SCHEME OF EXAMINATION

and

SYLLABI

for

Bachelor of Technology
Mechanical and Automation Engineering

Offered by

University School of Engineering and Technology

1st SEMESTER TO 8th SEMESTER

GURU GOBIND SINGH
INDRAPRASTHA
UNIVERSITY

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 one 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 one 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
(MECHANICAL AND AUTOMATION ENGINEERING)
THIRD SEMESTER EXAMINATION

Code No.	Paper ID	Paper	L	T/P	Credits	Status
THEORY PAPERS						
ETME-201		Fluid Mechanics	3	1	4	M
ETME-203		Thermal Science	3	1	4	M
ETAT-203		Strength of Material	3	1	4	M
ETME-205		Production Technology	3	1	4	M
ETME-207		Material Science and Metallurgy	3	0	3	
ETME-209		Electrical Machines	3	0	3	
PRACTICAL/VIVA VOCE						
ETME-251		Fluid Mechanics Lab	0	2	1	
ETAT-257		Strength of Material Lab	0	2	1	
ETTE-259		Machine Drawing Lab	0	3	2	
ETME-253		Electrical Machines Lab	0	2	1	
		NCC/NSS*	------	------	------	
TOTAL			**18**	**13**	**27**	

M: Mandatory for the award of degree.
**NCC/NSS can be completed in any one 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
(MECHANICAL AND AUTOMATION ENGINEERING)
FOURTH SEMESTER EXAMINATION

Code No.	Paper ID	Paper	L	T/P	Credits	Status
THEORY PAPERS						
ETMA-202		Numerical Analysis and Statistical Techniques	3	1	4	
ETAT-204		Fluid Systems	3	1	4	
ETAT-202		Theory of Machines	3	1	4	M
ETME-206		Manufacturing Machines	3	1	4	M
ETME-208		Measurements and Instrumentation	3	0	3	
ETEC-202		Switching Theory and Logic Design	3	0	3	M
PRACTICAL/VIVA VOCE						
ETMA-252		Numerical Analysis and Statistical Techniques Lab	-------	2	1	
ETAT-254		Fluid Systems Lab	-------	2	1	
ETAT-252		Theory of Machines Lab	-------	2	1	
ETME-256		Manufacturing Machines Lab	-------	2	1	
ETEC-252		Switching Theory and Logic Design Lab	-------	2	1	
ETSS-250		NCC/NSS*	-------	------	1	
TOTAL			**18**	**14**	**28**	

M: Mandatory for the award of degree.
**NCC/NSS can be completed in any one semester from Semester 1 – Semester 4. It will be evaluated internally by 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.

BACHELOR OF TECHNOLOGY
(MECHANICAL AND AUTOMATION ENGINEERING)
FIFTH SEMESTER EXAMINATION

Code No.	Paper ID	Paper	L	T/P	Credits	Status
THEORY PAPERS						
ETME-301		Management of Manufacturing Systems	3	0	3	
ETAT-303		Metal Cutting and Tool Design	3	1	4	M
ETAT-305		Heat Transfer and I.C. Engines	3	1	4	M
ETAT-307		Metrology	3	0	3	M
ETEL- 307		Control Systems	3	1	4	
ETHS-301		Communication Skills for Professionals	2	0	1	
PRACTICAL/VIVA VOCE						
ETAT-351		Metal cutting and Tool Design Lab	0	2	1	
ETAT-353		Heat Transfer and I.C. Engine lab	0	2	1	
ETAT-355		Metrology lab	0	2	1	
ETEL- 355		Control Systems Lab	0	2	1	
ETHS-351		Communication Skills for Professionals Lab	0	2	1	
ETAT-357		Industrial Training (conducted after fourth semester of 4-6 weeks)	0	0	1	
		Total	**17**	**13**	**25**	

M: Mandatory for the award of degree.

*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 ME will be held after 5th semester; however, viva-voce will be conducted in 6th Semester (ETAT 362).

BACHELOR OF TECHNOLOGY
(MECHANICAL AND AUTOMATION ENGINEERING)
SIXTH SEMESTER EXAMINATION

Code No.	Paper ID	Paper	L	T/P	Credits	Status
THEORY PAPERS						
ETAT-302		Machine Design	3	1	4	M
ETAT-304		Automobile Engineering	3	0	3	
ETEC-310		Data Communications and Networks	3	1	4	
ETAT- 306		Operations Research	3	1	4	
ETME-308		Refrigeration and Air Conditioning	3	1	4	M
ETEE-310		Microprocessors and Microcontrollers	3	1	4	M
PRACTICAL/VIVA VOCE						
ETAT-352		Machine Design Lab	0	2	1	
ETAT-354		Automobile Engg Lab	0	2	1	
ETEC- 358		Data Communications and Networks Lab	0	2	1	
ETME-358		Refrigeration and Air Conditioning Lab	0	2	1	
ETEE-358		Microprocessor and Microcontroller Lab	0	2	1	
ETAT-362		In-house training (two weeks)	0	0	1	
TOTAL			**18**	**15**	**29**	

M: Mandatory for award of degree

Note: Minimum of 4-6 weeks of industrial training related to MAE will be held after 6th semester; however, viva-voce will be conducted in 7th Semester (ETAT-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 7^{h} Semester is done before the 15th April every year before end of 6th semester.

BACHELOR OF TECHNOLOGY
(MECHANICAL AND AUTOMATION ENGINEERING)
SEVENTH SEMESTER EXAMINATION

Code No.	Paper ID	Paper	L	T/P	Credits
THEORY PAPERS					
ETAT-401		Computer Aided Design	3	1	4
ETME-403		Computer Integrated Manufacturing	3	1	4
ETAT-403		Mechatronics	3	0	3
Elective-I (choose any one)					
ETME-407		Optimization Techniques	3	0	3
ETME-409		Preventive Maintenance and Condition Monitoring	3	0	3
ETME-411		Computational Fluid Dynamics	3	0	3
ETME-423		Finite Element Methods	3	0	3
ETEE-419		Renewable Energy Resources	3	0	3
ETCS-429		Artificial Intelligence	3	0	3
ETCS-425		Database Management System	3	0	3
Elective-II (Choose any one)					
ETME-417		Advanced material science and metallurgy	3	0	3
ETEE-403		Advanced Control System	3	0	3
ETME-405		Power Plant Engineering	3	0	3
ETCS-411		Introduction to Data Science	3	0	3
ETME-421		Management Information System and ERP	3	0	3
ETAT-407		Advanced Manufacturing Methods	3	0	3
ETHS-419		Sociology and Elements of Indian History for Engineers	3	0	3
PRACTICAL/VIVA VOCE					
ETAT-451		Computer Aided Design Lab	0	2	1
ETME-453		Computer Integrated Manufacturing Lab	0	2	1
ETAT-453		Mechatronics Lab	0	2	1
ETAT-455		Lab Based on Elective- I or II	0	2	1
ETAT-457		Minor Project+	0	6	3
ETAT-459		Summer training#	0	0	1
TOTAL			**15**	**16**	**25**

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
(MECHANICAL AND AUTOMATION ENGINEERING)
EIGHTH SEMESTER EXAMINATION

Code No.	Paper ID	Paper	L	T/P	Credits
ETMT-402		Robotics	3	1	4
ETME-402		Engineering System Modelling and Simulation	3	1	4
ETHS-402		Human Values and Professional Ethics-II	1	0	1
Elective-III (choose any one)					
ETEC-432		Image Processing and Machine Vision	3	0	3
ETIT-410		Soft Computing	3	0	3
ETME-426		Total Quality Management	3	0	3
ETME-414		Applied Plasticity	3	0	3
ETME-430		Computer Aided Graphics and Product design	3	0	3
ETEC-434		Microprocessor System Based Process Design	3	0	3
Elective-IV(choose any one)					
ETAT-432		Gas Turbines and Compressors	3	0	3
ETME-424		Cryogenic Engineering	3	0	3
ETME-412		Rapid Prototyping	3	0	3
ETMT-428		Flexible Manufacturing System	3	0	3
ETTE-424		Supply Chain management-planning	3	0	3
ETAT-442		Process Planning and Cost Estimation	3	0	3
PRACTICAL/VIVA VOCE					
ETMT-452		Robotics Lab	0	2	1
ETME-452		Engineering System Modelling and Simulation Lab	0	2	1
ETAT-456		Lab based on Elective III or IV	0	2	1
ETAT-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 staring 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 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.

**Syllabus may be revised after 2 years.

NOTE:

1. The total number of the credits (MAE) Programme = 214.
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. (MAE) Programme = 160.
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

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

FLUID MECHANICS

Paper Code: ETME-201	**L**	**T/P**	**C**
Paper: Fluid Mechanics	**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 analyses 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., "Hydrualics 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,

THERMAL SCIENCE

Paper Code: ETME-203	**L**	**T/P**	**C**
Paper: Thermal Science	**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 Claussius 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. 13]

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. 9]

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 Tata McGraw Hill
[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

[R5] Shiv Kumar, " Fundamentals of Thermal Engineering" Ane Books Pvt. Ltd.
[R6] Onkar Singh "Engineering Thermodynamics", New Age International Publishers.
[R7] Lucin Borel, Daniel Favrat "Thermodynamics and Energy System Analysis" Vikas Publishing House

STRENGTH OF MATERIALS

Paper Code: ETAT-203	**L**	**T/P**	**C**
Paper: Strength of Materials	**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.

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. 11]

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 theorm

Slope and defection of cantilevers and beams under concentrated and uniformly distributed loads. Moment Area method, MaCaulay's method; principle of superposition.

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

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. 11]

UNIT – IV

Springs: Close-coiled springs, leaf springs.

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

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

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] Timoshenko S.P., Gere J "Elements of Strength of Materials", East-West affiliated, New Delhi,
[R2] Bhavikatti S. S. Strength of Materials", Vikas Publishers 2000
[R2] Sri Nath L.S. et.al., "Strength of Materials", McMillan, New Delhi,2001
[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

PRODUCTION TECHNOLOGY

Paper Code: ETME-205	**L**	**T/P**	**C**
Paper: Production Technology	**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, CO_2 - 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 Bean 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

MATERIAL SCIENCE & METALLURGY

Paper Code: ETME-207	**L**	**T/P**	**C**
Paper: Material Science & Metallurgy	**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 gain 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

ELECTRICAL MACHINES

Paper Code: ETME-209	**L**	**T/P**	**C**
Paper: Electrical Machines	**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: Providing sound knowledge about the principles of operation of various electrical machines, their constructional features, and their behavior and characteristics under various condition of operation.

UNIT – I

D.C. Machines: Constructional features, Principles of operation, EMF equation Voltage build up phenomenon in a D.C. shunt generator, characteristics of different types of generators. Principle of operation of DC motor, back emf, speed and torque equation, various characteristics of different motors, starters and speed control of DC motors, applications of DC generators and motors.

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

UNIT – II

A.C. Machines: Constructional features, concept of revolving magnetic field, and principle of operation of Three phase induction motors, torque slip characteristics and power flow in induction motors, induction motor as a transformer, equivalent circuit, performance calculations, starting and speed control.

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

UNIT – III

Three Phase synchronous Machine: Constructional features EMF equation. Armature reaction of synchronous generator, voltage regulation of generators, phasor diagrams and equivalent circuits of synchronous machine, computation of synchronous machine performance. Starting methods and principle of operation of synchronous motors, synchronous condenser.

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

UNIT – IV

Single phase induction motors: double revolving field theory, different types of single phase induction motors, characteristics and typical applications. Stepper motors, hysteresis motor, Servo motors, AC series motor and Universal motor and their applications to mechanical systems.

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

Text Books:

[T1] Electric Machinery, A Fitzgerald, Charles Kingsley, Stephen Umans, Tata McGraw Hill Education, 6th edition, 2002

[T2] Electrical Machines, D P Kothari, I.J. Nagrath by Tata McGraw Hill Education, 2014

Reference Books:

[R1] Electrical and Electronic Technology, Hughes Edward, Ian Mckenzie Smith, JohnHiley, Pearson Eduction, 10th edition, 2010

[R2] Electrical Engineering Fundamentals, Vincent Del Toro, Prentice-Hall, 2nd edition, 1989

[R3] Introduction to Electrical Engineering, Mulukutla S. Sarma, Oxford University Press Inc., 2001

[R4] Problems in Electrical Engineering: Power engineering and electronics with answers Partly Solved in S.I. Units: Parker Smith , CBS Publishers, 9th edition, 2003

[R5] Basic Electrical Engineering, C.L.Wadhwa, New Age International, 2007.

