SCHEME OF EXAMINATION

and

SYLLABI

for

Bachelor of Technology
Tool Engineering

Offered by

University School of Engineering and Technology

1st SEMESTER TO 8th SEMESTER

**GURU GOBIND SINGH
INDRAPRASTHA
UNIVERSITY**

Guru Gobind Singh Indraprastha University
Dwarka, Delhi – 110078 [INDIA]
www.ipu.ac.in

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

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

M: Mandatory for award of degree

#NUES (Non University Examination System)

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

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

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

M: Mandatory for award of degree

#NUES (Non University Examination System)

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

BACHELOR OF TECHNOLOGY
(TOOL ENGINEERING)
THIRD SEMESTER EXAMINATION

Code No.	Paper ID	Paper	L	T/P	Credits	Status
THEORY PAPERS						
ETME-209		Electrical Machines	3	0	3	
ETMA-203		Numerical Analysis and Statistical Techniques	3	1	4	M
ETME-205		Production Technology	3	1	4	M
ETME-207		Material Science and Metallurgy	3	0	3	M
ETME-201		Fluid Mechanics	3	1	4	
ETTE-211		Mechanics of Solids	3	1	4	
PRACTICAL/VIVA VOICE						
ETME-253		Electrical Machines Lab	0	2	1	
ETMA-253		Numerical Analysis and Statistical Techniques Lab	0	2	1	
ETTE-257		Mechanics of Solids and Fluids Lab.	0	2	1	
ETTE-259		Machine Drawing Lab.	0	3	2	
		NCC/NSS*	0	0	0	
TOTAL			**18**	**13**	**27**	

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

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BACHELOR OF TECHNOLOGY
(TOOL ENGINEERING)
FOURTH SEMESTER EXAMINATION

Code No.	Paper ID	Paper	L	T/P	Credits	Status
THEORY PAPERS						
ETAT-202		Theory of Machines	3	1	4	M
ETTE-204		Metal Forming	3	1	4	M
ETTE-206		Machine Tools	3	1	4	M
ETTE-208		Machine Element Design.	3	1	4	
ETTE-210		Thermal Science	3	1	4	
ETTE-212		Metrology and Quality Assurance	3	1	4	M
PRACTICAL/VIVA VOICE						
ETAT-252		Theory of Machine Lab.	0	2	1	
ETTE-252		Machine Tools Lab.	0	2	1	
ETTE-256		Machine Element Design Lab	0	2	1	
ETTE-258		Metrology and Quality Assurance Lab	0	2	1	
ETSS-250		NCC/NSS*	0	0	1	
TOTAL			18	14	29	

M: Mandatory for the award of degree.

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

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

BACHELOR OF TECHNOLOGY
(TOOL ENGINEERING)
FIFTH SEMESTER EXAMINATION

Code No.	Paper ID	Paper	L	T/P	Credits	Status
THEORY PAPERS						
ETTE-301		Production Planning and Control	3	1	4	
ETTE-303		CNC Machining and Programming	3	1	4	M
ETTE-305		Jigs, Fixture and Gauge Design	3	1	4	M
ETEL-307		Control Systems	3	1	4	M
ETTE-309		Plastic Technology	3	1	4	
ETHS 301		Communication Skills for Professionals	2	0	1	
PRACTICAL/VIVA VOICE						
ETTE-351		CNC Machining and Programming Lab.	0	2	1	
ETTE- 353		Jigs, Fixture and Gauge Design Lab	0	2	1	
ETEL-355		Control Systems Lab	0	2	1	
ETTE-357		Industrial Training*	0	0	1	
ETHS 351		Communication Skills for Professionals Lab	0	2	1	
TOTAL			17	13	26	

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 TE will be held after 5th semester; however, viva-voce will be conducted in 6th Semester (ETTE 360).

BACHELOR OF TECHNOLOGY
(TOOL ENGINEERING)
SIXTH SEMESTER EXAMINATION

Code No.	Paper ID	Paper	L	T/P	Credits	Status
THEORY PAPERS						
ETTE-302		Press Tool Design – I	3	1	4	M
ETME-304		Metal Cutting and Tool Design	3	1	4	M
ETTE-306		Mould Design-I	3	1	4	M
ETTE-308		Layered Manufacturing	3	1	4	
ETTE-310		Finite Element Method	3	1	4	
ETTE-312		Total Quality Management	3	1	4	
PRACTICAL/VIVA VOICE						
ETTE-352		Press Tool Design-I Lab	0	2	1	
ETME-354		Metal Cutting and Tool Design Lab	0	2	1	
ETTE-356		Mould Design-I Lab	0	2	1	
ETTE-358		Finite Element Method Lab	0	2	1	
ETTE-360		In-house training (two weeks)	0	0	1	
TOTAL			**18**	**14**	**29**	

M: Mandatory for award of degree

Note: Minimum of 4-6 weeks of industrial training related to TE will be held after 6th semester; however, viva-voce will be conducted in 7th Semester (ETTE 461).

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.

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BACHELOR OF TECHNOLOGY
(TOOL ENGINEERING)
SEVENTH SEMESTER EXAMINATION

Code No.	Paper ID	Paper	L	T/P	Credits
THEORY PAPERS					
ETTE-401		Press Tool Design – II	3	1	4
ETTE-403		Mould Design – II	3	1	4
ETTE-405		Computer Aided Graphics and Product Design	3	1	4
ELECTIVE-I(Choose any one)					
ETTE-407		Vibrations Engineering Design	3	0	3
ETMT-427		Operations Research	3	0	3
ETME-401		Automobile Engineering	3	0	3
ETTE-409		Creativity in Engineering	3	0	3
ETTE-415		Advanced Welding Technology	3	0	3
ETTE-417		Low Cost Automation	3	0	3
ETCS 425		Database Management Systems	3	0	3
ELECTIVE-II(Choose any one)					
ETEE 419		Renewable Energy Resources	3	0	3
ETME-421		Management Information Systems and ERP	3	0	3
ETTE-423		Value Engineering	3	0	3
ETTE-425		Material Management	3	0	3
ETTE-427		Concurrent Engineering	3	0	3
ETTE-429		Ergonomics	3	0	3
ETHS 419		Sociology and Elements of Indian History for Engineers	3	0	3
PRACTICAL/VIVA VOICE					
ETTE-451		Press Tool Design – II Lab	0	2	1
ETTE-453		Mould Design – II Lab	0	2	1
ETTE-455		Computer Aided Graphics and Product Design Lab	0	2	1
ETTE-457		Lab Based on Elective I or II	0	2	1
ETTE-459		Minor Project+	0	6	3
ETTE-461		Industrial Training#	0	0	1
TOTAL			**15**	**17**	**26**

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 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-Tool 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
(TOOL ENGINEERING)
EIGHTH SEMESTER EXAMINATION

Code No.	Paper ID	Paper	L	T/P	Credits
THEORY PAPERS					
ETTE-402		Advanced Die Casting and Die Design	3	1	4
ETTE-404		Modern Manufacturing Methods	3	1	4
ETHS-402		Human Values and Professional Ethics-II	1	0	1
ELECTIVE-III (Choose Any one from the following subjects)					
ETME-424		Cryogenic Engineering	3	0	3
ETTE-410		Theory of Design Optimization	3	0	3
ETMT-428		Flexible Manufacturing System	3	0	3
ETTE-414		Applied Plasticity	3	0	3
ETMT-402		Robotics	3	0	3
ETME-402		Engineering System Modeling and Simulation	3	0	3
ELECTIVE-IV (Choose Any one from the following subjects)					
ETTE-418		Project Management	3	0	3
ETIT-410		Soft Computing	3	0	3
ETTE-422		Industrial Management	3	0	3
ETTE-424		Supply Chain Management-Planning	3	0	3
ETTE-428		Safety Engineering	3	0	3
PRACTICAL/VIVA VOICE					
ETTE-452		Lab Based on Elective III or IV	0	2	1
ETTE-454		*Major Project	-	16	8
TOTAL			**13**	**20**	**24**

*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 15th November every year before end of seventh semester. New Electives may be added as per requirement after getting it duly approved by BOS and AC respectively.

NOTE:
1. The total number of the credits of (Tool Engineering) Programme = 215.
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. (Tool Engineering) Programme = 161.
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

ELECTRICAL MACHINES

		L	T/P	C
Paper Code: ETME-209		3	0	3
Paper: Electrical Machines				

Paper Code: ETME-209
Paper: Electrical Machines

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

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

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

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

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

Text Books:
[T1]   Electric Machinery, A Fitzgerald, Charles Kingsley, Stephen Umans, Tata McGraw Hill Education, 6th edition, 2002
[T2]   Electrical Machines, D P Kothari, I.J. Nagrath by Tata McGraw Hill Education, 2014

Reference Books:
[R1]   Electrical and Electronic Technology, Hughes Edward, Ian Mckenzie Smith, John Hiley, Pearson Education, 10th edition, 2010
[R2]   Electrical Engineering Fundamentals, Vincent Del Toro, Prentice-Hall, 2nd edition, 1989
[R3]   Introduction to Electrical Engineering, Mulukutla S. Sarma, Oxford University Press Inc., 2001
[R4]   Problems in Electrical Engineering: Power engineering and electronics with answers Partly Solved in S.I. Units: Parker Smith , CBS Publishers, 9th edition, 2003
[R5]   Basic Electrical Engineering, C.L.Wadhwa, New Age International, 2007.

NUMERICAL ANALYSIS & STATISTICAL TECHNIQUES

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

PRODUCTION TECHNOLOGY

	L	T/P	C
Paper Code: ETME-205			
Paper: Production Technology	**3**	**1**	**4**

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

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

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

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

UNIT - I
Moulding: Introduction to sand moulding, Pattern design, Pattern layout and construction, testing of moulding sand. moulding and core making machines, CO_2 - Process, fluid sand process, shell moulding, cold curing process, hot-box method, flask less moulding, Design of metal moulds, Die Design for die Casting.

[T1] [No. of Hrs: 10]

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

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

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

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

 UNIT - IV
Metal Forming: Introduction to Metal Forming, Elastic & plastic deformation, Hot working and cold working. Work required for forging, Hand, Power, Drop forging.
Analysis of wire drawing and maximum reduction. Tube drawing, Extrusion, types and its application. Rolling process, rolling mills & rolled-sections. Defects in metal forming processes. Sheet metal processes, shearing, calculation of punch force, shearing dies, stretch forming, Deep drawing and its analysis.

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

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

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

MATERIAL SCIENCE & METALLURGY

Paper Code: ETME-207	**L**	**T/P**	**C**
Paper: Material Science & Metallurgy	**3**	**0**	**3**

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

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

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

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

UNIT – I
Structure of metal: Crystal structure (BCC, FCC and HCP, Packing factor and density calculation), X-ray diffraction, miller indices, lattices, imperfections, elementary treatment of point and line defects and their relation to mechanical properties**.**
Diffusion: Diffusion mechanisms, steady state and non steady state diffusion, factors affecting diffusion
Deformation: Slip, twinning, effect of cold and hot working on mechanical properties, principles of recovery, re-crystallization and gain growth.
[T1,T2] [No. of Hrs. 11]

UNIT – II
Fracture: Types of fracture ductile and brittle, fatigue
Creep: Basic consideration in the selection of material for high and low temperature service, creep curve, effect of material variables on creep properties, brittle failure at low temperature.
Solidification: Phases in metal system, lever rule, solidification of metal and alloys, solid solution, eutectic, eutectoid and inter-metallic compounds, Iron carbon equilibrium diagram, TTT-diagram. Effect of alloying elements on TTT diagram, S-N curve.
[T1,T2][No. of Hrs. 13]

UNIT - III
Heat Treatment: Principles and purpose of heat treatment of plain carbon steels, annealing, normalizing, hardening, tempering, isothermal treatment, case hardening – carburizing, nitriding etc, precipitating hardening of aluminum alloys. Hardenability: determination of hardenability Jominy end quench test.
Materials: Plain Carbon steels, effect of alloying elements, properties, uses, springs, and wear resisting steels, IS standards codes for steels.
[T1,T3][No. of Hrs: 10]

UNIT - IV
Corrosion: Types of corrosion, Galvanic cell, rusting of Iron, Methods of protection from corrosion.
Fiber Reinforced Composites: General characteristics, Applications, Introduction to Fibers – glass, carbon, Kevlar 49 fibers. Matrix – Polymeric, Metallic, Ceramic Matrix, Coupling agents and fillers.
[T1,T3][No. of Hrs: 10]

Text Books:
[T1]   Callister "Materials Science and Engineering": An Introduction, 6th Edition
[T2]   Parashivamurthy K.I "Material Science and Metallurgy", Pearson,
[T3]   Sidney H Avner," Introduction to Physical Metallurgy", Tata McGraw-Hill,New Delhi-1997.

Reference Books:
[R1]   Degarmo E. Paul et.al, "Materials & Processes in Manufacture", Prentice Hall India, New Delhi, 2001.
[R2]   L. Krishna Reddi, "Principles of Engineering Metallurgy", New Age Publication, New Delhi, 2001.
[R3]   Buduisky et al, "Engineering Materials & Properties", Prentice Hall India, New Delhi, 2004.
[R4]   Peter Haasten, "Physical Metallurgy", Cambridge Univ. Press, 1996.
[R5]   Raymond A Higgin., "Engineering Metallurgy Part 1", Prentice Hall India, New Delhi, 1998

FLUID MECHANICS

	L	T/P	C
Paper Code: ETME -201			
Paper: Fluid Mechanics	3	1	4

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

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

UNIT- I
Fundamental Concepts of Fluid Flow: Fundamental definitions, Fluid properties, classification of fluids, Flow characteristics, Foundations of flow analysis, Incompressible and compressible fluids, one, two and three dimensional flows,
Pressure and its measurements: Pascal's law, pressure variation in a fluid at rest, Classification of different manometers.
Fluid Statics: Fluid pressure, Forces on solid surfaces, Buoyant forces, Metacentre and Metacentric height. Stability of floating bodies,
                                                    [T1, T2, R1, R2, R3] [No. of Hrs. 11]

UNIT- II
Kinematics of Fluid Flow: Types of fluid flow, streamline, path line and streak line; continuity equation, Equations for acceleration, Irrotational and rotational flow, velocity potential and stream function, Vortex flow, Continuity equation.
Dynamics of Fluid Flow: Control volume analysis, Eulers equation of motion, Bernoulli's equation, Bernoulli's theorems from steady flow energy equation, Venturi meter; Pitot tube, Momentum equation.
Laminar Flow: Reynold's experiment, Critical velocity, Steady laminar flow through a circular
tube, Measurement of viscosity.
                                                    [T1, T2, R1, R2, R3] [No. of Hrs. 11]

UNIT- III
Turbulent Flow: Shear stress in turbulent flow. Hydro dynamically smooth & rough boundaries.
Velocity distribution for turbulent flow in smooth and rough pipes.
Boundary Layer Flow: Boundary Layer Theory and Applications: Boundary Layer thickness, displacement, momentum and energy thickness, Flow separation, Drag and lift on immersed bodies.
Pipe Flow Systems: Darcy-Weisbach equation, Moody diagram, Energy losses in pipelines, concept of equivalent length, Flow between two reservoirs multiple pipe systems. Siphon.
                                                    [T1, T2, R1, R2, R3] [NO. of Hrs. 11]

UNIT- IV
Dimensional Analysis and Principles of Similarity: Buckingham's Theorem and its applications, Geometric, Kinematics and Dynamic similarity; Dimensionless numbers-Reynolds, Froude, Euler, Mach, Weber Number and their significance.
Flow Measurements: Measurement of flow using, orifice meter, nozzle, Measurement of flow in open channels – rectangular, triangular, trapezoidal weir, Cipoeletti weir. Hot-wire anemometer.
                                                    [T1, T2, R1, R2, R3][No. of Hrs. 11]

Text Books:
[T1]   R.K. Basal, "Fluid Mechanics & Hydraulic Machines", Laxmi Publications (P) Ltd.,2002.
[T2]   D.S. Kumar, "Fluid Mechanics and Fluid Power Engineering", S.K. Kataria & Sons, 2000.

Reference Books:
[R1]   I.H. Shames, "Mechanics of Fluids", Tata McGraw Hill
[R2]   V.L. Streeter and E.B. Wylie, "Fluid Mechanics", Tata McGraw Hill
[R3]   Modi, P.N., and Seth, S.H., "Hydrualics and Fluid Machines", Standard Book House,
[R4]   Vijay Gupta and S.K.Gupta, " Fluid Mechanics and its Applications", Wiley Eastern Ltd,
[R5]   Som, S.K. & Biswas G. : Introduction of fluid mechanics & Fluid Machines, TMH, 2000,

MECHANICS OF SOLIDS

		L	T	C
Paper Code: ETTE-211				
Paper: Mechanics of Solids		3	1	4

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

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

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

UNIT – I

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

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

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

UNIT – II

Simple bending: Shear force and bending moment diagrams of cantilevers, simply supported beams under concentrated, uniformly loaded and varying loads with and without overhangs.

Stresses in beams and cantilevers under bending, beam of uniform strength, bending due to eccentric loads. Shear stress in beams, strain energy, Castigliano's theorm

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

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

UNIT – III

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

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

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

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

UNIT – IV

Springs: Close-coiled springs, leaf springs.

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

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

Text Books:
[T1]   Dr. Sadhu Singh,"Strength of Materials", Khanna Pub.
[T2]   Hibbler R.C.,"Mechanics of Materials", Prentice Hall, New Delhi, 1994.

Reference Books:
[R1]   Sri Nath L.S. et.al., "Strength of Materials", McMillan, New Delhi,2001
[R2]   Timoshenko S.P., Gere J "Elements of Strength of Materials", East-West affiliated, New Delhi, 2000
[R2]   Bhavikatti S. S. Strength of Materials", Vikas Publishers
[R3]   Popov Eger P., "Engg. Mechanics of solids", Prentice Hall, New Delhi, 1998
[R4]   Fenner, Roger.T, "Mechanics of Solids", U.K. B.C. Publication, New Delhi, 1990

ELECTRICAL MACHINES LAB

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

<u>List of Experiments:</u>

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

EXP: 1 To study the magnetization characteristics of a separately excited D.C generator for different speeds
EXP: 2 To study the speed control of a d.c. shunt motor using

       A. Field current control method

       B. Armature control method

EXP: 3 To plot torque-speed characteristics and armature current characteristics of a D.C shunt motor.
EXP: 4 To determine the external or load characteristics of a D.C. shunt generator by actually loading the machine.
EXP: 5 To study 3-point/ 4-point starter for D.C. shunt motor.
EXP: 6

       A. To perform no load and short circuit test on a three-phase synchronous generator.

       B. Measure the resistance of the stator windings

       C. Find the voltage regulation at full load at (i) Unity power factor (ii) 0.85 power factor leading (iii) 0.85 power factor lagging by synchronous impendence method.

