ANNA UNIVERSITY, CHENNAI

AFFILIATED INSTITUTIONS

R - 2008

B.E. PRODUCTION ENGINEERING

II TO VIII SEMESTERS CURRICULUM AND SYLLABI
SEMESTER II

SL. No.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	HS2161	Technical English – II*	3	1	0	4
2.	MA2161	Mathematics – II*	3	1	0	4
3.	PH2161	Engineering Physics – II*	3	0	0	3
4.	CY2161	Engineering Chemistry – II*	3	0	0	3
5. a	ME2151	Engineering Mechanics **(For non-circuit branches)**	3	1	0	4
5. b	EE2151	Circuit Theory **(For branches under Electrical Faculty)**	3	1	0	4
5. c	EC2151	Electric Circuits and Electron Devices **(For branches under I & C Faculty)**	3	1	0	4
6. a	GE2151	Basic Electrical & Electronics Engineering **(For non-circuit branches)**	4	0	0	4
6. b	GE2152	Basic Civil & Mechanical Engineering **(For circuit branches)**	4	0	0	4
PRACTICAL						
7.	GE2155	Computer Practice Laboratory-II*	0	1	2	2
8.	GS2165	Physics & Chemistry Laboratory - II*	0	0	3	2
9. a	ME2155	Computer Aided Drafting and Modeling Laboratory **(For non-circuits branches)**	0	1	2	2

9. b	EE2155	Electrical Circuits Laboratory	0	0	3	2
		(For branches under Electrical Faculty)				
9. c	EC2155	Circuits and Devices Laboratory	0	0	3	2
		(For branches under I & C Faculty)				
				TOTAL : 28 CREDITS		
10.	-	English Language Laboratory [+]	0	0	2	-

* Common to all B.E. / B.Tech. Programmes

+ Offering English Language Laboratory as an additional subject (with no marks) during 2nd semester may be decided by the respective Colleges affiliated to Anna University Chennai.

A. CIRCUIT BRANCHES

I   Faculty of Electrical Engineering

1. B.E. Electrical and Electronics Engineering
2. B.E. Electronics and Instrumentation Engineering
3. B.E. Instrumentation and Control Engineering

II   Faculty of Information and Communication Engineering

1. B.E. Computer Science and Engineering
2. B.E. Electronics and Communication Engineering
3. B.E. Bio Medical Engineering
4. B.Tech. Information Technology

B. NON – CIRCUIT BRANCHES

I   Faculty of Civil Engineering

1. B.E. Civil Engineering

II   Faculty of Mechanical Engineering

1. B.E. Aeronautical Engineering
2. B.E. Automobile Engineering
3. B.E. Marine Engineering
4. B.E. Mechanical Engineering
5. B.E. Production Engineering

III   Faculty of Technology

1. B.Tech. Chemical Engineering
2. B.Tech. Biotechnology
3. B.Tech. Polymer Technology
4. B.Tech. Textile Technology
5. B.Tech. Textile Technology (Fashion Technology)
6. B.Tech. Petroleum Engineering
7. B.Tech. Plastics Technology

SEMESTER III

(Applicable to the students admitted from the Academic year 2008 – 2009 onwards)

CODE NO.	COURSE TITLE	L	T	P	C
THEORY					
MA 2211	Transforms And Partial Differential Equation	3	1	0	4
PR 2201	Basic Machining Process	3	0	0	3
PR 2202	Basic of Thermodynamics and Thermal Engineering	3	1	0	4
PR 2203	Engineering Metallurgy	3	0	0	3
ME 2204	Fluid Mechanics and Machinery	3	1	0	4
ME 2205	**Electrical Drives and Controls**	3	0	0	3
PRACTICAL					
PR 2207	Basic Machining Process Lab	0	0	3	2
ME 2208	Fluid Mechanics and Machinery Lab	0	0	3	2
ME 2209	Electrical Engineering Lab	0	0	3	2
	TOTAL	**18**	**3**	**9**	**27**

SEMESTER IV

(Applicable to the students admitted from the Academic year 2008 – 2009 onwards)

CODE NO.	COURSE TITLE	L	T	P	C
THEORY					
MA 2266	Statistics and Numerical Methods	3	1	0	4
ME 2254	Strength of Materials	3	1	0	4
PR 2251	Advanced Machining Process	3	0	0	3
PR 2252	Theory of Machines	**3**	**1**	**0**	**4**
PR 2253	Fluid Power Drives and Control	3	1	0	4
ME 2255	**Electronics and Microprocessors**	3	0	0	3
PRACTICAL					
PR 2254	Metallurgy Lab	0	0	3	2
ME 2256	Strength of Materials Lab	0	0	3	2
AT 2256	Computer Aided Machine Drawings Lab	0	0	4	2
	TOTAL	**18**	**4**	**10**	**28**

SEMESTER-V

CODE NO.	COURSE TITLE	L	T	P	C
THEORY					
GE 2021	Environmental Science & Engineering	3	0	0	3
ME 2304	Engineering Metrology and Measurements	3	0	0	3
PR 2302	Metal Forming Technology	3	1	0	4
PR 2303	Engineering Statistics and Quality Control	3	1	0	4
PR 2304	Machine Elements Design	3	1	0	4
PR 2305	Foundry and Welding Technology	3	0	0	3
PRACTICALS					
PR 2306	CNC Machine Lab	0	0	3	2
PR 2307	Fluid Power Lab	0	0	3	2
EC 2262	Electronics & Microprocessors Lab	0	0	3	2
GE 2321	Communication Skills Laboratory	0	0	4	2
	TOTAL	**18**	**3**	**13**	**29**

SEMESTER-VI

CODE NO.	COURSE TITLE	L	T	P	C
THEORY					
PR 2351	Finite Element Analysis In Manufacturing Engineering	3	0	0	3
PR 2352	Computer Aided Product Design	3	1	0	4
PR 2353	Automated Production and Computer Integrated Manufacturing	3	1	0	4
PR 2354	Design of Jigs, Fixture and Press Tools & Drawing	3	1	0	4
	Elective – I	3	0	0	3
	Elective – II	3	0	0	3
PRACTICALS					
PR 2355	Metal Forming Lab and Special Machines Lab	0	0	4	2
PR 2356	Metrology and Inspection Lab	0	0	3	2
PR 2357	Welding and Foundry Lab	0	0	4	2
	TOTAL	18	3	11	27

SEMESTER-VII

CODE NO.	COURSE TITLE	L	T	P	C
THEORY					
GE 2022	Total Quality Management	3	0	0	3
ME 2401	Mechatronics	3	0	0	3
ME 2027	Process Planning and Cost Estimation	3	0	0	3
ME 2028	Robotics	3	0	0	3
	Elective – III	3	0	0	3
	Elective – IV	3	0	0	3
PRACTICALS					
ME2404	Computer Aided Simulation and Analysis Laboratory	0	0	3	2
ME 2405	Mechatronics Laboratory	0	0	3	2
PR 2404	Design and Fabrication Project	0	0	4	2
	TOTAL	18	0	10	24

SEMESTER-VIII

CODE NO.	COURSE TITLE	L	T	P	C
THEORY					
MG 2451	Engineering Economics and Cost Analysis	3	0	0	3
	Elective – V	3	0	0	3
	Elective – VI	3	0	0	3
PRACTICALS					
PR 2451	Comprehension	0	0	2	1
PR 2452	Project Work	0	0	12	6
	TOTAL	9	0	14	16

SEMESTER – VI

ELECTIVE - I

SL.NO.	CODE NO.	COURSE TITLE	L	T	P	C
1.	ME 2026	Unconventional Machining Processes	3	0	0	3
2.	PR 2021	Precision Engineering	3	0	0	3
3.	PR 2024	Surface Engineering	3	0	0	3

ELECTIVE - II

SL.NO.	CODE NO.	COURSE TITLE	L	T	P	C
1.	MG 2021	Marketing Management	3	0	0	3
2.	ME 2021	Quality Control & Reliability Engineering	3	0	0	3
3.	PR 2022	Fuzzy Logic and ANN	3	0	0	3
4.	PR 2023	Instrumentation and Control	3	0	0	3

SEMESTER VII

ELECTIVE - III

SL.NO.	CODE NO.	COURSE TITLE	L	T	P	C
1.	PR 2025	Design of Machine Tool Structure	3	0	0	3
2.	ME 2030	Composite Materials	3	0	0	3
3.	PR 2028	Processing of Polymer and Composites	3	0	0	3
4.	PR 2031	Non Destructive Testing Methods	3	0	0	3
5.	PR 2032	Simulation of Manufacturing Systems	3	0	0	3

ELECTIVE - IV

SL.NO.	CODE NO.	COURSE TITLE	L	T	P	C
1.	PR 2026	Production Management	3	0	0	3
2.	PR 2027	Ergonomics	3	0	0	3
3.	PR 2029	Engineering Economics and Financial Management	3	0	0	3
4.	PR 2030	Purchasing and Material Management	3	0	0	3
5.	ME 2038	Operations Research	3	0	0	3

SEMESTER – VIII

ELECTIVE – V

SL.NO.	CODE NO.	COURSE TITLE	L	T	P	C
1.	PR 2033	Reliability Engineering	3	0	0	3
2.	PR 2034	Machine Tool Control and Condition Monitoring	3	0	0	3
3.	PR 2035	Mini Project	0	0	6	3
4.	GE 2025	Professional Ethics in Engineering	3	0	0	3
5.	ME 2035	Entrepreneurship Development	3	0	0	3

ELECTIVE – VI

SL.NO.	CODE NO.	COURSE TITLE	L	T	P	C
1.	PR 2036	Machine Vision	3	0	0	3
2.	PR 2037	Advances in Operation Research	3	0	0	3
3.	GE 2023	Fundamentals of Nanoscience	3	0	0	3
4.	ME 2036	Production Planning & Control	3	0	0	3
5.	ME 2037	Maintenance Engineering	3	0	0	3

TECHNICAL ENGLISH II **L T P C**
3 1 0 4

AIM:
To encourage students to actively involve in participative learning of English and to help them acquire Communication Skills.

OBJECTIVES:
1. To help students develop listening skills for academic and professional purposes.
2. To help students acquire the ability to speak effectively in English in real-life situations.
3. To inculcate reading habit and to develop effective reading skills.
4. To help students improve their active and passive vocabulary.
5. To familiarize students with different rhetorical functions of scientific English.
6. To enable students write letters and reports effectively in formal and business situations.

UNIT I **12**
Technical Vocabulary - meanings in context, sequencing words, Articles- Prepositions, intensive reading& predicting content, Reading and interpretation, extended definitions, Process description

Suggested activities:
1. Exercises on word formation using the prefix 'self' - Gap filling with preposition.
2. Exercises - Using sequence words.
3. Reading comprehension exercise with questions based on inference – Reading headings
4. and predicting the content – Reading advertisements and interpretation.
5. Writing extended definitions – Writing descriptions of processes – Writing paragraphs based on discussions – Writing paragraphs describing the future.

UNIT II **12**
Phrases / Structures indicating use / purpose – Adverbs-Skimming – Non-verbal communication - Listening – correlating verbal and non-verbal communication -Speaking in group discussions – Formal Letter writing – Writing analytical paragraphs.

Suggested activities:
1. Reading comprehension exercises with questions on overall content – Discussions analyzing stylistic features (creative and factual description) - Reading comprehension exercises with texts including graphic communication - Exercises in interpreting non-verbal communication.
2. Listening comprehension exercises to categorise data in tables.
3. Writing formal letters, quotations, clarification, complaint – Letter seeking permission for Industrial visits– Writing analytical paragraphs on different debatable issues.

UNIT III **12**
Cause and effect expressions – Different grammatical forms of the same word - Speaking – stress and intonation, Group Discussions - Reading – Critical reading - Listening, - Writing – using connectives, report writing – types, structure, data collection, content, form, recommendations .

Suggested activities:
1. Exercises combining sentences using cause and effect expressions – Gap filling exercises using the appropriate tense forms – Making sentences using different grammatical forms of the same word. (Eg: object –verb / object – noun)

2. Speaking exercises involving the use of stress and intonation – Group discussions– analysis of problems and offering solutions.
3. Reading comprehension exercises with critical questions, Multiple choice question.
4. Sequencing of jumbled sentences using connectives – Writing different types of reports like industrial accident report and survey report – Writing recommendations.

UNIT IV 12
Numerical adjectives – Oral instructions – Descriptive writing – Argumentative paragraphs – Letter of application - content, format (CV / Bio-data) - Instructions, imperative forms - Checklists, Yes/No question form – E-mail communication.

Suggested Activities:
1. Rewriting exercises using numerical adjectives.
2. Reading comprehension exercises with analytical questions on content – Evaluation of content.
3. Listening comprehension – entering information in tabular form, intensive listening exercise and completing the steps of a process.
4. Speaking - Role play – group discussions – Activities giving oral instructions.
5. Writing descriptions, expanding hints – Writing argumentative paragraphs – Writing formal letters – Writing letter of application with CV/Bio-data – Writing general and safety instructions – Preparing checklists – Writing e-mail messages.

UNIT V 9
Speaking - Discussion of Problems and solutions - Creative and critical thinking – Writing an essay, Writing a proposal.

Suggested Activities:
1. Case Studies on problems and solutions
2. Brain storming and discussion
3. Writing Critical essays
4. Writing short proposals of 2 pages for starting a project, solving problems, etc.
5. Writing advertisements.

TOTAL: 60 PERIODS

TEXT BOOK:
1. Chapters 5 – 8. Department of Humanities & Social Sciences, Anna University, 'English for Engineers and Technologists' Combined Edition (Volumes 1 & 2), Chennai: Orient Longman Pvt. Ltd., 2006. Themes 5 – 8 (Technology, Communication, Environment, Industry)

REFERENCES:
1. P. K. Dutt, G. Rajeevan and C.L.N Prakash, 'A Course in Communication Skills', Cambridge University Press, India 2007.
2. Krishna Mohan and Meera Banerjee, 'Developing Communication Skills', Macmillan India Ltd., (Reprinted 1994 – 2007).
3. Edgar Thorpe, Showick Thorpe, 'Objective English', Second Edition, Pearson Education, 2007.

EXTENSIVE READING:
1. Robin Sharma**, '**The Monk Who Sold His Ferrari', Jaico Publishing House, 2007

NOTE:
The book listed under Extensive Reading is meant for inculcating the reading habit of the students. They need not be used for testing purposes.

MA2161	**MATHEMATICS – II**	**L T P C**
		3 1 0 4

UNIT I   ORDINARY DIFFERENTIAL EQUATIONS   12
Higher order linear differential equations with constant coefficients – Method of variation of parameters – Cauchy's and Legendre's linear equations – Simultaneous first order linear equations with constant coefficients.

UNIT II   VECTOR CALCULUS   12
Gradient Divergence and Curl – Directional derivative – Irrotational and solenoidal vector fields – Vector integration – Green's theorem in a plane, Gauss divergence theorem and stokes' theorem (excluding proofs) – Simple applications involving cubes and rectangular parallelpipeds.

UNIT III   ANALYTIC FUNCTIONS   12
Functions of a complex variable – Analytic functions – Necessary conditions, Cauchy – Riemann equation and Sufficient conditions (excluding proofs) – Harmonic and orthogonal properties of analytic function – Harmonic conjugate – Construction of analytic functions – Conformal mapping : $w= z+c$, cz, $1/z$, and bilinear transformation.

UNIT IV   COMPLEX INTEGRATION   12
Complex integration – Statement and applications of Cauchy's integral theorem and Cauchy's integral formula – Taylor and Laurent expansions – Singular points – Residues – Residue theorem – Application of residue theorem to evaluate real integrals – Unit circle and semi-circular contour(excluding poles on boundaries).

UNIT V   LAPLACE TRANSFORM   12
Laplace transform – Conditions for existence – Transform of elementary functions – Basic properties – Transform of derivatives and integrals – Transform of unit step function and impulse functions – Transform of periodic functions.

Definition of Inverse Laplace transform as contour integral – Convolution theorem (excluding proof) – Initial and Final value theorems – Solution of linear ODE of second order with constant coefficients using Laplace transformation techniques.

TOTAL: 60 PERIODS

TEXT BOOK:

1. Bali N. P and Manish Goyal, "Text book of Engineering Mathematics", 3rd Edition, Laxmi Publications (p) Ltd., (2008).
2. Grewal. B.S, "Higher Engineering Mathematics", 40th Edition, Khanna Publications, Delhi, (2007).

REFERENCES:

1. Ramana B.V, "Higher Engineering Mathematics",Tata McGraw Hill Publishing

Company, New Delhi, (2007).

2. Glyn James, "Advanced Engineering Mathematics", 3rd Edition, Pearson Education, (2007).
3. Erwin Kreyszig, "Advanced Engineering Mathematics", 7th Edition, Wiley India, (2007).
4. Jain R.K and Iyengar S.R.K, "Advanced Engineering Mathematics", 3rd Edition, Narosa Publishing House Pvt. Ltd., (2007).

PH2161   **ENGINEERING PHYSICS – II**   **L T P C**
                                                                          3 0 0 3

UNIT I   CONDUCTING MATERIALS   9
Conductors – classical free electron theory of metals – Electrical and thermal conductivity – Wiedemann – Franz law – Lorentz number – Draw backs of classical theory – Quantum theory – Fermi distribution function – Effect of temperature on Fermi Function – Density of energy states – carrier concentration in metals.

UNIT II   SEMICONDUCTING MATERIALS   9
Intrinsic semiconductor – carrier concentration derivation – Fermi level – Variation of Fermi level with temperature – electrical conductivity – band gap determination – extrinsic semiconductors – carrier concentration derivation in n-type and p-type semiconductor – variation of Fermi level with temperature and impurity concentration – compound semiconductors – Hall effect –Determination of Hall coefficient – Applications.

UNIT III   MAGNETIC AND SUPERCONDUCTING MATERIALS   9
Origin of magnetic moment – Bohr magneton – Dia and para magnetism – Ferro magnetism – Domain theory – Hysteresis – soft and hard magnetic materials – anti – ferromagnetic materials – Ferrites – applications – magnetic recording and readout – storage of magnetic data – tapes, floppy and magnetic disc drives.
Superconductivity : properties - Types of super conductors – BCS theory of superconductivity(Qualitative) - High Tc superconductors – Applications of superconductors – SQUID, cryotron, magnetic levitation.

UNIT IV   DIELECTRIC MATERIALS   9
Electrical susceptibility – dielectric constant – electronic, ionic, orientational and space charge polarization – frequency and temperature dependence of polarisation – internal field – Claussius – Mosotti relation (derivation) – dielectric loss – dielectric breakdown – uses of dielectric materials (capacitor and transformer) – ferroelectricity and applications.

UNIT V   MODERN ENGINEERING MATERIALS   9
Metallic glasses: preparation, properties and applications.
Shape memory alloys (SMA): Characteristics, properties of NiTi alloy, application, advantages and disadvantages of SMA
Nanomaterials: synthesis –plasma arcing – chemical vapour deposition – sol-gels – electrodeposition – ball milling - properties of nanoparticles and applications.
Carbon nanotubes: fabrication – arc method – pulsed laser deposition – chemical vapour deposition - structure – properties and applications.

                                                            TOTAL: 45 PERIODS

TEXT BOOKS:
1. Charles Kittel ' Introduction to Solid State Physics', John Wiley & sons, 7th edition, Singapore (2007)
2. Charles P. Poole and Frank J.Ownen, 'Introduction to Nanotechnology', Wiley India(2007) (for Unit V)

REFERENCES:
1. Rajendran, V, and Marikani A, 'Materials science'Tata McGraw Hill publications, (2004) New delhi.
2. Jayakumar, S. 'Materials science', R.K. Publishers, Coimbatore, (2008).
3. Palanisamy P.K, 'Materials science', Scitech publications(India) Pvt. LTd., Chennai, second Edition(2007)
4. M. Arumugam, 'Materials Science' Anuradha publications, Kumbakonam, (2006).

CY2161   **ENGINEERING CHEMISTRY – II**   **L T P C**
                                                                      3 0 0 3
AIM
To impart a sound knowledge on the principles of chemistry involving the different application oriented topics required for all engineering branches.

OBJECTIVES
- The student should be conversant with the principles electrochemistry, electrochemical cells, emf and applications of emf measurements.
- Principles of corrosion control
- Chemistry of Fuels and combustion
- Industrial importance of Phase rule and alloys
- Analytical techniques and their importance.

UNIT I   ELECTROCHEMISTRY   9
Electrochemical cells – reversible and irreversible cells – EMF – measurement of emf – Single electrode potential – Nernst equation (problem) – reference electrodes –Standard Hydrogen electrode -Calomel electrode – Ion selective electrode – glass electrode and measurement of pH – electrochemical series – significance – potentiometer titrations (redox - Fe^{2+} vs dichromate and precipitation – Ag^+ vs Cl^- titrations) and conduct metric titrations (acid-base – HCl vs, NaOH) titrations,

UNIT II   CORROSION AND CORROSION CONTROL   9
Chemical corrosion – Pilling – Bedworth rule – electrochemical corrosion – different types – galvanic corrosion – differential aeration corrosion – factors influencing corrosion – corrosion control – sacrificial anode and impressed cathodic current methods – corrosion inhibitors – protective coatings – paints – constituents and functions – metallic coatings – electroplating (Au) and electroless (Ni) plating.

UNIT III   FUELS AND COMBUSTION   9
Calorific value – classification – Coal – proximate and ultimate analysis metallurgical coke – manufacture by Otto-Hoffmann method – Petroleum processing and fractions – cracking – catalytic cracking and methods-knocking – octane number and cetane number – synthetic petrol – Fischer Tropsch and Bergius processes – Gaseous fuels- water gas, producer gas, CNG and LPG, Flue gas analysis – Orsat apparatus – theoretical air for combustion.

UNIT IV   PHASE RULE AND ALLOYS   9
Statement and explanation of terms involved – one component system – water system – condensed phase rule – construction of phase diagram by thermal analysis – simple eutectic systems (lead-silver system only) – alloys – importance, ferrous alloys – nichrome and stainless steel – heat treatment of steel, non-ferrous alloys – brass and bronze.

UNIT V   ANALYTICAL TECHNIQUES   9
Beer-Lambert's law (problem) – UV-visible spectroscopy and IR spectroscopy – principles – instrumentation (problem) (block diagram only) – estimation of iron by colorimetry – flame photometry – principle – instrumentation (block diagram only) – estimation of sodium by flame photometry – atomic absorption spectroscopy – principles – instrumentation (block diagram only) – estimation of nickel by atomic absorption spectroscopy.

TOTAL: 45 PERIODS

TEXT BOOKS:
1. P.C.Jain and Monica Jain, "Engineering Chemistry" Dhanpat Rai Pub, Co., New Delhi (2002).
2. S.S.Dara "A text book of Engineering Chemistry" S.Chand & Co.Ltd., New Delhi (2006).

REFERENCES:
1. B.Sivasankar "Engineering Chemistry" Tata McGraw-Hill Pub.Co.Ltd, New Delhi (2008).
2. B.K.Sharma "Engineering Chemistry" Krishna Prakasan Media (P) Ltd., Meerut (2001).

ME2151   **ENGINEERING MECHANICS**   **L T P C**
                                                              3 1 0 4
OBJECTIVE
At the end of this course the student should be able to understand the vectorial and scalar representation of forces and moments, static equilibrium of particles and rigid bodies both in two dimensions and also in three dimensions. Further, he should understand the principle of work and energy. He should be able to comprehend the effect of friction on equilibrium. He should be able to understand the laws of motion, the kinematics of motion and the interrelationship. He should also be able to write the dynamic equilibrium equation. All these should be achieved both conceptually and through solved examples.

UNIT I   BASICS & STATICS OF PARTICLES   12
Introduction – Units and Dimensions – Laws of Mechanics – Lame's theorem, Parallelogram and triangular Law of forces – Vectors – Vectorial representation of forces and moments – Vector operations: additions, subtraction, dot product, cross product – Coplanar Forces – Resolution and Composition of forces – Equilibrium of a particle – Forces in space – Equilibrium of a particle in space – Equivalent systems of forces – Principle of transmissibility – Single equivalent force.

UNIT II   EQUILIBRIUM OF RIGID BODIES   12

Free body diagram – Types of supports and their reactions – requirements of stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis – Vectorial representation of moments and couples – Scalar components of a moment – Varignon's theorem – Equilibrium of Rigid bodies in two dimensions – Equilibrium of Rigid bodies in three dimensions – Examples \

UNIT III   PROPERTIES OF SURFACES AND SOLIDS   12
Determination of Areas and Volumes – First moment of area and the Centroid of sections – Rectangle, circle, triangle from integration – T section, I section, - Angle section, Hollow section by using standard formula – second and product moments of plane area – Rectangle, triangle, circle from integration – T section, I section, Angle section, Hollow section by using standard formula – Parallel axis theorem and perpendicular axis theorem – Polar moment of inertia – Principal moments of inertia of plane areas – Principal axes of inertia – Mass moment of inertia – Derivation of mass moment of inertia for rectangular section, prism, sphere from first principle – Relation to area moments of inertia.

