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
Dwarka, Delhi – 110078 [INDIA]
www.ipu.ac.in
**BACHELOR OF TECHNOLOGY**  
(Common to all branches)  
FIRST SEMESTER EXAMINATION

<table>
<thead>
<tr>
<th>Code No.</th>
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M: Mandatory for award of degree  
NUES (Non University Examination System)  
n*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

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NUES (Non University Examination System)

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Scheme and Syllabi for B. Tech-Mechanical and Automation Engineering, 1st year (Common to all branches) w.e.f batch 2014-15 and (2nd, 3rd & 4th years) w.e.f batch 2013-14 approved in the 22nd BOS of USET on 30th June, 2014 and approved in the 37th AC Sub Committee Meeting held on 10th July, 2014.
**BACHELOR OF TECHNOLOGY**
**(MECHANICAL AND AUTOMATION ENGINEERING)**
**THIRD SEMESTER EXAMINATION**

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**THEORY PAPERS**

**PRACTICAL/VIVA VOCE**

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**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

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<td>ETEC-202</td>
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|          | ETMA-252   | Numerical Analysis and Statistical       | ------ | 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.
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**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

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*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

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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 7th Semester is done before the 15th April every year before end of 6th semester.
# BACHELOR OF TECHNOLOGY
(MECHANICAL AND AUTOMATION ENGINEERING)
SEVENTH SEMESTER EXAMINATION

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**Elective-I (choose any one)**

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**Elective-II (Choose any one)**

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**PRACTICAL/VIVA VOCE**

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**TOTAL**

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**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)

Scheme and Syllabi for B. Tech-Mechanical and Automation Engineering, 1st year (Common to all branches) w.e.f batch 2014-15 and (2nd, 3rd & 4th years) w.e.f batch 2013-14 approved in the 22nd BOS of USET on 30th June, 2014 and approved in the 37th AC Sub Committee Meeting held on 10th July, 2014.
# BACHELOR OF TECHNOLOGY
## (MECHANICAL AND AUTOMATION ENGINEERING)
### EIGHTH SEMESTER EXAMINATION

<table>
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*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

Paper: Fluid Mechanics

L  T/P  C
3  1  4

INSTRUCTIONS TO PAPER SETTERS:

MAXIMUM MARKS: 75

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

2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

Objectives: The objective of this subject to provide an understanding of the fundamentals of fluid mechanics, an appreciation of the design principles in fluid systems, the ability to 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,

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.

UNIT- III


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


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.


Text Books:

Reference Books:
THERMAL SCIENCE

Paper Code: ETME-203  L  T/P  C
Paper: Thermal Science  3  1  4

INSTRUCTION TO PAPER SETTERS:

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.

Maximum Marks: 75

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

UNIT – I


[T1, T2, T3, R1, R2, R3] [No. of Hrs. 13]

UNIT – II


Thermodynamic Property Relations: Maxwell Relations. Clapeyron Equation.


[T1, T2, T3, R1, R2, R3] [No. of Hrs. 12]

UNIT - III:


[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.


[T1, T2, T3, R1, R2, R3] [No. of Hrs. 10]

Text Books:


Reference books:


Scheme and Syllabi for B. Tech-Mechanical and Automation Engineering, 1st year (Common to all branches) w.e.f batch 2014-15 and (2nd, 3rd & 4th years) w.e.f batch 2013-14 approved in the 22nd BOS of USET on 30th June, 2014 and approved in the 37th AC Sub Committee Meeting held on 10th July, 2014.
STRENGTH OF MATERIALS

Paper Code: ETAT-203
Paper: Strength of Materials

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.

[1, 2][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 theorem
Slope and deflection of cantilevers and beams under concentrated and uniformly distributed loads. Moment Area method, MaCaulay’s method; principle of superposition.

[1, 2][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.

[1, 2][No. of Hrs. 11]

UNIT – IV
Springs: Close-coiled springs, leaf springs.
Cylinders: Thin and thick cylinders, Lame’s Theorem, compound cylinders, spherical vessels.

[1, 2][No. of Hrs. 11]

Text Books:

Reference Books:
[R1] Timoshenko S.P., Gere J “Elements of Strength of Materials”, East-West affiliated, New Delhi,
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\textsubscript{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

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

UNIT - IV

[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:
MATERIAL SCIENCE & METALLURGY

Paper Code: ETME-207
Paper: Material Science & Metallurgy

INSTRUCTIONS TO PAPER SETTERS:

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.