EXP: 7 To study the effect of variation of field current upon the stator current and power factor of a synchronous motor running at no load and half load, hence draw V and inverted V curves of the motor.
EXP: 8 To Perform no load and blocked rotor test on three-phase induction motor and draw its equivalent circuit.
EXP: 9 To perform load test on 3-phase induction motor and compute torque, output power, efficiency, input power factor and slip for various load settings. Plot the relevant graphs.
EXP: 10 Perform no load and blocked rotor test on single-phase induction motor.

Reference Books:
R1. Laboratory Operations for Rotating Electric Machinery and Transformer Technology, Donald V. Richardson, Prentice Hall, 1980
R2. Electric Machinery Experiments: Laboratory Practices and Simulation Studies, Sailendra Nath Bhadra, Alpha Science International Ltd, 2013

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

NUMERICAL ANALYSIS & STATISTICAL TECHNIQUES LAB

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

 List of Experiments:-

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

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

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

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

MECHANICS OF SOLIDS & FLUID LAB

	L	T/P	C
Paper Code: ETTE-257			
Paper: Mechanics of Solids & Fluid Lab	**0**	**2**	**1**

<u>**List of Experiment:**</u>

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

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

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

MACHINE DRAWING LAB

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

List of Experiments:

UNIT – I
Theory of Dimensioning & BIS Convention: Element of Dimensioning, Chain Dimensioning, Parallel Dimensioning, Coordinate Dimensioning, Dimensioning of the Common Features such as Diameter, Radii, Arcs, Angles, chamfers, etc. Conventional representation of Threads and threads parts, springs, Gears, Welded and riveted joints, Threaded fasteners, Sectional views and sectioning convention and other common features
[T1,T2][No. of Hrs. 10]

UNIT – II
Theory of Tolerances & Surface Charatersictics: Some basic définition, Tolérances including the grade and application, different types of tolerance, Fundamental Deviation, Fits and its types, basis and sélection. Basic terminology of GD&T, Tolerance characteristics and symbols Surface texture symbols & Surface lay indication.
[T1,T2][No. of Hrs. 10]

UNIT - III
Different Fastening Arrangement and Joints: various threads profiles bolt variety of foundation Bolts such as Hoop Bolt, Lewis Bolt, Rag Bolt, Keyed Joints, Cotter Joints, Knuckle Joints, Rigid coupling and flexible coupling.
[T1,T2][No. of Hrs. 10]

UNIT-IV
Assembly drawing of plumber block, Tool Post, tool holder, Tail stock, etc. Tool head and clapper box of shapper, Hand drill.A significant part of the drawing work should be done using CAD package (e.g., Autodesk, Solid Work, Pro-E etc).
[T1,T2][No. of Hrs. 13]

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

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

THEORY OF MACHINES

Paper Code: ETAT-202   **L**   **T/P**   **C**
Paper: Theory of Machines   **3**   **1**   **4**

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

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

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

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

UNIT –II
Cams: Classification, Cams with uniform acceleration and retardation, SHM, Cylcloidal motion, oscillating followers.
Gyroscopes: Gyroscopic law, effect of gyroscopic couple on automobiles, ships, aircrafts.
Dynamic Analysis: Slider-crank mechanism, Klein's construction, turning moment computations.

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

UNIT – III
Gears: Geometry of tooth profiles, Law of gearing, involute profile, cycloidal profile, interference, helical, spiral and worm gears, simple, compound gear trains. Epicyclic gear trains – Analysis by tabular and relative velocity method, fixing torque.
Governors & Flywheel: Hartnel, Porter governors – construction and working, Flywheel.

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

UNIT – IV
Balancing: Static and Dynamic balancing- balancing of revolving masses, single and multi-cylinder engines. Reciprocating masses –single cylinder engine.
Vibrations: Vibration analysis of single degree of freedom, natural, damped forced vibrations, based-excited vibrations, transmissibility ratio.

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

Text Books:
[T1]   S.S. Rattan, "Theory of Machines", Tata McGraw Hill,
[T2]   Ghosh A & Malik A K " Theory of Mechanisms and Machines" Affiliated East West Press

Reference Books:
[R1]   Shigley J E "Theory of Machines", Pearson
[R2]   Thomas Beven, "The Theory of Machines", CBS Publishers,
[R3]   Dr. V.P. Singh, "Theory of Machines", Dhanpat Rai & Co.(P)Ltd
[R4]   Malhotra & Gupta, "The Theory of Machine", Satya Prakashan,.
[R5]   P.L. Ballaney, "Theory of Machines & Mechanism", Khanna Publishers.

METAL FORMIMG

Paper Code: ETTE-204   **L   T/P   C**
Paper: Metal Forming   **3   1   4**

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

Objective: The objective of this course to provide a fundamental and quantitative understanding of the principles and practice of metals processing.

UNIT-I
Fundamentals of Metal Forming:
Classification of various Forming Process, Cold, Hot, and warm Forming, Component of Stresses, Principal Stresses, Stress Invariants, Mean stress, Stress Deviator, Mohr's Stress circles, Shear strain theory, strain measure, Elastic Stress-Strain Laws, Von-Mises Stress-strain rate law, Tresca yield criterion, Von-Mises yield criterion, Spring Back, residual stresses.
[T1, T2][No. of Hrs. 10]

UNIT-II
Forging and Rolling:
Forging: Introduction, forging machines, open-die forging, closed-die forging, Impression Die forging, Forging defects, calculation of forging loads in closed-die forging.
Rolling: Introduction, Hot and Cold Rolling, Evaluation of Roll force, Roll torque, mill horsepower, Limiting thickness and limiting reduction, cambering of rolls, In-Process changing of roll camber.
[T1, T2][No. of Hrs. 12]

UNIT-III
Extrusion:
Introduction, Direct Extrusion, Indirect Extrusion, Impact Extrusion, Hydrostatic Extrusion, Continuous Extrusion, Lubrication in Extrusion, Extrusion through curved Dies, Lubrication, Defects and irregularities in extrusion process, Extrusion force Calculation, Influence of friction.
[T1, T2] [No of Hrs. 10]

UNIT-IV
Sheet Metal Forming:
Cutting off, Blanking, Punching, and Piercing Processes, Compound & Progressive Dies, Fine Blanking, Nesting, Forces in Blanking, Bending, Deep drawing, Drawability of sheet metal, factors affecting drawability, Forming limit diagrams(FLD), Forming with Hydrostatics pressure.
[T1,T2] [No of Hrs. 10]

Text Books:
[T1]   Surender Kumar. "Technology of Metal forming processes", PHI Learning Private limited.
[T2]   B.L. Juneja, "Fundamental of Metal Forming Processes", New age International Publication.

Reference Books:
[R1]   Metal Hank Book Vol.14, "Forming and Forging", Metal Park, Ohio,USA, 1990
[R2]   Nagpal G.R. "Metal forming processes", Khanna publishers, 1995.

MACHINE TOOLS

Paper Code: ETTE-206	**L**	**T/P**	**C**
Paper: Machine Tools	**3**	**1**	**4**

INSTRUCTIONS TO PAPER SETTERS: MAXIMUM MARKS: 75

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

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

Objective: The objective of the paper is to facilitate the student with the basics of Conventional and special purpose machines and theirapplication 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-type of surface generated.
Cutting Motion in Machine tools, Elements of Machine Tools, Direction of operation of controls for Machine Tools, Characteristics and Maintenance of Machine Tools Applications.
                                                                                    [T1] [No. of Hrs: 10]

UNIT II
Lathe Machines: Working Principle, Classification of lathes, Description of various parts of Lathe, Specifications-method of holding work and supporting devices, accessories, attachments-operations and types of tools for each operation, Turning Problems, their causes and remedy, Capstan and Turret lathe.
Milling Machines: Types of general purpose milling machines: horizontal, vertical and universal, Principal parts, Types of milling cutters and their applications, different milling operations, work holding devices: vice, clamps, chucks, dividing head and its use, simple, compound and differential indexing. Indexing calculations and machining time calculations. Introduction to machining centers.
                                                                                    [T1,T2][No. of Hrs: 12]

UNIT III
Reciprocating Type Machine Tools: Shaper, Planer and Slotter: Constructional features, operations, basic machines and kinematics and related calculations
Drilling Machines: Types of drilling machines and their Construction, Specifications, feed mechanism, work holding devices, Tool – holding devices. Different drilling operations: Drilling, Micro-drilling, reaming, counter boring and countersinking etc., estimation of drilling time.
                                                                                    [T1, T2][No. of Hrs: 10]

UNIT IV
Grinding Machines: Different types of grinding machines: cylindrical, surface and centre-less grinding machines, basic constructional features and mechanisms, specifications, Selection of grinding wheels, Wheel Truing and Dressing, different grinding operations, honing, lapping, Buffing and Polishing and super-finishing processes.
Special Purpose Machines: Introduction and applications.
                                                                                    [T1,T2][No. of Hrs: 10]

Text Books:
[T1]   R.K. Jain, "Production Technology", Khanna Publishers, 1986.
[T2]   O.P.Khanna and M.Lal, "Production Technology", DhanpatRai publications, 2012.

Reference books:
[R1]   P.C. Sharma, "A TEXT BOOK of Production. Engineering", S. Chand, New Delhi, 2004.
[R2]   Bangalore HMT, "Production Technology", Tata McGraw Hill, 1980.
[R3]   S.F. KrarStevan F. and Check A.F., "Technology of M/C Tools", McGraw Hill Book Co., 1986.
[R4]   Kibbe Richard et al, "M/c Tool practices", Prentice HallI ndia, 2003.

MACHINE ELEMENT DESIGN

Paper Code: ETTE-208   **L**   **T/P**   **C**
Paper: Machine Element Design   **3**   **1**   **4**

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

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

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

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

UNIT - II
Design of Elements: screwed fastenings, bolted and riveted joints under direct and eccentric loads, initial tightening loads in bolts. Welded joints, strength of welded joints, eccentrically loaded joints, welded joints subjected to bending moment and torsion.
Translation screws: force analysis and design of various types of power screws,: screw jack,
C- clamp, toggle screw jack.

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

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

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

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

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

Text Books:
[T1]   Maleeve Hartman and O.P.Grover, "Machine Design", CBS Publication & Publishers
[T2]   V.B. Bhandari, "Machine Design", Tata McGraw Hill

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

THERMAL SCIENCE

Paper Code: ETTE-210	**L**	**T/P**	**C**
Paper: Thermal Science	**3**	**1**	**4**

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

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

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

UNIT – I
Basic concepts: Introduction to the Basic definitions of Engineering Thermodynamics. Thermodynamic systems : Closed, Open and Isolated systems. Microscopic and Macroscopic view. Intensive and Extensive properties. Zeroth law of Thermodynamics. Phase, State, Process, Cycle. Point functions and Path functions. Gas Laws and Equation of State. Work and Heat.
First Law of Thermodynamics: Introduction to First Law of Thermodynamics, Internal energy. Non flow processes, p-v diagrams. Concept of Flow work, Enthalpy. Analysis of steady flow and unsteady flow processes and their applications. Throttling process.
Second Law of Thermodynamics: Limitations of First law and necessity of Second Law of Thermodynamics, Kelvin Planck statement and Claussius statement, Reversible and Irreversible processes. Carnot cycle, Reversed Carnot cycle. Carnot's Theorem, Clausius inequality. Entropy, Change in Entropy during various processes and representations on t-s diagrams, Entropy principle, Entropy Generation.
                                         [T1, T2, T3, R1, R2, R3] [No. of Hrs. 12]

UNIT – II
Availability and Irreversibility : High grade and low grade energy. Available and unavailable energy. Dead state. Loss of available energy due to Heat transfer through a Finite temperature difference. Availability. Reversible work and Irreversibility. Availability in non flow systems and steady flow systems. Second law efficiency.
Thermodynamic Property Relations:. Maxwell Relations. Clapeyron Equation.
Properties of a Pure Substance: Phase equilibrium of a pure substance on t-v diagram. Normal boiling point of a Pure substance. Saturation states. Compressed liquid. p-v & p-t diagram of a pure substance. Saturated steam, Dry and saturated steam, Superheated steam. Use of Steam tables and Mollier diagram. Different processes of vapour on p-v and t-s diagrams. Measurement of Dryness fraction.
                                         [T1, T2, T3, R1, R2, R3] [No. of Hrs. 12]

UNIT - III:
Vapour Power Cycles : Carnot cycle. Simple Rankine cycle. Effect of various parameters on the efficiency of Rankine cycle. Reheat and Regenerative cycles.
                                         [T1, T2, T3, R1, R2, R3] [No. of Hrs. 10]

UNIT – IV
Gas Power Cycles: Carnot cycle, Otto cycle, Diesel cycle, Dual cycle, Stirling cycle, and Ericsson cycle.
Gas Turbines: Brayton cycle, Thermal refinements. Performance of Gas turbines, Combined cycle. Principles of Jet Propulsion. Turbojet and Turbo-prop engines, Rocket engines.
                                         [T1, T2, T3, R1, R2, R3] [No. of Hrs. 10]

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

Reference books:
[R1]   M.J. Moran & H.N. Shapiro "Fundamentals of Thermal Engineering" John Wiley & sons.
[R2]   C. P. Arora " Thermodynamics", McGraw Hill
[R3]   S L Somasundaram "Engineering Thermodynamics", New Age International Publishers.
[R4]   R. K. Rajput, "Engineering Thermodynamics", Lakshmi Publications
[R5]   Shiv Kumar, " Fundamentals of Thermal Engineering" Ane Books Pvt. Ltd.

METROLOGY AND QUALITY ASSURANCE

Paper Code: ETTE-212   **L**   **T/P**   **C**
Paper: Metrology and Quality Assurance   **3**   **0**   **3**

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

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

UNIT- I
Principles of measurement: Definition of Metrology, difference between precision and accuracy. Sources of errors: Controllable and Random Errors, Effects of Environment and Temperature, Effects of support, alignment errors, errors in measurement of a quality which is function of other variables. Introduction to Coordinate Measuring Machine (**CMM**).
Length Standards: Line standards, end standards and wavelength standards, transfer from line standards to end standards. Numerical based on line standards. Slip gauges – its use and care, methods of building different heights using different sets of slip gauges.
Limits, fits and Tolerances: Different types of fits and methods to provide these fits. Numerical to calculate the limits, fits and tolerances as per IS 919-1963. ISO system of limits and fits; Gauges and its types, limit gauges – plug and ring gauges. Gauge Design – Taylor's Principle, wear allowance on gauges. Different methods of giving tolerances on gauges.
[T1, T2][No. of Hrs. 12]

UNIT–II
Types of Inspection:-Inspection by Gauging: limit gauging, plug gauges, Ring gauges, position gauges Inspection by Measurement: Direct measurement such as Vernier Caliper, Vernier Height gauge, Vernier Depth gauge Outside Micrometer, Inside Micrometer, Depth Micrometer, Slip gauges (gauge blocks), length bars , Bevel protractor etc. Indirect Measurement such as Mechanical, optical, & pneumatic comparators, Angular Measurements- Sine bar, angle gauges, precision levels, Introduction to Autocollimator, Interferometers, NPL Flatness Interferometer etc.
[T1, T2][No. of Hrs. 11]

UNIT-III
Straightness and flatness: Feature inspection such as flatness, roundness, straightness, parallelism, etc. Surface texture, different types of irregularities, Measurement of various surface roughness parameters. Tomlinson surface meter, Taylor-Hobson talysurf.
Screw Thread Measurement: Error in threads, Measurement of elements of screw threads –major dia, minor dia, pitch, flank angle and effective diameter. Various thread gauges.
Gear Measurement: Gear terminology, measurement of gear thickness, Gear tooth vernier caliper Parkinson gear tester.
[T1, T2][No. of Hrs. 11]

UNIT – IV
Introduction to Quality Assurance: Need of quality, Aspects of quality, Quality specification, Quality function Shewhart's control charts for variables: X bar and R charts, operating characteristics curves, producer's risk, consumer's risk, Sampling inspection , single double and multiple sampling plan.
[T3][No. of Hrs. 10]

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

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

THEORY OF MACHINES LAB

Paper Code: ETAT-252   **L T/P C**
Paper: Theory of Machines Lab   **0 2 1**

List of Experiments:

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

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

MACHINE TOOLS LAB

Paper Code-ETTE–252	**L**	**T/P**	**C**
Paper: Machine Tools Lab	**0**	**2**	**1**

List of experiments:

1. Tool grinding (to provide tool angles) on tool-grinder machine.
2. Experiments on turning and facing on lathe
3. To perform step turning and thread cutting on lathe.
4. To perform taper turning operation on lathe
5. To perform knurling, drilling operation on lathe.
6. To study the characteristic features of Milling machine and shaper machine.
7. To perform Gear cutting on Milling machine.
8. Machining a block on shaper machine.
9. Finishing of a surface on surface-grinding machine.
10. Drilling holes on drilling machine and study of twist-drill.
11. Study of different types of tools and its angles & materials.
12. Experiment on jigs/Fixtures and its uses

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

MACHINE ELEMENT DESIGN LAB

Paper Code-ETTE–256   **L**   **T/P**   **C**
Paper: Machine Element Design Lab   **0**   **2**   **1**

List of Experiments:

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

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

METROLOGY & QUALITY ASSURANCE LAB

Paper Code: ETTE-258	**L**	**T/P**	**C**
Paper: Metrology & Quality Assurance Lab	**0**	**2**	**1**

List of Experiments:

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

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

PRODUCTION PLANNING AND CONTROL

Paper Code: ETTE-301   **L   T/P   C**
Paper: Production Planning and Control   **3   1   4**

INSTRUCTIONS TO PAPER SETTERS: **MAXIMUM MARKS: 75**
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.
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: This paper provides understanding of production planning, inventory control, human factors and ergonomics to the students.

UNIT-I
Introduction: Types and characteristics of production systems, Objective and functions of Production, Planning & Control, Place of production, Planning in Engineering, manufacturing organization.
Preplanning: Forecasting & Market Analysis. Factory Location & Layout, Equipment policy and replacement. Preplanning production, capacity planning, Related numericals.
[T1,T2] [No. of Hrs. 12]

UNIT-II
Production Planning: Aggregate Planning, MPS, Material Resource Planning, Selection of materials, methods, machines & manpower. Routing, Scheduling and Dispatching and its sheets & charts, Production Line Balancing. Related numericals.
[T1,T2] [No. of Hrs. 11]

UNIT-III
Production and Inventory Control: Progress control through records and charts. Types of inventories, Inventory Classification. Inventory Control under constraints Economic lot (batch) size. Trends in purchasing and store keeping, JIT production MRP II, comparison of Push & Pull systems, ERP, CAPPC.
[T1,T2] [No. of Hrs. 11]

UNIT-IV
Productivity: Importance, Productivity patterns, productivity measurements & ratios, improvement-maintenance process.
Human Factors & Ergonomics: Human abilities, Training & motivation safety programs, workplace design & working conditions.
[T1,T2] [No. of Hrs. 10]

Text Books:
[T1]   Eilon, "Elements of Production Planning & Control", Mcmillan
[T2]   Jain and Agarwal, "Production Planning & Control", Khanna Publishers

Reference Books:
[R1]   Buffa, "Operations Management", Wiley India
[R2]   J.L. Riggs, "Production System", Wiley India
[R3]   S.K. Mukhopadhyay, "Production Planning and Control Test and Cases", 2nd edition, PHI learning

CNC MACHINING & PROGRAMMING

		L	T	C
Paper Code: ETTE-303 | | 3 | 1 | 4 |
Paper: CNC Machining & Programming | | | | |

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: This paper provides understanding of working and applications of CNC Machines to the students.