FLUID MECHANICS LAB

Paper Code: ETME-251	**L**	**T/P**	**C**
Paper: Fluid Mechanics Lab	**0**	**2**	**1**

Fluid Mechanics Lab experiments based on syllabus (ETME-201).

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

STRENGTH OF MATERIAL LAB

	L	T/P	C
Paper Code: ETAT-257			
Paper: Strength of Material Lab	**0**	**2**	**1**

List of Experiments:

1. To perform tensile test in ductile and brittle materials and to draw stress-strain curve and to evaluate 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 hardness test (Rockwell, Brinell & Vicker's test) on different materials (aluminium, steel, C.I, wood, Alloy Steel)
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.

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

MACHINE DRAWING LAB

	L	T/P	C
Paper Code: ETTE-259			
Paper: Machine Drawing Lab	**0**	**3**	**2**

List of Experiments:

UNIT – I

Theory of Dimensioning & BIS Convention: Element of Dimensioning, Chain Dimensioning, Parallel Dimensioning, Coordinate Dimensioning, Dimensioning of the Common Features such as Diameter, Radii, Arcs, Angles, chamfers, etc. Conventional representation of Threads and threads parts, springs, Gears, Welded and riveted joints, Threaded fasteners, Sectional views and sectioning convention and other common features.

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

Unit – II

Theory of Tolérances & Surface Charatersictics: Some basic définition, Tolérances including the grade and application, different types of tolerance, Fundamental Deviation, Fits and its types, basis and sélection. Basic terminology of GD&T, Tolerance characteristics and symbols Surface texture symbols & Surface lay indication.

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

Unit - III

Different Fastening Arrangement and Joints: various threads profiles bolt variety of foundation Bolts such as Hoop Bolt, Lewis Bolt, Rag Bolt, Keyed Joints, Cotter Joints, Knuckle Joints, Rigid coupling and flexible coupling.

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

Unit-IV

Assembly drawing of plumber block, Tool Post, tool holder, Tail stock, etc. Tool head and clapper box of shapper, Hand drill.

A significant part of the drawing work should be done using CAD package (e.g., Autodesk, Solid Work, Pro-E etc).

[T1,T2][No. of Hrs. 13]

Text Books:

[T1] Textbook of Machine Drawing by Er R.K. Dhawan S.Chand Publications
[T2] Machine Drawing by Basudeb Bhattacharyya OXFORD University Press

Reference Books:

[R1] Machine Drawing by N.Sideshwer, P. Kannaiaha, V.V.S. Sastry, Tata McGraw Hill Education
[R2] Machine drawing by N.D.Bhatt (Charotar Publications).
[R3] Machine drawing by P.S.Gill (S.K. Kataria & Sons)

ELECTRICAL MACHINE LAB

Paper Code: ETME-253	**L**	**T/P**	**C**
Paper : Electrical Machine Lab	**0**	**2**	**1**

List of Experiments:

Minimum 8 experiments are to be performed out of following list.

EXP: 1 To study the magnetization characteristics of a separately excited D.C generator for different speeds

EXP: 2 To study the speed control of a d.c. shunt motor using

A. Field current control method
B. Armature control method

EXP: 3 To plot torque-speed characteristics and armature current characteristics of a D.C shunt motor.

EXP: 4 To determine the external or load characteristics of a D.C. shunt generator by actually loading the machine.

EXP: 5 To study 3-point/ 4-point starter for D.C. shunt motor.

EXP: 6

A. To perform no load and short circuit test on a three-phase synchronous generator.
B. Measure the resistance of the stator windings
C. Find the voltage regulation at full load at (i) Unity power factor (ii) 0.85 power factor leading (iii) 0.85 power factor lagging by synchronous impendence method.

EXP: 7 To study the effect of variation of field current upon the stator current and power factor of a synchronous motor running at no load and half load, hence draw V and inverted V curves of the motor.

EXP: 8 To Perform no load and blocked rotor test on three-phase induction motor and draw its equivalent circuit.

EXP: 9 To perform load test on 3-phase induction motor and compute torque, output power, efficiency, input power factor and slip for various load settings. Plot the relevant graphs.

EXP: 10 Perform no load and blocked rotor test on single-phase induction motor.

Reference Books:

R1. Laboratory Operations for Rotating Electric Machinery and Transformer Technology, Donald V. Richardson, Prentice Hall, 1980

R2. Electric Machinery Experiments: Laboratory Practices and Simulation Studies, Sailendra Nath Bhadra, Alpha Science International Ltd, 2013

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

NUMERICAL ANALYSIS & STATISTICAL TECHNIQUES

Paper Code: ETMA-202	**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 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

Reference 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.

FLUID SYSTEMS

Paper Code: ETAT-204	**L**	**T/P**	**C**
Paper: Fluid 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: To introduce the student about Hydraulic Turbines, Reaction Turbines, Centrifugal Pumps and Hydraulic and pneumatic circuits.

UNIT - I

Introduction: Introduction and classification of fluid machineries; Introduction to hydrodynamic thrust of jet on a fixed and moving surface (flat & curve), jet propulsion.

Hydraulic Turbines: Classification of turbines, Impulse turbines, Constructional details, Velocity triangles, Power and efficiency calculations, Governing of Pelton wheel

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

UNIT – II

Reaction Turbines: Francis and Kaplan turbines, Constructional details, Velocity triangles, Power and efficiency calculations, Degree of reaction, Draft tube, Cavitations in turbines, Performance characteristics, Principles of similarity, Unit and specific speed, selection of turbines hydroelectric plants.

Centrifugal Pumps: Classifications and utility of various type pumps, introduction to **centrifugal Pumps,** Vector diagram, Work done by impellor, Efficiencies of centrifugal pumps, Specific speed, Model testing, Cavitations & separation and their control, Performance characteristics.

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

UNIT – III

Hydraulic Power and its Transmission: Transmission of hydraulic power through pipe lines; water hammer; precautions against water hammer in turbine and pump installations.

Power Hydraulics: Introduction to Positive pumps (gear, vane, screw, variable delivery pumps), Different types of Valves (flow control, pressure control, direction control, solenoid operated valve)

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

UNIT – IV

Hydraulic systems: Function, construction and operation of Hydraulic accumulator, hydraulic intensifier, hydraulic crane, hydraulic lift and hydraulic press, Fluid coupling and torque converter, Hydraulic ram

Hydraulic and Pneumatic Circuits: Basic principles, comparison of pneumatic and hydraulic Systems, hydraulic circuits, (meter-in, meter-out, bleed-off).

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

Text Books:

[T1] Dr. R.K. Bansal, "Fluid Mechanics & Hydraulic Machines", Laxmi Publications (P) Ltd., 2002.
[T2] Jagadish Lal, "Fluid machines Including Fluid mechanics", Metropolitan Book Co., New Delhi, 1995.

Reference Books:

[R1] Dr. D.S. Kumar, "Fluid Mechanics & Fluid Power Engineering", S.K. Kataria & Sons,2001
[R2] Kumar, K.L, "Engineering Fluid Mechanics", Eurasia Publishing House, New Delhi, 1995.
[R3] P.N Modi and S.M Seth, "Hydraulics and Fluid Mechanics", Standard Book House
[R4] S.K Agrawal, "Fluid mechanics and machinery", Tata McGraw hill
[R5] D.R. Malhotra & N.K. Malhotra, "The Fluid Mech. & Hydraulics", Satya Prakashan, 2001
[R6] Streeter & Wylie, "Fluid Mechanics", McGraw-Hill

THEORY OF MACHINES

	L	T/P	C
Paper Code: ETAT-202			
Paper: Theory of Machines	**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.

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. 11]

UNIT –II

Cams: Classification, Cams with uniform acceleration and retardation, SHM, Cylcloidal 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, based-excited vibrations, transmissibility ratio.

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

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.

MANUFACTURING MACHINES

Paper Code: ETME-206	**L**	**T/P**	**C**
Paper: Manufacturing Machines	**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 manufacturing processes using machine tools in use today and it's application in different type of Industries.

UNIT - I

Introduction: Classification of machine tools based on application and production rate: General purpose and Special purpose machines, Classification based on-types of machine tools and the processes, Generating and forming.

Elements of metal cutting processes: Elements of tool geometry, cutting tool materials and applications.

Lathe: Various types of lathe: Centre lathe, facing lathe, gap-bed lathe, capstan and turret lathe, NC, CNC and DNC lathe, major difference between CNC lathe and conventional lathe. Major sub-assemblies of a lathe: Bed, headstock, tail stock, carriage consisting of saddle, cross-slide, compound slide, tool post and apron. Work holding devices: self centering three jaw chuck, independent four jaw chuck, collets, face plates, dog carriers, centers and mandrels, Rest(Steady and Moving).

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

UNIT - II

Lathe Contd..: Driving mechanisms, apron mechanism, thread cutting mechanism and calculations, features of half-nut engagement – disengagement, indexing dial mechanism. Operations on lathe: taper turning, related calculations, thread cutting, facing, under-cutting, drilling, boring, parting-off, knurling, chamfering.

Reciprocating Type Machine Tools: Shaper, Planer and Slotter: Constructional features, basic machines and kinematics and related calculations.

[T1][No. of Hrs: 10]

UNIT III:

Drilling Machines: Constructional features of bench drilling machine, radial drilling machine, multi-spindle drilling machine, feed mechanism, work holding devices, Tool – holding devices. Different drilling operations: Drilling, reaming, counter boring and countersinking etc. estimation of drilling time.

Milling Machines: Types of general purpose milling machines: horizontal, vertical, universal and their principal parts. Types of milling cutters and their applications, different milling operations, work-holding devices: vice, clamps, chucks, dividing head and its use, simple, compound and differential indexing. Indexing calculations and machining time calculations. Introduction to machining centers.

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

UNIT IV:

Grinding Machines: Different types of grinding machines: cylindrical, surface and centre-less grinding machines, basic constructional features and mechanisms, specifications, different grinding operations, honing, lapping and super-finishing processes.

Gear Manufacturing Machines: Gear forming, gear generation, gear shaping and gear hobbing.

[T1][No. of Hrs: 10]

Text Books:

[T1] B.S. Raghuwanshi, "Workshop Technology", Vol.2, Dhanpat Rai & Sons, 2003.
[T2] S.F. Krar Stevan F. and Check A.F., "Technology of M/C Tools", McGraw Hill Book Co., 1986
[T3] Hazra Chandhari S.K., "Elements of Workshop Technology", Vol.2, Media Promoters, 2003.

Reference Books:

[R1] P.C. Sharma, "A Text Book of Production Engineering", S. Chand, New Delhi, 2004.
[R2] Bawa H.S., "Workshop Technology", Vol.2, Tata McGraw Hill, 2004.
[R3] Juneja & Shekhon, "Fundamental of Metal Cutting", New Age Publications
[R4] Kibbe Richard et al, "M/c Tool practices", Prentice Hall India, 2003.
[R5] Gerling Heinrich, "All about Machine Tools", New Age Publication, 2003

MEASUREMENTS AND INSTRUMENTATION

Paper Code: ETME-208	**L**	**T/P**	**C**
Paper: Measurements and Instrumentation	**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 about operational characteristics and applications of various sensors and transducers.

UNIT I

Introduction of Measurement:

Block diagram and components of measuring instrumentation system, classifications of instruments, static and dynamic characteristic of instruments. Errors in measurements: gross errors, systematic errors. Calibration of instruments: process of calibration, standard of calibration and classification of standard.

Different Sensors:

Introduction sensing element used in temperature, pressure, force, torque and flow measurement. Transducers: Introduction and classification.

