sustainable.

PS-3: 1. Observe that each one of us has Natural Acceptance, based on which one can verify right or not right for him. Verify this in case of following:

- a) What is naturally acceptable to you in relationship – feeling of respect or disrespect?
- b) What is naturally acceptable to you - to nurture or to exploit others? Is your living the same as your natural acceptance or different?

2. Out of three basic requirements for fulfillment of your aspirations, right understanding, relationship and physical facilities, observe how the problems in your family are related to each. Also observe how much time and efforts you devote for each in your daily routine.

Expected Outcome:

1. The students are able to see that verification on the basis of natural acceptance and experiential validation through living is the only way to verify the right or wrong, and referring to any external source life text or instrument or any other person cannot enable them to verify with authenticity, it will only develop assumptions.
2. The students are able to see that their practice in living is not in harmony with their natural acceptance at most of the time, and all they need to do is to refer to their natural acceptance to remove this disharmony.
3. The students are able to see that lack of right understanding leading to lack of relationship is the

major cause of the problems in their family and the lack of physical facilities in most of the cases; while they have given higher priority to earning of physical facilities in their life ignoring relationship and not being aware that right understanding is the most important requirement for any human being.

Module 2: Understanding harmony in human being – Harmony in myself!

PS-4: Prepare the list of your desires. Observe whether the desires are related with self “I” or body. If it appears to be related with the both, see which part of it is related to self “I” and which part is related to body.

Expected Outcome:

The students are able to see that they can enlist their desires and the desires are not vague, also they are able to relate their desires to “I” and “body” distinctly. If, any desire appears to be related with both, they are able to see that feeling is related to “I” while the physical facility is related to the body. They are also able to see that “I” and “body” are two realities, and most of their desires are related to “I” and not with the “Body”; while their efforts are mostly connected on the fulfillment of the need of the body assuming that it will meet the needs of “I” too.

PS-5:

1. {A}. Observe that any physical facilities you use, follows the given sequence with time; Necessary and tasteful – unnecessary & tasteful – unnecessary & tasteless.
 {B}. In contrast, observe that any feelings in you are either naturally acceptable or not acceptable at all. If, naturally acceptable, you want it continuously and if not acceptable, you do not want it at any moment.
2. List Down all your activities. Observe whether the activity is of “I” or of “body” or with the participation both “I” and “body”.
3. Observe the activities with “I”. Identify the object of your attention for different moments (over a period say 5 to 10 minute) and draw a line diagram connecting these points. Try to observe the link between any two nodes.

Expected Outcome:

1. The students are able to see that all physical facilities they use are required for limited time in a limited quantity. Also they are able to see that cause of feeling, they want continuity of the naturally acceptable feelings and they do not want feelings which are not naturally acceptable eve for a single moment.
2. The students are able to see that activities like understanding, desires, thoughts and selection are the activities of “I” only; the activities like breathing, palpitation of different parts of the body are fully the activities of the body. With the acceptance of “I”, while activities they do with their sense organs like hearing through ears, seeing through eyes, sensing through touch, tasting through tongue and smelling through nose or the activities they do with their work organs like hands, legs, etc. are such activities that require the participation of both “I” and “body”
3. The students become aware of their activities of “I” and start finding their focus of attention at different moments. Also they are able see that most of their desires are coming from outsides (through preconditioning or sensation) and are not based on their natural acceptance.

- PS-6:**
1. Chalk out the program to ensure that you are responsible to your body – for the nurturing, protection and right utilization of the body.
 2. Find out the plants and shrubs growing in and your campus. Find out their use for curing different diseases.

Expected Outcome:

The students are able to list down activities related to a proper upkeep of the body and practice them in their daily routine. They are also able to appreciate the plants wildly growing in and around the campus which can be beneficial in curing the different diseases.

Module 3: Understanding harmony in the family and society - Harmony in Human – Human relationship

PS-7: Form small groups in the class and in that group initiate the dialogue and ask the eight questions related to trust. The eight questions are-

S.No.	Intention (Natural Acceptance)	S.No.	Competence
1.a.	Do I want to make myself happy?	1.b.	Am I liable to make myself always Happy?
2.a.	Do I want to make the other happy?	2.b.	Am I liable to make the other always happy?
3.a.	Does the other want to make him happy?	3.b.	Is the other able to make him always happy?
4.a.	Does the other want to make me happy? What is answer?	4.b.	Is the other able to make me always happy? What is answer?

Let each student answer the question for himself and everyone else. Discuss the difference between intention and competence.

Expected Outcome:

The students are able to see that the first four questions are related to our natural acceptance i.e. intention and the next four to our competence. They are able to note that the intention is always correct, only competence is lacking. We generally evaluate ourselves on the basis of our intention and other on the basis of their competence. We seldom look at our competence and other's intention as a result we conclude that I am a good person and other is a bad person.

PS-8:

1. Observe that on how many occasions you are respecting your related ones (by doing the right evaluation) and on how many occasion you are disrespecting by way of under evaluation, over evaluation or otherwise evaluation.
2. Also observe whether your feeling of respect is based on treating the other as yourself or on differentiations based on body, physical facilities or beliefs.

Expected Outcome:

The students are able to see that respect is right evaluation and only right evaluation leads to fulfilment of relationship. Many present problems in the society are an outcome of differentiation (lack of understanding of respect) like gender biasness, generation gap, caste conflicts, class struggle, and domination through poor play, communal violence, and clash of isms and so on so forth.

All these problems can be solved by realizing that the other is like me as he has the same natural acceptance, potential and program to ensure a happy and prosperous life for him and for others though he may have different body, physical facilities or beliefs.

PS-9:

1. Write a note in the form of a story, poem, skit, essay, narration, dialogue, to educate a child.
Evaluate it in a group.
2. Develop three chapters to introduce "social science", its needs, scope and content in the primary education of children.

Expected Outcome:

The students are able to use their creativity for educating children. The students are able to see that they can play a role in providing value education for children. They are able to put in simple words the issues that are essential to understand for children and comprehensible to them. The students are able to develop an outline of holistic model for social science and compare it with the existing model.

Module 4: Understanding harmony in the nature and existence – Whole existence as Co – existence -

PS-10: Prepare the list of units (things) around you. Classify them into four orders. Observe and explain the mutual fulfilment of each unit with other orders.

Expected Outcome:

The students are able to differentiate between the characteristics and activities of different orders and study the mutual fulfilment among them. They are also able to see that human beings are not fulfilling to their orders today

and need to take appropriate steps to ensure right participation (in term of nurturing, protection and right utilization) in the nature.

PS-11:

1. Make a chart for the whole existence. List down different courses of studies and relate them to different or levels in the existence.
2. Choose any one subject being taught today. Evaluate and suggest suitable modifications to make it appropriate and holistic.

Expected Outcome:

The students are confident that they can understand the whole existence; nothing is a mystery in this existence. They are also able to see the interconnectedness in the nature, and point out how different courses of study relate to the different units and levels. Also they are liable to make out how these courses can be made appropriate and holistic.

Module 5: Implication of the above Holistic Understanding of Harmony at all Levels of Existence.

PS-12: Choose any two current problem of different kind in the society and suggest how they can be solved on the basis of the natural acceptance of human values. Suggest the steps you will take in present conditions.

Expected Outcome:

The students are liable to present sustainable solutions to the problem in society and nature. They are also able to see that these solutions are practicable and draw road maps to achieve them.

PS-13:

1. Suggest ways in which you can use your knowledge of engineering / technology / management for universal human order from your family to world family.
2. Suggest one format of humanistic constitution at the level of nation from your side.

Expected Outcome:

The students are able to grasp the right utilization of their knowledge in their streams of technology / engineering / management to ensure mutually enriching and recyclable production systems.

PS-14: The course is going to be over now. Evaluate your state before and after the course in terms of-

- Thoughts
- Behavior
- Work and
- Realization

Do you have any plan to participate in the transition of the society after graduating from the institute? Write a brief note on it.

Expected Outcome:

The students are able to sincerely evaluate the course and share with their friends. They are also able to suggest measures to make the course more effective and relevant. They are also able to make use of their understanding in the course for happy and prosperous society.

FUNDAMENTALS OF COMPUTING**Paper Code: ETCS-111****Paper: Fundamentals of Computing**

L	T	C
2	0	2

INSTRUCTIONS TO PAPER SETTERS:**Maximum Marks : 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks

Objective: The objective of the paper is to facilitate the student with applied working knowledge of computers. This is the first course of computing and does not assume any pre-requisite.

UNIT-I

Five Component Model of a Computer, System and Application software (introduction) storage devices , primary (RAM, ROM, PROM, EPROM, cache) Memory and secondary (magnetic tape, hard disk, Compact disks) memory , peripheral devices , printers.

[T1], [T2][8 Hours]**UNIT-II**

Operating Systems: DOS Internal, External commands, Windows (2000 and NT) , Overview of architecture of Windows, tools and system utilities including registry , partitioning of hard disk , Overview of Linux architecture , File system , file and permissions , concept of user and group , installation of rpm and deb based packages.

[T1], [T2][8 Hours]**UNIT-III**

Basics of programming through flow chart , Networking Basics - Uses of a network and Common types of networks , Network topologies and protocols , Network media and hardware , Overview of Database Management System.

[T1],[T2],[R1][8 Hours]**UNIT-IV**

Libre / Open Office Writer : Editing and Reviewing, Drawing, Tables, Graphs, Templates
 Libre / Open Office Calc : Worksheet Management , Formulas, Functions, Charts
 Libre / Open Office Impress: designing powerful power-point presentation

[R2][R3] [8 Hours]**Text:**

- [T1] Peter Norton, Introduction to computers, Sixth Edition Tata McGraw Hill (2007).
 [T2] Andrews Jean, A+Guide to Managing & Maintaining Your PC, Cengage Publication 6/e

References:

- [R1] Anita Goel, Computer Fundamentals, Pearson Education.
 [R2] Joiner Associates Staff, Flowcharts: Plain & Simple: Learning & Application Guide , Oriol Inc
 [R3] <http://www.openoffice.org/why/>
 [R4] <http://www.libreoffice.org/get-help/documentation/>

APPLIED CHEMISTRY

Paper Code: ETCHE – 113
Paper : Applied Chemistry

L	T	C
2	1	3

INSTRUCTIONS TO PAPER SETTER:**MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Each unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

Objective: The objective of the paper is to facilitate the student with the basics of Applied Chemistry aspects that are required for his understanding of basic chemistry

UNIT I: FUELS

Definition, Classification & Calorific value of fuels (gross and net), Dulong's formula (**Numericals**), Determination of calorific value of fuels using bomb's calorimeter (**Numericals**), Determination of calorific value of fuels using Boy's Gas Calorimeter (**Numericals**), Cracking – Thermal & catalytic cracking, Octane & Cetane numbers with their significance. High & Low temperature carbonization, Manufacture of coke (Otto – Hoffmann oven) Proximate and ultimate analysis of Coal (**Numericals**) Combustion of fuels (**Numericals**).

[T1,T2][No. of hrs. 08]**UNIT II: THE PHASE RULE & CATALYSIS**

Definition of various terms, Gibb's Phase rule & its derivation, Application of phase rule to One component system- The water system, Application of phase rule to Two component system- The Lead-Silver system (Pattinson's process).

Catalyst and its characteristics, Types of catalysts, Concept of promoters, inhibitors and poisons. Theories of catalysis: Intermediate compound formation theory, adsorption or contact theory. Application of catalysts for industrially important processes Enzyme catalysis: Characteristics, Kinetics & Mechanism of enzyme catalysed reaction (Michaelis-Menten equation), Acid-Base catalysis: Types, Kinetics & Mechanism, Catalysis by metals salts (Wilkinson's Catalyst), Auto-catalysis, Heterogeneous catalysis (Langmuir-Hinshelwood mechanism).

[T1,T2][No. of hrs. 08]**UNIT III: WATER**

Introduction and specifications of water , Hardness and its determination by EDTA method (**Numericals**), Alkalinity and its determination (**Numericals**), Reverse Osmosis, Electrodialysis, Disinfection by break-point chlorination. Boiler feed water, boiler problems– scale, sludge, priming & foaming: causes & prevention, Boiler problems– caustic embrittlement & corrosion: causes & prevention, Water Softening by Internal Treatment: carbonate & phosphate conditioning, colloidal conditioning & calgon treatment Water Softening by External Treatment: Lime-Soda Process (**Numericals**) Zeolite & Ion-Exchange Process.

[T1,T2][No. of hrs. 08]**UNIT IV: CORROSION & ITS CONTROL**

Causes, effects & consequences; Chemical or Dry corrosion & its mechanism (Pilling-Bedworth Rule) Electrochemical or Wet Corrosion & Its mechanism, Rusting of Iron Passivity, Galvanic series, Galvanic Corrosion, Soil Corrosion Pitting Corrosion, Concentration Cell or Differential Aeration Corrosion, Stress Corrosion. Factors Influencing Corrosion: Nature of metal and nature of corroding environment; Protective measures: Galvanization, Tinning Cathodic Protection, Sacrificial Anodic protection, Electroplating, Electroless plating, Prevention of Corrosion by Material selection & Design.

[T1,T2][No. of hrs. 08]**Text Books:**

- [T1] P. C. Jain & Monika Jain, *Engineering Chemistry*, Latest edition, Dhanpat Rai Publishing Co., 2002.
 [T2] P. Mathew, *Advance Chemistry*, 1 & 2 Combined Editions, Cambridge University Press, 2003.

Reference Books:

- [R1] P. W. Atkins and J. De Paula, *Atkins' Physical Chemistry*, Oxford, 2010.
 [R2] T. Engel and P. Reid, *Physical Chemistry*, Pearson Education, 2013.
 [R3] K. Qanungo, *Engineering Chemistry*, PHI Learning Private Limited, New Delhi, 2009.
 [R4] O. G. Palanna, *Engineering Chemistry*, Tata McGraw Hill Education Private Limited, 2012.
 [R5] D. A. Jones, *Principles and Prevention of Corrosion*, Prentice Hall, 2nd Edition, 1996.
 [R6] H. K. Chopra and A. Parmar, *Engineering Chemistry- A Text Book*, Narosa Publishing House, 2012.
 [R7] S. Chawla, *Engineering Chemistry-All India Edition*, Dhanpat Rai & Co., 2003.
 [R8] R. Gadi, S. Rattan and S. Mohapatra, *Environmental Studies*, S.K. Kataria & Sons, 2nd Edition 2009.

Modified Scheme and Syllabus of B. Tech-Mechatronics (1st Semester to 8th Semester) implemented from Academic Session w.e.f. 2015-16, approved in the 23rd BOS and 40th AC meeting of USET.

APPLIED PHYSICS LAB – I**Paper Code: ETPH-151****Paper : Applied Physics Lab – I****P**
2**C**
1**LIST OF EXPERIMENTS**

1. To determine the wavelength of sodium light by Newton's Rings.
2. To determine the wavelength of sodium light by Fresnel's biprism.
3. To determine the wavelength of sodium light using diffraction grating.
4. To determine the refractive index of a prism using spectrometer.
5. To determine the dispersive power of prism using spectrometer and mercury source.
6. To determine the specific rotation of cane sugar solution with the help of half shade polarimeter.
7. To find the wavelength of He-Ne laser using transmission diffraction grating.
8. To determine the numeral aperture (NA) of an optical fibre.
9. To plot a graph between the distance of the knife-edge from the center of the gravity and the time period of bar pendulum. From the graph, find
 - (a) The acceleration due to gravity
 - (b) The radius of gyration and the moment of inertia of the bar about an axis.
10. To determine the velocity of ultrasound waves using an ultrasonic spectrometer in a given liquid (Kerosene Oil).
11. To verify inverse square law.
12. To determine Planck's constant.

Text Books:

[T1] C. L. Arora 'B. Sc. Practical Physics' S. Chand

Note: Any 8-10 experiments out of the list may be chosen. Proper error – analysis must be carried out with all the experiments.

ELECTRICAL TECHNOLOGY LAB**Paper Code: ETEE 153****Paper: Electrical Technology Lab**

L	P	C
0	2	1

LIST OF EXPERIMENTS

1. To Design the circuit for a given load and selection of its various Components and instruments from the safety point of view
2. Study and applications of CRO for measurement of voltage, frequency and phase of signals.
3. Connection of lamp by
(1)Single Switch Method.(2) Two-way Switch Method.
OR
Performance comparison of fluorescent Tube & CFL Lamp.
4. To Verify Thevenin's & Norton's Theorem
OR
To Verify Superposition & Reciprocity Theorem.
OR
To Verify Maximum Power Transfer Theorem.
5. To Measure Power & Power Factor in a Single-Phase A.C Circuit using Three Ammeters or three Voltmeters.
6. To Measure Power & Power Factor in a Balanced Three Phase Circuit using Two Single Phase Wattmeters.
7. To study of Resonance in a series R-L-C or Parallel R-L-C Circuits.
8. To perform open circuit and short circuit test on 1-phase transformer.
9. Starting, Reversing and speed control of DC shunt Motor
10. Starting, Reversing and speed control of 3-phase Induction Motor
11. To Study different types of Storage Batteries & its charging system.
12. To Study different types of earthing methods including earth leakage circuit breaker (GFCI)

Note:- Any 8-10 Experiments out of the list may be chosen.

WORKSHOP PRACTICE

Paper Code: ETME-155
Paper: Workshop Practice

L	P	C
0	3	2

LIST OF EXPERIMENTS***Sheet Metal Shop***

1. To study the tools and machineries used in sheet metal shop.
2. To make a tray using sheet metal tools.
3. To make a Funnel using sheet metal tools.
4. To make a cylindrical mug in sheet metal shop.

Foundry Shop

5. To make a mould in Foundry Shop.

Carpentry Shop

6. To make a half lap T-joint in Carpentry Shop.
7. To make a half cross lap joint in Carpentry Shop.
8. To make a pattern using Carpentry Tools.

Welding Shop

9. To study arc and gas welding equipments and tools.
10. To make Lap Joint, T-Joint and Butt Joint in Welding shop.

Fitting Shop

11. To make V-Section and T-Slot in fitting shop.

Machine Shop

12. To study basic operations on lathe, shaper, milling, drilling and grinding machines..
13. To perform step turning, knurling and threading operations on lathe.
14. To prepare a simple job on shaper.

Note:- Any 8-10 Experiments out of the list may be chosen.

ENGINEERING GRAPHICS

Paper Code: ETME-157
Paper: Engineering Graphics Lab

L	P	C
0	3	2

LIST OF EXPERIMENTS**UNIT - I**

General: Importance, Significance and scope of engineering drawing, Lettering, Dimensioning, Scales, Sense of proportioning, Different types of projections, Orthographic Projection, B.I.S. Specifications,

Projections of Point and Lines: Introduction of planes of projection, Reference and auxiliary planes, projections of points and Lines in different quadrants, traces, inclinations, and true lengths of the lines, projections on Auxiliary planes, shortest distance, intersecting and non-intersecting lines.

(T₁, T₂, R₁, R₂, R₃)

Unit - II

Planes other than the Reference Planes: Introduction of other planes (perpendicular and oblique), their traces, inclinations etc., Projections of points and lines lying in the planes, conversion of oblique plane into auxiliary Plane and solution of related problems.

Projections of Plane Figures: Different cases of plane figures (of different shapes) making different angles with one or both reference planes and lines lying in the plane figures making different given angles (with one of both reference planes). Obtaining true shape of the plane figure by projection.

(T₁, T₂, R₁, R₂, R₃)

Unit - III

Projection of Solids: Simple cases when solid are placed in different positions, Axis faces and lines lying in the faces of the solid making given angles.

(T₁, T₂, R₁, R₂, R₃)

Unit-IV

Isometric Projection of plain surface and bodies.

(T₁, T₂, R₁, R₂, R₃)

Text Books:

[T1] Engineering drawing by N.D.Bhatt (Charotar Publications).

[T2] Engineering Drawing by S.C.Sharma & Navin Kumar (Galgotia Publications)

Reference Books:

[R1] Engineering Drawing by Venugopalan, (New Age International).

[R2] **Engineering Drawing by P.S.Gill (S.K. Kataria & Sons)**

[R3] Engineering Graphics by K.C.John (PHI)

Note:- Any 8-10 Experiments out of the list may be chosen.

FUNDAMENTAL OF COMPUTING LAB

Paper Code: ETCS 157

Paper: Fundamental of Computing Lab

L	P	C
0	2	1

LIST OF EXPERIMENTS

For program development an IDE e.g. CodeBlock^[a], Eclipse CDT^[b], Netbeans^[c] is recommended

1. Dismantling a PC Part -1
2. Dismantling a PC Part -2
3. Internal and External commands of DOS
4. System utilities of windows including regedit
5. Installation of any rpm or debianlinux distribution with emphasis on drive partitioning
6. Installation of rpm and deb based packages
7. Understanding of File system of Linux
8. Creating user and group (through CLI)
9. Understanding and working knowledge of .Libre / Open Office Writer
: Editing and Reviewing, Drawing, Tables, Graphs, Templates
10. Understanding and working knowledge of Libre / Open Office Calc
11. Understanding and working knowledge Libre / Open Office Impress
12. Understanding of flow chart development through Dia *
13. Two Mini Projects based on the skills learned in experiments 1-12
 - [Dia] <http://projects.gnome.org/dia/>

Note:- Any 8-10 Experiments out of the list may be chosen.

APPLIED CHEMISTRY LAB

Paper Code –ETCH-161

P**C**

Paper : Applied Chemistry Lab

2**1****LIST OF EXPERIMENTS**

1. Determination of alkalinity of water sample.
2. Determination of hardness of water sample by EDTA method.
3. Determine the percentage composition of sodium hydroxide in the given mixture of sodium hydroxide and sodium chloride.
4. Determine the amount of oxalic acid and Sulphuric acid in one litre of solution, given standard sodium hydroxide and Potassium Permanganate.
5. Determine the amount of copper in the copper ore solution, provided hypo-solution (Iodometric Titration).
6. Determine the amount of chloride ions present in water using silver nitrate (Mohr's Precipitation Method).
7. Determine the strength of MgSO₄ solution by Complexometric titration.
8. Determine the surface tension of a liquid using drop number method.
9. Determine the viscosity of a given liquid (density to be determined).
10. Determine the cell constant of conductivity cell and titration of strong acid/strong base conductometrically.
11. To determine (a) λ max of the solution of KMnO₄. (b) Verify Beer's law and find out the concentration of unknown solution by spectrophotometer.
12. Determination of the concentration of iron in water sample by using spectrophotometer.
13. Determination of the concentration of Iron (III) by complexometric titration.
14. Proximate analysis of coal.
15. Determination of eutectic point and congruent melting point for a two component system by method of cooling curve.

(At least 8 to 10 experiments are to be performed)

Suggested Books:

1. [A. I. Vogel](#), [G. H. Jeffery](#), *Vogel's Text Book of Quantitative Chemical Analysis*, Published by Longman Scientific & Technical, 5th Edition, 1989.
2. S. Chawla, *Essentials of Experimental Engineering Chemistry*, Dhanpat Rai & Co., 3rd Edition, 2008.
3. S. Rattan, *Experiments in Applied Chemistry*, Published by S.K.Kataria & Sons, 2nd Edition, 2003.
4. O. P. Pandey, D. N. Bajpai and S. Giri, *Practical Chemistry*, Published by S. Chand, 2005.
5. M. S. Kaurav, *Engineering Chemistry with Laboratory Experiments*, Published by PHI Learning Private Limited, 2011.
6. S. K. Bhasin and Sudha Rani, *Laboratory Manual on Engineering Chemistry*, Published by Dhanpat Rai Publishing Company, 2006.

Note:- Any 8-10 Experiments out of the list may be chosen.

APPLIED MATHEMATICS-II

Paper Code : ETMA-102
Paper: APPLIED MATHEMATICS-II

L	T	C
3	1	4

INSTRUCTIONS TO PAPER SETTERS:**Maximum Marks: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 12.5 marks.

Objective: The objective of the paper is to facilitate the student with the basics of Applied Mathematics that are required for an engineering student.

Unit –I

Partial differentiation and its Applications: Partial derivatives of first and second order. Euler's theorem for homogeneous functions (without proof). Derivatives of Implicit Functions, total derivatives. Change of variables. Jacobian. Taylor's theorem for function of two variables (without proof). Error and approximation. Extreme values of function of several variables (maxima, minima, saddle points). Lagrange method of undetermined multipliers. Partial differential equations: Formulation, solution of first order equations, Lagrange's equations, Charpit's method.

[T2][No. of 12hrs.]**Unit-II**

Laplace Transformation: Definition, Laplace transformation of basic functions, existence condition for Laplace transformation, Properties of Laplace transformation (Linearity, scaling and shifting). Unit step function, Impulse Function, Periodic Functions. Laplace transformation of derivatives, Laplace transformation of integrals, differentiation of transforms, Integration of transforms, Convolution theorem, inverse Laplace transformation. Solution of ordinary Differential equations.

[T1, T2][No. of 12hrs.]**Unit-III**

Complex Function: Definition, Derivatives, Analytic function, Cauchy's Riemann equation (without proof). Conformal and bilinear mappings, Complex Integration: Complex Line integration, Cauchy's integral theorem and integral formula (without proof). Zeros and Singularities, Taylor's and Laurent's series (without proof). Residues, Residue theorem (without proof). Evaluation of real definite integrals: Integration around the unit circle, Integration around a small semi circle and integration around rectangular contours.

[T1, T2][No. of 12hrs.]**Unit-IV**

Multiple integrals: Double integrals, Change of order of integration, Triple integrals. Vector Calculus: Scalar and vector functions, Gradient, Divergence and curl. Directional derivatives, Line Integrals. Surface integrals, volume integrals. Green's theorem, Stoke's theorem and Gauss divergence theorem (without proof).

[T1, T2][No. of 12hrs.]**Text:**

- [T1] E. Kresyzig, "Advance Engineering Mathematics", Wiley publications
 [T2] Michael Greenberg, "Advance Engineering mathematics", Pearson.

References:

- [R1] R.K. Jain and S.R.K. Iyengar, "Advanced Engineering Mathematics" Narosa Publications
 [R2] B. S. Grewal, "Higher Engineering Mathematics" Khanna Publications.
 [R3] S. Ponnusamy, "Foundation of Complex Analysis" Narosa Publication
 [R4] G.B. Thomas and R. N. Finny "Calculus and Analytic Geometry" Addison Wesley/ Narosa
 [R5] Wylie R, "Advance Engineering mathematics", McGraw-Hill
 [R6] M. Spiegel, "Schaum's Outline on Laplace Transform, Tata McGraw-Hill

APPLIED PHYSICS – II**Paper Code: ETPH-104****Paper : APPLIED PHYSICS – II**

L	T	C
2	1	3

INSTRUCTIONS TO PAPER SETTERS:**MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

Objective: The objective of the paper is to facilitate the student with the basics of Applied Physics aspects that are required for his understanding of basic physics.

UNIT I

Electromagnetic Theory : Gradient, Divergence, Curl, Gauss' law, Ampere's Law, Continuity equation, Maxwell's equations (differential and integral forms), Significance of Maxwell's equations, Poynting Theorem, Electromagnetic wave propagation in dielectrics and conductors.

[T1], [T2][No. of Hrs. 8]**UNIT II**

Statistical Physics: Black body radiation, Planck's radiation formula, Wien's and Rayleigh-Jeans Laws, Distribution laws: Qualitative features of Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac statistics & their comparison (without derivation).

Quantum Mechanics: Postulates of Quantum mechanics, de-Broglie hypothesis, Davisson Germer experiment, Wave function and its physical significance, Wave Packet, Phase and group velocities, Uncertainty principle, Schrodinger equation for free particle, Time dependent Schrodinger equation, Particle in a box (1-D).

[T1][T2][No. of Hrs. 8]**UNIT III**

Crystal Structure: Types of solids, Unit cell, Types of crystals, Translation vectors, Lattice planes, Miller indices, Simple crystal structures, Interplaner spacing, Crystal structure analysis: Bragg's law, Laue method, Point defects: Schottky and Frankel defects.

[T1], [T2][No. of Hrs. 8]**UNIT IV**

Band Theory of Solids: Introduction, Kronig-Penney model: E-k diagram, Effective mass of an electron, Intrinsic semiconductors: Electron concentration in conduction band, Hole concentration in valence band, Extrinsic semiconductor: p-type and n-type semiconductors, Fermi level, Hall Effect: Hall voltage and Hall coefficient.

[T1][T2][No. of Hrs. 8]**Text Books:**

[T1]. Arthur Beiser 'Concepts of Modern Physics', [McGraw-Hill], 6th Edition 2009.

[T2]. A. S.Vasudeva, 'Modern Engineering Physics', S. Chand, 6th Edition, 2013.

Reference Books

[R1]. Richard Wolfson 'Essential University Physics' Pearson, 1st edition, 2009.

[R2]. H.K. Malik & A. K. Singh 'Engineering Physics' [McGraw-Hill], 1st Edition, 2009.

[R3]. C. Kittle, 'Mechanics', Berkeley Physics Course, Vol.- I. Latest Edition.

[R4]. Irving Kaplan 'Nuclear Physics' Latest Edition.

[R5]. John R. Taylor, Chris D. Zafirator and Michael A. Dubson, 'Modern Physics For Scientists and Engineers', PHI, 2nd Edition.

[R6]. D.J. Griffith, 'Introduction to Electrodynamics', Prentice Hall, Latest Edition.

ELECTRONIC DEVICES

Paper Code: ETEC-106
Paper : Electronic Devices

L	T	C
3	0	3

INSTRUCTIONS TO PAPER SETTERS:**MAXIMUM MARKS: 75**

1. This is the first introductory course in Electronics Engineering to the students of all the branches of engineering during the first year.
2. Question No.1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions from each unit. It should be of 25 marks.
3. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

Objective: Objective of the paper is to facilitate the student with the basics of electronic aspects that are required for his understanding and applications in their respective field of study. The pre-requisites are, to have a basic understanding of Applied Physics and Mathematics.

Unit-I

Evaluation Of Electronics: Introduction & Application Of Electronics, Energy Band Theory Of Crystals, Energy Band Structures In Metals, Semiconductors And Insulators, Theory Of Semiconductors: Classification Of Semiconductors, Conductivity Of Semiconductors, Carrier Concentration In Intrinsic & Extrinsic Semiconductors, Properties Of Intrinsic And Extrinsic Semiconductors, Variation In Semiconductors Parameters With Temperature, Fermi-Dirac Function, Fermi Level In A Semiconductor Having Impurities, Band Structure Of Open-Circuited P-N Junction, Drift And Diffusion Currents, Carrier Life Time, Continuity Equation (Elementary Treatment Only)

[T1][T2][T3][No. Of Hours: 12]**Unit – II**

Theory of p-n junction Diode: Diode Current Equation, Diode Resistance, Transition Capacitance, Diffusion Capacitance, (Elementary treatment only), Effect of Temperature on p-n Junction Diode, Switching Characteristics, Piecewise Linear Model, **Special Diodes:** Zener Diode, Varactor Diode, Tunnel Diode, Photodiode, Light Emitting Diodes, Schottky Barrier Diode, **Applications of Diodes:** Half-Wave Diode Rectifier, Full-Wave Rectifier, Clippers and Clampers (Elementary treatment only).

[T1][T2][T3][No. of Hours: 11]**Unit – III**

Bipolar junction transistor: Introduction of transistor, construction, transistor operations, BJT characteristics, load line, operating point, leakage currents, saturation and cut off mode of operations, Eber-moll's model.

[T1][T2][T3][No. of Hours: 11]**Unit – IV**

Application of BJT: CB, CE, CC configurations, hybrid model for transistor at low frequencies, Introduction to FETs and MOSFETs.

Fundamentals of digital electronics: Digital and analog signals, number systems, Boolean algebra, logic gates with simple applications, logic gates, karnaugh maps.

[T1][T2][T3][No. of Hours: 11]**Text Books**

- [T1] S. Salivahanan, N. Suresh Kr. & A. Vallavaraj, "Electronic Devices & Circuit", Tata McGraw Hill, 2008
- [T2] Millman, Halkias and Jit, "Electronic devices and circuits" McGraw Hill
- [T3] Boylestad & Nashelsky, "Electronic Devices & Circuits", Pearson Education, 10TH Edition.