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, Centralised lubrication systems.

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

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

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

UNIT III
Tooling for CNC machine: introduction, cutting tool materials, types of cutting tools for NC machines, tool selection, ISO specification of cutting tools, different clamping system in tool holders, tooling for milling, angle plates, CNC vices, work holding devices, clamps, rotary tables.

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

UNIT IV
CNC Program generation from CAD, CNC controller & motion control in CNC system. Application of CNC and recent advances in CNC machines, maintenance of CNC machine tools, CNC trainer, DNC.

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

Text Books:
[T1]   T. K. Kundra, P. N. Rao and N. K. Tiwari, "Numerical Control and Computer Aided Manufacturing" TMH
[T2]   P. Radhakrishnan, "Computer Numerical Control Machine & Computer Aided Manufacturing", New Academic Science Limited.

Reference Books:
[R1]   Tilak Raj, "CNC Technology & Programming", Dhanpat Rai publishing Company (P) ltd., N Delhi
[R2]   M. Adithan & B. S. Pabla, CNC Machines, New Age International Publishers, N Delhi
[R3]   Binit Kumar Jha, CNC Programming Made Easy, UBS Publisher's Distributors limited, N Delhi
[R4]   Krak S. & Gill A., "CNC Technology & Programming, Tata McGraw-Hill Publishing Co., N Delhi
[R5]   M. Lynch, "Computer Numerical Control for Machining, McGraw Hill

JIGS, FIXTURE & GAUGE DESIGN

Paper Code: ETTE-305	**L**	**T/P**	**C**
Paper: Jigs, Fixture & Gauge Design	**3**	**1**	**4**

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

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

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

Objective: The objective of this paper is to learn the student about the designing of jigs, fixture for various machining processes wildly used in tooling industries.

UNIT I
Introduction to locating and clamping devices, difference between jigs and fixture, advantages of jigs and fixture, materials used in jigs and fixture, locating principle, locating methods and devices, standard parts, clamping – analysis of clamping forces, tolerance and error analysis. Consideration of Safety factor while designing of Jig Fixture and Gauge.

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

UNIT II
Introduction to drill jigs, Economics of drill jig, General considerations in design drill jigs , types of drill jigs , Drill bushings, Method of constructions , clearance – handling clearance, swarf and cutting fluid clearances, burr grooves Methods of inserting bushes, Design Drill jigs for given components, Drill jigs and modern manufacturing.

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

UNIT III
Introduction to fixtures, Economics of fixtures, Types of fixtures & Application – overview, Vise fixtures, milling fixtures , Boring fixtures, broaching fixtures , Lathe fixtures, grinding fixtures, welding fixture , indexing fixture, Design of fixtures for the given components.

[T1][No. of Hrs.: 08]

UNIT IV
Gauge design : introduction, Types of gauges, gauges tolerance , selection of materials for gauges. Taylors principle, ideal gauge. Design of Positional gauges, Indicator, Flush pin and Receiver gauges. Case studies of gauges for selected components.

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

Text Books :
[T1]   P H Joshi, "Jigs and Fixture", Tata McGraw Hill, 2006.
[T2]   P.C. Sharma, "A Text Book of Production Technology", S. Chand, 2007

Reference Books:
[R1]   Kempster, "Introduction to Jigs & Tool Design", Viva Books Pvt. Ltd,1998.
[R2]   Cyryll Donaldson, George H.Lecain, V.C. Goold, "Tool Design", Tata Mcgraw Hill, 2002.

CONTROL SYSTEMS

Paper Code: ETEL-307 L T/P C
Paper: Control Systems 3 1 4

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

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

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

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

UNIT I : Control Systems - - Basics & Components
Introduction to basic terms, classifications & types of Control Systems, block diagrams & signal flow graphs. Transfer function, determination of transfer function using block diagram reduction techniques and Mason's Gain formula. Control system components: Electrical/ Mechanical/Electronic/A.C./D.C. Servo Motors, Stepper Motors, Tacho Generators, Synchros, Magnetic Amplifiers, Servo Amplifiers,
[T1,T2][No. of Hrs. : 11]

UNIT II : Time – Domain Analysis
Time domain performance specifications, transient response of first & second order systems, steady state errors and static error constants in unity feedback control systems, response with P, PI and PID controllers, limitations of time domain analysis.
[T1,T2][No. of Hrs. : 10]

UNIT III : Frequency Domain Analysis
Polar and inverse polar plots, frequency domain specifications and performance of LTI systems, Logarithmic plots (Bode plots), gain and phase margins, relative stability. Correlation with time domain performance closes loop frequency responses from open loop response. Limitations of frequency domain analysis, minimum/non-minimum phase systems.
[T1,T2][No. of Hrs. : 10]

UNIT IV : Stability & Compensation Techniques
Concepts, absolute, asymptotic, conditional and marginal stability, Routh–Hurwitz and Nyquist stability criterion, Root locus technique and its application.
Concepts of compensation, series/parallel/ series-parallel/feedback compensation, Lag/Lead/Lag-Lead networks for compensation, compensation using P, PI, PID controllers.
[T1,T2][No. of Hrs. : 11]

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

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

PLASTIC TECHNOLOGY

		L	T/P	C
Paper Code: ETTE-309		3	1	4
Paper: Plastic Technology				

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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Objective: The objective of the paper is to facilitate the student with the basics of plastic properties, end use application of different plastic materials and the selection of processing techniques.

UNIT I
Introduction to Polymer Science : Concept of Monomer and Polymer, Classification of polymer, Types of Polymerization, Polymerization techniques, Molecular Weight and Degree of Polymerization, Molecular weight distribution, Number average and Weight average molecular Weight , Effect of Molecular Weight, linearity, non linearity, crystallinity and polarity of polymer on properties, Glass Transition Temperature.
[T1][No. of Hrs: 10]

UNIT II
Plastic Materials:- Introduction to Plastic Materials, General properties and applications of plastics – Polyethylene , Polypropylene, Polyvinyle Chloride, polystyrene, Acrylonitrile Butadiene Styrene, Polyamides (Nylon 66), Polycarbonates, Polyacetals, Polyurethanes , Phenolic Resins and Melamine Resins.
[T1][No. of Hrs: 10]

UNIT III
Additives and compounding of plastics: Functions and Working Mechanism- fillers, antioxidants, thermal stabilizers, lubricants, plasticizers, toughening agents, colourants, fire retardants, blowing agents, ultraviolet stabilizers, Impact Modifier, Antistatic Agents, Processing Aids and compounding of plastics.
[T1][No. of Hrs: 10]

UNIT IV
Plastic Processing Techniques
Injection Moulding: Introduction, injection moulding for thermoplastic, Machine types , injection moulding machines specifications - projected area, plasticizing capacity, shot weight, Day light, mould clamping system – toggle and hydraulic system. Common moulding defects, causes and remedies.
Extrusion: Introduction, Types of extruders, extrusion screw design features, breaker plate–screen pack & its functions, extrusion faults - causes and remedies.
Compression moulding & Transfer Moulding: General description of Compression and Transfer moulding and its application in the processing of thermosetting materials. Faults, Causes & Remedies.
Blow moulding: Introduction to blow moulding, Types of blow moulding operations, concept of extrusion blow moulding and injection blow moulding.
[T1,T2] [No. of Hrs: 12]

Text Books:
[T1]   Premamoy Ghosh, "Polymer Science and Technology, Plastics, Rubbers, Blends and Composites", McGraw Hill Education (India) Private Limited, 2013.
[T2]   M. Berins, "Plastics Engineering Handbook of the Society of the Plastics Industry", Springer, 1991.

Reference books:
[R1]   Irvin I. Rubin," Handbook of plastic materials and technology" New York: Wiley, 1990.
[R2]   Harper, "Handbook of Plastic Processes", MGH Publication, 2006.
[R3]   J.P. Beaumont, R. Nagel, R. Sherman, "Successful Injection Molding: Process, Design and Simulation", Hanser Gardner Publications, 2002 .
[R4]   Schwartz & good man "Plastics materials and processing" Van Nostrand Reinhold, New York, 1982.

COMMUNICATION SKILLS FOR PROFESSIONALS

	L	T/P	C
Paper Code: ETHS-301			
Paper: Communication Skills for Professionals	2	0	1

INSTRUCTIONS TO PAPER SETTERS: MAXIMUM MARKS: 75

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

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

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

UNIT I
Organizational Communication: Meaning, importance and function of communication, Process of communication, Communication Cycle - message, sender, encoding, channel, receiver, decoding, feedback, Characteristics, Media and Types of communication, Formal and informal channels of communication, 7 C's of communication, Barriers to communication, Ethics of communication (plagiarism, language sensitivity)
Soft Skills: Personality Development, Self Analysis through SWOT, Johari Window, Interpersonal skills -Time management, Team building, Leadership skills. Emotional Intelligence.Self Development and Assessment- Self assessment, Awareness, Perception and Attitudes, Values and belief, Personal goal setting, Career planning, Self esteem.

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

UNIT II
Introduction to Phonetics: IPA system (as in Oxford Advanced Learner's Dictionary), Speech Mechanism, The Description of Speech Sounds, Phoneme, Diphthong, Syllable, Stress, Intonation, Prosodic Features; Pronunciation; Phonetic Transcription - Conversion of words to phonetic symbols and from phonetic symbols to words. British & American English (basic difference in vocabulary, spelling, pronunciation, structure)
Non-Verbal Language: Importance, characteristics, types – Paralanguage (voice, tone, volume, speed, pitch, effective pause), Body Language (posture, gesture, eye contact, facial expressions), Proxemics, Chronemics, Appearance, Symbols.

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

UNIT III
Letters at the Workplace – letter writing (hard copy and soft copy): request, sales, enquiry, order, complaint. Job Application -- resume and cover letter
Meeting Documentation-- notice, memo, circular, agenda and minutes of meeting.
Report Writing - Significance, purpose, characteristics, types of reports, planning, organizing and writing a report, structure of formal report. Writing an abstract, summary, Basics of formatting and style sheet (*IEEE Editorial Style Manual)*, development of thesis argument, data collection, inside citations, bibliography; Preparing a written report for presentation and submission. Writing a paper for conference presentation/journal submission.

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

UNIT IV
Listening and Speaking Skills: Importance, purpose and types of listening, process of listening, difference between hearing and listening, Barriers to effective listening, Traits of a good listener, Tips for effective listening. Analytical thinking; Speech, Rhetoric, Polemics; Audience analysis. Telephone Skills - making and receiving calls, leaving a message, asking and giving information, etiquettes.
Presentations: Mode, mean and purpose of presentation, organizing the contents, nuances of delivery, voice and body language in effective presentation, time dimension.
Group Discussion: Purpose, types of GDs, strategies for GDs, body language and guidelines for group discussion.
Interview Skills: Purpose, types of interviews, preparing for the interview, attending the interview, interview process, employers expectations, general etiquettes.

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

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

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

CNC MACHINING & PROGRAMMING LAB

Paper Code: ETTE-351   **L   T/P   C**
Paper: CNC Machining & Programming Lab   **0   2   1**

<u>**List of Experiments:**</u>

1. Study of Graziano CNC lathe- programming codes – programs for simple components using linear interpolation, circular interpolation; study of tools & zero offsets.
2. Study of Duplo-standard CNC lathe – programming codes- programs for simple components using linear interpolation, circular interpolation ; study of tools & zero offsets.
3. Create a part program for component using canned cycles on Graziano or Duplo-standard CNC lathe for internal drill, boring & simulate in the software.
4. Create a part program for component using cycles of thread cutting and grooving operation on Graziano or Duplostandard CNC lathe & simulate in the software.
5. Absolute programming – Incremental programming – mixed programming for   component   on Graziano or Duplostandard CNC lathe & simulate in the software.
6. Create a part program for step turning & simulate in the software using G90 cycle of FANUC control.
7. Create a part program for multiple turning operations & simulate in the software using stock removal cycle and finishing cycle G71, G70 of FANUC control.
8. Study of RAMBAUDI copy milling VMC with FAGOR control – programming codes.
9. Study of NOVAR CNC milling machine with Heidenhain control–programming method.
10. Study of MCM horizontal machining center – programming codes – programs   for   simple   profiles using linear interpolation, circular interpolation – simulation   – Absolute & Incremental programming – machining.
11. Create a part program on MCM HMC for mirroring, Scaling, Rotation & simulate in software using sub-program & main program.
12. Create a part program on MCM HMC using Parametric programming method for engraving a profile on the top of a surface.

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

JIGS, FIXTURE & GAUGE DESIGN LAB

	L	T/P	C
Paper Code: ETTE-353	**0**	**2**	**1**
Paper: Jigs, Fixture & Gauge Design Lab			

List of Experiments:

1. Study of various elements and functions of jigs and fixture.
2. Study of various locating methods for plane, profile and cylinder surfaces.
3. Study of different types of clamps used in jigs and fixture.
4. Study of different types of bushes and their materials.
5. Design of plate jig.
6. Design of angle plate jig.
7. Design of leaf or latch jig
8. Design of milling fixture
9. Design of grinding fixture
10. Design of turning fixture
11. Design of broaching fixture

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

CONTROL SYSTEMS LAB

Paper Code: ETEL-355	**L**	**T/P**	**C**
Paper: Control Systems Lab	**0**	**2**	**1**

<u>**List of Experiments:**</u>

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:

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

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

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

PRESS TOOL DESIGN- 1

Paper Code: ETTE-302	L	T/P	C
Paper: Press Tool Design- 1	3	1	4

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

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

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

Objective: The objective of this paper is to learn the student about industrial sheet metal design depends upon the shape of various sheet metal components.

UNIT I
Principles of Blanking and Piercing Dies: Basic Blanking or piercing operation, Shearing Theory, Analysis of cutting force and stripping force, calculation of press tonnage, Designing of cutting clearance. Method of reducing the cutting force, Function of screw hole and dowel holes, Die and Punch life**.**
                                                           [T1, T2] [No. of Hrs: 10]

UNIT II
Introduction to various parts of Blanking and Piercing Dies: Functions, types and construction of Punches, Punch Plate, Die Plate, stripper plate, Top Plate, Shank, Guide pillar, Guide Bushes, gages , Stock guides ,Die stops, Nest Gages and Pushers, Stock material utilization and strip layouts. Materials selection and used for above referred parts. Selection of Presses, Types of Die Sets, Selection of Spring.
                                                           [T1, T2] [No. of Hrs: 12]

UNIT III
Designing of Shearing Tools: Design of blanking, Piercing Dies, Clearance and corner radii, Basic of shedder and Knockouts arrangement, Types and function of Pilots.
                                                           [T1, T2] [No. of Hrs: 12]

UNIT IV
Introduction and Design of Bending Dies: Basic of Bending, bending stress, bend allowance curve, estimating Flat Blank lengths, Introduction to Bending Dies to produce V,L and U shaped Bend components, Grain direction, Spring back effect, calculation of bending force and pad force, Design of Bending Dies.
                                                           [T1, T2] [No. of Hrs: 10]

Text Books:
[T1]   Ostergaard, "Basic Die Making", MGH, New York, 1993.
[T2]   P.H. Joshi, "Press Tool Design and Construction", Wheeler Publishing, Delhi, 2000.

Reference Books:
[R1]   Joshi, "Machine Tools Handbook : Design and Operation", McGraw Hill, 2008
[R2]   J.R.Paquin, Die Design Fundamental", Industrial Press, Inc. New York, NY, USA, 2005
[R3]   Vukota Boljanovic,"Sheet Metal Stamping Dies: Die Design and Die-Making Practice", Industrial Press, Inc. New York, NY, USA
[R4]   Oehler, "Hydrualic Presses", Arnold Press, 1968.
[R5]   Ghosh and Mallik,"Manufacturing Science", East West Publications.

METAL CUTTING & TOOL DESIGN

Paper Code: ETME-304	**L**	**T/P**	**C**
Paper: Metal Cutting & Tool Design	**3**	**1**	**4**

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

Objective: The objective of the paper is to facilitate the student with theories in metal cutting technology and design aspects of Jigs fixtures and tooling in use today and its application in different type of Industries.

UNIT - I
Introduction: Definition of feed, depth of cut and cutting speed. Concept of specific cutting energy in metal cutting and Numerical based on calculation of machining time on lathe, drilling machine, shaper, milling machine and grinding machines considering specific cutting energy of materials.
Theory of Metal Cutting: Orthogonal and oblique cutting, tool geometry (ASA & ISO), types of chips, Factors affecting the chip formation, Cutting forces in orthogonal cutting and their measurement, Merchant circle and derivation of relationships between the cutting forces, chip thickness ratio, shear angle, stress and strain in the chip, work done and power required in metal cutting and 'size effect', apparent mean shear strength of work material.
[T1,T2][No. of Hrs. 11]

UNIT - II
Ernst Merchant Theory: Ernst Merchant Theory, its assumptions and modifications. Relationship between cutting velocity, shear velocity and chip flow velocity. Mechanism of friction at chip-tool interface. Numericals based on metal-cutting. Lee & Shafer Theory – slip line method, determination of shear angle by Mohrs circle.
Heat Generation in Metal Cutting: Heat generation and temperature distribution in metal cutting. Calculation of temperature in primary and secondary deformation zones and their measuring methods.
[T1,T2][No. of Hrs. 11]

UNIT - III
Machinability: Machinability and its criteria, forms of tool-wear in metal cutting, tool-life and its criteria, effect of different cutting parameters on tool-life. Economics of machining and numericals. Cutting fluids, their physical action and applications.
Grinding: Specifications of grinding wheel, Mechanics of grinding, effect of grinding conditions and type of grinding on wheel behaviour, equivalent diameter of grinding wheel.
[T1,T2][No. of Hrs. 11]

UNIT - IV
Cutting Tool Design: General considerations, study of angle for single point cutting and drill. Principles of different cutting tool materials and their important characteristics. Geometry of a drill. Basic principles of design of a single point and multiple point tools i.e broaches and twist drill.
Jigs & Fixtures: Important considerations in jigs and fixture design. Main principles of designing of jigs & fixtures, elements of Jigs and fixtures. Different devices and methods of locations. Different types of clamps used in jigs & fixtures.
[T1,T2][No. of Hrs. 11]

Text Books:
[T1]   B.L. Juneja, G. S. Sekhon, Nitin Seth" Fundamental of Metal Cutting and Machine Tools", New Age International 2nd edition,
[T2]   P. H. Joshi" Jigs and Fixtures", 2nd Edition TMH

Reference Books:
[R1]   Geoffrey Boothroyd, "Fundamentals of Metal Machining & Machine Tools", TMH
[R2]   P.N. Rao, "Manufacturing Technology", Tata McGraw Hill Publication Ltd.
[R3]   B.J. Ranganath, "Metal Cutting & Tool Design" Vikas Publishing House Pvt. Ltd
[R4]   A.B. Chattopadhyay "Machining and Machine Tools" Wiley India
[R5]   G.K. Lal "Introduction to Machining Science", New age International.