UNIT IV   DYNAMICS OF PARTICLES   12
Displacements, Velocity and acceleration, their relationship – Relative motion – Curvilinear motion – Newton's law – Work Energy Equation of particles – Impulse and Momentum – Impact of elastic bodies.

UNIT V   FRICTION AND ELEMENTS OF RIGID BODY DYNAMICS   12
Frictional force – Laws of Coloumb friction – simple contact friction – Rolling resistance – Belt friction.
Translation and Rotation of Rigid Bodies – Velocity and acceleration – General Plane motion.

TOTAL: 60 PERIODS

TEXT BOOK:
1. Beer, F.P and Johnson Jr. E.R. "Vector Mechanics for Engineers", Vol. 1 Statics and Vol. 2 Dynamics, McGraw-Hill International Edition, (1997).

REFERENCES:
1. Rajasekaran, S, Sankarasubramanian, G., "Fundamentals of Engineering Mechanics", Vikas Publishing House Pvt. Ltd., (2000).
2. Hibbeller, R.C., "Engineering Mechanics", Vol. 1 Statics, Vol. 2 Dynamics, Pearson Education Asia Pvt. Ltd., (2000).
3. Palanichamy, M.S., Nagam, S., "Engineering Mechanics – Statics & Dynamics", Tata McGraw-Hill, (2001).
4. Irving H. Shames, "Engineering Mechanics – Statics and Dynamics", IV Edition – Pearson Education Asia Pvt. Ltd., (2003).
5. Ashok Gupta, "Interactive Engineering Mechanics – Statics – A Virtual Tutor (CDROM)", Pearson Education Asia Pvt., Ltd., (2002).

EE2151	CIRCUIT THEORY	L T P C
	(Common to EEE, EIE and ICE Branches)	3 1 0 4

UNIT I   BASIC CIRCUITS ANALYSIS   12

Ohm's Law – Kirchoffs laws – DC and AC Circuits – Resistors in series and parallel circuits – Mesh current and node voltage method of analysis for D.C and A.C. circuits.

UNIT II   NETWORK REDUCTION AND NETWORK THEOREMS FOR DC AND AC CIRCUITS: 12
Network reduction: voltage and current division, source transformation – star delta conversion.
Thevenins and Novton & Theorem – Superposition Theorem – Maximum power transfer theorem – Reciprocity Theorem.

UNIT III   RESONANCE AND COUPLED CIRCUITS   12
Series and paralled resonance – their frequency response – Quality factor and Bandwidth - Self and mutual inductance – Coefficient of coupling – Tuned circuits – Single tuned circuits.

UNIT IV   TRANSIENT RESPONSE FOR DC CIRCUITS   12
Transient response of RL, RC and RLC Circuits using Laplace transform for DC input and A.C. with sinusoidal input.

UNIT V   ANALYSING THREE PHASE CIRCUITS   12
Three phase balanced / unbalanced voltage sources – analysis of three phase 3-wire and 4-wire circuits with star and delta connected loads, balanced & un balanced – phasor diagram of voltages and currents – power and power factor measurements in three phase circuits.

TOTAL: 60 PERIODS

TEXT BOOKS:
1. William H. Hayt Jr, Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuits Analysis",Tata McGraw Hill publishers, 6th edition, New Delhi, (2002).
2. Sudhakar A and Shyam Mohan SP, "Circuits and Network Analysis and Synthesis",Tata McGraw Hill, (2007).

REFERENCES:
1. Paranjothi SR, "Electric Circuits Analysis," New Age International Ltd., New Delhi, (1996).
2. Joseph A. Edminister, Mahmood Nahri, "Electric circuits", Schaum's series, Tata McGraw-Hill, New Delhi (2001).
3. Chakrabati A, "Circuits Theory (Analysis and synthesis), Dhanpath Rai & Sons, New Delhi, (1999).
4. Charles K. Alexander, Mathew N.O. Sadik, "Fundamentals of Electric Circuits", Second Edition, McGraw Hill, (2003).

EC2151   ELECTRIC CIRCUITS AND ELECTRON DEVICES   L T P C
**   (For ECE, CSE, IT and Biomedical Engg. Branches)   3 1 0 4**

UNIT I   CIRCUIT ANALYSIS TECHNIQUES   12
Kirchoff's current and voltage laws – series and parallel connection of independent sources – R, L and C – Network Theorems – Thevenin, Superposition, Norton, Maximum power transfer and duality – Star-delta conversion.

UNIT II   TRANSIENT RESONANCE IN RLC CIRCUITS   12
Basic RL, RC and RLC circuits and their responses to pulse and sinusoidal inputs –
frequency response – Parallel and series resonances – Q factor – single tuned and
double tuned circuits.

UNIT III   SEMICONDUCTOR DIODES   12
Review of intrinsic & extrinsic semiconductors – Theory of PN junction diode – Energy
band structure – current equation – space charge and diffusion capacitances – effect of
temperature and breakdown mechanism – Zener diode and its characteristics.

UNIT IV   TRANSISTORS   12
Principle of operation of PNP and NPN transistors – study of CE, CB and CC
configurations and comparison of their characteristics – Breakdown in transistors –
operation and comparison of N-Channel and P-Channel JFET – drain current equation –
MOSFET – Enhancement and depletion types – structure and operation – comparison of
BJT with MOSFET – thermal effect on MOSFET.

UNIT V   SPECIAL SEMICONDUCTOR DEVICES (Qualitative Treatment only)   12
Tunnel diodes – PIN diode, varactor diode – SCR characteristics and two transistor
equivalent model – UJT – Diac and Triac – Laser, CCD, Photodiode, Phototransistor,
Photoconductive and Photovoltaic cells – LED, LCD.

TOTAL: 60 PERIODS

TEXT BOOKS:
1. Joseph A. Edminister, Mahmood, Nahri, "Electric Circuits" – Shaum series, Tata
   McGraw Hill, (2001)
2. S. Salivahanan, N. Suresh kumar and A. Vallavanraj, "Electronic Devices and
   Circuits",Tata McGraw Hill, 2nd Edition, (2008).
3. David A. Bell, "Electronic Devices and Circuits", Oxford University Press, 5th Edition,
   (2008).

REFERENCES:
1. Robert T. Paynter, "Introducing Electronics Devices and Circuits", Pearson Education,
   7th Education, (2006).
2. William H. Hayt, J.V. Jack, E. Kemmebly and steven M. Durbin, "Engineering Circuit
   Analysis",Tata McGraw Hill, 6th Edition, 2002.
3. J. Millman & Halkins, Satyebranta Jit, "Electronic Devices & Circuits",Tata McGraw
   Hill, 2nd Edition, 2008.

GE2151   BASIC ELECTRICAL AND ELECTRONICS ENGINEERING   L T P C
   (Common to branches under Civil, Mechanical and Technology faculty)   4 **0 0 4**

UNIT I   ELECTRICAL CIRCUITS & MEASURMENTS   12
Ohm's Law – Kirchoff's Laws – Steady State Solution of DC Circuits – Introduction to AC
Circuits – Waveforms and RMS Value – Power and Power factor – Single Phase and
Three Phase Balanced Circuits.

Operating Principles of Moving Coil and Moving Iron Instruments (Ammeters and Voltmeters), Dynamometer type Watt meters and Energy meters.

UNIT II   ELECTRICAL MECHANICS   12
Construction, Principle of Operation, Basic Equations and Applications of DC Generators, DC Motors, Single Phase Transformer, single phase induction Motor.

UNIT III   SEMICONDUCTOR DEVICES AND APPLICATIONS   12
Characteristics of PN Junction Diode – Zener Effect – Zener Diode and its Characteristics – Half wave and Full wave Rectifiers – Voltage Regulation.

Bipolar Junction Transistor – CB, CE, CC Configurations and Characteristics – Elementary Treatment of Small Signal Amplifier.

UNIT IV   DIGITAL ELECTRONICS   12
Binary Number System – Logic Gates – Boolean Algebra – Half and Full Adders – Flip-Flops – Registers and Counters – A/D and D/A Conversion (single concepts)

UNIT V   FUNDAMENTALS OF COMMUNICATION ENGINEERING   12
Types of Signals: Analog and Digital Signals – Modulation and Demodulation: Principles of Amplitude and Frequency Modulations.
Communication Systems: Radio, TV, Fax, Microwave, Satellite and Optical Fibre (Block Diagram Approach only).

TOTAL: 60 PERIODS

TEXT BOOKS:
1. V.N. Mittle "Basic Electrical Engineering",Tata McGraw Hill Edition, New Delhi, 1990.
2. R.S. Sedha, "Applied Electronics" S. Chand & Co., 2006.

REFERENCES:
1. Muthusubramanian R, Salivahanan S and Muraleedharan K A, "Basic Electrical, Electronics and Computer Engineering",Tata McGraw Hill, Second Edition, (2006).
2. Nagsarkar T K and Sukhija M S, "Basics of Electrical Engineering", Oxford press (2005).
3. Mehta V K, "Principles of Electronics", S.Chand & Company Ltd, (1994).
4. Mahmood Nahvi and Joseph A. Edminister, "Electric Circuits", Schaum' Outline Series, McGraw Hill, (2002).
5. Premkumar N, "Basic Electrical Engineering", Anuradha Publishers, (2003).

GE2152   **BASIC CIVIL & MECHANICAL ENGINEERING**   **L T P C**
                (Common to branches under Electrical and I & C Faculty)   **4 0 0 4**

A – CIVIL ENGINEERING

UNIT I   SURVEYING AND CIVIL ENGINEERING MATERIALS   15
Surveying: Objects – types – classification – principles – measurements of distances – angles – leveling – determination of areas – illustrative examples.

Civil Engineering Materials: Bricks – stones – sand – cement – concrete – steel sections.

UNIT II   BUILDING COMPONENTS AND STRUCTURES   15

Foundations: Types, Bearing capacity – Requirement of good foundations.

Superstructure: Brick masonry – stone masonry – beams – columns – lintels – roofing – flooring – plastering – Mechanics – Internal and external forces – stress – strain – elasticity – Types of Bridges and Dams – Basics of Interior Design and Landscaping.

TOTAL: 30 PERIODS

B – MECHANICAL ENGINEERING

UNIT III   POWER PLANT ENGINEERING   10
Introduction, Classification of Power Plants – Working principle of steam, Gas, Diesel, Hydro-electric and Nuclear Power plants – Merits and Demerits – Pumps and turbines – working principle of Reciprocating pumps (single acting and double acting) – Centrifugal Pump.

UNIT IV   I C ENGINES   10
Internal combustion engines as automobile power plant – Working principle of Petrol and Diesel Engines – Four stroke and two stroke cycles – Comparison of four stroke and two stroke engines – Boiler as a power plant.

UNIT V   REFRIGERATION AND AIR CONDITIONING SYSTEM   10
Terminology of Refrigeration and Air Conditioning. Principle of vapour compression and absorption system – Layout of typical domestic refrigerator – Window and Split type room Air conditioner.

TOTAL: 30 PERIODS

REFERENCES:
1. Shanmugam G and Palanichamy M S, "Basic Civil and Mechanical Engineering",Tata McGraw Hill Publishing Co., New Delhi, (1996).
2. Ramamrutham. S, "Basic Civil Engineering", Dhanpat Rai Publishing Co. (P) Ltd. (1999).
3. Seetharaman S. "Basic Civil Engineering", Anuradha Agencies, (2005).
4. Venugopal K and Prahu Raja V, "Basic Mechanical Engineering", Anuradha Publishers, Kumbakonam, (2000).
5. Shantha Kumar S R J., "Basic Mechanical Engineering", Hi-tech Publications, Mayiladuthurai, (2000).

| GE2155 | **COMPUTER PRACTICE LABORATORY – II** | **L T P C** |
| | | **0 1 2 2** |

LIST OF EXPERIMENTS

1. UNIX COMMANDS   **15**

Study of Unix OS - Basic Shell Commands - Unix Editor

2. SHELL PROGRAMMING   15
Simple Shell program - Conditional Statements - Testing and Loops

3. C PROGRAMMING ON UNIX   15
Dynamic Storage Allocation-Pointers-Functions-File Handling

TOTAL: 45 PERIODS

HARDWARE / SOFTWARE REQUIREMENTS FOR A BATCH OF 30 STUDENTS

Hardware
- 1 UNIX Clone Server
- 33 Nodes (thin client or PCs)
- Printer – 3 Nos.

Software
- OS – UNIX Clone (33 user license or License free Linux)
- Compiler - C

GS2165	PHYSICS LABORATORY – II	L T P C
		0 0 3 2

LIST OF EXPERIMENTS

1. Determination of Young's modulus of the material – non uniform bending.

2. Determination of Band Gap of a semiconductor material.

3. Determination of specific resistance of a given coil of wire – Carey Foster   Bridge.

4. Determination of viscosity of liquid – Poiseuille's method.

5. Spectrometer dispersive power of a prism.

6. Determination of Young's modulus of the material – uniform bending.

7. Torsional pendulum – Determination of rigidity modulus.

• **A minimum of FIVE experiments shall be offered.**

• **Laboratory classes on alternate weeks for Physics and Chemistry.**

• **The lab examinations will be held only in the second semester.**

GS2165   **CHEMISTRY LABORATORY – II**   **L T P C**
                                                                           0 0 3 2

LIST OF EXPERIMENTS

1. Conduct metric titration (Simple acid base)

2. Conduct metric titration (Mixture of weak and strong acids)

3. Conduct metric titration using $BaCl_2$ vs Na_2SO_4

4. Potentiometric Titration (Fe^{2+} / $KMnO_4$ or $K_2Cr_2O_7$)

5. PH titration (acid & base)

6. Determination of water of crystallization of a crystalline salt (Copper   sulphate)

7. Estimation of Ferric iron by spectrophotometry.

• **A minimum of FIVE experiments shall be offered.**

• **Laboratory classes on alternate weeks for Physics and Chemistry.**

• **The lab examinations will be held only in the second semester.**

ME2155   COMPUTER AIDED DRAFTING AND MODELING LABORATORY L T P C
                                                                                  0 1 2 2

List of Exercises using software capable of Drafting and Modeling

1. Study of capabilities of software for Drafting and Modeling – Coordinate systems (absolute, relative, polar, etc.) – Creation of simple figures like polygon and general multi-line figures.

2. Drawing of a Title Block with necessary text and projection symbol.

3. Drawing of curves like parabola, spiral, involute using Bspline or cubic spline.

4. Drawing of front view and top view of simple solids like prism, pyramid, cylinder, cone, etc, and dimensioning.

5. Drawing front view, top view and side view of objects from the given pictorial views (eg. V-block, Base of a mixie, Simple stool, Objects with hole and curves).

6. Drawing of a plan of residential building (Two bed rooms, kitchen, hall, etc.)

7. Drawing of a simple steel truss.

8. Drawing sectional views of prism, pyramid, cylinder, cone, etc,

9. Drawing isometric projection of simple objects.

10. Creation of 3-D models of simple objects and obtaining 2-D multi-view drawings from 3-D model.

NOTE: Plotting of drawings must be made for each exercise and attached to the records written by students.

List of Equipments for a batch of 30 students:

1. Pentium IV computer or better hardware, with suitable graphics facility -30 No.
2. Licensed software for Drafting and Modeling. – 30 Licenses
3. Laser Printer or Plotter to print / plot drawings – 2 No.

TOTAL: 45 PERIODS

EE2155   **ELECTRICAL CIRCUIT LABORATORY**   **L T P C**
                        (Common to EEE, EIE and ICE)   **0 0 3 2**

LIST OF EXPERIMENTS

1. Verification of ohm's laws and kirchoff's laws.

2. Verification of Thevemin's and Norton's Theorem

3. Verification of superposition Theorem

4. Verification of maximum power transfer theorem.

5. Verification of reciprocity theorem

6. Measurement of self inductance of a coil

7. Verification of mesh and nodal analysis.

8. Transient response of RL and RC circuits for DC input.

9. Frequency response of series and parallel resonance circuits.

10. Frequency response of single tuned coupled circuits.

TOTAL: 45 PERIODS

EC2155   **CIRCUITS AND DEVICES LABORATORY**   **L T P C**
                                                                             0 0 3 2

1. Verification of KVL and KCL

2. Verification of Thevenin and Norton Theorems.

3. Verification of superposition Theorem.

4. Verification of Maximum power transfer and reciprocity theorems.

5. Frequency response of series and parallel resonance circuits.

6. Characteristics of PN and Zener diode

7. Characteristics of CE configuration

8. Characteristics of CB configuration

9. Characteristics of UJT and SCR

10. Characteristics of JFET and MOSFET

11. Characteristics of Diac and Triac.

12. Characteristics of Photodiode and Phototransistor.

TOTAL: 45 PERIODS

ENGLISH LANGUAGE LABORATORY (Optional)

L T P C
0 0 2 -

1. Listening: 5
Listening & answering questions – gap filling – Listening and Note taking- Listening to telephone conversations

2. Speaking: 5
Pronouncing words & sentences correctly – word stress – Conversation practice.

Classroom Session 20
1. Speaking: Introducing oneself, Introducing others, Role play, Debate-Presentations: Body language, gestures, postures.
Group Discussions etc
2. Goal setting – interviews – stress time management – situational reasons

Evaluation
(1) Lab Session – 40 marks
Listening – 10 marks
Speaking – 10 marks
Reading – 10 marks
Writing – 10 marks

(2) Classroom Session – 60 marks

Role play activities giving real life context – 30 marks
Presentation – 30 marks

Note on Evaluation
1. Examples for role play situations:
a. Marketing engineer convincing a customer to buy his product.
b. Telephone conversation – Fixing an official appointment / Enquiry on availability of flight or train tickets / placing an order. etc.

2. Presentations could be just a Minute (JAM activity) or an Extempore on simple topics or visuals could be provided and students could be asked to talk about it.

REFERENCES:
1. Hartley, Peter, Group Communication, London: Routledge, (2004).
2. Doff, Adrian and Christopher Jones, Language in Use – (Intermediate level), Cambridge University Press, (1994).
3. Gammidge, Mick, Speaking Extra – A resource book of multi-level skills activities , Cambridge University Press, (2004).
4. Craven, Miles, Listening Extra - A resource book of multi-level skills activities, Cambridge, Cambridge University Press, (2004).
5. Naterop, Jean & Rod Revell, Telephoning in English, Cambridge University Press, (1987).

LAB REQUIREMENTS
1. Teacher – Console and systems for students
2. English Language Lab Software
3. Tape Recorders.

MA 2211   TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATION   L T P C
(Common to all branches)   3 1 0 4

OBJECTIVES
The course objective is to develop the skills of the students in the areas of Transforms and Partial Differtial Equations. This will be necessary for their effective studies in a large number of engineering subjects like heat conduction, communication systems, electro-optics and electromagnetic theory. The course will also serve as a prerequisite for post graduate and specialized studies and research.

UNIT I   FOURIER SERIES   9 + 3
Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Complex form of Fourier Series – Parseval's identify – Harmonic Analysis.

UNIT II   FOURIER TRANSFORMS   9 + 3
Fourier integral theorem (without proof) – Fourier transform pair – Sine and Cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

UNIT III   PARTIAL DIFFERENTIAL EQUATIONS   9 +3
Formation of partial differential equations – Lagrange's linear equation – Solutions of standard types of first order partial differential equations - Linear partial differential equations of second and higher order with constant coefficients.

UNIT IV   APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS   9 + 3
Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two-dimensional equation of heat conduction (Insulated edges excluded) – Fourier series solutions in cartesian coordinates.

UNIT V   Z -TRANSFORMS AND DIFFERENCE EQUATIONS   9 + 3
Z-transforms - Elementary properties – Inverse Z-transform – Convolution theorem - Formation of difference equations – Solution of difference equations using Z-transform.

LECTURES: 45 TUTORIALS: 15   TOTAL: 60 PERIODS

TEXT BOOKS
1. Grewal, B.S, 'Higher Engineering Mathematics' 40th Edition, Khanna publishers, Delhi, (2007)

REFERENCES
1. Bali.N.P and Manish Goyal 'A Textbook of Engineering Mathematics', Seventh Edition, Laxmi Publications(P) Ltd. (2007)
2. Ramana.B.V. 'Higher Engineering Mathematics' Tata Mc-GrawHill Publishing Company limited, New Delhi (2007).
3. Glyn James, 'Advanced Modern Engineering Mathematics', Third edition-Pearson Education (2007).
4. Erwin Kreyszig 'Advanced Engineering Mathematics', Eighth edition-Wiley India (2007).

PR 2201   **BASIC MACHINING PROCESSES**   **L T P C**
                                                                    3 0 0 3
OBJECTIVE:
- To impart the knowledge on basic concepts of various machining processes and machine tools

UNIT I   LATHE   9
Introduction to production processes – types of production (job, batch and mass) – production processes – Casting, Forming, Machining and Welding, Machine and Machine Tool – Lathe – Engine Lathe – block diagram – sketch – functions of each part – work holding devices in lathe – functions – Chuck, Centre, Dogs, Steady Rest and Follower Rest, mechanism of lathe – Apron, Feed, Tumbler Gear, various operations performed in Lathe – facing, turning, chamfering and knurling – relative positions of tool and job – Taper turning operations (three methods_ thread cutting – thread – RH and LH, single start and multi start with application – Method of thread cutting – selection and arrangement of tool and work. Problems in metric and inch thread conversion – Specifications of Lathe – Burnishing.

UNIT II   SHAPER, PLANER & SLOTTER   9
Purpose of shaping – block diagram – functions of each part. Purpose of planer – block diagram – functions of each part. Purpose of slotting machine – block diagram – functions and working principle. Operations carried out – horizontal plane, vertical plane, v type with relative position – Comparison of planer with shaper – work holding devices in shaper and planer – Quick return mechanism in shaper – mechanical and hydraulic – cross feed mechanism –Types of planer with application – mechanism in planer – Comparison of shaping with slotting – tool holding devices in shaper, planer and slotter – specifications of shaper, planer and slotter simple problems to calculate the velocity – speed, feed and depth of cut.

UNIT III   DRILLING   9
Purpose of drilling – block diagrm and function – types of drilling machines – portable drilling – bench type – sensitive drilling – radial arm drilling – functions of parts – purpose and operation – gang milling, multiple drill head, upright drilling, relative operations – reaming, boring, tapping, counter boring, courses sinking, trepanning and spot facing (with simple sketch, purpose and application). Work holding devices – specification torque calculation – speed, feed and depth of cut.

UNIT IV   MILLING   9

Milling machine purpose – up and down milling – classification of milling machines – slot, keyway machining – methods of milling – single piece, string, rotary, index, gang, progressive, copy. Horizontal milling machine – block diagram – functions of each part- applications – Vertical milling machine – block diagram – functions of each part applications – Gear cutting using milling machine – procedure with neat sketch – milling cutters – peripheral, face, end T slot, form etc. – attachments and special accessories for milling – rotary, slotting attachment – indexing mechanism – methods of indexing – direct, plain, compound and differential indexing – problems – specifications – cutting conditions and parameters.

UNIT V   GRINDING   9

Purpose – classification – surface finish – applications – grinding wheel – types – specifications – selection – surface grinding machine – block diagram – functions of each part – cylindrical grinding – Centreless grinding – Comparison – infeed, end feed and through feed. Balancing, dressing, loading and Truing of wheel – special grinding machines – specification of machine – cutting condition.

For all machines, demonstration to be done in a Workshop or using CD to explain the actual operation.

TOTAL: 45 PERIODS

TEXT BOOKS
1. HMT Bangalore, "Production Technology", Tata Mc-Graw Hill Publishing Company Limited, New Delhi, 2001.
2. P.C. Sharma, "A Text Book of Production Technology", S.Chand and Company, 2001.

REFERENCES
1. R.K. Jain, "Production Technology", Khanna Publishers, New Delhi, 2001.
2. Hajra Choudhary etal, "Elements of Production Technology –Vol.II", Asia Publishing House, 2000.
3. B.Kumar, "Manufacturing Technology", Khanna Publishers, New Delhi 2000.
4. P.Radhakrishnan, "Manufacturing Technology, Vol.I", Scitech Publications, 2002.

PR2202 BASICS OF THERMODYNAMICS AND THERMAL ENGINEERING   L T P C
3 1 0 4

OBJECTIVE
To introduce fundamental concepts in thermodynamics, heat tramsfer, propulsion and refrigeration and air conditioning.