Reference Books

- [R1] Sedra & Smith, "Micro Electronic Circuits" Oxford University Press, VI Edition
- [R2] Robert T. Paynter, "Introducing Electronic Devices & Circuits", Pearson Education, VII Edition, 2006

INTRODUCTION TO PROGRAMMING

Paper Code: ETCS-108

Paper: Introduction to Programming

L	T	C
3	0	3

INSTRUCTIONS TO PAPER SETTERS:

Maximum Marks : 75

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 12.5 marks

Objective: The objective of the paper is to facilitate the student with the basics of programming aspects, using C as the primary language. This course focuses on the programming constructs which are used in other languages as well. This is the first course on programming and does not assume any prerequisite.

UNIT I

Concept of algorithms, Flow Charts, Overview of the compiler (preferably GCC) , Assembler, linker and loader , Structure of a simple Hello World Program in C ,Overview of compilation and execution process in an IDE (preferably Code Block)

[T1],[T2], [R4][R5][No. of hrs 8]

UNIT II

Programming using C: Preprocessor Directive, C primitive input output using get char and put char , simple I/O Function calls from library , data type in C including enumeration , arithmetic, relational and logical operations, conditional executing using if, else, switch and break .Concept of loops , for, while and do-while , Storage Classes: Auto, Register, Static and Extern

[T1], [T2], [R7][No. of hrs 8]

UNIT III

Arrays (one and two dimensional), 2-d arrays used in matrix computation. Concept of Sub-programming, functions. Parameter transmission schemes i.e. call by value and call by reference, Pointers, relationship between array and pointer, Argument passing using pointers, Array of pointer, passing arrays as arguments

[T2], [R1], [R7][No. of hrs 8]

UNIT IV

Structure and unions , Strings and C string library, File Handling in C Using File Pointers,fopen(), fclose(),Input and Output using file pointers, Character Input and Output with Files , String Input / Output Functions , Formatted Input / Output Functions,Block Input / Output Functions, Sequential Vs Random Access Files , Positioning the File Pointer

[T1], [T2],[R2][R7][No. of hrs 8]

Text Books:

- [T1] Herbert Schildt, "C: The Complete Reference", OsbourneMcgraw Hill, 4th Edition, 2002.
 [T2] Forouzan Behrouz A. "Computer Science: A Structured Programming Approach Using C, Cengage Learning 2/e

Reference Books:

- [R1] Kernighan & Ritchie, "C Programming Language", The (Ansi C version), PHI, 2/e
 [R2] K.R Venugopal, "Mastering C ", TMH
 [R3] R.S. Salaria "Application Programming in C " Khanna Publishers4/e
 [R4] Yashwant Kanetkar " Test your C Skills ", BPB Publications
 [R5] <http://www.codeblocks.org/>
 [R6] <http://gcc.gnu.org/>
 [R7] Programming in ANSI C, E. Balagurusamy; Mc Graw Hill, 6th Edition.

ENGINEERING MECHANICS

Modified Scheme and Syllabus of B. Tech-Mechatronics (1st Semester to 8th Semester) implemented from Academic Session w.e.f. 2015-16, approved in the 23rd BOS and 40th AC meeting of USET.

Paper Code: ETME 110
Paper: Engineering Mechanics

L	T	C
2	1	3

INSTRUCTIONS TO PAPER SETTERS:

MAXIMUM MARKS: 75

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

OBJECTIVE: THE OBJECTIVE OF THE PAPER IS TO GIVE THE BASIC PRINCIPLES OF MECHANIC APPLIED IN DIFFERENT DISCIPLINES OF ENGINEERING.

UNIT- I

Force system: Free body diagram, Parallel force system, concurrent force system, Equilibrium equations and applications in different force systems.

Friction: Static and Kinetic friction, laws of dry friction, co-efficient of friction, angle of friction, angle of repose, cone of friction, Belt drive- derivation of equation $T_1/T_2 = e^{\mu\theta}$ and its application, M.A, V.R and Efficiency of Screw Jack, Application of friction in pivot and collar bearing..

[T1, T2, R1, R2, R4, R5][No. of Hrs. 08]

UNIT- II

Structure: Plane truss, perfect and imperfect truss, assumption in the truss analysis, analysis of perfect plane trusses by the method of joints, method of section, graphical method.

Distributed Force: Determination of center of gravity, center of mass and centroid by direct integration and by the method of composite bodies, mass moment of inertia and area moment of inertia by direct integration and composite bodies method, radius of gyration, parallel axis theorem, Pappus theorems, polar moment of inertia.

[T1, T2, R1, R2, R4, R5][No. of Hrs. 08]

Unit-III

Kinematics of Particles: Rectilinear motion, plane curvilinear motion-rectangular coordinates, normal and tangential component.

Kinetics of Particles: Equation of motion, rectilinear motion and curvilinear motion, work energy equation, conservation of energy, impulse and momentum, conservation of momentum, impact of bodies, co-efficient of restitution, loss of energy during impact.

[T1, T2, R1, R2, R4, R5][No. of Hrs. 08]

Unit-IV

Kinematics of Rigid Bodies: Concept of rigid body, type of rigid body motion, absolute motion, introduction to relative velocity, instantaneous center of velocity, Velocity polygons for four bar mechanism and single slider mechanism.

Kinetics of Rigid Bodies: Equation of motion, translatory motion and fixed axis rotation, application of work energy principles to rigid bodies conservation of energy.

Shear force and bending Moment Diagram.

[T1, T2, R1, R2, R4, R5][No. of Hrs. 08]

Text Books:

[T1] Engg Mechanics by A.K.Tayal (Umesh Publications).

[T2] Engg Mechanics by Basudeb Bhattacharya (Oxford university Press)

Reference Books:

[R1] Engg Mechanics by Irving H. Shames (Pearson publications).

[R2] Engg Mechanics by U.C.Jindal (Galgotia Publications).

[R3] Engg Mechanics by Beer & Johnston(TMH).

[R4] Engg Mechanics by K.L.Kumar (TMH).

[R5] Engg Mechanics by Sadhu Singh (Khanna Publishers).

COMMUNICATION SKILLS

Paper Code: ETHS – 112

L	T	C
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Modified Scheme and Syllabus of B. Tech-Mechatronics (1st Semester to 8th Semester) implemented from Academic Session w.e.f. 2015-16, approved in the 23rd BOS and 40th AC meeting of USET.

Paper: Communication Skills

2 1 3

INSTRUCTIONS TO PAPER SETTERS:**MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

Objective: To enhance the language and communication competence of professional students with emphasis on English for Specific Purposes (ESP) through communication skills related activities.

UNIT-I

I. Basic Remedial Grammar (Errors in Parts of Speech, Tenses, Verbs and Modal; Reported Speech; Active and Passive Voice; Conditional clauses; Question Tags and Short Responses)

[T1],[R2],[R3][No. of hrs 06]

UNIT-II

II. Vocabulary and usage (Synonyms and Antonyms; Suffixes and Prefixes; Homophones and Homonyms; One-word substitution; Prepositions; Phrasal verbs and Idioms, Indianism)

[T1],[R2],[R3][No. of hrs 06]

UNIT-III**(A)**

- I. Types of writing (Expository, Descriptive, Narrative, Analytical and Argumentative)
- II. Definition, description and explanation of scientific objects, instruments and processes etc.
- III. Interpretation and use of charts, graphs and tables in technical writing.[T1],[R1]

(B)

- I. Paragraph writing
- II. Precis writing
- III. Comprehension [T1],[R2],[R3]

[No. of hrs 10]

UNIT-IV

- I. Reading different types of texts (speed and purpose)[T1]
- II. Reading five essays [T2]
- III. E.M. FORSTER, *What I Believe* (Pg-123)
- IV. JAMES BRYCE, *Some Hints on Public Speaking* (Pg-135)
- V. L.A. HILL, *Principles of Good Writing* (Pg-150)
- VI. A.P.J. ABDUL KALAM, *Work Brings Solace* (Pg-207)
- VII. SALIM ALI, *Man and Nature in India: The Ecological Balance* (Pg-213)

[No. of hrs 10]

TEXT BOOKS

- [T1] Technical Communication: Principles and practice (OUP), (Meenakshi Raman and Sangeeta Sharma)
OXFORD UNIVERSITY PRESS
- [T2] Communication Skills for Engineers, Murli Krishna, Pearson.
- [T3] Wren and Martin: High School English Grammar and Composition; S. Chand
- [T4] Exploration of Ideas; An Anthology of Prose: Orient Blackswan.

REFERENCE BOOKS:

- [R1] Professional Communication: Aruna Koneru, MCGRAW HILLS EDUCATION PVT. LTD
- [R2] Wren and Martin: High School English Grammar and Composition; S. Chand
- [R3] Advanced English Grammar and Composition: Gurudas Mukherjee & Inidbar Mukherjee; (ANE BOOKS PVT. LTD.)

ENVIRONMENTAL STUDIES

Paper Code: ETEN-114
Paper : Environmental Studies

L	T	C
2	1	3

INSTRUCTIONS TO PAPER SETTER:

MAXIMUM MARKS: 75

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.

2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Each unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each

Objective: The objective of this course is to make students environment conscious. They will be exposed through the fundamental concepts of environment and ecosystem so that they can appreciate the importance of individual and collective efforts to preserve and protect our environment. This course must raise various questions in student's mind that how our environment is inter dependent on various factors and how human being must care for their natural surroundings.

UNIT I: Environmental Studies: Ecosystems, Bio-diversity and its Conservation

(i) The Multidisciplinary Nature of Environmental Studies-

Definition, scope and importance of Environmental Studies. Biotic and a biotic component of environment, need for environmental awareness.

(ii) *Ecosystems*

Concept of an ecosystem, structure and function of an ecosystem, producers, consumers and decomposers, energy flow in the ecosystem, ecological succession, food chains, food webs and ecological pyramids.

Introduction, types, characteristic features, structures and function of the following ecosystem:

(a) Forest ecosystem

(b) Grassland ecosystem

(c) Desert ecosystem

(d) Aquatic ecosystem (ponds, streams, lakes, rivers, oceans, estuaries).

(iii) *Bio-diversity and its Conservation*

Introduction to biodiversity —definition: genetic, species and ecosystem diversity, Bio-geographical classification of India, Value of biodiversity: Consumptive use, productive use, social, ethical, aesthetic and option values, Biodiversity at global, national and local levels, India as a mega-diversity nation, Hot-spots of biodiversity, Threats to biodiversity : Habitat loss, Poaching of wildlife, man-wildlife conflicts, rare endangered and threatened species(RET) endemic species of India, method of biodiversity conservation: *In-situ* and *ex-situ* conservation.

[T1], [R3][No. of hrs. 08]

UNITII: Natural Resources: problems and prospects

(i) Renewable and Non-renewable Natural Resources

Concept and definition of Natural Resources and need for their management

- *Forest resources:* Use and over-exploitation, deforestation, case studies, timber extraction, mining, dams and their effects on forests and tribal people.
- *Water resources:* Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems, Water conservation, rain water harvesting, watershed management.
- *Mineral resources:* Uses are exploitation, environmental effects of extracting and using mineral resources, case studies.
- *Food resources:* World food problems, changes causes by agriculture and over-grazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
- *Energy resources:* Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, Urban problems related to energy, case studies.
- *Land resources:* Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

[T1], [R3][No. of hrs. 08]

UNIT III: Environmental Chemistry and Pollution Control**(i) Chemistry of Environment****(a) Green Technology**

Principles of Green technology, Zero Waste Technology, Green Chemistry & Its basic principles, Atom Economy, Green Methodologies. clean development mechanisms (CDM), concept of environmental impact assessment,

(b) Eco-Friendly polymers

Environmental degradation of polymers, Biodegradable, Photo-biodegradable polymers, Hydrolysis & Hydrobiodegradable, Biopolymers & Bioplastics: polylactic acid, polyhydroxybutyrate, polycaprolactone,. Concept of bioremediation.

(ii) Environmental Pollution

Definition, types, causes, effects and control measures of (a) Air pollution, (b) Water pollution, (c) Soil pollution, (d) Marine pollution, (e) Noise pollution, (f) Thermal pollution, (g) Nuclear hazards. Pollution case studies. Solid waste and its management: causes, effects and control measures of urban and industrial waste.

Chemical toxicology-Terms related to toxicity, impact of chemicals (Hg, As, Cd, Cr, Pb) on environment.

[T1], [R3][No. of hrs. 08]

UNIT IV: Disaster Management, Social Issues, Human Population and the Environment**(i) Disaster Management**

Disaster management: floods, earthquake, cyclone and land-slides, nuclear accidents and holocaust, *case studies*.

(ii) Social Issues, Human Population and the Environment

Sustainable development, Climate change, global warming, acid rain, ozone layer depletion, Environmental ethics: Issues and possible solutions, Consumerism and waste products, , Wasteland reclamation. Population growth, problems of urbanisation.

Environment Protection Act, 1986; Air (Prevention and Control of Pollution) Act, 1981; Water (Prevention and Control of Pollution) Act, 1974; Wildlife Protection Act, 1972; Forest Conservation Act, 1980; Environmental management system standards-ISO 14000 series.

[T1][No. of hrs. 08]

Text Books:

[T1] E. Barucha, *Textbook of Environmental Studies for Undergraduate Courses*, Universities Press (India) Pvt. Ltd., 2005.

[T2] S. Chawla, *A Textbook of Environmental Studies*, McGraw Hill Education Private Limited, 2012

References Books:

[R1] G. T. Miller, *Environmental Science*, Thomas Learning, 2012

[R2] W. Cunningham and M. A. Cunningham, *Principles of Environment Science: Enquiry and Applications*, Tata McGraw Hill Publication, N. Delhi, 2003.

[R3] R. Rajagopalan, *Environmental Studies: From Crisis to Cure*, 2nd Edition, Oxford University Press, 2011.

[R4] A.K. De, *Environmental Chemistry*, New Age Int. Publ. 2012.,

[R5] A. Kaushik and C.P. Kaushik, *Perspectives in Environment Studies*, 4th Edition, New Age International Publishers, 2013

[R6] *Environmental Engineering* by Gerard Kiely, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2010.

APPLIED PHYSICS LAB – II**Paper Code: ETPH-152****Paper: Applied Physics Lab – II**

P	C
2	1

LIST OF EXPERIMENTS

1. To determine the e/m ratio of an electron by J.J. Thomson method.
2. To measure the frequency of a sine-wave voltage obtained from signal generator and to obtain lissajous pattern on the CRO screen by feeding two sine wave signals from two signal generators.
3. To determine the frequency of A.C. mains by using Sonometer .
4. To determine the frequency of electrically maintained tuning fork by Melde's method.
5. Computer simulation (simple application of Monte Carlo): Brownian motion, charging & discharging of a capacitor.
6. To study the charging and discharging of a capacitor and to find out the time constant.
7. To study the Hall effect.
8. To verify Stefan's law.
9. To determine the energy band gap of a semiconductor by four probe method/or by measuring the variation of reverse saturation current with temperature.
10. To study the I-V characteristics of Zener diode.
11. To find the thermal conductivity of a poor conductor by Lee's disk method.
12. To study the thermo emf using thermocouple and resistance using Pt. Resistance thermometer.

Suggested Books:

[T1] C. L. Arora 'B. Sc. Practical Physics' S. Chand, Latest edition.

Note: Any 8-10 experiments out of the list may be chosen. Proper error – analysis must be carried out with all the experiments.

Electronic Devices

Paper Code: ETEC-156
Paper: Electronic Devices Lab

P **C**
2 **1**

LIST OF EXPERIMENTS

1. Introduction to C.R.O, Function Generator & Bread Board Kit & to generate different types of waveform with the help of Function Generator & to calculate their frequency, amplitude AC & DC voltage.
2. Identification & testing of Active & passive components
3. To plot V-I characteristics of a semiconductor diode & Calculate Static & Dynamic Resistance
4. To Study the Reverse characteristics of Zener diode
5. To Study the Rectifier circuit.
 - a) Half Wave Rectifier
 - b) Centre Tapped Rectifier.
 - c) Bridge Rectifier.
6. To Study the output waveforms of different Filter Ckts of Rectifier.
7. To Plot Input & Output characteristics CB transistor.
8. To Plot Input & Output characteristics of CE transistor.
9. Realization of basic gates.
10. Implementation of Boolean functions (two or three variables).
11. Few experiments mentioned above to be performed on P-spice.
12. To develop a working model of any electronic circuit.

Note:- Any 8-10 Experiments out of the list may be chosen.

ENGINEERING MECHANICS LAB

Paper Code: ETME-158
Paper: Engineering Mechanics Lab

P **C**
2 **1**

LIST OF EXPERIMENTS:

1. To verify the law of Force Polygon
2. To verify the law of Moments using Parallel Force apparatus. (simply supported type)
3. To determine the co-efficient of friction between wood and various surface (like Leather, Wood, Aluminum) on an inclined plane.
4. To find the forces in the members of Jib Crane.
5. To determine the mechanical advantage, Velocity ratio and efficiency of a screw jack.
6. To determine the mechanical advantage, Velocity ratio and Mechanical efficiency of the Wheel and Axle
7. To determine the MA, VR, η of Worm Wheel (2-start)
8. Verification of force transmitted by members of given truss.
9. To verify the law of moments using Bell crank lever
10. To find CG and moment of Inertia of an irregular body using Computation method.

Note:- Any 8-10 Experiments out of the list may be chosen.

PROGRAMMING LAB

Paper Code	:	ETCS 154	P	C
Paper	:	Programming Lab	2	1

LIST OF EXPERIMENTS

For program development an IDE e.g. CodeBlock^[a], Eclipse CDT^[b], Netbeans^[c] is recommended

1. Write a program to find divisor or factorial of a given number.
2. Write a program to find sum of a geometric series
3. Write a recursive program for tower of Hanoi problem
4. Write a recursive program to print the first m Fibonacci number
5. Write a menu driven program for matrices to do the following operation depending on whether the operation requires one or two matrices
Addition of two matrices
Subtraction of two matrices
Finding upper and lower triangular matrices
Transpose of a matrix
Product of two matrices.
6. Write a program to copy one file to other, use command line arguments.
7. An array of record contains information of managers and workers of a company. Print all the data of managers and workers in separate files.
8. Write a program to perform the following operators on Strings without using String functions
To find the Length of String.
To concatenate two string.
To find Reverse of a string.
To Copy one string to another string.
9. Write a Program to store records of a student in student file. The data must be stored using Binary File. Read the record stored in "Student.txt" file in Binary code. Edit the record stored in Binary File. Append a record in the Student file.
10. Write a program to count the no of Lowercase, Uppercase numbers and special Characters presents in the contents of File.
11. Two Mini Projects based on the skills learned in experiments 1-10 [These mini projects may be done in a group not exceeding group size of 4]
[a] <http://www.codeblocks.org/>
[b] <http://www.eclipse.org/cdt/>
[c] <https://netbeans.org/features/cpp/>
Note:- Any 8-10 Experiments out of the list may be chosen.

ENVIRONMENTAL STUDIES LAB**Paper Code –ETEN-160****P C****Paper : Environmental Studies Lab****2 1****LIST OF EXPERIMENTS**

1. Determination of pH, conductivity and turbidity in drinking water sample.
2. Determination of pH and conductivity of soil/sludge samples.
3. Determination of moisture content of soil sample.
4. Determination of Total Dissolved Solids (TDS) of water sample.
5. Determination of dissolved oxygen (DO) in the water sample.
6. Determination of Biological oxygen demand (BOD) in the water sample.
7. Determination of Chemical oxygen demand (COD) in the water sample.
8. Determination of Residual Chlorine in the water sample.
9. Determination of ammonia in the water sample.
10. Determination of carbon dioxide in the water sample.
11. Determination of nitrate ions or sulphate ions in water using spectrophotometer.
12. Determination of the molecular weight of polystyrene sample using viscometer method.
13. Base catalyzed aldol condensation by Green Methodology.
14. Acetylation of primary amines using eco-friendly method.
15. To determine the concentration of particulate matter in the ambient air using High Volume Sampler.

P.S.: For better understanding of various aspects of environment visits to local areas, depending upon easy access and importance may be planned to any nearby river, forest, grassland, hills and students should write a report based on their observations.

Suggested Books:

1. [A. I. Vogel](#), [G. H. Jeffery](#), *Vogel's Text Book of Quantitative Chemical Analysis*, Published by Longman Scientific & Technical, 5th Edition, 1989.
2. dst.gov.in/green-chem.pdf (monograph of green chemistry laboratory experiments).
3. S. Chawla, *Essentials of Experimental Engineering Chemistry*, Dhanpat Rai & Co., 3rd Edition, 2008.
4. S. Rattan, *Experiments in Applied Chemistry*, Published by S.K.Kataria & Sons, 2nd Edition, 2003.
5. W. Cunningham and M. A. Cunningham, *Principles of Environment Science: Enquiry and Applications*, Tata McGraw Hill Publication, N. Delhi, 2003.
6. A. Kaushik and C. P. Kaushik, *Perspectives in Environment Studies*, 4th Edition, New Age International Publishers, 2013.

Note:- Any 8-10 Experiments out of the list may be chosen.

SWITCHING THEORY AND LOGIC DESIGN

Paper Code: ETEC-205

Paper: Switching Theory and Logic Design

L	T/P	C
3	1	4

INSTRUCTIONS TO PAPER SETTERS:

MAXIMUM MARKS: 75

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

Objective: The objective of the paper is to facilitate the student with the knowledge of Logic Systems and Circuits, thereby enabling the student to obtain the platform for studying Digital Systems and Computer Architecture.

UNIT- I

Number Systems and Codes:- Decimal, Binary, Octal and Hexadecimal Number systems, Codes- BCD, Gray Code, Excess-3 Code, ASCII, EBCDIC, Conversion between various Codes.

Switching Theory:- Boolean Algebra- Postulates and Theorems, De' Morgan's Theorem, Switching Functions- Canonical Forms- Simplification of Switching Functions- Karnaugh Map and Quine Mc-Clusky Methods.

Combinational Logic Circuits:- Review of basic gates- Universal gates, Adder, Subtractor, Serial Adder, Parallel Adder- Carry Propagate Adder, Carry Look-ahead Adder, Carry Save Adder, Comparators, Parity Generators, Decoder and Encoder, Multiplexer and De-multiplexer, ALU, PLA and PAL.

[T2,T3][No. of Hrs. 14]

UNIT- II

Integrated circuits:- TTL and CMOS logic families and their characteristics. Brief introduction to RAM and ROM.

Sequential Logic Circuits:- Latches and Flip Flops- SR, D, T and MS-JK Flip Flops, Asynchronous Inputs.

Counters and Shift Registers:- Design of Synchronous and Asynchronous Counters:- Binary, BCD, Decade and Up/Down Counters, Shift Registers, Types of Shift Registers, Counters using Shift Registers- Ring Counter and Johnson Counter.

[T2,T3][No. of hrs. 10]

UNIT- III

Synchronous Sequential Circuits:- State Tables State Equations and State Diagrams, State Reduction and State Assignment, Design of Clocked Sequential Circuits using State Equations.

Finite state machine-capabilities and limitations, Mealy and Moore models-minimization of completely specified and incompletely specified sequential machines, Partition techniques and merger chart methods-concept of minimal cover table.

[T1][No. of hrs. 10]

UNIT- IV

Algorithmic State Machine: Representation of sequential circuits using ASM charts synthesis of output and next state functions, Data path control path partition-based design.

Fault Detection and Location: Fault models for combinational and sequential circuits, Fault detection in combinational circuits; Homing experiments, distinguishing experiments, machine identification and fault detection experiments in sequential circuits.

[T1][No. of hrs. 10]

Text Book:

- [T1] Zyi Kohavi, "Switching & Finite Automata Theory", TMH, 2nd Edition
- [T2] Morris Mano, Digital Logic and Computer Design", Pearson
- [T3] R.P. Jain, "Modern Digital Electronics", TMH, 2nd Ed,

Reference Books:

- [R1] A Anand Kumar, "Fundamentals of Digital Logic Circuits", PHI
- [R2] Taub, Helbert and Schilling, "Digital Integrated Electronics", TMH

NUMERICAL ANALYSIS & STATISTICAL TECHNIQUES

Paper Code: ETMA-203	L	T/P	C
Paper: Numerical Analysis & Statistical Techniques	3	1	4

INSTRUCTIONS TO PAPER SETTERS:

MAXIMUM MARKS: 75

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

***Objective:** To develop numerical ability and to impart knowledge in Statistical methods and Probability theory and their applications in Engineering to enable them to apply that for solving real world problems.*

UNIT I

Probability Theory: conditional probability, Baye's theorem, Random variable: discrete probability distribution, continuous probability distribution, expectation, moments, moment generating function, skewness, kurtosis, binomial distribution, Poisson distribution, normal distribution, Curve Fitting: Principle of least square Method of least square and curve fitting for linear and parabolic curve .

[T1,T2][No. of Hrs. 11]

UNIT II

Correlation Coefficient, Rank correlation, line of regressions and properties of regression coefficients, ANOVA, Sampling distribution: Testing of hypothesis, level of significance, sampling distribution of mean and variance, Chi-square distribution, Student's T- distribution, F- distribution, Fisher's Z- distribution.

[T1,T2][No. of Hrs. 11]

UNIT III

Numerical Methods: Solution of algebraic and transcendental equations using bisection method, Regula-Falsi method and Newton – Raphson method. Solution of linear simultaneous equations using Gauss-Jacobi's iteration method and Gauss-Seidal's iteration methods. Finite differences: Forward differences, backward differences and Central differences. Interpolation: Newton's interpolation for equi-spaced values. Stirling's central difference interpolation formula, Divided differences and interpolation formula in terms of divided differences, Lagrange's interpolation formula for unequi-spaced values.

[T1,T2][No. of Hrs. 11]

UNIT IV:

Numerical Differentiation, maxima and minima of a tabulated function. Numerical Integration: Newton-Cote's quadrature formula, Trapezoidal rule, Simpson's one-third rule and Simpson's three-eighth rule .Numerical solution of ordinary differential equations: Picard's method, Taylor's method, Euler's method, modified Euler's method, Runge-Kutta method of fourth order.

[T1,T2][No. of Hrs. 11]

Text Books:

- [T1] R.K. Jain and S.R.K. Iyengar, "Numerical methods for Scientific and Engineering Computation", New Age.
- [T2] N.M. Kapoor, "Fundamentals of Mathematical Statistics", Pitambar Publications

References Books:

- [R1] E. kresyzig, "Advance Engineering Mathematics", Wiley publications
- [R2] P. B. Patil and U. P. Verma, "Numerical Computational Methods", Narosa
- [R3]. Partial Differential Equations "Schaum's Outline Series", McGraw Hill.
- [R4] Michael Greenberg, "Advance Engineering mathematics", Pearson.
- [R5] Schaum's Outline on Fourier Analysis with Applications to Boundary Value Problem, TMH
- [R6] B.S. Grewal., "Numerical Methods in Engg. And Science", Khanna Publications
- [R7] Miller and Freund, "Probability and statistics for Engineers", PHI
- [R8] Gupta and Kapoor, "Fundamentals of Mathematical Statistics" Sultan Chand and Sons

MEASUREMENTS AND INSTRUMENTATION

Paper Code ETMT-205

Paper: Measurements and Instrumentation

L	T/P	C
3	0	3

INSTRUCTIONS TO PAPER SETTERS:

MAXIMUM MARKS: 75

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

Objective: To provide the basic understanding regarding ac measurements and instrumentation, working principles of associated meters and instrumentation schemes.

UNIT-I

Introduction to Measurement:

Significance of measurement, Different methods of measurement, Classification of measuring instruments, Application of measurement systems, typical measurement schemes.

Units and Standards:

MKS, SI units of engineering parameters, Details of different standards-mass, length, time, frequency, temperature, EMF, ampere, sub standards and lab standards .

Performance Characteristics:

Definition of range, span, accuracy, precision, drift, sensitivity, reproducibility, repeatability, dead zone, resolution, hysteresis, threshold, zero error, noise, linearity, loading effect, static characteristics.

[T1][T2][No of Hrs: 10]

UNIT -II

Testing & Calibration of measurement setup:

Dynamic Characteristics:

Dynamic response; Transient response; speed of response, fidelity, measuring lag etc, Linear approximation, Introduction to compensation techniques.

Significance of testing and calibration, Calibration curve, Standards for calibration, Different calibration procedures-primary, secondary, direct, indirect, routine calibration, Calibration setup:pressure gauge, level etc. Calibration of Ammeter, Voltmeter and Wattmeter, Energy meter.

[T1][T2][No of Hrs: 12]

UNIT-III

Sensors and Transducers: Transducer classification, Active and Passive Transducers, Potentiometric Transducers, Linear and non-linear potentiometer, Resistance/Bonded Type Strain Gauge.

Displacement Measurement:Linear/ Angular displacement, Pneumatic/Electric/Optical/Ultrasonic/Magnetostrictive/Electronic Displacement Transducers, Proximity Sensors, Typical application schemes.

[T1][T2][No of Hrs: 10]

UNIT -IV

Pressure Measurement:Pressure Units, Force Summing Devices, Secondary Transducers, Vacuum Measurement, Torque Measurement, Tachogenerators.

Temperature Measurement:Electric Method, Change in Electrical Properties, Thermoelectricity, Thermocouples, Thermistors, Thermowells.

Flow Measurement:Reynold Number, Head type flowmeters, Velocity measurement type flowmeters, Mass flow measurement type flow meters.

Level Measurements: Importance, advantage and limitation of different instruments, visual level indicators, float type, Purge method of measuring level, Buoyancy method, Resistance and capacitance probes for level measurement, limit switches, level measurement in pressurized vessels, solid level measurement techniques, modern techniques for level measurements and their applications .

[T1][T2][No of Hrs:12]

Text Books:

[T1] K.L. Kishore,"Electronic Measurement and Instrumentation "Pearson .

[T2] A.K.Ghosh,"Introduction to Measurements and Instrumentation "4th Edition, PHI.

Reference Books:

- [R1] B. C. Nakra., K. K. Chaudhry, “Instrumentation, Measurement and Analysis”, 4th Edition, TMH.
[R2] W. D. Cooper, “Modern Electronics Instrumentation & Measurement Techniques”, PHI.
[R3] John .P.Bentley, “Principles of Measurement Systems”, Pearson



MATERIAL SCIENCE & METALLURGY**Paper Code: ETME-207****Paper: Material Science & Metallurgy**

L	T/P	C
3	0	3

INSTRUCTIONS TO PAPER SETTERS:**MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks

Objective: The objective of the paper is to introduce the student about knowledge of structure of materials and effect of deformation. This paper also provides understanding of heat treatment on materials and applications of different types of alloys and composite materials.

UNIT – I

Structure of metal: Crystal structure (BCC, FCC and HCP, Packing factor and density calculation), X-ray diffraction, miller indices, lattices, imperfections, elementary treatment of point and line defects and their relation to mechanical properties.

Diffusion: Diffusion mechanisms, steady state and non steady state diffusion, factors affecting diffusion

Deformation: Slip, twinning, effect of cold and hot working on mechanical properties, principles of recovery, re-crystallization and grain growth.

[T1,T2] [No. of Hrs. 11]**UNIT – II**

Fracture: Types of fracture ductile and brittle, fatigue

Creep: Basic consideration in the selection of material for high and low temperature service, creep curve, effect of material variables on creep properties, brittle failure at low temperature.

Solidification: Phases in metal system, lever rule, solidification of metal and alloys, solid solution, eutectic, eutectoid and inter-metallic compounds, Iron carbon equilibrium diagram, TTT-diagram. Effect of alloying elements on TTT diagram, S-N curve.

[T1,T2][No. of Hrs. 13]**UNIT - III**

Heat Treatment: Principles and purpose of heat treatment of plain carbon steels, annealing, normalizing, hardening, tempering, isothermal treatment, case hardening – carburizing, nitriding etc, precipitating hardening of aluminum alloys. Hardenability: determination of hardenability Jominy end quench test.

Materials: Plain Carbon steels, effect of alloying elements, properties, uses, springs, and wear resisting steels, IS standards codes for steels.

[T1,T3][No. of Hrs: 10]**UNIT - IV**

Corrosion: Types of corrosion, Galvanic cell, rusting of Iron, Methods of protection from corrosion.

Fiber Reinforced Composites: General characteristics, Applications, Introduction to Fibers – glass, carbon, Kevlar 49 fibers. Matrix – Polymeric, Metallic, Ceramic Matrix, Coupling agents and fillers.