[T1][No of Hrs.12]

UNIT-II

Transducers: Constructional features, working principle and applications of resistive**,** Inductive, Capacitive, Photoelectric, magnetostrictive, Ionization, piezoelectric, halleffect, Thermoelectric and digital transducers.

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

UNIT-III

Measurement of Pressure: Classification of pressure measuring devices, high pressure and low pressure measurement, Vacuum pressure measurement.

Measurement of Flow: Method of flow measurement, obstruction meters, electromagnetic flow meters, hot wire anemometer, ultrasonic flow meter.

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

UNIT-IV

Measurement of Temperature: Thermometer, thermocouples, thermisters, resistance thermometers and pyrometers.

Strain Gauges and Related Measurement: Electric resistance strain gauge, semiconductor strain gauge, temperature problems and compensation, applications of strain gauges in measurement, Measurement of Force, Displacement, Rotating speed, torque, Level ,Humidity and Moisture.

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

Text Books:

[T1] D. V. S. Murty, "Transducers and Instrumentation", PHI Learning Pvt. Ltd

[T2] A. K. Shawney, "Electrical & Electronic Measurement & Instruments", Dhanpat Rai & Sons Publications, 2000

Reference Book:

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

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

[R3] D. Patranabis, "Sensors and Transducers", PHI Learning Pvt. Ltd., 2nd edition

SWITCHING THEORY AND LOGIC DESIGN

Paper Code: ETEC-202	**L**	**T/P**	**C**
Paper: Switching Theory and Logic Design	**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 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 AND STATISTICAL TECHNIQUES LAB

Paper Code: ETMA-252	**L**	**T/P**	**C**
Paper: Numerical Analysis and Statistical Techniques Lab	**0**	**2**	**1**

List of Experiments:-

1. Solution of algebraic and transcendental equation.
2. Algebra of matrices: Addition, multiplication, transpose etc.
3. Inverse of a system of linear equations using Gauss-Jordan method.
4. Numerical Integration.
5. Solution of ordinary differential equations using Runge-Kutta Method.
6. Solution of Initial value problem.
7. Calculation of eigen values and eigen vectors of a matrix.
8. Plotting of Unit step function and square wave function.

It is expected that atleast 12 experiments be performed, including the above specified 8 experiments which are compulsory. The remaining experiments may be developed by faculty and students based on applications of Mathematics in Real Life problem.

Text Books:

[T1] B.S. Grewal., "Numerical Methods in Engg. And Science", Khanna Publications
[T2] P. Dechaumphai & N. Wansophark, "Numerical Methods in Engg.: Theories with Matlab, Fortran, C & Pascal Programs", Narosa Publications

Reference Books:

[R1] P.B. Patil & U.P. Verma, "Numerical Computational Methods", Narosa Publications
[R2] John C. Polking & David Arnold, "Ordinary Differential Equations using MATLAB", Pearson Publications
[R3] Rudra Pratap, "Getting Started With MatLab" Oxford University Press
[R4] Byrom Gottfried, "Programming With C" Shaum's Outline
[R5] Santosh Kumar, "Computer based Numerical & Statistical Techniques", S. Chand Publications.

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

FLUID SYSTEMS LAB

	L	T/P	C
Paper Code: ETAT-254			
Paper: Fluid Systems Lab	**0**	**2**	**1**

Fluid Systems Lab experiments based on syllabus (ETAT-204).

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

THEORY OF MACHINES LAB

Paper Code: ETAT-252	**L**	**T/P**	**C**
Paper: Theory of Machines 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 undamped 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.

MANUFACTURING MACHINES LAB

Paper Code: ETME-256	**L**	**T/P**	**C**
Paper: Manufacturing Machines Lab	**0**	**2**	**1**

Manufacturing Machines Lab experiments based on syllabus (ETME-206).

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

SWITCHING THEORY AND LOGIC DESIGN LAB

	L	T/P	C
Paper Code: ETEC-252			
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-Save 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.

MANAGEMENT OF MANUFACTURING SYSTEMS

Paper Code: ETME-301	**L**	**T/P**	**C**
Paper: Management of Manufacturing Systems	**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 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.

METAL CUTTING & TOOL DESIGN

Paper Code: ETAT-303	**L**	**T/P**	**C**
Paper: Metal Cutting & Tool Design	**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 theories in metal cutting technology and design aspects of Jigs fixtures and tooling in use today and its application in different type of Industries.

UNIT - I

Introduction: Definition of feed, depth of cut and cutting speed. Concept of specific cutting energy in metal cutting and Numerical based on calculation of machining time on lathe, drilling machine, shaper, milling machine and grinding machines considering specific cutting energy of materials.

Theory of Metal Cutting: Orthogonal and oblique cutting, tool geometry (ASA & ISO), types of chips, Factors affecting the chip formation, Cutting forces in orthogonal cutting and their measurement, Merchant circle and derivation of relationships between the cutting forces, chip thickness ratio, shear angle, stress and strain in the chip, work done and power required in metal cutting and 'size effect', apparent mean shear strength of work material.

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

UNIT - II

Ernst Merchant Theory: Ernst Merchant Theory, its assumptions and modifications. Relationship between cutting velocity, shear velocity and chip flow velocity. Mechanism of friction at chip-tool interface. Numericals based on metal-cutting. Lee & Shafer Theory – slip line method, determination of shear angle by Mohrs circle.

Heat Generation in Metal Cutting: Heat generation and temperature distribution in metal cutting. Calculation of temperature in primary and secondary deformation zones and their measuring methods.

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

UNIT - III

Machinability: Machinability and its criteria, forms of tool-wear in metal cutting, tool-life and its criteria, effect of different cutting parameters on tool-life. Economics of machining and numericals. Cutting fluids, their physical action and applications.

Grinding: Specifications of grinding wheel, Mechanics of grinding, effect of grinding conditions and type of grinding on wheel behaviour, equivalent diameter of grinding wheel.

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

UNIT - IV

Cutting Tool Design: General considerations, study of angle for single point cutting and drill. Principles of different cutting tool materials and their important characteristics. Geometry of a drill. Basic principles of design of a single point and multiple point tools i.e broaches and twist drill.

Jigs & Fixtures: Important considerations in jigs and fixture design. Main principles of designing of jigs & fixtures, elements of Jigs and fixtures. Different devices and methods of locations. Different types of clamps used in jigs & fixtures.

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

Text Books:

[T1] B.L. Juneja, G. S. Sekhon, Nitin Seth" Fundamental of Metal Cutting and Machine Tools", New Age International 2nd edition,

[T2] P. H. Joshi" Jigs and Fixtures", 2nd Edition TMH

[T3] G.K. Lal "Introduction to Machining Science", New age International.

Reference Books:

[R1] Geoffrey Boothroyd, "Fundamentals of Metal Machining & Machine Tools", TMH

[R2] P.N. Rao, "Manufacturing Technology", Tata McGraw Hill Publication Ltd.

[R3] B.J. Ranganath, "Metal Cutting & Tool Design" Vikas Publishing House Pvt. Ltd

[R4] A.B. Chattopadhyay "Machining and Machine Tools" Wiley India

HEAT TRANSFER & I. C. ENGINES

Paper Code: ETAT–305	L	T/P	C
Paper: Heat Transfer & I. C. Engines	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 this paper is to introduce the students about the knowledge of conduction, thermal radiation and I.C. Engines.

UNIT – I

Conduction: Introduction to Heat Transfer, One dimensional steady state conduction. Simple cases of conduction through, homogenous and composite plane walls, cylinders and spheres. Overall Heat transfer Coefficient, Heat transfer through cylindrical & Spherical surfaces, Critical thickness of insulation. Heat transfer from Fins of uniform cross section. Transient heat conduction.

Radiation: Concept of Thermal radiations, Type of bodies. Kirchoffs law. Planck's distribution law. Wein's displacement law. Stenfan-Boltzmann's relation. Configuration factor. Radiant heat exchange between black and grey surfaces. Radiation shielding.

[T1, T2, T3][No. of Hrs.11]

UNIT - II

Convection and Heat Exchanger – Concept of Hydrodynamic and Thermal boundary layers. Application of Dimensional analysis to Free and Forced convection. Important Dimensions- less numbers. Types of Heat exchangers, LMTD and NTU methods of heat exchangers Design and analysis

Heat transfer during Change of Phase: Film condensation and Drop wise condensation. Flow regimes. Boiling: Classification. Boiling regimes. Heat transfer correlations in boiling.

[T1, T2, T3][No. of Hrs.11]

UNIT – III

I.C. Engines: Working of Two stroke and Four stroke SI and CI Engines. Valve Timing Diagram, Actual indicator diagrams. Carburetor, Fuel Injection system for SI and CI Engine. Supercharging and Turbo charging.

Combustion in S.I. and C.I. Engines: Normal & Abnormal Combustion. Pre-ignition. Detonation. Knocking. Emissions from SI and CI Engines, Rating of Fuels.

[T1, T2, T3][No. of Hrs. 11]

UNIT – IV

Modern Automotive Engines*:* Changes in fuel injection methods in S. I. and C. I. engines. A brief review of Design changes to achieve high efficiency.

Performance parameters for IC Engines: BHP, IHP, FHP, Mechanical efficiency, Brake mean effective pressure and indicative mean effective pressure, Torque, Volumetric efficiency, Specific fuel consumption (BSFC, ISFC), Thermal efficiency, Heat balance, Basic engine measurements, Fuel and air consumption,

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

Text Books: Heat Transfer

[T1] R. C. Sachdeva, "Heat Transfers" McGraw Hill,
[T2] Incropera, Dewitt, "Fundamentals of Heat and Mass Transfer"
[T3] P. K. Nag "Heat and Mass Transfer" 3rd Ed McGraw Hill

Reference Books: Heat Transfer

[R1] Holman, J.P., "Heat Transfer", Tata McGraw Hill Book Company.
[R2] Kothandaraman C.P., "Fundamentals of Heat and Mass Transfer", New Age International Publisher.
[R3] Domkundwar S., Arora S.C., Domkundwar AnandV., "A course in Heat and Mass Transfer", Dhanpat Rai & Company.
[R4] Rathore Mahesh M., "Engineering Heat and Mass Transfer" University Science Press.

Text Books: I. C. Engines

[T1] Ganesan V., " Internal Combustion Engines", Tata Mcgraw-Hill
[T2] Mathur M.L and R.P. Sharma, "A Course in Internal Combustion Engines", Dhanpat Rai & sons

Reference Books:

[R1] K. K. Ramalingam, "Internal Combustion Engines" 2nd ed, SCITECH Publications
[R2] Ballaney P. L., "Internal Combustion Engines", Khanna Publications
[R3] John B Heywood," Internal Combustion Engine Fundamentals", Tata McGraw-Hill.
[R4] Domkundwar "A course in Internal Combustion Engines". Dhanpat Rai & Co.

METROLOGY

Paper Code: ETAT-307	**L**	**T/P**	**C**
Paper: Metrology	**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 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, application of Least Square principles, 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: Various definitions, IS919-1963, 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, Numericals.

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

UNIT - II

Comparators: Mechanical Comparators: Johanson Mikrokator and Sigma Mechanical Comparator. Mechanical-optical comparator. Principles of Electrical and electronic comparators. Pneumatic comparators – advantages, systems of Pneumatic gauging:- Flow type and back pressure type, Principle of working of back pressure gauges, different type of sensitivities and overall magnification, Solex Pneumatic gauges and differential comparators. Numericals based on pneumatic comparators.

Angular Measurement: Sine Bar – different types of sine bars, use of sine bars in conjunction with slip gauges, precautions and calibration of sine bars. Use of angle gauges, spirit level, errors in use of sine bars. Numericals. Circular Division: dividing head and circular tables, circular division by precision Polygons. Caliper Principle, Calibration of polygons. Numerical based on circular division.

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

UNIT - III

Straightness and Flatness: Definition of Straightness and Flatness error. Numericals based on determination of straightness error of straight edge with the help of spirit level and auto collimator. Numericals based on determination of flatness error of a surface plate with the help of spirit level or auto collimator. Surface texture, different types of irregularities, standard measures for assessment and measurement of surface finish.