Maximum Marks: 75

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.

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.

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

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

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

Reference Books:
ELECTRICAL MACHINES

Paper Code: ETME-209
Paper: Electrical Machines

<table>
<thead>
<tr>
<th>INSTRUCTIONS TO PAPER SETTERS</th>
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<td></td>
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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

[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:

Reference Books:
[R3] Introduction to Electrical Engineering, Mulukutla S. Sarma, Oxford University Press Inc., 2001
FLUID MECHANICS LAB

<table>
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<th>L</th>
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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**

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

Paper Code: ETTE-259  
Paper: Machine Drawing Lab  

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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 Charateristics: 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:

Reference Books:
## ELECTRICAL MACHINE LAB

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

### List of Experiments:

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

<table>
<thead>
<tr>
<th>EXP</th>
<th>Description</th>
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<tbody>
<tr>
<td>1</td>
<td>To study the magnetization characteristics of a separately excited D.C generator for different speeds</td>
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</table>
| 2   | To study the speed control of a d.c. shunt motor using  
|     | A. Field current control method  
|     | B. Armature control method |
| 3   | To plot torque-speed characteristics and armature current characteristics of a D.C shunt motor. |
| 4   | To determine the external or load characteristics of a D.C. shunt generator by actually loading the machine. |
| 5   | To study 3-point/ 4-point starter for D.C. shunt motor. |
| 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 impedance method. |
| 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. |
| 8   | To Perform no load and blocked rotor test on three-phase induction motor and draw its equivalent circuit. |
| 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. |
| 10  | Perform no load and blocked rotor test on single-phase induction motor. |

### Reference Books:

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

### NOTE:

At least 8 Experiments out of the list must be done in the semester.
NUMERICAL ANALYSIS & STATISTICAL TECHNIQUES

Paper Code: ETMA-202
Paper: Numerical Analysis & Statistical Techniques

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</table>

INSTRUCTIONS TO PAPER SETTERS:

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.

Maximum Marks: 75

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.

[11] [No. of Hrs. 1]

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.

[11] [No. of Hrs. 1]

UNIT III

[11] [No. of Hrs. 1]

UNIT IV:

[11] [No. of Hrs. 1]

Text Books:

Reference Books:
[R5] Schaum’s Outline on Fourier Analysis with Applications to Boundary Value Problem, TMH
### FLUID SYSTEMS

**Paper Code:** ETAT-204  
**Paper:** Fluid Systems  
**L** **T/P** **C**

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**INSTRUCTIONS TO PAPER SETTERS:**

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 & curved), 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:**


**Reference Books:**


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Scheme and Syllabi for B. Tech-Mechanical and Automation Engineering, 1st year (Common to all branches) w.e.f batch 2014-15 and (2nd, 3rd & 4th years) w.e.f batch 2013-14 approved in the 22nd BOS of USET on 30th June, 2014 and approved in the 37th AC Sub Committee Meeting held on 10th July, 2014.
THEORY OF MACHINES

Paper Code: ETAT-202
Paper: Theory of Machines

L T/P C
3 1 4

INSTRUCTIONS TO PAPER SETTERS:

Maximum Marks: 75

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

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, Cycloidal motion, oscillating followers.

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

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

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

UNIT – III

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


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

UNIT – IV


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:


Reference Books:

[R1] Shigley J E “Theory of Machines”, Pearson
[R2] Thomas Beven, “The Theory of Machines”, CBS Publishers,
**MANUFACTURING MACHINES**

**Paper Code:** ETME-206

**Paper:** Manufacturing Machines

**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 its 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).

**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.

**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.

**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.

**Text Books:**


**Reference Books:**


Scheme and Syllabi for B. Tech-Mechanical and Automation Engineering, 1st year (Common to all branches) w.e.f batch 2014-15 and (2nd, 3rd & 4th years) w.e.f batch 2013-14 approved in the 22nd BOS of USET on 30th June, 2014 and approved in the 37th AC Sub Committee Meeting held on 10th July, 2014.
MEASUREMENTS AND INSTRUMENTATION

Paper Code: ETME-208
Paper: Measurements and Instrumentation

L T/P C
3 0 3

INSTRUCTIONS TO PAPER SETTERS:

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:

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

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

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.

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.

Text Books:

Reference Book:
SWITCHING THEORY AND LOGIC DESIGN

Paper Code: ETEC-202

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INSTRUCTIONS TO PAPER SETTERS:

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.

Maximum Marks: 75

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.