[T1,T3][No. of Hrs: 10]**Text Books:**

[T1] Callister “Materials Science and Engineering”: An Introduction, 6th Edition

[T2] Parashivamurthy K.I “Material Science and Metallurgy”, Pearson,

[T3] Sidney H Avner,” Introduction to Physical Metallurgy”, Tata McGraw-Hill,New Delhi-1997.

Reference Books:

[R1] Degarmo E. Paul et.al, “Materials & Processes in Manufacture”, Prentice Hall India, New Delhi, 2001.

[R2] L. Krishna Reddi, “Principles of Engineering Metallurgy”, New Age Publication, New Delhi, 2001.

[R3] Buduisky et al, “Engineering Materials & Properties”, Prentice Hall India, New Delhi, 2004.

[R4] Peter Haasten, “Physical Metallurgy”, Cambridge Univ. Press, 1996.

[R5] Raymond A Higgin., “Engineering Metallurgy Part 1”, Prentice Hall India, New Delhi, 1998

FLUID MECHANICS**Paper Code: ETME-201****Paper: Fluid Mechanics**

L	T/P	C
3	1	4

INSTRUCTIONS TO PAPER SETTERS**MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks

Objectives : The objective of this subject to provide an understanding of the fundamentals of fluid mechanics, an appreciation of the design principles in fluid systems, the ability to analyse existing fluid systems and contribute to new designs.

UNIT- I

Fundamental Concepts of Fluid Flow: Fundamental definitions, Fluid properties, classification of fluids, Flow characteristics, Foundations of flow analysis, Incompressible and compressible fluids, one, two and three dimensional flows,

Pressure and its measurements: Pascal's law, pressure variation in a fluid at rest, Classification of different manometers.

Fluid Statics: Fluid pressure, Forces on solid surfaces, Buoyant forces, Metacentre and Metacentric height. Stability of floating bodies,

[T1, T2, R1, R2, R3][No. of Hrs-11]

UNIT- II

Kinematics of Fluid Flow: Types of fluid flow, streamline, path line and streak line; continuity equation, Equations for acceleration, Irrotational and rotational flow, velocity potential and stream function, Vortex flow, Continuity equation.

Dynamics of Fluid Flow: Control volume analysis, Eulers equation of motion, Bernoulli's equation, Bernoulli's theorems from steady flow energy equation, Venturi meter; Pitot tube, Momentum equation .

Laminar Flow: Reynold's experiment, Critical velocity, Steady laminar flow through a circular tube, Measurement of viscosity.

[T1, T2, R1, R2, R3][NO. of Hrs-11]

UNIT- III

Turbulent Flow: Shear stress in turbulent flow. Hydro dynamically smooth & rough boundaries.

Velocity distribution for turbulent flow in smooth and rough pipes.

Boundary Layer Flow: Boundary Layer Theory and Applications: Boundary Layer thickness, displacement, momentum and energy thickness, Flow separation, Drag and lift on immersed bodies.

Pipe Flow Systems: Darcy-Weisbach equation, Moody diagram, Energy losses in pipelines, concept of equivalent length, Flow between two reservoirs multiple pipe systems. Siphon.

[T1, T2, R1, R2, R3][NO. of Hrs-11]

UNIT- IV

Dimensional Analysis and Principles of Similarity: Buckingham's Theorem and its applications, Geometric, Kinematics and Dynamic similarity; Dimensionless numbers-Reynolds, Froude, Euler, Mach, Weber Number and their significance.

Flow Measurements: Measurement of flow using, orifice meter, nozzle, Measurement of flow in open channels - rectangular, triangular, trapezoidal weir, Cipoeletti weir. Hot-wire anemometer.

[T1, T2, R1, R2, R3][NO. of Hrs-11]

Text Books:

[T1] R.K. Basal, "Fluid Mechanics & Hydraulic Machines", Laxmi Publications(P) Ltd.,2002.

[T2] D.S. Kumar, "Fluid Mechanics and Fluid Power Engineering", S.K. Kataria & Sons,2000.

Reference Books:

[R1] I.H. Shames, "Mechanics of Fluids", Tata McGraw Hill

[R2] V.L. Streeter and E.B. Wylie, "Fluid Mechanics", Tata McGraw Hill

[R3] Modi, P.N., and Seth, S.H., "Hydraulics and Fluid Machines", Standard Book House,

[R4] Vijay Gupta and S.K.Gupta, "Fluid Mechanics and its Applications", Wiley Eastern Ltd,

[R5] Som, S.K. & Biswas G. : Introduction of fluid mechanics & Fluid Machines, TMH, 2000,

MECHANICS OF SOLIDS

Modified Scheme and Syllabus of B. Tech-Mechatronics (1st Semester to 8th Semester) implemented from Academic Session w.e.f. 2015-16, approved in the 23rd BOS and 40th AC meeting of USET.

Paper Code: ETTE-211
Paper: Mechanics of Solids

L	T/P	C
3	1	4

INSTRUCTIONS TO PAPER SETTERS

MAXIMUM MARKS: 75

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks

Objectives: The students in this course are required to analyse reasons for failure of different components and select the required materials for different applications. For this purpose, it is essential to teach them concepts, principles, applications and practices covering stress, strain, bending moment, shearing force, shafts, columns and springs. Hence this subject has been introduced. It is expected that efforts will be made to provide appropriate learning experiences in the use of basic principles to the solution of applied problems to develop the required competencies.

UNIT-I

Simple Stresses & strains: Concept of stress at a point, Tensile, Compressive, shear and volumetric stresses and Strains, Young's modulus, modulus of rigidity, complementary shear stress, lateral strain and Poisson's ratio. Strain relationships.

Compound bars and Temperature stresses: Stresses in compound bars carrying axial loads and subjected to temperature stresses.

[T1,T2][No. of Hrs. 10]

UNIT-II

Simple bending: Shear force and bending moment diagrams of cantilevers, simply supported beams under concentrated, uniformly loaded and varying loads with and without overhangs. Stresses in beams and cantilevers under bending, beam of uniform strength, bending due to eccentric loads. Shear stress in beams, strain energy, Castigliano's theorem Slope and deflection of cantilevers and beams under concentrated and uniformly distributed loads. Moment Area method, MaCaulay's method; principle of superposition.

[T1,T2][No. of Hrs. 12]

UNIT - III

Columns: Combined direct and bending stresses in columns, Euler's and Rankine Gordon equations.

Torsion: Stresses and strains in pure torsion of solid circular shafts and hollow circular shafts. Power transmitted by shafts; combined bending and torsion. Strain energy in torsion

Complex stresses and strains: Principle stress and strain due to combination of stresses, Mohr's circle, strain energy, theories of Failures.

[T1, T2][No. of Hrs.12]

UNIT- IV

Springs: Close-coiled springs, leaf springs.

Cylinders: Thin and thick cylinders, Lamé's Theorem, compound cylinders, spherical vessels.

[T1,T2][No. of Hrs.10]

Text Books:

[T1] Dr. Sadhu Singh "Strength of Materials", Khanna Pub.

[T2] Hibbler R.C., "Mechanics of Materials", Prentice Hall, New Delhi, 1994.

Reference Books:

[R1] Sri Nath L.S. et.al., "Strength of Materials", McMillan, New Delhi, 2001

[R2] Timoshenko S.P., Gere J "Elements of Strength of Materials", East-West affiliated, New Delhi, 2000

[R2] Bhavikatti S. S. Strength of Materials", Vikas Publishers

[R3] Popov Eger P., "Engg. Mechanics of solids", Prentice Hall, New Delhi, 1998

[R4] Fenner, Roger.T, "Mechanics of Solids", U.K. B.C. Publication, New Delhi, 1990

SWITCHING THEORY AND LOGIC DESIGN LAB

Modified Scheme and Syllabus of B. Tech-Mechatronics (1st Semester to 8th Semester) implemented from Academic Session w.e.f. 2015-16, approved in the 23rd BOS and 40th AC meeting of USET.

Paper Code: ETEC-253

L T/P C

Paper: Switching Theory and Logic Design Lab

0 2 1

List of Experiments:

1. Realize all gates using NAND & NOR gates
2. Realize Half Adder, Full Adder, Half subtracter, Full subtracter
3. Realize a BCD adder
4. Realize a Serial Adder
5. Realize a four bit ALU
6. Realize Master-Slave J K Flip-Flop, using NAND/NOR gates
7. Realize Universal Shift Register
8. Realize Self-Starting, Self Correcting Ring Counter
9. Realize Multiplexer and De-Multiplexer
10. Realize Carry Look ahead Adder / Priority Encoder
11. Simulation of PAL and PLA
12. Simulation Mealy and Moore State machines

NOTE: - At least 8 Experiments out of the list must be done in the semester

NUMERICAL ANALYSIS & STATISTICAL TECHNIQUES LAB

Paper Code: ETMA-253	L	T/P	C
Paper: Numerical Analysis & Statistical Techniques Lab	0	2	1

Based on theory courses ETMA 201 (10-12 experiments)

1. Curve fitting using Method of Least squares.
2. Solution of algebraic and transcendental equation using Gauss- Seidal's iteration method.
3. Solution of algebraic and transcendental equation using Finite difference method.
4. Numerical integration using Trapezoidal Rule & Simpson's one third rule.
5. Solution of ordinary differential equations using Runge-Kutta method.
6. Calculation of probability using probability distributions.
7. Calculation of correlation coefficient.
8. Calculation of Numerical measures such as mean, variance, Skewness & Kurtosis.
9. Estimation of mean & variance using sampling & Hypothesis.
10. Calculation of Rank Correlation.
11. Analysis os samples using ANOVA.

NOTE:- At least 8 Experiments out of the list must be done in the semester.

MEASUREMENTS AND INSTRUMENTATION LAB

Paper Code: ETMT-255	L	T/P	C
Paper: Measurements and Instrumentation Lab	0	2	1

Measurements And Instrumentation Lab experiments based on syllabus (ETMT-205).

NOTE:- At least 8 Experiments from the syllabus must be done in the semester.

MECHANICS OF SOLIDS & FLUIDS LAB**Paper Code: ETTE-257****Paper: MECHANICS OF SOLIDS & FLUIDS LAB**

L	T/P	C
0	2	1

List of Experiment:

1. To perform tensile test in ductile and brittle materials and to draw stress-strain curve and to determine various mechanical properties.
2. To perform compression test on C.I. and to determine ultimate compressive strength.
3. To perform shear test on different materials and determine ultimate shear strength.
4. To perform any one hardness test (Rockwell, Brinell & Vicker's test) and determine hardness of materials.
5. To perform impact test to determine impact strength.
6. To perform torsion test and to determine various mechanical properties.
7. Open Coil spring test.

Fluid Mechanics Lab experiments based on syllabus (ETME-201).**NOTE: At least 8 Experiments out of the list must be done in the semester.**

ORGANIZATIONAL BEHAVIOUR

Paper Code: ETMT-202
Paper: Organizational Behaviour

L	T/P	C
3	0	3

INSTRUCTIONS TO PAPER SETTERS

MAXIMUM MARKS: 75

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks

Objective: The aim of this paper is to provide managerial skills in the students.

UNIT-I

Introduction: Concept and nature of Organizational Behaviour; Contributing disciplines to the field of O.B.; O.B. Models; Need to understand human behaviour; Challenges and Opportunities, Management functions, Tasks and responsibilities of a professional manager; Managerial skills.

[T1,T2][No of Hrs. 10]

UNIT-II

Individual & Interpersonal Behaviour: Biographical Characteristics; Ability; Values; Attitudes-Formation, Theories, Organization related attitude, Relationship between attitude and behaviour; Personality – determinants and traits; Emotions; Learning-Theories and reinforcement schedules, Perception –Process and errors.

[T1,T2][No of Hrs. 12]

UNIT-III

Organization Structure and Process: Organizational climate and culture, Organizational Structure and Design, Managerial Communication, Motivation, Stress and its management, Decision Making: Organizational Context of Decisions, Decision Making Models; Problem Solving.

[T1,T2][No of Hrs. 10]

UNIT-IV

Interactive Aspects of Organizational Behaviour: Interpersonal Behaviour: Johari Window; Transactional Analysis – ego states, types of transactions, life positions, applications of T.A, Group Dynamics; Management of Organizational Conflicts; Leadership Styles.

[T1,T2][No of Hrs. 12]

Text Books:

- [T1] Luthans Fred., “Organizational Behaviour”, McGraw Hill, 2010, 12th ed.
[T2] Robbins & Judge (15th ed.), “Essentials of Organizational Behaviour”, Pearson 2012.

References:

- [R1] Stoner, R. James A.F., Edward Freeman Daniel R Gilbert Jr., Management 6TH Ed, PHI
[R2] George, J. M. & Jones, G.R. (2009). Understanding and Managing Organizational Behaviour, 5th Edition, Pearson Education.
[R3] Green Berg, J. and Baron, R.A. (2008), Behaviour in Organization. Prentice Hall of India.
[R4] Mcshane, S.L., Von Glinow, M.A., Sharma, R.R. (2006) Organizational Behaviour. Tata McGrawHill

KINEMATICS AND DYNAMICS OF MACHINERY

Paper Code: ETMT-204

Paper: KINEMATICS AND DYNAMICS OF MACHINERY

L	T/P	C
3	1	4

INSTRUCTIONS TO PAPER SETTERS

MAXIMUM MARKS: 75

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks

Objectives: The objective of the subject is to expose the students to learn the fundamentals of various laws governing rigid bodies and its motions

UNIT – I

General concepts, Velocity and Acceleration Analysis: Introduction of Simple mechanism, Different types of Kinematics pair, Grublers rule for degree of freedom, Grashof's Criterion for mobility determination Inversions of 3R-P, 2R-2P chains, Kinematic analysis of planar mechanism

[T1,T2][No. of Hrs. 10]

UNIT – II

Cams: Classification, Cams with uniform acceleration and retardation, SHM, Cycloidal motion, oscillating followers.

Gyroscopes: Gyroscopic law, effect of gyroscopic couple on automobiles, ships, aircrafts.

Dynamic Analysis: Slider-crank mechanism, Klein's construction, turning moment computations.

[T1,T2][No. of Hrs. 10]

UNIT – III

Gears: Geometry of tooth profiles, Law of gearing, involute profile, cycloidal profile, interference, helical, spiral and worm gears, simple, compound gear trains. Epicyclic gear trains – Analysis by tabular and relative velocity method, fixing torque.

Governors & Flywheel : Hartnel, Porter governors – construction and working, Flywheel.

[T1,T2][No. of Hrs. 10]

UNIT – IV

Balancing: Static and Dynamic balancing- balancing of revolving masses, single and multi-cylinder engines. Reciprocating masses –single cylinder engine.

Vibrations: Vibration analysis of single degree of freedom, natural, damped forced vibrations, base-excited vibrations, and transmissibility ratio.

[T1,T2][No. of Hrs. 10]

Text Books:

[T1] S.S. Rattan, "Theory of Machines", Tata McGraw Hill,

[T2] Ghosh A & Malik A K "Theory of Mechanisms and Machines" Affiliated East West Press

Reference Books:

[R1] Shigley J E "Theory of Machines", Pearson

[R2] Thomas Beven, "The Theory of Machines", CBS Publishers,

[R3] Dr. V.P. Singh, "Theory of Machines", Dhanpat Rai & Co.(P)Ltd

[R4] Malhotra & Gupta, "The Theory of Machine", Satya Prakashan,.

[R5] P.L. Ballaney, "Theory of Machines & Mechanism", Khanna Publishers.

SIGNALS AND SYSTEMS

Paper Code: ETMT-206

Paper: Signals and Systems

L	T/P	C
3	1	4

INSTRUCTIONS TO PAPER SETTERS:

Maximum Marks: 75

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 12.5 marks.

Objective: This is the first course for representation of various types of electronic signals and LTI systems. Applications of Fourier series, understanding of Fourier transforms and sampling of various signals. Analysis of various systems using the Z transforms, Laplace transforms.

UNIT- I

Continuous And Discrete Time Signals: Definition of signal, Classification of Signals: Periodic and Aperiodic, Even and Odd, Energy and Power signals, Deterministic and Random signals.

Singular Functions: Unit impulse, unit step, unit ramp, complex and exponential, parabolic, Signum, Sinc etc. Properties of unit impulse in continuous and discrete domain, properties of basic functions w.r.t. orthogonality.

Transformation in independent variable of signals: Time scaling, Time shifting, Amplitude scaling. Representation of signals in terms of singular function and orthogonal functions.

Systems: Definition of system, types of systems: Linear and nonlinear, static and dynamic, causal and non-causal, time variant and invariant, invertible and non-invertible, stable and non-stable. System described by differential equation and difference equation.

LTI System: Properties of LTI System, impulse response, convolution and its properties in continuous and discrete domain with proof. Linear convolution in continuous and discrete domain using graphical method, using general formula and matrix method.

[T1, T2] [No. of Hrs. 12]

UNIT- II

Fourier series: Need and application of Fourier series. Fourier series representation of continuous time and discrete time signals using exponential method and trigonometric method. Magnitude and Phase spectrum of signals.

Fourier Transform: Properties of the Continuous time and discrete time Fourier Transform. Magnitude and Phase representations of frequency response of LTI systems Analysis and characterization of LTI systems using Differential Equations and Difference equation.

[T1,T2][No. of Hrs. 11]

UNIT- III

Magnitude- Phase Representation of Frequency Response of LTI System: Linear phase, concept of phase delay and group delay. All pass system.

Laplace Transform: Properties of Laplace transform, concept of ROC and its properties. Computation of impulse response & transfer function using Laplace transform. Inverse-Laplace transforms. Computation of impulse response, total response (zero state and zero input response) & transfer function using Laplace transform.

[T1, T2] [No. of Hrs. 11]

UNIT- IV

Sampling: Sampling of low pass signals, ideal sampling. Aliasing effect, Nyquist rate, reconstruction of signal. Sampling of discrete time signals.

Z Transform: Region of convergence – properties of ROC, Properties of Z-transform.

Inverse Z-transform using contour integration - Residue theorem, Power series expansion and partial fraction expansion. Relationship between Z-transform, Fourier transform and Laplace transform. Computation of impulse response, total response (Zero state and Zero input response) & Transfer function using Z-Transform. Stability of discrete-time LTI System.

[T1, T2] [No. of Hrs. 10]

Text Books:

[T1] Alan V. Oppenheim, Alan S. Willsky, S. Hamid Nawab, "Signals & Systems", 2nd edition, Pearson Education, 1997.

[T2] Simon Haykin and Barry Van Veen, "Signals and Systems", John Wiley, 1999.

Modified Scheme and Syllabus of B. Tech-Mechatronics (1st Semester to 8th Semester) implemented from Academic Session w.e.f. 2015-16, approved in the 23rd BOS and 40th AC meeting of USET.

Reference Books:

- [R1] M.J.Roberts, “Signals and Systems Analysis using Transform Method and MATLAB”, TMH 2003.
- [R2] Tarun kumar rawat “signals and systems “, Oxford University Press, Incorporated, 2010
- [R3] A. Anand kumar, “signals and systems” 3rd edition , PHI
- [R4] Ramesh Babu and R.Anandanatrajan ,”Signals and system”, 4th edition Sci Tech ,2013
- [R5] Moman .H. Hays, “Digital Signal Processing”, Schaum’s outlines, Tata McGraw-Hill2004.
- [R6] John G.Proakis and Dimitris G.Manolakis, “Digital Signal Processing, Principles, Algorithms and Applications”, 3rd edition. PHI, 2000.



CONTROL SYSTEMS

Paper Code: ETEE-212

Paper: Control Systems

L	T/P	C
3	1	4

INSTRUCTIONS TO PAPER SETTERS:

MAXIMUM MARKS: 75

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

Objective: To teach the fundamental concepts of Control systems and mathematical modeling of the system. To study the concept of time response and frequency response of the system. To teach the basics of stability analysis of the system

UNIT I : Control Systems - - Basics & Components

Introduction to basic terms, classifications & types of Control Systems, block diagrams & signal flow graphs. Transfer function, determination of transfer function using block diagram reduction techniques and Mason's Gain formula. Control system components: Electrical/ Mechanical/Electronic/A.C./D.C. Servo Motors, Stepper Motors, Tacho Generators, Synchros, Magnetic Amplifiers, Servo Amplifiers,

[T1,T2][No. of Hrs. : 11]

UNIT II : Time – Domain Analysis

Time domain performance specifications, transient response of first & second order systems, steady state errors and static error constants in unity feedback control systems, response with P, PI and PID controllers, limitations of time domain analysis.

[T1,T2][No. of Hrs. : 10]

UNIT III : Frequency Domain Analysis

Polar and inverse polar plots, frequency domain specifications and performance of LTI systems, Logarithmic plots (Bode plots), gain and phase margins, relative stability. Correlation with time domain performance closes loop frequency responses from open loop response. Limitations of frequency domain analysis, minimum/non-minimum phase systems.

[T1,T2][No. of Hrs. : 10]

UNIT IV : Stability & Compensation Techniques

Concepts, absolute, asymptotic, conditional and marginal stability, Routh–Hurwitz and Nyquist stability criterion, Root locus technique and its application.

Concepts of compensation, series/parallel/ series-parallel/feedback compensation, Lag/Lead/Lag-Lead networks for compensation, compensation using P, PI, PID controllers.

[T1,T2][No. of Hrs. : 11]

Text Books:

- [T1] B. C. Kuo, "Automatic control system", Prentice Hall of India, 7th edition 2001.
 [T2] Nagraath Gopal "Control Systems Engineering -Principles and Design" New Age Publishers

Reference Books:

- [R1] Norman S. Nise, "Control systems engineering" John Wiley & Sons (Asia) Singapore.
 [R2] Raymond T. Stefani, Design of Feedback Control System, Oxford University Press.
 [R3] K. Ogata, "Modern control engineering", Pearson 2002.
 [R4] S. P.Eugene Xavier, "Modern control systems", S. Chand & Company.
 [R5] M. Gopal "Control Systems-Principles and Design" TMH 4th Edition 2012

THERMAL SCIENCE**Paper Code: ETTE-210****Paper: Thermal Science**

L	T/P	C
3	1	4

INSTRUCTION TO PAPER SETTERS:**MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from question no. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

Objective: The objective of the paper is to introduce basic concepts, thermodynamics and other concepts related to thermal science.

UNIT – I

Basic concepts: Introduction to the Basic definitions of Engineering Thermodynamics. Thermodynamic systems : Closed, Open and Isolated systems. Microscopic and Macroscopic view. Intensive and Extensive properties. Zeroth law of Thermodynamics. Phase, State, Process, Cycle. Point functions and Path functions. Gas Laws and Equation of State. Work and Heat.

First Law of Thermodynamics: Introduction to First Law of Thermodynamics, Internal energy. Non flow processes, p-v diagrams. Concept of Flow work, Enthalpy. Analysis of steady flow and unsteady flow processes and their applications. Throttling process.

Second Law of Thermodynamics: Limitations of First law and necessity of Second Law of Thermodynamics, Kelvin Planck statement and Clausius statement, Reversible and Irreversible processes. Carnot cycle, Reversed Carnot cycle. Carnot's Theorem, Clausius inequality. Entropy, Change in Entropy during various processes and representations on t-s diagrams, Entropy principle, Entropy Generation.

[T1, T2, T3, R1, R2, R3] [No. of Hrs. 12]**UNIT – II**

Availability and Irreversibility : High grade and low grade energy. Available and unavailable energy. Dead state. Loss of available energy due to Heat transfer through a Finite temperature difference. Availability. Reversible work and Irreversibility. Availability in non flow systems and steady flow systems. Second law efficiency.

Thermodynamic Property Relations: Maxwell Relations. Clapeyron Equation.

Properties of a Pure Substance: Phase equilibrium of a pure substance on t-v diagram. Normal boiling point of a Pure substance. Saturation states. Compressed liquid. p-v & p-t diagram of a pure substance. Saturated steam, Dry and saturated steam, Superheated steam. Use of Steam tables and Mollier diagram. Different processes of vapour on p-v and t-s diagrams. Measurement of Dryness fraction.

[T1, T2, T3, R1, R2, R3] [No. of Hrs. 12]**UNIT - III:**

Vapour Power Cycles : Carnot cycle. Simple Rankine cycle. Effect of various parameters on the efficiency of Rankine cycle. Reheat and Regenerative cycles.

[T1, T2, T3, R1, R2, R3] [No. of Hrs. 10]**UNIT – IV**

Gas Power Cycles: Carnot cycle, Otto cycle, Diesel cycle, Dual cycle, Stirling cycle, and Ericsson cycle.

Gas Turbines: Brayton cycle, Thermal refinements. Performance of Gas turbines, Combined cycle. Principles of Jet Propulsion. Turbojet and Turbo-prop engines, Rocket engines.

[T1, T2, T3, R1, R2, R3] [No. of Hrs. 10]**Text Books:**

- [T1] P.K. Nag, "Engineering Thermodynamics", 5th edition McGraw Hill
 [T2] Y. A. Cengel & M. A Boles "Thermodynamics- An Engineering Approach", 7th edition TMH
 [T3] Gordon Rosers, & Yon Mahew; "Engineering Thermodynamics", Pearson.

Reference books:

- [R1] M.J. Moran & H.N. Shapiro "Fundamentals of Thermal Engineering" John Wiley & sons.
 [R2] C. P. Arora " Thermodynamics", McGraw Hill
 [R3] S L Somasundaram "Engineering Thermodynamics", New Age International Publishers.
 [R4] R. K. Rajput, "Engineering Thermodynamics", Lakshmi Publications

Modified Scheme and Syllabus of B. Tech-Mechatronics (1st Semester to 8th Semester) implemented from Academic Session w.e.f. 2015-16, approved in the 23rd BOS and 40th AC meeting of USET.

[R5] Shiv Kumar, “Fundamentals of Thermal Engineering” Ane Books Pvt. Ltd.

HYDRAULICS AND PNEUMATICS

Paper Code: ETMT-212

Paper: Hydraulics and Pneumatics

L	T/P	C
3	1	4

INSTRUCTIONS TO PAPER SETTERS:

MAXIMUM MARKS: 75

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from question no. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

Objective: The objective of the paper is to facilitate the students with the working and applications of a large class of pneumatic and hydraulic instruments used in various plants and industries.

UNIT I

Hydraulic Systems

Introduction to fluid power system, Advantage and Disadvantage of Fluid power, Hydraulic fluids- functions, fluid characteristics. Construction, operation, characteristics and graphical symbols of hydraulic components, Sources of hydraulic power, pump classification. Fluid power actuator, Fluid motors.

Pneumatic Systems

Introduction, comparison of pneumatic/ hydraulic and electrical systems, characteristics & symbols of pneumatic components. Air Compression system, Air preparation – principles and components.

[T1, T2][No. of Hrs. 12]

UNIT II

Hydraulic Components & Hydraulic Circuits

Introduction, function of control elements, direction control valve, check valve, pressure control valve, pressure reducing valve, flow control valves, sequence valve, electrical control solenoid valves, Accumulators – types of accumulators, applications and accumulator circuits, intensifier – application and circuits.

[T1, T2][No. of Hrs. 11]

UNIT III

Pneumatic Components & Pneumatic Circuits

Pneumatic Components- Filter, regulators, lubricators, pneumatic actuators, quick exhaust valve, pressure sequence valve, time delay valve, solenoid valve, electrical limit switch, proximity switch, speed control circuits, cascade method- sequential circuit design, synchronizing circuits, time delay circuits.

[T1, T2][No. of Hrs. 11]

UNIT IV

Application, failure and trouble shooting

Development of hydraulic / pneumatic circuits applied to machine tools, presses, material handling systems, automotive systems, packaging industries, manufacturing automation. Maintenance of fluid power systems – preventive and breakdown. Maintenance procedures. Trouble shooting of fluid power systems – fault finding process, equipments/tools used, causes and remedies. Safety aspects involved.

[T1, T2][No. of Hrs. 10]

Text Books:

[T1] Introduction to Hydraulics and Pneumatics, S Ilango, V. Soundarajan, PHI 2013.

[T2] Hydraulics and Pneumatic Controls, K Shanmuga Sundaram, S Chand, 2012.

Reference Books:

[R1] Pneumatic & Hydraulic, Andrew Parr PHI, 1999.

[R2] Industrial Hydraulics, McGraw, John Pippenger, Tyler Hicks, Hill International Edition, 1980.

[R3] Esposito A., “Fluid Power with Applications”, Pearson Education 2005.

[R4] Srinivasan.R, “Hydraulic and Pneumatic controls”, Vijay Nicole, 2006.

[R5] Michael J, Princes and Ashby J. G, “Power Hydraulics”, Prentice Hall, 1989.

KINEMATICS AND DYNAMICS OF MACHINERY LAB

Paper Code: ETMT-252	L	T/P	C
Paper: Kinematics and Dynamics of Machinery Lab	0	2	1

List of Experiments:

1. Draw velocity and acceleration diagram of engine mechanism using graphical methods including Klien's construction.
2. CAM Analysis - angle Vs displacement and jump phenomenon.
3. Determination of gear- train value of compound gear trains and Epicyclic gear trains.
4. To study various types of gears – Helical , cross helical worm, bevel gear.
5. To perform experiment on watt and Porel Governor to prepare performance characteristic Curves, and to find stability and sensitivity.
6. To analyse the motion of a motorized gyroscope when the couple is applied along its spin axis.
7. Static and Dynamic Balancing of rotating masses.
8. Dynamic Balancing of reciprocating masses (IC engine).
9. To determine whirling speed of shaft theoretically and experimentally
10. To determine the natural frequency of un damped torsional vibration of two rotor shaft system.
11. To determine the frequency of undamped free vibration of an equivalent spring mass system.
12. To determine the frequency of damped force vibration of a spring mass system

NOTE: At least 8 Experiments out of the list must be done in the semester.

SIGNALS AND SYSTEMS LAB**Paper Code: ETMT-254****L T/P C****Paper: Signals and Systems Lab****0 2 1****List of Experiments:**

1. Introduction to MATLAB and its basic commands.
2. Plot unit step, unit impulse, unit ramp, exponential, parabolic functions and sinusoidal signals
3. Plot the linear convolution of two sequences.
4. Plot the correlation of two sequences.
5. Plot the magnitude and phase spectra of a signal using Fourier transforms.
6. Plot the magnitude and phase spectrum of signal using Fourier series.
7. Find out the Z transform of a signal and check the stability using pole zero location.
8. Plot the spectra of ideally sampled signal w.r.t. sampling of Discrete time signals.
9. Verification of few properties of Fourier transform.
10. Evaluate the DTFS coefficients of a signal and plot them.
11. Plot the step response for any impulse response entered by user.

NOTE: - At least 8 Experiments out of the list must be done in the semester

CONTROL SYSTEMS LAB**Paper Code: ETEE-260****Paper: Control Systems Lab**

L	T/P	C
0	2	1

List of Experiments:

1. Comparison of open loop & closed loop control in speed control of D.C. motor & to find the transfer function.
2. To study the characteristics of positional error detector by angular displacement of two servo potentiometers
 - a. excited with dc
 - b. excited with ac
3. To study synchro transmitter in terms of position v/s phase and voltage magnitude with respect to rotor voltage magnitude /phase.
4. To study remote position indicator systems using synchro transmitter/receiver.
5. To plot speed- torque curves for ac servomotor for different voltages.
6. To study ac motor position control system & to plot the dynamic response & calculate peak time, settling time, peak overshoot, damping frequency, steady state error etc.
7. To study the time response of simulated linear systems.
8. To study the performance of PID Controller.
9. Plot impulse response, unit step response, unit ramp response of any 2nd order transfer function on same graph using MATLAB.
10. To draw the magnetization (Volt Amps) characteristics of the saturable core reactor used in the magnetic amplifier circuits.
11. Plot root locus for any 2nd order system (with complex poles). For Mp=30%, find the value of K using MATLAB.
12. To design lead-lag compensator for the given process using Bode plots in MATLAB.

NOTE:- At least 8 Experiments out of the list must be done in the semester.

HYDRAULICS AND PNEUMATICS LAB

Paper Code: ETMT-258	L	T/P	C
Paper: Hydraulics and Pneumatics Lab	0	2	1

List of Experiments:

1. Study of Graphical Symbol as per DIN-ISO: 1219.
2. To understand working and construction of hydraulic components and basic circuits using transparent model and cut out sections.
3. To study single acting and double acting pneumatic cylinder using D.C. Valve.
4. To understand use of Logic element 'OR' gate and 'AND' gate.
5. To understand use of Quick Exhaust & Flow control valve.
6. To study pressure sequence valve and time delay valve in pneumatic circuit.
7. Design and develop a sequential circuit using cascade methods for the following sequences A+ B+ A- B-.
8. Speed control of Hydraulic cylinder through Throttle valve.
9. Speed control of Hydraulic cylinder through The Flow control valve in Bypass.
10. Study of Meter-in & Meter-out circuits.
11. To understand use of accumulator in hydraulic circuit.
12. Electro Pneumatic circuit –Speed and Pressure control of double acting cylinder..