Screw Thread Measurement: Errors in threads, Measurement of elements of screw threads –major dia, minor dia, pitch, flank angle and effective diameter (Two and three wire methods). Effect of errors in pitch and flank angles and its mathematical derivation. Numericals.

Gear Measurement: Measurement of tooth thickness – Gear tooth vernier caliper, Constant chord method, base tangent method and derivation of mathematical formulae for each method. Test plug method for checking pitch diameter and tooth spacing. Measurement of Gear Pitch, Parkinson Gear Tester, Numericals.

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

UNIT - IV

Machine Tool Alignment: Machine tool tests and alignment tests on lathe. Alignment tests on milling machine. Alignment tests on a radial drilling machine.

Interferometry: Principle of measurement, Interferometry applied to flatness testing, surface contour tests, optical flats, testing of parallelism of a surface with the help of optical flat. Quantitative estimate of error in parallelism, Flatness Interferometer NPL-Gauge length interferometer for checking the error in slip gauges. Numericals based on Interferometry.

Introduction to Seismic Transducers - Displacement and acceleration measurement, Pressure measurement - Bourdon pressure gauge, bulk modulus gauge, pirani gauge.

[T1,T2][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

Reference Books:

[R1] F.W. Galyer & C.R. Shotbolt, "Metrology for Engineers", ELBS edition\
[R2] Beckwith, Buck, Lienhard, *Mechanical Measurements,* Pearson Education\
[R3] Anand K Bewoor, Vinay A Kulkarni " Metrology and Measurement",TMH

CONTROL SYSTEMS

Paper Code: ETEL-307	**L**	**T/P**	**C**
Paper: Control 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**: 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

COMMUNICATION SKILLS FOR PROFESSIONALS

Paper Code: ETHS-301	**L**	**T/P**	**C**
Paper: Communication Skills for Professionals	**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.

METAL CUTTING & TOOL DESIGN LAB

Paper Code: ETAT-351	**L**	**T/P**	**C**
Paper: Metal Cutting & Tool Design Lab	**0**	**2**	**1**

List of Experiments:

1. Designing a single point cutting tool using tool grinder.
2. Measurement and analysis of cutting forces in orthogonal turning for different materials at different speeds.
3. Measurement and analysis of cutting forces in orthogonal turning for different materials at different feed and depth of cut.
4. Flank wear – time characteristics for single point cutting tools for different materials at different speeds.
5. Flank wear – time characteristics for single point cutting tools for different materials at different feed and depth of cut.
6. A study of chips formed at different speed, feed, depth of cut, for different materials.
7. (i) Checking the level of installation of a lathe in horizontal & vertical planes.
   (ii) Checking the bed ways for straightness and parallelism.
8. Testing the main spindle of a lathe for axial movement and true running.
   a. Process capability determination of a center lathe.
   b. Flatness checking of a surface plate.
9. A study of gear indexing mechanism and using it to cut a gear
10. Find temperature at tool chip interface.
11 Efficiency testing of lathe at various parameters-values.
12. Accuracy analysis of finished cylindrical work-pieces produced on a lathe.

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

HEAT TRANSFER & I.C. ENGINES LAB

Paper Code: ETAT-353	**L**	**T/P**	**C**
Paper: Heat Transfer & I.C. Engines Lab	**0**	**2**	**1**

List of Experiments: Heat Transfer

1. To determine thermal conductivity of a conducting material.
2. To determine thermal conductivity of an insulating powder.
3. To determine overall heat transfer coefficient and the temperature distribution across the width of a composite wall.
4. To determine the surface heat transfer coefficient for a heated vertical cylinder in natural convection.
5. To determine the heat transfer coefficient in forced convection of air in a tube.
6. To determine temperature distribution, efficiency and effectiveness of a pin fin.
7. To determine Stefan-Boltzman constant of radiation heat transfer.
8. To determine emissivity of a metallic plate.
9. To study boiling heat transfer phenomenon for pool boiling.
10. To study and compare the heat transfer rate, LMTD, overall heat transfer coefficient and effectiveness of a heat exchanger working in a parallel flow/counter flow mode.
11. To determine the overall heat transfer coefficient of a horizontal condenser.
12. To compare the performance characteristics of a heat pipe with two other geometrically similar pipis of copper and stainless steel.

Reference: R. C. Sachdeva, "Heat Transfers", McGraw Hill,

List of Experiments: I C Engines

1. Valve timing Diagram
2. Study of Petrol Engine parts and circuits
3. Study of Diesel Engine parts and circuits
4. Thermal Efficiency of single cylinder Petrol Engine
5. Thermal Efficiency of single cylinder Petrol Engine
6. Thermal Efficiency of single cylinder Diesel Engine
7. Heat Balance of any engine
8. Morse test

NOTE:- At least 8 Experiments out of the list of Heat Transfer & I.C. Engines Lab must be done in the semester.

METROLOGY LAB

Paper Code: ETAT-355	**L**	**T/P**	**C**
Paper: Metrology 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.

CONTROL SYSTEMS LAB

	L	T/P	C
Paper Code: ETEL-355			
Paper: Control Systems Lab	**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 2^{nd} 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 2^{nd} 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.

COMMUNICATION SKILLS FOR PROFESSIONALS LAB

Paper Code: ETHS-351	**L**	**T/P**	**C**
Paper: Communication Skills for Professionals Lab	**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.

MACHINE DESIGN

Paper Code: ETAT-302	**L**	**T/P**	**C**
Paper: Machine Design	**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

AUTOMOBILE ENGINEERING

Paper Code: ETAT-304	**L**	**T/P**	**C**
Paper: Automobile Engineering	**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 wheel and 4 wheel 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

DATA COMMUNICATION & NETWORKS

Paper Code: ETEC-310	**L**	**T/P**	**C**
Paper: Data Communication & Network s	**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.

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

OPERATIONS RESEARCH

Paper Code: ETAT-306	**L**	**T/P**	**C**
Paper: Operations Research	**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 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.

REFRIGERATION & AIR CONDITIONING

Paper Code: ETME-308	**L**	**T/P**	**C**
Paper: Refrigeration & Air Conditioning	**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 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 NH_3-H_2O & LiBr-H_2O. 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

MICROPROCESSORS AND MICROCONTROLLERS

Paper Code: ETEE-310	**L**	**T/P**	**C**
Paper: Microprocessors and Microcontrollers	**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] Vaneet Singh, Gurmeet Singh, "Microprocessor and Interfacing", Satya Prakashan, 2007.

MACHINE DESIGN LAB

	L	T/P	C
Paper Code: ETAT-352			
Paper: Machine Design Lab	**0**	**2**	**1**

List of Experiments:

The Practicals will involve design of all the elements of the following systems

1. Design of cotter joint
2. Knuckle joint
3. Pipe Joint
4. Screw jack/ Toggle screw jack
5. Rigid and Flexible coupling
6. Spur Gear train
7. Ball & Roller Bearings

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

AUTOMOBILE ENGINEERING LAB

	L	T/P	C
Paper Code: ETAT-354			
Paper: Automobile Engineering Lab	**0**	**2**	**1**

Automobile Engineering Lab experiments based on syllabus (ETAT-304).

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

DATA COMMUNICATION & NETWORKS LAB

Paper Code: ETEC-358	**L**	**T/P**	**C**
Paper: Data Communication & Networks Lab	**0**	**2**	**1**

List of Experiments:

1. PC to PC Communication
2. Parallel Communication using 8 bit parallel cable & Serial communication using RS 232C
3. Ethernet LAN protocol
4. To create scenario and study the performance of CSMA/CD protocol through Simulation
5. To create scenario and study the performance of token bus and token ring protocols through simulation
6. To create scenario and study the performance of network with CSMA / CA protocol and compare with
7. CSMA/CD protocols.
8. Implementation and study of stop and wait protocol
9. Implementation and study of Go back-N and selective repeat protocols
10. Implementation of distance vector routing algorithm
11. Implementation of Link state routing algorithm.

***All Practical can be conducted using C-Language and LAN Emulator.**

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

REFRIGERATION AND AIR CONDITIONING LAB

	L	T/P	C
Paper Code: ETME-358			
Paper: Refrigeration and Air Conditioning Lab	**0**	**2**	**1**

List of Experiments:

1. Test on Vapour compression Test Rig.
2. Test on ice plant test rig.
3. Test on air conditioning test rig.
4. Trial on vapour absorption refrigeration system.
5. Study of installation/operation/maintenance practices for refrigeration systems.
6. Determination of refrigeration load in cold storage (case study/visit).
7. Visit to any refrigeration or air conditioning plant.
8. Thermal analysis of any refrigeration or air-conditioning cycle.

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

MICROPROCESSORS AND MICROCONTROLLERS LAB

Paper Code: ETEE-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	**L**	**T/P**	**C**
Paper: Computer Aided Design	**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.

COMPUTER INTEGRATED MANUFACTURING

Paper Code: ETME-403	**L**	**T/P**	**C**
Paper: Computer Integrated Manufacturing	**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.

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

MECHATRONICS

Paper Code: ETAT-403	**L**	**T/P**	**C**
Paper: Mechatronics	**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

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, air compressors and treatment, Cylinders, Direction Control Valves, Process control valves, Rotary Actuators, Accumulators, Amplifiers, and Pneumatic Sequencing Problems.

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

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.

Digital Electronics and systems:

Number Systems, Binary Mathematics, Boolean Algebra, Gates and Integrated Circuits Like 7408, 7402, Karnaugh Maps, Application of Logic Gates as: Parity Generators, Digital Comparators, BCD to Decimal Decoders, Flip Flops and applications, sequential logic, Microprocessor and microcontrollers, programming, instruction set, assembly language, C programming for Intel 8051 / 8082 micro-controller.

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

UNIT - III

Sensors, transducers and application: Performance Terminology, Static and Dynamic Characteristics, Displacement, Position and Proximity Sensors, Potentiometer Sensors, Strain Gauge Element, LVDT, Optical Encoders, Pneumatic Sensors, Hall Effect Sensors, Tachogenerators, Strain Gauge Load Cell, Thermostats, Photo Darlington. Interfacing Sensors in Mechatronic System.

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.

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,

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

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: 11]

Text Book:

[T1] W. Bolton, "Mechatronics – Electronic control systems in Mechanical & Electrical Engineering", Pearson Education Ltd., 2003.

[T2] K. P. Ramachandran, G.K. Vijayaraghavan, M.S. Balasundaram, Mechatronics - Integrated Mechanical Electronic Systems, Wiley;

Reference Books:

[R1] Joji P, Pneumatic Controls, Wiley.

[R2] Dan Necsulescu, Mechatronics, Pearson

[R3] David g Alciatore, Michael B Histand, "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.

OPTIMIZATION TECHNIQUES

Paper Code: ETME-407	**L**	**T/P**	**C**
Paper: 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 12.5 marks

Objectives: The objective of this course is to teach the students about the linear programming PERT and CPM and other numerical methods to solve various engineering problems.

UNIT- I

Linear Programming: Mathematical Preliminaries, Formulation of the problem and solution by Graphical Method, The Simplex Method, The Big M Method.

[T1][No. of Hrs: 10]

UNIT- II:

Linear Programming: Dual problem formulation and solution, Primal and Dual Simplex Method.

[T1][No. of Hrs: 10]

UNIT-III:

Transportation problems & solutions, Assignment problems and its solutions by Hungarian Method.

[T1][No. of Hrs: 10]

UNIT- IV:

PERT and CPM, Arrow network, Time estimates, Earliest expected time, Latest allowable occurrence time, Calculation of CPM network, Floats for activities, Critical path.

[T1][No. of Hrs: 10]

Text Books:

[T1] Kanti Swarup, P.K. Gupta and Man Mohan: Operations Research, Sultan Chand and Sons.

References Books:

[R1] G. Hadley, "Linear Programming", Narosa Publications.
[R2] Taha H. A. "Operation Research An Introduction" Mc Milan Publishing Company, NY.
[R3] Miller and Lieberman G. J., "Introductions of Operational Resource" Holden Day, NY.
[R4] Kambo N. S., "Mathematical Programming Techniques", McGraw Hill.