UNIT-II

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


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.

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.

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.

Text Book:


Reference Books:

**NUMERICAL ANALYSIS AND STATISTICAL TECHNIQUES LAB**

**Paper Code:** ETMA-252  
**Paper:** Numerical Analysis and Statistical Techniques Lab  
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**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.  
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 at least 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:**


**Reference Books:**

[R3] Rudra Pratap, “Getting Started With MatLab” Oxford University Press  
[R4] Byrom Gottfried, “Programming With C” Shaum’s Outline  

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

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<td>Paper: Fluid Systems Lab</td>
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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

Paper: Theory of Machines Lab

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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.
4. To study various types of gears – Helical, cross helical worm, bevel gear.
5. To perform experiment on watt and Forel 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

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<td>Paper: Manufacturing Machines Lab</td>
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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

Paper Code: ETEC-252

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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-Savé 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
Paper: Management of Manufacturing Systems

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 shall 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.

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.

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.

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

Text Books:

Reference Book:
METAL CUTTING & TOOL DESIGN

Paper Code: ETAT-303
Paper: Metal Cutting & Tool Design

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<th>INSTRUCTIONS TO PAPER SETTERS:</th>
<th>MAXIMUM MARKS: 75</th>
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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.

UNIT - II


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.

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.


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

Reference Books:
[R4] A.B. Chattopadhyay “Machining and Machine Tools” Wiley India
HEAT TRANSFER & I. C. ENGINES

Paper Code: ETAT-305
Paper: Heat Transfer & I. C. Engines

INSTRUCTION TO PAPER SETTERS:

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.

MAXIMUM MARKS: 75

UNIT – I

UNIT - II

UNIT – III
Emissions from SI and CI Engines, Rating of Fuels.

UNIT – IV
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.

Text Books: Heat Transfer

Text Books: I. C. Engines

Objective: The objective of this paper is to introduce the students about the knowledge of conduction, thermal radiation and I.C. Engines.
Reference Books:

## METROLOGY

**Paper Code:** ETAT-307  
**Paper:** Metrology

### INSTRUCTIONS TO PAPER SETTERS:

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.


[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.

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**Scheme and Syllabi for B. Tech-Mechanical and Automation Engineering, 1\textsuperscript{st} year (Common to all branches) w.e.f batch 2014-15 and (2\textsuperscript{nd}, 3\textsuperscript{rd} & 4\textsuperscript{th} years) w.e.f batch 2013-14 approved in the 22\textsuperscript{nd} BOS of USET on 30\textsuperscript{th} June, 2014 and approved in the 37\textsuperscript{th} AC Sub Committee Meeting held on 10\textsuperscript{th} July, 2014.**
**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:**

**Reference Books:**
- [R2] Beckwith, Buck, Lienhard, *Mechanical Measurements*, Pearson Education
CONTROL SYSTEMS

Paper Code: ETEL-307
Paper: Control Systems

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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, Synchrons, 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

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

Text Books:

Reference Books:

Scheme and Syllabi for B. Tech-Mechanical and Automation Engineering, 1st year (Common to all branches) w.e.f batch 2014-15 and (2nd, 3rd & 4th years) w.e.f batch 2013-14 approved in the 22nd BOS of USET on 30th June, 2014 and approved in the 37th AC Sub Committee Meeting held on 10th July, 2014.
COMMUNICATION SKILLS FOR PROFESSIONALS

Paper Code: ETHS-301
Paper: Communication Skills for Professionals

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<th>INSTRUCTIONS TO PAPER SETTERS:</th>
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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)

[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.

[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:


References Books:
METAL CUTTING & TOOL DESIGN LAB

Paper Code: ETAT-351
Paper: Metal Cutting & Tool Design Lab

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.
   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

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<td>Paper: Heat Transfer &amp; I.C. Engines Lab</td>
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**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-Boltzmann 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 pipes of copper and stainless steel.


**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
Paper: Metrology Lab

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List of Experiments:

1. Study & working of simple measuring instruments - Vernier calipers, micrometer, tachometer.
4. Study of angular measurement using level protector.
5. Adjustment of spark plug gap using feeler gauges.
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.
14. Precision Angular measurement using Autocollimator / Angle Dekkor.
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

Paper Code: ETEL-355
Paper: Control Systems Lab

List of Experiments:

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

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


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  
Paper: Machine Design  
L T/P C  
3 1 4

INSTRUCTIONS TO PAPER SETTERS:  
MAXIMUM MARKS: 75

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

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

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

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.