MOULD DESIGN-I

Paper Code: ETTE-306   **L**   **T**   **C**
Paper: Mould Design–I   **3**   **1**   **4**

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

Objective: The objective of this paper is to learn the student about industrial mould design depend upon the shape of various plastics components, related to injection moulding techniques.

UNIT I
Injection Mould design concepts:
Introduction, Basic terminology ,Bolsters and its types, guide pillars and guide bushes, mould plate fastening, attachment of mould to platen, concept of design, design principles, types of moulds, construction of core and cavities, consideration of safety factor while designing.

[T1][No. of Hrs: 12]

UNIT II
Ejection and Feed system:
Ejection, ejection techniques, ejection from fixed half. ejection grid design, ejector plate assembly, return system,
Types of gates, position of gate, gate balancing, runner, runner cross sectional shape, efficiency of various runner profiles. Rising, Razor design and its placements.

[T1][No. of Hrs: 10]

UNIT III
Parting surface and Mould temperature control:
Parting line, stepped parting line, irregular parting surface, angled surface, local stepped and profile parting surface, complex edge forms, venting.
Mould cooling methods – integral cooling circuit, baffle cooling, spiral insert cooling, cooling through heat pipes, heat rods and its applications. Plugs, o-rings, Mould temperature, melt temperature, heat removal, re - calculation of filling and cooling time, case studies.

[T1][No. of Hrs: 12]

UNIT IV
Product design:
Product design concepts – size, shape, function, aesthetics, life, tooling aspects on product design, process variables Vs product design, product design thumb rules for plastics, cost reduction through product design concepts, design of external, internal undercuts, side openings, hinges, design of ribs, bosses, molded holes. case studies.

[T2] [No. of Hrs: 10]

Text Books:
[T1]   R.J.W. Pye, "Injection Mould Design", Affiliated East West Press, Delhi, 2000.
[T2]   Beck, Ronald D, "Plastic Product Design" Van Nostrand Reinhold Company, 1970.

Reference books:
[R1]   Rosato, "Injection Molding HandBook", CBS Publishers, Delhi, 1987.
[R2]   Irvin I Rubin, "Injection Moulding Theory & Practice", John Willey, 1972.

LAYERED MANUFACTURING

Paper Code: ETTE-308   L   T/P   C
Paper: Layered Manufacturing   3   1   4

<table>
<tr><td>INSTRUCTIONS TO PAPER SETTERS:</td><td>MAXIMUM MARKS: 75</td></tr>
</table>

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 RP systems, types of machines, lamination of object manufacturing, rapid tooling, software for RP and other various process related to layered manufacturing.

UNIT I
Introduction: Need for the compression in product development, history of RP systems, survey of applications, growth of RP industry, classification of RP systems.
Fused Deposition Modeling: Principle, process parameters, path generation, applications
Selective Laser Sintering: Types of machines, principles of operation, process parameters, data preparation for SLS, applications.
Stereolithography Systems: Principle, process parameters, process details, data preparation, data files and machine details, applications.
                                                                       [T1,T2] [No. of Hrs: 11]

UNIT II
Laminated Object Manufacturing: Principle of operation, LOM materials, process details, applications.
Solid Ground Curing: Principle of operation, machine details, applications
Laser Engineered Net Shaping (LENS): Net shaping development at Sandia National Lab.
Concept Modelers: Principle, Thermo jet printer, Sander's model market, 3-D printer, Genisys Xs printer, JP system 5, object quadra system.
                                                                       [T1,T2] [No. of Hrs: 11]

UNIT III
Rapid Tooling: Indirect rapid tooling - silicone rubber tooling, aluminum filled epoxy tooling, spray metal tooling, cast Kirksite, 3D Keltool, etc., direct rapid tooling - direct AIM, quick cast process, copper polyamide, rapid tool, DMILS, prometal, sand casting tooling, laminate tooling, soft tooling Vs hard tooling.
Software for RP: STL files, overview of solid view, magics, mimics, magics communicator, etc., internet based softwares, collaboration tools.
                                                                       [T1,T2] [No. of Hrs: 11]

UNIT IV
Rapid Manufacturing Process Optimization: Factors influencing accuracy, data preparation errors, part building errors, errors in finishing, influence of part build orientation.
Allied Processes: Vacuum casting, surface digitizing, surface generation from point cloud, surface modification, data transfer to solid models.
                                                                       [T1,T2] [No. of Hrs: 11]

Text Books:
[T1]   Pham D T and Dimov S S, "Rapid Manufacturing", Verlag, 2001.
[T2]   Paul F Jacobs, "Stereo lithography and other RP&M Technologies", SME, 1996.

Reference Books:
[R1]   Terry Wohlers, "Wohlers Report 2001", Wohlers Associates, 2008.
[R2]   FDM Maxum User Guide.
[R3]   FDM 1650 User Guide.
[R4]   Sinterstation 2500 plus System User Guide.
[R5]   MK-Technology Gmbh. System User Guide.

FINITE ELEMENT METHODS

Paper Code: ETTE-310   **L**   **T/P**   **C**
Paper: Finite Element Methods   **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 objectives of the subject are to equip the students with the Finite Element Analysis fundamentals. The study of this subject is also enabling the students to formulate the design problems into FEA and introduce basic aspects of finite element technology.

UNIT – I
Basic of Finite Element Method, Variational calculus, Integral formulation, variational methods: Methods of weighted residuals, Approximate solution using variational method, Modified Galerkin method, Boundary conditions

Basic Finite Element Concepts: Basic ideas in a finite element solution, General finite element solution procedure, Finite element equations using modified Galerkin method, Axis symmetric Problems

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

UNIT II
Discrete System:
Axial spring element, Axial bars, Torsion bars, Application in Heat transfer and Solid Mechanic Problems, Plane truss problem, software application ANSYS etc

Beam: Euler Beam element and its application.

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

UNIT III
Eigen value problems: Formulation and problems

Single value problem in 2D: Boundary value problem, axis symmetric problems

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

UNIT IV
Numerical on 2D Solid mechanics
Interpolation function (triangular, Quadrilateral, serendipity elements), numerical integration and modelling consideration.

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

Text Books:
[T1]   J N Reddy "An Introduction to finite element method" Tata Mc Graw Hill 3rd edition
[T2]   S.S. Rao, "Finite Element Method In Engineering", Pergaman Press

Reference Books:
[R1]   O.C. ZienKiewicz, "The Finite Element Method", Tata McGraw Hill
[R2]   Larry J. Segerlind, "Applied Finite-Element Analysis", John Wiley and Sons
[R3]   Kenneth H. Huebner, "Finite Element Method for Engineers", John Wiley and Sons
[R4]   Darell W. Pepper, J.C Heinrich "The Finite Element Method" CRC press
[R5]   V.Ramamurti "Finite Element Method in Machine Design"Norosa Publishing House.

TOTAL QUALITY MANAGEMENT

Paper Code: ETTE– 312　　　　　　　　　　　　　　　　　　**L**　　**T/P**　　**C**
Paper: Total Quality Management　　　　　　　　　　　　　**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 quality management in the industries, basic concepts of quality management and strategic planning to get quality in production.

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

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

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

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

UNIT – III
The seven traditional tools of quality – New management tools – Six-sigma: Concepts, methodology, applications to manufacturing, service sector including IT – Bench marking – Reason to bench mark, Bench marking process – FMEA – Stages, Types.
Quality circles – Quality Function Deployment (QFD) – Taguchi quality loss function – TPM – Concepts, improvement needs – Cost of Quality – Performance measures.

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

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

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

Text Books:
[T1]　　Janakiraman, B and Gopal, R.K, "Total Quality Management – Text and Cases", Prentice Hall (India) Pvt. Ltd., 2006.
[T2]　　Dale H.Besterfiled, et at., "Total Quality Management", Pearson Education Asia

Reference Books:
[R1]　　James R. Evans and William M. Lindsay, "The Management and Control of Quality", 6th Edition, South-Western (Thomson Learning), 2005.
[R2]　　Oakland, J.S., "TQM – Text with Cases", Butterworth – Heinemann Ltd., Oxford, 3rd Edition
[R3]　　Suganthi,L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd.,2006

PRESS TOOL DESIGN-I LAB

Paper Code: ETTE-352   **L**   **T/P**   **C**
Paper: Press Tool Design - I Lab   **0**   **2**   **1**

List of Experiments:

1. Design of Blanking Die with fixed stripper having lower plan view, upper plan view given any blank shape.
2. Sections of assembly of Blanking Die with fixed stripper for given blank shape.
3. Detailing, Ballooning and BOM of Die with fixed stripper for given blank shape.
4. Design of Blanking Die with moving stripper having lower plan view, upper plan view given any blank shape.
5. Sections of assembly of a Blanking Die with moving stripper for a given blank shape.
6. Detailing, Ballooning and BOM of a Blanking Die with moving stripper for a given blank shape.
7. Design of Piercing Die having lower plan view, upper plan view given any piercing shape component.
8. Sections of assembly of a piercing Die for a given piercing shape component
9. Detailing, Ballooning and BOM of a piercing Die for a given piercing shape component
10. Design of 'V' Bending Die having lower plan view, upper plan view given any V shape bend component.
11. Sections, Detailing, Ballooning and BOM of the same V Bending Die given in Sr.No.-10.
12. Design of 'U' Bending Die having lower plan view, upper plan view, section given any U shape bend component BOM of the parts.

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

METAL CUTTING & TOOL DESIGN LAB

Paper Code: ETME-354   **L   T/P   C**
Paper: Metal Cutting & Tool Design Lab   **0   2   1**

List of Experiments:

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

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

MOULD DESIGN-I LAB

Paper Code: ETTE-356		**L**	**T/P**	**C**
Paper: Mould Design-I Lab		**0**	**2**	**1**

<u>**List of Experiments:**</u>

1. Study of basic elements of two plate mould design
2. Study and design of different types of gates used in injection moulding.
3. Design and study of Different types of runners.
4. Study the working principle of ejector plate assembly
5. Study the working principle of different types of ejector pins.
6. Design of integer core/cavity cooling circuit.
7. Design of insert core/cavity cooling circuit.
8. Study of heat pipe/heat rod method for conducting heat from core/cavity of injection mould.
9. Study and design the layout of gate and runner balancing.
10. Study of injection moulding machine.
11. Study the defects and remedies of injection moulded parts.

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

FINITE ELEMENT METHODS LAB

Paper Code: ETTE-358   **L**   **T/P**   **C**
Paper: Finite Element Methods Lab   **0**   **2**   **1**

Finite Element Methods Lab Experiments based on ETTE- 310

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

PRESS TOOL DESIGN-II

Paper Code: ETTE-401   **L**   **T/P**   **C**
Paper: Press Tool Design-II   **3**   **1**   **4**

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

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

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

Objective: The objective of this paper is to learn the student about the designing of jigs, fixture for various machining processes wildly used in tooling industries.

UNIT I
Presses, Compound Dies & Inverted Dies: Press Working Terminologies, Types of presses, Computation of press capacity, mechanical and automatic feed, Introduction to Inverted Dies, function of various parts of Inverted dies, Compound dies, function of various parts of Compound dies, Design of compound and Inverted Dies.

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

UNIT II
Progressive Dies and Secondary Operation: Definition of Progressive dies, introduction to the progressive dies, Types of Progressive Dies, Progressive strip layouts, Mechanical and automatic feed, Secondary operations-Trimming Dies, shear form operation, Notching, Side action Dies, combination Dies, Flanging Dies, De-Burring operation, Restrike operation, concept of Design of progressive Dies.

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

UNIT III
Drawing Dies and Forming Dies: Difference between drawing and other forming operation, Introduction to Draw Dies, Selection of material for Draw Dies, Inverted Draw Dies, Deep drawing process, Drawability, Strain factor, Effects and Anisotropy, Redraw and reverse redraw dies, Deformation, Blank development range of draw, Draw force analysis, Wrinkling Erickson test, Defects in drawing, Forming theory, Flow limit diagram, Failures in forming and drawing. Analysis and Remedies. Manufacturing methods of forming and Drawing Dies.

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

UNIT IV
Fine Blanking and Advanced Forming Process: Fine blanking process techniques and application. Reconditioning and repair of tools. Importance of safety. Cost analysis with a view on the quantity of production. Use of CAD for design of Press Tools: Work Piece checks, Find developed Length/Blank Size, Nesting. Basics of Advanced forming process-Hydro forming process high energy rate forming and Micro forming Dies.

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

Text Books:
[T1]   Ostergaard, "Advance Die Making", MGH, New York, 1993.
[T2]   P.H. Joshi, "Press Tool Design and Construction", Wheeler Publishing, Delhi, 2000.

Reference Books:
[R1]   Vukota Boljanovic,"Sheet Metal Stamping Dies: Die Design and Die-Making Practice", Industrial Press, Inc. New York, NY, USA
[R2]   Oehler, "Hydrualic Presses", Arnold Press, 1968.
[R3]   Makelt, "Mechanical Presses", Arnold Press, 1968.
[R4]   Eary Reed, "Technique of Press Working Sheet Metal", Prentice Hall, 1974
[R5]   Ivana Suchy, HANDBOOK OF DIE DESIGN, Design Engineer Fair Lawn, New Jersey, Second Edition, McGraw-HILL
[R6]   Design Data Hand Book, Delhi Institute of Tool Engineering, Delhi

MOULD DESIGN–II

Paper Code: ETTE-403	**L**	**T/P**	**C**
Paper: Mould Design–II	**3**	**1**	**4**

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

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

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

Objective: The objective of this paper is to learn the student about industrial mould design depend upon the shape of various complex shape plastics components, related to injection moulding techniques.

UNIT I
Splits:
Sliding splits, guiding and retention of splits, method of operations, finger cam actuation, dog leg cam actuation, cam tract actuation, spring actuation and hydraulic actuation. Splits locking method, splits safety arrangements, stripper plate design. Angled lift splits.

[T1][No. of Hrs. 12]

UNIT II
Side core, Side cavity and Internal undercut:
Principle of side core and side cavity, moulding embodying side holes or slots. Design features for internal and external side core or side cavity assembly. Method of actuations and angle withdrawal.
Moulding internal undercuts: Form pin, form pin straight action and angled action, split cores, split core straight action and angled action, side cores.

[T1][No. of Hrs. 11]

UNIT III
Mould for Threaded Components:
Component design, mould for internally threaded components, single interrupted thread design, stripping thread design, split core design fixed threaded core design, loose threaded core design, collapsible core design and unscrewing mould design.

[T1] [No. of Hrs. 10]

UNIT IV
Multi daylight moulds:
Mould types, day lights, single, double and triple daylight moulds, underfeed moulds, types of feed, secondary sprue gate, reverse tapered secondary sprue. Design of undercut runner system.

[T1] [No. of Hrs. 10]

Text Books:
[T1]   R.J.W. Pye, "Injection Mould Design", Affiliated West Press, Delhi, 2000.

Reference books:
[R1]   Rosato, "Injection Molding Handbook", CBS Publishers, Delhi, 1987.
[R2]   Irvin I Rubin, "Injection Moulding Theory & Practice", John Willey, 1972.

COMPUTER AIDED GRAPHICS & PRODUCT DESIGN

Paper Code: ETTE-405   **L**   **T/P**   **C**
Paper: Computer Aided Graphics & Product Design   **3**   **1**   **4**

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

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

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

Objective: To introduce the students about the knowledge of Computer graphics and design and modern approaches of product design.

UNIT-I
Introduction to CAD: Design process, Fundamentals of CAD: Role of computers in design.
Computer Graphics: Raster scans graphics, Coordinate system, Database structure for graphic modeling Transformation of geometry: Translation, Rotation, Reflection, Scaling, Homogenous representation,
Projection: Orthographic projection, Isometric Projection.

                                                 [T1][No. of Hrs: 10]

UNIT-II
Geometric Modeling: Requirement of Geometric Modelling, Geometric models, Geometric Construction Methods, Wireframe modeling, Curves representation, Curve fitting,
Synthetic Curves: Cubic splines, Bezier curve.
Surfacing: Surface of revolution, ruled surface.
Solid Representation concepts: B-Rep, CSG.
CAD Standards: Standardization in graphics, Exchange of modeling data- IGES, Standard for the exchange of product model data (STEP), Drawing Exchange Format, DMIS

                                                 [T1][No. of Hrs: 13]

UNIT-III
Introduction Product Design: Definition, Design by Evolution, Design by Innovation, Essential factors of Product Design, Morphology of Design, Role of Allowance, Primary design phases and flow charting, Process capability and Tolerance in detailed design and assembly, Product strategies, Product characteristics, Designer and his role, Basic design considerations, Types of Models designed by designers.

                                                 [T2][No. of Hrs: 10]

UNIT-IV
Computer & Design: Product cycle & CAD/CAM, Role of computer in design process.
Modern approaches to Product Design: Concurrent Design, Quality function deployment.
New Product Development: New product development**,** Model utilized in various phases, Managing product life cycle, Diffusion models: Models of first purchase.

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

Text Book:
[T1]:   P.N. Rao, "CAD/CAM Principles and Applications", Tata McGraw Hill, 2003
[T2]   A.K Chitale and R.C.Gupta, "Product Design and Manufacturing", Prentice-Hall of India Pvt. Ltd; 3rd edition (March 30, 2005)

Reference Books:
[R1]   Rogers, D. F. and Adams, A., "Mathematical Elements for Computer Graphics",   McGraw-Hill Inc., NY, 1989.
[R2]   Groover and Zimmer, "CAD / CAM : Computer Aided Design & Manufacturing",   Prentice Hall, 1984.
[R3]   Karl.T.Ulrich, Steven D.Eppinger, Anita Goyal "Product Design and   Development" Tata McGrawHill , 2009

VIBRATIONS ENGINEERING DESIGN

Paper Code: ETTE-407   **L   T/P   C**
Paper: Vibrations Engineering Design   **3   0   3**

INSTRUCTION TO PAPER SETTER: **MAXIMUM MARKS: 75**
1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. 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

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Objective: To make student understand the different vibration systems and to use this knowledge while performing engineering design.

UNIT-I
Fundamentals of Vibration: Introduction, vector method for representing harmonic motion, complex method for representing
Harmonic vibration, Fourier series and harmonic analysis- analytical method for harmonic analysis, numerical method for harmonic analysis.
[T1, T2][No. of Hrs. 10]

UNIT-II
Vibration of single degree of freedom (SDF) system- Undamped free vibration, damped free vibration Forced vibration-forced vibration with constant harmonic excitation, forced vibrations due to excitation of supports, forced vibration with coulomb damping, forced vibrations with structural damping, vibration isolation and transmissibility, vibration measuring instruments.
[T1,T2][No. of Hrs. 11]

UNIT-III
Two degree freedom system: Principal modes of vibrations, system with damping, undamped forced vibrations with harmonic excitation.
Multidegree freedom systems: Modal analysis, Rayleigh's and Dunkerley's method, Holzer's method.
[T1,T2][No. of Hrs. 11]

UNIT IV
Critical speed of shaft, secondary critical speed, transient vibration:- laplace transformation, response to a impulsive input, response to a step input, response to a pulse input, phase plane method.
[T1,T2][No. of Hrs. 11]

Text Books:
[T1]   G.K. Grover, "Mechanical Vibration", Nem Chand and Bross, Roorkee
[T2]   V.P. Singh, "Mechanical Vibration", Dhanpat Rai Publications.