PREVENTIVE MAINTENANCE & CONDITION MONITORING

Paper Code: ETME-409	**L**	**T/P**	**C**
Paper: Preventive Maintenance & Condition Monitoring	**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 techniques being adopted in industry for quality control.

UNIT- I

Maintenance Policies and Preventive Maintenance: Maintenance, Scope of Responsibilities, Types of maintenance, Maintenance planning & control, Maintainability & Availability, Failure modes and the Bath Tub Curve. Preventive maintenance, Maintenance schedules: Repair cycle, Principles and methods of lubrication, Fault Tree Analysis, Total Productive Maintenance: Methodology and Implementation.

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

UNIT- II

Principles And Practices Of Maintenance Planning: Basic Principles of maintenance planning – Objectives and principles of planned maintenance activity – Importance and benefits of sound Maintenance systems – Reliability and machine availability, Equipment Life cycle, Measures for Maintenance Performance: Equipments breakdowns, Mean Time Between Failures, Mean Time To Repair, Factors of availability, Maintenance organization, Maintenance economics.

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

UNIT- III

Condition Monitoring: Condition Monitoring: Cost comparison with and without Condition Monitoring, Onload testing and off load. Methods and instruments for Condition Monitoring, Temperature sensitive tapes, Pistol thermometers, wear-debris analysis, noise vibration and harshness analysis of machines.

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

UNIT-IV

Repair methods for basic machine elements & equipment:

Repair methods for beds, slide-ways, spindles, gears, lead screws and bearings – Failure analysis – Failures and their development – Logical fault location methods – Sequential fault location. Repair methods for Material handling equipment - Equipment records –Job order systems -Use of computers in maintenance.

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

Text Books:

[T1] Srivastava, S.K., "Industrial Maintenance Management", S. Chand and Co.
[T2] Bhattacharya, S.N., "Installation, Servicing and Maintenance", S. Chand and Co.

Reference Books:

[R1] White, E.N., "Maintenance Planning", Documentation, Gower Press
[R2] Garg, M.R., "Industrial Maintenance", S. Chand and Co.
[R3] Higgins, L.R., "Maintenance Engineering Hand book", 5th Edition, McGraw Hill
[R4] Armstrong, "Condition Monitoring", BSIRSA
[R5] Davies, "Handbook of Condition Monitoring", Chapman and Hall

COMPUTATIONAL FLUID DYNAMICS

Paper Code: ETME-411	**L**	**T/P**	**C**
Paper: Computational Fluid Dynamics	**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 about the applications of Heat Conduction, Convection Heat Transfer and governing differential equations and finite difference method and applications of computational Fluid Dynamics with computer graphics in CFD.

UNIT - I

Governing Differential Equations and Finite Difference Method- Classification of PDEs, Initial and Boundary conditions, Initial and Boundary value problems, Finite difference method Central, Forward, Backward difference for a uniform grid, Central difference expressions for a non-uniform grid, Numerical error, Accuracy of solution, Grid independence test.

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

UNIT – II

Conduction Heat Transfer- Applications of Heat conduction- Steady and Unsteady conductions, One dimensional steady state problems, Two dimensional steady state problems, Three dimensional steady state problems, Transient one dimensional problems,

Convection Heat Transfer- Introduction- Steady one dimensional Convection, Diffusion, Unsteady one. Dimensional Convection – Diffusion – Unsteady two dimensional, Convection, Diffusion.

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

UNIT – III

Incompressible Fluid Flow, Introduction- Governing equations, Difficulties in solving, Navier- Stokes equation, Stream function, Vorticity method, In viscid flow (steady) Determination of pressure for viscous flow.

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

UNIT – IV

Applications of Computational Fluid Dynamics, Computer graphics in CFD, Future of CFD, Enhancing the design process, understanding, Applications, Automobile, Engine, Industrial, Civil, Environmental.

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

Text Books:

[T1] Muralidhar, K., and Sundararajan, T., "Computational Fluid flow and Heat Transfer", Narosa Publishing House,

[T2] Ghoshdasdidar, P.S., "Computer simulation of flow and heat transfer", Tata McGraw – Hill, New Delhi

Reference Books:

[R1] Anderson, D. A., Tannehill, J. L, and Pletcher, R.H., "Computational fluid mechanics and Heat Transfer", Hemisphere Publishing Corporation,

[R2] John David Anderson, "Computational Fluid Dynamics: The Basics with Applications", McGraw Hill, New York

FINITE ELEMENT METHODS

Paper Code: ETME-423	**L**	**T/P**	**C**
Paper: Finite Element Methods	**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.

RENEWABLE ENERGY RESOURCES

Paper Code: ETEE-419	**L**	**T/P**	**C**
Paper: Renewable Energy Resources	**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, phyrolysis, 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 stead-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

ARTIFICIAL INTELLIGENCE

Paper Code: ETCS-429	**L**	**T/P**	**C**
Paper: Artificial Intelligence	**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

DATABASE MANAGEMENT SYSTEMS

Paper Code: ETCS-425	**L**	**T/P**	**C**
Paper: Database Management Systems	**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.

ADVANCED MATERIAL SCIENCE AND METALLURGY

Paper Code: ETME-417	**L**	**T/P**	**C**
Paper: Advanced Material Science and Metallurgy	**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 advanced materials in use today and it's application in different type of Industries.

UNIT - I

Ultra light Materials and Metallic Foams -Material Definition and Processing Characterization of cellular metals Material properties.

[T1][No. of Hrs. 11]

UNIT - II

Bio-Materials-Classes of materials used in medicine Application of materials in medicine and dentistry various materials and coatings for implants.

[T2][No. of Hrs. 11]

UNIT - III

Composite material definition and classifications composite material properties and applications, piezoelectric ceramics, magnetostrictive materials, electro-rheological fluids.

[T3][No. of Hrs.: 10]

UNIT - IV

Coatings and High- Temperature Materials Thin Film Shape Memory Alloys for MEMS application. Introduction to Nano-engineered materials.

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

Text Books:

[T1] Handbook of Cellular metals, Production, processing, Application, Edited by Hans Peter Degischer and Brigitte Kriszt, Wiley - VCH, 2002

[T2] Biomaterials Science, An Introduction to Materials in Medicine, Edited by B.D. Ratner, A.S. Hoffman, F.J. Sckoen, and J.E.L Emons, Academic Press, second edition, 2004

[T3] Materials Science and Engineering, An Introduction, 5th Edition, William D. Callister, Jr., John Wiley & Sons, Inc., New York, 1999, with CD-ROM.

Reference Books:

[R1] Mikell P. Grover, "Fundamentals of Modern Manufacturing, Materials, Processing, and Systems", 2nd Edition, John Wiley & Sons, inc.

[R2] L.J. Gibson, and M.F. Ashby, "Cellular Solids, Structure and Properties", 2nd Edition, Cambridge University Press, 1999.

[R3] Ashby, M. F., Evans, A., Fleck, N. A., Gibson, L. J., Hutchinson, J. W., & Wadley, H. N. G., Metal Foams: A Design Guide, Butterworth-Heinmann, Massachusetts; 2000

[R4] Milton Ohring, "Materials Science of Thin Films", 2nd Edition, Academic Press, 2002.

[R5] C.T. Herakovich, "Mechanics of Fibrous Composites", John Wiley & Sons, Inc., New York, 1998.

ADVANCED CONTROL SYSTEMS

Paper Code: ETEE-403	**L**	**T/P**	**C**
Paper: Advanced Control Systems	**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: To impart knowledge of state space, discrete systems, non-linear systems and adaptive control.

UNIT – I: State Space Analysis

Introduction, state space representation of continuous LTI systems, transfer function and state variables, transfer matrix, EIGEN values and EIGEN vectors, Solution of State equations, state and output controllability and observability, canonical forms (CCF, OCF, DCF, JCF).

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

UNIT – II: Discrete System

Introduction to discrete time systems, sampling process, Z-transform and inverse Z-transforms and hold circuits, presentation by difference equation and its solution, pulse transfer function, transient and steady state responses, Dead beat response, steady state error, Representation of discrete systems in state variable form and its solution, stability of digital control system, digital equivalent of conventional controller/compensator.

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

UNIT – III: Non-Linear System

Introduction, Non-linear system behavior and different types of non-linearities, Describing function analysis, assumptions and definitions, DF of common non-linearities, Phase Plane Analysis, singular points, construction of phase portrait, phase plane analysis of linear/non-linear systems, existence of limit cycles, jump phenomenon, stability analysis:

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

UNIT – IV: Lyapunov Theory and Adaptive Control

Lyapunov direct method, positive definite functions and Lyapunov functions, existence of Lyapunov functions, Lyapunov analysis of LTI systems, variable gradient method, Krasvoskii method, performance analysis, Popov's stability criteria.

Introduction to basic approaches to adaptive control - Model reference adaptive control systems, self tuning regulators, Applications of adaptive control.

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

Text Books:

[T1] B.Ogata-State Space Analysis, Modern Control System, Pearson 4th edition, 2002
[T2] M. Gopal-Digital Control and State Variable Methods, TMH 4th Edition.

Reference Books:

[R1] J. J. Stoline, Nonlinear Control System.
[R2] Brian D.O.Adnerson & John B. Moore, Optimal Control
[R3] R.C. Sukla – Control Stystems, Dhanpat Rai & Co. (P) Ltd.
[R4] Shastri & Badson, Adaptive Control, PHI
[R5] S. Das Gupta, Control System Theory, Khanna Publications.

POWER PLANT ENGINEERING

Paper Code: ETME-405	**L**	**T/P**	**C**
Paper: Power Plant Engineering	**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 paper is to introduce the students about the knowledge of steam generator plant, fuel handling, types of nozzles and its application, about the steam turbines and other power plants.

UNIT – I

Steam Generator Plant: Fuel handling systems, Indian coals, combustion of coal in furnaces; Elementary boilers- Cochran, Babcock & Wilcox. High pressure heavy duty boilers, Super critical and once through boilers layout of evaporator, super heater, re-heater and economizer; dust collectors; ash disposal, fans and draft systems, fluidized bed combustion.

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

UNIT – II

Steam Nozzles: Application of Nozzles. Types of Nozzles. Expansion of steam through a Nozzle. Effect of friction. Critical pressure ratio. Areas at Throat & Exit for maximum discharge conditions. Performance at off-design conditions.

Steam Turbines: Classification. Impulse and Reaction Turbines. Compounding of steam turbines. Velocity diagrams. Conditions for maximum efficiency.. Losses in steam turbines. Reheat Factor.

Turbine Plant: Feed water heaters-surface and de-aerator, construction of large condensers- zoning, air cooling zone. Calculations effect of air cooling on vacuum pump rating, cooling water systems and cooling towers Feed water treatment-make up and internal conditioning. Governing of steam turbine

[T2, R1, R2] [No. of Hrs. 11]

UNIT – III

Other Power Plants: General layout of I.C. Engines and turbine power plants, types, gas turbine plants, fields of application, Nuclear power plants, power reactors and nuclear steam turbines; handling of nuclear waste and safety measures, peak load power generation methods. [**T1] [No. of Hrs. 11]**

UNIT –IV

Control: Important instruments on steam generator and turbine; drum water level control, combustion control and super heat temperature control; testing of power plants and heat balance.

Economics: Planning for power generation in India, super thermal power plants, estimation of cost of power generation; choice of plant site. [**T1, R3] [No. of Hrs. 11]**

Text Books:

[T1] Arora & Domkundwar, "A course in Power Plant Engineering", Dhanpat Rai & Sons
[T2] P.L.Balaney "Thermal Engineering", Khanna Publishers.

Reference Books:

[R1] R.K.Rajput "Thermal Engineering", Laxmi Publications (P) Ltd.
[R2] A.S Sarao "Thermal Engineering", Satya Prakshan.
[R3] Shamsher Gautam "Power Plant Engineering" Vikas Publishing House

INTRODUCTION TO DATA SCIENCE

Paper Code: ETCS-411	**L**	**T/P**	**C**
Paper: Introduction to Data Science	**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 and overview of R or Octave statistical package, data transformation and merging, data visualization and illustration of techniques through R or Octave.