NOTE:- At least 8 Experiments out of the list must be done in the semester.

COMMUNICATION SKILLS FOR PROFESSIONALS

Paper Code: ETHS-301

Paper: Communication Skills For Professionals

L	T/P	C
2	0	1

INSTRUCTIONS TO PAPER SETTERS:

MAXIMUM MARKS: 75

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

***Objective:** To develop communication competence in prospective engineers so that they are able to communicate information as well as their thoughts and ideas with clarity and precision. This course will also equip them with the basic skills required for a variety of practical applications of communication such as applying for a job, writing reports and proposals. Further, it will make them aware of the new developments in communication that have become part of business organisations today.*

UNIT-I

Organizational Communication: Meaning, importance and function of communication, Process of communication, Communication Cycle - message, sender, encoding, channel, receiver, decoding, feedback, Characteristics, Media and Types of communication, Formal and informal channels of communication, 7 C's of communication, Barriers to communication, Ethics of communication (plagiarism, language sensitivity)

Soft Skills: Personality Development, Self Analysis through SWOT, Johari Window, Interpersonal skills -Time management, Team building, Leadership skills. Emotional Intelligence. Self Development and Assessment- Self assessment, Awareness, Perception and Attitudes, Values and belief, Personal goal setting, Career planning, Self esteem.

[T1,T2][No. of Hrs. 08]

UNIT-II

Introduction to Phonetics: IPA system (as in Oxford Advanced Learner's Dictionary), Speech Mechanism, The Description of Speech Sounds, Phoneme, Diphthong, Syllable, Stress, Intonation, Prosodic Features; Pronunciation; Phonetic Transcription - Conversion of words to phonetic symbols and from phonetic symbols to words. British & American English (basic difference in vocabulary, spelling, pronunciation, structure)

Non-Verbal Language: Importance, characteristics, types – Paralanguage (voice, tone, volume, speed, pitch, effective pause), Body Language (posture, gesture, eye contact, facial expressions), Proxemics, Chronemics, Appearance, Symbols.

[T1,T2][No. of Hrs. 08]

UNIT-III

Letters at the Workplace – letter writing (hard copy and soft copy): request, sales, enquiry, order, complaint.

Job Application -- resume and cover letter

Meeting Documentation-- notice, memo, circular, agenda and minutes of meeting.

Report Writing - Significance, purpose, characteristics, types of reports, planning, organizing and writing a report, structure of formal report. Writing an abstract, summary, Basics of formatting and style sheet (*IEEE Editorial Style Manual*), development of thesis argument, data collection, inside citations, bibliography; Preparing a written report for presentation and submission. Writing a paper for conference presentation/journal submission.

[T1,T2][No. of Hrs. 08]

UNIT-IV

Listening and Speaking Skills: Importance, purpose and types of listening, process of listening, difference between hearing and listening, Barriers to effective listening, Traits of a good listener, Tips for effective listening. Analytical thinking; Speech, Rhetoric, Polemics; Audience analysis. Telephone Skills - making and receiving calls, leaving a message, asking and giving information, etiquettes.

Presentations: Mode, mean and purpose of presentation, organizing the contents, nuances of delivery, voice and body language in effective presentation, time dimension.

Group Discussion: Purpose, types of GDs, strategies for GDs, body language and guidelines for group discussion.

Interview Skills: Purpose, types of interviews, preparing for the interview, attending the interview, interview process, employers expectations, general etiquettes.

[T1,T2][No. of Hrs. 07]

Text Books:

- [T1] Anna Dept. Of English. Mindscapes: English for Technologists & Engineers PB. New Delhi: Orient Blackswan.
- [T2] Farhathullah, T. M. Communication Skills for Technical Students. Orient Blackswan, 2002.

References Books:

- [R1] Masters, Ann and Harold R. Wallace. Personal Development for Life and Work, 10th Edition. Cengage Learning India, 2012.
- [R2] Institute of Electrical and Electronics Engineers. IEEE Editorial Style Manual. IEEE, n.d. Web. 9 Sept. 2009.
- [R3] Sethi and Dhamija. A Course in Phonetics and Spoken English. PHI Learning, 1999.
- [R4] Khera, Shiv. You Can Win. New York: Macmillan, 2003.

MACHINE ELEMENT DESIGN

Paper Code: ETMT-303
Paper: Machine Element Design

L	T/P	C
3	1	4

INSTRUCTIONS TO PAPER SETTERS:

MAXIMUM MARKS: 75

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

Objectives: The primary objective of this course is to demonstrate how engineering design uses the many principles learned in previous engineering science courses and to show how these principles are practically applied. The emphasis in this course is on machine design: the design and creation of devices that consist of interrelated components used to modify force and/or motion.

UNIT– I

Introduction: Principles of mechanical design, systematic design process, aesthetic and ergonomic considerations in design, use of standards in design. Manufacturing consideration in design, casting, machining, forging, Dynamic and fluctuating stresses, fatigue failure and endurance limit, stress concentration, causes and remedies in design. Factor of safety Tolerances and types of fits as per BIS Selection of materials, designation of steels .Design of Cotter and knuckle joints.

[T1,T2][No. of Hrs.10]

UNIT - II

Design of Elements: screwed fastenings, bolted and riveted joints under direct and eccentric loads, initial tightening loads in bolts. Welded joints, strength of welded joints, eccentrically loaded joints, welded joints subjected to bending moment and torsion.

Translation screws: force analysis and design of various types of power screws,; screw jack, C- clamp, toggle screw jack.

[T1,T2][No. of Hrs.10]

UNIT - III

Shafts, keys and couplings –design of rigid and pin bushed flexible couplings. Levers design Springs, uses and design of close coiled helical springs shot peening of springs.

[T1,T2][No. of Hrs. 12]

UNIT – IV

Classification of Gears, spur gears, Lewis equation, subjected to dynamic and wear loads, gear failures. Bearings - types of sliding bearing, design of sliding bearing using McKee’s equation; types of lubrication Types of Ball & Roller Bearings- selection of bearings from manufacturer’s catalogue based on static & dynamic load carrying capacity, load-life relationships.

[T1,T2][No. of Hrs. 12]

Text Books:

- [T1] Maleeve Hartman and O.P.Grover, “Machine Design”, CBS Publication & Publishers
 [T2] V.B. Bhandari, “Machine Design”, Tata McGraw Hill

Reference Book:

- [R1] Mahadevan, “Design Data Book”, CBS Publishers & Distributors
 [R2] J.E. Shigley & C.R. Mischke, "Mechanical Engineering Design", Tata McGraw Hill Co.Inc.
 [R3] P.C. Sharma and D.K Aggarwal., “Machine Design”, S.K. Kataria & Sons
 [R4] Juvinal R C, Marshek K M, “ Fundamentals of Machine component Design”, Wiley India
 [R5] Norton R. l. “Machine Design” Pearson

METROLOGY AND QUALITY CONTROL

Paper Code: ETMT-305

Paper: Metrology and Quality Control

L	T/P	C
3	1	4

INSTRUCTIONS TO PAPER SETTERS:

MAXIMUM MARKS: 75

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

Objective: The objective of the paper is to facilitate the student with techniques being adopted in industry for inspection and quality checks.

UNIT- I

Principles of measurement: Definition of Metrology, difference between precision and accuracy. Sources of errors: Controllable and Random Errors, Effects of Environment and Temperature, Effects of support, alignment errors, errors in measurement of a quality which is function of other variables. Introduction to Coordinate Measuring Machine (CMM).

Length Standards: Line standards, end standards and wavelength standards, transfer from line standards to end standards. Numerical based on line standards. Slip gauges – its use and care, methods of building different heights using different sets of slip gauges.

Limits, fits and Tolerances: Different types of fits and methods to provide these fits. Numerical to calculate the limits, fits and tolerances as per IS 919-1963. ISO system of limits and fits; Gauges and its types, limit gauges – plug and ring gauges. Gauge Design – Taylor’s Principle, wear allowance on gauges. Different methods of giving tolerances on gauges.

[T1, T2][No. of Hrs. 12]

UNIT-II

Types of Inspection:- Inspection by Gauging: limit gauging, plug gauges, Ring gauges, position gauges
Inspection by Measurement: Direct measurement such as Vernier Caliper, Vernier Height gauge, Vernier Depth gauge Outside Micrometer, Inside Micrometer, Depth Micrometer, Slip gauges (gauge blocks), length bars , Bevel protractor etc. Indirect Measurement such as Mechanical, optical, & pneumatic comparators, Angular Measurements- Sine bar, angle gauges, precision levels, Introduction to Autocollimator, Interferometers, NPL Flatness Interferometer etc.

[T1, T2][No. of Hrs. 11]

UNIT-III

Straightness and flatness: Feature inspection such as flatness, roundness, straightness, parallelism, etc. Surface texture, different types of irregularities, Measurement of various surface roughness parameters. Tomlinson surface meter, Taylor-Hobson talysurf.

Screw Thread Measurement: Error in threads, Measurement of elements of screw threads –major dia, minor dia, pitch, flank angle and effective diameter. Various thread gauges.

Gear Measurement: Gear terminology, measurement of gear thickness, Gear tooth vernier caliper Parkinson gear tester.

[T1, T2][No. of Hrs. 11]

UNIT – IV

Introduction to Quality Assurance: Need of quality, Aspects of quality, Quality specification, Quality function Shewhart’s control charts for variables: X bar and R charts, operating characteristics curves, producer’s risk, consumer’s risk, Sampling inspection , single double and multiple sampling plan.

[T3][No. of Hrs. 10]

Text Books:

- [T1] R.K. Jain, “Engineering Metrology”, Khanna Publishers, Delhi
 [T2] I.C. Gupta, “Engineering Metrology”, Dhanpat Rai Publications, Delhi
 [T3] EL Grant & RS Leavenworth, “Statistical Quality Control”, McGraw Hill & Co, 1988.

Reference Books:

- [R1] F.W. Galyer & C.R. Shotbolt, “Metrology for Engineers”, ELBS Edition
 [R2] Beckwith, Buck, Lienhard, Mechanical Measurements, Pearson Education Asia.
 [R3] Anand K Bewoor, Vinay A Kulkarni “Metrology and Measurement”, TMH

DIGITAL SIGNAL PROCESSING

Paper Code: ETMT-307
Paper: Digital Signal Processing

L	T/P	C
3	1	4

INSTRUCTIONS TO PAPER SETTERS:

MAXIMUM MARKS: 75

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

***Objectives:** The aim of this course is to provide in depth knowledge of various digital signal processing techniques and design of digital filters, learn the concept of DFT FFT algorithms, and design of digital filters using different approximations, DSP processor and architecture.*

UNIT-I :

Frequency Domain Sampling: The Discrete Fourier Transform, Properties of the DFT, Linear filtering methods based of the DFT.

Efficient computation of the DFT: Principal Of FFT, Fast Fourier Transform Algorithms, Applications of FFT Algorithms, A linear filtering approach to computation of the DFT.

Application of DFT, Design of Notch filter

[T2,T1][No. of Hours: 11]

Unit-II :

Design & Structure of IIR filters from analog filters: Impulse Invariance; Bilinear transformation and its use in design of Butterworth and Chebyshev IIR Filters; Frequency transformation in Digital Domain, Direct, Cascade, Parallel & transposed structure

Design & structure of FIR filters: Symmetric and anti-symmetric FIR filters; Design of Linear Phase FIR filters using windows, Frequency Sampling Method of FIR design, Direct, Cascade, Frequency Sampling, transposed structure

[T1,T2] [No. of Hours: 11]

Unit-III:

Implementation of Discrete Time Systems:

Lattice structures, Lattice and Lattice-Ladder Structures, Schur - Cohn stability Test for IIR filters; Discrete Hilbert Transform.

Linear predictive Coding:

Lattice filter design, Levenson Darwin Technique, Schur Algorithm

[T1,T2] [No. of Hours: 10]

Unit-IV:

Quantization Errors in Digital Signal Processing: Representation of numbers, Quantization of filter coefficients, Round-off Effects in digital filters.

Multirate Digital Signal Processing: Decimation, Interpolation, Sampling rate conversion by a rational factor; Frequency domain characterization of Interpolator and Decimator; Polyphase decomposition.

[T1, T2][No. of Hours: 10]

Text Books:

[T1] Oppenheim & Schafer, Digital Signal Processing, PHI-latest edition.

[T2] Proakis and Manolakis, Digital Signal Processing, PHI Publication

Reference Books:

[R1] S. K. Mitra, Digital Signal Processing, TMH edition 2006

[R2] Johnny. R. Johnson, Introduction to Digital Signal Processing, PHI-latest edition

[R3] R.Babu ,Digital Signal Processing , Scitech Publication.

SENSORS AND TRANSDUCERS

Paper Code: ETMT-309
Paper: Sensors and Transducers

L	T/P	C
3	1	4

INSTRUCTIONS TO PAPER SETTERS:**MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

Objective: To provide the basic understanding about operational characteristics and applications of various sensors and transducers.

UNIT I**Introduction to Sensors:**

Definition and differences of sensors and transducers, Classification, static and dynamic characteristics, electrical characterization, mechanical and thermal characterization including bath-tub curve.

Different Sensors:

Mechanical & Electromechanical: Potentiometer, Strain gauges, Inductive sensors—Ferromagnetic type, Transformer type, Electromagnetic, Capacitive sensors— parallel plate, variable permittivity, electrostatic, piezoelectric, Introduction to PZT family

[T1][T2] [No of Hrs 10]**UNIT-II**

Thermal sensors: Gas thermometric sensors, Dielectric constant, refractive index thermo-sensors, nuclear thermometers, resistance change type thermometric sensors, Thermoemf sensors.

Magnetic sensors: Basic working principles, Magnetostrictive, Hall effect, Eddy current type, SQUID sensors.

Radiation sensors: Photo-detectors, Photo-emissive, photomultiplier, scintillation detectors.

[T1][T2] [No of Hrs 11]**UNIT-III**

Electroanalytical sensors: Electrochemical cell, SHE, Polarization, Reference electrode, Metal electrodes, Membrane electrodes, Electroceramics.

Advancement in Sensor technology: Introduction to smart sensors, Film sensors, Introduction to semiconductor IC technology and Micro Electro Mechanical System(MEMS), Nano-sensors. Bio-Sensors.

[T1][T2] [No of Hrs 11]**UNIT-IV****Different Transducers:**

LVDT, RTD, Thermistor, Wire anemometer, piezoresistors, Variable diaphragm capacitance transducers, Angular movement transducers, seismic mass transducer, interferometer transducer.

Feedback transducer system: Inverse transducer, Self-balancing transducer, Servo-operated manometer, Feedback pneumatic load cell, integrating servo.

[T1][T2] [No of Hrs 12]**Text Books:**

[T1] D. Patranabis, "Sensors and Transducers", PHI Learning Pvt. Ltd., 2nd edition

[T2] D V S Murty, "Transducers and Instrumentation", PHI Learning Pvt. Ltd.

Reference Book:

[R1] E.O.Doebelin, Dhanesh N Manik, "Measurement Systems", 6th Edition, Mcgraw Hill Edu.

[R2] John P. Bentley, "Principles of Measurement System", 4th Edition, Pearson Prentice Hall

POWER ELECTRONICS AND DRIVES

Paper Code: ETMT-311

Paper: Power Electronics and Drives

L	T/P	C
3	0	3

INSTRUCTIONS TO PAPER SETTERS:

MAXIMUM MARKS: 75

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

Objective: The objective of the paper is to facilitate the student with the basics of Power Electronics that are required for an engineering student.

UNIT- I

Introduction : Characteristics and switching behaviour of Power Diode, SCR, UJT, TRIAC, DIAC, GTO, MOSFET, IGBT, MCT and power BJT, two-transistor analogy of SCR, firing circuits of SCR and TRIAC, SCR gate characteristics, SCR ratings. Protection of SCR against over current, over voltage, high dV/dt , high dI/dt , thermal protection, Snubber circuits, Methods of commutation, series and parallel operation of SCR, Driver circuits for BJT/MOSFET.

[T1][No. of Hrs. 11]

UNIT- II

A.C. to D.C. Converter: Classification of rectifiers, phase controlled rectifiers, fully controlled and half controlled rectifiers and their performance parameters, three phase half wave, full wave and half controlled rectifiers and their performance parameters, effect of source impedance on the performance of single phase and three phase controlled rectifiers, single-phase and three phase dual converter.

[T1][T2][No. of Hrs. 11]

UNIT- III

Dynamics of Electric Drives: Types of loads, quadrant diagram of speed time characteristics, Basic and modified characteristics of dc and ac motors, equalization of load, steady state stability, calculation of time and energy loss, control of electric drives, modes of operation, speed control and drive classifications, closed loop control of drives, selection of motor power rating, class of duty, thermal considerations.

[T1][T2][No. of Hrs. 11]

UNIT- IV

DC Motor Drives: DC motor speed control, Methods of armature control, field weakening, semiconductor controlled drives, starting, braking, transient analysis, controlled rectifier fed dc drives, chopper controlled dc drives.

[T1][T2] [No. of Hrs. 11]

Text:

- [T1] M.H. Rashid, "Power Electronics: Circuits, Devices and Applications" Pearson Publications.
 [T2] Daniel W. Hart, "Power Electronics" Tata McGraw-Hill

References:

- [R1] Singh, Kanchandani, "Power Electronics", Tata McGraw-Hill.
 [R2] Ned Mohan, Tore M. Undeland and Robbins, "Power Electronics: Converters, Applications and Design" Wiley India Publication
 [R3] V R Moorthi, "Power Electronics: Devices, Circuits and Industrial Applications", Oxford Publication.
 [R4] Kassakian, Schlecht, Verghese, "Principles of Power Electronics", Pearson Publications
 [R5] M.S. Jamil Asghar, "Power Electronics" PHI Publication
 [R6] P. S. Bimbhra "Power Electronics", Khanna Publishing.

COMMUNICATION SKILLS FOR PROFESSIONALS LAB

Modified Scheme and Syllabus of B. Tech-Mechatronics (1st Semester to 8th Semester) implemented from Academic Session w.e.f. 2015-16, approved in the 23rd BOS and 40th AC meeting of USET.

Paper Code: ETHS-351

Paper: Communication Skills for Professionals Lab

L	T/P	C
0	2	1

Objective: To develop communication competence in prospective engineers so that they are able to communicate information as well as their thoughts and ideas with clarity and precision. These activities will enhance students' communication skills with a focus on improving their oral communication both in formal and informal situations. They will develop confidence in facing interviews and participating in group discussions which have become an integral part of placement procedures of most business organisations today.

Lab Activities to be conducted:

- 1. Listening and Comprehension Activities** – Listening to selected lectures, seminars, news (BBC, CNN, etc.). Writing a brief summary or answering questions on the material listened to.
- 2. Reading Activities** -- Reading different types of texts for different purposes with focus on the sound structure and intonation patterns of English. Emphasis on correct pronunciation.
- 3. Conversation Activities**-- Effective Conversation Skills; Formal/Informal Conversation; Addressing higher officials, colleagues, subordinates, a public gathering; Participating in a video conference.
- 4. Making an Oral Presentation**–Planning and preparing a model presentation; Organizing the presentation to suit the audience and context; Connecting with the audience during presentation; Projecting a positive image while speaking; Emphasis on effective body language.
- 5. Making a Power Point Presentation** -- Structure and format; Covering elements of an effective presentation; Body language dynamics.
- 6. Making a Speech** -- Basics of public speaking; Preparing for a speech; Features of a good speech; Speaking with a microphone. Famous speeches may be played as model speeches for learning the art of public speaking. Some suggested speeches: Barack Obama, John F Kennedy, Nelson Mandela, Mahatma Gandhi, Jawahar Lal Nehru, Atal Bihari Vajpayee, Subhash Chandra Bose, Winston Churchill, Martin Luther King Jr.
- 7. Participating in a Group Discussion** -- Structure and dynamics of a GD; Techniques of effective participation in group discussion; Preparing for group discussion; Accepting others' views / ideas; Arguing against others' views or ideas, etc.
- 8. Participating in Mock Interviews** -- Job Interviews: purpose and process; How to prepare for an interview; Language and style to be used in an interview; Types of interview questions and how to answer them.

Suggested Lab Activities:

1. Interview through telephone/video-conferencing
2. Extempore, Story Telling, Poetry Recitation
3. Mock Situations and Role Play; Enacting a short skit
4. Debate (Developing an Argument), News Reading and Anchoring.

Reference Books:

1. Patnaik, Priyadarshi. *Group Discussion and Interview Skills: With VCD*. Cambridge University Press India (Foundation Books), 2012 edition.
2. Kaul, Asha. *Business Communication*. PHI Learning: 2009.
3. Hartman and Lemay. *Presentation Success: A Step-by-Step Approach*. Thomson Learning, 2000.

Note: The Communication Skills Lab should be equipped with computers, microphones, an internet connection, overhead projector, screen, sound system, audio/video recording facilities, and seating arrangement for GDs and mock interviews. The student activities may be recorded and students may replay them to analyse and improve their pronunciation, tone, expressions, body language, etc.

Traditional language lab softwares are not mandatory and may be used by students to practice and enhance their language competence. Such softwares are usually elementary in nature and are mostly based on British/American English (pronunciation, accent and expression). They should preferably be in Indian English.

METROLOGY AND QUALITY CONTROL LAB**Paper Code: ETMT-353****L T/P C****Paper: Metrology and Quality Control Lab****0 2 1****List of Experiments:**

1. Study & working of simple measuring instruments- Vernier calipers, micrometer, tachometer.
2. Measurement of effective diameter of a screw thread using 3 wire method.
3. Measurement of angle using sine bar & slip gauges. Study of limit gauges.
4. Study of angular measurement using level protector.
5. Adjustment of spark plug gap using feeler gauges.
6. Study of dial indicator & its constructional details.
7. Use of dial indicator to check a shape run use.
8. Study and understanding of limits, fits & tolerances
9. Study of Pressure and Temperature measuring equipment.
10. Speed measurement using stroboscope.
11. Flow measurement experiment
12. Vibration/work measuring experiment.
13. Determination of linear / Angular dimensions of a part using any other precision / non-precision measuring instruments.
14. Precision Angular measurement using Autocollimator / Angle Dekkor.
15. Machine Tool Alignment Test on any machine like-Lathe, Milling, Drilling.
16. Measurement of Screw Thread using Floating Carriage Micrometer.
17. Measurement of Gear Tooth Thickness by Gear Tooth vernier caliper/Constant Chord /Span Micrometer.
18. Measurement of Circularity / Roundness using Mechanical Comparator.
19. Calibration of Dial gauge using dial gauge Tester.
20. Study of Surfaces using optical flat.
21. Study and applications of profile projector and Tool Makers microscope.
22. Inspection of Production Job by statistical Process Control.

NOTE: At least 8 Experiments out of the list must be done in the semester.

DIGITAL SIGNAL PROCESSING LAB**Paper Code: ETMT-355****Paper: Digital Signal Processing Lab**

L	T/P	C
0	2	1

List of Experiments:**Software Experiments:**

1. Generation of basic signals sine, cosine, ramp, step, impulse and exponential in continuous and discrete domains using user defined functions.
2. Write a MATLAB program to find convolution (linear/circular) and correlation of two discrete signals.
3. Perform linear convolution using circular convolution and vice versa.
4. Write a MATLAB program to
 - a. Find 8 point DFT, its magnitude and phase plot and inverse DFT.
 - b. Find 16 point DFT, its magnitude and phase plot and inverse DFT.
5. Perform the following properties of DFT-
 - a. Circular shift of a sequence.
 - b. Circular fold of a sequence.
6. Write a MATLAB Program to design FIR Low pass filter using
 - a. Rectangular window
 - b. Hanning window
 - c. Hamming window
 - d. Bartlett window
7. Write a MATLAB program to
 - a. Implement a Low pass / High pass / Band pass / Band stop IIR Filter using Butterworth Approximation.
 - b. Implement a Low pass / High pass / Band pass / Band stop IIR Filter using Chebyshev Approximation.

Hardware Experiments using Texas Instruments Kits-DSK 6713:

8. Introduction to Code composer Studio.
9. Write a program to generate a sine wave and see the output on CRO
10. Write a Program to Generate ECHO to give audio file.
11. Write a program to demonstrate Band Stop filter by FIR.

Additional Experiments:

12. Write a program to generate a cos wave and see the output on CRO
13. Write a program to blink the LED
14. Write a program to display a string on LCD.

NOTE: At least 8 Experiments out of the list must be done in the semester.

SENSORS AND TRANSDUCERS LAB**Paper Code: ETMT-357****Paper: Sensors and Transducers Lab**

L	T/P	C
0	2	1

List of Experiments:

1. Study of various sensors e.g. thermocouple, RTD, thermistor, magnetic sensors, load cells, film sensors.
2. Characteristics of (Resistive and Thermo emf) temperature sensor
3. Measurement of displacement using LVDT
4. Measurement of strain and torque using strain gauges
5. Measurement of speed using photoelectric sensors, tachogenerators and stroboscope.
6. Calibration and measurement of temperature using PRT.
7. Static and Dynamic Characteristics of sensors.
8. Liquid level measurement using capacitive measurement system.
9. Pressure measurement using load cell.
10. Study and operation of Electrochemical Cell.

NOTE: At least 8 Experiments out of the list must be done in the semester.

POWER ELECTRONICS AND DRIVES LAB

Paper Code: ETMT-359

L T/P C

Paper: Power Electronics And Drives Lab

0 2 1

List of Experiments:

1. To study and analyze V-I characteristics of SCR and TRIAC.
2. To study the switching characteristics of MOSFET and IGBT.
3. To study R and RC and UJT based firing circuits using SCR.
4. To study single phase Semi-converter and Full converters feeding R and RL load.
5. To study A.C phase control using SCR (half and full wave) using DIAC and TRIAC for dimmer application.
6. To study single-phase cyclo-converter feeding R and RL loads.
7. Load equalization by flywheel for intermittent duty loads.
8. Comparison of various braking methods and their range of braking for induction motor.
9. Open loop AC voltage Control of single phase capacitor run induction motor.
10. Verification of linear relationship between duty cycle vs speed in open loop step down chopper controlled DC motor drive.
11. Single phase thyristorised full converter fed closed loop speed control of DC motor drive.
12. Closed loop speed control of 4 quadrant DC motor drive.

NOTE: At least 8 Experiments out of the list must be done in the semester.

MANAGEMENT OF MANUFACTURING SYSTEMS

Paper Code: ETMT-302	L	T/P	C
Paper: Management of Manufacturing systems	3	1	4

INSTRUCTIONS TO PAPER SETTERS:

MAXIMUM MARKS: 75

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks

Objective: The objective of the paper is to facilitate the student with problems and solutions in managing factory operations.

UNIT I:

Introduction: Production functions, Management systems, production and productivity.

Plant Organization: Principles of organization, Organization structure-line and staff organization.

Plant Location, Layout: Process layout, product layout and combination – methods of layout, economics of layout; group technology.

[T1,T2][No. of Hrs. 11]

UNIT II:

Production Planning & Control: Types of products, demand, demand forecasting, marketing strategies, scheduling and control of scheduling production control.

Method Study: Definition and concepts, method study procedures, symbols, advantages, Operation process chart, Flow process charts, Two hand process chart, Motion study, micro motion, SIMO charts, Systems Concepts, Classification analysis techniques, Principle of motion economics.

Work Measurement: Definition, objectives & techniques, Time study equipment, performance rating, allowances, standard time, work sampling, PMTS.

[T1,T2][No. of Hrs. 11]

UNIT III:

Industrial Maintenance: Types, organization for maintenance department, Breakdown and preventive maintenance and corrective maintenance.

Inventory control and replacement analysis: Introduction replacement policy and method adopted, EOQ.

[T1,T2][No. of Hrs. 11]

UNIT IV:

Management Concepts: Development of management principles, scientific management, human relation aspects.

Production Cost Concepts: Introduction, cost of production, cost centre and unit, Classification and analysis of cost, break Even Analysis.

[T1,T2][No. of Hrs. 11]

Text Books:

[T1] Ravi Shankar, "Industrial Engg. & Management", Galgotia Publications

[T2] S.K. Sharma, "Industrial Engg. & Operation Management", S.K. Kataria & Sons.

Reference Book:

[R1] Joseph S. Martinich, "Production & Operation Management", John Wiley & Sons.

[R2] S. N. Chary, "Production and operations management, TMH 4th edition

[R3] Harold T. Amrine, John A. Ritchey, Colin L. Moodie, Joseph F. Kmec "Manufacturing organization and Management" Pearson publication 6th edition

[R4] S. Anil Kumar, N. Suresh "Production and operations management", New age International, 2nd Ed.

[R5] M. Mahajan, "Industrial Engg. & Production Management", Dhanpat Rai & Co.

MANUFACTURING TECHNOLOGY

Paper Code: ETMT-304
Paper: Manufacturing Technology

L	T/P	C
3	1	4

INSTRUCTIONS TO PAPER SETTERS:

MAXIMUM MARKS: 75

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks

Objective: The objective of the paper is to facilitate the student with conventional techniques being used in industry for production purposes.

UNIT - I

Moulding: Introduction to sand moulding, Pattern design, Pattern layout and construction, testing of moulding sand. moulding and core making machines, CO₂ - Process, fluid sand process, shell moulding, cold curing process, hot-box method, flask less moulding, Design of metal moulds, Die Design for die Casting.

[T1] [No. of Hrs: 10]

UNIT - II

Casting: Directional principles, Solidification, types of gating systems, Pouring time and temperature. Design criteria of pouring basin, sprue, runner, gate and riser, gating ratio- related numerical problems, Use of chaplet, chills and padding, Selection of melting furnaces, Crucible furnaces, Electric furnaces, Induction furnace, Control of melt and Cupola charge calculations. Foundry mechanization and layout.

[T1,T2] [No. of Hrs: 10]

UNIT - III

Welding: Principle, advantages, limitations and applications, Tungsten Inert Gas welding, Metal Inert Gas welding, Electro - slag welding, Electro - Gas Welding, Explosive Welding, Ultrasonic Welding, Electron Beam Welding, Laser Beam Welding, Friction Welding, Cold Welding, Thermit Welding. Welding Defects-causes and remedies. Numerical problems on electric arc welding and resistance welding.

[T1,T2][No. of Hrs: 11]

UNIT - IV

Metal Forming: Introduction to Metal Forming, Elastic & plastic deformation, Hot working and cold working. Work required for forging, Hand, Power, Drop forging.

Analysis of wire drawing and maximum reduction. Tube drawing, Extrusion, types and its application. Rolling process, rolling mills & rolled-sections. Defects in metal forming processes. Sheet metal processes, shearing, calculation of punch force, shearing dies, stretch forming, Deep drawing and its analysis.

[T1,T2] [No. of Hrs: 11]

Text Books:

- [T1] Manufacturing processes Vol. 1, by H.S. Shan, Pearson Education
 [T2] Manufacturing Engineering & Technology by Kalpakjian, Pearson Publication

Reference Books:

- [R1] Mikell P. Groover" Principles of Modern Manufacturing, 5th Edition SI Version , Wiley
 [R2] Jain P.L., "Principles of Foundry Technology", Tata McGraw Hill, New Delhi, 1998.
 [R3] Sharma P.C., "A Text Book of Production Engineering", Vol.1, S. Chand Publication, New Delhi, 2001.
 [R4] Heine & Rosenthal, "Principle of Metal Casting", Tata McGraw Hills, New Delhi, 2003.
 [R5] Little Richard L, "Welding & Welding Technology", Tata McGraw Hill, New Delhi, 2003.
 [R6] Jain, R.K., "Production Technology", Khanna Publishers, 2001.
 [R7] HMT Bangalore, "Production Technology", Tata McGraw Hill, 1980.
 [R8] A.K. Chakrabarti "Casting Technology and cast alloys" 2011, PHI learning

PROGRAMMABLE LOGIC CONTROLLER & SCADA

Paper Code: ETMT-306

L T/P C

Paper: Programmable Logic Controller & SCADA

3 1 4

INSTRUCTIONS TO PAPER SETTERS:

MAXIMUM MARKS: 75

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

Objective: The objective of this paper is to introduce the students about the knowledge of programmable logic controller, principles of PLC and functions and SCADA and its elements and functions.