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.

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.

Text Books:

Reference Book:  
AUTOMOBILE ENGINEERING

Paper Code: ETAT-304

INSTRUCTIONS TO PAPER SETTERS:

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.

MAXIMUM MARKS: 75

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.

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.


UNIT III


Steering System: Steering terminologies and geometry. Davis and Ackermann steering. Power steering.

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.

Text Books:

[T2] R K Rajput,” A text Book on Automobile Engineering”, Laxmi publication

Reference Books:


[No. of Hrs.12]

[No. of Hrs.11]

[No. of Hrs.11]
DATA COMMUNICATION & NETWORKS

Paper Code: ETEC-310
Paper: Data Communication & Networks

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

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

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

[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:

Reference Books:
OPERATIONS RESEARCH

Paper Code: ETAT-306
Paper: Operations Research

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INSTRUCTIONS TO PAPER SETTERS:  
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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,

[T1][No. of Hrs. 11]

UNIT-II

[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.

[T2][No. of Hrs. 11]

Text Books:

Reference Books:
REFRIGERATION & AIR CONDITIONING

Paper Code: ETME-308
Paper: Refrigeration & Air Conditioning

L T/P C
3 1 4

INSTRUCTIONS TO PAPER SETTERS:

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.

MAXIMUM MARKS: 75

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
Air Refrigeration systems: Bell Coleman Cycle, Dense Air System, Open Air System, Analysis of Simple Air Refrigeration Cycle for Aircraft.

UNIT II
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.

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.

UNIT IV:

Text Books:

References Books:
MICROPROCESSORS AND MICROCONTROLLERS

Paper Code: ETEE-310  
Paper: Microprocessors and Microcontrollers

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

[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:
[T3] Ramesh Gaonkar, “MicroProcessor Architecture, Programming and Applications with the 8085”, PHI

References Books:
MACHINE DESIGN LAB

Paper Code: ETAT-352  L  T/P  C
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

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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

Paper Code: ETME-358
Paper: Refrigeration and Air Conditioning Lab

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
Paper: Microprocessors and Microcontrollers Lab

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List of Experiments:

1. Write a program to add and subtract two 16-bit numbers with/without carry using 8086.
2. Write a program to multiply two 8-bit numbers by repetitive addition method using 8086.
3. Write a Program to generate Fibonacci series.
4. Write a Program to generate Factorial of a number.
5. Write a Program to read 16-bit Data from a port and display the same in another port.
6. Write a Program to generate a square wave using 8254.
7. Write a Program to generate a square wave of 10 kHz using Timer 1 in mode 1 (using 8051).
8. Write a Program to transfer data from external ROM to internal (using 8051).
9. Design a Minor project using 8086 Micro processor (Ex: Traffic light controller/temperature controller etc)
10. Design a Minor project using 8051 Micro controller

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

Paper Code: ETAT-401  
Paper: Computer Aided Design  

L  T/P  C  
3  1  4

INSTRUCTIONS TO PAPER SETTERS:  
MAXIMUM MARKS: 75  
1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.  
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

Objective: The objective of the paper is to introduce the students about the knowledge of CAD and CAD systems evaluation, 3D transformation, Curves and other geometric mapping and formulation.

UNIT- I  
CAD: CAD Hardware: Types of Systems, CAD Systems Evaluation Criteria, Input Devices, Output Devices;  
Three Dimensional Transformations: Point representations, Transformation Matrices, Scaling, Translation, Rotation, Reflection.  
Projections: Orthographic, Isometric, Perspective, Point at Infinity & Vanishing Point.

[UT][UT][No. of Hrs: 11]

UNIT-II  
Curves: Representation of Space Curves, Cubic Spline, Normalized Cubic Splines, Bezier Curves, B-spline Curves, Numerical problems.  

[UT][UT][No. of Hrs: 11]

UNIT- III  

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

UNIT-IV  

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

Text Books:  

Reference Book:  
COMPUTER INTEGRATED MANUFACTURING

Paper Code: ETME-403
Paper: Computer Integrated Manufacturing

L T/P C
3 1 4

INSTRUCTIONS TO PAPER SETTERS:

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.

MAXIMUM MARKS: 75

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

UNIT-I
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.

UNIT-II

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.

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.

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.

Automated Material Handling Systems and Advanced Manufacturing Systems:

Text Books:
Reference Books:
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.

UNIT - II
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.

UNIT - III
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.

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.