UNIT- I

Overview of R or Octave statistical package, Data Pre-processing, Data Scales, Similarity and Dissimilarity measures, sampling and quantization of data, filtering, Data transformation and merging, Data visualization, PCA, Correlation, Chi-Square test. Illustration of These techniques through R, or Octave.

[T1][R2][No. of hrs. 10]

UNIT- II

Regression Analysis, linear, generalized, regularized regression, Cross-validation, Training and Testing data set, Overview of nonlinear regression, Overview of Ridge regression, Latent variables, Structure Equation modelling. Illustration of These techniques through R, or Octave.

[T1][R1][R2] [No. of hrs. 10]

UNIT- III

Forecasting, time series data analysis, Stationarity, Seasonality, recurrent models, autoregressive models. Illustration of These techniques through R, or Octave.

[T1][T2][R1][R2][No. of hrs. 10]

UNIT- IV

Classification, Linear discriminant analysis, overview of support vector machine, Decision trees, Clustering, Clustering techniques. Illustration of These techniques through R, or Octave.

[T1][T2][R1][R2][No. of hrs. 10]

Text Books:

[T1] Runkler, Thomas A. Data Analytics: Models and Algorithms for Intelligent Data Analysis, Springer, 2012.

[T2] Friedman, Jerome, Trevor Hastie, and Robert Tibshirani. The elements of statistical learning. Vol. 1. New York: Springer Series in Statistics, 2001.

References Books:

[R1] Zuur, Alain, Elena N. Ieno, and Erik Meesters. A Beginner's Guide to R. Springer, 2009.

[R2] Hansen, Jesper Schmidt. GNU Octave: Beginner's Guide: Become a Proficient Octave, User by Learning this High-level Scientific Numerical Tool from the Ground Up. Packt Publishing Ltd, 2011.

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.

ADVANCED MANUFACTURING METHODS

Paper Code: ETAT-407	**L**	**T/P**	**C**
Paper: Advanced Manufacturing Methods	**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 Non-Conventional or Modern Manufacturing Methods and it'sapplication in different type of Industries.

UNIT I

Introduction: An overview of Modern Manufacturing Methods (MMM) - Classification, their comparative study, Need of MMM.

Process Selection: Physical Parameters, Shape applications, Material applications, Process capability, Effects on equipments and Tooling, Process economy.

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

UNIT II

Ultrasonic Machining: Construction and working Principle, Elements of Process, Effect of process parameters, Applications and limitations.

Abrasive Jet Machining: Working Principle, equipment used, Variables in AJM, Advantages, Disadvantages, Application.

Water Jet Machining: Working Principle, equipment used, process parameter, Advantages, Disadvantages, Application.

Abrasive Flow Machining: Working Principle, equipment used, process parameter, Advantages, Disadvantages, Application.

Chemical Machining: Working Principle, equipment used, process parameter, Advantages, Disadvantages, Application.

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

UNIT III

Electro Chemical Machining (ECM): Principle, Elements of ECM process, Electrochemistry of ECM, selection of electrolytes and analysis of ECM, Advantages, Limitations, Applications.

Electro Chemical Grinding (ECG): Process: Working principle, equipment used, Process parameters, Advantages, Disadvantages and Applications.

Electro Chemical Honing (ECH): Process: Working principle, equipment used, Process parameters, Advantages, Disadvantages and Application.

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

UNIT IV

Laser Beam Machining: Working principle, equipments, Process parameters, Advantages, Disadvantages and Application.

Plasma Arc Machining: Working Principle, Parameters, Safety precautions, Applications.

Electron Beam Machining: Principle, beam control techniques, Process capabilities, Comparison of thermal and non-thermal processes, Advantages and limitations.

Electric Discharge Machining: Working Principle, Mechanism of metal removal, Basic EDM circuits, selection of tool material and dielectrics, Flushing, Advantages, Disadvantages and Applications.

Wire Cut EDM: Working principle, process parameter, equipments, characteristics of machining process, applications, Ion Beam Machining (IBM): Working principle, equipment used, Process parameters, Advantages, Disadvantages and Application.

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

Text Books:

[T1] P.C. Pandey & H.S. Shan, "Modern Machining Process", Tata McGraw Hills, 2006.

[T2] Amitabh Gosh and A.K. Mallik, "Manufacturing Science", Affiliated East-West Press Pvt. Ltd., 1985.

Reference books:

[R1] Vijay K Jain, "Advance Machining Processes", Allied Publishers Pvt. Ltd., New Delhi, 2002.

[R2] P K Mishra, "Nonconventional Machining", Narosa Publication, 1997.

[R3] McGeough, "Advanced Methods of Machining", Chapman and Hall, London, 1998.

SOCIOLOGY AND ELEMENTS OF INDIAN HISTORY FOR ENGINEERS

Paper Code: ETHS-419	**L**	**T/P**	**C**
Paper: Sociology and Elements of Indian History for Engineers	**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

ADVANCED CONTROL SYSTEMS LAB

Paper Code: ETAT-455 (ELECTIVE)	**L**	**T/P**	**C**
Paper: Advanced Control Systems Lab	**0**	**2**	**1**

List of Experiments:

1. Study of open loop and closed loop time/ frequency responses of first/second order LTI system
2. Conversion of transfer functions to state model of LTI system and vice versa
3. Determine State Space Model of a given system and determine its controllability and observability.
4. Analysis of Zero order hold and first order hold circuits.
5. Conversion of transfer functions to state model of discrete time system.
6. To determine state transition matrix of a given system.
7. Study of saturation and dead zone non-linearity using describing function technique of a relay control system.
8. To draw phase trajectory of a given non-linear system.
9. Experiments based on PLC applications e.g. Lift control models, pick and place module etc.
10. Study of operation of a stepper motor interface with microprocessor.

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

CAD LAB

Paper Code: ETAT-451	**L**	**T/P**	**C**
Paper: CAD LAB	**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.

COMPUTER INTEGRATED MANUFACTURING LAB

Paper Code: ETME-453	**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.

MECHATRONICS LAB

	L	T/P	C
Paper Code: ETAT-453			
Paper: Mechatronics Lab	**0**	**2**	**1**

List of Experiments:

1. Study of DC valves and actuators and develop pneumatic circuits to sequence A+A-,A+B+A-B-;
2. Develop Electro –pneumatic sequencing circuits in sequence - A+A-, A+B+A-B-;
3. Develop pneumatic circuits to sequence A+A- B+B-, A+B+C+A-B-C-; A+B+B-A-;
4. Develop Electro –pneumatic sequencing circuits in sequence - A+A-B+B-; A+B+B-A-;
5. Study a simulation software for simulating ladder diagram for a PLC and make AND/OR/NAND/ NOR / XOR logic.
6. Simulate ladder diagram on a PLC software for using flags, latch(s), timer(s), counter(s), registers.
7. Wire an industrial PLC and program it for AND/ OR/ NAND / XOR logic.
8. Wire and industrial PLC and program for using flags, latch(s), timer(s),counter(s),Integers.
9. Program a 8051 / 8052 microcontroller to use input and output ports;
10. Program a 8051 / 8052 microcontroller to run a stepper motor;
11. Program a 8051 / 8052 microcontroller to use a dc motor;
12. Program a 8051 / 8052 microcontroller to use a servo motor;
13. Introduction to SCADA and HMI programming

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

PREVENTIVE MAINTENANCE CONDITION MONITORING LAB

Paper Code: ETAT-455 (ELECTIVE)	**L**	**T/P**	**C**
Paper: Preventive Maintenance Condition Monitoring Lab	**0**	**2**	**1**

List of Experiments:

1. To verify the various statistical relationships from the results of observations of 200 drawings from the Shewhart's Normal Bowl containing 998 chips and to fit a normal curve by making a histogram from the individual observations. Take a subgroup of 5. The given statistical relationships are:
2. $\bar{\bar{X}}' = \bar{\bar{X}}$ $\quad \sigma' = \sigma_{\bar{X}}\sqrt{n}$ $\quad \sigma' = \bar{R}/d_2$ $\quad \sigma' = \bar{\sigma}/c_2$ $\quad \sigma' = \sigma_\sigma / c_5$
3. To plot and determine the given unknown distribution from the results of observations of 180 drawings from the given bowl containing 778 chips. Take a sample size of 4.
4. To determine the process capability of the manual sheet metal cutting process by cutting 80 rectangular pieces (length = 30 mm & breadth = 25 mm) from 28 gauge G. I. sheet. Take a subgroup size of 5.
5. To plot p and np charts from the observations of 20 samples of 100 each drawn from the population of 3000 balls containing 5% defective balls.
6. To plot the $\bar{\bar{X}}$, R & σ control charts from the observations of 120 drawings from the Shewhart Normal Bowl containing 998 chips having population parameters as $\bar{\bar{X}}' = 30$ and $\sigma' = 9.954$, Take a subgroup size of 5.
7. To state and prove the Central Limit Theorem. Take 180 observations from the Shewhart's Normal Bowl and take a sample size of 4.
8. To design a 2% A.O.Q.L single sampling plan by inspecting a population of 3000 balls submitted in 10 lots of 300 balls each with a process average as 0.3% to 3.0% in steps of 0.3%.
9. To plot control chart for c from the observations of 24 sample items drawn from population of 110 items.
10. To design a sequential sampling plan in which the producer's risk of rejecting the lots containing 5% defectives is 4% and the consumer's risk of accepting the lots containing 30% defectives is 20%. Use the designed sampling plan to inspect a population having process average 6% to 30% in steps of 6%. The maximum number of pieces to be inspected is 24.

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

COMPUTATIONAL FLUID DYNAMICS LAB

Paper Code: ETAT-455(ELECTIVE)	**L**	**T/P**	**C**
Paper: Computational Fluid Dynamics Lab	**0**	**2**	**1**

CFD softwares as per the theory syllabus such as ANSYS etc.

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

DATABASE MANAGEMENT SYSTEMS LAB

Paper Code: ETAT-455(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.

ADVANCED MATERIAL SCIENCE AND METALLURGY LAB

Paper Code: ETAT-455(ELECTIVE)	**L**	**T/P**	**C**
Paper: Advanced Material Science and Metallurgy Lab	**0**	**2**	**1**

List of experiments:

1. Making a plastic mould for small metallic specimen.
2. Specimen preparation for micro structural examination-cutting, grinding, polishing, etching.
3. Grain Size determination of a given specimen.
4. Comparative study of microstructures of different given specimens (mild steel,
    a. Gray C.I., brass, copper etc.)
5. Effect of annealing, normalizing and hardening on hardness of the specimen.
6. Effect of annealing, normalizing and hardening on toughness of the specimen
7. Effect of case hardening on the hardness of the specimen
8. Material identification of, say, 50 common items kept in a box.
9. Faradays law of electrolysis experiment.
10. Study of corrosion and its effects.
11. Study of microstructure of welded component and HAZ. Macro & Micro Examination.
12. Suitable experiment on Magnetic/ Electrical/Electronic materials.

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

ADVANCED MANUFACTURING METHODS LAB

Paper Code: ETAT-455(ELECTIVE)	**L**	**T/P**	**C**
Paper: Advanced Manufacturing Methods 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 Flexible manufacturing system.
8. Study of Computer integrated manufacturing.
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.

ROBOTICS

Paper Code: ETMT-402	**L**	**T/P**	**C**
Paper: Robotics	**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 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 analyzer/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, Maipulator 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

ENGINEERING SYSTEM MODELLING AND SIMULATION

Paper Code: ETME-402	**L**	**T/P**	**C**
Paper: Engineering System Modeling and Simulation	**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 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.

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: Kelleg'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: _____

IMAGE PROCESSING AND MACHINE VISION

Paper Code: ETEC-432	**L**	**T/P**	**C**
Paper: Image Processing and Machine Vision	**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.

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, Smoothening 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: Piks Inside", John Wiley & Sons, 2001.

SOFT COMPUTING

Paper Code: ETIT-410	**L**	**T/P**	**C**
Paper: Soft Computing	**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 understand the various concepts of neural networks and fuzzy logic.