UNIT-I

Programmable Logic Controller (PLC) Basics: Introduction, Parts of PLC, Principles of operation, PLC size and applications, PLC Advantages and Disadvantages, PLC Manufacturers, PLC hardware components, I/O section, Analog I/O modules, Digital I/O modules, CPU- Processor memory module, Programming devices, Devices which can be connected to I/O modules, Relay, Contactor, SPST, Push Buttons, NO/NC Concept

[T1,T2] [No of Hrs 10]

UNIT-II

Programming of Programmable Logic Controller: General PLC Programming Procedures, Contacts and Coils, Program SCAN, Programming Languages, Ladder Programming, Relay Instructions, Instruction Addressing, Concept of Latching, Branch Instructions, Contact and Coil I/O Programming Examples, Relation of Digital Gate Logic to Contact/Coil Logic.

[T1,T2] [No of Hrs 12]

UNIT-III

Programmable Logic controller Functions: Timer Instructions: ON DEAY Timer and OFF DELAY timer, Counter Instructions: UP/DOWN Counters, Timer and Counter Applications, Program Control Instructions: Master Control Reset, Jump and Subroutine, Math Instructions- ADD, SUB. Data Handling: Data Move, Data Compare, Data Selection, Electro-pneumatic Sequential Circuits and Applications.

[T1,T2] [No of Hrs 12]

UNIT-IV

SCADA: Definition of SCADA, Applicable Processes, Elements of SCADA System, A Limited Two-Way System. Real Time Systems: Communication Access and Master-Slave determining scan interval. Introduction to Remote Control, Communications-A/D Conversion, Long Distance Communication, Communication System components in brief- Protocol, Modems, Synchronous/Asynchronous telephone cable/radio, Half Duplex, Full Duplex System, Brief introduction to RTU and MTU, Applications-Automatic Control, Advisory Applications.

[R1] [No of Hrs 10]

Text Books:

[T1] Frank D. Petruzella “Programmable Logic Controllers”, McGraw-Hill Book Company.

[T2] John w. Webb and Ronald A. Reis, “Programmable Logic Controllers”, PHI

Reference Books:

[R1] Stuart A.Boyer “Supervisors Control and Data Acquisition”, ISA

[R2] William I. Fletcher “An Engineering Approach to Digital Design”, PHI.

[R3] Simpson, Colin “Programmable Logic Controllers”, Englewood Cliffs NJ PHI.

[R4] Gray Dunning, “Introduction to Programmable Logic Controllers”, Delmar Thompson Learning

[R5] Stenerson, John “Fundamentals Logic Controllers Sensors, & Communications”, Englewood Cliffs, NJ, 1993. Prentice Hall.

[R6] Programmable Logic Controllers, W.Bolton, Elsevier

COMPUTER INTEGRATED MANUFACTURING**Paper Code: ETMT-308****Paper: COMPUTER INTEGRATED MANUFACTURING**

L	T/P	C
3	1	4

INSTRUCTIONS TO PAPER SETTERS:**MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

Objective: To study of application of CNC in Manufacturing & Computers in planning and scheduling in Manufacturing.

UNIT-1**An overview of CNC machines:**

Need, benefits & limitations, classification of CNC machines, Constructional features of CNC machines, Design considerations of CNC machine tools, elements of CNC machine & systems, precision measuring & positioning of CNC, Function of MCU, Machining centre, Turning centre, CNC EDM, Ball screw, Bearings, Centralized lubrication systems.

Manual part programming - preparatory, miscellaneous functions- Fanuc, Sinumeric, Hass controls. Linear interpolation, circular interpolation, canned cycles, cycles of threading & grooving operations, tool compensation, sub-program, main program, part programming structure, work co-ordinate system, absolute & incremental commands, feed, program zero point, co-ordinate system, process planning & flow chart for part programming, scaling, rotating, mirroring, copy & special cycles for CNC lathe and milling.

[T1][T2][T3][No. of Hrs 10]

UNIT- II

Functions and Components of CIM System: Concept of CAD/CAM and CIMS; Software Technology for CIM System: Business Database System: File processing, Data Processing and Database Design, File Organization and Relational Analysis; Decision Support System, Personal / Distributed Computing and Local Area Network.

Tooling for CNC machine: introduction, cutting tool materials, types of cutting tools for NC machines, tool selection, ISO specification of cutting tools, different clamping system in tool holders, tooling for milling, angle plates, CNC vices, work holding devices, clamps, rotary tables.

[T1] [T2] [T3][No. of Hrs 12]

UNIT-III**Planning and Scheduling Functions in CIM System:**

Aggregate Production Planning (APP), Master Production Schedule (MPS), Material Requirement Planning (MRP), Capacity Requirement Planning (CRP), Manufacturing Resource Planning (MRPII), Just-In-time Production Systems and Concept of Enterprise Resource Planning (ERP). CNC Program generation from CAD, CNC controller & motion control in CNC system. Application of CNC and recent advances in CNC machines, maintenance of CNC machine tools, CNC trainer, DNC.

[T1][T2][T3][No. of Hrs 10]

UNIT-IV**Computer-Aided Process Planning:**

Approaches – Variant and Generative, Feature Classification and Recognition; Process Classifications and Selections, Machines and Tool Selection, Setting Process Parameters, Process Sheet Documentation. Programming;

Automated Material Handling Systems and Advanced Manufacturing Systems:

Industrial Robots, Conveyors, AGVs, Automatic Storage and Retrieval Systems; Lean Manufacturing Systems, Agile Manufacturing Systems, Reconfigurable Manufacturing Systems, Holonic Manufacturing Systems and Agent-Based Manufacturing Systems. Programming.

[T1][T2][T3][No. of Hrs 10]

Text Books:

- [T1] T.K. Kundra, P. N.Rao & N.K.Tiwari, "Numerical Control and Computer Aided Manufacturing", TMH
 [T2] Mikell P. Groover, "Automation, Production Systems and Computer- Integrated Manufacturing", 2nd Edition, Prentice Hall, 2001.
 [T3] S.K. Sinha, "CNC Programming", Galgotia Publications 2003.

Modified Scheme and Syllabus of B. Tech-Mechatronics (1st Semester to 8th Semester) implemented from Academic Session w.e.f. 2015-16, approved in the 23rd BOS and 40th AC meeting of USET.

Reference Books:

- [R1] P. Radhakrishnan, "Computer Numerical Control Machine & Computer Aided Manufacturing", New Academic Science Limited.
- [R2] U. Rembold, "Computer Integrated Manufacturing and Engineering", Addison Wesley Publishers, 1993 edition
- [R3] S. Kant Vajpayee, "Principles of Computer Integrated Manufacturing", PHI Learning Private Limited, New Delhi, 2012
- [R4] M. Adithan, B.S. Pabla, "CNC Machines", New Age
- [R5] Binit Kumar Jha, "CNC programming made Easy", Vikas Publications



AUTOMOTIVE ELECTRONICS

Paper Code: ETMT-310
Paper: Automotive Electronics

L	T/P	C
3	1	4

INSTRUCTIONS TO PAPER SETTERS:

MAXIMUM MARKS: 75

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

Objective: To study about the automotive engineering, basic and electrical systems, automotive components, sensor, controls, monitoring and diagnostics.

UNIT - I
FUNDAMENTALS OF AUTOMOTIVE ELECTRONICS

Introduction to Automobile Engineering, Basic automotive system, Electrical systems, Evolution of electronics in automotive, Automotive Control Systems, Components for Electronic Engine Management, Electronic management of chassis system, Current trends in Automobiles.

[T1,T2] [No. of Hrs 10]

UNIT - II
AUTOMOTIVE CONTROL SYSTEM APPLICATIONS OF SENSORS AND ACTUATORS:

Introduction, Basic sensor arrangement, Air flow rate sensor, Engine crankshaft angular position sensor, Engine speed sensor, Timing sensor for ignition and fuel delivery, Throttle angle sensor, Pressure sensor, Temperature sensors, Exhaust gas oxygen sensors, Knock Sensor, Engine torque sensors, Automotive engine control actuators – Fuel injection, Exhaust gas recirculation actuator.

[T1,T2][No of Hrs 11]

UNIT- III
AUTOMOTIVE ENGINE CONTROL SYSTEMS: Engine Control Objectives, Spark Ignition Engines: Engine control functions, Engine control modes, Fuel delivery systems, MPFI, Ignition Systems, Diagnostics – Compression Ignition Engines – Emission control.

Automotive Transmission Control Systems : Transmission control, Cruise control system, Antilock braking system, Tire-slip controller, Traction control, Electronic Suspension system, Steering control, Stability control, Integrated engine control.

[T1][No of Hrs 12]

UNIT- IV
AUTOMOTIVE MONITORING AND DIAGNOSTICS: Electromagnetic Interference (EMI) Suppression, Electromagnetic Compatibility, Electronic Dashboard Instruments, Fundamentals of diagnostics, Diagnostics procedure and sequence, On board and off board Diagnostics in automotive, Security and warning Systems.

[T1, T2][No of Hrs 11]

Text Books:

- [T1] William B. Ribbens, "Understanding Automotive, Elsevier.
 [T2] Robert Bosch, Automotive Electronics Handbook, John Wiley and Sons.

Reference Books:

- [R1] Tom Weather Jr and Cland C. Hunter, "Automotive Computers and Control System" Prentice Hall Inc., New Jersey.
 [R2] Young A.P. and Griffiths, L., Automobile Electrical Equipment "English Language Book Society and New Press.
 [R3] Crouse, W.H. Automobile Electrical Equipment, McGraw Hill Book Co Inc., New York.
 [R4] Robert N Brady, Automotive Computers and Digital Instrumentation, Areston Book Prentice Hall, Eagle Wood Cliffs, New Jersey..
 [R5] R.K. Jurgen, Automotive Electronics Handbook, McGraw Hill 2nd Edition

MICROPROCESSORS AND MICROCONTROLLERS

Paper Code: ETMT-312

Paper: Microprocessors and Microcontrollers

L	T/P	C
3	1	4

INSTRUCTIONS TO PAPER SETTERS:

MAXIMUM MARKS: 75

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks

Objective: The objective of the paper is to facilitate the student with the knowledge of microprocessor systems and microcontroller.

UNIT- I

Introduction to Microprocessor Systems: Architecture and PIN diagram of 8085, Timing Diagram, memory organization, Addressing modes, Interrupts. Assembly Language Programming.

[T1][No. of hrs. 10]

UNIT- II

8086 Microprocessor: 8086 Architecture, difference between 8085 and 8086 architecture, generation of physical address, PIN diagram of 8086, Minimum Mode and Maximum mode, Bus cycle, Memory Organization, Memory Interfacing, Addressing Modes, Assembler Directives, Instruction set of 8086, Assembly Language Programming, Hardware and Software Interrupts.

[T2][No. of hrs. :12]

UNIT- III

Interfacing of 8086 with 8255, 8254/ 8253, 8251, 8259: Introduction, Generation of I/O Ports, Programmable Peripheral Interface (PPI)-Intel 8255, Sample-and-Hold Circuit and Multiplexer, Keyboard and Display Interface, Keyboard and Display Controller (8279), Programmable Interval timers (Intel 8253/8254), USART (8251), PIC (8259), DAC, ADC, LCD, Stepper Motor.

[T1][No. of hrs. :12]

UNIT-IV

Overview of Microcontroller 8051: Introduction to 8051 Micro-controller, Architecture, Memory organization, Special function registers, Port Operation, Memory Interfacing, I/O Interfacing, Programming 8051 resources, interrupts, Programmer's model of 8051, Operand types, Operand addressing, Data transfer instructions, Arithmetic instructions, Logic instructions, Control transfer instructions, Timer & Counter Programming, Interrupt Programming.

[T3][No. of hrs. 11]

Text Books:

- [T1] Muhammad Ali Mazidi, "Microprocessors and Microcontrollers", Pearson, 2006
 [T2] Douglas V Hall, "Microprocessors and Interfacing, Programming and Hardware" Tata McGraw Hill, 2006.
 [T3] Ramesh Gaonkar, "MicroProcessor Architecture, Programming and Applications with the 8085", PHI

References Books:

- [R1] Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin D. MCKinlay "The 8051 Microcontroller and Embedded Systems", 2nd Edition, Pearson Education 2008.
 [R2] Kenneth J. Ayala, "The 8086 Microprocessor: Programming & Interfacing The PC", Delmar Publishers, 2007.
 [R3] A K Ray, K M Bhurchandi, "Advanced Microprocessors and Peripherals", Tata McGraw Hill, 2007.
 [R4] Vaneeet Singh, Gurmeet Singh, "Microprocessor and Interfacing", Satya Prakashan, 2007.

PROGRAMMABLE LOGIC CONTROLLER & SCADA LAB

Paper Code: ETMT-352	L	T/P	C
Paper: Programmable Logic Controller & SCADA Lab	0	2	1

Name of the Experiments

1. To study about software components like contacts and coils.
2. Study of input and output of PLC with physical wiring.
3. To develop a ladder program for GO-DOWN Wiring and verify it on PLC using SPST Switches.
4. To develop a ladder program for STAIR-CASE Wiring and verify it on PLC using SPST Switches.
5. To develop a ladder program for START/STOP of a motor and verify it on PLC using Push Buttons.
6. To develop a ladder program for FORWARD/REVERSE of a motor and verify it on PLC using Push Buttons.
7. To study about software functional blocks like TIMERS and COUNTERS.
8. To develop a ladder program to generate a SQUARE WAVE and verify it on PLC using Timers.
9. To develop a ladder program to generate an RTC using timer and counter.
10. To develop a ladder program to generate a SEQUENTIAL SQUARE CYCLE(A+B+A-B-) for the movement of a piston using Mono-Stable and Bi-Stable Electro-Pneumatic valves.
11. PLC interfaced with SCADA and status read/command transfer operation.
12. Parameter reading of PLC in SCADA.

NOTE: At least 8 Experiments out of the list must be done in the semester.

COMPUTER INTEGRATED MANUFACTURING LAB

Paper Code: ETMT-354	L	T/P	C
Paper: Computer Integrated Manufacturing Lab	0	2	1

List of Experiments:

1. To study the characteristic features of CNC machine.
2. Part programming (in word address format) experiment for turning operation (including operations such as grooving and threading) and running on CNC machine.
3. Part programming (in word address format or ATP) experiment for drilling operation (point to point) and running on CNC machine.
4. Part programming (in word address format or ATP) experiment for milling operation (contouring) and running on CNC machine.
5. Experiment on Robot and programs.
6. Experiment on Transfer Line/Material Handling.
7. Experiment on difference between ordinary and NC machine, study or retrofitting.
8. Experiment on study of system devices such as motors and feedback devices.
9. Experiment on Mechatronics and Controls.

NOTE: At least 8 Experiments out of the list must be done in the semester.

AUTOMOTIVE ELECTRONICS LAB

Modified Scheme and Syllabus of B. Tech-Mechatronics (1st Semester to 8th Semester) implemented from Academic Session w.e.f. 2015-16, approved in the 23rd BOS and 40th AC meeting of USET.

Paper Code: ETMT-356
Paper: Automotive Electronics Lab

L	T/P	C
0	2	1

List of experiments:

1. Study of automotive electrical system (Starting system, Ignition system, lighting system, wiring harness).
2. Study of SCR and IC timer.
3. Study of rectifiers and filters.
4. Study the function of solenoid switch and starting motors.
5. Study of different sensor used in modern automotive system.
6. Study of Electronic ignition system.
7. Study of Electronic fuel injection system.
8. Study the cruise control system.
9. Study of Electronic dash board instruments.
10. Study of security and warning system.

NOTE: At least 8 Experiments out of the list must be done in the semester.

MICROPROCESSORS AND MICROCONTROLLERS LAB

Paper Code: ETMT-358	L	T/P	C
Paper: Microprocessors and Microcontrollers Lab	0	2	1

List of Experiments:

1. Write a program to add and subtract two 16-bit numbers with/ without carry using 8086.
2. Write a program to multiply two 8 bit numbers by repetitive addition method using 8086.
3. Write a Program to generate Fibonacci series.
4. Write a Program to generate Factorial of a number.
5. Write a Program to read 16 bit Data from a port and display the same in another port.
6. Write a Program to generate a square wave using 8254.
7. Write a Program to generate a square wave of 10 kHz using Timer 1 in mode 1(using 8051).
8. Write a Program to transfer data from external ROM to internal (using 8051).
9. Design a Minor project using 8086 Micro processor (Ex: Traffic light controller/temperature controller etc)
10. Design a Minor project using 8051 Micro controller

NOTE: - At least 8 Experiments out of the list must be done in the semester.

COMPUTER AIDED DESIGN**Paper Code: ETAT-401****Paper: Computer Aided Design**

L	T/P	C
3	1	4

INSTRUCTIONS TO PAPER SETTERS:**MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

Objective: The objective of the paper is to introduce the students about the knowledge of CAD and CAD systems evaluation, 3D transformation, Curves and other geometric mapping and formulation.

UNIT- I

CAD: CAD Hardware: Types of Systems, CAD Systems Evaluation Criteria, Input Devices, Output Devices;
CAD Software: Standards, Basic Definitions – Data Structure, Database, DBMS, Database Coordinate System, Working Coordinate System, Screen Coordinate System, Modes of Operations, User Interface, Software Modules – OS Module, Applications Module, Programming Module, Communications Module, Modelling and Viewing.

Mapping of Geometric Models: Translation, Rotational, General, Changes of Coordinate System, Numerical problems.

Three Dimensional Transformations: Point representations, Transformation Matrices, Scaling, Translation, Rotation, Reflection.

Projections: Orthographic, Isometric, Perspective, Point at Infinity & Vanishing Point.

[T1][T2][No. of Hrs: 11]

UNIT-II

Curves: Representation of Space Curves, Cubic Spline, Normalized Cubic Splines, Bezier Curves, B-spline Curves, Numerical problems.

Surface Generation: Plane Surfaces, Ruled Surfaces, Surface of Revolution, Sweep Surface, Bezier Surface, Cubic Surface Patch, B-Spline Surface, Composite Surface, Numerical problem.

[T1][T2][No. of Hrs: 11]

UNIT- III

Solid Modeling: Set Theory, Boolean Operations, B-rep Modeling, CSG, Sweep Representations, Spatial Occupancy Enumeration Numerical problems.

Geometric Property Formulation: Curve Length, Surface Area, Volume Calculation, Mass Calculation, Centroid Calculation, Numerical problems.

[T1][T2][No. of Hrs: 10]

UNIT-IV

CAD/CAM Data Exchange: Introduction, IGES, PDS, Finite Element Methods: General Method for FEM, Finite Element Analysis, Numerical problems

[T1][T2][No. of Hrs: 10]

Text Books:

- [T1] Ibrahim Zeid, "CAD/CAM Theory and Practice", Tata McGraw-Hill Publishing Company Limited. 2nd Edition.
- [T2] David F. Rogers and J. Alan Adams, "Mathematical Elements for Computer Graphics, Prentice Hall India", Tata McGraw-Hill.

Reference Book:

- [R1] Foley et. al., "Computer Graphics Principles & practice", Addison Wesley, 1999.
- [R2] Ibrahim Zeid, "Mastering CAD/CAM", Tata McGraw-Hill Publishing Company Limited.

MICRO ELECTRO MECHANICAL SYSTEM & NANOTECHNOLOGY

Paper Code: ETMT-403	L	T/P	C
Paper: Micro Electro Mechanical System & Nanotechnology	3	1	4

INSTRUCTIONS TO PAPER SETTERS:

MAXIMUM MARKS: 75

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

Objective: To introduce the student about the knowledge of sensors, actuators, micro-actuators and nanotechnology.

UNIT I

Introduction to MEMS:

Production engineering, ultra precision engineering, ICs, micro sensors, micro actuators, microelectronic fabrication, micro machining, Mechanical MEMS, MOEMS. Magnetic MEMS, RF MEMS, micro fluidic systems, Bio and Chemo devices, Nano technology, modeling and simulation, MEMS packaging & design considerations, Micro instrumentation.

[T1][No. of Hrs: 11]

UNIT II

Micro Machining:

Photo lithography, structural and sacrificial materials, other lithography methods, Thin film deposition, impurity doping, Etching, problem with bulk micro machining. Surface micro machining, wafer bonding.

System Modelling:

System types, basic modelling elements in – Mechanical systems, electrical systems, fluid systems, thermal systems. Modeling hybrid systems.

Passive Components And Systems:

System on a chip, passive electronic systems, passive mechanical systems

Mechanical Sensors and Actuators:

Principle of sensing and actuating, beam and cantilever, micro plates, capacitive effect, piezoelectric material, strain measurement, pressure measurement, flow measurement, MEMS gyroscope, shear mode piezo-actuator, gripping piezo-actuator, inch worm technology.

Thermal Sensors and Actuators:

Heat transfer process, Thermistors, micro machined thermocouple probe, peltier effect heat pumps, thermal flow sensors, micro hotplate gas sensors, MEMS thermo vessels, pyro-electricity, shape memory alloys, Thermally actuated MEMS relay, Micro spring thermal actuator, data storage cantilever.

[T1][No. of Hrs: 12]

UNIT III

Micro-Opto-Electromechanical Systems:

Principle of MOEMS technology, properties of light, light modulators, beam splitters, micro lens, micro mirrors, light detectors, optical switch.

CNT and Nano Technology:

Introduction, nanotechnology materials, Fullerenes, Carbon Nano Tubes, development and application of CNTs, properties of CNTs, molecular machine components.

[T1, T2][No. of Hrs: 11]

UNIT IV

Simulation Based Micro and Nano System Design:

FEM, design flow using simulation tool, Ansys Multi-physics, Atomistic to continuum theory, Analytical theory and computational modeling, multi-scale concepts and methods, complexity of multi scale systems.,

Nano Materials:

Silicon carbide, Nano particles of Alumina and Zirconia, Mechanical, Magnetic, Electric and optical properties.

[T1, T2][No. of Hrs: 11]

Text Books:

[T1] Nitaigour Premchand Mahalik, MEMS, Mc Graw Hill.

[T2] A.K. Bandhopadhyay, Nano Materials, New Age

MECHATRONICS SYSTEM DESIGN

Paper Code: ETMT-405

Paper: Mechatronics System Design

L	T/P	C
3	0	3

INSTRUCTIONS TO PAPER SETTERS:

MAXIMUM MARKS: 75

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks

Objective: Mechatronics is the combination of mechanical and electronics automation and computers. Nowadays all the mechanical machines have been made computer controlled. The Subject details the basic hardware and software elements used for proper and successful operation of various equipments. The knowledge of this subject will be helpful to students while working in industries.

UNIT - I

Introduction: Evolution of Mechatronics, origins, Multidisciplinary scenario.

Signal Theory and Engineering Tools: Signal nomenclature, Signal analysis and processing, Multi domain signal representation, Analysis and representation of periodic analog signals, discrete fourier transforms and fast fourier transform, analysis of signal in time frequency domain, Differential equation, Laplace transform, difference equation, Z- transform, power and energy of the signal.

Electrical components and Electronic devices:: Introduction, Basics of electrical components, Basic of electronic devices.

Basics of digital technology: Number system, Gray codes, DNS architecture, Boolean Algebra, Logic states, logic functions, universal gates, combinational and sequential logic circuits, flip flops, Karnaugh maps, TTL & CMOS.

[T1][T2][No. of Hrs: 12]

UNIT - II

Introduction to signal conditioning: Signal Conditioning Processes, Inverting Amplifiers, Non Inverting Amplifiers, Summing, Integrating, Differential, Logarithmic Amplifiers, Comparators, Amplifiers Error, Filtering, Wheatstone Bridge, Temperature Compensation, Thermocouple Compensation, Modeling of Mechanical systems and Simulations

[T1][T2][No. of Hrs: 10]

UNIT - III

Electrical Actuation Systems: Switching Devices, Mechanical Switches – SPST, SPDT, DPDT, Debouncing keypads; Relays, Solid State Switches, Diodes, Thyristors, Transistors, Solenoid Type Devices: Solenoid Operated Hydraulic and Pneumatic Valves, Control of DC Motors, Permanent Magnet DC Motors, Bush less Permanent Magnet DC Motors, AC Motors and speed controls, Stepper Motors and Controls, Servo Motors.

System Interfacing and data acquisition:

Data acquisition systems, Data loggers, SCADA, Interfacing requirements, Buffers, Darlington Pair, Handshaking, Serial and Parallel Port Interfacing, Peripheral Interface Adapters, Analog to Digital Conversion, Digital To Analog Conversion, Sample and Hold Amplifiers, Multiplexers, Time Division Multiplexing, Digital Signal Processing, Pulse Modulation, Component Interconnection and Impedance Matching, Interfacing Motor drives. Electrical power supply and protection.

[T1][T2][No. of Hrs: 10]

UNIT - IV

Programmable logic controllers: Programmable logic controllers (PLC) Structure, Input / Output Processing, principles of operation, PLC versus computer, Programming Languages, programming using Ladder Diagrams, Logic Functions, Latching, Sequencing, Timers, Internal Relays And Counters, Shift Registers, Master and Jump Controls, Jumps, Data Movement, Code Conversion, Data handling and manipulation, selecting a PLC.

Case Studies: Mechatronic approach to design, Boat Auto pilot, high speed tilting train, automatic car park system, coin counter, engine management system, autonomous mobile system, antilock brake system control, Auto-Focus Camera, Printer, Domestic Washing Machine, Optical Mark Reader, Bar Code Reader and Pick and Place robot Arm, Using PLC for extending and retracting a pneumatic piston and two pneumatic pistons in different combinations, control of vibrating machine, control of process tank, control of conveyor motor, detecting, sorting and packaging unit.

[T1][T2][No. of Hrs: 10]

Modified Scheme and Syllabus of B. Tech-Mechatronics (1st Semester to 8th Semester) implemented from Academic Session w.e.f. 2015-16, approved in the 23rd BOS and 40th AC meeting of USET.

Text Book:

- [T1] W. Bolton, “Mechatronics – Electronic control systems in Mechanical & Electrical Engineering”, Pearson Education Ltd., 2003.
- [T2] Nitaigour Premchand Mahalik, Mechatronics principles, concepts and applications, Tata Mc Graw Hill.

Reference Books:

- [R1] Joji P, Pneumatic Controls, Wiley.
- [R2] Dan Neculescu, Mechatronics, Pearson
- [R3] David g Alciatore, Michael B Hestand, “Introduction to Mechatronics and measurement systems”, Mc Graw Hill Education.
- [R4] A Smaili, F Mrad, “Mechatronics – Integrated Technologies for Intelligent Machines, Oxford Higher Education.
- [R5] Nitaigour Premchand Mahalik, “Mechatronics Principles, Concepts & Application”, Tata McGraw Hill Publishing Co.Ltd., 2003.

I.C. ENGINES**Paper Code: ETMT-407****Paper: I.C. Engines**

L	T/P	C
3	0	3

INSTRUCTIONS TO PAPER SETTERS:**MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from question no. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

Objective: To introduce the students about the knowledge of SI and CI engines.

UNIT-I

Introduction: Basic Engine components and Nomenclature, Classification of Engines, The working principle of Engines, Comparison of 2-Stroke and 4-Stroke Engines; CI, and SI Engines, Ideal and Actual Working Cycles and their analysis, Valve timing Diagram.

Fuels: Fossil fuels, Chemical structure of Petroleum, Properties of SI and CI Engine Fuels, Fuel Ratings; Octane Number, Cetane Number.

[T1, R1, R2] [No. of Hrs. 10]**UNIT-II**

Carburetors & Fuel Injection: Air Fuel Mixture Requirements, Construction and Working of Simple Carburetor, Calculation of Air-Fuel Ratio, Parts of Carburetor.

Requirement of Injection Systems, Classification of Injection Systems, Fuel Feed pump, Injection Pumps, Working principles of Governors, Nozzles and Fuel Injector, Injection in SI and CI Engines.

[T1, R1, R2] [No. of Hrs.10]**UNIT-III**

Combustion and Ignition Systems in SI and CI Engines: Normal and Abnormal Combustion in SI and CI Engines, Stages of Combustion, Detonation and Knocking.

Performance parameters for IC Engines: Engine Power, Engine Efficiencies, Performance Characteristics, Variables Effecting Performance Characteristics, Methods of Improving Engine Performance, Heat Balance.

[T1, T2, R1][No. of Hrs. 10]**UNIT-IV**

Modern Automotive Engines: Changes in Fuel injection Methods in S.I and C.I engines, Common Rail Direct Injection System, Gasoline Direct Injection, Variable Valve Technology, A brief review of Design changes to achieve high efficiency.

[T1, T2, R1, R2][No. of Hrs. 10]**Text Books:**

[T1] Ganesan V., "Internal Combustion Engines", Tata McGraw-Hill

[T2] K. K. Ramalingam, "Internal Combustion Engines" 2nd Ed, SCITECH Publications

Reference Books:

[R1] John B Heywood," Internal Combustion Engine Fundamentals", Tata McGraw-Hill.

[R2] E.T. Vincent "Theory & Design of Gas Turbine and jet engine" McGraw Hill.

DIGITAL IMAGE PROCESSING

Paper Code: ETMT-409
Paper: Digital Image Processing

L	T/P	C
3	0	3

INSTRUCTIONS TO PAPER SETTERS:**MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from question no. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

Objectives: The aim of this course is to provide digital image processing fundamentals, hardware and software, digitization, encoding, segmentation, feature extraction etc. It will enhance the ability of students to apply tools in image restoration, enhancement and compression and to apply the techniques in both the spatial and frequency domains. It will enhance the ability of students to identify the quality characteristics of medical images, differences between computer vision and image processing and help in studying the remote sensing images of the environmental studies.

UNIT- I:

Introduction and Digital Image Fundamentals: The origins of Digital Image Processing, Examples of Fields that Use Digital Image Processing, Fundamentals Steps in Image Processing, Elements of Digital Image Processing Systems, Image Sampling and Quantization, Some basic relationships like Neighbors, Connectivity, Distance Measures between pixels, Linear and Non Linear Operations.

Image Enhancement in the Spatial Domain: Some basic Gray Level Transformations, Histogram Processing, Enhancement Using Arithmetic and Logic operations, Basics of Spatial Filters, Smoothing and Sharpening Spatial Filters, Combining Spatial Enhancement Methods.

[T1, T2][No. of Hrs: 10]

UNIT- II:

Filtering in the Frequency Domain: Introduction to Fourier Transform and the frequency Domain, Smoothing and Sharpening Frequency Domain Filters.

Image Restoration: A model of The Image Degradation / Restoration Process, Noise Models, Restoration in the presence of Noise Only Spatial Filtering, Periodic Noise Reduction by Frequency Domain Filtering, Estimation of Degradation Function, Inverse filtering, Wiener filtering, Constrained Least Square Filtering, Geometric Mean Filter, Geometric Transformations.

[T1, T2][No. of Hrs. 12]

UNIT- III:

Image Compression: fundamentals of compression, coding redundancy, Lossy and lossless compression, Spatial and temporal redundancy, Image compression models. Some basic compression methods

Image Segmentation: Detection of Discontinuities, Edge linking and boundary detection, Region Oriented Segmentation, Motion based segmentation.

[T1, T2][No. of Hrs. 12]

UNIT- IV:

Representation and Description: Representation, Boundary Descriptors, Regional Descriptors, Use of Principal Components for Description, Introduction to Morphology, Some basic Morphological Algorithms.

Object Recognition: Patterns and Pattern Classes, Decision-Theoretic Methods, Structural Methods.

[T1, T2][No. of Hrs: 10]

Text Books:

[T1] Rafael C. Gonzalez & Richard E. Woods, "Digital Image Processing", 3rd edition, Pearson Education, 2002.

[T2] A.K. Jain, "Fundamental of Digital Image Processing", PHI, 1989.

Reference Books:

[R1] Bernd Jahne, "Digital Image Processing", 5th Ed., Springer, 2002.

[R2] William K Pratt, "Digital Image Processing: Paks Inside", John Wiley & Sons, 2001.

PRODUCT DESIGN AND COSTING

Paper Code: ETMT-411
Paper: Product Design and Costing

L	T/P	C
3	0	3

INSTRUCTIONS TO PAPER SETTERS:

MAXIMUM MARKS: 75

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from question no. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

Objectives: The focus of Product Design and costing is integration of the marketing, design, and manufacturing functions of the firm in creating a new product.