UNIT I   BASIC THERMODYNAMICS   16
Systems, Zeroth low, First law. Steady flow energy equation. Heat and work transfer in flow and non-flow processes. Second law, Kelvin-Planck statement - Clausius statement - Concept of Entropy, Clausius inequality, Entropy change in non-flow processes. Properties of gases and vapours.

UNIT II   AIR CYCLE AND COMPRESSORS   12
Otto, Diesel, Dual combustion and Brayton cycles. Air standard efficiency . Mean effective pressure, Reciprocating compressors.

UNIT III   STEAM AND JET PROPULSION   12
Properties of steam – Rankine cycle – Steam Nozzles – Simple jet propulsion system – Thrust rocket motor – Specific impulse.

UNIT IV   REFRIGERATION AND AIR-CONDITIONING   10
Principles of Psychrometry and refrigeration - Vapour compression - Vapour absorption types - Co-efficient of performance, Properties of refrigerants – Basic Principle and types Air conditioning.

UNIT V   HEAT TRANSFER   10
Conduction in parallel, radial and composite wall – Basics of Convective heat transfer - Fundamentals of Radiative heat transfer – Flow through heat exchangers.

L = 45, T = 15, TOTAL = 60 PERIODS

(Use of standard thermodynamic tables, Mollier diagram and Refrigerant property tables are permitted)

TEXT BOOKS
1. Nag.P.K., "Engineering Thermodynamics", Tata McGraw-Hill, New Delhi, 2007.
2. Rathakrishnan E., "Fundamentals of Engineering Thermodynamics", Prentice-Hall India, 2005.

REFERENCES
1. Ramalingam K.K. "Thermodynamics", Sci-Tech Publications, 2006
2. Holman.J.P., "Thermodynamics", 3rd Ed. McGraw-Hill, 2007.
3. Venwylen and Sontag, "Classical Thermodynamics", Wiley Eastern, 1987
4. Arora C.P, " Thermodynamics", Tata McGraw-Hill, New Delhi, 2003.
5. Merala C, Pother, Craig W, Somerton, " Thermodynamics for Engineers", Schaum Outline Series, Tata McGraw-Hill, New Delhi, 2004.

PR 2203   ENGINEERING METALLURGY   L T P C
**   3 0 0 3**

OBJECTIVE:
- To introduce the various concepts of metallurgy, metallurgical structures and mechanical properties, testing of metals
- To impart the knowledge on metallurgy with respect to foundry and welding processes

UNIT I   CONSTITUTION OF ALLOYS AND PHASE DIAGRAMS   10
Crystal structure – BCC, FCC and HCP structure – unit cell – crystallographic planes and directions, miller indices – crystal imperfection, point, line, planner and volume defects – Grain size, ASTM grain size number.   Constitution of alloys – Solid solutions, substitutional and interstitial – phase diagrams, isomorphous, eutectic, peritectic, eutectoid and peritectoid reactions, Iron – Iron carbide and Iron – Charbide & Iron Graphite equilibrium diagram. Classification of steel and cast iron - microstructures of Steels & Cast irons - properties and application.

UNIT II   HEAT TREATMENT   10
Defintion – Full annealing, stress relief, recrystallisation and spheroidizing – normalizing, hardening and tempering of steel, Isothermal transformation diagrams – cooling curves

superimposed on I.T. diagram CCR – Hardenability, Jominy end quench test – Austempering martempering – case hardening, carburizing, nitriding cyaniding, carbonitriding – Flame, Induction Laser and Electron beam and plasma phase hardening – Special and Duplex surface hardening processes.

UNIT III   FERROUS AND NON FERROUS METALS   9
Effect of alloying additions on steel (Mn, Si, Cr, Mo, V Ti & W) – stainless and tool steels – HSLA – maraging steels – Gray, white, malleable spheroidal, graphite, alloy cast irons Copper and Copper alloys, Brass, Bronze and Cupronickel – Aluminium and AI-Cu – precipitation strengthening treatment – Bearing alloys, Alloys of Ti, Zn Mg and Ni – Intermetallics, Ni, Ti Aluminides – Shape memory alloys.

UNIT IV   MECHANICAL PROPERTIES AND TESTING   8
Mechanism of plastic deformation, slip and twinning – Types of fracture – Testing of materials under tension, compression and shear loads – hardness tests (Brinell, Vickers and Rockwell) micro and nano hardness test impact test, Izod and charpy, fatigue and creep mechanisms – types of wear – preventions.

UNIT V   WELDING AND FOUNDRY METALLURGY   8
Weld thermal cycle – Microstructure of HAZ in Steel and Aluminium alloys – weldability of steel, cast iron and non-ferrous alloys – Pre and Post weld heat treatment – Residual stress and distortion – casting solidification – Formation of dendrite, columnar and equiaxed grains – castability of steel, cast iron, Stainless Steel Al and Cu alloys.

TOTAL: 45 PERIODS

TEXT BOOKS
1. Donald R.Askeland – The Science and Engineering of materials – 4th Edition – Thomson Engineering – 2002
2. Keneth G.Budinski and Michael K.Budinski "Engineering Materials" Prentice Hall of India Private Limited, 7th Edition Indian Reprint 2004".

REFERENCES
1. Sydney H.Avner "Introduction to Physical Metallurgy" McGraw Hill Book Co., 2001
2. Raghavan V. Materials Science & Engg" Prentice Hall of India Pvt.Ltd., 2004
3. William D Callister "Material Science & Engg – John Wiley & Sons, 2002
4. L.H.Van Vlack, "Materials Engg. Concepts and Applications, 2001.

ME2204	FLUID MECHANICS AND MACHINERY	L T P C
	(Common to Aeronautical, Mechanical, Automobile & Production)	3 1 0 4

OBJECTIVES

- The student is introduced to the mechanics of fluids through a thorough understanding of the properties of the fluids. The dynamics of fluids is introduced through the control volume approach which gives an integrated under standing of the transport of mass, momentum and energy.
- The applications of the conservation laws to flow though pipes and hydraulics machines are studied

UNIT I INTRODUCTION   12
Units & Dimensions. Properties of fluids – Specific gravity, specific weight, viscosity, compressibility, vapour pressure and gas laws – capillarity and surface tension. Flow characteristics: concepts of system and control volume. Application of control volume to

continuity equiation, energy equation, momentum equation and moment of momentum equation.

UNIT II   FLOW THROUG CIRCULAR CONDUITS   12
Laminar flow though circular conduits and circular annuli. Boundary layer concepts. Boundary layer thickness. Hydraulic and energy gradient. Darcy – Weisbach equaition. Friction factor and Moody diagram. Commercial pipes. Minor losses. Flow though pipes in series and in parallel.

UNIT III   DIMENSIONAL ANALYSIS   9
Dimension and units: Buckingham's theorem. Discussion on dimensionless parameters. Models and similitude. Applications of dimensionless parameters.

UNIT IV   ROTO DYNAMIC MACHINES   16
Homologus units. Specific speed. Elementary cascade theory. Theory of turbo machines. Euler's equation. Hydraulic efficiency. Velocity components at the entry and exit of the rotor. Velocity triangle for single stage radial flow and axial flow machines. Centrifugal pumps, turbines, performance curves for pumps and turbines.

UNIT V   POSITIVE DISPLACEMENT MACHINES   11
Recriprocating pumps, Indicator diagrams, Work saved by air vessels. Rotory pumps. Classification. Working and performance curves.

TOTAL: 60 PERIODS

TEXT BOOKS:

1. Streeter. V. L., and Wylie, E.B., Fluid Mechanics, McGraw Hill, 1983.
2. Rathakrishnan. E, Fluid Mechanics, Prentice Hall of India (II Ed.), 2007.

REFERENCES:

1. Ramamritham. S, Fluid Mechanics, Hydraulics and Fluid Machines, Dhanpat Rai & Sons, Delhi, 1988.
2. Kumar. K.L., Engineering Fluid Mechanics (VII Ed.) Eurasia Publishing House (P) Ltd., New Delhi, 1995.
3. Bansal, R.K., Fluid Mechanics and Hydraulics Machines, Laxmi Publications (P) Ltd., New Delhi.

ME2205	ELECTRICAL DRIVES AND CONTROLS	L T P C
	(Common to Mechanical, Production &Technology Faculty)	3 0 0 3

OBJECTIVES
- To understand the basic concepts of different types of electrical machines and their performance.
- To study the different methods of starting D.C motors and induction motors.
- To study the conventional and solid-state drives

UNIT I   INTRODUCTION   8
Basic Elements – Types of Electric Drives – factors influencing the choice of electrical drives – heating and cooling curves – Loading conditions and classes of duty – Selection of power rating for drive motors with regard to thermal overloading and Load variation factors

UNIT II   DRIVE MOTOR CHARACTERISTICS   9
Mechanical characteristics – Speed-Torque characteristics of various types of load and drive motors – Braking of Electrical motors – DC motors: Shunt, series and compound - single phase and three phase induction motors.

UNIT III   STARTING METHODS   8
Types of D.C Motor starters – Typical control circuits for shunt and series motors – Three phase squirrel cage and slip ring induction motors.

**UNIT IV   CONVENTIONAL AND SOLID STATE SPEED CONTROL
            OF D.C. DRIVES   10**
Speed control of DC series and shunt motors – Armature and field control, Ward-Leonard control system - Using controlled rectifiers and DC choppers –applications.

**UNIT V   CONVENTIONAL AND SOLID STATE SPEED CONTROL
            OF A.C. DRIVES   10**
Speed control of three phase induction motor – Voltage control, voltage / frequency control, slip power recovery scheme – Using inverters and AC voltage regulators – applications**.**

                                                    TOTAL : 45 PERIODS

TEXT BOOKS
1. EDAM SUBRAHMANIAM, "Electric Drives (concepts and applications)", Tata
    McGraw-Hill, 2001
2. NAGRATH.I.J. & KOTHARI.D.P, "Electrical Machines", Tata McGraw-Hill, 1998

REFERENCES
1.   PILLAI.S.K "A first course on Electric drives", Wiley Eastern Limited, 1998
2.   M.D.SINGH, K.B.KHANCHANDANI, "Power Electronics", Tata McGraw-Hill, 1998
3.   H.Partab, "Art and Science and Utilisation of electrical energy", Dhanpat Rai and
     Sons, 1994

**PR 2207   BASIC MACHINING PROCESS LAB   L T P C
                                                                 0 0 3 2**

LIST OF EXPERIMENTS:
1.   Lathe: Facing, Plain turning,Step Turning
2.   Lathe: Taper Turning, Threading, Knurling
3.   Lathe: Multi start Threading, Burnishing
4.   Shaper: Cube
5.   Shaper: Cube, V-Block
6.   Drilling: Counter sinking, Counter Boring, Tapping
7.   Milling Vertical: Surfacing, Pocket Milling
8.   Milling Horizontal: Polygonal shape milling
9.   Grinding: Surface & Cylindrical grinding
10. Slotting: Machining an internal spline

                                                    TOTAL: 45 PERIODS

ME2208   **FLUID MECHANICS AND MACHINERY LAB**   **L T P C**
                    (Common to Mechanical & Production)   **0 0 3 2**

LIST OF EXPERIMENTS

1. Determination of the Coefficient of discharge of given Orifice meter.
2. Determination of the Coefficient of discharge of given Venturi meter.
3. Calculation of the rate of flow using Rota meter.
4. Determination of friction factor for a given set of pipes.
5. Conducting experiments and drawing the characteristic curves of centrifugal pump / submergible pump
6. Conducting experiments and drawing the characteristic curves of reciprocating pump.
7. Conducting experiments and drawing the characteristic curves of Gear pump.
8. Conducting experiments and drawing the characteristic curves of Pelton wheel.
9. Conducting experiments and drawing the characteristics curves of Francis turbine.
10. Conducting experiments and drawing the characteristic curves of Kaplan turbine.

LIST OF EQUIPMENT
(for a batch of 30 students)

1. Orifice meter setup
2. Venturi meter setup
3. Rotameter setup
4. Pipe Flow analysis setup
5. Centrifugal pump/submergible pump setup
6. Reciprocating pump setup
7. Gear pump setup
8. Pelton wheel setup
9. Francis turbine setup
10. Kaplan turbine setup
   Quantity: one each.

                                                          TOTAL: 45 PERIODS

ME 2209   **ELECTRICAL ENGINEERING LABORATORY**   **L T P C**
                     (Common to Mechanical & Production)   **0 0 3 2**

LIST OF EXPERIMENTS

1. Load test on DC Shunt & DC Series motor
2. O.C.C & Load characteristics of DC Shunt and DC Series generator
3. Speed control of DC shunt motor (Armature, Field control)
4. Load test on single phase transformer
5. O.C & S.C Test on a single phase transformer
6. Regulation of an alternator by EMF & MMF methods.

7. V curves and inverted V curves of synchronous Motor
8. Load test on three phase squirrel cage Induction motor
9. Speed control of three phase slip ring Induction Motor
10. Load test on single phase Induction Motor.
11. Study of DC & AC Starters

TOTAL: 45 PERIODS

LIST OF EQUIPMENT
(for batch of 30 students)

Equipment	-	No.
1. DC Shunt motor	-	2
2. DC Series motor	-	1
3. DC shunt motor-DC Shunt Generator set	-	1
4. DC Shunt motor-DC Series Generator set	-	1
5. Single phase transformer	-	2
6. Three phase alternator	-	2
7. Three phase synchronous motor	-	1
8. Three phase Squirrel cage Induction motor	-	1
9. Three phase Slip ring Induction motor	-	1
10. Single phase Induction motor	-	1

TOTAL: 45 PERIODS

MA 2266   **STATISTICS AND NUMERICAL METHODS**   **L T P C**
(Common to Mechanical, Automobile & Production)   **3 1 0 4**

UNIT I   TESTING OF HYPOTHESIS   **9 + 3**
Sampling distributions - Tests for single mean, Proportion, Difference of means (large and small samples) – Tests for single variance and equality of variances – chi-square test for goodness of fit – Independence of attributes.

UNIT II   DESIGN OF EXPERIMENTS   **9 + 3**
Completely randomized design – Randomized block design – Latin square design - 2^2 - factorial design.

UNIT III   SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS   **9 +3**
Newton-Raphson method-   Gauss Elimination method – Pivoting - Gauss-Jordan methods – Iterative methods of Gauss-Jacobi and Gauss-Seidel - Matrix Inversion by Gauss-Jordan method - Eigenvalues of a matrix by Power method .

UNIT IV   INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL
                INTEGRATION   **9 + 3**
Lagrange's and Newton's divided difference interpolation –Newton's forward and backward difference interpolation - Approximation of derivatives using interpolation polynomials - Numerical integration using Trapezoidal and Simpson's 1/3 rules.

UNIT V   NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS 9+3
Taylor's series method - Euler's method - Modified Euler's method - Fourth order Runge-Kutta method for solving first and second order equations - Milne's predictor-corrector methods for solving first order equations - Finite difference methods for solving second order equation.

TEXT BOOKS

1. R.A. Johnson and C.B. Gupta, "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 7th edition, 2007 (For units 3, 4 and 5).
2. Grewal, B.S. and Grewal,J.S., " Numerical methods in Engineering and Science", 6th Edition, Khanna Publishers, New Delhi, 2004.

REFERENCES:

1. R.E. Walpole, R.H. Myers, S.L. Myers, and K Ye, "Probability and Statistics for Engineers and Scientists", Pearson Education, Asia , 8th edition, 2007.
2. M.R. Spiegel, J. Schiller and R.A. Srinivasan, "Schaum's Outlines Probability and Statistics", Tata McGraw Hill edition, 2004.
3. Chapra, S. C and Canale, R. P. "Numerical Methods for Engineers", 5th Edition, Tata McGraw-Hill, New Delhi, 2007.
4. Gerald, C. F. and Wheatley, P. O., "Applied Numerical Analysis", 6th Edition, Pearson Education Asia, New Delhi, 2006.

ME 2254	STRENGTH OF MATERIALS	L T P C
	(Common to Mechanical, Automobile & Production)	3 1 0 4

OBJECTIVES

- To gain knowledge of simple stresses, strains and deformation in components due to external loads.
- To assess stresses and deformations through mathematical models of beams, twisting bars or combinations of both.
- Effect of component dimensions and shape on stresses and deformations are to be understood.
- The study would provide knowledge for use in the design courses

UNIT I   STRESS STRAIN DEFORMATION OF SOLIDS   9
Rigid and Deformable bodies – Strength, Stiffness and Stability – Stresses; Tensile, Compressive and Shear – Deformation of simple and compound bars under axial load – Thermal stress – Elastic constants – Strain energy and unit strain energy – Strain energy in uniaxial loads.

UNITII   BEAMS - LOADS AND STRESSES   9
Types of beams: Supports and Loads – Shear force and Bending Moment in beams – Cantilever, Simply supported and Overhanging beams – Stresses in beams – Theory of simple bending – Stress variation along the length and in the beam section – Effect of shape of beam section on stress induced – Shear stresses in beams – Shear flow

UNIT III   TORSION   9
Analysis of torsion of circular bars – Shear stress distribution – Bars of Solid and hollow circular section – Stepped shaft – Twist and torsion stiffness – Compound shafts – Fixed and simply supported shafts – Application to close-coiled helical springs – Maximum shear stress in spring section including Wahl Factor – Deflection of helical coil springs under axial loads – Design of helical coil springs – stresses in helical coil springs under torsion loads

UNIT IV   BEAMDEFLECTION   9
Elastic curve of Neutral axis of the beam under normal loads – Evaluation of beam deflection and slope: Double integration method, Macaulay Method, and Moment-area

Method –Columns – End conditions – Equivalent length of a column – Euler equation – Slenderness ratio – Rankine formula for columns

UNIT V   ANALYSIS OF STRESSES IN TWO DIMENSIONS   9
Biaxial state of stresses – Thin cylindrical and spherical shells – Deformation in thin cylindrical and spherical shells – Biaxial stresses at a point – Stresses on inclined plane – Principal planes and stresses – Mohr's circle for biaxial stresses – Maximum shear stress - Strain energy in bending and torsion.

TUTORIALS 15 TOTAL: 60 PERIODS

TEXT BOOKS
1. Popov E.P, "Engineering Mechanics of Solids", Prentice-Hall of India, New Delhi, 1997
2. Beer F. P. and Johnston R," Mechanics of Materials", McGraw-Hill Book Co, Third Edition, 2002.

REFERENCES
1. Nash W.A, "Theory and problems in Strength of Materials", Schaum Outline Series, McGraw-Hill Book Co, New York, 1995
2. Kazimi S.M.A, "Solid Mechanics", Tata McGraw-Hill Publishing Co., New Delhi, 1981.
3. Ryder G.H, "Strength of Materials, Macmillan India Ltd"., Third Edition, 2002
4. Ray Hulse, Keith Sherwin & Jack Cain, "Solid Mechanics", Palgrave ANE Books, 2004.
5. Singh D.K "Mechanics of Solids" Pearson Education 2002.
6. Timoshenko S.P, "Elements of Strength of Materials", Tata McGraw-Hill, New Delhi, 1997.

PR 2251   ADVANCED MACHINING PROCESS   L T P C
                                                                     3 0 0 3

OBJECTIVES:
- To understand the theory of metal cutting
- To understand the concepts of gear manufacture
- To understand CNC machines constructional features, working and programming

UNIT I   MECHANICS OF METAL CUTTING   10
Cutting tool angles – tool signature – orthogonal & oblique cutting – cutting forces, Merchant circle diagram – force & velocity relation.

UNIT II   TOOL MATERIAL, TOOL WEAR AND TOOL LIFE   9
Requirement of tool materials – types of tool materials – Tool wear – Types, mechanism – Tool life - Machinability - types of chips – cutting fluids.

UNIT III   GEAR MANUFACTURE   8
Different methods of gear manufacture – Gear hobbling and gear shaping machines specifications – gear generation – different methods – gear finishing and shaving – grinding and lapping of hobs and shaping cutters – gear honing – gear broaching.

UNIT IV   CNC MACHINES   9
NC, CNC & DNC – types of CNC – constructional features – drives and control systems – feed back devices – Interchangeable tooling system – preset & qualified tools – ISO specification – Machining center – Turning center – CNC wire cut EDM.

UNIT V   CNC PROGRAMMING   9

Manual part programming – steps involved – sample program in lathe & milling. - Computer aided part programming – APT program - CAM package – canned cycles - Programming.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Hazlehurst M, "Manufacturing Technology", - EI.BS, 1978
2. Jonathan Lin.S.C., Computer Numerical Control from Programming to Networking, Delmar Publishers, 1994

REFERENCES

1. Groover.M.P., Automatic production systems and computer integrated manufacturing, Prentice Hall , 1990.
2. GE Thyer, Computer Numerical Control of Machine Tools, BH.Newners, 1991
3. Hajra Choudhury C.J., "Elements of Workshop Technology", Vol.I and Vol.II, Asia Publishing House, 1992.
4. Nagpal G.R., Machine Tool Engineering, Khanna Publishers, 2002

PR 2252   **THEORY OF MACHINES**   **L T P C**
                                                                                        3 1 0 4

OBJECTIVE:
To understand the basic concepts of mechanisms and machinery

UNIT I   MECHANISMS   14
Definition – Machine and Structure – Kinematic link, pair and chain – classification of Kinematic pairs – Constraint & motion – Degrees of freedom - Slider crank – single and double – Crank rocker mechanisms – Inversions, applications – Introduction to Kinematic analysis and synthesis of simple mechanisms – Determination of velocity and acceleration of simple mechanisms.

UNIT II   FRICTION   12
Types of friction – friction in screw and nut – screw jack – pivot, collar and thrust bearings – plate and cone clutch – belt (flat & vee) and rope drives – creep in belts – open and crossed belt drives – Ratio of tensions – Effect of centrifugal and initial tensions – condition for maximum power transmission.

UNIT III   GEARING AND CAMS   12
Gear – Types and profile – nomenclature of spur & helical gears – laws of gearing – interference – requirement of minimum number of teeth in gears – gear trains – simple, compound and reverted gear trains – determination of speed and torque in epicyclic gear trains – cams different types of followers – Cam – Types of cams and followers – Cam design for different follower motions.

UNIT IV   BALANCING   11
Static and dynamic balancing – single and several masses in different planes – primary and secondary balancing of reciprocating masses – Balancing of single and multi cylinder engines – Governors and Gyroscopic effects.

UNIT V   VIBRATION   11

Free, forced and damped vibrations of single degree of freedom systems – force transmitted to supports – vibration Isolation – vibration absorption – torsional vibration of shafts – single and multirotor systems – geared shafts – critical speed of shafts.

TOTAL: 60 PERIODS

TEXT BOOKS

1. Bansal Dr.R.K. " Theory of Machines" Laxmi Publications (P) Ltd., New Delhi 2001
2. Rattan S.S."Theory of machines" Tata McGraw Hill publishing Co., New Delhi, 2002.

REFERENCES

1. Rao J.S.and Dukkipati R.V. "Mechanism and Machine Theory" Second Edition, Wiley Eastern Limited, 1992.
2. Malhotra D.R. and Gupta H.C "The Theory of machines" Satya Prakasam, Tech. India Publications, 1989
3. Gosh A and Mallick A.K. "Theory of Machines and Mechanisms" affiliated east west press, 1989
4. Shigley J.E. and Uicker J.J. Theory of Machines and Mechanisms" McGraw Hill, 1986.

PR 2253   FLUID POWER DRIVES AND CONTROL   L T P C
3 1 0 4

OBJECTIVES:

- To understand the working principle of hydraulic and pneumatic components and its selection
- To design hydraulic and pneumatic circuits for different applications

UNIT I   INTRODUCTION TO FLUID POWER & HYDRAULICS PRINCIPLE   12

Introduction to fluid power controls – Hydraulics and pneumatics – Selection criteria, Application of Fluid power, Application of Pascal's Law, equation, Transmission and multiplication of force – Pressure Losses – Fluids, selection & properties – ISO symbols.

UNIT II   FLUID POWER DRIVES   12

Fluid Power drives – Pumps – working principle and construction details of Gear, vane and piston pumps, Hydraulic motors, Hydrostatic transmission drives and characteristics, Hydraulic supply components Pneumatic power supply – compressors, air distribution, air motors.

UNIT III   FLUID POWER ELEMENTS   12

Control valves – pressure, flow, direction - working principle and construction – Special type - valves – Cartridge, modular, proportional, and servo – Selection and actuation methods. Actuators – Selection and specification, cylinders, mounting, cushioning, pipe fittings – Fluid conditioning elements – Accumulators.

UNIT IV   HYDRAULIC AND PNEUMATIC CIRCUITS DESIGN   12

Design of Hydraulic and pneumatic circuits for automation, selection and specification of circuit components, sequencing circuits, cascade, and karnaugh – Veitch map method – Regenerative, speed control, synchronizing circuits.