UNIT-I

Neural Networks:

History, overview of biological Neuro-system, Mathematical Models of Neurons, ANN architecture, Learning rules, Learning Paradigms-Supervised, unsupervised and reinforcement Learning, ANN training Algorithms-perceptions, Training rules, Delta, Back Propagation Algorithm, Multilayer Perceptron Model, Hopfield Networks, Associative Memories, Applications of Artificial Neural Networks.

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

UNIT-II

Fuzzy Logic:

Introduction to Fuzzy Logic, Classical and Fuzzy Sets: Overview of Classical Sets, Membership Function, Fuzzy rule generation. Operations on Fuzzy Sets: Compliment, Intersections, Unions, Combinations of Operations, Aggregation, Operations.

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

UNIT-III

Fuzzy Arithmetic:

Fuzzy Numbers, Linguistic Variables, Arithmetic Operations on Intervals & Numbers, Lattice of Fuzzy Numbers, Fuzzy Equations. Fuzzy Logic:
Classical Logic, Multivalued Logics, Fuzzy Propositions, Fuzzy Qualifiers,

Uncertainty based Information:

Information & Uncertainty, Nonspecificity of Fuzzy & Crisp Sets, Fuzziness of Fuzzy Sets.

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

UNIT-IV

Introduction of Neuro-Fuzzy Systems:

Architecture of Neuro Fuzzy Networks.

Application of Fuzzy Logic:

Medicine, Economics etc.

Genetic Algorithm:

An Overview, GA in problem solving, Implementation of GA.

[T1, T2][No of Hrs 11]

Text Books:

[T1] Hertz J. Krogh, R.G. Palmer, "Introduction to the Theory of Neural Computation", Addison-Wesley, California, 1991.
[T2] G.J. Klir & B. Yuan, "Fuzzy Sets & Fuzzy Logic", PHI, 1995.
[T3] Melanie Mitchell, "An Introduction to Genetic Algorithm", PHI, 1998.
[T4] F. O. Karray and C. de Silva, "Soft computing and Intelligent System Design", Pearson, 2009.

Reference Books:

[R1] "Neural Networks-A Comprehensive Foundations", Prentice-Hall International, New Jersey, 1999.
[R2] Freeman J.A. & D.M. Skapura, "Neural Networks: Algorithms, Applications and Programming Techniques", Addison Wesley, Reading, Mass, (1992).

TOTAL QUALITY MANAGEMENT

Paper Code: ETME-426	**L**	**T/P**	**C**
Paper: Total Quality Management	**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: To introduce the students about the knowledge of quality management, Cost quality and six-sigma concepts.

UNIT-I

Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of manufacturing and service quality - Basic concepts of TQM - Definition of TQM – TQM Framework - Contributions of Deming, Juran and Crosby – Barriers to TQM.

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

UNIT-II

Leadership – Strategic quality planning, Quality statements - Customer focus – Customer orientation, Customer satisfaction, Customer complaints, Customer retention - Employee involvement – Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal - Continuous process improvement – PDSA cycle, 5s, Kaizen - Supplier partnership – Partnering, Supplier selection, Supplier Rating.

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

UNIT-III

The seven traditional tools of quality – New management tools – Six-sigma: Concepts, methodology, applications to manufacturing, service sector including IT – Bench marking – Reason to bench mark, Bench marking process – FMEA – Stages, Types.

Quality circles – Quality Function Deployment (QFD) – Taguchi quality loss function – TPM – Concepts, improvement needs – Cost of Quality – Performance measures.

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

UNIT-IV

Need for ISO 9000- ISO 9000-2000 Quality System – Elements, Documentation, Quality auditing- QS 9000 – ISO 14000 – Concepts, Requirements and Benefits – Case studies of TQM implementation in manufacturing and service sectors including IT.

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

Text Books:

[T1] Janakiraman, B and Gopal, R.K, "Total Quality Management – Text and Cases", Prentice Hall (India) Pvt. Ltd., 2006.

[T2] Dale H.Besterfiled, et at., "Total Quality Management", Pearson Education Asia

Reference Books:

[R1] James R. Evans and William M. Lindsay, "The Management and Control of Quality", 6th Edition, South-Western (Thomson Learning), 2005.

[R2] Oakland, J.S., "TQM – Text with Cases", Butterworth – Heinemann Ltd., Oxford, 3rd Edition,

[R3] Suganthi,L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd.,2006

APPLIED PLASTICITY

	L	T/P	C
Paper Code: ETME-414			
Paper: Applied Plasticity	**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: To introduce the students about the knowledge of Plasticity.

UNIT I

Introduction to Plasticity:

Idealized stress-strain systems, approximate equation for stress strain curves (Ramberg-Osgood,Ludwig's and Karunes equations), Bauschinger effect-yield locus, yield surface.

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

UNIT II

Yield Criteria and Flow Rules:

Tresca theory & Von-Mises yield criterion, their geometrical representation, experimental evidence for the criteria.

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

UNIT III

Slip Line Field Theory:

Two-dimensional plasticity, slip lines, basic equations, Hencjy's first theorem, Geiringer's Velocity equation, Applications of slip line field theory to plane strain problems.

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

UNIT IV

Load Bounding:

The lower bound theorem, the upper bound theorem and their corollaries. Application of load bounding to plane strain problems.

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

Text Books:

[T1] George E. Dieter "Mechanical Metallurgy", TMH 3rd edition
[T2] G.W. Rowe, Geoffrey W. Rowe "Elements of Metalworking Theory" C.B. S. Publication.

Reference Books:

[R1] Betzatel Avitzer "Metal forming : processes and analysis" McGraw-Hill, 1968
[R2] Johanson and Miller, Plasticity for mechanical Engineers, Van Nostrand.
[R3] Calladina, Engg Plasticity, Pergmean Press.
[R4] B.L. Juneja "Fundamentals of metal forming processes" New age Publication.
[R5] G.K.lal, P.M. Dixit, N.Venkata Reddy " Modelling Techniquues for metal forming processes", Narosa 2011

COMPUTER AIDED GRAPHICS & PRODUCT DESIGN

Paper Code: ETME-430	**L**	**T/P**	**C**
Paper: Computer Aided Graphics & Product Design	**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: To introduce the students about knowledge of computer aided graphics and graphic based product design.

UNIT – I

Geometric Transformations:

Transformations of Geometric models, Projections of geometric models.

Visual Realism:

Introduction, Model clean up, Hidden line removal, hidden surface removal, Hidden solid removal, Shading, Coloring, User interface for shading and coloring.

[T2] [No. of Hrs. 11]

UNIT – II

Interactive Tools:

Graphic Aids:

Introduction, Geometric modifiers, Names, Layers, colors, grids, groups, Dragging and Rubber banding, Clipping, Problems.

Graphics Manipulation and Editing:

Introduction, Entity selection methods, Manipulation Operations, Editing Operations, Design and Engineering Applications.

[T2] [No. of Hrs. 11]

UNIT – III

Product design:

Introduction to Product Design: Asimow's Model, Product Design Practice and Industry, Strength Consideration in Product Design, Design for Stiffness and Rigidity, Design for Production—Metal Parts.

[T1] [No. of Hrs. 10]

UNIT – IV

Product design:

Designing with Plastics, Rubber, Ceramics and Wood, Optimization in Design, Economic Factors Influencing Design, Human Engineering Considerations in Product Design, Value Engineering and Product Design, Modern Approaches to Product Design.

[T2] [No. of Hrs. 11]

Text Books:

[T1] A.K Chitale and R.C.Gupta, "Product Design and Manufacturing", Prentice-Hall of India Pvt. Ltd. 6th Edition.

[T2] Ibrahim Zeid, "CAD/CAM Theory and Practice", Tata McGraw-Hill Publishing Company Limited. 2nd Edition.

References Books:

[R1] Geoffrey Boothroyd , Peter Dewhurst , Winston A Knight, "Product Design for Manufacture and Assembly", Tata Mc GRaw Hill.

[R2] Foley et. al., "Computer Graphics Principles & practice", Addison Wesley.

MICROPROCESSOR SYSTEM BASED PROCESS DESIGN

Paper Code: ETEC-434	**L**	**T/P**	**C**
Paper: Microprocessor System Based Process Design	**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 course is to gain a basic understanding of microprocessor-based systems. Fundamental concepts and techniques for designing and programming microprocessor-based systems will be covered. The Intel 80x86 family of microprocessors and 80x86 assembly languages will be discussed during the course.

UNIT I

80x86 Processor Architecture: Introduction, Processor Model, Programmer's model, Designer's Model : 8086 hardware details, Clock generator 8284A, Bus buffering and latching, Processor Read & Write bus cycles, Ready and wait state generation, Minimum versus Maximum mode operation.

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

UNIT II

Memory Interfacing: 80x86 processor-Memory interfacing, Address decoding techniques, Memory Devices – ROM, EPROM, SRAM, FLASH, DRAM devices, Memory internal organization, Memory read and write timing diagrams**,** DRAM Controller

Basic I/O Interfacing: Parallel I/O, Programmed I/O, I/O port address decoding, The 8255A Programmable Peripheral Interface(PPI), programming 8255, Operation modes, Interface examples – Keyboard matrix, LCD/7-Segment Display, Printer, stepper motor, A/D and D/A converter.

[T1][T2][No. of Hrs. 14]

UNIT III

Timer Interfacing: The 8254 Programmable Interval Timer (PIT), Timing applications.

Serial I/O Interface: Asynchronous communication, Physical communication standard-EIA RS232, Programmable Communication Interface - UART 8251, Interfacing serial I/O devices- mouse, modem, PC Keyboard.

Interrupts: Interrupt driven I/O, Software & Hardware interrupts, Interrupt vectors and vector table, Interrupt processing, The 8259A Programmable Interrupt Controller(PIC)- cascading of 8259s, programming 8259, Interrupt examples – Printer, Real-Time Clock, PC Keyboard.

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

UNIT IV

Direct Memory Access: Basic DMA operation, DMA Controlled I/O, The 8237 DMA Controller, Disk Memory Systems- Floppy disk, Hard disk, optical disk memory systems, video displays

Bus Interfaces: PC bus standards & interfaces – PCI, USB, Firewire, AGP.

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

Text Books:

[T1] John B. Peatman, "Microcomputer Based Interfacing", McGraw Hill, 1988.
[T2] Douglass V. Hall, "Microprocessor and Interfacing", McGraw Hill, 1987.

Reference Books:

[R1] Williams.G.B, "Troubleshooting on Microprocessor Based Systems", Pergamon Press 1984.
[R2] Yu-Cheng Liu and Glenn A. Gibson, "Microcomputer systems, The 8086/8088 family", Second edition, Prentice Hall of India, 1990.
[R3] Ramesh S. Gaonkar, "Microprocessor Architecture programming and applications with 8085", Fourth edition, Penram International publications, 2000.

GAS TURBINES AND COMPRESSORS

Paper Code: ETAT-432	**L**	**T/P**	**C**
Paper: Gas Turbines and Compressors	**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: To introduce the students about the knowledge of Gas Turbines and Compressors.

UNIT I

Introduction: Development, classification and field of application of gas turbines, Marine and land transportation, industrial applications

Gas Turbine Cycle: Ideal and actual cycles; multi-stage compression; reheating, regeneration, combined and cogeneration. Gas Turbine cycle for air craft propulsion, Status of development.

[T1][No. of Hrs.11]

UNIT II

Centrifugal Compressors: Principles of operation; work done and pressure rise, diffuser, compressibility effect, power unit; design consideration for impeller and diffuser systems; performance characteristics and analysis.

Axial Flow Compressors : Elementary theory; factors affecting stage pressure ration, degree of reaction; simple design; elementary air-foil theory; three dimensional flow; stage efficiency and overall efficiency; performance characteristics.

[T1][No. of Hrs.11]

UNIT III

Turbines: Axial flow and radial flow turbines, impulse and reaction turbines; fundamental relations and velocity triangles; elementary vortex theory; limiting factors in turbine design; the study of flow through turbine blades; blade materials; blade attachments and blade cooling.

[T1][No. of Hrs.10]

UNIT IV

Combustion System: operational requirement, types, important factors affecting combustion system, Classification of combustion chambers and their uses.

Gas Turbine Power Plants: Fuel and fuel feed systems; and flame stabilization; regenerator types; gas turbine power plant.