UNIT – I

Introduction to Product Design, Engineering Design, Modern Product Development, Reverse Engineering development process,

Product Development Process Tools: Team and product planning, concept development, system level design, detail design, testing and refinement.

Scoping Product Development: Technical and Business.

[T1, T2][No. of Hrs. 10]

UNIT – II

Identifying Customer Needs: Gather raw data from customers, interpret raw data in terms of customer needs, organize the needs into a hierarchy, establish the relative importance of the needs and reflect on the results and the process.

Concept Generation: Process, Basic methods of information gathering and brain storming.

Benchmarking and Establishing Engineering Specifications: Benchmarking approach, product specification.

[T1, T2][No. of Hrs. 11]

UNIT – III

Concept Selection: Introduction, technical feasibility, Pugh concept selection chart

Concept Embodiment: Refining Geometry and Layout

Design for manufacturing and Assembly: design Guidelines.

[T1, T2][No. of Hrs. 10]

UNIT – IV

Product Cost Analysis: various types and elements of cost, cost of development, cost component of initial investment, cost of financing, manufacturing cost.

Design for environment: Environmental objectives, techniques to reduce environmental Impact.

[T3][No. of Hrs. 10]

Text Books:

[T1] Kevin Otto, Kristin Wood “Product Design” Pearson

[T2] Karl T. Ulrich and Steven D. Eppinger, “Product Design and Development”, 5th Edition 2011

[T3] Khan, Siddiquee, Kumar “Engineering Economy” Pearson

Reference Books:

[R1] Magrab B. Edward, Gupta K.S, Mccluskey P.F “Integrated Product and Process Design and Development” CRC Press (Taylor & Francis group)

NON-CONVENTIONAL MANUFACTURING PROCESSES**Paper Code: ETME-413****L T/P C****Paper: Non-Conventional Manufacturing Processes****3 0 3****INSTRUCTIONS TO PAPER SETTERS:****MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

Objective: The objective of the paper is to facilitate the student with non conventional manufacturing processes.

UNIT - I

Introduction: Limitations of conventional manufacturing processes need of unconventional manufacturing processes & its classification and its future possibilities.

[T1][No. of Hrs. 06]**UNIT - II**

Unconventional Machining Process: Principle, Working, Process parameters and applications of unconventional machining process such as Electro-Discharge machining, WEDM, Chemical machining, Electro-chemical machining, Ultrasonic machining, Abrasive jet machining, Abrasive flow machining, Water jet machining, Laser beam machining, Electron beam machining, IBM and other advanced manufacturing processes.

[T1][No. of Hrs. 15]**UNIT – III**

Unconventional welding processes: Explosive welding, Cladding etc. Under water welding, Metalizing, Plasma arc welding/cutting etc.

[T1][No. of Hrs. 10]**UNIT-IV**

Unconventional Forming processes: Principle, working and applications of High energy forming processes such as Explosive Forming, Electromagnetic forming, Electro Discharge forming, water hammer forming, explosive compaction etc.

Electronic-device Manufacturing: Brief description of Diffusion and Photo- Lithography process for electronic-device manufacturing.

[T1][No. of Hrs. 11]**Text Books:**

[T1] P.C. Pandey & H.S. Shan, “Modern Machining Process”, Tata McGraw Hills, 2001

[T2] Amitabh Gosh and A.K. Mallik, “Manufacturing Science”, Affiliated East-West Press Pvt. Ltd., 1985.

Reference Books:

[R1] J.T. Black, Ronald A. Kosher DeGarmo's Materials and Processes in Manufacturing, 11th Edition , Wiley

[R2] Mikell P. Groover" Principles of Modern Manufacturing, 5th Edition SI Version, Wiley

PROCESS MODELLING & OPTIMIZATION TECHNIQUES

Paper Code: ETMT-415	L	T	C
Paper: Process Modelling & Optimization Techniques	3	0	3

INSTRUCTIONS TO PAPER SETTERS:

MAXIMUM MARKS: 75

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

Objective: The objective of the paper is to facilitate the students with the field concerned with the modeling and optimization techniques of various industrial processes.

UNIT - I

Process modelling, SISO and MIMO processes, Coupled processes, Study of Biochemical reactors, CSTR, Steam drum level, surge vessel level control, Batch reactor and Biomedical systems.

[T1, T2][No. of Hrs. 11]

UNIT - II

Introduction to Control and optimization of Boiler, Cooling Tower, Distillation column, Reactors, Heat exchangers, condenser and evaporator.

[T1, T2][No. of Hrs. 11]

UNIT - III

Overview of optimisation techniques, Cost functions, supervised and unsupervised methods, Linear Optimisation–Least squares method, Recursive Least square, subset selection.

[T1, T2][No. of Hrs. 11]

UNIT - IV

Nonlinear Local optimisation- Direct search algorithms, general gradient based algorithms, constrained nonlinear optimisation. Nonlinear Global optimisation – Simulated annealing, Genetic algorithms, Ant colony optimisation, Process Modelling using soft computing methods.

[T1, T2][No. of Hrs. 11]

Text Books:

- [T1] Oliver Nelles, “Process Nonlinear System Identification”, Springer
 [T2] Stephanopoulos G. “Chemical Process Control: An Introduction to Theory and Practice”, PHI

Reference Books:

- [R1] Bela G. Liptak, ‘Process Control- Instrument Engineers’ Handbook, Chilton Book Co.
 [R2] Regina M Murphy, ‘Introduction to Chemical Processes’, McGraw Hill Education
 [R3] John E. Hewson, “Process Instrumentation Manifolds”, Instrumentation society of America.
 [R4] W. L. Luben, “Process Modeling & Simulation Control for Chemical Engineers”, McGraw Hill. 1995
 [R5] B. Wayne Bequette, “Process Control- Modelling, Design and Simulation”, PHI

AUTOMOBILE ENGINEERING

Paper Code: ETME-401
Paper: Automobile Engineering

L	T/P	C
3	0	3

INSTRUCTIONS TO PAPER SETTERS:**MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from question no. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks

Objective: The objective of the paper is to introduce the student about Power plant, Transmission Systems, Clutches and its principles of friction clutch, types of suspension, Mechanical and hydraulic brakes and other automobile s engineering functions.

UNIT – I

Power Plant: Selection of power plant for automotive vehicle, requirements of vehicle. Characteristics of various power plants (Petrol engines, Diesel engines, CNG and LPG engine.); constructional details of C.I. and S.I. engines, crank shafts, connecting rods, pistons, piston pins, piston rings, valves mechanisms, manifolds, air cleaners, mufflers, radiators and oil filters.

Vehicular Performance: Load, air and grade resistance; matching of engine output and demand power, performance requirements of Passenger cars, heavy duty trucks. Performance characteristics of internal combustion engines, drive effectiveness for 2 wheel and 4 wheel drive vehicles.

[T1, T2, T3] [No. of Hrs. 12]**UNIT II**

Transmission Systems: Transmission requirements, general arrangement of clutch, gear box and transmission, for various combinations of front wheel, rear wheel, front engine and rear engine for 2 wheels and 4 wheels drives De-Dion drive.

Clutches: Principle of friction clutch, single and multi-plate clutches, centrifugal clutch and related Numericals. Friction materials. Bonding materials. Fluid fly wheel clutch.

[T1, T2, T3] [No. of Hrs. 11]**UNIT III**

Transmission: Description and working of manually operated gearboxes like sliding mesh, constant mesh, synchromesh. Hydraulic torque converter and its construction, working and performance. Analysis of Semi-automatic and Automatic transmission, overdrives, Differentials and Wilson Gear Box. Construction and working of Live axles.

Steering System: Steering terminologies and geometry. Davis and Ackermann steering. Power steering.

[T1, T2, T3] [No. of Hrs. 11]**UNIT IV**

Suspension: Types of suspension systems, Dead Axle and Independent suspension;., air suspension, shock absorbers.

Wheels, Tyres and Brakes:., Mechanical and hydraulic brakes, shoe arrangements and analysis, disc brakes, braking effectiveness requirements. Concept of Anti lock brakes. Wheel and tyre requirements, Tyre dynamics.

[T1, T2, T3] [No. of Hrs.12]**Text Books:**

- [T1] N.K. Giri, “Automotive Mechanics”, Khanna Publishers
 [T2] R K Rajput,” A text Book on Automobile Engineering”, Laxmi publication
 [T3] Kirpal Singh, “Automobile Engg.”, Vol. .I & II, Standard Publishers, 2004

Reference Books:

- [R1] Narang G.B.S., “Automobile Engg.”, Khanna Publishers
 [R2] Srinivasan, “Automotive Engines”, Tata McGraw Hill
 [R3] K.K. Jain & R.B. Asthana, “Automobile Engineering”, Tata McGraw Hill
 [R4] Joseph Haitner, “Automotive Mechanics”, C.B.S. Publications

DATABASE MANAGEMENT SYSTEMS

Paper Code: ETCS-425

Paper: Database Management Systems

L	T/P	C
3	0	3

INSTRUCTIONS TO PAPER SETTERS:

Maximum Marks: 75

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 12.5 marks.

Objective: The concepts related to database, database techniques, SQL and database operations are introduced in this subject. This creates strong foundation for application data design.

UNIT-I : Introductory Concepts of DBMS: Introduction and application of DBMS, Data Independence, Database System Architecture – levels, Mapping, Database users and DBA, Entity – Relationship model, constraints, keys, Design issues, E-R Diagram, Extended E-R features- Generalization, Specialization, Aggregation, Translating E-R model into Relational model.

[T1, T2][No. of Hrs. 10]

UNIT-II : Relational Model: The relational Model, The catalog, Types, Keys, Relational Algebra, Fundamental operations, Additional Operations-, SQL fundamentals, DDL,DML,DCL PL/SQL Concepts, Cursors, Stored Procedures, Stored Functions, Database Integrity – Triggers.

[T2, R3][No. of Hrs. 10]

UNIT-III: Functional Dependencies, Non-loss Decomposition, First, Second, Third Normal Forms, Dependency Preservation, Boyce/Codd Normal Form, Multi-valued Dependencies and Fourth Normal Form, Join Dependencies and Fifth Normal Form.

[T2, R1][No. of Hrs. 10]

UNIT-IV: Transaction Management: ACID properties, serializability of Transaction, Testing for Serializability and concurrency control, Lock based concurrency control (2PL, Deadlocks), Time stamping methods, Database recovery management.

Implementation Techniques: Overview of Physical Storage Media, File Organization, Indexing and Hashing, B+ tree Index Files, Query Processing Overview, Catalog Information for Cost Estimation, Selection Operation, Sorting, Join Operation, Materialized views, Database Tuning.

[T1, T2, R2][No. of Hrs. 12]

Text Books:

- [T1] Abraham Silberschatz, Henry F. Korth, S. Sudharshan, “Database System Concepts”, 5th Edition, Tata McGraw Hill, 2006
- [T2] Elmsari and Navathe, “Fundamentals of Database Systems”, 4th Ed., A. Wesley, 2004

References Books:

- [R1] C.J.Date, A.Kannan, S.Swamynathan, “An Introduction to Database Systems”, 8th Edition, Pearson Education, 2006.
- [R2] J. D. Ullman, “Principles of Database Systems”, 2nd Ed., Galgotia Publications, 1999.

ARTIFICIAL INTELLIGENCE**Paper Code: ETCS-429****Paper: Artificial Intelligence**

L	T/P	C
3	0	3

INSTRUCTIONS TO PAPER SETTERS:**MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

Objective: To learn the basics of designing intelligent agents that can solve general purpose problems, represent and process knowledge, plan and act, reason under uncertainty and can learn from experiences

UNIT-I**Introduction:** Introduction to intelligent agents

Problem solving: Problem formulation, uninformed search strategies, heuristics, informed search strategies, constraint satisfaction solving problems by searching, state space formulation, depth first and breadth first search, iterative deepening

[T1, T2][No. of hrs. 12]**UNIT-II**

Logical Reasoning: Logical agents, propositional logic, inferences, first-order logic, inferences in first order logic, forward chaining, backward chaining, unification, resolution

[T1, T2][No. of hrs. 10]**UNIT-III**

Game Playing: Scope of AI -Games, theorem proving, natural language processing, vision and speech processing, robotics, expert systems, AI techniques- search knowledge, abstraction

[T1, T2][No. of hrs. 12]**UNIT-IV**

Learning from observations: Inductive learning, learning decision trees, computational learning theory, Explanation based learning

Applications: Environmental Science, Robotics, Aerospace, Medical Sciences etc.

[T1, T2][No. of hrs. 10]**Text Book:**

[T1] Rich and Knight, "Artificial Intelligence", Tata McGraw Hill, 1992

[T2] S. Russel and P. Norvig, "Artificial Intelligence – A Modern Approach", Second Edition, Pearson Edu.

Reference Books:

[R1] KM Fu, "Neural Networks in Computer Intelligence", McGraw Hill

[R2] Russel and Norvig, "Artificial Intelligence: A modern approach", Pearson Education

WASTE AND HEAT RECOVERY SYSTEMS

Paper Code: ETMT-421

Paper: Waste and Heat Recovery Systems

L	T/P	C
3	1	4

INSTRUCTIONS TO PAPER SETTERS:

MAXIMUM MARKS: 75

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from question no. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

Objective: To introduce the students about the knowledge heat recovery equipments and their importance in power plants etc.

UNIT- I

Waste Heat Recovery: Introduction - Principles of Thermodynamics and Second Law, Cogeneration system. Sources of waste heat and its potential applications, Waste heat survey and measurements, Data collection, Limitations and affecting factors Heat recovery equipment and systems.

[T1, T2, R1, R2][No. of Hrs. 11]

UNIT- II

Waste Heat Recovery Systems: Introduction, classification and design of Recuperators, Regenerators, and economizers.

[T1, T2, R1, R2][No. of Hrs. 10]

UNIT- III

Waste Heat Boilers: Classification, Location, Service Conditions, Design Considerations, Unfired combined Cycle, Supplementary fired combined cycle, fired combined cycle, Thermic fluid heaters.

[T1, T2, R1, R2][No. of Hrs. 11]

UNIT- IV

Applications & Techno Economics of Waste Heat Recovery Systems: Applications in industries, selection of waste heat recovery technologies - financial considerations - operations and investment costs of waste heat recovery. Introduction to tri-generation and quad-generation.

[T1, T2, R1, R2][No. of Hrs. 11]

Text Books:

- [T1] Khartchenko N.V. Green Power: Eco-Friendly Energy Engineering, Tech Books New Delhi,
 [T2] Boyce M.P. Cogeneration and Combined Cycle Power Plants, ASME Press, 2nd ed., 2010

Reference Books:

- [R1] Khartchenko N.V. Advanced Energy Systems, Taylor and Francis, Washington DC, 1998
 [R2] Institute of Fuel, London, Waste Heat Recovery, Chapman and Hall Publishers, London, 1963.

MANAGEMENT INFORMATION SYSTEMS AND ERP

Paper Code: ETME-421

L T/P C

Paper: Management Information Systems and ERP

3 0 3

INSTRUCTIONS TO PAPER SETTERS:

MAXIMUM MARKS: 75

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Q. No. 1 rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

***Objectives:** The objective of this course is to expose the students to the managerial issues relating to information systems and help them identify and evaluate various options in this regard.*

UNIT I

Meaning and Role of Information Systems. Types of Information Systems: Operations Support Systems, Management Support Systems, Expert Systems, and Knowledge Management Systems. Information Systems for Strategic Management: Competitive Strategy Concepts, Strategic Role of Information Systems. Integrating Information Systems with Business Strategy, Value Chain Analysis, and Strategic Information Systems Framework.

[T1,T2][No. of Hrs. 12]

UNIT II

Planning for Information Systems: Identification of Applications, Business Planning Systems and Critical Success Factors, Method of Identifying Applications, Risks in Information Systems. Resource Requirements for Information Systems: Hardware and Capacity Planning, Software Needs, Procurement Options – Make or Buy decisions, Outsourcing as an Option.

[T1,T2][No. of Hrs. 12]

UNIT III

Systems design and Development Methodologies: SDLC Approach, Prototyping, Spiral Method, End User Development. Logical and Physical Design. Evaluation of Information Systems.

[T1,T2][No. of Hrs. 10]

UNIT IV

Emerging Concepts and Issues in Information Systems: Supply Chain Management, Customer Relationship Management, ERP. Introduction to Data Warehousing, Data Mining and its Applications.

[T1,T2][No. of Hrs. 10]

Text Books:

- [T1] Kenneth Laudon and Jane Laudon (2013). Management Information Systems, Twelfth Edition, Pearson, New Delhi.
- [T2] James O'Brien, George Marakas and Ramesh Behl (2014). Management Information Systems, Tenth Edition, McGraw Hill Education, New Delhi.

References Books:

- [R1] Sahil Raj, "Management Information Systems", Pearson 2013
- [R2] Girdhar Joshi (2013). Management Information Systems, Oxford University Press, New Delhi.
- [R3] Effy Oz (2009). Management Information Systems, Sixth Edition, Cengage Learning, Delhi.
- [R4] Nirmalya Bagchi (2014). Management Information Systems, Vikas Publishing House, New Delhi.

FUZZY LOGIC AND NEURAL NETWORKS

Paper Code: ETMT-425

Paper: Fuzzy Logic and Neural Networks

L	T/P	C
3	0	3

INSTRUCTIONS TO PAPER SETTERS:

MAXIMUM MARKS: 75

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

Objective: To impart knowledge of fuzzy logic and neural networks alongwith their techniques and applications in engineering systems.

UNIT -I

Neural Networks: Fundamental of neural network, overview of biological Neuro-system, Mathematical Models of Neurons, ANN architecture, Learning Methods, Learning Paradigms-Supervised, Unsupervised and reinforcement Learning, ANN training Algorithms-perceptions, Training rules, Delta, Back Propagation Algorithm, Multilayer Perceptron Model, Radial Basis functions, Hopfield Networks, Associative Memories, Applications of Artificial Neural Networks.

[T1, T2][No. of Hrs. 11]

UNIT-II

Fuzzy sets: Introduction to Fuzzy Logic, Classical and Fuzzy Sets: Overview of Classical Sets, Operations on Fuzzy Sets: Compliment, Intersections, Unions, Combinations of Operations, Extension principle and fuzzy relations Fuzzy Logic: Fuzzification and defuzzification, Membership Function, Linguistic Variables, Linguistic hedges, Fuzzy rules and reasoning, lamda cut-sets. Arithmetic operations on Fuzzy numbers.

[T1, T2][No. of Hrs. 10]

UNIT-III

Fuzzy Inference System: Fuzzy Modeling, Mamdani Fuzzy model, TSK Fuzzy model, Fuzzy Controller, Industrial Applications.

Introduction of Neuro-Fuzzy Systems, Architecture of Neuro Fuzzy Networks, Hybrid learning algorithms, Neuro-fuzzy Control.

[T1, T2][No. of Hrs. 11]

UNIT-IV

Introduction to Evolutionary Techniques: Genetic Algorithm, Basic Concepts, Flow Chart of GA, Genetic representations (Encoding), Initialization and Selection, Genetic Operators, Mutation, Generational Cycle, Convergence of GA and Applications.

[T1, T2][No. of Hrs. 10]

Text Books:

- [T1] S. Rajasekaran, "Neural Network, Fuzzy Logic and Genetic Algorithms", PHI Learning India 2011
 [T2] S. N. Sivanandam, S.N. Deepa, "Principles of Soft Computing", Wiley India.

References Books:

- [R1] Patricks Henry, Winston, "Artificial Intelligence", Pearson Education, 2001
 [R2] Nilsson, Morgon, "Artificial Intelligence", Kufmann 1998.
 [R3] J.-S.R.Jung, c.T.Sun, "Neuro-Fuzzy and Soft Computing", PHI Learning India 2011
 [R4] Hagan Demuth, Beale, "Neural Network Design", Cengage Learning 2013
 [R5] S N Sivanandam, "Neural Network using Matlab" TMH 2013

OPERATIONS RESEARCH**Paper Code: ETMT-427****Paper: Operations Research**

L	T/P	C
3	0	3

INSTRUCTIONS TO PAPER SETTERS:**MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

Objective: The objective of the paper is to acquaint the student with mathematical techniques being adopted in industry which help managers in decision taking.

UNIT-I

Linear Programming: Formulation of LP Problem. Graphical method, Simplex method for maximization and minimization LP Problems. Duality in Simplex Problems,

Queuing Theory: Introduction to probability concept for queuing problems. Basic structure, Terminology, Classification, Birth and Death Process. Queuing Models.

[T1][No. of Hrs. 11]**UNIT-II**

Transportation Models: MODI method for optimality check, North West Corner Method, Least-cost Method and Vogel's Approximation Method (VAM) for solving balanced and unbalanced transportation problems. Problems of degeneracy and maximization.

Assignment Models: Assignment model for maximization & minimization problems. Traveling Salesman Problems, Industrial Problems.

[T2][No. of Hrs. 11]**UNIT-III**

Sequencing Theory: Processing of n-jobs through m-machines with each job having same processing order. Processing of two jobs through m-machines with each job having different processing order.

Decision Theory: Decision making under uncertainty and under risk, Multistage decision making, Multi criteria decision making.

[T1][No. of Hrs. 11]**UNIT - IV**

Network Models: Introduction to PERT and CPM. Fundamental concept of Network models and construction of network diagrams. Activity time estimates. Critical path and project time duration. Probability of completing the project on or before specified time. Concept of Float and slack.

Game Theory: Two person zero-sum games. Minimax and Maximin principle. Arithmetic, Algebraic, Matrix Algebra method. Solution by Dominance, Subgame, Graphical method, linear programming method.

[T2][No. of Hrs. 11]**Text Books:**

[T1] Hira and Gupta "Operation Research" S. Chand Publications

[T2] H.A. Taha, "Operations Research", Prentice-Hall India, 6th Edition, 2004.

Reference Books:

[R1] S.Kalavathy, "Operations Research", Vikas Publication, 4th Edition, 2013.

[R2] N.D. Vohra, "Operations Research", Tata McGraw Hill, 2004.

[R3] Richard Bronson, Govindasami Naadimuthu, "Operations Research", Tata McGraw Hill, 2004

[R4] A.P. Verma, "Operations Research", S.K. Kataria & Sons, 2004.

[R5] J.K. Sharma, "Operation Research", Macmillan India Ltd. 2005.

DECISION SCIENCE**Paper Code: ETMT-429****Paper: Decision Science**

L	T/P	C
3	0	3

INSTRUCTIONS TO PAPER SETTERS:**MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks

Objective: Skills acquired from this course will enable students to apply various decisions making and optimization techniques in solving problems pertaining to their respective areas of study.

UNIT- I

Descriptive Statistics, Presentation of Data, Measures of Central Tendency and Variation, Probability-Concepts, Theorems, Bayes' Rule, Linear Programming, Formulation, Graphical and Simplex Method.

[T1][R1] [No. of hrs. 10]**UNIT- II**

Decision Sciences & Role of quantitative techniques, Steps in decision making. Decision making under uncertainty, including optimism criterion, pessimism criterion, Laplace criterion, optimism criterion, Hurwicz criterion and Regret criterion. Decision making under risk, Multistage decision making, Multi criteria decision making. Posterior probabilities and Bayesian Analysis.

[T1][T2][No. of hrs. 12]**UNIT- III**

Game Theory: Two person zero-sum games, concept of dominance, Pure & Mixed Strategy. Arithmetic, Algebraic, Matrix Algebra method. Solution by Dominance, Subgame and Linear programming method. Queuing Theory, Basic structure, Terminology, Classification, Birth and Death Process. Queuing Models upto 2 service stations.

[T1][R1][No. of hrs. 11]**UNIT-IV**

Transportation Problems, Initial Basic Feasible Solution, Test for Optimality. Assignment problems. Network Analysis - PERT and CPM.

Network Models, Concept, Drawing network, identifying critical path, Calculating EST, LST, EFT, LFT, Slack & probability of project completion (CPM &PERT), Crashing of Network.

[T1][R3][No. of hrs. 12]**Text Books:**

[T1] Ken Black (2009) Business Statistics: For Contemporary Decision Making, 5th edition, Wiley-India.

[T2] Barry Render, RM Stair, ME Hanna and TN Badri (2009) Quantitative Analysis for Management, 10th edition, Pearson Prentice Hall.

References Book:

[R1] Operations Research, H.A. Taha , Prentice-Hall India, 6th Edition, 2004

RENEWABLE ENERGY RESOURCES

Paper Code: ETEE-419

Paper: Renewable Energy Resources

L	T/P	C
3	0	3

INSTRUCTIONS TO PAPER SETTERS:

MAXIMUM MARKS: 75

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Q. No. 1 rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

Objective: The objective of the paper is to introduce the knowledge of upcoming and future promising area of renewable energy resources to the students, which is developing rapidly.

UNIT- I

Solar Energy: radiation – extra terrestrial, spectral distribution, solar constant, solar radiation on earth, measurements; solar thermal system – solar thermal power and its conversion, solar collectors, flat plate, solar concentrating collectors, - types and applications; photovoltaic (PV) technology - photovoltaic effect, efficiency of solar cells, semi-conductor materials, solar PV system, standards and applications, tracking.

[T1][No. of hrs. 10]

UNIT- II

Wind and Small Hydropower Energy: wind data, properties, speed and power relation, power extracted, wind distribution and speed prediction, wind map of India; wind turbines and electric generators. fundamentals – types of machines and their characteristics, horizontal and vertical wind mills, elementary design principle, wind energy farms, off-shore plants; small, mini and micro hydro power plants and their resource assessment, plant layout with major components shown.

[T2][No. of hrs. 10]

UNIT- III

Other Non-conventional Energy Sources: biomass – photosynthesis and origin of biomass energy, resources, cultivated resources, waste to biomass, terms and definitions – incineration, wood and wood waste, harvesting super tree, energy forest, pyrolysis, thermo-chemical biomass conversion to energy, gasification, anaerobic digester, fermentation, gaseous fuel; geothermal – resources, hot spring, steam system, principle of working, site selection, associated problems in development; ocean and tidal energy – principle of ocean thermal energy conversion, wave energy conversion machines, problems and limitations, fundamentals of tidal power, conversion systems and limitations; hydrogen energy – properties of hydrogen, sources, production and storage, transportation, problems for use as fuel; fuel cells – introduction with types, principle of operation and advantages.

[T1,R2][No. of hrs. 12]

UNIT-IV

Grid Connectivity: wind power interconnection requirement - low-voltage ride through (LVRT), ramp-rate limitations, supply of ancillary services for frequency and voltage control, load following, reserve requirement, impact of connection on steady-state and dynamic performance of power system; interfacing dispersed generation of solar energy with the grid, protective relaying, islanding, voltage flicker and other power quality issues; role of non-conventional energy system in smart grid.

[T2,R3][No. of hrs. 10]

Text Books:

- [T1] Tiwari and Ghosal, “Renewable Energy Resources: Basic Principle & Application”, Narosa Publication
- [T2] S N Bhadra ,D, Kastha, 'Wind Electrical Systems" Oxford Publication 2014

References Books:

- [R2] John Twidell, “Renewable Energy Sources”, Taylor and Francis
- [R3] Godfrey Boyle, “Renewable Energy: Power for a Sustainable Future”, Oxford University Press
- [R4] Ewald F. Fuchs, “Power Conversion of Renewable Energy Systems”, Springer
- [R5] B. H. Khan, “Non Conventional Energy”, Tata McGraw Hill
- [R6] D P kothari ,”Wind energy System and applications” Narosa Pub 2014

FINITE ELEMENT METHODS

Paper Code: ETME-423
Paper: Finite Element Methods

L	T/P	C
3	0	3

INSTRUCTIONS TO PAPER SETTERS:

MAXIMUM MARKS: 75

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Q. No. 1 rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

Objectives: The objectives of the subject are to equip the students with the Finite Element Analysis fundamentals. The study of this subject is also enabling the students to formulate the design problems into FEA and introduce basic aspects of finite element technology.

UNIT – I

Basic of Finite Element Method, Variational calculus, Integral formulation, variational methods: Methods of weighted residuals, Approximate solution using variational method, Modified Galerkin method, Boundary conditions

Basic Finite Element Concepts: Basic ideas in a finite element solution, General finite element solution procedure, Finite element equations using modified Galerkin method, Axis symmetric Problems

[T1, T2][No. of Hrs. 11]

UNIT II

Discrete System:

Axial spring element, Axial bars, Torsion bars, Application in Heat transfer and Solid Mechanic Problems, Plane truss problem, software application ANSYS etc

Beam: Euler Beam element and its application.

[T1, T2][No. of Hrs. 11]

UNIT III

Eigen value problems: Formulation and problems

Single value problem in 2D: Boundary value problem, axis symmetric problems

[T1, T2][No. of Hrs. 11]

UNIT IV

Numerical on 2D Solid mechanics

Interpolation function (triangular, Quadrilateral, serendipity elements), numerical integration and modelling consideration.

[T1, T2][No. of Hrs. 11]

Text Books:

[T1] J N Reddy “An Introduction to finite element method” Tata Mc Graw Hill 3rd edition

[T2] S.S. Rao, “Finite Element Method In Engineering”, Pergaman Press

Reference Books:

[R1] O.C. ZienKiewicz, “The Finite Element Method”, Tata McGraw Hill

[R2] Larry J. Segerlind, “Applied Finite-Element Analysis”, John Wiley and Sons

[R3] Kenneth H. Huebner, “Finite Element Method for Engineers”, John Wiley and Sons

[R4] Darell W. Pepper, J.C Heinrich “The Finite Element Method” CRC press

[R5] V.Ramamurti “Finite Element Method in Machine Design”Norosa Publishing House.

SOCIOLOGY AND ELEMENTS OF INDIAN HISTORY FOR ENGINEERS

Paper Code: ETHS-419

Paper: Sociology and Elements of Indian History for Engineers

L	T/P	C
3	0	3

INSTRUCTIONS TO PAPER SETTERS:

MAXIMUM MARKS: 75

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

Objective: The objective of this course is to familiarize the prospective engineers with elements of Indian history and sociological concepts and theories by which they could understand contemporary issues and problems in Indian society. The course would enable them to analyze critically the social processes of globalization, modernization and social change. All of this is a part of the quest to help the students imbibe such skills that will enhance them to be better citizens and human beings at their work place or in the family or in other social institutions.

UNIT I

Module 1A: Introduction to Elements of Indian History: What is History? History Sources-Archaeology, Numismatics, Epigraphy & Archival research; Methods used in History; History & historiography.

[3 Lectures]

Module 1B: Introduction to sociological concepts-structure, system, organization, social institution, Culture social stratification (caste, class, gender, power). State & civil society.

[7 Lectures]

[T1][No. of Hrs. 10]

UNIT II

Module 2A: Indian history & periodization; evolution of urbanization process: first, second & third phase of urbanization; Evolution of polity; early states of empires; Understanding social structures-feudalism debate.

[3 Lectures]

Module 2B: Understanding social structure and social processes: Perspectives of Marx, Weber & Durkheim.

[7 Lectures]

[T1][No. of Hrs. 10]

UNIT III

Module 3A: From Feudalism to colonialism-the coming of British; Modernity & struggle for independence.

[3 Lectures]

Module 3B: Understanding social structure and social processes: Perspectives of Marx, Weber & Durkheim.

[9 Lectures]

[T1][No. of Hrs. 12]

UNIT IV

Module 4A: Issues & concerns in post-colonial India (upto 1991); Issues & concerns in post-colonial India 2nd phase (LPG decade post 1991).

[3 Lectures]

Module 4B: Social change in contemporary India: Modernization and globalization, Secularism and communalism, Nature of development, Processes of social exclusion and inclusion, Changing nature of work and organization.

[10 Lectures]

[T1][No. of Hrs. 13]

Text Books:

[T1] Desai, A.R. (2005), Social Background of Indian Nationalism, Popular Prakashan.