Text Book:

Reference Books:
[R2] Dan Neculescu, Mechatronics, Pearson
OPTIMIZATION TECHNIQUES

Paper Code: ETME-407

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

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

UNIT-III:
Transportation problems & solutions, Assignment problems and its solutions by Hungarian Method.

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.

Text Books:

References Books:
PREVENTIVE MAINTENANCE & CONDITION MONITORING

Paper Code: ETME-409

Paper: Preventive Maintenance & Condition Monitoring

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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

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

UNIT- II

[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:

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

Text Books:

Reference Books:
COMPUTATIONAL FLUID DYNAMICS

Paper Code: ETME-411
Paper: Computational Fluid Dynamics

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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.

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.

UNIT – III

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.

Text Books:

Reference Books:

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.

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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.

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.

UNIT – III

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.

Text Books:

Reference Books:
FINITE ELEMENT METHODS

Paper Code: ETME-423
Paper: Finite Element Methods

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:

Reference Books:
[R2] Larry J. Segerlind, “Applied Finite-Element Analysis”, John Wiley and Sons
RENEWABLE ENERGY RESOURCES

Paper Code: ETEE-419
Paper: Renewable Energy Resources

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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.

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.

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, phyoysis, 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.

UNIT-IV
Grid Connectivity: wind power interconnection requirement - low-voltage ride through (LVRT), ramp-rate limitations, supply of ancillary services for frequency and voltage control, load following, reserve requirement, impact of connection on steady-state and dynamic performance of power system; interfacing dispersed generation of solar energy with the grid, protective relaying, islanding, voltage flicker and other power quality issues; role of non-conventional energy system in smart grid.

Text Books:

References Books:
ARTIFICIAL INTELLIGENCE

Paper Code: ETCS-429
Paper: Artificial Intelligence

L T/P C
3 0 3

INSTRUCTIONS TO PAPER SETTERS:

MAXIMUM MARKS: 75
1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

Objective: To learn the basics of designing intelligent agents that can solve general purpose problems, represent and process knowledge, plan and act, reason under uncertainty and can learn from experiences

UNIT-I
Introduction: Introduction to intelligent agents
Problem solving: Problem formulation, uninformed search strategies, heuristics, informed search strategies, constraint satisfaction solving problems by searching, state space formulation, depth first and breadth first search, iterative deepening

[UNIT-I][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

[UNIT-II][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

[UNIT-III][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.

[UNIT-IV][No. of hrs. 10]

Text Book:

Reference Books:
[R1] KM Fu, "Neural Networks in Computer Intelligence", McGraw Hill
DATABASE MANAGEMENT SYSTEMS

Paper Code: ETCS-425
Paper: Database Management Systems

L T/P C
3 0 3

INSTRUCTIONS TO PAPER SETTERS:

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-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.

Text Books:

References Books:
ADVANCED MATERIAL SCIENCE AND METALLURGY

Paper Code: ETME-417
Paper: Advanced Material Science and Metallurgy

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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.

Maximum Marks: 75

Objective: The objective of the paper is to facilitate the student with advanced materials in use today and its 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

Reference Books:
ADVANCED CONTROL SYSTEMS

Paper Code: ETEE-403
Paper: Advanced Control Systems

INSTRUCTIONS TO PAPER SETTERS:

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).

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.

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.

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.

Text Books:

Reference Books:
[R2] Brian D.O. Adnerson & John B. Moore, Optimal Control
[R4] Shastri & Badson, Adaptive Control, PHI

Software & Hardware:

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.
POWER PLANT ENGINEERING

Paper Code: ETME-405
Paper: Power Plant Engineering

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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.

**MAXIMUM MARKS: 75**

**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.

**UNIT – II**


**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

**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.

**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.

**Text Books:**


**Reference Books:**

- [R3] Shamsher Gautam “Power Plant Engineering” Vikas Publishing House

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Scheme and Syllabi for B. Tech-Mechanical and Automation Engineering, 1st year (Common to all branches) w.e.f batch 2014-15 and (2nd, 3rd & 4th years) w.e.f batch 2013-14 approved in the 22nd BOS of USET on 30th June, 2014 and approved in the 37th AC Sub Committee Meeting held on 10th July, 2014.
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
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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.