Reference Books:
[R1]   Singiresu Rao, "Mechanical Vibrations", Pearson Education
[R2]   Dukikipati RV Srinivas J, "A Text book of Mechanical Vibrations". PHI

OPERATIONS RESEARCH

Paper Code: ETMT-427   **L**   **T/P**   **C**
Paper: Operations Research   **3**   **0**   **3**

Objective: The objective of the paper is to acquaint the student with mathematical techniques being adopted in industry which help managers in decision taking.

UNIT-I
Linear Programming: Formulation of LP Problem. Graphical method, Simplex method for maximization and minimization LP Problems. Duality in Simplex Problems,
Queuing Theory: Introduction to probability concept for queuing problems. Basic structure, Terminology, Classification, Birth and Death Process. Queuing Models.

[T1][No. of Hrs. 11]

UNIT-II
Transportation Models: MODI method for optimality check, North West Corner Method, Least-cost Method and Vogel's Approximation Method (VAM) for solving balanced and unbalanced transportation problems. Problems of degeneracy and maximization.
Assignment Models: Assignment model for maximization & minimization problems. Traveling Salesman Problems, Industrial Problems.

[T2][No. of Hrs. 11]

UNIT-III
Sequencing Theory: Processing of n-jobs through m-machines with each job having same processing order. Processing of two jobs through m-machines with each job having different processing order.
Decision Theory: Decision making under uncertainty and under risk, Multistage decision making, Multi criteria decision making.

[T1][No. of Hrs. 11]

UNIT - IV
Network Models: Introduction to PERT and CPM. Fundamental concept of Network models and construction of network diagrams. Activity time estimates. Critical path and project time duration. Probability of completing the project on or before specified time. Concept of Float and slack.
Game Theory: Two person zero-sum games. Minimax and Maximin principle. Arithmetic, Algebraic, Matrix Algebra method. Solution by Dominance, Subgame, Graphical method, linear programming method.

[T2][No. of Hrs. 11]

Text Books:
[T1]   Hira and Gupta " Operation Research" S. Chand Publications
[T2]   H.A. Taha, "Operations Research", Prentice-Hall India, 6th Edition, 2004.

Reference Books:
[R1]   S.Kalavathy, "Operations Research", Vikas Publication, 4th Edition, 2013.
[R2]   N.D. Vohra, "Operations Research", Tata McGraw Hill, 2004.
[R3]   Richard Bronson, Govindasami Naadimuthu, "Operations Research", Tata McGraw Hill, 2004
[R4]   A.P. Verma, "Operations Research", S.K. Kataria & Sons, 2004.
[R5]   J.K. Sharma, "Operation Research", Macmillan India Ltd. 2005.

AUTOMOBILE ENGINEERING

Paper Code: ETME-401	**L**	**T/P**	**C**
Paper: Automobile Engineering	**3**	**0**	**3**

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

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

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Objective: The objective of the paper is to introduce the student about Power plant, Transmission Systems, Clutches and its principles of friction clutch, types of suspension, Mechanical and hydraulic brakes and other automobile s engineering functions.

UNIT – I
Power Plant: Selection of power plant for automotive vehicle, requirements of vehicle. Characteristics of various power plants (Petrol engines, Diesel engines, CNG and LPG engine,); constructional details of C.I. and S.I. engines, crank shafts, connecting rods, pistons, piston pins, piston rings, valves mechanisms, manifolds, air cleaners, mufflers, radiators and oil filters.
Vehicular Performance: Load, air and grade resistance; matching of engine output and demand power, performance requirements of Passenger cars, heavy duty trucks. Performance characteristics of internal combustion engines, drive effectiveness for 2 wheel and 4 wheel drive vehicles.
[T1, T2, T3] [No. of Hrs. 12]

UNIT II
Transmission Systems: Transmission requirements, general arrangement of clutch, gear box and transmission, for various combinations of front wheel, rear wheel, front engine and rear engine for 2 wheels and 4 wheels drives De-Dion drive.
Clutches: Principle of friction clutch, single and multi-plate clutches, centrifugal clutch and related Numericals. Friction materials. Bonding materials. Fluid fly wheel clutch.
[T1, T2, T3] [No. of Hrs. 11]

UNIT III
Transmission: Description and working of manually operated gearboxes like sliding mesh, constant mesh, synchromesh. Hydraulic torque converter and its construction, working and performance. Analysis of Semi-automatic and Automatic transmission, overdrives, Differentials and Wilson Gear Box. Construction and working of Live axles.
Steering System: Steering terminologies and geometry. Davis and Ackermann steering. Power steering.
[T1, T2, T3] [No. of Hrs. 11]

UNIT IV
Suspension: Types of suspension systems, Dead Axle and Independent suspension;., air suspension, shock absorbers.
Wheels, Tyres and Brakes:, Mechanical and hydraulic brakes, shoe arrangements and analysis, disc brakes, braking effectiveness requirements. Concept of Anti lock brakes. Wheel and tyre requirements, Tyre dynamics.
[T1, T2, T3] [No. of Hrs.12]

Text Books:
[T1]   N.K. Giri, "Automotive Mechanics", Khanna Publishers
[T2]   R K Rajput," A text Book on Automobile Engineering", Laxmi publication
[T3]   Kirpal Singh, "Automobile Engg.", Vol. .I & II, Standard Publishers, 2004

Reference Books:
[R1]   Narang G.B.S., "Automobile Engg.", Khanna Publishers
[R2]   Srinivasan, "Automotive Engines", Tata McGraw Hill
[R3]   K.K. Jain & R.B. Asthana, "Automobile Engineering", Tata McGraw Hill
[R4]   Joseph Haitner, "Automotive Mechanics", C.B.S. Publications

CREATIVITY IN ENGINEERING

Paper Code: ETTE-409	L	T/P	C
Paper: Creativity in Engineering	3	0	3

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

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

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

Objective: The objective of the paper is to facilitate the student with the basics of implementing the creativity idea to any kind of engineering applications.

UNIT-I
The design methodology, various design phases, design formulation, need, convergence, divergence, ideonomics, developing of selected ideas, Iterations, Integrated approach, optimal engineering solutions, Kind of knowledge, User Centre feedback.

[T1][No. of Hrs. 10]

UNIT-II
Seeking several concepts of creativity, Flexibility, Design activity: original design, Adaptive Design, Variant Design, the various tools used for generating ideas such as Deep Encounter, Chance Intrusion, Analogy, Brainstorming, Realizing Constraints, etc.

[T1][No. of Hrs. 11]

UNIT-III
Decision making, delegating responsibility, some important elements of decision making such as Thinking, Analysis, synthesis, Emotions, Intuitions etc, Optimum duration for taking decision, Decision Tree, feasibility, and implementations.

[T1][No. of Hrs. 12]

UNIT –IV
Keen Observation, Flexibility, Initiative Courage to create, Express test and cycle, perseverance, simplicity, shedding & trimming, oversimplification, complex system, value of complexity.

[T1][No. of Hrs. 10]

Text Books:
[T1]   Prashant Kumar, "Product Design Creativity, Concept and Usability", PHI publications

Reference books:
[R1]   B. S. Dhillon, "Creativity for Engineers", World Scientific Publishing Co. Ltd.
[R2]   Semyon. D. Savransky, "Engineering of Creativity" by CRC Press

ADVANCED WELDING TECHNOLOGY

		L	T/P	C
Paper Code: ETTE-415				
Paper: Advanced Welding Technology		3	0	3

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

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

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

Objective: To introduce the students about the knowledge of advanced welding techniques used in industry.

UNIT-I
Introduction : Importance and application of welding, classification of welding process.
Selection of welding process.
Conventional welding process : Gas welding, Arc welding, Gas Metal Arc welding, Gas tungsten arc welding. Resistance welding. Electroslag welding, Friction welding etc. Welding of Mild Steel, Cast iron, Aluminum and Stainless steel. Soldering & Brazing.

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

UNIT-II
Advanced Welding Techniques- Principle and working and application of advanced welding techniques such as Plasma Arc welding, Laser beam welding, Electron beam welding, Ultrasonic welding etc.

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

UNIT-III
Advanced welding Techniques (continued) : Principle and working and application of advanced welding techniques such as explosive welding/ cladding, Underwater welding, Spray-welding/ Metallising, Hard facing.

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

UNIT-IV
Weld Design: Welding machines/equipments and its characteristics and arc-stability, Weld defects and distortion and its remedies, Inspection/testing of welds, Weld Design, Welding of pipe-lines and pressure vessels. Life predication.

Thermal and Metallurgical consideration.: Thermal considerations for welding, temperature distribution, Analytical/Empirical analysis/formulae, heating & cooling curves. Metallurgical consideration of weld, HAZ and Parent metal, micro & macro structure. Solidification of weld and properties.

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

Text Books:
[T1]   Sindo kau "Welding Metallurgy" 2nd edition, Wiley
[T2]   O.P.Khanna, "Welding Technology, Dhanpat Rai Publications

Reference Books:
[R1]   AWS Welding Handbook, Vol. 1 to 4, AWS
[R2]   George Allenard Unwin, "Metallurgy & Welding", Lancaster J.F

LOW COST AUTOMATION

Paper Code: ETTE-417   **L**   **T/P**   **C**
Paper: Low Cost Automation   **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: This paper introduces the knowledge of automation in industry using hydraulic, pneumatic and programmable logic controllers.

UNIT I
Basic Concepts of Automation: Introduction, Types of automation, Degree of automation, Technical, Economic and human factors in automation, Automatic handling of parts, using relays, positioned limit switches, etc., hard automation of dedicated system of handling using in line transfer, rotary transfer by Geneva mechanism, electro-hydraulic or pneumatic systems, Low cost automation.

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

UNIT II
Technologies: Mechanical, Electrical, Hydraulic, Pneumatic, Electronic, Hybrid systems, Comparative evaluation. Basics of pneumatics system, Compressed air generation Basics of hydraulic systems, Source of Hydraulic power, Pump classification, Electrical and Electronic control – sensors and transducers.

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

UNIT III
Hydraulic and Pneumatic Circuits : Hydraulic and Pneumatic symbols, Hydraulic actuators, Design of hydraulic circuits, Meter in circuits, Meter out circuits, Accumulator circuits, Regenerative circuits, ,Pneumatic actuators and valves, Design of Pneumatic Circuits, Speed control of double acting cylinder, Multiple actuator circuits, Electro pneumatic multiple actuator circuits , Illustrative examples of the above types of systems as well as hybrid systems used for automation of working cycles of machines, Material Handling, Inspection and Assembly etc.

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

UNIT IV
Programmable Logic Controllers : Introduction, Components of PLC, Programming of PLC- Ladder diagram based, Low level based on Boolean expression, functional blocks, high level language, PLC - Timer, PLC-Counter, PLC Memory element, Designing for automation, Areas of application of PLC, Cost-benefit analysis.

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

Text Books:
[T1] Groover, Mikell P, "Automation, Production Systems and Computer Integrated Manufacturing", Prentice Hall, 1987.
[T2] Soundararajan V., "Introduction to Hydraulic and Pneumatic", Prentice Hall of India, 2007.

Reference Books:
[R1] Johnson, David G., "Programmable Controllers for Factory Automatha", Marcel Dekker, New York, 1987.
[R2] Boothroyd, G. and Poli, C., "Automatic Assembly", Marcel Dekkar, New York, 1982.
[R3] Sapiro, Steve Smith, Robert J., "Handbook of Design Automation", Prentice Hall, 1986.
[R4] Fawcett J.R., "Pneumatic Circuits and Low Cost Automation", Trad & Technica Press, England, 1968.
[R5] Pneumatics Control, Joji P, Wiley India Publication

DATABASE MANAGEMENT SYSTEMS

Paper Code: ETCS-425   **L   T/P   C**
Paper: Database Management Systems   **3   0   3**

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

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

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

Objective: The concepts related to database, database techniques, SQL and database operations are introduced in this subject. This creates strong foundation for application data design.

UNIT-I : Introductory Concepts of DBMS: Introduction and application of DBMS, Data Independence, Database System Architecture – levels, Mapping, Database users and DBA, Entity – Relationship model, constraints, keys, Design issues, E-R Diagram, Extended E-R features- Generalization, Specialization, Aggregation, Translating E-R model into Relational model.

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

UNIT-II : Relational Model: The relational Model, The catalog, Types, Keys, Relational Algebra, Fundamental operations, Additional Operations-, SQL fundamentals, DDL,DML,DCL PL/SQL Concepts, Cursors, Stored Procedures, Stored Functions, Database Integrity – Triggers.

[T2, R3][No. of Hrs. 10]

UNIT-III: Functional Dependencies, Non-loss Decomposition, First, Second, Third Normal Forms, Dependency Preservation, Boyce/Codd Normal Form, Multi-valued Dependencies and Fourth Normal Form, Join Dependencies and Fifth Normal Form.

[T2, R1][No. of Hrs. 10]

UNIT-IV: Transaction Management: ACID properties, serializability of Transaction, Testing for Serializability and concurrency control, Lock based concurrency control (2PL, Deadlocks), Time stamping methods, Database recovery management.

Implementation Techniques: Overview of Physical Storage Media, File Organization, Indexing and Hashing, B+ tree Index Files, Query Processing Overview, Catalog Information for Cost Estimation, Selection Operation, Sorting, Join Operation, Materialized views, Database Tuning.

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

Text Books:

[T1]   Abraham Silberschatz, Henry F. Korth, S. Sudharshan, "Database System Concepts", 5th Edition, Tata McGraw Hill, 2006

[T2]   Elmsari and Navathe, "Fundamentals of Database Systems", 4th Ed., A. Wesley, 2004

References Books:

[R1]   C.J.Date, A.Kannan, S.Swamynathan, "An Introduction to Database Systems", 8th Edition, Pearson Education, 2006.

[R2]   J. D. Ullman, "Principles of Database Systems", 2nd Ed., Galgotia Publications, 1999.

RENEWABLE ENERGY RESOURCES

Paper Code: ETEE-419		**L**	**T/P**	**C**
Paper: Renewable Energy Resources		**3**	**0**	**3**

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

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

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

Objective: The objective of the paper is to introduce the knowledge of upcoming and future promising area of renewable energy resources to the students, which is developing rapidly.

UNIT- I
Solar Energy: radiation – extra terrestrial, spectral distribution, solar constant, solar radiation on earth, measurements; solar thermal system – solar thermal power and its conversion, solar collectors, flat plate, solar concentrating collectors, - types and applications; photovoltaic (PV) technology - photovoltaic effect, efficiency of solar cells, semi-conductor materials, solar PV system, standards and applications, tracking.

[T1][No. of hrs. 10]

UNIT- II
Wind and Small Hydropower Energy: wind data, properties, speed and power relation, power extracted, wind distribution and speed prediction, wind map of India; wind turbines and electric generators. fundamentals – types of machines and their characteristics, horizontal and vertical wind mills, elementary design principle, wind energy farms, off-shore plants; small, mini and micro hydro power plants and their resource assessment, plant layout with major components shown.

[T2][No. of hrs. 10]

UNIT- III
Other Non-conventional Energy Sources: biomass – photosynthesis and origin of biomass energy, resources, cultivated resources, waste to biomass, terms and definitions – incineration, wood and wood waste, harvesting super tree, energy forest, phyrolysis, thermo-chemical biomass conversion to energy, gasification, anaerobic digester, fermentation, gaseous fuel; geothermal – resources, hot spring, steam system, principle of working, site selection, associated problems in development; ocean and tidal energy – principle of ocean thermal energy conversion, wave energy conversion machines, problems and limitations, fundamentals of tidal power, conversion systems and limitations; hydrogen energy – properties of hydrogen, sources, production and storage, transportation, problems for use as fuel; fuel cells – introduction with types, principle of operation and advantages.

[T1,R2][No. of hrs. 12]

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

[T2,R3][No. of hrs. 10]

Text Books:
[T1]   Tiwari and Ghosal, "Renewable Energy Resources: Basic Principle & Application", Narosa Publication
[T2]   S N Bhadra ,D, Kastha,'Wind Electrical Systems" Oxford Publication 2014

References Books:
[R2]   John Twidell, "Renewable Energy Sources", Taylor and Francis
[R3]   Godfrey Boyle, "Renewable Energy: Power for a Sustainable Future", Oxford University Press
[R4]   Ewald F. Fuchs, "Power Conversion of Renewable Energy Systems", Springer
[R5]   B. H. Khan, "Non Conventional Energy", Tata McGraw Hill
[R6]   D P Kothari,"Wind energy System and applications" Narosa Pub 2014

MANAGEMENT INFORMATION SYSTEMS AND ERP

Paper Code: ETME-421   **L**   **T/P**   **C**
Paper: Management Information Systems and ERP   **3**   **0**   **3**

INSTRUCTIONS TO PAPER SETTERS: **MAXIMUM MARKS: 75**
1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from 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 course is to expose the students to the managerial issues relating to information systems and help them identify and evaluate various options in this regard.

UNIT I
Meaning and Role of Information Systems. Types of Information Systems: Operations Support Systems, Management Support Systems, Expert Systems, and Knowledge Management Systems. Information Systems for Strategic Management: Competitive Strategy Concepts, Strategic Role of Information Systems. Integrating Information Systems with Business Strategy, Value Chain Analysis, and Strategic Information Systems Framework.
[T1,T2][No. of Hrs. 12]

UNIT II
Planning for Information Systems: Identification of Applications, Business Planning Systems and Critical Success Factors, Method of Identifying Applications, Risks in Information Systems. Resource Requirements for Information Systems: Hardware and Capacity Planning, Software Needs, Procurement Options – Make or Buy decisions, Outsourcing as an Option.
[T1,T2][No. of Hrs. 12]

UNIT III
Systems design and Development Methodologies: SDLC Approach, Prototyping, Spiral Method, End User Development. Logical and Physical Design. Evaluation of Information Systems.
[T1,T2][No. of Hrs. 10]

UNIT IV
Emerging Concepts and Issues in Information Systems: Supply Chain Management, Customer Relationship Management, ERP. Introduction to Data Warehousing, Data Mining and its Applications.
[T1,T2][No. of Hrs. 10]

Text Books:
[T1]   Kenneth Laudon and Jane Laudon (2013). Management Information Systems, Twelfth Edition, Pearson, New Delhi.
[T2]   James O'Brien, George Marakas and Ramesh Behl (2014). Management Information Systems, Tenth Edition, McGraw Hill Education, New Delhi.

References Books:
[R1]   Sahil Raj, "Management Information Systems", Pearson 2013
[R2]   Girdhar Joshi (2013). Management Information Systems, Oxford University Press, New Delhi.
[R3]   Effy Oz (2009). Management Information Systems, Sixth Edition, Cengage Learning, Delhi.
[R4]   Nirmalya Bagchi (2014). Management Information Systems, Vikas Publishing House, New Delhi.

