



GOVERNMENT COLLEGE OF TECHNOLOGY

(An Autonomous Institution Affiliated to Anna University)

Coimbatore - 641 013

Regulations, Curriculum And Syllabi For B.E. (PRODUCTION ENGINEERING) (Full Time)

2012

Regulations

**OFFICE OF THE CONTROLLER OF EXAMINATION
GOVERNMENT COLLEGE OF TECHNOLOGY
THADAGAM ROAD, COIMBATORE - 641 013**

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CURRICULUM FOR CANDIDATES ADMITTED DURING 2012-2013 AND ONWARDS

FIRST SEMESTER

S. No.	Subject Code	Course title	Session marks	Final Exam marks	Total marks	Credits			
						L	T	P	C
		THEORY							
1	12P1Z1	Communication Skills in English - I	25	75	100	3	1	0	4
2	12P1Z2	Engineering Mathematics - I	25	75	100	3	1	0	4
3	12P103	Applied Physics	25	75	100	3	0	0	3
4	12P104	Basics of Electrical Sciences	25	75	100	3	0	0	3
5	12P105	Engineering Mechanics	25	75	100	3	1	0	4
6	12P106	Programming with C and C++	25	75	100	3	0	0	3
		PRACTICAL							
7	12P107	Physics Laboratory	25	75	100	0	0	3	2
8	12P108	Engineering Graphics	25	75	100	2	0	3	4
9	12P109	C And C++ Programming Laboratory	25	75	100	0	0	3	2
		TOTAL			900				29

SECOND SEMESTER

S. No.	Subject Code	Course title	Session marks	Final Exam marks	Total marks	Credits			
						L	T	P	C
		THEORY							
1	12P2Z1	Communication Skills In English - II	25	75	100	3	1	0	4
2	12P2Z2	Engineering Mathematics - II	25	75	100	3	1	0	4
3	12P203	Renewable Energy Systems	25	75	100	3	0	0	3
4	12P204	Materials Technology	25	75	100	3	0	0	3
5	12P205	Engineering Chemistry	25	75	100	3	0	0	3
6	12P206	Manufacturing Technology - I	25	75	100	3	0	0	3
		PRACTICAL							
7	12P207	Workshop	25	75	100	0	0	3	2
8	12P208	Chemistry Laboratory	25	75	100	0	0	3	2
9	12P209	Engineering Graphics and Drafting Laboratory	25	75	100	0	0	3	2
		TOTAL			900				26

THIRD SEMESTER

S. No.	Subject Code	Course title	Session marks	Final Exam marks	Total marks	Credits			
						L	T	P	C
		THEORY							
1	12P3Z1	Engineering Mathematics - III	25	75	100	3	1	0	4
2	12P302	Environmental Science and Engineering	25	75	100	3	1	0	4
3	12P303	Fluid Mechanics and Machinery	25	75	100	3	0	0	3
4	12P304	Engineering Metallurgy	25	75	100	3	0	0	3
5	12P305	Manufacturing Technology - II	25	75	100	3	0	0	3
6	12P306	Strength of Materials	25	75	100	3	1	0	4
		PRACTICAL							
1	12P307	Machine Drawing	25	75	100	0	0	3	2
2	12P308	Strength of Materials and Fluid Mechanics and Machinery Laboratory	25	75	100	0	0	3	2
3	12P309	Metallurgy Laboratory	25	75	100	0	0	3	2

FOURTH SEMESTER

S. No.	Subject Code	Course title	Session marks	Final Exam marks	Total marks	Credits			
						L	T	P	C
		THEORY							
1	12P401	Probability and Statistics	25	75	100	3	1	0	4
2	12P402	Metrology and Measurements	25	75	100	3	0	0	3
3	12P403	Applied Electronics and Microprocessor	25	75	100	3	0	0	3
4	12P404	Electrical Machines and Drives	25	75	100	3	0	0	3
5	12P405	Mechanics of Machines	25	75	100	3	1	0	4
6	12P406	Thermal Sciences	25	75	100	3	1	0	4
		PRACTICAL							
1	12P407	Electrical Engineering Laboratory	25	75	100	0	0	3	2
2	12P408	Thermal Engineering Laboratory	25	75	100	0	0	3	2
3	12P409	Microprocessor Laboratory	25	75	100	0	0	3	2
		TOTAL			900				27