UNIT- II

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

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

Text Books:

References Books:
MANAGEMENT INFORMATION SYSTEMS AND ERP

Paper Code: ETME-421

Paper: Management Information Systems and ERP

L T/P C
3 0 3

INSTRUCTIONS TO PAPER SETTERS:

MAXIMUM MARKS: 75

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

Objectives: The 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

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

UNIT II

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

UNIT III

[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:

References Books:
ADVANCED MANUFACTURING METHODS

Paper Code: ETAT-407
Paper: Advanced Manufacturing Methods

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INSTRUCTIONS TO PAPER SETTERS:

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Objective: The objective of the paper is to facilitate the student with the basics of Non-Conventional or Modern Manufacturing Methods and its application in different types 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.

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

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

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

Text Books:

Reference books:

Scheme and Syllabi for B. Tech-Mechanical and Automation Engineering, 1st year (Common to all branches) w.e.f batch 2014-15 and (2nd, 3rd & 4th years) w.e.f batch 2013-14 approved in the 22nd BOS of USET on 30th June, 2014 and approved in the 37th AC Sub Committee Meeting held on 10th July, 2014.
SOCIOLOGY AND ELEMENTS OF INDIAN HISTORY FOR ENGINEERS

Paper Code: ETHS-419
Paper: Sociology and Elements of Indian History for Engineers

INSTRUCTIONS TO PAPER SETTERS:

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.

MAXIMUM MARKS: 75

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 workplace 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.

Module 1B: Introduction to sociological concepts—structure, system, organization, social institution, Culture social stratification (caste, class, gender, power). State & civil society.

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.

Module 2B: Understanding social structure and social processes: Perspectives of Marx, Weber & Durkheim.

UNIT III
Module 3A: From Feudalism to colonialism—the coming of British; Modernity & struggle for independence.

Module 3B: Understanding social structure and social processes: Perspectives of Marx, Weber & Durkheim.

UNIT IV

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.

Text Books:

Reference Books:
[R1] Guha, Ramachandra (2007), India After Gandhi, Pan Macmillan

Scheme and Syllabi for B. Tech-Mechanical and Automation Engineering, 1st year (Common to all branches) w.e.f batch 2014-15 and (2nd, 3rd & 4th years) w.e.f batch 2013-14 approved in the 22nd BOS of USET on 30th June, 2014 and approved in the 37th AC Sub Committee Meeting held on 10th July, 2014.
### ADVANCED CONTROL SYSTEMS LAB

**Paper Code: ETAT-455 (ELECTIVE)**

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<tr>
<th>Paper: Advanced Control Systems Lab</th>
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**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
Paper: Computer Integrated Manufacturing Lab

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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**

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<th>Paper Code: ETAT-453</th>
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<td>Paper: Mechatronics Lab</td>
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**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  0  2  1

Paper: Preventive Maintenance Condition Monitoring Lab

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:

   \[ \bar{X} = \bar{X}, \quad \sigma = \sigma \sqrt{n}, \quad \sigma = \frac{\bar{R}}{d_2}, \quad \sigma = \frac{\bar{R}}{c_2}, \quad \sigma' = \frac{\sigma}{c_s} \]

2. 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.

3. 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.

4. 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.

5. To plot the \( \bar{X} \), R & \( \sigma \) control charts from the observations of 120 drawings from the Shewhart Normal Bowl containing 998 chips having population parameters as \( \bar{X}' = 30 \) and \( \sigma' = 9.954 \), Take a subgroup size of 5.

6. To state and prove the Central Limit Theorem. Take 180 observations from the Shewhart’s Normal Bowl and take a sample size of 4.

7. 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%.

8. 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.

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**

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<td>Computational Fluid Dynamics Lab</td>
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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)
Paper: Database Management Systems Lab

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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:

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)  
**Paper:** Advanced Material Science and Metallurgy Lab  
**L** | **T/P** | **C**  
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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.
10. Study of corrosion and its effects.

**NOTE:** At least 8 Experiments out of the list must be done in the semester.
ADVANCED MANUFACTURING METHODS LAB

Paper Code: ETAT-455(ELECTIVE)  
Paper: Advanced Manufacturing Methods Lab  

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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.
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
Paper: Robotics

L T/P C
3 1 4

INSTRUCTIONS TO PAPER SETTERS:

MAXIMUM MARKS: 75
1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from question no. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

Objective: To introduce the foundations of robotics. Also, a course on Robotics must use one or more software to not only visualize the motion and characteristics of robots but also to analyze/synthesize/design robots for a given application.