UNIT V   ELECTRO PNEUMATICS AND PLC CIRCUITS   12

Use of electrical timers, switches, solenoid, relays, proximity sensors etc. electro pneumatic sequencing Ladder diagram – PLC – elements, functions and selection – PLC programming – Ladder and different programming methods - Sequencing circuits.

TOTAL: 60 PERIODS

TEXT BOOKS:
1. Anthony Esposito "Fluid power with applications", 5th editor, Pearson education 2003.
2. Majumdar, "Oil hydraulics: Principles and Maintenance", Tata McGraw Hill, 2004
3. Majumdar, "Pneumatic system: Principles and Maintenance", Tata McGraw Hill, 2004

REFERENCES:
1. William W.Reaves, Technology of Fluid Power, Delmer Publishers, 1997.
2. Petor Rohner, Fluid Power Logic circuit, Design Macmillon Press Ltd., 1990.
3. Andrew Parr "Hydraulics & Pneumatics, Jaico Publishing House, 2004

		L T P C
ME2255	**ELECTRONICS AND MICROPROCESSORS**	**L T P C**
	(Common to Mechanical, Automobile & Production)	**3 0 0 3**

OBJECTIVE
To enable the students to understand the fundamental concepts of Semi Conductors, Transistors, Rectifiers, Digital Electronics and 8085 Microprocessors

UNIT I   SEMICONDUCTORS AND RECTIFIERS   9

Classification of solids based on energy band theory-Intrinsic semiconductors-Extrinsic semiconductors-P type and N type-PN junction-Zenor effect-Zenor diode characteristics-Half wave and full wave rectifiers -Voltage regulation

UNIT II   TRANSISTORS AND AMPLIFIERS   12

Bipolar junction transistor- CB, CE, CC configuration and characteristics-Biasing circuits-Class A, B and C amplifiers- Field effect transistor-Configuration and characteristic of FET amplifier-SCR, Diac, Triac, UJT-Characteristics and simple applications-Switching transistors-Concept of feedback-Negative feedback-Application in temperature and motor speed control.

UNIT III   DIGITAL ELECTRONICS   9

Binary number system - AND, OR, NOT, NAND, NOR circuits-Boolean algebra-Exclusive OR gate - Flip flops-Half and full adders-Registers-Counters-A/D and D/A conversion.

UNIT IV   8085 MICROPROCESSOR   9

Block diagram of microcomputer-Architecture of 8085-Pin configuration-Instruction set-Addressing modes-Simple programs using arithmetic and logical operations.

UNIT V   INTERFACING AND APPLICATIONS OF MICROPROCESSOR   6

Basic interfacing concepts - Interfacing of Input and Output devices-Applications of microprocessor Temperature control, Stepper motor control, traffic light control.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Milman and Halkias, "Integrated Electronics", Tata McGraw-Hill   publishers, 1995.
2. Ramesh Goankar, "Microprocessor Architecture", Programming and Applications with

   8085, Wiley Eastern, 1998.

REFERENCES
1. Malvino and Leach, "Digital Principles and Applications", Tata McGraw-Hill, 1996
2. Mehta V.K, "Principles of Electronics", S. Chand and Company Ltd., 1994
3 Dougles V.Hall, "Microprocessor and Interfacing", Programming and Hardware, Tata McGraw-Hill, 1999.
4 Salivahanan S, Suresh Kumar N, Vallavaraj A, "Electronic Devices
   and Circuits" First Edition, Tata McGraw-Hill, 1999.

PR 2254   **METALLURGY LABORATORY**   **L T P C**
                                                                  0 0 3 2

OBJECTIVES:
- To train the students in observation and interpretation of Microstructure of Engineering materials.
- To train students in Heat treatment, hardenability and surface   treatment of Engineering Materials
- To train the students in testing of Foundry sand

LIST OF EXPERIMENTS:
1. Specimen preparation for macro – examination.
2. Specimen preparation for micro examination and study of Micro structure of –
   a) Carbon steel s(High, Medium, and Low)
   b) Cast Iron (Gray, White, Nodular, Malleable)
   c) Brass (70/30), Bronze (tin bronze), Al-Si alloy, cupro-nickel, Ti alloy.
3. Quantitative metallography – Estimation of volume fraction, particle size, size distribution, and shape.
4. Cooling curves
    a) Pure Metal (Pb or Sn)
    b) Alloy (Pb-Sn or Pb-Sb)
5. Heat treatments (carry out the following heat treatment and study the micro structure before and after heat treatments)
   a) Annealing
   b) Normalising
   c) Quench Hardening
   d) Tempering
6. Jominy End Quench Test
7. Foundry Sand testing
   a) Sieve analysis
   b) Strength of moulding sand
   c) Permeability of moulding sand
   d) Clay content of moulding sand
   e) Moisture content of moulding sand
8. Electro-chemical Test
   a) Electro deposition
   b) Electro-chemical etching test

ME 2256	STRENGTH OF MATERIALS LAB	L T P C
	(Common to Auto, Mechanical & Production)	0 0 3 2

OBJECTIVE

To supplement the theoretical knowledge gained in Mechanics of Solids with practical testing for determining the strength of materials under externally applied loads. This would enable the student to have a clear understanding of the design for strength and stiffness

LIST OF EXPERIMENTS

1. Tension test on a mild steel rod
2. Double shear test on Mild steel and Aluminium rods
3. Torsion test on mild steel rod
4. Impact test on metal specimen
5. Hardness test on metals - Brinnell and Rockwell Hardness Number
6. Deflection test on beams
7. Compression test on helical springs
8. Strain Measurement using Rosette strain gauge
9. Effect of hardening- Improvement in hardness and impact resistance of steels.
10. Tempering- Improvement Mechanical properties Comparison
    (i) Unhardened specimen
    (ii) Quenched Specimen and
    (iii) Quenched and tempered specimen.
11. Microscopic Examination of
    (i) Hardened samples and
    (ii) Hardened and tempered samples.

LIST OF EQUIPMENT

(for a batch of 30 students)

1.	Universal Tensile Testing machine with double shear attachment – 40 Ton Capacity	1
2.	Torsion Testing Machine (60 NM Capacity)	1
3.	Impact Testing Machine (300 J Capacity)	1
4.	Brinell Hardness Testing Machine	1
5.	Rockwell Hardness Testing Machine	1
6.	Spring Testing Machine for tensile and compressive loads (2500 N)	1
7.	Metallurgical Microscopes	3
8.	Muffle Furnace (800 $^\circ$C)	1

TOTAL: 45 PERIODS

AT 2256   COMPUTER AIDED MACHINE DRAWING LAB   L T P C
            (Common to Automobile & Production)   **0 0 4 2**

1. Drawing of automobile components such as piston, connecting rod, valves, manifold and crank shaft.
2. Assembly drawing of screw jack, piston – connecting rod assembly, valve assembly, clutch assembly and gear box assembly.

TOTAL: 60 PERIODS

LIST OF EQUIPMENTS
(for a batch of 30 students)

1. Computer nodes   - 30 Nos.
2. Software
         i)   Auto CAD   - 15 licenses
         ii)   Pro-E   - 5 Nos.

GE2021   ENVIRONMENTAL SCIENCE AND ENGINEERING   LT P C
                                                                 3 0 0 3

AIM

The aim of this course is to create awareness in every engineering graduate about the importance of environment, the effect of technology on the environment and ecological balance and make them sensitive to the environment problems in every professional endeavour that they participates.

OBJECTIVE

At the end of this course the student is expected to understand what constitutes the environment, what are precious resources in the environment, how to conserve these resources, what is the role of a human being in maintaining a clean environment and useful environment for the future generations and how to maintain ecological balance and preserve bio-diversity. The role of government and non-government organization in environment managements.

UNIT I   ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY   14

Definition, scope and importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels –

India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.
Field study of common plants, insects, birds
Field study of simple ecosystems – pond, river, hill slopes, etc.

UNIT II ENVIRONMENTAL POLLUTION 8
Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – soil waste management: causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and landslides.
Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

UNIT III NATURAL RESOURCES 10
Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles.
Field study of local area to document environmental assets – river / forest / grassland / hill / mountain

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 7
From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization- environmental ethics: Issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment production act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – enforcement machinery involved in environmental legislation- central and state pollution control boards- Public awareness.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6
Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare – role of information technology in environment and human health – Case studies.

TOTAL : 45 PERIODS

TEXT BOOKS
1. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education (2004).
2. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, (2006).

REFERENCES
1. R.K. Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media.
2. Cunningham, W.P. Cooper, T.H. Gorhani, 'Environmental Encyclopedia', Jaico Publ., House, Mumbai, 2001.
3. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT LTD, New Delhi, 2007.
4. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press (2005)

ME 2304   ENGINEERING METROLOGY AND MEASUREMENTS   L T P C
**   (Common to Mechanical, Production and Automobile)   3 0 0 3**

OBJECTIVE
- To understand the basic principles of measurements
- To learn the various linear and angular measuring equipments, their principle of operation and applications
- To learn about various methods of measuring Mechanical parameters

UNIT I   CONCEPT OF MEASUREMENT   10
General concept – Generalised measurement system-Units and standards-measuring instruments: sensitivity, stability, range, accuracy and precision-static and dynamic response-repeatability-systematic and random errors-correction, calibration - Introduction to Dimensional and Geometric Toleranceing - interchangeability,

UNIT II   LINEAR AND ANGULAR MEASUREMENT   12
Definition of metrology-Linear measuring instruments: Vernier, micrometer, Slip gauges and classification, - Tool Makers Microscope - interferometery, optical flats, - Comparators: limit gauges Mechanical, pneumatic and electrical comparators, applications. Angular measurements: -Sine bar, Sine center, bevel protractor and angle Decker..

UNIT III   FORM MEASUREMENT   12
Measurement of screw threads: Thread gauges, floating carriage micrometer-measurement of gear tooth thickness: constant chord and base tangent method-Gleason gear testing machine – radius measurements-surface finish: equipment and parameters, straightness, flatness and roundness measurements.

UNIT IV   LASER AND ADVANCES IN METROLOGY   12
Precision instruments based on laser-Principles- laser interferometer-application in measurements and machine tool metrology- Coordinate measuring machine (CMM): need, construction, types, applications.- computer aided inspection.

UNIT V   MEASUREMENT OF MECHANICAL PARAMETERS   14
Force, torque, power:-mechanical, pneumatic, hydraulic and electrical type-Pressure measurement - Flow: Venturi, orifice, rotameter, pitot tube –Temperature: bimetallic strip, thermocouples, pyrometer, electrical resistance thermistor
.

                                                TOTAL: 60 PERIODS

TEXT BOOKS

1. Jain R.K., "Engineering Metrology", Khanna Publishers, 2005
2. Alan S. Morris, "The Essence of Measurement", Prentice Hall of India, 1997

REFERENCES

1. Gupta S.C, "Engineering Metrology", Dhanpat rai Publications, 2005
2. Jayal A.K, "Instrumentation and Mechanical Measurements", Galgotia Publications 2000
3. Beckwith, Marangoni, Lienhard, "Mechanical Measurements", Pearson Education, 2006.
4. Donald Deckman, "Industrial Instrumentation", Wiley Eastern, 1985.

PR2302	METAL FORMING TECHNOLOGY	L	T	P	C
		3	1	0	4

OBJECTIVES:
To understand the principle, procedure and applications of Bulk Metal Forming and Sheet Metal Forming

UNIT I FUNDAMENTALS OF METAL FORMING 15
State of stress – Components of stress, symmetry of stress tensor, principal stresses – Stress deviator – von-mises, Tresca yield criteria – Octahedral shear stress and shear strain theory – Flow stress determination – Temperature in metal forming – Hot, cold and warm working – strain rate effects –metallurgical structures – residual stresses – Spring back.

UNIT II FORGING AND ROLLING 10
Principle – classification – equipment – tooling – processes parameters and calculation of forces during forging and rolling processes – Ring compression test - Post forming heat treatment – defects (causes and remedies) – applications – Roll forming.

UNIT III EXTRUSION AND DRAWING PROCESSES 15
Classification of extrusion processes – tool, equipment and principle of these processes – influence of friction – extrusion force calculation – defects (causes and remedies) – Rod/Wire drawing – tool, equipment and principle of processes – defects – Tube drawing and sinking processes – mannessmann process of seamless pipe manufacturing – Tube bending.

UNIT IV SHEET METAL FORMING PROCESSES 10
Classification – conventional and HERF processes – presses – types and selection of presses – formability studies – FLD, Limiting Draw ratio - processes: Deep drawing, spinning, stretch forming, plate bending, Rubber pad forming, bulging and press brake forming – Explosion forming, electro hydraulic forming, Magnetic pulse forming.

UNIT V RECENT ADVANCES 10
Super plastic forming – Electro forming – fine blanking – Hydro forming – Peen forming – Laser Forming – Micro forming - P/M forging – Isothermal forging – high speed hot forging – near net shape forming high velocity extrusion – CAD and CAM in forming

TEXT BOOKS:
1. Dieter G.E., "Mechanical Metallurgy", McGraw Hill, Co., S.I. Edition, 2001
2. Nagpal G.R. "Metal forming processes", Khanna publishers, New Delhi, 2004

REFERENCES:
1. Serope Kalpakjian, Steven R Schmid, "Manufacturing Process for Engineering Materials" – Pearson Education, 4th Edition, 2003.
2. Rao, P.N. "Manufacturing Technology", TMH Ltd., 2003
3. Edward M.Mielink, "Metal working science Engineering, McGraw Hill, Inc, 2000.
4. Metal Hank book Vol.14, "Forming and Forging", Metal Park, Ohio,USA, 1990

PR2303   ENGINEERING STATISTICS AND QUALITY CONTROL   L T P C
3 1 0 4

OBJECTIVES:
- To provide an introduction to fundamental concepts of statistical Process control Enhance the student understanding of the complexities of Statistical Analysis and control chart interpretation
- To understand the concept of reliability and it's improving techniques and design of experiments

UNIT I   SAMPLING THEORY AND TESTING OF HYPOTHESIS   11
Population, sample – influence of sample size – Estimation of population parameter from sample – mean and variance, difference of means, variances and ratios of variances – Tests of hypothesis – large and small samples – Chi-square distribution – F distribution.

UNIT II   STATISTICAL PROCESS CONTROL   15

Variation in process – Factors – control charts – variables $\overline{X}$ R and $\overline{X},\sigma$, - Attributes P, C and U-Chart Establishing and interpreting control charts process capability – Quality rating – Short run SPC.

UNIT III   ACCEPTANCE SAMPLING   15
Lot by lot sampling types – probability of acceptance in single, double, multiple sampling plans – OC curves – Producer's risk and consumer's risk. AQL, LTPD, AOQL, Concepts Design of single sampling plan – standard sampling plans for AQL end LTPD – use of standard sampling plans – Sequential sampling plan.

UNIT IV   RELIABILITY AND QUALITY   10
Life testing – failure characteristics – meantime to failure – maintainability and availability – reliability – system reliability – OC curves – reliability improvement techniques – Reliability testing techniques - Pareto analysis.

UNIT V   EXPERIMENTAL DESIGN AND TAGUCHI METHOD   9

Fundamentals – factorial experiments – random design, Latin square design – Taguchi method – Loss function – experiments – S/N ratio and performance measure – Orthogonal array.

TOTAL: 60 PERIODS

TEXT BOOKS:
1. Amcta Mitra "Fundamentals of Quality Control and improvement" Pearson Education, 2002.

REFERENCES:
1. Bester field D.H., "Quality Control" Prentice Hall, 7th edition 2003
2. Manohar Mahajan, "Statistical Quality Control", Dhanpal Rai & Sons, 2001.
3. Sharma S.C., "Inspection Quality Control and Reliability", Khanna Publications, 2004.

PR2304	MACHINE ELEMENTS DESIGN	L T P C
		3 1 0 4

OBJECTIVE:
To introduce students to the design and theory of common machine elements and to give students experience in solving design problems involving machine elements.

UNIT I   INTRODUCTION   12
Fundamentals of Machine Design-Engineering Design, Phases of Design, Design Consideration - Standards and Codes - Selection of Materials –Design against Static and Dynamic Load –Modes of Failure, Factor of Safety, Principal Stresses, Theories of Failure-Stress Concentration, Stress Concentration Factors, Variable Stress, Fatigue Failure, Endurance Limit, Design for Finite and Infinite Life, Soderberg and Goodman Criteria.

UNIT II   DETACHABLE AND PERMANENT JOINTS   12
Design of Bolts under Static Load, Design of Bolt with Tightening/Initial Stress, Design of Bolts subjected to Fatigue – Keys -Types, Selection of Square and Flat Keys-Design of Riveted Joints and Welded Joints

UNIT III   SHAFTS, COUPLING AND BRAKES   12
Design of Shaft –For Static and Varying Loads, For Strength and Rigidity-Design of Coupling-Types, Flange, Muff and Flexible Rubber Bushed Coupling-Design of Brakes-Block and Band Brakes

UNIT IV   GEARS AND BELT DRIVES   12
Design of Spur, Helical, Bevel and Worm Gear drives-Design of Belt drives-Flat and V Belts

UNIT V   SPRINGS AND BEARINGS   12
Design of Helical Spring-Types, Materials, Static and Variable Loads-Design of Leaf Spring-Design of Journal Bearing -Antifriction Bearing-Types, Life of Bearing, Reliability Consideration, Selection of Ball and Roller Bearings

TEXTBOOKS:

1. Joseph Edward Shigley, Charles R. Mischke " Mechanical Engineering Design", McGraw Hill, International Edition, 1992
2. C.S.Sharma and Kamlesh Purohit, " Design of Machine Elements", Prentice Hall of India Private Limited, 2003

REFERENCES:

1. V.B.Bhandari, "Design of Machine Elements", Tata McGraw-Hill Publishing Company Limited, 2003.
2. Robert L.Norton, "Machin Design – An Integrated Approach", Prentice Hall International Edition, 2000.

PR 2305   FOUNDRY AND WELDING TECHNOLOGY   L T P C
                                                           3 0 0 3

OBJECTIVE:

To understand the principle, procedure and applications of Foundry and Welding Processes

UNIT I   CASTING PROCESS   10

Introduction to casting – pattern – materials allowances – coding – types – moulds – mould making, sand – properties, types and testing of sands – core making – type of cores – single box, two box and 3 box moulding processes, runner, riser and gate.

UNIT II   WELDING PROCESSES   9

Introduction to soldering, brazing and welding types of joining – plane of welding – edge preparation – filler material – flux – shielding gases – fusion welding – gas welding – gas flame types – Manual arc welding – arc theory – power supply – braze welding – Thermit welding – Resistance welding – spot, seam, projection, percussion & flash.

UNIT III   SPECIAL CASTING PROCESSES   8

Pressure die casting – Centrifugal – continuous – investment – shell moulding – squeeze – electro slag casting – CO_2 moulding – Plaster mould castings – Antioch process – Slush casting.

UNIT IV   SPECIAL WELDING PROCESSES   9

Atomic H_2 arc welding – Shielded gas arc welding GMAW & GTAW – Submerged arc welding – Electro slag welding – friction welding – explosive welding – Underwater welding – Diffusion bonding – EBW – LBW – PAW – Stud welding – welding of dissimilar materials – Friction stir welding.

UNIT V   TESTING OF CASTINGS & WELDMENTS   9

Causes and remedies for casting defects – welding defects – Destructive testing – NDT – Dye penetrant – magnetic particle – X-ray, ultrasonic cell – studies in testing of joints & castings.

TOTAL: 45 PERIODS

TEXT BOOKS:
1. Welding Engineering & Technology R.S.Parmer – Khanna Publishers – 2002.
2. Principle of metal casting – Heime, Looper and Rosenthal – Tata McGraw Hill – 2001

REFERENCES
1. Principle of Foundry Technology – P.L.John Tata McGraw Hill – 2003
2. Modern Welding Technology – B.Curry – Prentice Hall – 2002
3. Welding Principle & applications – Larry Jeff in Delmar – 1997
4. Foundry Engineering – Taylor HF Fleming, M.C. & Wiley Eastern Ltd., 93

PR 2306   **CNC MACHINE LAB**   **L T P C**
                                                           0 0 3 2

LIST OF EXPERIMENTS

1. Study of different control systems and NC codes.
2. Program for Turning, Facing operation.
3. Program for circular interpolation, Taper turning operation
4. Program for thread cutting operation
5. Program using Do-Loop and Sub-routine.
6. Program for profile milling operation, circular interpolation
7. Program for Circular, rectangular pocket milling
8. Program for drilling cycle
9. Program for tool compensation and Program offset
10. NC code generation using CAD software packages
11. Study of cam packages
12. Study of CNC Wire cut EDM

TOTAL: 45 PERIODS

(Requirement for a batch of 30 Students)

S. No.	Description of Equipment	Quantity required	Quantity available	Deficiency %
.	CNC Trainer Lathe	2 No.		
.	CNC Trainer milling machine	2 No.		
.	Any standard CAM software (Examples : PRO-E, Master CAM, SMART CAM, etc.,)	10 users		
.	CNC wire cut EDM	1		

	Computers (Pentium 4, 128 RAM, 20 GB HDD, 17" Color Monitor)	5		

PR 2307   **FLUID POWER LAB**   **L T P C**
                                                       0 0 3 2

OBJECTIVES:
* To study the functional aspects of different pneumatic and hydraulic components and its usage in circuits.
* To train the students in designing different pneumatic and hydraulic circuits for different application.

LIST OF EXPERIMENTS

1. Study and use of pneumatic and hydraulic elements.
2. Simulation of speed control circuits in a hydraulic trainer.
3. Simulation of hydraulic circuits in a hydraulic trainer.
4. Simulation of single and double acting cylinder circuits using different directional control values
5. One shot and regenerative pneumatic circuits
6. Sequencing of pneumatic circuits
7. Simulation of Electro-pneumatic latch circuits
8. Simulation of Logic pneumatic circuits
9. Simulation of electro pneumatic sequencing circuits
10. Simulation of PLC based electro pneumatic sequencing circuits
11. Simulation of pneumatic circuits using PLC

TOTAL: 45 PERIODS

(Requirement for a batch of 30 Students)

S. No.	Description of Equipment	Quantity required	Quantity available	Deficiency %
1.	Hydraulic cut section models	1 kit		
2.	Pneumatic cut section models	1 kit		
3.	Hydraulic trainer kit	1 No.		
4.	Pneumatic trainer kit	1 No.		
5.	Electro Pneumatic trainer kit	1 No.		
6.	PLC Trainer Kit	1 No.		
7.	Hydraulic Simulation Software	5 Licenses		
8.	Pneumatic Simulation software	5 Licenses		

EC 2262   ELECTRONICS AND MICROPROCESSORS LAB   L T P C

OBJECTIVE

To supplement the theoretical knowledge with practical use of electronic components and programming and control using micro-processors

LIST OF EXPERIMENTS

Electronics   **30**

VI Characteristics of PN Junction Diode
VI Characteristics of Zener Diode
Characteristics of CE Transistor
Characteristics of JFET
Characteristics of Uni Junction Transistor
RC or Wein Bridge Oscillator
Study of Logic Gates (Basic Gates)
Half Adder and Full Adder
Shift Registers and Counters
Operational Amplifier (Adder, Subtractor, Differentiator, Integrator, Inverting and Non - Inverting

MICROPROCESSORS   **15**

Block Transfer
8 bit Addition, Subtraction
Multiplication and Division
Maximum and minimum of block of data
Sorting
Stepper Motor Interfacing

LIST OF EQUIPMENT
 (for a batch of 30 students)

Voltmeters	5 No.
Ammeters	5 No.
PN Diode, BJT, JFET, Logic Gates, Shift Registers and Counters	1 set.
Digital Logic Trainer Kits	1 No.
Breadboards	1 No.
Microprocessor Kits – 8085	5 No.
D/A Converter Interface	1 No.
Stepper Motor Interface	1 No.
CRO	1 No.
Wavefarm Generator	1 No.
Multimeter	1 No.

TOTAL: 45 PERIODS

(Requirement for a batch of 30 Students)

S. No.	Description of Equipment	Quantity required	Quantity available	Deficiency %
1.	Voltmeters	5 No.		
2.	Ammeters	5 No.		
3.	PN Diode, BJT, JFET, Logic Gates, Shift Registers and Counters	1 Set.		
4.	Digital Logic Trainer Kits	1 No.		
5.	Breadboards	1 No.		
6.	Microprocessor Kits – 8085	5 No.		
7.	D/A Converter Interface	1 No.		
8.	Stepper Motor Interface	1 No.		
9.	CRO	1 No.		
10.	Wavefarm Generator	1 No.		
11.	Multimeter	1 No.		