FIFTH SEMESTER

S. No.	Subject Code	Course title	Session marks	Final Exam marks	Total marks	Credits			
						L	T	P	C
		THEORY							
1	12P501	Engineering Economics and Management	25	75	100	3	0	0	3
2	12P502	Machine Elements Design	25	75	100	3	1	0	4
3	12P503	Fluid Power Drives and Controls	25	75	100	3	0	0	3
4	12P504	Theory of Metal Cutting	25	75	100	3	1	0	4
5	12P505	CNC Machines and Control Systems	25	75	100	3	0	0	3
6	12P506	Process Planning and Cost Estimation	25	75	100	3	0	0	3
		PRACTICAL							
7	12P507	Computer Aided Design Laboratory	25	75	100	0	0	3	2
8	12P508	Manufacturing Technology Laboratory - I	25	75	100	0	0	3	2
		TOTAL			800				24

SIXTH SEMESTER

S. No.	Subject Code	Course title	Session marks	Final Exam marks	Total marks	Credits			
						L	T	P	C
		THEORY							
1	12P601	Mechatronic Systems	25	75	100	3	0	0	3
2	12P602	Robotics and Machine Vision System	25	75	100	3	0	0	3
3	12P603	Finite Element Techniques	25	75	100	3	1	0	4
4	12P604	Automation and CIM	25	75	100	3	0	0	3
5	12P605	Production of automotive Components	25	75	100	3	0	0	3
6	E-I	Elective - I	25	75	100	3	0	0	3
		PRACTICAL							
7	12P607	Automation and Computer Aided Manufacturing Laboratory	25	75	100	0	0	3	2
8	12P608	Modeling and Simulation Laboratory	25	75	100	0	0	3	2
		TOTAL			900				23

SEVENTH SEMESTER

S. No.	Subject Code	Course title	Session marks	Final Exam marks	Total marks	Credits			
						L	T	P	C
		THEORY							
1	12P701	Resource Management Techniques	25	75	100	3	0	0	4
2	12P702	Design of Jigs, Fixtures and Press Tools	25	75	100	3	0	0	3
3	12P703	Total Quality Management	25	75	100	3	1	0	3
4	12P704	Newer Production Processes	25	75	100	3	0	0	3
5	E-II	Elective - II	25	75	100	3	0	0	3
6	E-III	Elective - III	25	75	100	3	0	0	3
		PRACTICAL							
7	12P707	Metrology and Quality Control Laboratory	25	75	100	0	0	3	2
8	12P708	Manufacturing Technology Laboratory - II	25	75	100	0	0	3	2
		TOTAL			800				23

EIGHTH SEMESTER

S. No.	Subject Code	Course title	Session marks	Final Exam marks	Total marks	Credits			
						L	T	P	C
		THEORY							
1	E-IV	Elective - IV	25	75	100	3	0	0	3
2	E-V	Elective - V	25	75	100	3	0	0	3
		PRACTICAL							
1	12P801	Project Work	50	150	200	0	0	12	6
		TOTAL			400				12

**LIST OF ELECTIVE SUBJECTS
BRANCH –PRODUCTION ENGINEERING
(SIXTH SEMESTER)**

S. No.	Subject Code	Course title	Session marks	Final Exam marks	Total marks	Credits			
						L	T	P	C
1	12P6E0	Management Information Systems	25	75	100	3	0	0	3
2	12P6E1	Numerical Methods	25	75	100	3	0	0	3
3	12P6E2	Modern Control Technology	25	75	100	3	0	0	3
4	12P6E3	Production Management	25	75	100	3	0	0	3
5	12P6E4	Production Planning and Control	25	75	100	3	0	0	3

**LIST OF ELECTIVE SUBJECTS
BRANCH – PRODUCTION ENGINEERING
(SEVENTH SEMESTER)**

S. No.	Subject Code	Course title	Session marks	Final Exam marks	Total marks	Credits			
						L	T	P	C
1	12P7E0	Statistical Quality Control and Reliability Engineering	25	75	100	3	0	0	3
2	12P7E1	Basic French and Initiative to German Language	25	75	100	3	0	0	3
3	12P7E2	Design for Manufacture and Assembly	25	75	100	3	0	0	3
4	12P7E3	Patent System for Engineering	25	75	100	3	0	0	3
5	12P7E4	Composite Materials	25	75	100	3	0	0	3
6	12P7E5	Supply Chain Management	25	75	100	3	0	0	3
7	12P7E6	Human Values and Professional Ethics	25	75	100	3	0	0	3
8	12P7E7	Robust Design	25	75	100	3	0	0	3
9	12P7E8	Surface Engineering	25	75	100	3	0	0	3
10	12P7E9	Plant Layout and Material Handling	25	75	100	3	0	0	3