UNIT - I
Fundamentals of Robot Technology:
Robot definition, automation and robotics, Robot anatomy, Work volume, Drive systems. Control systems and dynamic performance. Accuracy and repeatability. Sensors and actuators used in robotics. Machine Vision, Robot configurations, Path control. Introduction to robot languages. Applications; Types (Mobile, Parallel); Serial: Cartesian, Cylindrical, etc.; Social Issues

UNIT - II
Robot Kinematics: Mapping, Homogeneous transformations, Rotation matrix, Forward Kinematics (DH Notation) and inverse kinematics: Closed form solution.
Robot Differential Motion: Linear and Angular velocity of rigid link, Velocity along link, Manipulator jacobian, Statics: Use of jacobian.

UNIT – III
Robot Dynamics: Lagrangian Mechanics, Lagrangian Formulation and numercials. 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.

UNIT - IV
Typical applications of robots in material transfer, machine loading/unloading; processing operations; assembly and inspection.

Text Books:

Reference Books:
ENGINEERING SYSTEM MODELLING AND SIMULATION

Paper Code: ETME-402
Paper: Engineering System Modeling and Simulation

L T/P C
3 1 4

INSTRUCTIONS TO PAPER SETTERS:

MAXIMUM MARKS: 75

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

Objective: To introduce the students about the knowledge 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.
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.

UNIT – II
Mechanical Event Simulation (Finite Element modelling and Analysis):

UNIT – III
System Simulation:
Introduction, Review of probability and statistics, Managing the event calendar in a discrete event simulation model, Modelling input data.

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.

Text Book:

Reference Books:
[R2] Gordon, Geoffrey, System Simulation, PHI.
HUMAN VALUES & PROFESSIONAL ETHICS – II

Paper Code: ETHS-402
Paper: Human Values & Professional Ethics-II

INSTRUCTIONS TO PAPER SETTERS:

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.

MAXIMUM MARKS: 75

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:
   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.

UNIT II – Engineers responsibility for safety:
Some Case Studies: Case Studies, BHOPAL Gas Tragedy, Nuclear Power Plant Disasters, Space Shuttle Challenger, Three Mile Island Accident, etc.

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.

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**,

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.
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Business Ethics: Corporate Governance, Finance and Accounting, IPR.
Corporate Social Responsibility (CSR): Definition, Concept, ISO, CSR.
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Computer Ethics: Cyber Crimes, Data Stealing, Hacking, Embezzlement.

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**,
Text Books:
[T1] Professional Ethics, R. Subramanian, Oxford University Press.

References Books:
[R9] PSR Murthy, “Indian Culture Values and Professional Ethics”, BS Publications
[R10] Caroline Whitback< Ethics in Engineering Practice and Research, Cambriggs University Press
[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
Paper: Image Processing and Machine Vision

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:

[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.

[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:

Reference Books:
SOFT COMPUTING

Paper Code: ETIT-410
Paper: Soft Computing

INSTRUCTIONS TO PAPER SETTERS:

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.

MAXIMUM MARKS: 75

Objective: To understand the various concepts of neural networks and fuzzy logic.

UNIT-I
Neural Networks:

UNIT-II
Fuzzy Logic:

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.

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.

Text Books:

Reference Books:
TOTAL QUALITY MANAGEMENT

Paper Code: ETME-426
Paper: Total Quality Management

INSTRUCTIONS TO PAPER SETTERS:
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.

MAXIMUM MARKS: 75

Objective: To introduce the students about the knowledge of quality management, Cost quality and six-sigma concepts.

UNIT-I

[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

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

UNIT-IV

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

Text Books:

Reference Books:
APPLIED PLASTICITY

Paper Code: ETME-414
Paper: Applied Plasticity

L T/P C
3 0 3

INSTRUCTIONS TO PAPER SETTERS:

MAXIMUM MARKS: 75
1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 12.5 marks.

Objective: 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, Hencky’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:

Reference Books:
[R2] Johanson and Miller, Plasticity for mechanical Engineers, Van Nostrand.
[R3] Calladina, Engg Plasticity, Pergmean Press.

Scheme and Syllabi for B. Tech-Mechanical and Automation Engineering, 1st year (Common to all branches) w.e.f batch 2014-15 and (2nd, 3rd & 4th years) w.e.f batch 2013-14 approved in the 22nd BOS of USET on 30th June, 2014 and approved in the 37th AC Sub Committee Meeting held on 10th July, 2014.
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.

UNIT – II
Interactive Tools:
Graphic Aids:
Introduction, Geometric modifiers, Names, Layers, colors, grids, groups, Dragging and Rubber banding, Clipping, Problems.