VALUE ENGINEERING

	L	**T/P**	**C**
Paper Code: ETTE-423			
Paper: Value Engineering	**3**	**0**	**3**

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

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

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

Objective: The objective of the paper is to facilitate the student with the basics of Non-Conventional or Modern Manufacturing Methods and it's application in different type of Industries.

UNIT-I
Introduction: Value, Basic Kinds of Value, Reasons for Poor Value, Value Index, Value Gap.
Function: Primary, Secondary, Necessary, Unnecessary, Aesthetic, Cost, Life Cycle Cost.
V.E/V.A: Introduction, Objectives, Application, Quality.

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

UNIT-II
V.E/V.A: Job Plan: Various phases, Technique employed, Benefits, Selection of project.
Cases: V.E: Raises Production and Productivity, Prevents unnecessary use of resources, Not mere cost reduction, Find value in discards etc.

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

UNIT-III
Finance: Break Even point, Payback period, Return on investment, Cash flow, Net present value: Examples and illustrations.
Creativity Techniques: Creativity, Brainstorming, ABC analysis etc.
False Material, False Labor, Overhead saving.

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

UNIT-IV
Human Relation: Human aspects in value engineering,
Team Building: Team work, Team Leader, Team members, Team coordinator.
Managerial Traits: Introduction, Development role of value engineering.
Function-cost-worth analysis, Function analysis system technique.

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

Text Books:
[T1]   S.S. Iyer, "Value Engineering", New Age International, New Delhi, 2009.
[T2]   Anil Kumar Mukopadhyaya, "Value Engineering Mastermind", SAGE Publications India Pvt. Ltd. 2009.
Reference books:
[R1]   Miles, Lawrence D., "Technology of Value Analysis And Engineering", McGraw Hill, 1961.
[R2]   American Society of Tools and Manufacturing Engineers, "Value Engineering in Manufacturing", Prentice Hall, 1967.
[R3]   Mudge Arthur E., "Value Engineering : Systematic Approach", Mcgraw Hill, New York, 1971.
[R4]   Claswon, H. Robert, "Value Engineering for Management", Auerbach, 1970.

MATERIAL MANAGEMENT

		L	T/P	C
Paper ode: ETTE-425		**3**	**0**	**3**
Paper: Material Management				

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

1. Question no. 1 should be compulsory & 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 syllabus. Every unit should have two questions. However, student may be asked to attempt only one question from each unit. Each question should be of 12.5 marks.

Objective: To introduce the students about the knowledge of material, inventory management and planning.

UNIT-I
Introduction: Scope, objectives and phases in materials management,
Procurement: Purchase procedure, tender, earnest money, security deposit, purchase order, vendor rating.
Receipt: Invoice, cash memo, inspection.
Storage: Methods of storage. Selective control techniques of inventory - ABC & VED analysis.
Inventory Theory: Objectives of keeping inventory, structure of inventory problems and their analysis, relevant cost.

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

UNIT-II
Static inventory problems under risk: General characteristics, Christmas tree problem, total cost matrix, cost of risk, opportunity cost matrix, mathematical formulation of discrete and continuous cases.
Dynamic inventory problems under certainty: General characteristics, optimal lot size models with constant demand and infinite delivery rate with and without back ordering, quantity discounts.

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

UNIT-III
Dynamic inventory problems under risk: general characteristics, basic kinds of inventory control systems – demand probability distribution – approximate methods to find optimal P & Q systems of inventory, optimal selling policy with fluctuating prices.

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

UNIT-IV
Material requirement planning: master production schedule, bill of materials, inventory stock, files, MRP process, logic and computational procedure using simple example, lot sizing in MRP.

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

Text Books:
[T1] Gopalakrishnan & Sundarresen, "Material Management: An integrated approach", Prentice Hall of India.
[T2] A. Deb, "Material Management", Academic Publishers, Calcutta, India.

Reference Books:
[R1] Starr & Miller, "Inventory Control – theory and Practice", Prentice Hall of India
[R2] G. Monk, "Operations Management", McGraw Hill, India
[R3] Kanishka Bedi, "Production & Operations Management", Oxford university Press.
[R4] Materials Management – Text & cases" by A. K. Chitale & R. C. Gupta, Prentice- Hall of India Private Limited.
[R5] J. R. Tony Arnold, Stephen N. Chapman, Lioyd M. Clive, "Introduction to Materials Management", Prentice Hall/ Pearson.

CONCURRENT ENGINEERING

Paper Code: ETTE-427   **L   T/P   C**
Paper: Concurrent Engineering   **3   0   3**

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

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

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

Objective: The student will able to learn about concurrent engineering which will going to merge as discipline to help the objective of reduced cost, better quality and improve delivery performance.

UNIT- I

Components of QFD, Limitations in deploying QFD, QFD methodology, Product life cycle, quality products, evaporative markets, globalization and Concurrent engineering. Review of concurrent engineering techniques like DFM (design for manufacture). DFA (design for assembly), QFD (quality function deployment), RP (rapid prototyping), TD (total design) for integrating these technologies.

[T1][No. of Hrs. 10]

UNIT-II

Introduction to CE Metrics and measures, measurements, VCM, Design for X – ability, VMC management, Total value management, elements, Methodology, value management tools, TVM measures.

[T1][No. of Hrs. 11]

UNIT-III

Product Development Methodology, Product and Process systemization, Product information modeling, CE Architecture, life cycle intent, Integration of information models and end users applications. Computer aided simultaneous engineering systems. Integrated concurrent design and product development, Product and Process intelligence.

[T1][No. of Hrs. 11]

UNIT-IV

Life cycle mechanization, CE Network tools and services, CE Mechanized environment, IPD Deployment methodology, Constraint networks. CE Case studies, IPD automation, cost and risk reduction tools.

[T1][No. of Hrs. 10]

Text Books:

[T1]   Biren Prasad, "Concurrent Engineering Fundamentals : Integrated Product and Process Organization", Prentice Hall, New Jersey, 1997.

Reference Books:

[R1]   M. Helander, M. Nagamachi, "Design for Manufacturing a Systems   approach to Concurrent Engineering and Ergonomics", Taylor & Francis, London, 1992.

[R2]   D.D. Bedworth, M.R. Henderson and P.M. Wolfe, "Computer Integrated Design and Manufacturing", McGraw Hill, 1991. .

ERGONOMICS

Paper Code: ETTE-429   **L   T/P   C**
Paper: Ergonomics   **3   0   3**

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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.

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Objective: After completion of course the students must know that human needs for safe and efficient working are met in the design of work system

UNIT I
Introducing Ergonomics, Discipline approach: Ergonomics/ Human factors, To develop awareness, acquire information, and experience human factors in design. Data logging, data collection, data reduction and data analysis techniques. Design Ergonomics in India: scope for exploration.

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

UNIT II
Environmental conditions including temperature, illumination, noise and vibration. Perception and information processing, design of displays, hand controls, typography and readability, layout and composition.

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

UNIT III
Environmental conditions including temperature, illumination, noise and vibration. Perception and information processing, design of displays, hand controls, typography and readability, layout and composition.

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

UNIT IV
Exercises in evaluation of human response to product interface. Product safety and products liability. Legal and safety issues, Various Case Studies.

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

Text Books:
[T1]   D.C. Alexander, "Applied Ergonomics", Taylor and Francis, 2001.
[T2]   Pulat, B.Mustafa, "Fundamental of Industrial Ergonomics", Prentice Hall, 1992.

Reference Books :
[R1]   Mark R. Letho and James R. Buck, "Introduction to Human Factors and Ergonomics for Engineers", Taylor and Francis, New York, 2007.
[R2]   Phillips, Chandler Allen, "Human Factor Engineering", John Willey & Sons, New York, 2000.
[R3]   Franus, Edward A., "Connective Networks in Ergonomics: General Methodological Consideration", Elsevier, Amesterdam, 1991.

SOCIOLOGY AND ELEMENTS OF INDIAN HISTORY FOR ENGINEERS

	L	**T/P**	**C**
Paper Code: ETHS-419	3	0	3
Paper: Sociology and Elements of Indian History for Engineers			

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

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

Objective: The objective of this course is to familiarize the prospective engineers with elements of Indian history and sociological concepts and theories by which they could understand contemporary issues and problems in Indian society. The course would enable them to analyze critically the social processes of globalization, modernization and social change. All of this is a part of the quest to help the students imbibe such skills that will enhance them to be better citizens and human beings at their work place or in the family or in other social institutions.

UNIT I
Module 1A: Introduction to Elements of Indian History: What is History? History Sources-Archaeology, Numismatics, Epigraphy & Archival research; Methods used in History; History & historiography.

[*3 Lectures*]

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

[*7 Lectures*]
[T1][No. of Hrs. 10]

UNIT II
Module 2A: Indian history & periodization; evolution of urbanization process: first, second & third phase of urbanization; Evolution of polity; early states of empires; Understanding social structures-feudalism debate.

[*3 Lectures*]

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

[*7 Lectures*]
[T1][No. of Hrs. 10]

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

[*3 Lectures*]

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

[9 *Lectures*]
[T1][No. of Hrs. 12]

UNIT IV
Module 4A: Issues & concerns in post-colonial India (upto 1991); Issues & concerns in post-colonial India 2nd phase (LPG decade post 1991).

[*3 Lectures*]

Module 4B: Social change in contemporary India: Modernization and globalization, Secularism and communalism, Nature of development, Processes of social exclusion and inclusion, Changing nature of work and organization.

[*10 Lectures*]
[T1][No. of Hrs. 13]

Text Books:
[T1]   Desai, A.R. (2005), Social Background of Indian Nationalism, Popular Prakashan.
[T2]   Giddens, A (2009), Sociology, Polity, 6th Edition

Reference Books:
[R1]   Guha, Ramachandra (2007), India After Gandhi, Pan Macmillan
[R2]   Haralambos M, RM Heald, M Holborn, (2000), Sociology, Collins

PRESS TOOL DESIGN–II LAB

Paper Code: ETTE-451 **L** **T/P** **C**
Paper: Press Tool Design–II Lab **0** **2** **1**

List of Experiment:

1. Design of INVERTED DIE with knockout arrangement for any shape.
2. Sections of assembly Dies of the same Die given in Sr. No Die.-1.
3. Detailing, Ballooning and BOM of the same Die given in Sr. No Die.-1.
4. Design of COMPOUND DIE with shedder-knockout and shedder -spring arrangement given any shape component.
5. Sections of assembly Dies of the same Die given in Sr. No Die.-4.
6. Detailing, Ballooning and BOM of the same Die given in Sr. No Die.-4.
7. Design of PROGRESSIVE DIE having lower plan view, upper plan view given any shape of the parts.
8. Sections of assembly Dies of the same Die given in Sr. No Die.-7.
9. Detailing, Ballooning and BOM of the same Die given in Sr. No Die.-7.
10. Design of PROGRESSIVE DIE given bending shape of the component having three or more stations.
11. Design of DRAWING DIE using simple Drawing shape component.
12. Design of Lancing, Combination, restrike tool (any one) given shape component.

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

MOULD DESIGN–II LAB

Paper Code: ETTE-453   **L   T/P   C**
Paper: Mould Design – II Lab   **0   2   1**

List of Experiments:

Design of the following types of moulds:

1.   Two plate moulds with pin ejection and edge gate.
2.   Two plate moulds with sleeve ejection and submarine gate
3.   Two plate moulds with stripper plate ejection
4.   Two plate moulds with blade ejection.
5.   Four impression mould with round pin, blade, stepped pin and D-pin ejection techniques.
6.   Two plate moulds with internal undercut
7.   Two plate moulds with spilt mould and mould with side core
8.   Two plate moulds for threaded parts (loose core and automatic rack & pinion design).
9.   Three plate moulds with multi impressions

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

COMPUTER AIDED GRAPHICS & PRODUCT DESIGN LAB

Paper Code: ETTE-455	**L**	**T/P**	**C**
Paper: Computer Aided Graphics & Product Design Lab	**0**	**2**	**1**

List of Experiments:

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

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

1. Line(s) Drawing;
2. Drawing Bezier curve(s);
3. Drawing B-Spline curve(s);
4. Develop menu-bar and buttons for above;
5. Do geometric transformations for translation
6. Use menu-bar for rotation / mirror;
7. Use menu-bar for scaling;
8. Perform numerical calculations of any problem done in class and show its graphical manipulation on software.
9. Exposure to any 2D / 3D modeling commercially available software;

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

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

AUTOMOBILE ENGINEERING LAB

Paper Code: ETTE-457(ELECTIVE)   **L**   **T/P**   **C**
Paper: Automobile Engineering Lab   **0**   **2**   **1**

Automobile Engineering Lab experiments based on syllabus (ETME-401).

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

OPERATIONS RESEARCH LAB

Paper Code: ETTE-457(ELECTIVE)		**L**	**T/P**	**C**
Paper: Operations Research Lab		**0**	**2**	**1**

List of Experiments:

1. To study the working of TORA software package.
2. To solve the given Linear Programming Problem by simplex method manually and TORA software package.
3. To solve the given Transportation Problem manually and TORA software package.
4. To solve the given Problem of CPM and PERT by manually and TORA software package.
5. To solve the given Queuing Theory Problem manually and TORA software package.
6. Make a program in C++ for the Formulation of Linear Programming Problem.
7. Make a program in C++ to make the 1st Simplex Table for the given Linear Programming Problem.
8. Make a program in C++ for the conversion of Primal into Dual form of Linear Programming Problem.
9. Make a program in C++ to find the basic feasible solution of the given Transportation Problem using North West Corner Rules or by least cost method.
10. Make a program in C++ to find the optimal solution of the given Assignment Problem.
11. Make a program in C++ to solve the given Queuing Theory Problem of model 1.
12. Make a program in C++ to solve the given n job 2-machine sequencing problem.
13. Make a program in C++ to give the critical path for the given network problem.
14. Make a program in C++ to find the Saddle Point of the given game programming problem.

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

LOW COST AUTOMATION LAB

Paper Code: ETTE-457(ELECTIVE)   **L**   **T/P**   **C**
Paper: Low Cost Automation Lab   **0**   **2**   **1**

<u>**List of Experiments:**</u>

1. Exercise on sorting Device.
2. Exercise on turning device.
3. Exercise on lid lifting device.
4. Exercise on cutting device.
5. Exercise on hopper control
6. Exercise on conveyor belt control.
7. Exercise on rotary indexing table.
8. Exercise on clamping device.
9. Exercise on stamping device.
10. Exercise on heat sealing device.

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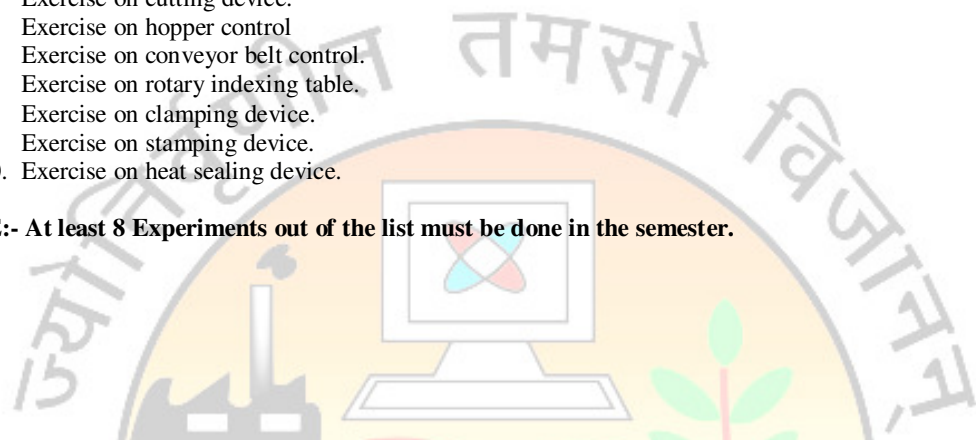
DATABASE MANAGEMENT SYSTEMS LAB

	L	T/P	C
Paper Code: ETMT-453(ELECTIVE)	**0**	**2**	**1**
Paper: Database Management Systems Lab			

LAB BASED ON DBMS

Lab includes implementation of DDL, DCL, DML i.e SQL in Oracle.

List of Experiments:

1. Design a Database and create required tables. For e.g. Bank, College Database
2. Apply the constraints like Primary Key, Foreign key, NOT NULL to the tables.
3. Write a SQL statement for implementing ALTER, UPDATE and DELETE
4. Write the queries to implement the joins
5. Write the queries for implementing the following functions: MAX (), MIN (),AVG (),COUNT ()
6. Write the queries to implement the concept of Integrity constrains
7. Write the queries to create the views
8. Perform the queries for triggers
9. Perform the following operation for demonstrating the insertion, updation and deletion using the referential integrity constraints

TEXT BOOK:
1. SQL/ PL/SQL, The programming language of Oracle, Ivan Bayross, 4th Edition BPB Publications

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

ADVANCED DIE CASTING AND DIE DESIGN

		L	T/P	C
Paper Code: ETTE-402		3	1	4
Paper: Advanced Die Casting and Die Design				

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

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

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

Objective: The objective of the paper is to facilitate the student with the basics of Die Casting and Die Design and its application in different type of Industries.

UNIT I
Introduction: Die casting Process, Requirements for successful Die Casting, Advantages, Disadvantages, Application, Comparison with other Casting processes.
Die Casting Alloys: Types of alloys, Factors for choosing an alloy, understanding the properties of Copper and Aluminium & Zinc alloys, effect of alloying constituents, Recent Development.
Die casting Machine; Construction and working principle of die casting machine, difference between cold and hot chamber machines.

[T1][No. of Hrs. 10]

UNIT II
Die casting dies: Specific details of die construction, casting ejection, cores slides, and loose die pieces, core actuating and locking devices, classification of dies, general details of die design, die layout, die making techniques.
Die steel: Characteristics of die steels and carbides.
Theoretical and practical aspects of die casting : Frommers theory, others theory , practical analysis and control of casting variables, correlating shot speed and pressure, die lubrication-Properties of Ideal Lubricant, rules for Die lubrication, Modern sprayable die-face lubricants, Sprayable lubricants.

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

UNIT III
Design of Die Casting: General principles-Selection of Parting Line, Wall thickness, Fillets and Radii, Tolerances, Inserts, Designing for Economy for Production, Runner and Gating Design, Venting.
Metal Melting and Handling: Decision for Arrangement of Melting and Distribution, Central Melting, Furnaces.
Finishing of die casting: Types of Finishes, finishing for zinc base alloys, finishing for Copper and Aluminium base alloys, finishing for magnesium base alloys.

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

UNIT IV
Inspection of die castings: first inspection, final inspection. Die casting defects, causes and its solution.
Cost Estimation: Estimating the cost of die castings.
Safety in the die casting plant: Safety-Melting and Alloying Department, Casting Department, Machining and Trimming and Maintenance Department.
Heat Treatment: Heat treatment of alloy steels.