GE2321   **COMMUNICATION SKILLS LABORATORY**   **L T P C**
(Fifth / Sixth Semester)   **0 0 4 2**

Globalisation has brought in numerous opportunities for the teeming millions, with more focus on the students' overall capability apart from academic competence. Many students, particularly those from non-English medium schools, find that they are not preferred due to their inadequacy of communication skills and soft skills, despite possessing sound knowledge in their subject area along with technical capability. Keeping in view their pre-employment needs and career requirements, this course on Communication Skills Laboratory will prepare students to adapt themselves with ease to the industry environment, thus rendering them as prospective assets to industries. The course will equip the students with the necessary communication skills that would go a long way in helping them in their profession.

OBJECTIVES:
- To equip students of engineering and technology with effective speaking and listening skills in English.
- To help them develop their soft skills and interpersonal skills, which will make the transition from college to workplace smoother and help them excel in their job.
- To enhance the performance of students at Placement Interviews, Group Discussions and other recruitment exercises.

I. PC based session	(Weightage 40%)	24 periods

A. ENGLISH LANGUAGE LAB   **(18 Periods)**

1. LISTENING COMPREHENSION: **(6)**
Listening and typing – Listening and sequencing of sentences – Filling in the blanks - Listening and answering questions.

2. READING COMPREHENSION: **(6)**
Filling in the blanks - Close exercises – Vocabulary building - Reading and answering questions.

3. **SPEAKING:** **(6)**

Phonetics: Intonation – Ear training - Correct Pronunciation – Sound recognition exercises – Common Errors in English.

Conversations: Face to Face Conversation – Telephone conversation – Role play activities (Students take on roles and engage in conversation)

B. DISCUSSION OF AUDIO-VISUAL MATERIALS **(6 PERIODS)**

(Samples are available to learn and practice)

1. **RESUME / REPORT PREPARATION / LETTER WRITING** **(1)**
   Structuring the resume / report - Letter writing / Email Communication - Samples.

2. **PRESENTATION SKILLS:** **(1)**
   Elements of effective presentation – Structure of presentation - Presentation tools – Voice Modulation – Audience analysis - Body language – Video samples

3. **SOFT SKILLS:** **(2)**
   Time management – Articulateness – Assertiveness – Psychometrics – Innovation and Creativity - Stress Management & Poise - Video Samples

4. **GROUP DISCUSSION:** **(1)**
   Why is GD part of selection process ? - Structure of GD – Moderator – led and other GDs - Strategies in GD – Team work - Body Language - Mock GD -Video samples

5. **INTERVIEW SKILLS:** **(1)**
   Kinds of interviews – Required Key Skills – Corporate culture – Mock interviews- Video samples.

II. Practice Session	(Weightage – 60%)	24 periods

1. **Resume / Report Preparation / Letter writing**: Students prepare their own resume and report. (2)

2. **Presentation Skills:** Students make presentations on given topics. (8)

3. **Group Discussion**: Students participate in group discussions. (6)

4. **Interview Skills**: Students participate in Mock Interviews (8)

REFERENCES:
1. Anderson, P.V, **Technical Communication**, Thomson Wadsworth, Sixth Edition, New Delhi, 2007.
2. Prakash, P, **Verbal and Non-Verbal Reasoning**, Macmillan India Ltd., Second Edition, New Delhi, 2004.
3. John Seely, **The Oxford Guide to Writing and Speaking**, Oxford University Press, New Delhi, 2004.
4. Evans, D, **Decisionmaker**, Cambridge University Press, 1997.
5. Thorpe, E, and Thorpe, S, **Objective English**, Pearson Education, Second Edition, New Delhi, 2007.
6. Turton, N.D and Heaton, J.B, **Dictionary of Common Errors**, Addison Wesley

Longman Ltd., Indian reprint 1998.

LAB REQUIREMENTS:

1. Teacher console and systems for students.
2. English Language Lab Software
3. Career Lab Software

Requirement for a batch of 60 students

Sl.No.	Description of Equipment	Quantity required

1.	**Server**
	  o PIV system
	  o 1 GB RAM / 40 GB HDD
	  o OS: Win 2000 server
	  o Audio card with headphones (with mike)
	  o JRE 1.3
		1 No.

2.	Client Systems
	  o **PIII or above**
	  o **256 or 512 MB RAM / 40 GB HDD**
	  o **OS: Win 2000**
	  o Audio card with headphones (with mike)
	  o JRE 1.3
		60 No.

3.	**Handicam Video Camera (with video lights and mic input)**	1 No.
4.	Television - 29"	1 No.
5.	Collar mike	1 No.
6.	Cordless mikes	1 No.
7.	Audio Mixer	1 No.
8.	DVD Recorder / Player	1 No.
9.	LCD Projector with MP3 /CD /DVD provision for audio / video facility – **Desirable**	1 No.

PR 2351   FINITE ELEMENT ANALYSIS IN MANUFACTURING   L T P C
ENGINEERING   3 0 0 3

OBJECTIVES:
To introduce the concept of FEM and to apply in the field of Manufacturing Engineering

UNIT I   INTRODUCTION   9

General field problems in engineering-Discrete and continuous models-Characteristics-the relevance and place of finite element method-variational calculus-Variational formulation of boundary value problems-The method of weighted residuals-Rayleigh-Ritz and Galerkin methods-Solution of large system of equations-Choleski Decomposition-Gaussian elimination procedures.

UNIT II   GENERAL PROCEDURE OF FET   9
Discretization of Domain selection of interpolation polynomials-Convergence requirements-Formulation of element characteristics matrices and load vectors – Assembly of element characteristics matrices-Solution of finite element equations-Post processing of results.

UNIT III   FINITE ELEMENT ANALYSIS OF ONE DIMENSIONAL AND TWO
DIMENSIONAL PROBLEMS   10
One dimensional finite element analysis-Linear bar element-Quadratic bar element-Beam element-Frame elements-One dimensional heat transfer-Two dimensional finite element analysis approximation of geometry and field variables-Three nodded triangular element-Four nodded rectangular element-Six nodded triangular element-Natural coordinates and coordinate transformation – Numerical integration-Incorporation of boundary conditions

UNIT IV   ISO-PARAMETRIC ELEMENTS   9
Iso-parametric elements-Dynamic analysis-Equations of motion using Lagrange's approach-Consistent and Lumped mass matrices-Formulation of FE equations for vibration problems-Solutionof Eigen value problems-Transient vibration analysis-Thermal transients.

UNIT V   APPLICATION OF FINITE ELEMENT ANALYSIS   8
Finite element analysis of Machine elements - Axi-symmetric FEA of a pressure vessel-Application of FEM in various metal forming processes – Solid formulation and flow formulation – FEA simulation of Metal cutting, Solidification of castings and Weldments.

TOTAL: 45 PERIODS

TEXT BOOKS:
1. Chandraputla T.R., and Belegundu A.D., "Introduction of Finite Element in Engineering", Prentice Hall of India, 1997.
2. Reddy.J.N., "An Introduction to Finite Element Method" McGraw Hill, International Student Edition, 1993.

REFERENCES:
1. Rao.S.S., "The Finite Element Method in Engineering", Pergamon Press, 1993.
2. Segarland. L.J., "Applied Finite Element Analysis", John Wiley and Sons, Inc.
3. Seshu.P., "Text Book of Finite Element Analysis", Prentice Hall of India, 2003
4. Rajasekaran.S., "Numerical Methods for Initial and Boundary Value Problems", Wheeler and Co., Pvt. Ltd., 1987
5. Lewis R.W., Morgan K., Thomas H.R. and Seetharamu K.N., The Finite Element Method in Heat Transfer Analysis, John Wiley & Sons Ltd., 1996.

PR2352   COMPUTER AIDED PRODUCT DESIGN   L T P C

OBJECTIVE:
- To introduce the concepts and applications of CAD
- To introduce the various concepts and techniques used for Product design and to develop product design skills.

UNIT I   INTRODUCTION TO COMPUTER AIDED DESIGN   12
Introduction to Engineering Design – Various phases of systematic design – sequential engineering and concurrent engineering – Computer hardware & Peripherals – software packages for design and drafting.

UNIT II   COMPUTER GRAPHICS FUNDAMENTALS   12
Computer graphics – applications – principals of interactive computer graphics – 2D 3D transformations – projections – curves – Bezier, B-Spline and NURBS – Concepts.

UNIT III   GEOMETRIC MODELING   12
Geometric Modeling – types – Wire frame surface and solid modeling – Boundary Representation, constructive solid geometry – Graphics standards – assembly modeling – use of software packages

UNIT IV   PRODUCT DESIGN CONCEPTS   12
Product modeling – types of product models; product development process tools – TRIZ – Altshuller's inventive principles – Modeling of product metrics – Design for reliability – design for manufacturability – machining, casting, and metal forming – design for assembly and disassembly - Design for environment; Bench marking – FMEA – QFD – DOE – Taguchi method of DOE – Quality loss functions – Design for product life cycle.

UNIT V   PRODUCT DATA MANAGEMENT   12
Product Data Management – concepts – Collaborative product design and commerce – Information Acquisition – Sourcing factor – manufacturing planning factor – Customization factor – Product life cycle management.
                                                                TOTAL: 60 PERIODS

TEXT BOOKS
1. Kevin Otto, Kristin Wood, "Product Design", Pearson Education, 2000
2. Ibrahim Zeid, "CAD/CAM theory and Practice", Tata McGraw Hill, 1991.

REFERENCES
1. Biren Prasad, "Concurrent Engineering Fundamentals Vol.11", Prentice Hall, 1997.
2. James G.Bralla, "Handbook of Product Design for Manufacturing", McGraw Hill, 1994
3. David F.Rogers.J, Alan Adams, "Mathematical Elements for Computer Graphics", McGraw Hill, 1990

PR 2353   AUTOMATED PRODUCTION & COMPUTER INTEGRATED   L T P C
**   MANUFACTURING   3 1 0 4**

AIM

To impart the knowledge of computer technology in all of the operational and information processing activities related to manufacturing.

OBJECTIVES:
- To understand the various automated manufacturing activities
- To study the application of computer Technology in the Manufacturing activities
- To know the smooth transition from conventional manufacturing to automated production and computer integrated manufacturing

PRE-REQUISITES:

Students must have sound knowledge on various Manufacturing   types, – system and operations

UNIT I   INTRODUCTION   12

Product design & CAD, CAM, CAD/CAM and CIM – CIM Hardware and software – three step process for implementation CIM – production concepts and mathematical models covering production rate, manufacturing lead time, capacity utilisation, availability & WIP – Automation – Reason for Automation and Automation strategies – The future automated factory.

UNIT II   AUTOMATED PRODUCTION SYSTEMS AND MATERIAL
**   HANDLING AND STORAGE SYSTEM   12**

Basic elements of an automated system – Advanced automated functions – Levels of Automation - Fundamentals of Automated Production Lines – Work part Transfer Mechanisms – Storage Buffers – Control of the Production Line – Application to Machining System.

Factors influencing material handling system – 10 principles of Material handling – Material transport system – Industrial Trucks, Mono-rails and other rail-guided vehicles, conveyors, cranes & Hoists – Automated guided vehicle system – Types. Guidance technology, vehicle management, despatch rules and safety.

Storage systems – Performance, storage location strategies, conventional methods – Automated Storage and Retrieval systems – carousel storage systems.

UNIT III   GROUP TECHNOLOGY AND CELLULAR MANUFACTURING   12

Part families – visual – parts classification and coding – case studies in coding – Production flow analysis – benefits of G.T. – Application of G.T.

Cellular Manufacturing – Composite part concept – Machine cell design – Key machine concept - quantitative analysis in cellular manufacturing – Rank order clustering technique – Arranging machines in G.T. Cell – Hollier method 1 and 2.

UNIT IV   FLEXIBLE MANUFACTURING SYSTEM   12

What is an FMS? – Types of FMS – FMS components – Workstations, Material Handling and storage system – FMS Layout type, computer control system, Human resource – Flow chart showing various operations in FMS – Dead lock in FMS – FMS application and benefits – FMS planning and implementation issues.
Quantitative analysis of FMS – various bottle neck model – Sizing the FMS – Illustrative examples.

UNIT V   AUTOMATED ASSEMBLY, COMPUTER PROCESS CONTROL AND SHOP

FLOOR CONTROL   **12**

Automated assembly – Fundamental – system configuration, part delivery at work station – Design for automated assembly

Computer process control – continuous, discrete process, control requirement, capabilities, Level of process control – Computer process control – Computer process interface, computer process monitoring, Direct Digital control, Supervisory control – Distributed control system and personal computer.

Short floor control – Three phases – Factory data collection – manual method – Automated and semiautomated data collection (ADC) – Bar code technologies and other ADC Technologies.

TOTAL: 60 PERIODS

TEXT BOOK:
1. Mikell P.Groover, "Automation, Production Systems and Computer-integrated Manufacturing", Prentice Hall of India Private Limited, 2003
2. Radhakrishnan.P, Subramanyan.S and Raju.V, "CAD/CAM/CIM", New Age\ International Publishers, 2000

REFERENCES:
1. James A.Retrg and Henry W. Kraebher, "Computer Integrated Manufacturing", Pearson Education, Asia, 2001
2. Viswamathan.N and Narahari.Y, "Performance modelling of automated manufacturing system", Prentice Hall of India Private Limited, 1994.

PR2354   **DESIGN OF JIGS, FIXTURE AND PRESS TOOLS & DRAWING**   **L T P C**
                                                             3 1 0 4

OBJECTIVE:
- To introduce the concepts of various types of jigs, fixtures and dies
- To design and draw jig / fixture/ die for a given component

UNIT I   LOCATION AND CLAMPING DEVICES IN JIGS AND FIXUTRES   **9+3**
Principles of Jigs and Fixture – Design concepts – Different types of locating devices – different types of clamps – Drill bushes – types – Elements of fixtures.

UNIT II   DESIGN OF ELEMENTS OF JIGS AND FIXTURE   **9+3**
Design concepts of Template Jig, Plate Jig, Sandwich Jig, Vice Jaw Jig, Latch Jig, Turnover jig, Box jig – Fixtures for Milling, Grinding, Turning, Welding, and Assembly – Modular fixtures.

UNIT III   PRESS WORKING OPERATION AND FORMING DIES   **9+3**
Blanking, Piercing, lancing, notching, bending design features of dies for drawing, extrusion, wire drawing and forging.

UNIT IV   ELEMENTS OF DIE   **9+3**
Design concepts of the following elements of progressive, compound and

Combination dies – Die block – Die shoe – Bolster plate – punch – punch plate – punch holder – guide pins and guide bushes – strippers – knockouts – stops - pilots – selection of standard die sets – strip layout and development.

UNIT V   DESIGN AND DRAWING DIES, JIGS AND FIXTURES   9+3

Progressive die – compound die – Bending and drawing dies – Drill Jigs – Milling fixtures, turning fixtures.

TOTAL: 60 PERIODS

TEXT BOOKS:
1. Donaldson, B.H. Lecain, Goold V.V., Tool Design, TMH Edition, 1978.
2. Kempster M.H.A., Introduction to Jigs and Fixtures, ELBS Edition, 1976

REFERENCES:
1. Handbook of metal forming, Kurt Lunge, McGraw Hill, Pub.Co. 1985.
2. Paquin, Die Design Fundamentals, Industrial Press Inc, New York, 1979
3. ASTME, Fundamentals of Tool design, Prentice Hall 1974

PR2355   METAL FORMING LAB AND SPECIAL MACHINES LAB   L T P C
                                                                 0 0 4 2

AIM:
To understand the basic principles of Metal forming process and to impart practical knowledge in special machines.

OBJECTIVES:

- To establish hands-on experience in sheet metal forming, bulge forming and Super plastic forming.

- To get hands on experience in machining gear, V-block, dovetail, etc.
- To study tool wear, acceptance test for machine tool

Metal Forming Lab:
1. Construction Flow Stress – Strain curve
2. Erichsen cupping Test
3. Determination of interface friction factor using ring compression test
4. Construction of FLD of sheet metal
5. Water hammer forming
6. Determination of Power consumption in sheet rolling process
7. Determination of strain rate sensitivity index of given specimen
8. Superplastic forming studies on Pb-Sn alloys
9. Deep drawing
10. Forward Extrusion process
11. Micro-forming
12. Simulation studies on metal forming

Special Machine Lab:
1. Gear Hobbing
    a. Spur Gear
    b. Helical Gear
2. Planning Machine
    a. V-Block
    b. Dove Tail
3. Centreless Cylindrical Grinding

4. Milling Machine
   a. Spur Gear
5. Tool And Cutter Grinding
6. Tool Wear Studies
7. Acceptance Test Of Machine Tool As Per ISI Test Chart
8. EDM
9. Capstan And Turret Lathe
10. Measurement Of Cutting Force

TOTAL: 60 PERIODS

Sl.No.	Description of Equipment	Quantity required
1.	Universal Testing Machine 10T	1
2.	Erichsen cupping Tester	1
3.	Hydraulic Press 50T	1
4.	Water hammer forming apparatus	1
5.	Two high Rolling mill	1
6.	Top open muffle furnace (Max 1200 $_oC$)	1
7.	Dies for deep drawing	1 set
8.	Dies for Micro forming	1 set
9.	Dies for super plastic forming	1 set
10.	FEM package (ABAQUS, ANSYS…)	Any one
11.	Dies for Constructing FLD of sheet metals	1 set

PR2356   **METROLOGY AND INSPECTION LAB**   **L T P C**
                                                      0 0 3 2

LIST OF EXPERIMENTS

1. Measurements of angle using Sine bar / bevel protractor
2. Measurement of External and internal Taper angle
3. Measurement of Bore Diameter
4. Calibration of Dial gauge
5. Measurement of Roundness
6. Measurements of Screw Thread Parameters using three-wire method
7. Measurements of Surface Roughness
8. Measurements using toolmaker Microscope
9. Measurements using Profile Projector
10. Measurements using Vision Measuring System
11. Measurements using CMM

TOTAL: 45 PERIODS

PR2357   **WELDING AND FOUNDRY LABORATORY**   **L T P C**
                                                               0 0 4 2

OBJECTIVE

To familiarize the students with test procedures followed in foundry and to practice various types of welding processes.

LIST OF EXPERIMENTS

Welding

Study of different welding equipments and accessories: Gas, Electric Welding
Oxy-acetylene gas welding of Lap joint, Butt Joint and T Joint.

S.No.	Description of Equipment	Quantity required
1.	Vernier Calipers 0-150	5 Nos.
	Vernier Calipers 0-300	2 Nos.
2.	Micrometer 0-25	5 Nos.
	Micrometer 25-50	2 Nos.
	Micrometer 50-75	2 Nos.
3.	Dial gauges LC 10micrometer	3 Nos.
	Dial gauge L.C. 2micrometer, 1	2 Nos.
4.	Height gauge Analog	1 No.
	Height gauge Digital	1 No.
5.	Slip gauge set	2 sets
6.	Sin~ Bar 100 mm	1 No.
	Sine Bar 200 mm	1 No.
7.	Toolmakers microscope	1 No.
	Profile Projector	1 No.
8.	Gear tooth verniers	2 Nos.
9.	Flangernic 0-25	1 No.
	Flangemic 25-50	1 No.
10.	Floating carriage micrometer	1 No.
	Thread plug gauges m24 x 3	1 No.
	Thread plug gauges m20 x 2.5	1 No.
11.	3 wire set box	1 No.
12.	Surface roughness measuring Instrument with accessories	1 No.
13.	Precision spheres different dias	1 set
14.	Dial Guage Caliberator	1 No.
15.	Precision level	1 No.
16.	Digital Micrometer	1 No.
17.	Digital Vernier 0-150	1 No.
18.	Digital Ht. Guage	1 No.
19.	Bevel Protractor	1 No.
20.	CMN	1 System
21.	Vision measuring system	1 System
22.	Boredial gauge 16-35, 35-60	1 Box each
23.	Depth Vernier 0-150	1 No.
24.	Depth micrometer with 6	1 No.
25.	Internal micrometer with Extn	1 No.
26.	Precision Rollers 8	2 Nos.
27.	Surface plate	1 No.
28.	Bench centre	1 No.

Electric are welding of Lap Joint, Butt Joint, and T Joint.
Welding of pipes in different positions.
Brazing practice – furnace brazing.
Brazing welding of cast iron.
Thermit welding of thick material like rod plates etc.

Foundry

Preparation of green moulding sand using a 5 kg muller and testing for

Compression, shear, tensile, transverse strengths, hardness
in green condition:
ii. in dry condition after drying in oven at 150 ° C for one and half hour.
 Permeability testing.
 Determining the clay content.
 Sieve analysis of dry silica sand.
 Determining the moisture content by various methods.
 Melting any non-ferrous metal and making simple castings - Demonstration.

                                                                    TOTAL: 60 PERIODS

LIST OF EQUIPMENTS
 (for a batch of 30 students)
5 Kg Muller	- 1No.
Sand rammer	- 1 No
Weighing balance	- 1 No.
Universal sand strength testing with all accessories	- 1 Set.
Permeability tester	- 1 No.
Quick moisture tester	- 1 No.
Infra-red drier	- 1 No.
Sieve shaker with Sieves	- 1 Set.
Crucible furnace	- 1 No.
Oxy acetylene gas welding equipment	- 1 Set.
Electric Welding Transformer, welding booth	- 5 No.

GE2022   **TOTAL QUALITY MANAGEMENT**   **L T P C**
                                                        3 0 0 3
 UNIT I   INTRODUCTION   9
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.

UNIT II   TQM PRINCIPLES   9
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.

UNIT III   TQM TOOLS & TECHNIQUES I   9
The seven traditional tools of quality – New management tools – Six-sigma: Concepts, methodology, applications to manufacturing, service sector including IT – Bench marking – Reason to bench mark, Bench marking process – FMEA – Stages, Types.

UNIT IV   TQM TOOLS & TECHNIQUES II   9

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

UNIT V   QUALITY SYSTEMS   9

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.

TOTAL: 45 PERIODS

TEXT BOOK:

1. Dale H.Besterfiled, et at., "Total Quality Management", Pearson Education Asia, Third Edition, Indian Reprint (2006).

REFERENCES:

1. James R. Evans and William M. Lindsay, "The Management and Control of Quality", 6th Edition, South-Western (Thomson Learning), 2005.
2. Oakland, J.S. "TQM – Text with Cases", Butterworth – Heinemann Ltd., Oxford, 3rd Edition, 2003.
3. Suganthi,L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd.,2006.
4. Janakiraman,B and Gopal, R.K, "Total Quality Management – Text and Cases", Prentice Hall (India) Pvt. Ltd., 2006.

ME2401	MECHATRONICS	L T P C
	(Common to Mechanical and Production)	**3 0 0 3**

OBJECTIVE

To understand the interdisciplinary applications of Electronics, Electrical, Mechanical and Computer Systems for the Control of Mechanical and Electronic Systems.

UNIT I   MECHATRONICS, SENSORS AND TRANSDUCERS   9

Introduction to Mechatronics Systems – Measurement Systems – Control Systems – Microprocessor based Controllers. Sensors and Transducers – Performance Terminology – Sensors for Displacement, Position and Proximity; Velocity, Motion, Force, Fluid Pressure, Liquid Flow, Liquid Level, Temperature,Light Sensors – Selection of Sensors

UNIT II   ACTUATION SYSTEMS   9

Pneumatic and Hydraulic Systems – Directional Control Valves – Rotary   Actuators. Mechanical Actuation Systems – Cams – Gear Trains – Ratchet and pawl – Belt and Chain Drives – Bearings. Electrical Actuation Systems – Mechanical Switches – Solid State Switches – Solenoids – Construction and working principle of DC and AC Motors – speed control of AC and DC drives, Stepper Motors-switching circuitries for stepper motor – AC & DC Servo motors

UNIT III   SYSTEM MODELS AND CONTROLLERS   9

Building blocks of Mechanical, Electrical, Fluid and Thermal Systems, Rotational – Transnational Systems, Electromechanical Systems – Hydraulic – Mechanical Systems. Continuous and discrete process Controllers – Control Mode – Two – Step mode –

Proportional Mode – Derivative Mode – Integral Mode – PID Controllers – Digital Controllers – Velocity Control – Adaptive Control – Digital Logic Control – Micro Processors Control.

UNIT IV   PROGRAMMING LOGIC CONTROLLERS   9
Programmable Logic Controllers – Basic Structure – Input / Output Processing – Programming – Mnemonics – Timers, Internal relays and counters – Shift Registers – Master and Jump Controls – Data Handling – Analogs Input / Output – Selection of a PLC.

UNIT V   DESIGN OF MECHATRONICS SYSTEM   9
Stages in designing Mechatronics Systems – Traditional and Mechatronic Design - Possible Design Solutions. Case studies of Mechatronics systems- Pick and place Robot- Autonomous mobile robot-Wireless suriviellance balloon- Engine Management system-Automatic car park barrier.