Graphics Manipulation and Editing:

UNIT – III
Product design:

UNIT – IV
Product design:

Text Books:


References Books:

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**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.

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**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.

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**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 8259a, programming 8259, Interrupt examples – Printer, Real-Time Clock, PC Keyboard.

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**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.

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**Text Books:**

|----|---------------------------------------------------------------------|

**Reference Books:**

|----|---------------------------------------------------------------------|
GAS TURBINES AND COMPRESSORS

Paper Code: ETAT-432
Paper: Gas Turbines and Compressors

INSTRUCTIONS TO PAPER SETTERS:

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.

MAXIMUM MARKS: 75

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:

Reference Books
[R2] Gas Turbine Principles and Practice Cox Newnes
CRYOGENIC ENGINEERING

Paper Code: ETME-424
Paper: Cryogenic Engineering

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

UNIT-II

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

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.

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.

Text Books:
[T1] Randall Baron, Cryogenic System, Mc Graw Hill

Reference Books:
[R1] Russel B Scott, Cryogenic Engineering, Van Nostrand
RAPID PROTOTYPING

Paper Code: ETME-412
Paper: Rapid Prototyping

L  T/P  C
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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

Liquid Based and Solid Based Rapid Prototyping Systems

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

UNIT II
Powder Based Rapid Prototyping Systems

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

UNIT III
Reverse Engineering and Cad Modeling

[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]

REFERENCES:

Text Books:

References Books:

Scheme and Syllabi for B. Tech-Mechanical and Automation Engineering, 1st year (Common to all branches) w.e.f batch 2014-15 and (2nd, 3rd & 4th years) w.e.f batch 2013-14 approved in the 22nd BOS of USET on 30th June, 2014 and approved in the 37th AC Sub Committee Meeting held on 10th July, 2014.
FLEXIBLE MANUFACTURING SYSTEM

Paper Code: ETMT-428
Paper: Flexible Manufacturing System

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INSTRUCTIONS TO PAPER SETTERS:

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.

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.

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.

UNIT IV

Text Books:

Reference Books:
[R1] Ibrahim Zeid, R Sivsubramanian, CAD/ CAM Theory & Practice, MCGraw Hill.

Scheme and Syllabi for B. Tech-Mechanical and Automation Engineering, 1st year (Common to all branches) w.e.f batch 2014-15 and (2nd, 3rd & 4th years) w.e.f batch 2013-14 approved in the 22nd BOS of USET on 30th June, 2014 and approved in the 37th AC Sub Committee Meeting held on 10th July, 2014.
SUPPLY CHAIN MANAGEMENT - PLANNING

Paper Code: ETTE-424
Paper: Supply Chain Management - Planning

L  T/P C
3   0   3

INSTRUCTIONS TO PAPER SETTERS:
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.

MAXIMUM MARKS: 75

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

[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

[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

Reference Books:
PROCESS PLANNING AND COST ESTIMATION

Paper Code: ETAT-442
Paper: Process Planning and Cost Estimation

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

UNIT-II

UNIT-III

UNIT-IV

Text Books:

Reference Books:

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

UNIT-II

UNIT-III

UNIT-IV

Text Books:

Reference Books:
ROBOTICS LAB

Paper Code: ETMT-452
Paper: Robotics Lab

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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
Paper: Engineering System Modeling and Simulation Lab

List of Experiments:

A. Mechanical Event Simulation:

The students are exposed to simulating in CAD software in this lab (software can be choice of institute – such as PROE - wildfire 5 / PROE -CREO / NX / Solid Edge / solid works / Catia / any other.

1. Study assembly module on CAD software;
2. Simulate movement of cam and follower mechanism on CAD software;
3. Simulation of Spring Mass Damper System and do dynamic analysis on CAD software.
4. Perform FEM Analysis (using a simple 3D tetrahedron element) on a Simple model with pressure loading and surface constraints;

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)
Paper: Soft Computing Lab

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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.
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)  
Paper: Rapid Prototyping Lab  
L  T/P  C  
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 Selective laser sintering (SLS).
6. Study the Room temperature vulcanized (RTV) silicone molding.
7. Study the stereo lithography (STL) format and cubital facet list (CFL).
8. Study the spin casting, investment casting, abrading, metal spraying, and direct shell production casting (DSPC).
9. 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)  
Paper: Computer Aided Graphics and Product Design Lab  

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**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

**Paper Code:** ETME 456 (ELECTIVE)  
**Paper:** Applied Plasticity Lab  
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**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.
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.