[T2] Giddens, A (2009), Sociology, Polity, 6th Edition

Reference Books:

[R1] Guha, Ramachandra (2007), India After Gandhi, Pan Macmillan

[R2] Haralambos M, RM Heald, M Holborn, (2000), Sociology, Collins

CAD LAB

Paper Code: ETAT-451
Paper: CAD Lab

L	T/P	C
0	2	1

List of Experiments:**CAD Experiments (Any 6 (six)):**

1. Use computer software such as: C / C++ / MATLAB / SCILAB / Java / any other to make programs for under mentioned:

- 1) Line(s) Drawing;
- 2) Drawing Bezier curve(s);
- 3) Drawing B-Spline curve(s);
- 4) Develop menu-bar and buttons for above;
- 5) Do geometric transformations for translation
- 6) Use menu-bar for rotation / mirror;
- 7) Use menu-bar for scaling;
- 8) Perform numerical calculations of any problem done in class and show its graphical manipulation on software.
- 9) Exposure to any 2D / 3D modeling commercially available software;

NOTE:- At least 8 Experiments from the syllabus must be done in the semester.

DATABASE MANAGEMENT SYSTEMS LAB

Paper Code: ETMT-453(ELECTIVE)	L	T/P	C
Paper: Database Management Systems Lab	0	2	1

LAB BASED ON DBMS

Lab includes implementation of DDL, DCL, DML i.e SQL in Oracle.

List of Experiments:

1. Design a Database and create required tables. For e.g. Bank, College Database
2. Apply the constraints like Primary Key, Foreign key, NOT NULL to the tables.
3. Write a SQL statement for implementing ALTER, UPDATE and DELETE
4. Write the queries to implement the joins
5. Write the queries for implementing the following functions: MAX (), MIN (),AVG (),COUNT ()
6. Write the queries to implement the concept of Integrity constrains
7. Write the queries to create the views
8. Perform the queries for triggers
9. Perform the following operation for demonstrating the insertion, updation and deletion using the referential integrity constraints

TEXT BOOK:

1. SQL/ PL/SQL, The programming language of Oracle, Ivan Bayross, 4th Edition BPB Publications

NOTE:- At least 8 Experiments out of the list must be done in the semester.

NON-CONVENTIONAL MANUFACTURING PROCESSES LAB

Paper Code: ETMT-453(ELECTIVE)	L	T/P	C
Paper: Non-Conventional Manufacturing Processes Lab	0	2	1

List of Experiments:

1. Study of electric discharge machining process.
2. Determination of material removal rate on electric discharge machine (EDM).
3. Determination of surface roughness on EDM.
4. Study of electrochemical machining process.
5. Determination of material removal rate on electro chemical machine (ECM).
6. Determination of surface roughness on ECM.
7. Study of plasma arc welding(PAW) process
8. Determination of heat affected zone in plasma arc welding process.
9. Study the effect of current on material removal rate in EDM.
10. Study of the effect of different tool material on material removal rate in EDM.
11. Study the effect of current on surface finish rate in EDM.
12. Study of the effect of different tool surface finish on surface finish in EDM.

NOTE:- At least 8 Experiments out of the list must be done in the semester.

AUTOMOBILE ENGINEERING LAB

Paper Code: ETMT-453(ELECTIVE)
Paper: Automobile Engineering Lab

L	T/P	C
0	2	1

Automobile Engineering Lab experiments based on syllabus (ETME-401).

NOTE: - At least 8 Experiments from the syllabus must be done in the semester.



OPERATIONS RESEARCH LAB

Paper Code: ETMT-453(ELECTIVE)
Paper: Operations Research Lab

L	T/P	C
0	2	1

List of Experiments:

1. To study the working of TORA software package.
2. To solve the given Linear Programming Problem by simplex method manually and TORA software package.
3. To solve the given Transportation Problem manually and TORA software package.
4. To solve the given Problem of CPM and PERT by manually and TORA software package.
5. To solve the given Queuing Theory Problem manually and TORA software package.
6. Make a program in C++ for the Formulation of Linear Programming Problem.
7. Make a program in C++ to make the 1st Simplex Table for the given Linear Programming Problem.
8. Make a program in C++ for the conversion of Primal into Dual form of Linear Programming Problem.
9. Make a program in C++ to find the basic feasible solution of the given Transportation Problem using North West Corner Rules or by least cost method.
10. Make a program in C++ to find the optimal solution of the given Assignment Problem.
11. Make a program in C++ to solve the given Queuing Theory Problem of model 1.
12. Make a program in C++ to solve the given n job 2-machine sequencing problem.
13. Make a program in C++ to give the critical path for the given network problem.
14. Make a program in C++ to find the Saddle Point of the given game programming problem.

NOTE:- At least 8 Experiments out of the list must be done in the semester.

ROBOTICS**Paper Code: ETMT-402**

L	T/P	C
3	1	4

Paper: Robotics**INSTRUCTIONS TO PAPER SETTERS:****MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from question no. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

Objective: To introduce the foundations of robotics. Also, a course on Robotics must use one or more software to not only visualize the motion and characteristics of robots but also to analyze/synthesize/design robots for a given application.

UNIT - I**Fundamentals of Robot Technology:**

Robot definition, automation and robotics, Robot anatomy, Work volume, Drive systems. Control systems and dynamic performance. Accuracy and repeatability. Sensors and actuators used in robotics. Machine Vision, Robot configurations, Path control. Introduction to robot languages. Applications; Types (Mobile, Parallel); Serial: Cartesian, Cylindrical, etc.; Social Issues

[T1,T2,T3][No. of Hrs: 11]**UNIT - II**

Robot Kinematics: Mapping, Homogeneous transformations, Rotation matrix, Forward Kinematics (DH Notation) and inverse kinematics: Closed form solution.

Robot Differential Motion: Linear and Angular velocity of rigid link, Velocity along link, Manipulator jacobian, Statics: Use of jacobian.

[T1,T2,T3][No. of Hrs: 11]**UNIT – III**

Robot Dynamics: Lagrangian Mechanics, Lagrangian Formulation and numericals. Dynamics, Newton-Euler Recursive Algorithm, Simulation. Euler-Lagrange Equations of motion/Any one other formulation like using Decoupled Natural Orthogonal Complements (DeNOC)

End effectors: Mechanical and other types of grippers. Tools as end effectors. Robot and effector interface. Gripper selection and design.

[T1,T2,T3][No. of Hrs: 12]**UNIT - IV**

Applications for Manufacturing. Flexible automation. Robot cell layouts. Machine interference. Other considerations in work cell design. Work cell control, interlocks. Robot cycle time analysis. Mechanical design of robot links.

Typical applications of robots in material transfer, machine loading/unloading; processing operations; assembly and inspection.

[T1,T2,T3][No. of Hrs: 10]**Text Books:**

- [T1] R.K. Mittal, I.J. Nagrath, "Robotics & Control", Tata McGraw & Hills, 2005.
 [T2] Mikell P Groover, Mitchell Weiss "Industrial Robotics :Technology, Programming and Application" Tata McGraw & Hills, 2009.
 [T3] Saha, S.K., Introduction to Robotics, 2nd Edition, McGraw-Hill Education, New Delhi, 2014

Reference Books:

- [R1] John J.Craig; "Introduction to Robotics Mechanics & Control", Pearson Education, 2004.
 [R2] Robert J. Schilling, "Fundamentals of Robotics, analysis & Control", Prentice Hall (I) P. Ltd., 2002
 [R3] Mark W. Spong, Seth Hutchinson, M. Vidyasagar "Robot Modeling and Control" John Wiley 2nd Ed
 [R4] J Srinivasan, R.V.Dukkipati, K. Ramji, "Robotics control & programming", Narosa.
 [R5] Ghosal, Ashitava, "Robotics: Fundamental Concepts and Analysis," Oxford University Press, 2006
 [R6] M. Murray, M., Li, Zexiang, Sastry, S.S., "A Mathematical Introduction to Robotic Manipulation," CRC Press, 1994
 [R7] Tsai, L.W., "Robot Analysis: The Mechanics of Serial & Parallel Manipulators," Wiley 1999
 [R8] Niku, S. B., "Introduction to Robotics: Analysis, Systems, Applications", Prentice Hall, 2001

EMBEDDED SYSTEMS

Modified Scheme and Syllabus of B. Tech-Mechatronics (1st Semester to 8th Semester) implemented from Academic Session w.e.f. 2015-16, approved in the 23rd BOS and 40th AC meeting of USET.

Paper Code: ETMT-404
Paper: Embedded Systems

L	T/P	C
3	1	4

INSTRUCTIONS TO PAPER SETTERS:

MAXIMUM MARKS: 75

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks

Objective: The objective of the paper is to enable a student to design an embedded system for specific tasks..

UNIT- I

Overview of Embedded Systems: Characteristics of Embedded Systems. Comparison of Embedded Systems with general purpose processors. General architecture and functioning of micro controllers. 8051 micro controllers.

PIC Microcontrollers: Architecture, Registers, memory interfacing, interrupts, instructions, programming and peripherals.

[T1][No. of hrs. 11]

UNIT- II

ARM Processors: Comparison of ARM architecture with PIC micro controller, ARM 7 Data Path, Registers, Memory Organization, Instruction set, Programming, Exception programming, Interrupt Handling, Thumb mode Architecture.

Bus structure: Time multiplexing, serial, parallel communication bus structure. Bus arbitration, DMA, PCI, AMBA, I2C and SPI Buses.

[T2][No. of hrs. 12]

UNIT- III

Embedded Software, Concept of Real Time Systems, Software Quality Measurement, Compilers for Embedded System

[T3][No. of hrs. 10]

UNIT-IV

RTOS: Embedded Operating Systems, Multi Tasking, Multi Threading, Real-time Operating Systems, RT-Linux introduction, RTOS kernel, Real-Time Scheduling.

[T3][No. of hrs. 10]

Text book:

[T1] Design with PIC Microcontrollers, John B. Peatman, Pearson Education Asia, 2002

[T2] ARM System Developer's Guide: Designing and Optimizing System Software, Andrew N. Sloss, Dominic Symes, Chris Wright, , Morgan Kaufman Publication, 2004.

[T3] Computers as components: Principles of Embedded Computing System Design, Wayne Wolf, Morgan Kaufman Publication, 2000

References Books:

[R1] The Design of Small-Scale embedded systems, Tim Wilmshurst, Palgrave2003

[R2] Embedded System Design, Marwedel ,Peter , Kluwer Publishers , 2004.

HUMAN VALUES & PROFESSIONAL ETHICS – II**Paper Code: ETHS-402****L T C****Paper : Human Values & Professional Ethics-II****1 0 1****INSTRUCTIONS TO PAPER SETTERS:****MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.
3. Two internal sessional test of 10 marks each and one project report* carrying 5 marks.

Objectives:

1. *The main object of this paper is to inculcate the skills of ethical decision making and then to apply these skills to the real and current challenges of the engineering profession.*
2. *To enable student to understand the need and importance of value-education and education for Human Rights.*
3. *To acquaint students to the National and International values for Global development*

UNIT I - Appraisal of Human Values and Professional Ethics:

Review of Universal Human Values: Truth, Love, Peace, Right conduct, Non violence, Justice and Responsibility. Living in harmony with 'SELF', Family, Society and Nature. Indian pluralism - the way of life of Islam, Buddhism, Christianity, Jainism, Sikhism and Hinduism, Greek - Roman and Chinese cultural values.

Sensitization of Impact of Modern Education and Media on Values:

- a) Impact of Science and Technology
- b) Effects of Printed Media and Television on Values
- c) Effects of computer aided media on Values (Internet, e-mail, Chat etc.)
- d) Role of teacher in the preservation of tradition and culture.
- e) Role of family, tradition & community prayers in value development.

Review of Professional Ethics: Accountability, Collegiality, Royalty, Responsibility and Ethics Living. Engineer as a role model for civil society, Living in harmony with 'NATURE', Four orders of living, their inter-correctness, Holistic technology (eco-friendly and sustainable technology).

[T1] [T2] [R1] [R5] [R4][No. of Hrs. 03]

UNIT II – Engineers responsibility for safety:

Safety and Risks, Risk and Cost, Risk benefit analysis, testing methods for safety. Engineer's Responsibility for Safety Social and Value dimensions of Technology - Technology Pessimism – The Perils of Technological Optimism – The

Promise of Technology – Computer Technology Privacy

Some Case Studies: Case Studies, BHOPAL Gas Tragedy, Nuclear Power Plant Disasters, Space Shuttle

Challenger , Three Mile Island Accident, etc.

[T1] [T2] [R4] [R2][No. of Hrs. 03]

UNIT III – Global Issues:

Globalization and MNCs: International Trade, Issues,

Case Studies: Kellogg's, Satyam, Infosys Foundation, TATA Group of Companies

Business Ethics: Corporate Governance, Finance and Accounting, IPR.

Corporate Social Responsibility (CSR): Definition, Concept, ISO, CSR.

Environmental Ethics: Sustainable Development, Eco-System, Ozone depletion, Pollution.

Computer Ethics: Cyber Crimes, Data Stealing, Hacking, Embezzlement.

[T1] [T2] [R4][No. of Hrs. 05]

UNIT IV - Engineers Responsibilities and Rights and Ethical Codes:

Collegiality and loyalty, Conflict of interests, confidentiality, occupational crimes, professional rights, responsibilities. To boost industrial production with excellent quality and efficiency, To enhance national economy, To boost team spirit, Work Culture and feeling of job satisfaction, National integration, Examples of some illustrious professionals.

Need for Ethical Codes, Study of some sample codes such as institution of Electrical and Electronics Engineers, Computer Society of India etc., Ethical Audit.

Development and implementation of Codes: Oath to be taken by Engineering graduates and its importance**,

[T1] [T2] [R4][R2][No. of Hrs. 05]

Text Books:

- [T1] Professional Ethics, R. Subramanian, Oxford University Press.
 [T2] Professional Ethics & Human Values: Prof. D.R. Kiran, TATA Mc Graw Hill Education.

References Books:

- [R1] Human Values and Professional Ethics: R. R. Gaur, R. Sangal and G. P. Bagaria, Eecel Books (2010, New Delhi). Also, the Teachers" Manual by the same author
 [R2] Fundamentals of Ethics, Edmond G. Seebauer & Robert L. Barry, Oxford University Press
 [R3] Values Education: The paradigm shift, by Sri Satya Sai International Center for Human Values, New Delhi.
 [R4] Professional Ethics and Human Values – M.Govindrajan, S.Natarajan and V.S. Senthil Kumar, PHI Learning Pvt. Ltd. Delhi
 [R5] A Textbook on Professional Ethics and Human Values – R.S. Naagarazan – New Age International (P) Limited, Publishers New Delhi.
 [R6] Human Values & Professional Ethics- S B Gogate- Vikas publishing house PVT LTD New Delhi.
 [R7] Mike Martin and Roland Schinzinger, "Ethics in Engineering" McGraw Hill
 [R8] Charles E Harris, Micheal J Rabins, "Engineering Ethics, Cengage Learning
 [R9] PSR Murthy, "Indian Culture Values and Professional Ethics", BS Publications
 [R10] Caroline Whitback< Ethics in Engineering Practice and Research, Cambridgs University Press
 [R11] Charles D Fleddermann, "Engineering Ethics", Prentice Hall.
 [R12] George Reynolds, "Ethics in Information Technology", Cengage Learning
 [R13] C, Sheshadri; The Source book of Value Education, NCERT
 [R14] M. Shery; Bhartiya Sanskriti, Agra (Dayalbagh)

*Any topic related to the experience of the B.Tech student in the assimilation and implementation of human values and professional ethics during the past three years of his/her studies in the institute OR A rigorous ethical analysis of a recent case of violation of professional ethics particularly related to engineering profession.

**All students are required to take OATH in writing prior to submission of major project and the record of the same is to be maintained at the college level and/or, this oath may be administered by the head of the institutions during the graduation ceremonies. The draft for the same is available alongwith the scheme and syllabus.

OATH TO BE TAKEN BY ENGINEERING GRADUATES

In a manner similar to the Hippocratic Oath taken by the medical graduates, Oath to be taken by the engineering graduates is as given below.

1. I solemnly pledge myself to consecrate my life to the service of humanity.
2. I will give my teacher the respect and gratitude, which is their due.
3. I will be loyal to the profession of engineering and be just and generous to its members.
4. Whatever project I undertake, it will be for the good of mankind.
5. I will exercise my profession solely for the benefit of humanity and perform no act for criminal purpose and not contrary to the laws of humanity.
6. I will keep away from wrong, corruption and avoid tempting others to vicious practices.
7. I will endeavor to avoid waste and consumption of non-renewable resources.
8. I will speak out against evil and unjust practices whenever and wherever I encounter them.
9. I will not permit considerations of religion, nationality, race, party politics or social standing to intervene between my duty and my work, even under threat.
10. I will practice my profession with conscience, dignity and uprightness.
11. I will respect the secrets, which are confided to me.

I make these promises solemnly, freely and upon my honor.

(Name of the Student)

Correspondence Address: _____

Email: _____

ENGINEERING SYSTEM MODELLING AND SIMULATION**Paper Code: ETME-402****L T/P C****Paper: Engineering System Modeling and Simulation****3 0 3****INSTRUCTIONS TO PAPER SETTERS:****MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

Objective: To introduce the students about the knowledge of basic and dynamic system models of engineering and simulation system.

UNIT - I

Basic System models: Mathematical models, Mechanical system building blocks, Electrical system building block, fluid system building block, thermal system building block.

System Models: Engineering systems, Rotational translational systems, Electro-mechanical systems, linearity, Hydraulic Mechanical systems.

Dynamic Response of Systems:

Modelling dynamic systems, Terminology, First order systems, Second order systems, performance measure of second order systems, system identification.

System Transfer Functions:

The transfer function, first order systems, second order systems, systems in series, systems with feedback loops, effect of pole location on transient response.

[T1][No. of Hrs. 12]**UNIT – II****Mechanical Event Simulation (Finite Element modelling and Analysis):**

Introduction, General procedure of finite element method, finite element analysis, iso-parametric evaluation of element matrices, finite element modelling, mesh generation, design and engineering applications. Introduction to Pro E software - Mechanica & dynamic simulation module.

[T2][No. of Hrs. 12]**UNIT – III****System Simulation:**

Introduction, Review of probability and statistics, Managing the event calendar in a discrete event simulation model, Modelling input data.

[T3][No. of Hrs. 10]**UNIT – IV**

Generation of random numbers and variates, generic features and introduction to Arena Software, Real world applications of simulation, Discrete continuous simulation, verification and validation of simulation models.

[T3][No. of Hrs. 10]**Text Book:**

- [T1] W. Bolton, “Mechatronics – Electronic control systems in Mechanical & Electrical Engineering”, Pearson Education Ltd.
- [T2] Ibrahim Zeid, “CAD/CAM Theory and Practice”, Tata McGraw-Hill Publishing Company Limited.
- [T3] Sankar Sengupta, System Simulation and modelling, Pearson.

Reference Books:

- [R1] Deo, Narsingh, Millican Charles E.,”System Simulation With Digital Computer”, PHI.
- [R2] Gordon, Geoffrey, System Simulation, PHI.
- [R3] P. Radhakrishnan, S Subramanyan, V. Raju, CAD/CAM/CIM, New Age International Publishers.

FACILITY & LAYOUT PLANNING

Paper Code: ETMT-410	L	T/P	C
Paper title: Facility & Layout Planning	3	0	3

INSTRUCTIONS TO PAPER SETTERS:

MAXIMUM MARKS: 75

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks

Objective: The course objective is to develop an awareness of the need to use the systematic approach to facilities planning. Be able to identify the various factors in developing a facility design and to develop a working knowledge of the tools used to design an efficient, flexible facility design.

UNIT-I

Plant location:

Concept and factors influencing plant location, theories of industrial locations, theory of maximum profit location, interdependence theory of location, linear programming technique, location analogue model, theory of least-cost location, Weber's theory of location, theory of location by Predohl.

Plant Layout:

Introduction, objective of plant Layout, types merits and demerits, process layout, product layout, combination layout, fixed position layout, principles of plant layout, symptoms of plant layout, advantages of plant layout, Construction of Layout Plans, Muther's Systematic Layout Planning (SLP) Procedure.

[T1][No. of Hrs. 11]

UNIT-II

Material Handling:

Scope of material handling, definition of material handling, material handling principles, designing material handling systems, Material Handling Equipment & Classifications Factors Affecting the Selection of Materials Handling Equipment Basic Layout Types , Nadler's Ideal Systems Approach ,iminer's Basic Steps.

[T1][No. of Hrs. 10]

UNIT-III

Computer Programme:

Introduction to Computer Programme, CRAFT (Computerized Relative Allocation of Facilities Technique), ALDEP (Automated Layout Design Program), CORELAP (Computerized Relationship Layout Planning), COFAD (Computerized Facilities and Design), PLANET (Plant Layout Evaluation Technique)

Space determination and area allocation:

Determination of space requirement, office facility planning, plant maintenance area allocation.

[T1, T2][No. of Hrs. 11]

UNIT-IV

Quantitative approaches to facilities planning:

Facility Location Models , Rectilinear Facility Location Problem, Single Facility Location Models , location Allocation Problems , Special Facility Layout Models, Quadratic Assignment Problem, Warehouse Layout Models, Conventional storage models , Block Stacking , Safety Stock, Automated Storage and Retrieval Systems, Fixed-Path Material Handling Models , Towline or Trolley Conveyors.

[T1][No. of Hrs. 10]

Text Books:

[T1] Chandershekhar Hiregoudar, Raghavendra Reddy "Facility Planning & Layout Design, an industrial perspective" Technical publications Pune.

Reference Books:

[R1] Tompkins, White, Bozer, Tanchoco "Facilities Planning" fourth edition John Wiley & Sons.

OBJECT ORIENTED SOFTWARE ENGINEERING

Paper Code: ETCS-412

Paper: Object Oriented Software Engineering

L	T/P	C
3	0	3

INSTRUCTIONS TO PAPER SETTERS:

MAXIMUM MARKS: 75

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from question no. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

Objective: To make the students well versed with current s/w developments in the industry.

UNIT I:

Introduction – Overview of Object-Orientation; Basic Concepts of Object-Orientation: Data abstraction, Encapsulation, Inheritance, Aggregation, classes, objects, messages, inheritance, polymorphism. Importance of modeling, principles of modeling, Object oriented modeling.

OO Life cycle – Object Oriented analysis, modeling and design; Requirement Elicitation. Introduction to Object Oriented Methodologies, Overview of Requirements Elicitation, Requirements Model-Action & Use cases.

[T1][R1][R2][No. of Hours: 10]

UNIT II:

Architecture: Introduction, System development is model building, model architecture, requirement model, analysis model, design model, implementation model.

Analysis: Introduction, System development based on user requirement, Use case model, interface descriptions, Problem domain objects, interface objects, entity objects, control objects.

Code Design Improvement: Refactoring, Anti patterns, Visitor Patterns.

[T1][R3][No. of Hours: 10]

UNIT III:

Construction: Introduction, the design model, design model dimensions, block design, working with construction.

Testing: Introduction, Object Oriented testing process, testing of analysis and design model, testing of classes.

[T1][R1][No. of Hours: 10]

UNIT IV:

Modelling with UML: Basic Building Blocks of UML, A Conceptual Model of UML.

Basic structural modelling: Classes, interfaces, Dependency, generalization and association relationship, comparison of E-R diagram and UML class Diagram, forward and reverse engineering.

Basic Behavioral Modeling- Use case diagram-relationships between use cases- extend, include, and generalize. Activity diagram-Action state, Activity state, Transition (Fork, Merge, Join), State diagram-events, State Diagram states, transitions, Interaction diagrams: Sequence diagram, Collaboration diagram (iterations, conditional messaging, branching, object creation and destruction, time constraints, origin of links.)

Architectural modelling:

Deployment: Common Modelling technique; Modelling processors and devices, modelling distribution of artifacts.

Collaboration: Modeling roles, modelling the realization of a Use Case, modelling the realization of an operation, modelling a mechanism.

[T1][R3][No. of Hours: 10]

Text Books:

[T1] Ivar Jacobson, “Object Oriented Software Engineering”, Pearson.

[T2] Grady Booch, James Runbaugh, Ivar Jacobson, “The UML User Guide”, Pearson.

Reference Books:

[R1] Rumbaugh et. al, “Object Oriented Modeling and Design”, Pearson.

[R2] Booch, Maksimchuk, Engle, Young, Conallen and Houston, “Object Oriented Analysis and Design with Applications”, Pearson Education.

[R3] Object-Oriented Analysis and Design: using UML Mike O'Docherty Wiley Publication.

[R4] Edwards Yourdon. Carl Argila, “Case Studies in object oriented analysis and design” Prentice Hall.

FACTORY AUTOMATION

Paper Code: ETMT-414
Paper: Factory Automation

L	T/P	C
3	0	3

INSTRUCTIONS TO PAPER SETTERS:**MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks

Objective: To introduce the students about the knowledge of mechanical and electrical actuating systems and their automation in the industry or factory.

UNIT - I

Mechanical Actuating Systems: Types of motion, Degrees of freedom, constraints, Kinematic Chains, Cam, Gear and gear trains, Ratchet and pawl Belt drive, chain drive, bearing, pre loading.

Hydraulic & Pneumatic Actuation Systems: Fluid power systems, hydraulic systems, Pneumatic systems, system structure and signal flow, hydraulic pumps and Pressure Control Valves and regulation, introduction to air compressors and treatment, Introduction to Cylinders, Direction Control Valves, Process control valves, Rotary Actuators, Accumulators, Amplifiers, and Pneumatic Sequencing Problems.

Compressed air generation and contamination control

Air compressor types, preparation, stages of reparation, after cooler, mail line filter, oil removal, dryer, Air receiver, air distribution system, secondary air treatment.

Pneumatic Actuators: Basic actuator functioning, thrust, cylinder air consumption, cylinder speed and its relation to flow rate, stroke length, construction details, seals, installation of cylinder, cylinder cushioning, diaphragm cylinders, cylinder and magnetic piston, cylinder with non rotational guiding, rod less cylinders, below actuators, pneumatic muscle, multi-position cylinder, hydro pneumatic feed unit, gripper, air motors, pneumatic tools.

[T1, T2][No. of Hrs: 12]**UNIT - II**

Electrical Actuation Systems: Switching Devices, Mechanical Switches – SPST, SPDT, DPDT, keypads; Relays, Electronic sensors, Diodes, Thyristors, Transistors, solenoid operating Valve, Solenoid Operated Hydraulic and Pneumatic Valves, Electro-Pneumatic Sequencing Problems. Control of DC Motors, Permanent Magnet DC Motors, Bush less Permanent Magnet DC Motors, AC Motors and speed controls, Stepper Motors and Controls, Servo Motors.

Industrial control voltages, control devices, push button station, electric logic controls, memory function, operation of dominant Off circuit and dominant ON circuit, electronic sensors, read switch, proximity sensor, Time delay relay, two hand safety operations, electric counters, pressure switch, mounting methods and arrangement, modular valve technology, miniaturization, Modularity, integration and intelligence.

[T1, T2][No. of Hrs: 12]**UNIT - III****Interfacing with PLC:**

Hard wired control systems, comparison of PLC and relays, PLC system components, structure, CPU memory areas, PLC hardware design, Modular PLC, software, Project structure, Hardware configuration, PLC bit logic operations, program contacts versus switching contacts,

Programmable logic controllers:

Programmable logic controllers (PLC) - Input / Output Processing, principles of operation, PLC versus computer, Programming Languages, programming using Ladder Diagrams, Logic Functions, Latching, Sequencing, Timers, Internal Relays And Counters, Shift Registers, Master and Jump Controls, Jumps, Data Movement, Code Conversion, Data handling and manipulation, selecting a PLC. Introduction to HMI and SCADA

Case studies:, Printer, Domestic Washing Machine, Optical Mark Reader, Bar Code Reader and Pick and Place robot Arm, Using PLC for extending and retracting a pneumatic piston and two pneumatic pistons in different combinations.

[T1, T2][No. of Hrs: 11]

UNIT - IV**Maintenance, Trouble Shooting and Safety:**

Requirement of preventive maintenance, Definition of maintenance activities, preventive maintenance of pneumatic systems, system malfunctions, Maintenance tips, trouble shooting, General malfunctions, safety in pneumatic systems, Energy saving.

[T2][No. of Hrs: 12]

Text Book:

- [T1] W. Bolton, "Mechatronics – Electronic Control Systems in Mechanical & Electrical Engineering", Pearson Education Ltd., 2003.
[T2] Joji P, Pneumatic Controls, Wiley;

Reference Books:

- [R1] Dan Neculescu, Mechatronics, Pearson
[R2] David g Alciatore, Michael B Histan, "Introduction to Mechatronics and Measurement Systems", McGraw Hill Education.
[R3] A Smaili, F Mrad, "Mechatronics – Integrated Technologies for Intelligent Machines, Oxford Higher Education.
[R4] Nitaigour Premchand Mahalik, "Mechatronics Principles, Concepts & Application", Tata McGraw Hill Publishing Co. Ltd., 2003.

REFRIGERATION & AIR CONDITIONING

Paper Code: ETMT-416

Paper: Refrigeration & Air Conditioning

L	T/P	C
3	0	3

INSTRUCTIONS TO PAPER SETTERS:

MAXIMUM MARKS: 75

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from question no. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

Objective: The objective of the paper is to facilitate the student with the basics of Refrigeration & Air conditioning that are required for an engineering student.

UNIT-I

Introduction to Refrigeration: Brief history of refrigeration. Concepts of various refrigeration systems, Heat Pump COP, Unit of Refrigeration,

Air Refrigeration systems: Bell Coleman Cycle, Dense Air System, Open Air System, Analysis of Simple Air Refrigeration Cycle for Aircraft.

Refrigerants: ASHRAE Nomenclature. Eco Friendly Refrigerants, Properties of Refrigerants, Introduction to Azeotropic & Non Azeotropic Refrigerant Mixtures (NARM).

[T1][T2][R3][No. of Hrs. 11]

UNIT-II

Vapour Compression Refrigeration System: Simple Saturated Cycle. T-S, P-h diagrams. COP. Dry and Wet Compression. Effect of operating parameters. Liquid-Suction Heat Exchanger. Actual vapour compression cycle.

Compound Vapour Compression System: Concepts of (i) Liquid Flash cooler, (ii) Flash Inter cooler. (iii) Back pressure valves. (iv) Individual Expansion valves (v) Multiple expansion valves.

Vapour Absorption Refrigeration System: Vapour absorption refrigeration system for NH₃-H₂O & LiBr-H₂O. Electrolux Refrigerator.

[T1][T2][R3][No. of Hrs. 11]

UNIT III:

Instruments & Controls: Sensing and Actuating Elements, H.P and L.P cut out, Thermostat, Solenoid valve, Rotameter, Humidistat, Anemometer etc.

Components of Refrigeration System: Classification of compressors, Reciprocating compressor, Clearance Volume and Volumetric efficiency, Need for Multistage Compression, Different types of Condensers, Expansion devices and Evaporators.

[T1][T2][R2][No. of Hrs. 11]

UNIT IV:

Psychrometry: Brief History of Air Conditioning. Working substance in Air Conditioning system. Dalton's Law of Partial Pressures. Psychometric Properties and Psychometric Chart. Psychometric Processes, Concept of Room Sensible Heat Factor, Grand Sensible Heat Factor, Apparatus Dew point, Effective Sensible Heat Factor. High Latent Heat Load applications, Human comfort, Summer & Winter Air Conditioning.

Heat Load Estimation: Inside and Outside design conditions. Solar heat gain through glass and structures. Occupancy load, Lighting load and miscellaneous loads. Infiltration and Ventilation. Summary of Heat Loads. Duct Design.

[T1][T3][R3][No. of Hrs. 11]

Text Books:

[T1] C.P. Arora, "Refrigeration & Air Conditioning", Tata McGraw Hill Publication.

[T2] R.C. Jordand & G.B. Prister, "Refrigeration & Air Conditioning", Prentice Hall of India Publication.

References Books:

[R1] W.F. Stocker & J.W. Jones, "Refrigeration & Air Conditioning", Tata McGraw Hill Publication.

[R2] Manohar Prasad, "Refrigeration & Air Conditioning", Wiley Eastern.

[R3] S. Domkundwar, "A Course in Refrigeration & Air Conditioning", Dhanpat Rai & Sons

VLSI DESIGN**Paper Code: ETIC-414****Paper: VLSI Design**

L	T/P	C
3	0	3

INSTRUCTIONS TO PAPER SETTERS:**MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 12.5 marks.

Objective: The prerequisite are analog devices, STLD, Digital system design and micro-electronics. The students are introducing to MOS technology, design rules and some applications.