TOTAL: 45 PERIODS

TEXT BOOKS
1. Bolton,W, "Mechatronics" , Pearson education, second edition, fifth Indian Reprint, 2003
2. Smaili.A and Mrad.F , "Mechatronics integrated technologies for intelligent machines", Oxford university press, 2008

REFERENCES:
1. Rajput. R.K, A textbook of mechatronics, S. Chand & Co, 2007
2. Michael B. Histand and David G. Alciatore, "Introduction to Mechatronics and Measurement Systems", McGraw-Hill International Editions, 2000.
3. Bradley D. A., Dawson D., Buru N.C. and. Loader A.J, "Mechatronics", Chapman and Hall, 1993.
4. Dan Necsulesu, "Mechatronics", Pearson Education Asia, 2002 (Indian Reprint).
   Lawrence J. Kamm, "Understanding Electro – Mechanical Engineering", An Introduction to Mechatronics, Prentice – Hall of India Pvt., Ltd., 2000.
5. Nitaigour Premchand Mahadik, "Mechatronics", Tata McGraw-Hill publishing Company Ltd, 2003

ME 2027   **PROCESS PLANNING AND COST ESTIMATION**   **L T P C**
                 (Common to Production and Mechanical)   **3 0 0 3**

OBJECTIVE
- To introduce the process planning concepts
- To make cost estimation for various products after process planning

UNIT I   WORK STUDY AND ERGONOMICS   10
Method study – Definition – Objectives-Motion economy- Principles – Tools and Techniques-Applications – Work measurements- purpose – use – procedure – tools and techniques- Standard time –Ergonomics – principles – applications.

UNIT II   PROCESS PLANNING   10
Definition – Objective – Scope – approaches to process planning- Process planning activities – Finished part requirements - operating sequences - machine selection – material selection parameters- Set of documents for process planning - Developing

manufacturing logic and knowledge- production time calculation – selection of cost optimal processes.

UNIT III   INTRODUCTION TO COST ESTIMATION   7
Objective of cost estimation- costing – cost accounting- classification of cost- Elements of cost.

UNIT IV   COST ESTIMATION   8
Types of estimates – methods of estimates – data requirements and sources- collection of cost- allowances in estimation.

UNIT V   PRODUCTION COST ESTIMATION   10
Estimation of material cost, labour cost and over heads, allocation of overheads – Estimation for different types of jobs.

TOTAL: 45 PERIODS

TEXT BOOKS
1. Banga and Shama, Cost estimation, Sinha.B.P., "Mechanical Estimating and Costing", Tata McGraw-Hill, Publishing Co., 1995

REFERENCES
1. Phillip.F Ostwalal and Jairo Munez, "Manufacturing Processes and systems", John Wiley, 9th Edition, 1998
2. Russell.R.S and Tailor, B.W, "Operations Management", PHI, 4th Edition, 2003.
3. Chitale.A.V. and Gupta.R.C., "Product Design and Manufacturing", PHI , 2nd Edition, 2002.

ME2028   **ROBOTICS**   **L T P C**
   (Common to Production and VII Semester Elective for Mechanical)   **3 0 0 3**

OBJECTIVES
- To introduce the basic concepts, parts of robots and types of robots
- To make the student familiar with the various drive systems for robot, sensors and their applications in robots, programming of robots
- To discuss about the various applications of robots, justification, implementation and safety of robot

UNIT I   FUNDAMENTALS OF ROBOT   7
Robot – Definition – Robot Anatomy – Co-ordinate Systems, Work Envelope, types and classification – Specifications – Pitch, Yaw, Roll, Joint Notations, Speed of Motion, Pay Load – Robot Parts and Their Functions – Need for Robots – Different Applications

UNIT II   ROBOT DRIVE SYSTEMS AND END EFFECTORS   10
Pneumatic Drives – Hydraulic Drives – Mechanical Drives – Electrical Drives – D.C. Servo Motors, Stepper Motor, A.C. Servo Motors – Salient Features, Applications and Comparison of All these Drives

End Effectors – Grippers – Mechanical Grippers, Pneumatic and Hydraulic Grippers, Magnetic Grippers, Vacuum Grippers; Two Fingered and Three Fingered Grippers; Internal Grippers and External Grippers; Selection and Design Considerations

UNIT III   SENSORS AND MACHINE VISION   10

Requirements of a sensor, Principles and Applications of the following types of sensors – Position of sensors (Piezo Electric Sensor, LVDT, Resolvers, Optical Encoders, Pneumatic Position Sensors), Range Sensors (Triangulation Principle, Structured, Lighting Approach, Time of Flight Range Finders, Laser Range Meters), Proximity Sensors (Inductive, Hall Effect, Capacitive, Ultrasonic and Optical Proximity Sensors), Touch Sensors, (Binary Sensors, Analog Sensors), Wrist Sensors, Compliance Sensors, Slip Sensors

Camera, Frame Grabber, Sensing and Digitizing Image Data – Signal Conversion, Image Storage, Lighting Techniques. Image Processing and Analysis – Data Reduction, Edge detection, Segmentation Feature Extraction, Object Recognition, Other Algorithms. Applications – Inspection, Identification, Visual Serving and Navigation.

UNIT IV   ROBOT KINEMATICS AND ROBOT PROGRAMMING   10

Forward Kinematics, Inverse Kinematics and Differences; Forward Kinematics and Reverse Kinematics of Manipulators with Two, Three Degrees of Freedom (In 2 Dimensional), Four Degrees of Freedom (In 3 Dimensional) – Deviations and Problems Teach Pendant Programming, Lead through programming, Robot programming Languages – VAL Programming – Motion Commands, Sensor Commands, End effecter commands, and Simple programs.

UNIT V   IMPLEMENTATION AND ROBOT ECONOMICS   8

RGV, AGV; Implementation of Robots in Industries – Various Steps; Safety Considerations for Robot Operations; Economic Analysis of Robots – Pay back Method, EUAC Method, Rate of Return Method.

TOTAL: 45 PERIODS

TEXT BOOK
1. M.P.Groover, "Industrial Robotics – Technology, Programming and Applications", McGraw-Hill, 2001
2. Yoram Koren, "Robotics for Engineers", McGraw-Hill Book Co., 1992

REFERENCES
1. Fu.K.S. Gonzalz.R.C., and Lee C.S.G., "Robotics Control, Sensing, Vision and Intelligence", McGraw-Hill Book Co., 1987
3. Janakiraman.P.A., "Robotics and Image Processing", Tata McGraw-Hill, 1995

ME2404	COMPUTER AIDED SIMULATION AND ANALYSIS LABORATORY	L T P C 0 0 3 2

LIST OF EXPERIMENTS

A.   Simulation   **8**
Simulation of Air conditioning system with condenser temperature and evaporator temperatures as input to get COP using C /MAT Lab.
Simulation of Hydraulic / Pneumatic cylinder using C / MAT Lab.
Simulation of cam and follower mechanism using C / MAT Lab.

B.   Analysis (Simple Treatment only)   **37**

Stress analysis of a plate with a circular hole.
Stress analysis of rectangular L bracket
Stress analysis of an axi-symmetric component
Stress analysis of beams (Cantilever, Simply supported, Fixed ends)
Mode frequency analysis of a 2 D component
Mode frequency analysis of beams (Cantilever, Simply supported, Fixed ends)
Harmonic analysis of a 2D component
Thermal stress analysis of a 2D component
Conductive heat transfer analysis of a 2D component
Convective heat transfer analysis of a 2D component

TOTAL: 45 PERIODS

LIST OF EQUIPMENTS
(for a batch of 30 students)

Computer System   **30**
17" VGA Color Monitor
Pentium IV Processor
40 GB HDD
512 MB RAM

Color Desk Jet Printer   **01**
Software
Suitable analysis software   30 licenses
C / MATLAB   5 licenses

ME2405	MECHATRONICS LABORATORY	L T P C
	(Common to Mechanical and Production)	0 0 3 2

LIST OF EXPERIMENTS

1.   Design and testing of fluid power circuits to control
     (i) Velocity **(ii)** direction and **(iii)** force of single and double acting actuators
2.   Design of circuits with logic sequence using Electro pneumatic trainer kits.
3.   Simulation of basic Hydraulic, Pneumatic and Electric circuits using software
4.   Circuits with multiple cylinder sequences in Electro pneumatic using PLC
5.   Speed Control of AC & DC drives
6.   Servo controller interfacing for DC motor
7.   PID controller interfacing
8.   Stepper motor interfacing with 8051 Micro controller
     (i) full step resolution   (ii) half step resolution

9. Modeling and analysis of basic electrical, hydraulic and pneumatic systems Using appropriate softwares
11. Computerized data logging system with control for process variables like pressure flow and temperature.

TOTAL: 45 PERIODS

LIST OF EQUIPMENT
(for a batch of 30 students)

1. Basic Pneumatic Trainer Kit with manual and electrical controls/ PLC   Control   - 1 each
2. Basic Hydraulic Trainer Kit   - 1 No.
3. Hydraulics and Pneumatics Systems Simulation Softwares   - 10 sets.
4. 8051 - Microcontroller kit with stepper motor and drive circuit - 2 sets
5. Simulation Softwares and Sensors to measure Pressure, Flow rate, direction, speed, velocity and force.   -2 sets

PR2404	**DESIGN AND FABRICATION PROJECT**	L T P C
		0 0 4 2

The objective of this project is to provide opportunity for the students to implement their skills acquired in the previous semesters to practical problems.
The students in convenient groups of not more than 4 members have to take one small item for design and fabrication. Every project work shall have a guide who is the member of the faculty of the institution and if possible with an industry guide also.

The item chosen may be small machine elements (Example-screw jack, coupling, machine vice, cam and follower, governor etc), attachment to machine tools, tooling (jigs, fixtures etc), small gear box, automotive appliances, agricultural implements, simple heat exchangers, small pumps, hydraulic /pneumatic devices etc.

The students are required to design and fabricate the chosen item in the college and demonstrate its working apart from submitting the project report. The report should contain assembly drawing, parts drawings, process charts relating to fabrication.

TOTAL: 60 PERIODS

MG2451	**ENGINEERING ECONOMICS AND COST ANALYSIS**	L T P C
	(Common to Mechanical, Production, Automobile)	3 0 0 3

OBJECTIVES

To learn about the basics of economics and cost analysis related to engineering so as to take economically sound decisions.

UNIT I   INTRODUCTION TO ECONOMICS   8
Introduction to Economics- Flow in an economy, Law of supply and demand, Concept of Engineering Economics – Engineering efficiency, Economic efficiency, Scope of engineering economics- Element of costs, Marginal cost, Marginal Revenue, Sunk cost, Opportunity cost, Break-even analysis- V ratio, Elementary economic Analysis – Material selection for product Design selection for a product, Process planning.

UNIT II   VALUE ENGINEERING   10
Make or buy decision, Value engineering – Function, aims, Value engineering procedure. Interest formulae and their applications –Time value of money, Single payment compound amount factor, Single payment present worth factor, Equal payment series sinking fund factor, Equal payment series payment Present worth factor- equal payment series capital recovery factor-Uniform gradient series annual equivalent factor, Effective interest rate, Examples in all the methods.

UNIT III   CASH FLOW   9
Methods of comparison of alternatives – present worth method (Revenue dominated cash flow diagram), Future worth method (Revenue dominated cash flow diagram, cost dominated cash flow diagram), Annual equivalent method (Revenue dominated cash flow diagram, cost dominated cash flow diagram), rate of return method, Examples in all the methods.

UNIT IV   REPLACEMENT AND MAINTENANCE ANALYSIS   9
Replacement and Maintenance analysis – Types of maintenance, types of replacement problem, determination of economic life of an asset, Replacement of an asset with a new asset – capital recovery with return and concept of challenger and defender, Simple probabilistic model for items which fail completely.

UNIT V   DEPRECIATION   9
Depreciation- Introduction, Straight line method of depreciation, declining balance method of depreciation-Sum of the years digits method of depreciation, sinking fund method of depreciation/ Annuity method of depreciation, service output method of depreciation- Evaluation of public alternatives- introduction, Examples, Inflation adjusted decisions – procedure to adjust inflation, Examples on comparison of alternatives and determination of economic life of asset.

TOTAL: 45 PERIODS

TEXT BOOKS
1. Panneer Selvam, R, "Engineering Economics", Prentice Hall of India Ltd, New Delhi, 2001.
2. Suma Damodaran, " Managerial economics", Oxford university press 2006.

REFERENCES
1. Chan S.Park, "Contemporary Engineering Economics", Prentice Hall of India, 2002.
2. Donald.G. Newman, Jerome.P.Lavelle, "Engineering Economics and analysis" Engg. Press, Texas, 2002
3. Degarmo, E.P., Sullivan, W.G and Canada, J.R, "Engineering Economy", Macmillan, New York, 1984
4. Grant.E.L., Ireson.W.G., and Leavenworth, R.S, "Principles of Engineering Economy", Ronald Press, New York,1976.

5. Smith, G.W., "Engineering Economy", Lowa State Press, Iowa, 1973.
6. Truett & Truett, " Managerial economics- Analysis, problems & cases " Wiley India 8th edition 2004.
7. Luke M Froeb / Brian T Mccann, " Managerial Economics – A problem solving approach" Thomson learning 2007.

PR2451   **COMPREHENSION**   **L T P C**
                                                                     0 0 2 1

OBJECTIVE

The objective of comprehension is to provide opportunity for the student to apply the knowledge acquired during the earlier semesters to real life problems which he / she may have to face in future as an engineer. While learning as how to solve the real life problems, student will receive guidance from the faculty and also review various courses learnt earlier.

Further this comprehension is to achieve an understanding of the fundamentals of contemporary manufacturing systems including materials, manufacturing process, product and process control, computer integrated manufacture and quality. The students work in groups and solve a variety of problems given to them. The problems given to the students should be of real like industrial problems selected by a group of faculty members of the concerned department. A minimum of three small problems has to be solved by each group of students. The evaluation is based on continuous assessment by a group of Faculty Members constituted by the professor in-charge of the course.

TOTAL: 45 PERIODS

PR2452   **PROJECT WORK**   **L T P C**
                                                                    0 0 12 6

OBJECTIVE

The objective of the project work is to enable the students in convenient groups of not more than 4 members on a project involving theoretical and experimental studies related to the branch of study. Every project work shall have a guide who is the member of the faculty of the institution. Six periods per week shall be allotted in the time table and this time shall be utilized by the students to receive the directions from the guide, on library reading, laboratory work, computer analysis or field work as assigned by the guide and also to present in periodical seminars on the progress made in the project.

The aim of the project work is to deepen comprehension of principles by applying them to a new problem which may be the design and manufacture of a device, a research investigation, a computer or management project or a design problem.

The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department.

Each student shall finally produce a comprehensive report covering background information, literature survey, problem statement, project work details and conclusion. This final report shall be typewritten form as specified in the guidelines.

The continuous assessment shall be made as prescribed in the regulations (vide clause 10.3 of Regulations 2004 for B.E., B.Tech. programmes)

MG 2021   **MARKETING MANAGEMENT**   **L T P C**
                                                       3 0 0 3

OBJECTIVE:
- To understand the various processes involved in Marketing and its Philosophy.
- To learn the Psychology of consumers.
- To formulate strategies for advertising, pricing and selling

UNIT I   MARKETING PROCESS   9
Definition, Marketing process, dynamics, needs, wants and demands, marketing concepts, environment, mix, types. Philosophies, selling versus marketing, organizations, industrial versus consumer marketing, consumer goods, industrial goods, product hierarchy

UNIT II   BUYING BEHAVIOUR AND MARKET SEGMENTATION   9
Cultural, demographic factors, motives, types, buying decisions, segmentation factors - demographic -Psycho graphic and geographic segmentation, process, patterns.

UNIT III   PRODUCT PRICING AND MARKETING RESEARCH   9
Objectives, pricing, decisions and pricing methods, pricing management. Introduction, uses, process of marketing research.

UNIT IV   MARKETING PLANNING AND STRATEGY FORMULATION   9
Components of marketing plan-strategy formulations and the marketing process, implementations, portfolio analysis, BCG, GEC grids.

UNIT V   ADVERTISING, SALES PROMOTION AND DISTRIBUTION   9
Characteristics, impact, goals, types, and sales promotions- point of purchase- unique selling proposition. Characteristics, wholesaling, retailing, channel design, logistics, and modern trends in retailing.

TOTAL: 45 PERIODS

TEXT BOOKS:
1. Govindarajan. M, "Marketing management – concepts, cases, challenges and trends", Prentice hall of India, second edition 2007.
2. Philip Kolter,Koshy Jha "Marketing Management", Pearson Education ,Indian adapted edition.2007

REFERENCES:

1. Ramasamy and Nama kumari, "Marketing Environment: Planning, implementation and control the Indian context", 1990.
2. Czinkota&Kotabe, "Marketing management", Thomson learning, Indian edition 2007
3. Adrain palmer, " Introduction to marketing theory and practice", Oxford university press IE 2004.
4. Donald S. Tull and Hawkins, "Marketing Reasearch", Prentice Hall of Inida-1997.
5. Philip Kotler and Gary Armstrong "Principles of Marketing" Prentice Hall of India, 2000.
6. Steven J.Skinner, "Marketing", All India Publishers and Distributes Ltd. 1998.
7. Graeme Drummond and John Ensor, Introduction to marketing concepts, Elsevier, Indian Reprint, 2007

ME2021   QUALITY CONTROL AND RELIABILITY ENGINEERING   L T P C
(Common to Mechanical, Automobile and Production)   3 0 0 3

OBJECTIVE:
- To introduce the concept of SQC
- To understand process control and acceptance sampling procedure and their application.
- To learn the concept of reliability.

UNIT I   INTRODUCTION AND PROCESS CONTROL FOR VARIABLES   10
Introduction, definition of quality, basic concept of quality, definition of SQC, benefits and limitation of SQC, Quality assurance,Quality control: Quality cost-Variation in process- causesof variation –Theory of control chart- uses of control chart – Control chart for variables – X chart, R chart and σ chart -process capability – process capability studies and simple problems.Six sigma concepts.

UNIT II   PROCESS CONTROL FOR ATTRIBUTES   8
Control chart for attributes –control chart for non conformings– p chart and np chart – control chart for nonconformities– C and U charts, State of control and process out of control identification in charts, pattern study.

UNIT III   ACCEPTANCE SAMPLING   9
Lot by lot sampling – types – probability of acceptance in single, double, multiple sampling techniques – O.C. curves – producer's Risk and consumer's Risk. AQL, LTPD, AOQL concepts-standard sampling plans for AQL and LTPD- uses of standard sampling plans.

UNIT IV   LIFE TESTING - RELIABILITY   9
Life testing – Objective – failure data analysis, Mean failure rate, mean time to failure, mean time between failure, hazard rate – Weibull model, system reliability, series, parallel and mixed configuration – simple problems. Maintainability and availability – simple problems. Acceptance sampling based on reliability test – O.C Curves.

UNIT V   QUALITY AND RELIABLITY   9

Reliability improvements – techniques- use of Pareto analysis – design for reliability – redundancy unit and standby redundancy – Optimization in reliability – Product design – Product analysis – Product development – Product life cycles.

TOTAL: 45 PERIODS

Note: Use of approved statistical table permitted in the examination.

TEXT BOOKS:
1. Douglas.C.Montgomery, " Introduction to Statistical quality control" John wiley 4th edition2001.
2. L.S.Srinath, "Reliability Engineering", Affiliated East west press, 1991.

REFERENCES:
1. John.S. Oakland. Statistical process control", Elsevier, 5th edition, 2005
2. Connor, P.D.T.O., " Practical Reliability Engineering", John Wiley, 1993
3. Grant, Eugene .L "Statistical Quality Control", McGraw-Hill, 1996
4. Monohar Mahajan, "Statistical Quality Control", Dhanpat Rai & Sons, 2001.
5. R.C.Gupta, "Statistical Quality control", Khanna Publishers, 1997.
6. Besterfield D.H., "Quality Control", Prentice Hall, 1993.
7. Sharma S.C., "Inspection Quality Control and Reliability", Khanna Publishers, 1998.
8. Danny Samson, "Manufacturing & Operations Strategy", Prentice Hall, 1991

ME2026	UNCONVENTIONAL MACHINING PROCESSES	L T P C
	(Common to Mechanical and Production)	3 0 0 3

OBJECTIVE:
To learn about various unconventional machining processes, the various process parameters and their influence on performance and their applications

UNIT I   INTRODUCTION   5
Unconventional machining Process – Need – classification – Brief overview .

UNIT II   MECHANICAL ENERGY BASED PROCESSES   10
Abrasive Jet Machining – Water Jet Machining – Abrasive Water Jet Machining - Ultrasonic Machining. (AJM, WJM, AWJM and USM). Working Principles – equipment used – Process parameters – MRR-Variation in techniques used – Applications.

UNIT III   ELECTRICAL ENERGY BASED PROCESSES   8
Electric Discharge Machining (EDM)- working Principle-equipments-Process Parameters-Surface Finish and MRR- electrode / Tool – Power and control Circuits-Tool Wear – Dielectric – Flushing – Wire cut EDM – Applications.

**UNIT IV   CHEMICAL AND ELECTRO-CHEMICAL ENERGY BASED
                   PROCESSES   12**
Chemical machining and Electro-Chemical machining (CHM and ECM)-Etchants-maskant-techniques of applying maskants-Process Parameters – Surface finish and MRR-Applications. Principles of ECM-equipments-Surface Roughness and MRR-Electrical circuit-Process Parameters-ECG and ECH - Applications.

UNIT V   THERMAL ENERGY BASED PROCESSES   10
Laser Beam machining and drilling (LBM), plasma Arc machining (PAM) and Electron Beam Machining (EBM). Principles – Equipment –Types - Beam control techniques – Applications.

TOTAL: 45 PERIODS

TEXT BOOK:
1. Vijay.K. Jain "Advanced Machining Processes" Allied Publishers Pvt. Ltd., New Delhi, 2007
2. Pandey P.C. and Shan H.S. "Modern Machining Processes" Tata McGraw-Hill, New Delhi (2007).

REFERENCES:
1. Benedict. G.F. "Nontraditional Manufacturing Processes" Marcel Dekker Inc., New York (1987).
2. Mc Geough, "Advanced Methods of Machining" Chapman and Hall, London (1998).
3. Paul De Garmo, J.T.Black, and Ronald.A.Kohser, "Material and Processes in Manufacturing" Prentice Hall of India Pvt. Ltd., New Delhi ,8th Edition,2001.

PR2021   **PRECISION ENGINEERING**   L T P C
                                                                 3 0 0 3

OBJECTIVES :
To impart knowledge in the increasing quality concepts of parts, accuracy requirement of machine tools and also to introduce latest topics in Manufacturing like micro machining and smart materials so as to equip them to join core electronic manufacturing industries.

UNIT I   CONCEPTS OF ACCURACY AND MACHINE TOOLS   9
Part Accuracy – errors, accuracy of machine tools – spindle accuracy – displacement accuracy – errors due to numerical interpolation – definition of accuracy of N.C system – errors in the NC machines – feed stiffness – zero stability.

UNIT II   STIFFNESS, THERMAL EFFECTS AND FINISH MACHINING   12
Overall stiffness of Lathe – compliance of work piece – errors caused by cutting forces – deformation in turning – boring – milling – heat sources – thermal effects – Finish Turning, boring, grinding – Surface roughness.

UNIT III   DIMENSIONING   6
Definition of terms – Key dimension – Superfluous dimension – dimensional stepped shaft – assigning tolerances in the constituent dimensions – dimensional chains.

UNIT IV   MICRO-MACHINING MICRO FABRICATION   9
Micro Machining – Photo resist process – Lithography – LIGA Process – Optical, processing of materials – electron beam machining – beam machining – micro forming, diamond turning – micro positioning devices – etching – physical vapour deposition – Chemical vapour deposition

UNIT V   SMART STRUCTURES, MATERIALS AND MICRO ACTUATORS   9
Smart structures – Smart materials types and applications - smart sensors – micro valves – MEMS – Micro motors – Micro pumps – micro dynamometer – micro machines – micro optics – micro nozzles.

TOTAL: 45 PERIODS

TEST BOOKS:

1. Murthy R.L. "Precision Engineering in Manufacturing", New Age Internaional Pvt. Limited. (19
2. Juliar W.Gardner. Vijay K. Varadan, 'Micro sensors, MEMS and Smart Devices, John wiley and sons, 2001.