**LIST OF ELECTIVE SUBJECTS
BRANCH – PRODUCTION ENGINEERING
(EIGHTH SEMESTER)**

S. No.	Subject Code	Course title	Session marks	Final Exam marks	Total marks	Credits			
						L	T	P	C
1	12P8E0	Risk Analysis and Risk Management	25	75	100	3	0	0	3
2	12P8E1	Advanced Welding Technology	25	75	100	3	0	0	3
3	12P8E2	Micro And Nano Manufacturing	25	75	100	3	0	0	3
4	12P8E3	Industrial Safety Engineering	25	75	100	3	0	0	3
5	12P8E4	Image Processing in Manufacturing	25	75	100	3	0	0	3
6	12P8E5	Intelligent Manufacturing Systems	25	75	100	3	0	0	3
7	12P8E6	Precision Engineering	25	75	100	3	0	0	3
8	12P8E7	Project Management	25	75	100	3	0	0	3
9	12P8E8	Lean Manufacturing	25	75	100	3	0	0	3
10	12P8E9	Product Design and Process Engineering	25	75	100	3	0	0	3

12P1Z1 COMMUNICATION SKILLS IN ENGLISH - I

(Common to all branches of Engineering and Technology)

L T P C
3 1 0 4

UNIT-I **(9)**

Tenses - Word formation- Vocabulary (Synonyms and Antonyms)- Listening and transfer of information-Pronunciation Practice-Word Stress-Sentence Stress-Intonation-Introducing oneself-Role play activities based on real life situations- Non-Verbal Communication -Reading Comprehension (Skimming and Scanning)- An introduction to Letter Writing – E-Tender Notices

UNIT-II **(9)**

Technical Vocabulary-Abbreviations and Acronyms- Commonly Confused Words- Active Voice to Passive Voice-Impersonal Passive- Listening at Specific Contexts such as Airport, Railway Station, Bus Stand, Sea Port/Shipboard etc - Debates on Chosen Topics -Reading For Identifying Stylistic Features- Recommendations-Letter to the Editor of a News Paper

UNIT-III **(9)**

Subject-Verb Agreement (Concord) - Preposition-Listening to News in English- Mini Oral Presentation on the assumption of a historian, celebrity, famous Personality etc.- Reading and Note-making- - Notice-Agenda- Memo-Advertisement and Slogan Writing

UNIT-IV **(9)**

Common Errors in English-Conditional Statements -Use of Modal Auxiliaries- Definition-Listening to a Discussion at a Business Meeting- Group Discussion on chosen topics-Reading for interpreting tables, charts etc. - Writing E-mails- Graphic Description

UNIT-V **(9)**

Extensive Reading- APJ Abdul Kalam’s “Wings of Fire”- An Abridged Special Edition for Students.

LECTURE: 45 TUTORIAL: 15 TOTAL: 60

Reference Books

1. Meenakshi Raman, Sangeetha Sharma, *“Technical Communication: English Skills for Engineers”* Oxford University Press: New Delhi, 2008
2. Rizvi Ashrav.M, *“Effective Technical Communication”* Tata McGraw Hill’New Delhi, 2005
3. Herbert, A.J, *“Structure of Technical English”*: the English Language Society.
4. *Authentic NET Resources*

12P1Z2 ENGINEERING MATHEMATICS - I

(Common to all branches)

L T P C

3 1 0 4

UNIT-I MATRICES

(9)

Characteristic equation – Eigen values and Eigen vectors of a real matrix - Properties of Eigen values - Cayley-Hamilton Theorem(statement only) and applications- Diagonalisation by similarity transformation - Reduction of quadratic form to canonical form.

UNIT-II HYPERBOLIC FUNCTIONS AND SOLID GEOMETRY

(9)

Hyperbolic functions and Inverse Hyperbolic functions -Identities-Real and imaginary parts- solving problems using hyperbolic functions.