UNIT I

Evolution of VLSI, MOS transistor theory, MOS structure, enhancement & depletion transistor, threshold voltage, MOS device design equations, MOSFET scaling and small geometry effects, MOSFET capacitances. NMOS inverter, CMOS inverter, DC characteristics, static load MOS inverter, pull up/pull down ratio, static & dynamic power dissipation, CMOS & NMOS process technology – explanation of different stages in fabrication, body effect, latch up in CMOS.

[T1,T2][No. of Hours: 11]**UNIT II**

Stick diagram and design rules, lambda based design rules, switching characteristics & inter connection effects: rise time, fall time delays, noise margin. CMOS logic gate design: NAND, NOR, XOR and XNOR gates, Transistor sizing, combinational MOS logic circuits: pass transistor and transmission gate designs, Pseudo NMOS logic.

[T1,T2][No. of Hours: 11]**UNIT III**

Sequential MOS logic circuits: SR latch, clocked latch and flip flop circuits, CMOS D latch and edge triggered flip flop, dynamic logic circuits; basic principle, non ideal effects, domino CMOS logic, high performance dynamic CMOS circuits, clocking issues, clock distribution.

[T1,T2][No. of Hours: 11]**UNIT IV**

VLSI designing methodology, design flow, design Hierarchy, concept of regularity, modularity & locality, VLSI design style, Design quality, computer aided design technology, adder design and multiplier design examples. Low power design concepts using CMOS Technology.

[T1,T2][No. of Hours: 11]**Text Books:**

- [T1] Basic VLSI Design - Pucknell Douglas A., Eshraghian Kamran, PHI Learning Pvt Limited, 2013.
 [T2] N. Weste and D. Harris, "CMOS VLSI Design: A Circuits and Systems Perspective - 4th Edition", Pearson Education, India.

Reference Book:

- [R1] S. M. Kang, Y. Leblebici, "CMOS digital integrated circuits analysis & design" Tata McGraw Hill, 3rd Edition.
 [R2] Digital Integrated Circuit Design- Ken Martin, Oxford University Press
 [R3] The MOS Transistor- Yaniiis Tsividis and Colin Mcandrew, Oxford University Press, 2013
 [R4] J. M. Rabaey, "Digital Integrated Circuits" PHI Learning Pvt Limited, India
 [R5] J. P. Uyemura, "Introduction to VLSI Circuits and Systems", John Wiley & Sons, Inc., New York, NY
 [R6] Neelam Sharma, "Digital Logic Design", Ashirwad Publication 2013-14

DATA COMMUNICATION & NETWORKS**Paper Code: ETEC-420****Paper: Data Communication & Networks**

L	T/P	C
3	0	3

INSTRUCTIONS TO PAPER SETTERS:**MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 12.5 marks.

Objectives: The objective of the paper is to provide an introduction to the fundamental concepts on data communication and the design, deployment, and management of computer networks.

UNIT- I

Data Communications : Components, protocols and standards, Network and Protocol Architecture, Reference Model ISO-OSI, TCP/IP-Overview ,topology, transmission mode, digital signals, digital to digital encoding, digital data transmission, DTE-DCE interface, interface standards, modems, cable modem, transmission media-guided and unguided, transmission impairment, Performance, wavelength and Shannon capacity. Review of Error Detection and Correction codes.

Switching: Circuit switching (space-division, time division and space-time division), packet switching (virtual circuit and Datagram approach), message switching.

[T1, T2, R1, R4] [No. of Hours: 11]**UNIT- II**

Data Link Layer: Design issues, Data Link Control and Protocols: Flow and Error Control, Stop-and-wait ARQ. Sliding window protocol, Go-Back-N ARQ, Selective Repeat ARQ, HDLC, Point-to –Point Access: PPP Point –to- Point Protocol, PPP Stack,

Medium Access Sub layer: Channel allocation problem, Controlled Access, Channelization, multiple access protocols, IEEE standard 802.3 & 802.11 for LANS and WLAN, high-speed LANs, Token ring, Token Bus, FDDI based LAN, Network Devices-repeaters, hubs, switches bridges.

[T1, T2,R1][No. of Hours: 11]**UNIT- III**

Network Layer: Design issues, Routing algorithms, Congestion control algorithms,

Host to Host Delivery: Internetworking, addressing and routing, IP addressing (class full & Classless), Subnet, Network Layer Protocols: ARP, IPV4, ICMP, IPV6 ad ICMPV6.

[T1, T2,R1][No. of Hours: 11]**UNIT- IV**

Transport Layer: Process to Process Delivery: UDP; TCP, congestion control and Quality of service.

Application Layer: Client Server Model, Socket Interface, Domain Name System (DNS): Electronic Mail (SMTP), file transfer (FTP), HTTP and WWW.

[T2, T1, R1, R4][No. of Hours: 11]**Text Books:**

- [T1] A. S. Tannenbum, D. Wetherall, “Computer Networks”, Prentice Hall, Pearson, 5th Ed
 [T2] Behrouz A. Forouzan, “Data Communications and Networking”, Tata McGraw-Hill, 4th Ed

Reference Books:

- [R1] Fred Halsall, “Computer Networks”, Addison – Wesley Pub. Co. 1996.
 [R2] Larry L, Peterson and Bruce S. Davie, “Computer Networks: A system Approach”, Elsevier, 4th Ed
 [R3] Tomasi, “Introduction To Data Communications & Networking”, Pearson 7th impression 2011
 [R4] William Stallings, “Data and Computer Communications”, Prentice Hall, Imprint of Pearson, 9th Ed.
 [R5] Zheng , “Network for Computer Scientists & Engineers”, Oxford University Press
 [R6] Data Communications and Networking: White, Cengage Learning

CONSUMER ELECTRONICS**Paper Code: ETEC-408****Paper: Consumer Electronics**

L	T/P	C
3	0	3

INSTRUCTIONS TO PAPER SETTERS:**MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from question no. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

Objective: The objective of teaching this subject is to give students in depth knowledge of various electronic audio and video devices and systems. Further this subject will introduce the students with working principles, block diagram, main features of consumer electronics gadgets/goods/devices like audio-systems, CD systems, TV, VCR and other items like fax machine washing machine, microwave ovens, digital camera & iPODS etc., which in-turn will develop in them capabilities of assembling, fault diagnosis and rectification in a systematic way.

UNIT I**Audio System: Microphones, Construction, Working principles and applications of microphone:**

Carbon, Moving coil, velocity, crystal, condenser type, Cordless microphone, Dynamic & wireless microphone.

Loud Speakers: Direct radiating, horn loaded, woofer, tweeter and squeeaker, baffles and enclosures.

Sound recording on magnetic tape its principles, block diagram and tape transport mechanism, Wow, Flutter & Rumble distortion. Relationship between gap width, tape speed and frequency. Optical recording and reproduction system, Blue ray technology,

VCD & DVD system, HI- Fi system, condition for good acoustic features, stereo amplifiers

[T1, T2][No. of Hours: 11]**UNIT II**

Television: Monochrome TV Communication: Elements of TV communication system; Scanning – its need for picture transmission; Need synchronizing and blanking pulses; Progressive scanning, interlaced scanning, ell effect, resolution and band width requirement, Composite Video signal (CVS)at the end of even and odd fields, advantage & disadvantage of negative modulation, need of pre & post Equalizing pulses; Monochrome picture tube– construction and working, comparison of magnetic and electric of Construction and working of camera tube: vidicon and plumbicon, night vision camera.

Block diagram of a TV receiver: function of each block and wave form at the input and output of each block; Frequency range of various VHF bands and channels used in India, Major specification of the CCIR B standard. Typical circuits of scanning and EHT stages of TV receiver, keyed AGC, SAW filter; trap circuit, Identification of faulty stage by analyzing the symptoms and basic idea of a few important faults and there remedies.

[T1, T2][No. of Hours: 12]**UNIT III**

Color TV: Primary colors, trisimulus values, trichromite coefficients, concepts of additive and subtracting mixing of colours, concepts of luminance, Hue and saturation, Compatibility of colour TV system with monochrome system. Block diagram of colour TV camera, Construction and working principles of Trinitron, delta gun and PIL types of colour picture tubes. Concepts of degaussing, purity, beam shifting; burst signal and its need, chrominance signal; analysis of G-Y signal is not transmitted, Block diagram of PAL TV receiver.

[T1, T2] [No. of Hours: 11]**UNIT IV**

Comparison of digital TV LCD, LED, HDTV, Plasma TV & Three dimension TV.

Cable Television: Block diagram and principle of working of STB and DTH, Study of FAX machine, group-3 fax machine, Fuzzy logic washing machine, study of digital camera, RFID & Bluetooth technology, study of iPods, MP4 players & accessories, block diagram of microwave oven and its function of each block.

[T1, T2] [No. of Hours: 11]**Text Books:**[T1] R. R. Gulati, “Modern Television Practice” New Age International, 2nd Edition.[T2] S. P. Bali, “Consumer Electronics” Pearson Education, 1st Edition.**Reference Books:**[R1] A. Dhake, “Television & Video Engineering” TMH – 2nd Edition.

Modified Scheme and Syllabus of B. Tech-Mechatronics (1st Semester to 8th Semester) implemented from Academic Session w.e.f. 2015-16, approved in the 23rd BOS and 40th AC meeting of USET.

- [R2] R.R. Gulati, "Monochrome & Colour Television" New age International Publisher, 2nd Edition.
[R3] R.G. Gupta, "Audio & Video Systems" TMH – 2nd Edition.



SUPPLY CHAIN MANAGEMENT - PLANNING**Paper Code: ETTE-424****Paper: Supply Chain Management - Planning**

L	T/P	C
3	0	3

INSTRUCTIONS TO PAPER SETTERS:**MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 12.5 marks.

Objectives: The objective of the course is to provide a comprehensive analysis of the principles and practices of supply chain management. It will help the student to understand the activities of SCM and provide grounding in this field.

UNIT-I

Supply Chain Management - Concepts, Issues in Supply Chain Management; Demand Volatility and information distortion, Managing networks and relationships; Sourcing Internationally, Subcontracting within an International Dimension, The Architecture of Physical distribution network : Distribution Management: Types of Intermediaries, Channel Objectives and Constraints, Channel Selection and Management, Global Retailing, International Channel Innovation.

[T1, T2][No. of Hrs. 10]**UNIT-II**

Logistics Framework – Concept, Objective and Scope; Transportation, Warehousing, Inventory Management; Packing and Unitization; Control and Communication, Role of Information Technology in Logistics, Logistics Service Firms and Third Party Logistics.

[T1, T2][No. of Hrs. 10]**UNIT-III**

Logistics Network Design for Domestic/Global Operations: Logistics Network Configuration, Orienting International Facilities: Considerations and Framework, Trade-offs Associated with each Approach, Mapping the different Approaches, Capacity Expansion Issues; Information Management for Global Logistics: The Global LIS/LITS: Capabilities and Limitations, Characteristics of Logistics Information and Telecommunications Systems.

[T1, T2][No. of Hrs. 12]**UNIT-IV**

Performance Measurement and Evaluation in Global Logistics: Operations and Logistics Control: Key Activities Performance Information, Measuring Performance in Functional Integration, Measuring Performance in Sectoral Integration; Measurements and improvements of SCM service quality and performance; Past, present and future of Supply Chain Management.

[T1, T2][No. of Hrs. 10]**Text Books**

- [T1] Christopher Martin. (2005). Logistics & Supply Chain Management Creating Value-adding Networks, 3rd Edition, Pearson Education..
- [T2] S.K. Bhattacharyya (2010) Logistics Management, Definition, Dimensions and Functional Applications, S. Chand and Company, Delhi.

Reference Books:

- [R1] Chopra Sunil and Peter Meindl (2009). Supply Chain Management, 4th Edition, Pearson Education.
- [R2] Ballou, R. H. (2004). Business Logistic Management, 5th Edition, Prentice Hall, New Delhi.
- [R3] Bowersox, D. J., David, J & Cooper (2002). Supply Chain Logistics Management, McGraw Hill.

INTELLIGENT AND SMART INSTRUMENTATION

Paper Code ETMT-424

Paper: Intelligent and Smart Instrumentation

L	T/P	C
3	0	3

INSTRUCTIONS TO PAPER SETTERS:

MAXIMUM MARKS: 75

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks

Objective:- To introduce modern devices and techniques used in instrumentations, especially in automation and critical applications.

UNIT-I

Recent Trends in Sensor Technologies: Introduction; Film sensors (Thick film sensors, Thin film sensors); Semiconductor IC technology – standard methods; Microelectro-mechanical systems (Micro-machining, some application examples); Nano-sensors, Bulk Micromachining, Micromachining Surface Micromachining. Other Micromachining Techniques. (LIGA Process) Micromilling. Micromachined Materials, Digital transducers.

[T1][T2][No. of Hrs. 12]

UNIT-II

Sensors:- Primary sensors; Excitation; Amplification; Filters; Converters; Compensation (Nonlinearity: look up table method, polygon interpolation, polynomial interpolation, cubic spline interpolation, Approximation & regression; Noise & interference; Response time; Drift; Cross-sensitivity); Information Coding/ Processing; Data Communication; Standards for smart sensor interface.

[T1][T2][No. of Hrs. 11]

UNIT-III

VI and Data Acquisition: Introduction to virtual Instrumentation, VI programming using LabVIEW, Signal Conditioning, DAQ Hardware Configuration, DAQ Hardware, DAQ Software Architecture, DAQ Assistant, Channel and Task configuration, Selecting and Configuring a DAQ device, Serial interfacing - RS 232C, RS 422, RS 423, RS 485.

[T2][No. of Hrs. 12]

UNIT IV

Instrumentation Systems:- Types of Instrumentation systems, Intelligent Instrumentation, Component of Intelligent Instrumentation System, Concept of real time system and its industrial application, realization of real time system using microcontroller and typical applications.

[T2][No. of Hrs. 10]

Text Books:

[T1] Mathivanan, “PC Based Instrumentation”, 1st Ed., PHI

[T2] D.Patranabis, “sensors and Transducers” 2nd Edition, PHI

Reference Books:-

[R1] J.Jerome, “Virtual Instrumentation using LabVIEW”, PHI

[R2] P.Rai Choudhury, MEMS and MOEMS Technology and Application, PHI

[R3] Barney, “ Intelligent Instrumentation, Microprocessor Applications in measurement and Control”, PHI

[R4] M.Bhuyan, “Intelligent Instrumentation: Principles and Applications”, CRC Press

RELIABILITY AND MAINTENANCE MANAGEMENT

Paper Code: ETMT-426

Paper: Reliability and Maintenance Management

L	T/P	C
3	0	3

INSTRUCTIONS TO PAPER SETTERS:

MAXIMUM MARKS: 75

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

Objective: To provide students with a comprehensive understanding on various maintenance management processes and understands the impact of maintenance management on reliability and cost effectiveness.

UNIT I

Reliability fundamentals: Reliability Mathematics. Failure distributions. Causes of failures and their treatment. Reliability apportionment and prediction. Reliability data books. Data Recording and Corrective Action System (DRACAS).

[T1, T2][No. of Hrs. 10]

UNIT II

Reliability analysis and modelling methods: Fault tree analysis, Failure Mode Effects and Criticality Analysis (FMECA), Reliability block diagram, Reliability Growth Models – IBM and Duane Reliability Growth Modelling, Reliability testing. Monte Carlo Reliability Simulation. Weibull Analysis.

[T1, T2][No. of Hrs. 10]

UNIT III

Maintenance Techniques and Tools: Maintenance as an essential element for asset management. Reliability Centred Maintenance as a means for maintenance decision. Topics on conditioned based maintenance.

[T1, T2][No. of Hrs. 10]

UNIT IV

Management for business performance: Computerized Maintenance Management System – from planning to implementation. Alternative spare sourcing. Maintenance outsourcing management.

[T1, T2][No. of Hrs. 10]

Text Books:

- [T1] J. Mouray, “Reliability Centred Maintenance”, 2nd Edition, Industrial Press, 1997
 [T2] C.E. Ebeling, “An Introduction to Reliability and Maintainability Engineering”, TMH

Reference Books:

- [R1] P. D. T. O'Connor, Practical Reliability Engineering, Wiley, 2006

FLEXIBLE MANUFACTURING SYSTEM

Paper Code: ETMT-428

Paper: Flexible Manufacturing System

L	T/P	C
3	0	3

INSTRUCTIONS TO PAPER SETTERS:

MAXIMUM MARKS: 75

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from question no. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

Objective: The objective of the paper is to acquaint the student with modern manufacturing environment having automation with CNC machines and robots.

UNIT I

Introduction and Definition: Flexible Automation and Manufacturing Cell and Flexible Manufacturing System. Flexible Automation and Manufacturing systems and its productivity, History of FMS systems, definition, concept, benefits, problems in batch production, Types of FMS, Components of FMS, control of workstation, AGV systems, Functions of FMS, Scheduling and loading FMS, Layout configurations for FMS, communication in FMS, simulation in FMS, Installation and examples of FMS, optimization of FMS, typical layout of FMS, The FMS software. Feasibility report of FMS, advanced control cycle of FMS.

[T1][T2][No. of Hrs. 11]

UNIT II

CIM System: Introduction to CAD & CAM and its tools, Concept and origin of CIM, components of CIM, Emerging technologies of CIM, computer control system, sensing and identifying for manufacturing, CIMS data files, factors affecting performance, advantages and limitations, performance evaluation of a CIM system. Human centered CIM system, CIM technology in manufacturing environments, Factory information system, Sequential and concurrent engineering.

[T1][T2][No. of Hrs. 11]

UNIT III

High Volume Production System: Types of Automated assembly systems, Automated production or transfer lines, Equipment and arrangement of transfer lines, methods of work transport, transfer mechanisms, Assembly line balancing, numericals on line balancing, computerized line balancing methods.

Automated Material Movement: Function, Types of material movement systems, material movement through conveyors, material movement through robots, material movement through AGVs, automated guided vehicle operation and control, Advantages and limitations of AGVs, economic considerations.

Automatic tool changer (ATC), Storage and automated production line, Automated storage and retrieval system (ASRS), Carousel storage system, In-process storage system, communication with material in storage and in movement.

[T2][No. of Hrs. 12]

UNIT IV

Introduction to artificial intelligence in manufacturing automation, expert systems, AI programming for expert systems.

Computer Aided Quality Control: CNC 3D Coordinate Measuring machines, TQM, QC & CIM, Inspection and Testing, SPC, Role of computers in QC, Non contact inspection methods, Post process Metrology, Computer aided inspection using robots, integration of CAD / CAM with inspection system, Flexible Inspection system, Reverse Engineering.

[T1,T2][No. of Hrs. 10]

Text Books:

- [T1] P Radhakrishnan, S subramanym, V Raju; CAD/CAM/CIM; New Age International Publishers.
 [T2] K.C. Jain, Sanjay Jain, Principles of Automation and Advanced Manufacturing systems, Khanna Publications.

Reference Books:

- [R1] Ibrahim Zeid, R Sivsubramanian, CAD/ CAM Theory & Practice, MCGraw Hill.

ENGINEERING ECONOMICS & COST ANALYSIS

Paper Code: ETMT-430

Paper: Engineering Economics & Cost Analysis

L	T/P	C
3	0	3

INSTRUCTIONS TO PAPER SETTERS:

MAXIMUM MARKS: 75

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks

Objective: The objective of this course is to give the working engineer an overview of the economics principles often employed in effective engineering decisions as related to the designing, planning and implementation of successful civil engineering projects.

UNIT – I

Engineering economics and its definition, Nature and scope, Overview of Indian Financial Scenario. Utility, Theory of demand, law of demand and its exceptions, Elasticity of demand, Law of supply and elasticity of supply, Determination of equilibrium price under perfect competition. Time value of money-Simple and Compound Interest, Cash Flow Diagram, Principle of Economic Equivalence Evaluation of Engineering projects, Concept of Internal rate of return (IRR).

[T1,T2] [No. of Hrs: 10]

UNIT – II

Cost Concepts, Elements of costs, Preparation of cost sheet, Segregation of costs into Fixed and variable costs, Break-even Analysis-Linear Approach. Engineering Accounting, Manufacturing Cost, Manufacturing Cost Estimation, Preparing Financial Business Cases, Profit and loss A/c Balance sheet. Asset Depreciation and its Impact on Economic Analyses, Depreciation Policy, Straight line method and declining balance method, Economic Justification of Asset Replacements.

[T1,T2] [No. of Hrs. 12]

UNIT – III

Types of business ownership: Private ownership- individual, Partnership, Joint stock companies, Co-operative societies, State ownership-government departmental organization, Public corporations, Government companies, Public Private Partnership (PPP) and its management. Store keeping, Elements of Materials management and control polices. Banking: Meaning and functions of commercial banks, Function of Reserve Bank of India.

[T2,R4] [No. of Hrs. 12]

UNIT IV

Asset Depreciation and its Impact on Economic Analyses, Depreciation Policy, Straight line method and declining balance method, Economic Justification of Asset Replacements. Development of business case analyses for new product development projects and the impact of taxes on engineering economic decisions. Inflation and its impact on economy.

[T1, R5][No. of Hours: 11]

Text Books:

- [T1] Sullivan, Wicks, Koelling, "Engineering Economy", Pearson Education
 [T2] S.C. Sharma and T.R. Banga, "Industrial organization and engineering economics"

References Books:

- [R1] Riggs, Bedworth and Randhwa, "Engineering Economics", McGraw Hill Education India.
 [R2] C. T. Horngreen, "Cost Accounting", Pearson Education India.
 [R3] R. R. Paul, "Money banking and International Trade", Kalyani Publuisher, New-Delhi.
 [R4] Engineering Economics by Tahir Hussain, University Science Press, 2010
 [R5] Engineering Economics by Dr. Rajan Mishra – University Science Press, 2009
 [R6] H.L. Ahuja, "Principle of Economics", S. Chand
 [R7] Khan, Siddiquee, Kumar, "Engineering Economy" Pearson Education

ROBOTICS LAB

Paper Code: ETMT-452
Paper: Robotics Lab

L	T/P	C
0	2	1

List of Experiments:

1. Study of robotic arm, end effectors and its configuration and introduction to any software (such as workspace) used to simulate or program a robot;
2. Program / simulate a robot for moving on a path;
3. Program / simulate a robot for pick and place operation;
4. Program / simulate a robot for welding operation;
5. Program / simulate a robot for water jet machining;
6. Program / simulate a robot for saving it from striking any other object in workspace;
7. Program / simulate two robots working together;
8. Make a 3R robot and simulate its motion.
9. Use a microcontroller to program simple toy robot / model robot;
10. Micro controller program to use different sensors and further move toy robot(s) / model robot;
11. Use MATLAB / Scilab. Any other software to program numericals (Robot Arm kinematics) taught in class.
12. Use MATLAB / Scilab and other robot specific software like Robo-Analyzer for the study of kinematic and dynamics of 3R robots.
13. Demos of a real robot; Introduce Virtual Robotics Lab. in ADAMS or SimMechanics of MATLAB.

Note:

- a. Total Experiments are to be 12 (Twelve).
- b. Experiments suggested by committee are given above- Choose any eight.
- c. Rest (In above list / not in list) is liberty of respective institute to choose as per syllabus.
- d. Suggested Software

A course on Robotics must use one or more software to not only visualize the motion and characteristics of robots but also to analyze/synthesize/design robots for a given application (say, as class projects). Typical software which can be used are as follows:

- RoboAnalyzer (Developed by IIT Delhi; <http://www.roboanalyzer.com>)
 - Virtual Labs. (Developed by IIT Kharagpur; <http://vlabs.iitkgp.ernet.in/moodle/>)
 - MATLAB, its modules Simulink and SimMechanics (<http://www.mathworks.com>)
 - Mathematica: Symbolic software (<http://www.wolfram.com>)
 - Multi Bondgraph (<http://bondgraph.org>)
 - ADAMS (by MSC software; <http://www.mscsoftware.com>)
 - RerurDyn (by Function Bay, Korea; <http://www.functionbay.co.kr>)
- e. **Other Aids**
- **Possible Class projects and presentations:** Kinematic/Dynamic modeling, programming, and analyses of a robotic arm (say, an RP manipulator); 2. Modeling of an AGV; 3. Building prototypes using, say, LEGO kits
 - Video of practical applications
 - Industry visits
 - Robocon competitions: A national-level competition held every year during the 1st weekend of March

NOTE:- At least 8 Experiments out of the list must be done in the semester.

EMBEDDED SYSTEMS LAB

Paper Code: ETMT-454	L	T/P	C
Paper: Embedded Systems Lab	0	2	1

List of Experiments:

1. Introduction to microcontroller and interfacing modules.
2. To interface the seven segment display with microcontroller 8051
3. To create a series of moving lights using PIC on LEDs.
4. To interface the stepper motor with microcontroller.
5. To display character 'A' on 8*8 LED Matrix.
6. Write an ALP to add 16 bits using ARM 7 Processor
7. Write an ALP for multiplying two 32 bit numbers using ARM Processor
8. Write an ALP to multiply two matrices using ARM processor

NOTE:- At least 8 Experiments out of the list must be done in the semester.

ENGINEERING SYSTEM MODELLING AND SIMULATION LAB

Paper Code: ETMT-456(ELECTIVE)	L	T/P	C
Paper: Engineering System Modeling and Simulation Lab	0	2	1

List of Experiments:

A. Mechanical Event Simulation:

The students are exposed to simulating in CAD software in this lab (software can be choice of institute – such as PROE - wildfire 5 / PROE -CREO / NX / Solid Edge / solid works / Catia / any other.

1. Study assembly module on CAD software;
2. Simulate movement of cam and follower mechanism on CAD software.
3. Simulation of Spring Mass Damper System and do dynamic analysis on CAD software.
4. Perform FEM Analysis (using a simple 3D tetrahedron element) on a Simple model with pressure loading and surface constraints;
5. Perform stress analysis of rectangular L bracket using Pro E / any other software and do global sensitivity analysis.

B. System Simulation:

The students are exposed to simulation software like Arena / any other.

1. Study modeling environment;
2. Study basic process panel;
3. Study basic process panel - more;
4. Study advanced process panel;
5. Study advanced process panel - more;
6. Study flow process panel;
7. Study flow process panel- more;

NOTE:- At least 8 Experiments out of the list must be done in the semester.

OBJECT ORIENTED PROGRAMMING LAB**Paper Code: ETMT-456(ELECTIVE)****L T/P C****Paper: Object Oriented Programming Lab****0 2 1****List of Experiment:**

1. Write a program for multiplication of two matrices using OOP.
2. Write a program to perform addition of two complex numbers using constructor overloading. The first constructor which takes no argument is used to create objects which are not initialized, second which takes one argument is used to initialize real and imag parts to equal values and third which takes two argument is used to initialize real and imag to two different values.
3. Write a program to find the greatest of two given numbers in two different classes using friend function.
4. Implement a class string containing the following functions:
 - Overload + operator to carry out the concatenation of strings.
 - Overload = operator to carry out string copy.
 - Overload <= operator to carry out the comparison of strings.
 - Function to display the length of a string.
 - Function tolower() to convert upper case letters to lower case.
 - Function toupper() to convert lower case letters to upper case.
5. Create a class called LIST with two pure virtual function store() and retrieve(). To store a value call store and to retrieve call retrieve function. Derive two classes stack and queue from it and override store and retrieve.
6. Write a program to define the function template for calculating the square of given numbers with different data types.
7. Write a program to demonstrate the use of special functions, constructor and destructor in the class template. The program is used to find the bigger of two entered numbers.
8. Write a program to perform the deletion of white spaces such as horizontal tab, vertical tab, space ,line feed ,new line and carriage return from a text file and store the contents of the file without the white spaces on another file.
9. Write a program to read the class object of student info such as name , age ,sex ,height and weight from the keyboard and to store them on a specified file using read() and write() functions. Again the same file is opened for reading and displaying the contents of the file on the screen.
10. Write a program to raise an exception if any attempt is made to refer to an element whose index is beyond the array size.

NOTE:- At least 8 Experiments out of the list must be done in the semester.

FACTORY AUTOMATION LAB**Paper Code: ETMT-456(ELECTIVE)****L T/P C****Paper: Factory Automation Lab****0 2 1****List of Experiments:**

1. Design and assembly of hydraulic / pneumatic circuit.
2. Demonstration and working of power steering mechanism
3. Study of reciprocating movement of double acting cylinder using pneumatic direction control valves
4. Use of direction control valve and pressure control valves clamping devices for jig and fixture
5. Study of robotic arm and its configuration
6. Study the robotic end effectors
7. Study of different types of hydraulic and pneumatic valves and develop circuits for pneumatic sequencing
8. Study of different types of hydraulic and pneumatic valves and develop circuits for electro-pneumatic sequencing

NOTE:- At least 8 Experiments out of the list must be done in the semester.

DATA COMMUNICATION & NETWORKS LAB

Paper Code: ETMT-456(ELECTIVE)	L	T/P	C
Paper: Data Communication & Networks Lab	0	2	1

List of Experiments:

1. Introduction to Computer Network laboratory
Introduction to Discrete Event Simulation
Discrete Event Simulation Tools - ns2/ns3, Omnet++
2. Using Free Open Source Software tools for network simulation – I Preliminary usage of the tool ns3
Simulate telnet and ftp between N sources - N sinks (N = 1, 2, 3). Evaluate the effect of increasing data rate on congestion.
3. Using Free Open Source Software tools for network simulation - II
Advanced usage of the tool ns3
Simulating the effect of queuing disciplines on network performance - Random Early Detection/Weighted RED / Adaptive RED (This can be used as a lead up to DiffServ / IntServ later).
4. Using Free Open Source Software tools for network simulation - III
Advanced usage of the tool ns3 Simulate http, ftp and DBMS access in networks
5. Using Free Open Source Software tools for network simulation - IV
Advanced usage of the tool ns3
Effect of VLAN on network performance - multiple VLANs and single router.
6. Using Free Open Source Software tools for network simulation - IV
Advanced usage of the tool ns3
Effect of VLAN on network performance - multiple VLANs with separate multiple routers.
7. Using Free Open Source Software tools for network simulation - V
Advanced usage of the tool ns3
Simulating the effect of DiffServ / IntServ in routers on throughput enhancement.
8. Using Free Open Source Software tools for network simulation - VI
Advanced usage of the tool ns3
Simulating the performance of wireless networks
9. Case Study I : Evaluating the effect of Network Components on Network Performance
To Design and Implement LAN With Various Topologies and To Evaluate Network Performance Parameters for DBMS etc)
10. Case Study II : Evaluating the effect of Network Components on Network Performance
To Design and Implement LAN Using Switch/Hub/Router As Interconnecting Devices For Two Different LANs and To Evaluate Network Performance Parameters.
11. Mini project - one experiment to be styled as a project of duration 1 month (the last month)

NOTE:- At least 8 Experiments out of the list must be done in the semester.

VLSI DESIGN LAB

Paper Code: ETMT-456(ELECTIVE)
Paper: VLSI Design Lab

L	T/P	C
0	2	1

List of Experiments:

- 1) To study the MOS characteristics and introduction to tanner EDA software tools.
- 2) To design and study the DC characteristics of PMOS and NMOS.
- 3) To design and study the DC characteristics of resistive inveter.
- 4) To design and study the transient and DC characteristics of CMOS inverter.
- 5) To design and study the characteristics of CMOS NAND and NOR gate.
- 6) To design and study the characteristics of CMOS multiplexer.
- 7) To design any Boolean function using transmission gates.
- 8) To design and study the characteristics of CMOS Full adder.
- 9) To design and study the characteristics of CMOS D Flip Flop.
- 10) To design and study the transient characteristics of CMOS XOR/XNOR.
- 11) To design and study the characteristics of Schmitt trigger circuit.

NOTE:- At least 8 Experiments out of the list must be done in the semester.

FLEXIBLE MANUFACTURING SYSTEM LAB

Paper Code: ETMT-456(ELECTIVE)	L	T/P	C
Paper: Flexible Manufacturing System Lab	0	2	1

List of Experiments:

1. Develop programs on CNC lathe;
2. Develop programs on CNC milling;
3. Study and operate a Coordinated Measuring Machine and 6 axis robot;
4. Study working of a Flexible manufacturing system.
5. Operate FMS with automatic storage and retrieval, conveyor, lathe, robot milling machine.
6. Simulation of CIM and scheduling problem 1 on CIM Software (such as ER-Virtual / any other).
7. Simulation of CIM and scheduling problem 2 on CIM Software.
8. Simulation of CIM and scheduling problem 3 on CIM Software.

NOTE:- At least 8 Experiments out of the list must be done in the semester.