REFERENCES:

1. Stephen A.Campbell, "The Science and Engineering of Micro electronic Fabrication", Oxford University Press, 1996.
2. Raady Frank, "Understanding smart sensors", Artech. House, Boston, 1996.
3. MEMS Hand Book, CRC Press, 2001

PR2022	**FUZZY LOGIC AND ANN**	**L T P C**
		3 0 0 3

UNIT I   INTRODUCTION TO FUZZY LOGIC PRINCIPLES   9

Basic concepts of fuzzy set theory – operations of fuzzy sets – properties of fuzzy sets – Crisp relations – Fuzzy relational equations – operations on fuzzy relations – fuzzy systems – propositional logic – Inference – Predicate Logic – Inference in predicate logic – fuzzy logic principles – fuzzy quantifiers – fuzzy inference – fuzzy rule based systems – fuzzification and defuzzification – types.

UNIT II   ADVANCED FUZZY LOGIC APPLICATIONS   9

Fuzzy logic controllers – principles – review of control systems theory – various industrial applications of FLC adaptive fuzzy systems – fuzzy decision making – Multiobjective decision making – fuzzy classification – means clustering – fuzzy pattern recognition – image processing applications – systactic recognition – fuzzy optimization – various

UNIT III   INTRODUCTION TO ARTIFICIAL NEURAL NETWORKS   9

Fundamentals of neural networks – model of an artificial neuron – neural network architectures – Learning methods – Taxonomy of Neural network architectures – Standard back propagation algorithms – selection of various parameters – variations

Applications of back propagation algorithms.

UNIT IV   OTHER ANN ARCHITECTURES   9

Associative memory – exponential BAM – Associative memory for real coded pattern pairs – Applications adaptive reasonance theory – introduction – ART 1 – ART2 – Applications – neural networks based on competition – kohenen self organizing maps – learning vector quantization – counter propagation networks – industrial applications.

UNIT V   RECENT ADVANCES   9

Fundamentals of genetic algorithms – genetic modeling – hybrid systems – integration of fuzzy logic, neural networks and genetic algorithms – non traditional optimization techniques like ant colony optimization – Particle swarm optimization and artificial immune systems – applications in design and manufacturing.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. S.Rajasekaran.G.A.Vijayalakshmi Pai "Neural Networks, fuzzy logic and genetic algorithms", prentice hall of India private limited, 2003

2. Timothy J.Ross, "Fuzzy logic with engineering applications", McGraw Hill, 1995
3. Zurada J.M. "Introduction to artificial neural systems", Jaico publishing house, 1994

REFERENCES:
1. Klir.G, Yuan B.B. "Fuzzy sets and fuzzy logic prentice Hall of India private limited, 1997.
2. Laurance Fausett, "Fundamentals of neural networks", Prentice hall, 1992
3. Gen, M. and R. Cheng "Genetic algorithm and engineering design", john wiley 1997

PR2023	**INSTRUMENTATION AND CONTROL**	**L T P C**
		3 0 0 3

UNIT I   INTRODUCTION   9
Static and dynamic characteristics of measurement systems, standards and calibration, error and uncertainty analysis, statistical analysis of data, and curve fitting.

UNIT II   MECHANICAL MEASUREMENTS AND INDUSTRIAL
**   INSTRUMENTATION   10**
Measurement of displacement, velocity (linear and rotational), acceleration, shock, vibration, force torque power, strain, stress, pressure temperature.

UNIT III   DATA DISPLAY AND RECORDING DEVICES   8
Data display-CRO,LED, LCD, magnetic tape recorders, x-y recorders, UV recorders, Oscilloscope recorders, digital printers and data loggers.

UNIT IV   CONTROL   9
Introduction to control systems, mathematical model of physical systems in transfer function and state space forms, response of dynamic systems, concept of pole and zero of a system, realization of transfer functions.

UNIT V   STABILITY ANALYSIS   9
Stability criteria bode plots, routh and Nyquist criteria.

TOTAL: 45 PERIODS

TEXT BOOKS:
1. B.C.Nakra, K.K.choudry, "Instrumentation, Measurement and analysis", Tata McGraw Hill 2002
2. J.J.Nagrath and Gopal, "control system engineering", New age international (p) ltd., 2000

REFERENCES:
1. C.S.Rangan, G.R.Sarma, VSV Mani, Instrumentation devices and systems", Tata McGraw Hill, 2000
2. A.K. Sowhney, "electricaland electronic measurement and instrumentation, "Dhanpat rai & Cu, 2003.
3. Benjamin C.Kuo, "Automatic control system", prentice hall of India pvt ltd.,2002
4. Ernest O.Doeblin, "measurement systems applications and design", McGraw Hill International editions, 1990
5. S.Renganathan, "transducer engineering", Allied publishers, 1990.

PR2024 **SURFACE ENGINEERING** **L T P C**
3 0 0 3

UNIT I   METAL CLEANING AND PREVIEW ON SURFACE ENGINEERING   8
Need and relevance of surface engineering – pre-treatment of coating, General cleaning process for ferrous and non-ferrous metals and alloys – selection of cleaning process – alkaline cleaning – emulsion cleaning- ultrasonic cleaning – acid and pickling salt bath descaling – abrasive bath cleaning – polishing and short peening – classification of surface engineering processes.

UNIT II   THERMAL SPRAYING PROCESSES AND ELECTRODEPOSITED
COATINGS   10
Thermal spraying – flame, arc, plasma and HVOF processes – PLV process – design for thermally sprayed coatings – coating production – spray consumables principles of electroplating – Technology and control electroplating systems – properties and Faraday's Law – factors affecting throwing power – Applications of electrodeposites – non-aqueous and electroless deposition.

UNIT III   HOT DIP COATING AND DIFFUSION COATINGS   10
Principles – surface preparation batch coating and continuous coating process – coating properties and applications, Principles of cementation – cladding – Diffusion coating of C.N. Al, Si, Cr and B – structure, properties and application of diffusion coatings – chemical vapour deposition – physical vapour deposition.

UNIT IV   NON-METALLIC COATING OXIDE AND COVENSION COATINGS   9
Plating coating – laequers – rubbers and elastomers – vitreous enamels – anodizing phosphating and chromating – application to aluminium, magnesium, tin, zinc, cadmium copper and silver – phosphating primers.

UNIT V   QUALITY ASSURANCE, TESTING AND SELECTION OF COATINGS   8
The quality plan – design – testing and inspection of thickness adhesion, corrosion, resistance and porosity measurement – selection of coatings – industrial applications of engineering coatings. Basic mechanisms of wear – abrasive, adhesive wear, contact fatigue – fretting corrosion – testing wear resistance practical diagnosis of wear.

TOTAL: 45 PERIODS
TEXT BOOKS:
1. STAND GRAINGER engineering coatings – design and application jaico publishing House, 1994

REFERENCES:
1. N.V.Parthasarathy, Electroplating Handbooks, Prentice Hall, 1992
2. Metals Hand Book vol.2 8th edition,American society of metals 1994

3. D.R. Gabe, Principles of Metal surface treatment and protection, Pergamon, 1990
4. Niku-Lavi, advances in surface treatments, Pergamon,1990

PR2025 **DESIGN OF MACHINE TOOL STRUCTURE** **L T P C**
3 0 0 3

UNIT I   INTRODUCTION   10
Classification of machining processes, machine tools – machine tool construction – factors – performance criteria – trends in modern machine tool – kinematic arrangement of different types of machine tools – work holding and tool holding devices – calculation of cutting forces and power requirements for turning, milling, boring and grinding – force distribution on different parts of drilling, milling and grinding machine tools.

UNIT II   STRENGTH AND RIGIDITY OF MACHINE TOOL STRUCTURES   10
Basic principles of design – comparison of materials used in machine tool construction – dependence of process capability on rigidity – static compliance – design of lathe beds – materials – typical construction – torsional modulus of regangular and box sections – methods of increasing rigidities.

UNIT III   SLIDEWAYS   9
Slide ways – types – materials – constructions – clearance adjustments – Hydrostatically lubricated slide ways – slide way design – pressure distribution – antifriction ways – design – construction.

UNIT IV   SPINDLES AND SPINDLE SUPPORTS   8
Spindle units – materials – spindle design – spindle bearings – types of materials – constructions.

UNIT V   MACHINE TOOL DYNAMICS   9
Dynamic system – elastic system – working processes – vibration in machine tools – self excited vibration and dynamic stability – basic principles of chatter – effects of vibration – vibration elimination – damping – isolation of vibration – dynamic absorber with damping.

TOTAL: 45 PERIODS

TEXT BOOKS:
1. G.C. Sen and A.Battacharya, "Principles of machine tools", New central book agency, 1999
2. N.K.Metha, "Machine Tool Design and Numerical control", Tata McGraw Hill publishing company, 1996

REFERENCES:
1. Manfred week, "Hand Book of machine tools – vol1, vol 2, vol.3 John Wiley & Sons, 1984.
2. Acherkan.N, "Machine Tool Design", vol 3, MIR publishers, 1978

PR2026   **PRODUCTION MANAGEMENT**   L T P C
                                                              3 0 0 3

UNIT I   PRINCIPLES OF MANAGEMENT AND PERSONNEL MANAGEMENT   7
General principles of management – management functions – organization – types – comparison – functions of personnel management – recruitment training leadership/motivation – communication – Conflict industrial relations – trade union.

UNIT II   INVENTORY MANAGEMENT   11

Purpose of Inventory – Cost related to inventors – Basic EOQ model – variations in EOQ model – Finite Production quality discounts – ABC Analysis – MRP Analysis.

UNIT III   OPERATIONS MANAGEMENT   10
Plant Location – Layout – Materials Handling – Method Study – Time Study – Ergonomics – Aggregate Planning – Value Analysis

UNIT IV   FINANCIAL MANAGEMENT   10
Capital – Types – sources – break even analysis – financial statements – income statement – balance – balance sheet – capital budgeting – working capital management – inventory pricing.

UNIT V   MARKETING MANAGEMENT   7
Functions of marketing – Sales promotion methods – advertising – product packaging – marketing variables – distribution channels – organization – market research market research techniques.

TOTAL: 45 PERIODS

TEXT BOOKS:
1. R. Kesavan, C.Elanchezhian and T.Sundar Selwyn – Engineering management – Eswar Press, 2005
2. K. Panneerselvam – Production and Operations Management – Prentice Hall of India, 2003

REFERENCES:
1. Koont and G'donnel-Essentials of Management, McGraw Hill 1992.
2. Philips Kotler – Principles of marketing, Prentice Hall of India, 1995
3. I.M. Pandey – Financial Management, Vikas Publishing house, 1995
4. K.K.Ahuja – Personal Management, Kalyane Publication 1992
5. Martand T. Telesand – Industrial and Business management – S.Chand & Co., 2001

PR2027   **ERGONOMICS**   **L T P C**
                                                               3 0 0 3

OBJECTIVES:
To introduce the concepts of man machine systems and techniques of providing human comfort in man-making work systems.

UNIT I   INTRODUCTION   9
Inter disciplinary nature of ergonomics modern ergonomics human performance – information processing – factors affecting human performance – physical workload and energy expenditure.

UNIT II   WORK SPACE DESIGN   9
Anthropometry – workspace design for standing and seatedworkers – Arrangements of components within a physical space – Interpersonal aspect of workplace design.

UNIT III   DESIGN OF EQUIPMENT   9

Programme factors to be considered, design of displays and controls – design for maintainability – heat stresses – manual lifting.

UNIT IV DESIGN FOR ENVIRONMENT 9
Illumination – Climate – Noise – Vibration – Heat, cold – Lighting design considerations – Effect of noise on task performance.

UNIT V RECENT ADVANCES AND TRENDS 9
Legislative trends – Trends in work system design – occupational diseases – Application of Ergonomcis in automobiles.

TOTAL: 45 PERIODS

TEXT BOOK:
1. Martin Helander, A guide to Ergonomics of Manufacturing, TMH, 1996.

REFERENCES:
1. Bridger, R.S. Introduction to Ergonomics, McGraw Hill, 1995.
2. Micormic, J. Human factors in Engineering and Design, McGraw Hill, 1992.
3. Wilson,J.R.Corlect EN, Evaluation of Human work, A. practical Ergonomcis
4. methodology, Taylor and Frances, 1990.
5. Shackel, B.Richardson S, Human Factors for Inforamtion usability, Cambridge University, Cambridge University Press, 1991.

ME2030	COMPOSITE MATERIALS	L T P C
		3 0 0 3

OBJECTIVES:
- To understand the fundamentals of composite material strength and its mechanical behavior Understanding the analysis of fiber reinforced Laminate design for different
- combinations of plies with different orientations of the fiber.
- Thermo-mechanical behavior and study of residual stresses in Laminates during processing. Implementation of Classical Laminate Theory (CLT) to study and analysis for residual stresses in an isotropic layered structure such as electronic chips.

UNIT I INTRODUCTION, LAMINA CONSTITUTIVE EQUATIONS & MANUFACTURING 12
Definition –Need – General Characteristics, Applications. Fibers – Glass, Carbon, Ceramic and Aramid fibers. Matrices – Polymer, Graphite, Ceramic and Metal Matrices – Characteristics of fibers and matrices. Lamina Constitutive Equations: Lamina Assumptions – Macroscopic Viewpoint. Generalized Hooke's Law. Reduction to Homogeneous Orthotropic Lamina – Isotropic limit case, Orthotropic Stiffness matrix (Q_{ij}), Typical Commercial material properties, Rule of Mixtures. Generally Orthotropic Lamina – Transformation Matrix, Transformed Stiffness. Manufacturing: Bag Moulding – Compression Moulding – Pultrusion – Filament Winding – Other Manufacturing Processes

UNIT II FLAT PLATE LAMINATE CONSTITUTE EQUATIONS 10
Definition of stress and Moment Resultants. Strain Displacement relations. Basic Assumptions of Laminated anisotropic plates. Laminate Constitutive Equations – Coupling Interactions, Balanced Laminates, Symmetric Laminates, Angle Ply Laminates, Cross Ply Laminates. Laminate Structural Moduli. Evaluation of Lamina Properties from

Laminate Tests. Quasi-Isotropic Laminates. Determination of Lamina stresses within Laminates.

UNIT III   LAMINA STRENGTH ANALYSIS   5
Introduction - Maximum Stress and Strain Criteria. Von-Misses Yield criterion for Isotropic Materials. Generalized Hill's Criterion for Anisotropic materials. Tsai-Hill's Failure Criterion for Composites. Tensor Polynomial (Tsai-Wu) Failure criterion. Prediction of laminate Failure

UNIT IV   THERMAL ANALYSIS   8
Assumption of Constant C.T.E's. Modification of Hooke's Law. Modification of Laminate Constitutive Equations. Orthotropic Lamina C.T.E's. C.T.E's for special Laminate Configurations – Unidirectional, Off-axis, Symmetric Balanced Laminates, Zero C.T.E laminates, Thermally Quasi-Isotropic Laminates

UNIT V   ANALYSIS OF LAMINATED FLAT PLATES   10
Equilibrium Equations of Motion. Energy Formulations. Static Bending Analysis. Buckling Analysis. Free Vibrations – Natural Frequencies

TOTAL: 45 PERIODS

TEXT BOOK:
1. Gibson, R.F., Principles of Composite Material Mechanics, McGraw-Hill, 1994, Second Edition - CRC press in progress.
2. Hyer, M.W., "Stress Analysis of Fiber – Reinforced Composite Materials", McGraw-Hill, 1998

REFERENCES:
1. Issac M. Daniel and Ori Ishai, "Engineering Mechanics of Composite Materials", Oxford University Press-2006, First Indian Edition - 2007
2. Mallick, P.K., Fiber –"Reinforced Composites: Materials, Manufacturing and Design", Maneel Dekker Inc, 1993.
3. Halpin, J.C., "Primer on Composite Materials, Analysis", Techomic Publishing Co., 1984.
4. Agarwal, B.D., and Broutman L.J., "Analysis and Performance of Fiber Composites", John Wiley and Sons, New York, 1990.
5. Mallick, P.K. and Newman, S., (edition), "Composite Materials Technology: Processes and Properties", Hansen Publisher, Munish, 1990.

PR2028   PROCESSING OF POLYMER AND COMPOSITES   L T P C
3 0 0 3
UNIT I   INTRODUCTION   8
Classification of polymers – properties and applications of selective engineering polymers – fundamentals of composites – need for composites – enhancement of properties – classification of composites – matrix polymer matrix composites (PMC), metal matrix composites (MMC), Ceramic matrix composites (CMC) reinforcement – particle reinforced composites, fibre reinforced composites, applications of various types of composites.

UNIT II   POLYMER MATRIX COMPOSITES   12
Polymer matrix resins – thermosetting resins, thermoplastic resins – reinforcement fibres – rovings – woven fabrics – non woven random mats – various types of fibres, PMC

processes – hand lay up processes – spray lay up processes – compression moulding – reinforced reaction injection moulding – resin transfer moulding – poltrusion – filament winding – injection moulding fibre reinforced plastics (FRP) (Glass fibre reinforced plastics (GRP).

UNIT III METAL MATRIX COMPOSITES 9

Characteristics of MMC, various types of metal matrix composites alloy vs. MMC, advantages of MMC limitations of MMC – Metal matrix – reinforcements – particles – fibres. Effect of reinforcement – volume fraction – Rule of mixtures, processing of MMC – Powder metallurgy process diffusion bonding – stir casting squeeze casting.

UNIT IV CERAMICS MATRIX COMPOSITES 9

Engineering ceramic materials – properties – advantages – limitations – Monolithic ceramics – Need for CMC – Ceramic matrix – various types of ceramic matrix composites – oxide ceramics – non oxide ceramics – aluminium oxide – silicon nitride – reinforcements – particles – fibres – whiskers. Sintering- Hot pressing – Cold isostatic pressing (CIPing) – Hot isostatic pressing (HIPing).

UNIT V ADVANCES IN POLYMERS & COMPOSITES 7

Carbon/carbon composites – advantages of carbon matrix – limitations of carbon matrix carbon fibre – chemical vapour deposition of carbon on carbon fibre perform. Solgel technique. Composites for aerospace industrial applications.

TOTAL: 45 PERIODS

TEXT BOOKS:
1. Mathews F.L. and Rawings R.D., "Composite materials, Engineering and Science", Chapman.
2. Chawla K.K. "Composite Materails", Springer Verlag, 1987
3. Kenneth G.Budinski & Michael K. Budinski, "Engineering Materials", Prentice Hall of India pvt ltd., 4th Indian reprint, 2002

REFERENCES:
1. T.W.Clync and P.J. Withers, "Introduction to Metal Matrix Composites". Cambridge University Press, 1993.
2. B.Strong, "Fundamentals of composite manufacturing, SME, 1989
3. S.C.Sharma, "Composite materials", Narosa publications, 2000
4. "Short term course on advances in composite materials", "composite technology centre, department of metallurgy, iit – madras, December 2001.
5. Brydson, Hand book of plastic processing
6. Weatherhead R.G. "FRP technology" (Fibre Reinforced Resin System), Applied Science Publishers Limited, London, 1990.

PR2029 ENGINEERING ECONOMICS AND FINANCIAL MANAGEMENT L T P C
3 0 0 3

UNIT I FINANCIAL ACCOUNTING 13

Accounting principles – basic records depreciation – depreciation methods – preparation and interpretation of profit and loss statement – balance sheet – fixed assets – current assets.

UNIT II   PROFIT VALUE ANALYSIS   10

Cost valume profit relationship – relevant costs in decision making profit management analysis – break even analysis – margin of safety Angle of incident & multi product break even analysis – Effect of changes in volume selling price fixed cost and variable cost on profit.

UNIT III   WORKING CAPITAL MANAGEMENT   8

Current assets and liability decisions – estimation of working capital requirements – Management of accounts receivable – Inventory – cash – inventory valuation methods.

UNIT IV   CAPITAL BUDGETING   7

Significance of capital budgeting – payback period – present value method – Accounting rate of return method.

UNIT V   ENGINEERING ECONOMICS   7

Economics – Engineering economics – Demand analysis Laws of demand – Production and cost – Pricing methods

TOTAL: 45 PERIODS

TEXT BOOKS:
1. R. Kesavan, C.Elanchezhian and T.Sundar Selwyn – Engineering Economics and Financial Accounting, Laxmi Publications 2005
2. S.N.Maheswaran, Management Accounting and Financial Control, Sultan Chand, 1992.

REFERENCES:
1. C.James, Vanhorn, Fundamentals of Financial management PHI 1996
2. Charles T.Homgren, Cost Accounting, PHI 1985

PR2030   PURCHASING AND MATERIALS MANAGEMENT   L T P C
                                                               3 0 0 3

UNIT I   FUNCTIONS OF MATERIALS MANAGEMENT   6

Introduction to materials management – objectives – Organization – Functions – Operating Cycle – Value analysis – Make or buy decisions.

UNIT II   PURCHASING MANAGEMENT   8

Purchasing policies and procedures – Selection of sources of supply – Vendor development – Vendor evaluation and rating – Methods of purchasing – Imports – Buyer – Seller relationship – Negotiations - Insurance and claims managements

UNIT III   STORES MANAGEMENT   8

Store function – Location – Layout – Stock taking – Materials handling – codification – Inventory pricing – MIS for stores management

UNIT   IV   MATERIALS PLANNING   12

Forecasting - ABC analysis – Materials requirements planning - Inventory systems – Quantity – periodic – Deterministic models – Aggregate planning – JIT.

UNIT   V   INVENTORY MANAGEMENT   11

Basic EOQ Model – Discount Model - Finite Production – Lot size under constraints – Application of O.R. Techniques in Materials Management.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Lamer Lee and Donald W.Dobler, Purchasing and Material Management, Text and Cases, Tata McGraw Hill, 1996.

REFERENCES:

1. Gopalakrishnan P.Handbook of Materials Management, Prentice Hall of India, 1996.
2. Guptha P.K. and Manmohan, Problems in Operations Research, Sultan Chand & Sons, 1994
3. R. Kesavan, C.Elanchezhian and T.Sundar Selwyn, Engineering Management, Eswar Press 2005

ME2038	OPERATIONS RESEARCH	L T P C
	(Common to Mechanical, Automobile)	3 0 0 3

OBJECTIVES:
*   To create awareness about optimization in utilization of resources.
*   To understand and apply operations research techniques to industrial operations.

UNIT I   LINEAR MODEL   10

The phases of OR study – formation of an L.P model- graphical solution – simplex algorithm – artificial variables technique– Big M method, two phase method, Duality in LPP. Transportation problems- VAM – MODI technique, Assignment problems.

UNIT II   NETWORK MODELS   8

Shortest route – minimal spanning tree - maximum flow models – project network- CPM and PERT network-critical path scheduling.

UNIT II   INVENTORY MODEL   9

Types of Inventory- EOQ –ERL- Deterministic inventory problems – Price breaks - Stochastic inventory problems- selective inventory control techniques.

UNIT II   REPLACEMENT MODELS   9

Replacement of items that deteriorate with time – value of money changing with time –not charging with time – optimum replacement policy – individual and group replacement. Sequencing problem: models with n jobs with 2 machines – problem with n jobs with m machines.

UNIT III   QUEUING THEORY   9

Queuing models – queuing systems and structures – notation –parameter – single server and multiserver models – Poisson input – exponential service – constant rate service – infinite population.

TOTAL: 45 PERIODS

TEXT BOOK:
1. Wayne.L.Winston, Operations research applications and algorithms, Thomson learning,4th edition 2007.
2. Taha H.A, "Operation Research", Pearson Education sixth edition, 2003

REFERENCES:
1. Frederick.S.Hiller and Gerald.J.Lieberman, "Operations research concepts and cases", TMH (SIE) 8th edition.
2. J.K.Sharma, "Operations research theory and applications", Macmillan India .3rd edition 2007,
3. Hira and Gupta " Problems in Operations Research", S.Chand and Co,2002.
4. Panneerselvam, "Operations Research" Prentice Hall of India, 2003.
5. G Srinivasan, "Operations research principles and applications", PHI (EEE) 2007.
6. Wagner, "Operations Research", Prentice Hall of India, 2000.

PR2031   NON-DESTRUCTIVE TESTING METHODS   L T P C
                                                                    3 0 0 3

AIM:
To impart knowledge on Non Destructive Testing procedures.

OBJECTIVES :
• To understand principle behind various NDT techniques.
• To study about NDT equipments and accessories.
• To learn working procedures of various NDT techniques.

PRE-REQUISITES: Basic knowledge on various process defects

UNIT I   NON-DESTRUCTIVE TESTING: AN INTRODUCTION   6

Introduction to various non-destructive methods- Comparison of Destructive and Non destructive Tests, Visual Inspection, Optical aids used for visual inspection, Applications.