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

Text Books:
[T1]   H.H.Doehler, "Die Casting", Mc Graw Hill Co., New York, 1951.
[T2]   Street A.C., "The Die Casting Book", Surrey Portcullis, 1986.

Reference Books:
[R1]   Wilson Frank W., "Die Design Handbook", McGraw Hill, 1965.
[R2]   SME, "Die Design Handbook", MGH Publication, 1990.
[R3]   Jones, "Die Design & Die Making Practice", Industrial Press, 1951.

MODERN MANUFACTURING METHODS

Paper Code: ETTE-404   **L**   **T/P**   **C**
Paper: Modern Manufacturing Methods   **3**   **1**   **4**

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

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

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

Objective: The objective of the paper is to facilitate the student with the basics of Non-Conventional or Modern Manufacturing Methods and it'sapplication in different type of Industries.

UNIT I
Introduction: An overview of Modern Manufacturing Methods (MMM) - Classification, their comparative study, Need of MMM.
Process selection: Physical Parameters, Shape applications, Material applications, Process capability, Effects on equipments and Tooling, Process economy.

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

UNIT II
Ultrasonic Machining: Construction and working Principle, Elements of Process, Effect of process parameters, applications and limitations.
Abrasive Jet Machining: Working Principle, equipment used, Variables in AJM, Advantages, Disadvantages, Applications.
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: 11]

UNIT III
Electro Chemical Machining (ECM): Principle, Elements of ECM process, Electrochemistry of ECM, selection of electrolytes and analysis of ECM, Advantages, Limitations, Applications.
Electro Chemical Grinding (ECG): Process: Working principle, equipment used, Process parameters, Advantages, Disadvantages and Application.
Electro Chemical Honing (ECH): Process: Working principle, equipment used, Process parameters, Advantages, Disadvantages and Application.

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

UNIT IV
Laser Beam Machining: Working principle, equipments, Process parameters, Advantages, Disadvantages and Application.
Plasma Arc Machining: Working Principle, Parameters, Safety precautions, Applications.
Electron Beam Machining: Principle, beam control techniques, Process capabilities, Comparison of thermal and non-thermal processes, Advantages and limitations.
Electric Discharge Machining: Working Principle, Mechanism of metal removal, Basic EDM circuits, selection of tool material and dielectrics, Flushing, Advantages, Disadvantages and Applications.
Wire Cut EDM: Working principle, process parameter, equipments, characteristics of machining process, applications, Ion Beam Machining (IBM): Working principle, equipment used, Process parameters, Advantages, Disadvantages and Application.

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

Text Books:
[T1]   P.C. Pandey & H.S. Shan, "Modern Machining Process", Tata McGraw Hills, 2006.
[T2]   Amitabh Gosh and A.K. Mallik, "Manufacturing Science", Affiliated East-West Press Pvt. Ltd., 1985.

Reference Books:
[R1]   Vijay K Jain, "Advance Machining Processes", Allied Publishers Pvt. Ltd., New Delhi, 2002.
[R2]   P K Mishra, "Nonconventional Machining", Narosa Publication, 1997.
[R3]   McGeough, "Advanced Methods of Machining", Chapman and Hall, London, 1998.

HUMAN VALUES & PROFESSIONAL ETHICS – II

		L	T	C
Paper Code: ETHS-402		1	0	1
Paper: Human Values & Professional Ethics-II				

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

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

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

3. Two internal sessional test of 10 marks each and one project report* carrying 5 marks.

Objectives:

1. *The main object of this paper is to inculcate the skills of ethical decision making and then to apply these skills to the real and current challenges of the engineering profession.*
2. *To enable student to understand the need and importance of value-education and education for Human Rights.*
3. *To acquaint students to the National and International values for Global development*

UNIT I - Appraisal of Human Values and Professional Ethics:
Review of Universal Human Values: Truth, Love, Peace, Right conduct, Non violence, Justice and Responsibility. Living in harmony with 'SELF', Family, Society and Nature. Indian pluralism - the way of life of Islam, Buddhism, Christianity, Jainism, Sikhism and Hinduism, Greek - Roman and Chinese cultural values.
Sensitization of Impact of Modern Education and Media on Values:
a) Impact of Science and Technology
b) Effects of Printed Media and Television on Values
c) Effects of computer aided media on Values (Internet, e-mail, Chat etc.)
d) Role of teacher in the preservation of tradition and culture.
e) Role of family, tradition & community prayers in value development.
Review of Professional Ethics: Accountability, Collegiality, Royalty, Responsibility and Ethics Living. Engineer as a role model for civil society, Living in harmony with 'NATURE', Four orders of living, their inter-correctness, Holistic technology (eco-friendly and sustainable technology).
[T1] [T2] [R1] [R5] [R4][No. of Hrs. 03]

UNIT II – Engineers responsibility for safety:
Safety and Risks, Risk and Cost, Risk benefit analysis, testing methods for safety. Engineer's Responsibility for Safety Social and Value dimensions of Technology - Technology Pessimism – The Perils of Technological Optimism – The Promise of Technology – Computer Technology Privacy
Some Case Studies: Case Studies, BHOPAL Gas Tragedy, Nuclear Power Plant Disasters, Space Shuttle Challenger , Three Mile Island Accident, etc.
[T1] [T2] [R4] [R2][No. of Hrs. 03]

UNIT III – Global Issues:
Globalization and MNCs: International Trade, Issues,
Case Studies: Kelleg's, Satyam, Infosys Foundation, TATA Group of Companies
Business Ethics: Corporate Governance, Finance and Accounting, IPR.
Corporate Social Responsibility (CSR): Definition, Concept, ISO, CSR.
Environmental Ethics: Sustainable Development, Eco-System, Ozone depletion, Pollution.
Computer Ethics: Cyber Crimes, Data Stealing, Hacking, Embezzlement.
[T1] [T2] [R4][No. of Hrs. 05]

UNIT IV - Engineers Responsibilities and Rights and Ethical Codes:
Collegiality and loyalty, Conflict of interests, confidentiality, occupational crimes, professional rights, responsibilities. To boost industrial production with excellent quality and efficiency, To enhance national economy, To boost team spirit, Work Culture and feeling of job satisfaction, National integration, Examples of some illustrious professionals.
Need for Ethical Codes, Study of some sample codes such as institution of Electrical and Electronics Engineers, Computer Society of India etc., Ethical Audit.
Development and implementation of Codes: Oath to be taken by Engineering graduates and its importance**,
[T1] [T2] [R4][R2][No. of Hrs. 05]

Text Books:
[T1]   Professional Ethics, R. Subramanian, Oxford University Press.
[T2]   Professional Ethics & Human Values: Prof. D.R. Kiran, TATA Mc Graw Hill Education.

References Books:
[R1]   Human Values and Professional Ethics: R. R. Gaur, R. Sangal and G. P. Bagaria, Eecel Books (2010, New Delhi). Also, the Teachers‟ Manual by the same author
[R2]   Fundamentals of Ethics, Edmond G. Seebauer & Robert L. Barry, Oxford University Press
[R3]   Values Education: The paradigm shift, by Sri Satya Sai International Center for Human Values, New Delhi.
[R4]   Professional Ethics and Human Values – M.Govindrajan, S.Natarajan and V.S. Senthil Kumar, PHI Learning Pvt. Ltd. Delhi
[R5]   A Textbook on Professional Ethics and Human Values – R.S. Naagarazan – New Age International (P) Limited, Publishers New Delhi.
[R6]   Human Values & Professional Ethics- S B Gogate- Vikas publishing house PVT LTD New Delhi.
[R7]   Mike Martin and Roland Schinzinger, "Ethics in Engineering" McGraw Hill
[R8]   Charles E Harris, Micheal J Rabins, "Engineering Ethics, Cengage Learning
[R9]   PSR Murthy, "Indian Culture Values and Professional Ethics", BS Publications
[R10]   Caroline Whitback< Ethics in Engineering Practice and Research, Cambridgs University Press
[R11]   Charles D Fleddermann, "Engineering Ethics", Prentice Hall.
[R12]   George Reynolds, "Ethics in Information Technology", Cengage Learning
[R13]   C, Sheshadri; The Source book of Value Education, NCERT
[R14]   M. Shery; Bhartiya Sanskriti, Agra (Dayalbagh)

*Any topic related to the experience of the B.Tech student in the assimilation and implementation of human values and professional ethics during the past three years of his/her studies in the institute OR A rigorous ethical analysis of a recent case of violation of professional ethics particularly related to engineering profession.

**All students are required to take OATH in writing prior to submission of major project and the record of the same is to be maintained at the college level and/or, this oath may be administered by the head of the institutions during the graduation ceremonies. The draft for the same is available alongwith the scheme and syllabus.
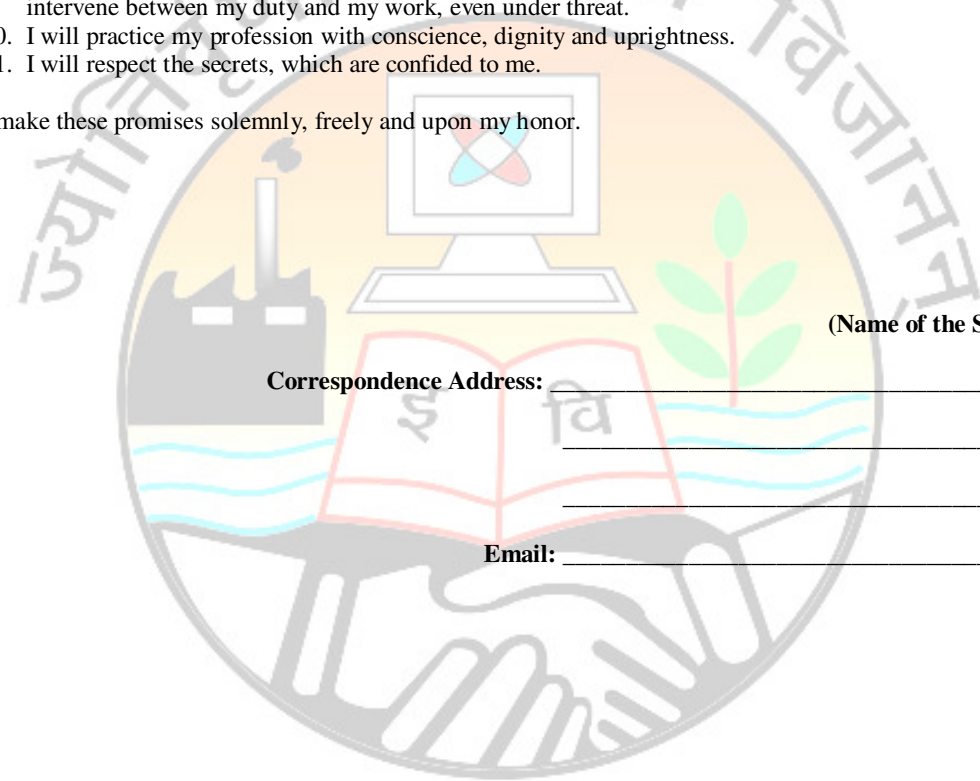
OATH TO BE TAKEN BY ENGINEERING GRADUATES

In a manner similar to the Hippocratic Oath taken by the medical graduates, Oath to be taken by the engineering graduates is as given below.

1. I solemnly pledge myself to consecrate my life to the service of humanity.
2. I will give my teacher the respect and gratitude, which is their due.
3. I will be loyal to the profession of engineering and be just and generous to its members.
4. Whatever project I undertake, it will be for the good of mankind.
5. I will exercise my profession solely for the benefit of humanity and perform no act for criminal purpose and not contrary to the laws of humanity.
6. I will keep away from wrong, corruption and avoid tempting others to vicious practices.
7. I will endeavor to avoid waste and consumption of non-renewable resources.
8. I will speak out against evil and unjust practices whenever and wherever I encounter them.
9. I will not permit considerations of religion, nationality, race, party politics or social standing to intervene between my duty and my work, even under threat.
10. I will practice my profession with conscience, dignity and uprightness.
11. I will respect the secrets, which are confided to me.

I make these promises solemnly, freely and upon my honor.

(Name of the Student)

Correspondence Address: _____

_____

_____

Email: _____

CRYOGENIC ENGINEERING

Paper Code: ETME-424   L   T/P   C
Paper: Cryogenic Engineering   3   0   3

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

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

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

Objective: To introduce the students about the knowledge of principles of refrigeration and liquefaction, gas liquefaction systems and cryogenic equipment.

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

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

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

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

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

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

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

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

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

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

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

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

THEORY OF DESIGN OPTIMIZATION

		L	T/P	C
Paper Code: ETTE-410		**3**	**0**	**3**
Paper: Theory of Design Optimization				

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

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

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

Objective: The objective of the paper is to facilitate the student with the basics of design optimization and how to design the experiments to get the optimum output.

UNIT-I
Introduction to Design:- Introduction, Design through Flow Chart, analysis and Design, Constraints in design , Optimum Design, Introduction to detail design optimization by Simulation and prototyping, Different classes of Simulation, Various techniques for system simulation, Selection of configuration, materials and processes.

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

UNIT-II
Introduction to optimization, optimization problems, Classical approaches, Single-variable optimization, Multi variable optimization with Equality constraints, Multi Variable optimization with inequality constraints. Issues of human safety & welfare, Professional ethics.

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

UNIT-III
Application of linear programming, Simplex algorithm, Two phase of Simplex method, Duality in Linear programming, Dual Simplex method, Transportation problem, Karmarkar's method, quadratic programming, Engineering applications of linear problems.

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

UNIT-IV
Multi objective optimization, Calculus of variations, optimal control theory, Genetic algorithms, simulated Annealing, Introduction to neural network, Training of neural networks based optimization, Fuzzy logics, System modeling by fuzzy logic optimization.

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

Text Books:
[T1]   S. S. Rao, "Optimization: Theory & Application", Wiley Eastern,
[T2]   Singiresu S. Rao: Engineering optimization, New age international publishers.

References Books:
[R1]   Deb. K, "Optimization methods for Engineering Design", Prentice Hall, 1995
[R2]   J. S. Arora, "Introduction to Optimum Design", McGraw Hill

FLEXIBLE MANUFACTURING SYSTEM

Paper Code: ETMT-428   **L   T/P   C**
Paper: Flexible Manufacturing System   **3   0   3**

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

Objective: The objective of the paper is to acquaint the student with modern manufacturing environment having automation with CNC machines and robots.

UNIT I
Introduction and Definition: Flexible Automation and Manufacturing Cell and Flexible Manufacturing System. Flexible Automation and Manufacturing systems and its productivity, History of FMS systems, definition, concept, benefits, problems in batch production, Types of FMS, Components of FMS, control of workstation, AGV systems, Functions of FMS, Scheduling and loading FMS, Layout configurations for FMS, communication in FMS, simulation in FMS, Installation and examples of FMS, optimization of FMS, typical layout of FMS, The FMS software. Feasibility report of FMS, advanced control cycle of FMS.
[T1][T2][No. of Hrs. 11]

UNIT II
CIM System: Introduction to CAD & CAM and its tools, Concept and origin of CIM, components of CIM, Emerging technologies of CIM, computer control system, sensing and identifying for manufacturing, CIMS data files, factors affecting performance, advantages and limitations, performance evaluation of a CIM system. Human centered CIM system, CIM technology in manufacturing environments, Factory information system, Sequential and concurrent engineering.
[T1][T2][No. of Hrs. 11]

UNIT III
High Volume Production System: Types of Automated assembly systems, Automated production or transfer lines, Equipment and arrangement of transfer lines, methods of work transport, transfer mechanisms, Assembly line balancing, numericals on line balancing, computerized line balancing methods.
Automated Material Movement: Function, Types of material movement systems, material movement through conveyors, material movement through robots, material movement through AGVs, automated guided vehicle operation and control, Advantages and limitations of AGVs, economic considerations.
Automatic tool changer (ATC), Storage and automated production line, Automated storage and retrieval system (ASRS), Carousel storage system, In-process storage system, communication with material in storage and in movement.
[T2][No. of Hrs. 12]

UNIT IV
Introduction to artificial intelligence in manufacturing automation, expert systems, AI programming for expert systems.
Computer Aided Quality Control: CNC 3D Coordinate Measuring machines, TQM, QC & CIM, Inspection and Testing, SPC, Role of computers in QC, Non contact inspection methods, Post process Metrology, Computer aided inspection using robots, integration of CAD / CAM with inspection system, Flexible Inspection system, Reverse Engineering.
[T1,T2][No. of Hrs. 10]

Text Books:
[T1]   P Radhakrishnan, S subramanym, V Raju; CAD/CAM/CIM; New Age International Publishers.
[T2]   K.C. Jain, Sanjay Jain, Principles of Automation and Advanced Manufacturing systems, Khanna Publications.

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

APPLIED PLASTICITY

Paper Code: ETTE-414		**L**	**T/P**	**C**
Paper: Applied Plasticity		**3**	**0**	**3**

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

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

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

Objective: To introduce the students about the knowledge of Plasticity.

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

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

UNIT II
Yield Criteria and Flow Rules:
Tresca theory & Von-Mises yield criterion, their geometrical representation, experimental evidence for the criteria.

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

UNIT III
Slip Line Field Theory:
Two-dimensional plasticity, slip lines, basic equations, Hencjy's first theorem, Geiringer's Velocity equation, Applications of slip line field theory to plane strain problems.

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

UNIT IV
Load Bounding:
The lower bound theorem, the upper bound theorem and their corollaries. Application of load bounding to plane strain problems.

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

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

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

ROBOTICS

Paper Code: ETMT-402   **L**   **T/P**   **C**
Paper: Robotics   **3**   **0**   **3**

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

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

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

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

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

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

UNIT – III
Robot Dynamics: Lagrangian Mechanics, Lagrangian Formulation and numericals. Dynamics, Newton-Euler Recursive Algorithm, Simulation. Euler-Lagrange Equations of motion/Any one other formulation like using Decoupled Natural Orthogonal Complements (DeNOC)
End effectors: Mechanical and other types of grippers. Tools as end effectors. Robot and effector interface. Gripper selection and design.

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

UNIT - IV
Applications for Manufacturing. Flexible automation. Robot cell layouts. Machine interference. Other considerations in work cell design. Work cell control, interlocks. Robot cycle time analysis. Mechanical design of robot links.
Typical applications of robots in material transfer, machine loading/unloading; processing operations; assembly and inspection.