[T1][No. of Hrs.11]

Text Books:

[T1] HIH Saravanamutto, H. Cohen, GFC Rogers "Gas Turbine Theory" Pearson.

Reference Books

[R1] E.T. Vincent "Theory & Design of Gas Turbine and jet engine" McGraw Hill
[R2] Gas Turbine Principles and Practice Cox Newnes

CRYOGENIC ENGINEERING

Paper Code: ETME-424	**L**	**T/P**	**C**
Paper: Cryogenic Engineering	**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: To introduce the students about the knowledge of principles of refrigeration and liquefaction, gas liquefaction systems and cryogenic equipment.

UNIT-I

Refrigeration And Liquefaction Principles: Joule Thomson effect and inversion curve; Adiabatic and isenthalpic expansion with their comparison. Properties of cryogenic fluids; Properties of solids at cryogenic temperatures ,Superconductivity. Adiabatic Expansion - Liquefaction Systems for Air, Neon, Hydrogen and Helium - Effect of component efficiencies on System Performance.

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

UNIT-II

Gas Liquefaction Systems: Recuperative – Linde – Hampson, Claude, Cascade, Heylandt, Kapitza, Collins, Simon; Regenerative – Stirling cycle and refrigerator, Slovay refrigerator, Gifford-McMahon refrigerator, Vuilleumier refrigerator, Pulse Tube refrigerator; Liquefaction of natural gas.

Cryogenic insulation: Vacuum insulation, Evacuated porous insulation, Gas filled Powders and fibrous materials, Solid foams, Multilayer insulation, Liquid and vapour Shields, Composite insulations.

[T1, T2, R2][No. of Hrs.12]

UNIT-III

Storage Of Cryogenic Liquids: Design considerations of storage vessel; Dewar vessels; Industrial storage vessels; Storage of cryogenic fluids in space; Transfer systems and Lines for cryogenic liquids; Cryogenic valves in transfer lines; Two phase flow in Transfer system; Cool-down of storage and transfer systems.

Cryogenic instrumentation: Measurement of strain, pressure, flow, liquid level and Temperature in cryogenic environment; Cryostats.

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

UNIT-IV

Cryogenic equipment: Cryogenic heat exchangers – recuperative and regenerative; Variables affecting heat exchanger and system performance; Cryogenic compressors, Pumps, expanders; Turbo alternators; Effect of component inefficiencies; System Optimization. Magneto-caloric refrigerator; 3He-4He Dilution refrigerator; Cryopumping Cryogenic Engineering applications in energy, aeronautics, space, industry, biology, preservation Application of Cryogenic Engineering in Transport.

[T1, T2, R1,][No. of Hrs.11]

Text Books:

[T1] Randall Baron, Cryogenic System, Mc Graw Hill
[T2] K.D. Timmerhaus & T.M. Flynn, Cryogenic Process Engineering, Plenum Press

Reference Books:

[R1] Russel B Scott, Cryogenic Engineering, Van Nostrand
[R2] R W Yance and WM Duke, Applied Cryogenic Engineering, John Willey.

RAPID PROTOTYPING

Paper Code: ETME-412	**L**	**T/P**	**C**
Paper: Rapid Prototyping	**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 liquid, solid and powder based rapid prototyping systems.

UNIT I

Introduction

Need - Development of RP systems – RP process chain - Impact of Rapid Prototyping and Tooling on Product Development – Benefits- Applications – Digital prototyping – Virtual Prototyping.

Liquid Based and Solid Based Rapid Prototyping Systems

Stereo lithography Apparatus, Fused deposition Modeling, Laminated object manufacturing, three dimensional printing: Working Principles, details of processes, products, materials, advantages, limitations and applications - Case studies.

[T1][T2][T3][No. of Hrs: 12]

UNIT II

Powder Based Rapid Prototyping Systems

Selective Laser Sintering, Direct Metal Laser Sintering, Three Dimensional Printing, Laser Engineered Net Shaping, Selective Laser Melting, Electron Beam Melting: Processes, materials, products, advantages, applications and limitations – Case Studies.

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

UNIT III

Reverse Engineering and Cad Modeling

Basic concept- Digitization techniques – Model Reconstruction – Data Processing for Rapid Prototyping: CAD model preparation, Data Requirements – geometric modeling techniques: Wire frame, surface and solid modeling – data formats - Data interfacing, Part orientation and support generation, Support structure design, Model Slicing and contour data organization, direct and adaptive slicing, Tool path generation.

[T1][T2][T3][No. of Hrs: 12]

UNIT IV

Rapid Tooling

Classification: Soft tooling, Production tooling, Bridge tooling; direct and indirect – Fabrication processes, Applications. Case studies - automotive, aerospace and electronic industries.

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

Text Books:

[T1] Rapid prototyping: Principles and applications, second edition, Chua C.K., Leong K.F., and Lim C.S., World Scientific Publishers, 2003

[T2] Rapid Tooling: Technologies and Industrial Applications, Peter D. Hilton, Hilton/Jacobs, Paul F.Jacobs, CRC press, 2000.

[T3] Serope Kalpakjian, "Manufacturing Engg and Tech"; 4th edition, Pearson education

References Books:

[R1] Rapid prototyping, Andreas Gebhardt, Hanser Gardener Publications, 2003

[R2] Rapid Prototyping and Engineering applications: A tool box for prototype development, Liou W.Liou, Frank W.Liou, CRC Press, 2007.

[R3] Rapid Prototyping: Theory and practice, Ali K. Kamrani, Emad Abouel Nasr, Springer

FLEXIBLE MANUFACTURING SYSTEM

Paper Code: ETMT-428	**L**	**T/P**	**C**
Paper: Flexible Manufacturing System	**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.

SUPPLY CHAIN MANAGEMENT - PLANNING

Paper Code: ETTE-424	**L**	**T/P**	**C**
Paper: Supply Chain Management - 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 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.

PROCESS PLANNING AND COST ESTIMATION

Paper Code: ETAT-442	**L**	**T/P**	**C**
Paper: Process Planning and Cost Estimation	**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 objective of the course is to provide planning in engineering, manufacturing organization, process planning and cost estimation.

UNIT-I

Nature and scope of process planning activities. Operating sequences – machine selection, material selection documentation of process planning. Material requirement planning scheduling. Supply chain management; Inventory planning. Production time calculations and applicability of Just in time production.

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

UNIT-II

Process selection and facilities layout. Determinants of process selection. Manufacturing logic and line balancing. Synchronous manufacturing. Design for assembly. Tools and techniques. Quality function deployment. Work measurement and job design.

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

UNIT-III

Basics of cost estimation. Elements of cost and cost determination: Material cost – purchase procedure, store keeping, stock control. Pricing of issue of material and recording of the same. Correcting of discrepancies in stock. Labour cost – payroll procedures, monetary and non-monetary cost. Treatment of idle time and overtime. Other direct expenses – nature classification and treatment. Overheads – Production overheads collection apportionment, absorption. Use of predetermined rates. Administration Selling and Distribution overheads.

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

UNIT-IV

Methods of cost estimations. Specific order costing – Job, batch and contract. Valuation of work in progress. Process costing – treatment of normal and abnormal losses and gains. Computations of cost of joint products, by-products, treatment of waste, scraps, spoilage and defectives. Research and Development expenses. Identification of cost unit in case of service or operating costing.

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

Text Books:

[T1] Clark, "Facility Planning" (latest edition), Pearson Education.
[T2] Sinha. B. P., "Mechanical Estimating and Costing" (latest edition), Tata McGraw-Hill

Reference Books:

[R1] Chase, R.B. et.al, "Operations Management for Competitive Advantage", Tata McGraw Hill
[R2] Russell. R.S et al, Operations Management", PHI

ROBOTICS LAB

Paper Code: ETMT-452	**L**	**T/P**	**C**
Paper: Robotics Lab	**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-Analizer 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 analyzer/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.

ENGINEERING SYSTEM MODELLING AND SIMULATION LAB

Paper Code: ETME-452	**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 tetrhedran 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.

SOFT COMPUTING LAB

Paper Code: ETAT-456 (ELECTIVE)	**L**	**T/P**	**C**
Paper: Soft Computing Lab	**0**	**2**	**1**

List of Experiments:

1. Write Matlab code for McCulloch-Pitts neuron for implementation of logical NOT, AND and OR gates.
2. Write a Matlab program to implement Back Propagation Method.
3. Write a Matlab program to calculate union, intersection, complement and difference of two fuzzy sets.
4. Write a Matlab program to calculate the Demorgan's Law.
5. Write a Matlab program to find whether the given matrix is (a) reflexive (b) tolerance and (c) transitivity matrix or not.
6. Write a Matlab program to find whether the given matrix is symmetry or not.
7. Using max–product and max-min method by a Matlab program to find the fuzzy relation between two vectors.
8. Using Matlab program find the crisp lambda cut set relations.
9. Use Matlab's Fuzzy Logic Toolbox to model the tip given after a dinner for two, where the food can be disgusting, not good, bland, satisfying, good, or delightful, and the service can be poor, average, or good. To get started, you type fuzzy in a Matlab window. Then use the fuzzy inference system and membership function editors to define and tune your rules.
10. Write a program in Matlab to implement Roulette wheel and ranking selection method.

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

CRYOGENIC ENGINEERING LAB

Paper Code: ETME-456 (ELECTIVE)	**L**	**T/P**	**C**
Paper: Cryogenic Engineering Lab	**0**	**2**	**1**

List of Experiments:

1. Visit to Nitrogen liquefaction plant.
2. Design of a recuperative cryogenic heat exchanger for a given liquefaction system.
3. Calibration of a cryogenic temperature-measuring instrument.
4. Trial / Design of Stirling cycle refrigerator.
5. Trial / Design of Pulse tube refrigerator.

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

RAPID PROTOTYPING LAB

Paper Code: ETAT-456(ELECTIVE)	**L**	**T/P**	**C**
Paper: Rapid Prototyping Lab	**0**	**2**	**1**

List of Experiments:

1. Study the various rapid prototyping, rapid tooling, and reverse engineering technologies.
2. Study the Photo-polymerisation-based technologies (SL, SGC, Poly-Jet, Per-Factory, etc.).
3. Study the selective laser sintering (SLS).
4. Study the fused deposition modeling (FDM), ballistic particle modeling (BPM).
5. Study the Stereo lithography (STL) format and cubital facet list (CFL).
6. Study the Room temperature vulcanized (RTV) silicone molding.
7. Study the spin casting, investment casting, abrading, metal spraying, and direct shell production casting (DSPC).
8. Study the 3D scanning, 3D digitizing, and data fitting.

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

COMPUTER AIDED GRAPHICS AND PRODUCT DESIGN LAB

Paper Code: ETAT-456(ELECTIVE)	**L**	**T/P**	**C**
Paper: Computer Aided Graphics and Product Design Lab	**0**	**2**	**1**

List of Experiments:

1. Use computer software such as: C / C++ / MATLAB / SCILAB / Java / any other to make programs for under mentioned:

Computer Graphics – Make more complex problems for these as compared to CAD syllabus:

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;

Product Design:

Use any software and solve more numericals than done in Machine design -1 / MD-2 Lab.

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

FLEXIBLE MANUFACTURING SYSTEM LAB

Paper Code: ETAT-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.

APPLIED PLASTICITY LAB

	L	T/P	C
Paper Code: ETME 456 (ELECTIVE)			
Paper: Applied Plasticity Lab	**0**	**2**	**1**

List of Experiments:

1. To study and observe through demonstration of the rolling process.
2. To study and observe through demonstration Sheet metal forming.
3. To study of the effect of clearance on the blanking and piercing operations.
4. To study of the effect of shear angle on the blanking and piercing operations.
5. To determine the effect of percentage of reduction on the drawing load.
6. To determine the effect of the semi-cone angle of the die on the drawing load.
7. To find the effect of percentage of reduction on extruding force.
8. To find the effect of the die geometry on extruding force.
9. Experimental determination of coefficient of friction for metal forming.
10. Study of the drop forging operation (flow ability, forging load etc by plasticine model.
11. To determine roll load in the sheet rolling process.
12. To manufacture a small object using hot forging technique

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