UNIT II   LIQUID PENETRANT TESTING AND MAGNETIC PARTICLE TESTING   10

Physical principles, procedure for penetrant testing, Penetrant testing materials, Penetrant testing methods – Applications
Principle of MPT, Magnetising technical and procedure used for testing a component , Equipment used for MPT , Applications

UNIT III   EDDY CURRENT TESTING AND ACOUSTIC EMISSION TESTING   10

Principles, Instrumentation for ECT, Various Techniques – High sensitivity Techniques, Single, Multi and high frequency ECT, Applications
Principle of AET,AE signal parameters, Applications.

UNIT IV   ULTRASONIC TESTING   10
Principle, Ultrasonic transducers, Inspection Methods – Normal Incident Pulse-echo Inspection, Through - transmission Testing, angle Beam Pulse-echo testing, Techniques for Normal Beam Inspection, Ultrasonic Flaw detection Equipment, Modes of display – A-scan, B-Scan & C- Scan- Applications

UNIT V   RADIOGRAPHY, COMPARISON AND SELECTION OF NDT METHODS   9
Basic principle, Effect of radiation on Film, Radiographic imaging – Inspection Techniques – Single wall single image, Double wall Penetration & Multiwall Penetration technique – Comparison and selection of various NDT techniques

TOTAL: 45 PERIODS

TEXT BOOKS:
1. Baldev raj, T Jeyakumar, M. Thavasimuthu "Practical Non Destructive Testing" Narosa publishing house, New Delhi, 2002

REFERENCES:
1. Krautkramer. J., "Ultra Sonic Testing of Materials", 1st Edition, Springer – Verlag Publication, New York, 1996.
2. Peter J. Shull "Non Destructive Evaluation: Theory, Techniques and Application" Marcel Dekker, Inc., New York, 2002
3. www.**ndt.net**
4. Baldev Raj and B.Venkataraman, "Practical Radiology", Narosa Publishing House, 2004
5. Birchan.B, "Non-Destructive Testing", Oxford, London, 1975

PR2032	SIMULATION OF MANUFACTURING SYSTEMS	L T P C
		3 0 0 3

OBJECTIVE:
To introduce the concepts of simulation and to apply them for manufacturing system

UNIT I   INTRODUCTION   8
Basic concept of system – elements of manufacturing system - concept of simulation – simulation as a decision making tool – types of simulation – system modeling – types of modeling.

UNIT II   RANDOM NUMBERS   10

Probability and statistical concepts of simulation – Pseudo random numbers – methods of generating random numbers – discrete and continuous distribution – testing of random numbers – sampling - simple, random and simulated.

UNIT III   DESIGN OF SIMULATION EXPERIMENTS   10
Problem formulation – data collection and reduction – time flow mechanical – key variables -   logic flow chart starting condition – run size – experimental design consideration – output analysis, interpretation and validation – application of simulation in engineering industry.

UNIT IV   SIMULATION LANGUAGE   9
Study of GPSS (Basic blocks only) Generate, Queue, Depart, Size, Release, Advance, Terminate, Transfer, Enter and Leave.

UNIT V   CASE STUDIES   10
Development of simulation models using GPSS for queuing, production, inventory, maintenance and replacement systems, (Students may be asked to prepare and present the case studies)

TOTAL: 45 PERIODS

TEXT BOOK:
1. Jerry Banks and John S.Carson, "Discrete event system simulation", Prentice Hall 1991

REFERENCES:
1. John H.Mize and J.Grady Cox, "Essential of simulation" – Prentice hall 1989.
2. Geoffrey Gordon "System simulation" – Prentice Hall of India, 1992
3. Jeffrey L.Written, Lonnie D, Bentley and V.M. Barice, "System analysis and Design Methods", Galgotia publication, 1995
4. Averill M.Law and W.David Kelton, "Simulation Modelling and analysis", McGraw Hill International Editions, 1991
5. Shannon R.E., "System simulation", Prentice Hall 1993.

PR2033	RELIABILITY ENGINEERING	L T P C
		3 0 0 3

OBJECTIVES:
To stress the importance of reliability in Engineering and products also the concept of maintability, failure modes and testing methods.

UNIT I   CONCEPTS OF RELIABILITY, SYSTEM AND MODELS   12
Definition of reliability – reliability Vs quality-reliability function-MTTF – hazard rate function- bathtub curve – derivation of the reliability function-constant failure rate model – time dependent failure models. Weibull distribution – normal distribution – the lognormal distribution.   Serial configuration – parallel configuration – combined series parallel systems – system structure function, minimal cuts and minimal paths – Markov analysis – load sharing systems, standby system, degraded systems, three state devices – covariate models, static models, dynamic models, physics of failure models

UNIT II   DESIGN FOR RELIABILITY AND MAINTAINABILITY   12

Reliability design process – system effectiveness – economic analysis and life cycle cost – reliability allocation – optimal, Arinc, Agree, - Design methods – parts and material selection, derating, stress-strength analysis – failure analysis – identification of failure mode – determination of causes – assessment of effects – classification of seventy – computation of critically index – corrective action – system safety and FTA. Analysis of downtime – the repair time distribution – stochastic point processes – system repair time – reliability under preventive maintenance – state dependent systems with repair – MTTR-mean system downtime – MTR – MH/OH – cost model – fault isolation and self diagnostics – repair Vs replacement – replacement model – proactive, preventive, predictive maintenance – maintenance and spares provisioning – maintainability prediction and demonstration – concepts and definition of availability.

UNIT III   OPTIMIZATION OF SYSTEM RELIABILITY   7

Optimization techniques for system reliability with redundancy – heuristic methods applied to optimal system reliability- redundancy allocation by dynamic programming – reliability optimization by non linear programming.

UNIT IV   THE ANALYSIS OF FAILURE DATA AND RELIABILITY TESTING   7

Data collection – empirical methods – ungrouped and grouped complete, censored data – static life estimation – test time calculation – burn in testing, acceptance, sequential, binomial testing – accelerated life testing – ther acceleration models – experimental design – reliability growth process – idealized growth curve – various growth models – identifying failure and repair distributions.

UNIT V   PACKAGING AND TRANSPORTATION FOR RELIABILITY   7

Objectives – preservation-packaging – transportation and subsequent storage – reliability and the customer - Purchase of equipment – installation – commissioning a new system – reliability prediction and control – reliability management – the people concerned with reliability, coordination, training

TOTAL: 45 PERIODS

TEXT BOOKS:
1. Charles E. Ebling, "An introduction to Reliability and Maintainability Engg", Tata McGraw-Hill, 2000.

REFERENCES:
1. Patrick D T o'connor, "Practical Reliability Engineringt", John-Wiley and Sons inc, 2002.
2. David J Smith, "Reliability, Maintainability and Risk: Practical Methods for Engineers", Butterworth, 2002
3. Way kuo, Rajendra Prasad V, Frank A and Tillman, ching- lai Hwang "Optimal Reliability Design and Applciations", Cambridge University Press P ltd., 2001.
4. Srinath I.S, Engineering Design and Reliability, ISTE, 1999.
5. Oleg Vinogradov, "Introduction to Mechanical Reliability: A Designers Approach, Hemisphere Publications, 1991.

PR2034   MACHINE TOOL CONTROL & CONDITION MONITORING   L T P C
**   3 0 0 3**

OBJECTIVES:
- To understand the control system of machine tools and its applications
- To understand the objectives, aims and methodology of machine tool condition onitoring and diagnostics.

UNIT I   OVERVIEW OF AUTOMATIC CONTROLS IN MACHINE TOOLS   6
Open loop – closed loop system – block diagram representation of machine tool control systems.

UNIT II   COMPUTER CONTROL SYSTEM   15
Process computer-peripherals – Data logger-Direct digital control-Supervisory computer control-Adaptive control-types-adaptive control for turning, milling, grinding and EDM-Programmable logic controller-Functions-applications in machine tools.

UNIT III   DRIVE SYSTEMS IN MACHINE TOOLS   8
Electrical, hydraulic and pneumatic types – servo motor-stepper motor-ball screw mechanism. Feed back devices-Syncro, resolver, diffraction gratings, potentiometer, and inductosyn-encoders-application in machine tools.

UNIT IV   CONDITION MONITORING   8
Condition monitoring techniques – Visual, temperature, vibration, lubricant, thickness, noise and sound. Condition monitoring of machine tools.

UNIT V   MACHINE TOOL DIAGNOSTICS   8
Objectives-aims-examples of monitoring and diagnosis-control structures for machine diagnosis-utilization of diagnostic results.

**   TOTAL: 45 PERIODS**

REFERENCES:

1. Manfred weck, "Hand book of machine tools – Vol.3, John Wiley & Sons, 1984.
2. Sushil Kumar Srivstava " industrial maintenance management" S.Chand & company ltd., New Delhi, 1998.
3. Mikell P.Groover, "Automation Production system and Computer Integrated Manufacturing", Prentice Hall of India, Pvt.Ltd., 1995.

PR 2035   MINI PROJECT   L T P C
**   0 0 6 3**

OBJECTIVES:
1. The students in batches (not exceeding three in a batch) have to take up a project in the area of manufacturing engineering.
2. Each batch is guided by a faculty member. The students have to select a suitable problems, design, prepare the drawings, produce the components, assemble and commission the project.
3. The students have to prepare and present a detailed project report at the end of the VIII semester.
4. The evaluation will ne made for the continuous internal assessment for the Project by a committee nominated by the Head of the Department.

GE2025   **PROFESSIONAL ETHICS IN ENGINEERING**   **L T P C**
                                                                            3 0 0 3

UNIT I   ENGINEERING ETHICS   9
Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Professions and Professionalism – Professional Ideals and Virtues – Uses of Ethical Theories

UNIT II   ENGINEERING AS SOCIAL EXPERIMENTATION   9
Engineering as Experimentation – Engineers as responsible Experimenters – Research Ethics - Codes of Ethics – Industrial Standards - A Balanced Outlook on Law – The Challenger Case Study

UNIT III   ENGINEER'S RESPONSIBILITY FOR SAFETY   9
Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis – Reducing Risk – The Government Regulator's Approach to Risk - Chernobyl Case Studies and Bhopal

UNIT IV   RESPONSIBILITIES AND RIGHTS   9
Collegiality and Loyalty – Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) - Discrimination

UNIT V   GLOBAL ISSUES   9
Multinational Corporations – Business Ethics - Environmental Ethics – Computer Ethics - Role in Technological Development – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Honesty – Moral Leadership – Sample Code of Conduct

TOTAL: 45 PERIODS

TEXT BOOKS:
1. Mike Martin and Roland Schinzinger, "Ethics in Engineering", McGraw Hill, New York (2005).
2. Charles E Harris, Michael S Pritchard and Michael J Rabins, "Engineering Ethics – Concepts and Cases", Thompson Learning, (2000).

REFERENCES:
1. Charles D Fleddermann, "Engineering Ethics", Prentice Hall, New Mexico, (1999).
2. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, (2003)
3. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, (2001)
4. Prof. (Col) P S Bajaj and Dr. Raj Agrawal, "Business Ethics – An Indian Perspective", Biztantra, New Delhi, (2004)
5. David Ermann and Michele S Shauf, "Computers, Ethics and Society", Oxford University Press, (2003)

ME2035   **ENTREPRENEURSHIP DEVELOPMENT**   **L T P C**
           (Common to Mechanical, Production & Automobile)   **3 0 0 3**

OBJECTIVE:
- Study of this subject provides an understanding of the scope of an entrepreneur, key areas of development, financial assistance by the institutions, methods of taxation and tax benefits, etc.

UNIT I   ENTREPRENEURSHIP   **9**
Entrepreneur – Types of Entrepreneurs – Difference between Entrepreneur and Intrapreneur – Entrepreneurship in Economic Growth, Factors Affecting Entrepreneurical Growth.

UNIT II   MOTIVATION   **9**
Major Motives Influencing an Entrepreneur – Achievement Motivation Training, self Rating, Business Game, Thematic Apperception Test – Stress management, Entrepreneurship Development Programs – Need, Objectives.

UNIT III   BUSINESS   **9**
Small Enterprises – Definition, Classification – Characteristics, Ownership Structures – Project Formulation – Steps involved in setting up a Business – identifying, selecting a Good Business opportunity, Market Survey and Research, Techno Economic Feasibility Assessment – Preparation of Preliminary Project Reports – Project Appraisal – Sources of Information – Classification of Needs and Agencies.

UNIT IV   FINANCING AND ACCOUNTING   **9**
Need – Sources of Finance, Term Loans, Capital Structure, Financial Institution, management of working Capital, Costing, Break Even Analysis, Network Analysis Techniques of PERT/CPM – Taxation – Income Tax, Excise Duty – Sales Tax.

UNIT V   SUPPORT TO ENTREPRENEURS   **9**
Sickness in small Business – Concept, Magnitude, causes and consequences, Corrective Measures – Government Policy for Small Scale Enterprises – Growth Strategies in small industry – Expansion, Diversification, Joint Venture, Merger and Sub Contracting.

TOTAL: 45 PERIODS

TEXT BOOKS:
1. S.S.Khanka "Entrepreneurial Development" S.Chand & Co. Ltd. Ram Nagar New Delhi, 1999.
2. Kuratko & Hodgetts, "Enterprenuership – Theory, process and practices", Thomson learning 6th edition.

REFERENCES:
1. Hisrich R D and Peters M P, "Entrepreneurship" 5th Edition Tata McGraw-Hill, 2002.
2. Mathew J Manimala," Enterprenuership theory at cross roads: paradigms and praxis" Dream tech 2nd edition 2006.
3. Rabindra N. Kanungo "Entrepreneurship and innovation", Sage Publications, New Delhi, 1998.
4. EDII " Faulty and External Experts – A Hand Book for New Entrepreneurs Publishers: Entrepreneurship Development" Institute of India, Ahmadabad, 1986.

PR2036   **MACHINE VISION**   **L T P C**
                                                                    3 0 0 3

OBJECTIVE:

To understand the principle, importance and application of machine vision system in Manufacturing and measurement

UNIT I   INTRODUCTION TO MACHINE VISION   6
Machine Vision use of machine vision – tasks for a vision system – relation to other fields – place of vision in CIM.

UNIT II   IMAGE ACQUISITION AND CONVERSION   6
Colour systems – light sources – lighting techniques – image formation by lensing – image scanning – television cameras – sensors, charge coupled devices – camera and system interface – frame buffers and frame grabbers – digital and smart camers.

UNIT III   IMAGE PROCESSING DECISION MAKING   12
Processing of binary images – thresholding, geometrical properties, topological properties – processing of gray scale images statistical operations, spatial operations, segmentation edge detection, morphological operations – image analysis – factors extraction – decision making.

UNIT IV   PATTERN RECOGNITION   9
Fundamentals – parametric classifiers – nonparametric, classifiers nearest neighbor CART, neural networks, generic classifiers.

UNIT V   MACHINE VISION APPLICATIONS   12
Applications in user industries automotive, semiconductor, electronic manufacturing, printing industries etc. – generic applications founding manufacturing metrology, inspection assembly verification – application analysis and implementation.

                                                        TOTAL: 45 PERIODS

REFERENCES:
1. Milan sonka, Vaclav hlavac, roger boyie, image processing, analysis and machine vision publisher, 1995
2. Richard O.Duda, Peter E. Hurt, Pattern Classification and Scene Analysis Publisher, 1973
3. Rafael C. Gonzaies, Richard E. Woods, Digital Image processing publisher, 1992
4. Nella zuech, 'Understanding & applying machine vision Marceldekker Inc. 2000.

PR 2037   **ADVANCES IN OPERATION RESEARCH**   **L T P C**
                                                                3 0 0 3
OBJECTIVE :
 To introduce the advanced OR models and to apply them for Engineering problems

UNIT I   INTRODUCTION   5
Optimization – Historical Development – Engineering applications of optimization – Statement of an Optimization problem – classification of optimization problems.

UNIT II   CLASSIC OPTIMIZATION TECHNIQUES   10
Linear programming - Graphical method – simplex method – dual simplex method – revised simplex method – duality in LP – Parametric Linear programming.

UNIT III   NON-LINEAR PROGRAMMING   9
Introduction – Lagrangeon Method – Kuhn-Tucker conditions – Quadratic programming – Separable programming – Stochastic programming

UNIT IV   INTEGER PROGRAMMING   11
Cutting plane algorithm – Branch and bound technique - Zero-one implicit enumeration; Goal programming – geometric programming; Network Techniques – Shortest Path Model – Minimum Spanning Tree Problem – Maximal flow problem.

UNIT V   DYNAMIC PROGRAMMING   10
Formulation – Application to capital budgeting, reliability improvement, shortest path, solution of LP using DP.

TOTAL: 45 PERIODS

TEXT BOOKS:
1. R. Panneerselvam, "Operations Research", Prentice Hall of India Private Limited, New Delhi 1 – 2005

REFERENCES:
1. P.K. Guptha and Man-Mohan, Problems in Operations Research – Sultan chand & Sons, 1994
2. Ravindran, Philips and Solberg, Operations Research Principles and Practice, John Wiley & Sons, Singapore, 1992
3. J.K.Sharma, Operations Research – Theory and Applications – Macmillan India Ltd., 1997
4. Hamdy A. Taha, Operations Research – An Introduction, Prentice Hall of India, 1997

GE2023   FUNDAMENTALS OF NANOSCIENCE   L T P C
3 0 0 3

UNIT I   INTRODUCTION   10
Nanoscale Science and Technology- Implications for Physics, Chemistry, Biology and Engineering-Classifications of nanostructured materials- nano particles- quantum dots, nanowires-ultra-thinfilms-multilayered materials. Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties. Introduction to properties and motivation for study (qualitative only).

UNIT II   PREPARATION METHODS   10
Bottom-up Synthesis-Top-down Approach: Precipitation, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE.

UNIT III   PATTERNING AND LITHOGRAPHY FOR NANOSCALE DEVICES   5

Introduction to optical/UV electron beam and X-ray Lithography systems and processes, Wet etching, dry (Plasma /reactive ion) etching, Etch resists-dip pen lithography

UNIT IV   PREPARATION ENVIRONMENTS   10
Clean rooms: specifications and design, air and water purity, requirements for particular processes, Vibration free environments: Services and facilities required. Working practices, sample cleaning, Chemical purification, chemical and biological contamination, Safety issues, flammable and toxic hazards, biohazards.

UNIT V   CHARECTERISATION TECHNIQUES   10
X-ray diffraction technique, Scanning Electron Microscopy - environmental techniques, Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques- AFM, SPM, STM, SNOM, ESCA, SIMS-Nanoindentation

TOTAL: 45 PERIODS

TEXT BOOKS:
1. A.S. Edelstein and R.C. Cammearata, eds., "Nanomaterials: Synthesis, Properties and Applications", Institute of Physics Publishing, Bristol and Philadelphia, 1996.
2. N John Dinardo, "Nanoscale charecterisation of surfaces & Interfaces", 2nd Edition, Weinheim Cambridge, Wiley-VCH, 2000

REFERENCES:
1. G Timp (Editor), "Nanotechnology", AIP press/Springer, 1999
2. Akhlesh Lakhtakia (Editor), "The Hand Book of Nano Technology, "Nanometer Structure", Theory, Modeling and Simulations. Prentice-Hall of India (P) Ltd, New Delhi, 2007.

ME2036   PRODUCTION PLANNING AND CONTROL   L T P C
3 0 0 3

OBJECTIVES:
- To understand the various components and functions of production planning and control such as work study, product planning, process planning, production scheduling, Inventory Control.
- To know the recent trends like manufacturing requirement Planning (MRP II) and Enterprise Resource Planning (ERP).

UNIT I   INTRODUCTION   9
Objectives and benefits of planning and control-Functions of production control-Types of production-job- batch and continuous-Product development and design-Marketing aspect - Functional aspects-Operational aspect-Durability and dependability aspect-aesthetic aspect. Profit consideration-Standardization, Simplification & specialization-Break even analysis-Economics of a new design.

UNIT II   WORK STUDY   9

Method study, basic procedure-Selection-Recording of process - Critical analysis, Development - Implementation - Micro motion and memo motion study - work measurement - Techniques of work measurement - Time study - Production study - Work sampling - Synthesis from standard data - Predetermined motion time standards.

UNIT III   PRODUCT PLANNING AND PROCESS PLANNING   9
Product planning-Extending the original product information-Value analysis-Problems in lack of product planning-Process planning and routing-Pre requisite information needed for process planning-Steps in process planning-Quantity determination in batch production-Machine capacity, balancing-Analysis of process capabilities in a multi product system.

UNIT IV   PRODUCTION SCHEDULING   9
Production Control Systems-Loading and scheduling-Master Scheduling-Scheduling rules-Gantt charts-Perpetual loading-Basic scheduling problems - Line of balance - Flow production scheduling-Batch production scheduling-Product sequencing - Production Control systems-Periodic batch control-Material requirement planning kanban – Dispatching-Progress reporting and expediting-Manufacturing lead time-Techniques for aligning completion times and due dates.

UNIT V   INVENTORY CONTROL AND RECENT TRENDS IN PPC   9
Inventory control-Purpose of holding stock-Effect of demand on inventories-Ordering procedures. Two bin system -Ordering cycle system-Determination of Economic order quantity and economic lot size-ABC analysis-Recorder procedure-Introduction to computer integrated production planning systems-elements of JUST IN TIME SYSTEMS-Fundamentals of MRP II and ERP.

TOTAL: 45 PERIODS

TEXT BOOK:
1. Martand Telsang, "Industrial Engineering and Production Management", S. Chand and Company, First   edition, 2000.
2. James.B.Dilworth,"Operations management – Design, Planning and Control for manufacturing and services" Mcgraw Hill International edition1992.

REFERENCES:
1. Samson Eilon, "Elements of production planning and control", Universal Book Corpn.1984
2. Elwood S.Buffa, and Rakesh K.Sarin, "Modern Production / Operations Management", 8th Ed. John Wiley and Sons, 2000.
3. Kanishka Bedi, " Production and Operations management", Oxford university press, 2nd Edition 2007.
4. Melynk, Denzler, " Operations management – A value driven approach" Irwin Mcgrawhill.
5. Norman Gaither, G. Frazier, " operations management" Thomson learning 9th edition IE, 2007
6. K.C.Jain & L.N. Aggarwal, "Production Planning Control and Industrial Management", Khanna Publishers, 1990.
7. S.N.Chary, "Theory and Problems in Production & Operations Management", Tata McGraw Hill, 1995.
8. Upendra Kachru, " Production and operations management – Text and cases" Excel books 1st edition 2007.

ME 2037   **MAINTENANCE ENGINEERING**   **L T P C**
                      (Common to Mechanical and Production)   **3 0 0 3**

OBJECTIVES:
- To enable the student to understand the principles, functions and practices adapted in industry for the successful management of maintenance activities.
- To explain the different maintenance categories like Preventive maintenance, condition monitoring and repair of machine elements.
- To illustrate some of the simple instruments used for condition monitoring in industry.

UNIT I   PRINCIPLES AND PRACTICES OF MAINTENANCE PLANNING   10
Basic Principles of maintenance planning – Objectives and principles of planned maintenance activity – Importance and benefits of sound Maintenance systems – Reliability and machine availability – MTBF, MTTR and MWT – Factors of availability – Maintenance organization – Maintenance economics.

UNIT II   MAINTENANCE POLICIES – PREVENTIVE MAINTENANCE   9
Maintenance categories – Comparative merits of each category – Preventive maintenance, maintenance schedules, repair cycle - Principles and methods of lubrication – TPM.

UNIT III   CONDITION MONITORING   9
Condition Monitoring – Cost comparison with and without CM – On-load testing and off-load testing – Methods and instruments for CM – Temperature sensitive tapes – Pistol thermometers – wear-debris analysis

UNIT IV   REPAIR METHODS FOR BASIC MACHINE ELEMENTS   10
Repair methods for beds, slideways, spindles, gears, lead screws and bearings – Failure analysis – Failures and their development – Logical fault location methods – Sequential fault location.

UNIT V   REPAIR METHODS FOR MATERIAL HANDLING EQUIPMENT   7
Repair methods for Material handling equipment - Equipment records –Job order systems -Use of computers in maintenance.

                                                              TOTAL: 45 PERIODS
TEXT BOOKS:
1. Srivastava S.K., "Industrial Maintenance Management", - S. Chand and Co., 1981
2. Bhattacharya S.N., "Installation, Servicing and Maintenance", S. Chand and Co., 1995

REFERENCES:
1. White E.N., "Maintenance Planning", I Documentation, Gower Press, 1979.
2. Garg M.R., "Industrial Maintenance", S. Chand & Co., 1986.
3. Higgins L.R., "Maintenance Engineering Hand book", McGraw Hill, 5th Edition, 1988.
4. Armstrong, "Condition Monitoring", BSIRSA, 1988.
5. Davies, "Handbook of Condition Monitoring", Chapman &Hall, 1996.
6. "Advances in Plant Engineering and Management", Seminar Proceedings - IIPE, 1996.