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

Text Books:
[T1]   R.K. Mittal, I.J. Nagrath, "Robotics & Control", Tata McGraw & Hills, 2005.
[T2]   Mikell P Groover , Mitchell Weiss "Industrial Robotics :Technology,   Programming   and Application" Tata McGraw & Hills, 2009.
[T3]   Saha, S.K., Introduction to Robotics, 2nd Edition, McGraw-Hill Education, New Delhi, 2014

Reference Books:
[R1]   John J.Craig; "Introduction to Robotics Mechanics & Control", Pearson Education, 2004.
[R2]   Robert J. Schilling, "Fundamentals of Robotics, analysis & Control", Prentice Hall (I) P. Ltd., 2002
[R3]   Mark W. Spong, Seth Hutchinson, M. Vidyasagar "Robot Modeling and Control" John Wiley 2nd Ed
[R4]   J Srinivasan, R.V.Dukkipati, K. Ramji, "Robotics control & programming", Narosa.
[R5]   Ghosal, Ashitava, "Robotics: Fundamental Concepts and Analysis," Oxford University Press, 2006
[R6]   M. Murray, M., Li, Zexiang, Sastry, S.S., "A Mathematical Introduction to Robotic Manipulation," CRC Press, 1994
[R7]   Tsai, L.W., "Robot Analysis: The Mechanics of Serial & Parallel Manipulators," Wiley 1999
[R8]   Niku, S. B., "Introduction to Robotics: Analysis, Systems, Applications", Prentice Hall, 2001

ENGINEERING SYSTEM MODELLING AND SIMULATION

		L	T/P	C
Paper Code: ETME-402		**3**	**0**	**3**
Paper: Engineering System Modeling and Simulation				

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

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

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

Objective: To introduce the students about the knowledge of basic and dynamic system models of engineering and simulation system.

UNIT - I
Basic System models: Mathematical models, Mechanical system building blocks, Electrical system building block, fluid system building block, thermal system building block.
System Models: Engineering systems, Rotational translational systems, Electro-mechanical systems, linearity, Hydraulic Mechanical systems.
Dynamic Response of Systems:
Modelling dynamic systems, Terminology, First order systems, Second order systems, performance measure of second order systems, system identification.
System Transfer Functions:
The transfer function, first order systems, second order systems, systems in series, systems with feedback loops, effect of pole location on transient response.

[T1][No. of Hrs. 12]

UNIT – II
Mechanical Event Simulation (Finite Element modelling and Analysis):
Introduction, General procedure of finite element method, finite element analysis, iso-parametric evaluation of element matrices, finite element modelling, mesh generation, design and engineering applications. Introduction to Pro E software - Mechanica & dynamic simulation module.

[T2][No. of Hrs. 12]

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

[T3][No. of Hrs. 10]

UNIT – IV
Generation of random numbers and variates, generic features and introduction to Arena Software, Real world applications of simulation, Discrete continuous simulation, verification and validation of simulation models.

[T3][No. of Hrs. 10]

Text Book:
[T1]   W. Bolton, "Mechatronics – Electronic control systems in Mechanical & Electrical Engineering", Pearson Education Ltd.
[T2]   Ibrahim Zeid, "CAD/CAM Theory and Practice", Tata McGraw-Hill Publishing Company Limited.
[T3]   Sankar Sengupta, System Simulation and modelling, Pearson.

Reference Books:
[R1]   Deo, Narsingh, Millican Charles E.,"System Simulation With Digital Computer", PHI.
[R2]   Gordon, Geoffrey, System Simulation, PHI.
[R3]   P. Radhakrishnan, S Subramanyan, V. Raju, CAD/CAM/CIM, New Age International Publishers.

PROJECT MANAGEMENT

	L	T/P	C
Paper Code: ETTE–418			
Paper: Project Management	3	0	3

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

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

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

Objectives: The student is introduced to the concepts of project management which becomes back bone knowledge for an engineer to have a holistic view of executing a project.

UNIT – I
Introduction to Project management: Characteristics of projects, Definition and objectives of Project Management, Stages of Project Management, Project Planning Process, Establishing Project organization.
[T1,T2][No. of Hrs. 11]

UNIT –II
Work definition: Defining work content, Time Estimation Method, Project Cost Estimation and budgeting, Project Risk Management, Project scheduling and Planning Tools: Work Breakdown structure, LRC, Gantt charts, CPM/PERT Networks.
[T1,T2][No. of Hrs. 11]

UNIT – III
Developing Project Plan (Baseline), Project cash flow analysis, Project scheduling with resource constraints: Resource Leveling and Resource Allocation. Time Cost Trade off: Crashing Heuristic.
[T1,T2][No. of Hrs. 10]

UNIT – IV
Project Implementation: Project Monitoring and Control with PERT/Cost, Computers applications in Project Management, Contract Management, Project Procurement Management. Post-Project Analysis.
[T1,T2][No. of Hrs. 10]

Text Books:
[T1]   Shtub, Bard and Globerson, Project Management: Engineering, Technology, and Implementation, Prentice Hall, India
[T2]   P. K. Joy, Total Project Management: The Indian Context, Macmillan India Ltd.

Reference Books:
[R1]   Cleland and King, VNR Project Management Handbook.
[R2]   Lock, Gower, Project Management Handbook.
[R3]   Wiest and Levy, Management guide to PERT/CPM, Prentice Hall. India
[R4]   Horald Kerzner, Project Management: A Systemic Approach to Planning, Scheduling and Controlling, CBS Publishers.
[R5]   S. Choudhury, Project Scheduling and Monitoring in Practice.
[R6]   John M Nicholas, Project Management for Business and Technology: Principles and Practice, Prentice Hall, India.
[R7]   N. J. Smith (Ed), Project Management, Blackwell Publishing.
[R8]   Robert K. Wysocki, Robert Back Jr. and David B. Crane, Effective Project Management, John Wiley.
[R9]   Jack R Meredith and Samuel J Mantel, Project Management: A Managerial Approach, John Wiley.

SOFT COMPUTING

Paper Code: ETIT-410   **L**   **T/P**   **C**
Paper: Soft Computing   **3**   **0**   **3**

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

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

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

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

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

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

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

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

UNIT-III
Fuzzy Arithmetic:
Fuzzy Numbers, Linguistic Variables, Arithmetic Operations on Intervals & Numbers, Lattice of Fuzzy Numbers, Fuzzy Equations. Fuzzy Logic:
Classical Logic, Multivalued Logics, Fuzzy Propositions, Fuzzy Qualifiers,
Uncertainty based Information:
Information & Uncertainty, Nonspecificity of Fuzzy & Crisp Sets, Fuzziness of Fuzzy Sets.

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

UNIT-IV
Introduction of Neuro-Fuzzy Systems:
Architecture of Neuro Fuzzy Networks.
Application of Fuzzy Logic:
Medicine, Economics etc.
Genetic Algorithm:
An Overview, GA in problem solving, Implementation of GA.

[T1, T2][No of Hrs 11]

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

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

INDUSTRIAL MANAGEMENT

Paper Code: ETTE-422   L   T/P   C
Paper: Industrial Management   3   0   3

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

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

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

Objective: The course provides a broad introduction to some aspects of business management and running of business organization.

UNIT I
Industrial relations- Definition and main aspects. Industrial disputes and strikes. Collective bargaining.
Labour Legislation- Labour management cooperation/worker's participation in management. Factory legislation. International Labour Organization.

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

UNIT II
Trade Unionism- Definition, Origin, Objectives of Trade Unions. Methods of Trade unions. Size and finance of Indian Trade unions-size, frequency distribution, factors responsible for the small size. Finance-sources of income, ways of improving finance.

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

UNIT III
Work Study-Method study and time study. Foundations of work study. Main components of method study. Time study standards. Involvement of worker's unions. Work Sampling. Application of work study to office work.

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

UNIT IV
Quality Management- What is Quality? Control Charts. Quality is everybody's job. Taguchi Philosophy. Service Quality. What is Total Quality Management (TQM)? Roadmap for TQM. Criticism of TQM. Six Sigma.

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

Text Books:
[T1]   Sinha, P.R.N., Sinha I.B. and Shekhar S.M.(2013), Industrial Relations, Trade Unions and Labour Legislation. Pearson Education
[T2]   Chary, S.N. (2012), Production and Operations Management. Tata McGraw Hill Education.

Reference Books:
[R1]   Srivastava, S.C. (2012), Industrial Relations and Labour Laws, Vikas Publishing
[R2]   Shankar R (2012), Industrial Engineering and Management. Galgotia Publications
[R3]   Telsang, M. (2006), Industrial Engineering and Production Management. S.Chand
[R4]   Thukaram, Rao (2004), M.E. Industrial Management. Himalaya Publishing House

SUPPLY CHAIN MANAGEMENT PLANNING

	L	T/P	C
Paper Code: ETTE-424	3	0	3
Paper: Supply Chain Management Planning			

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

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

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

Objectives: The objective of the course is to provide a comprehensive analysis of the principles and practices of supply chain management. It will help the student to understand the activities of SCM and provide grounding in this field.

UNIT-I

Supply Chain Management - Concepts, Issues in Supply Chain Management; Demand Volatility and information distortion, Managing networks and relationships; Sourcing Internationally, Subcontracting within an International Dimension, The Architecture of Physical distribution network : Distribution Management: Types of Intermediaries, Channel Objectives and Constraints, Channel Selection and Management, Global Retailing, International Channel Innovation.

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

UNIT-II

Logistics Framework – Concept, Objective and Scope; Transportation, Warehousing, Inventory Management; Packing and Unitization; Control and Communication, Role of Information Technology in Logistics, Logistics Service Firms and Third Party Logistics.

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

UNIT-III

Logistics Network Design for Domestic/Global Operations: Logistics Network Configuration, Orienting International Facilities: Considerations and Framework, Trade-offs Associated with each Approach, Mapping the different Approaches, Capacity Expansion Issues; Information Management for Global Logistics: The Global LIS/LITS: Capabilities and Limitations, Characteristics of Logistics Information and Telecommunications Systems.

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

UNIT-IV

Performance Measurement and Evaluation in Global Logistics: Operations and Logistics Control: Key Activities Performance Information, Measuring Performance in Functional Integration, Measuring Performance in Sectoral Integration; Measurements and improvements of SCM service quality and performance; Past, present and future of Supply Chain Management.

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

Text Books
[T1]   Christopher Martin. (2005). Logistics & Supply Chain Management Creating Value-adding Networks, 3rd Edition, Pearson Education..
[T2]   S.K. Bhattacharyya (2010) Logistics Management, Definition, Dimensions and Functional Applications, S. Chand and Company, Delhi.

Reference Books:
[R1]   Chopra Sunil and Peter Meindl (2009). Supply Chain Management, 4th Edition, Pearson Education.
[R2]   Ballou, R. H. (2004). Business Logistic Management, 5th Edition, Prentice Hall, New Delhi.
[R3]   Bowersox, D. J., David, J & Cooper (2002). Supply Chain Logistics Management, McGraw Hill.

SAFETY ENGINEERING

Paper Code: ETTE-428   L   T/P   C
Paper: Safety Engineering   3   0   3

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

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

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

Objective: The objective of the paper is to facilitate the student with the basics of Safety Engineering and it's importancein various field.

UNIT I
Introduction : Hazard, System, Stimulus, Accident, Safety, Risk etc., System safety concept, System safety objective, System safety as a design parameter, Life cycle definitions, System safety control milestones, Concept phase, Definition phase, Development phase, Production phase, Deployment phase.
[T1] [No. of Hrs. 10]

UNIT II
System Safety Implementation: Policy and procedures, System safety program plan: Elements, System interfacing, Human engineering: Design of workplace, Environment, Cause of errors, Design vs procedural safeguards, Software considerations
[T1][No. of Hrs. 10]

UNIT III
Safety Management: Why do Accidents occur, Accident cause and consequences.
Safety Procedures, Arrangements and Performance Measures: Operations, Maintenance, Modifications, Storage of Hazardous substances, Safety performance measurement.
Education, Training and Development in Safety: Human factors, Occupational safety and health training, Health promotion training, In-situ safety training, Brainstorming.
[T2][No. of Hrs: 12]

UNIT IV
Emergency Preparedness and Response: General principles, On-site and Off-site Emergency plans, Medical aspects, Emergency response.
Safety Systems: Permit-to-work system and its element, Consideration and application.
Safeguarding against Common Potential Hazards: Trips, Slips and Falls, Preventing electrocution, Static electricity, Hazardous Energy control.
[T2][No. of Hrs: 10]

Text Books:
[T1]   Ronald, Harold E., Brian, "System Safety Engineering and Management", John Wiley, New York, 1990.
[T2]   L M Desmukh, "Indusrial Safety Management", Tata McGraw Hill, 2006.

Reference books:
[R1]   A M Sharma, "Industrial Health & Safety Management", Himalaya Publishing House, 2002.
[R2]   Gloss, David S., "Introduction to Safety Engineering", Wiley, New York, 1984.
[R3]   Grimaldi and Simonds, "Safety Management", AITBS Publishers, New Delhi, 2001.

CRYOGENIC ENGINEERING LAB

Paper Code: ETTE-452 (ELECTIVE)   **L**   **T/P**   **C**
Paper: Cryogenic Engineering Lab   **0**   **2**   **1**

List of Experiments:

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

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

FLEXIBLE MANUFACTURING SYSTEM LAB

Paper Code: ETTE-452(ELECTIVE)	**L**	**T/P**	**C**
Paper: Flexible Manufacturing System Lab	**0**	**2**	**1**

<u>List of Experiments:</u>

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.
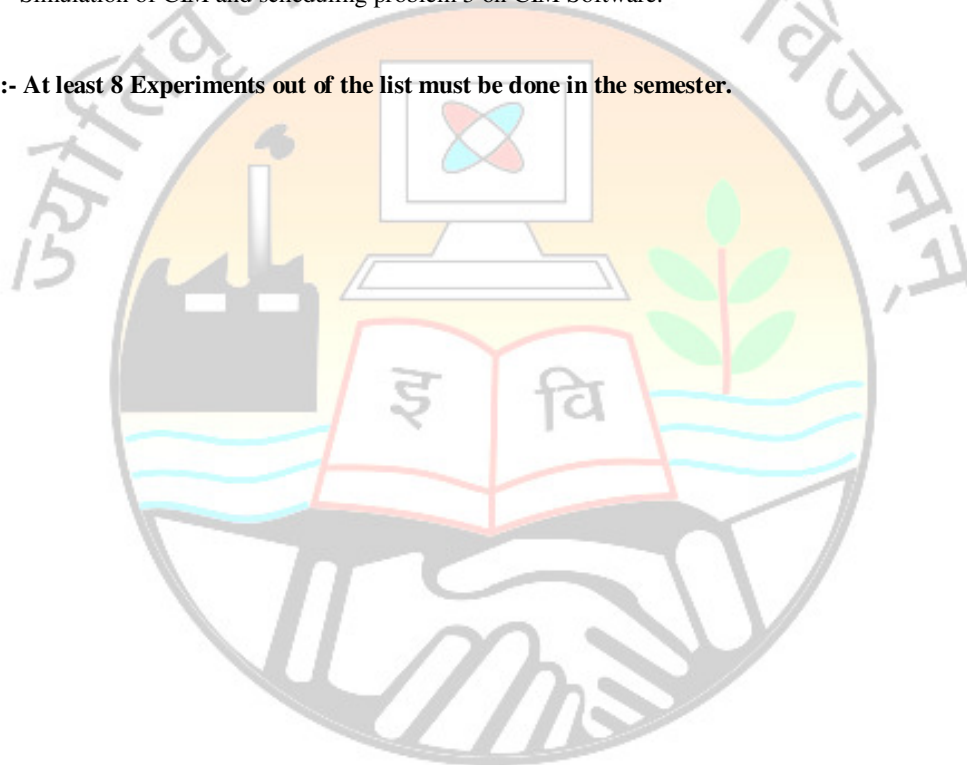
APPLIED PLASTICITY LAB

Paper Code: ETTE-452(ELECTIVE)	**L**	**T/P**	**C**
Paper: Applied Plasticity Lab	**0**	**2**	**1**

<u>**List of Experiments:**</u>

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

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

ROBOTICS LAB

Paper Code: ETTE-452(ELECTIVE)   **L**   **T/P**   **C**
Paper: Robotics Lab   **0**   **2**   **1**

List of Experiments:

1. Study of robotic arm, end effectors and its configuration and introduction to any software (such as workspace) used to simulate or program a robot;
2. Program / simulate a robot for moving on a path;
3. Program / simulate a robot for pick and place operation;
4. Program / simulate a robot for welding operation;
5. Program / simulate a robot for water jet machining;
6. Program / simulate a robot for saving it from striking any other object in workspace;
7. Program / simulate two robots working together;
8. Make a 3R robot and simulate its motion.
9. Use a microcontroller to program simple toy robot / model robot;
10. Micro controller program to use different sensors and further move toy robot(s) / model robot;
11. Use MATLAB / Scilab. Any other software to program numericals (Robot Arm kinematics) taught in class.
12. Use MATLAB / Scilab and other robot specific software like Robo-Analizer for the study of kinematic and dynamics of 3R robots.
13. Demos of a real robot; Introduce Virtual Robotics Lab. in ADAMS or SimMechanics of MATLAB.

Note:
a. Total Experiments are to be 12 (Twelve).
b. Experiments suggested by committee are given above- Choose any eight.
c. Rest (In above list / not in list) is liberty of respective institute to choose as per syllabus.
d. Suggested Software

A course on Robotics must use one or more software to not only visualize the motion and characteristics of robots but also to analyzer/synthesize/design robots for a given application (say, as class projects). Typical software which can be used are as follows:

- RoboAnalyzer (Developed by IIT Delhi; http://www.roboanalyzer.com)
- Virtual Labs. (Developed by IIT Kharagpur; http://vlabs.iitkgp.ernet.in/moodle/)
- MATLAB, its modules Simulink and SimMechanics (http://www.mathworks.com)
- Mathematica: Symbolic software (http://www.wolfram.com)
- Multi Bondgraph (http://bondgraph.org)
- ADAMS (by MSC software; http://www.mscsoftware.com)
- RerurDyn (by Function Bay, Korea; http://www.functionbay.co.kr)

e. **Other Aids**

- **Possible Class projects and presentations:** Kinematic/Dynamic modeling, programming, and analyses of a robotic arm (say, an RP manipulator); 2. Modeling of an AGV; 3. Building prototypes using, say, LEGO kits
- Video of practical applications
- Industry visits
- Robocon competitions: A national-level competition held every year during the 1st weekend of March

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

ENGINEERING SYSTEM MODELLING AND SIMULATION LAB

Paper Code: ETTE-452(ELECTIVE)	**L**	**T/P**	**C**
Paper: Engineering System Modeling and Simulation Lab	**0**	**2**	**1**

List of Experiments:

A.   Mechanical Event Simulation:

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

1.   Study assembly module on CAD software;
2.   Simulate movement of cam and follower mechanism on CAD software.
3.   Simulation of Spring Mass Damper System and do dynamic analysis on CAD software.
4.   Perform FEM Analysis (using a simple 3D tetrhedran element) on a Simple model with pressure loading and surface constraints;
5.   Perform stress analysis of rectangular L bracket using Pro E / any other software and do global sensitivity analysis.

B.   System Simulation:

The students are exposed to simulation software like Arena / any other.
1.   Study modeling environment;
2.   Study basic process panel;
3.   Study basic process panel - more;
4.   Study advanced process panel;
5.   Study advanced process panel - more;
6.   Study flow process panel;
7.   Study flow process panel- more;

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

SOFT COMPUTING

Paper Code: ETTE-452(ELECTIVE)   **L**   **T/P**   **C**
Paper: Soft Computing   **0**   **2**   **1**

List of Experiments:

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

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