Sphere – tangent plane – Orthogonal spheres - Cone- right circular cone – Cylinder – right circular cylinder.

UNIT-III APPLICATIONS OF DIFFERENTIAL CALCULUS

(9)

Curvature - cartesian and polar coordinates – centre and radius of curvature - circle of curvature -Evolutes - Envelopes - Evolutes as envelope of normal.

UNIT-IV FUNCTION OF SEVERAL VARIABLES

(9)

Function of two variables - Taylor’s theorem (statement only) and expansions - maxima and minima - constrained maxima and minima by Lagrangian multiplier method - Jacobians - differentiation under integral sign.

UNIT-V INTEGRAL CALCULUS

(9)

Gamma and Beta functions - Double integration - Cartesian and Polar Coordinates – change of order of integration - Area as double integral – Triple integration –Volume as a triple integral - Transformation to Cylindrical and Spherical co-ordinates.

LECTURE: 45 TUTORIAL: 15 TOTAL: 60

Text Books

1. Veerarajan.T., “**Engineering Mathematics**” for Semesters I and II , Tata McGraw Hill Publishing Co. New Delhi., 2010.
2. Dr.Kandasamy.P., Dr.Thilagavathy.K and Dr.Gunavathy.K., “**Engineering Mathematics**” for First Year B.E/B.Tech, S. Chand and Co., Ram Nagar, New Delhi, 2010.

Reference Books

1. N.P.Bali., Dr. Manish Goyal., “**A text book of Engineering Mathematics**” vol. I , University science Press, New Delhi, 2010.
2. H.C.Taneja., “**Advanced Engineering Mathematics**” vol. I, I.K.International Pub.House Pvt.Ltd., New Delhi, 2007.
3. Baburam., “**Engineering Mathematics**” vol. I, Pearson, New Delhi, 2010.
4. B.V.Ramana., “**Higher Engineering Mathematics**” Tata McGraw Hill Publishing Co., New Delhi, 2007.
5. Grewal B.S., “**Higher Engineering Mathematics**” (40th Edition) Khanna Publishers, New Delhi, 2007

12P103 APPLIED PHYSICS*(Common to Civil, Mechanical, Production and Industrial Biotechnology)***L T P C****3 0 0 3****UNIT-I LASERS**

(9)

Introduction- Principle of laser action - characteristics of laser - Spontaneous emission and Stimulated emission –Einstein’s coefficients - population inversion – methods of achieving population inversion -Types of pumping –Optical Resonator - Types of Lasers – Principle, construction and working of different types of laser- CO₂, Nd-YAG, Semiconductor laser and Dye laser- applications of laser -Lasers in microelectronics, welding, heat treatment, cutting – holography – construction and reconstruction of a hologram – applications of holography.

UNIT-II FIBER OPTICS AND APPLICATIONS

(9)

Introduction – Basics Principles involved in fiber optics- Total internal reflection – Structure of optical fiber –Propagation of light through optical fiber –Derivation for Numerical Aperture and acceptance angle - fractional index change - Preparation of optical fiber- Crucible and Crucible technique - Classification of optical fiber based on materials, refractive index profile and Modes - Splicing-fusion and multiple splices - Light sources for fiber optics.- LED- Detectors- Principle of photo detection - PIN Photodiode, - Fiber optical communication links-Fiber optic sensors-Temperature, displacement

UNIT-III QUANTUM PHYSICS AND APPLICATIONS

(9)

Limitations of classical Physics - Introduction to Quantum theory - Dual nature of matter and radiation- de-Broglie wavelength in terms of voltage, energy, and temperature –Heisenberg’s Uncertainty principle – verification - Schrödinger’s Time independent and Time dependent wave equations – physical significance of a wave function - Particle in a one dimensional deep potential well– microscope – basic definitions of microscope - Electron microscope-Scanning Electron Microscope (SEM)-Transmission Electron Microscope (TEM).

UNIT-IV ULTRASONICS

(9)

Introduction – properties of ultrasonic waves – production of ultrasonic waves Magnetostriction effect- Magnetostriction generator- Piezoelectric crystals - Piezoelectric effect- Piezoelectric generator- Detection of ultrasonic wave – kundt’s tube method – sensitive flame method – thermal detector method – piezo electric detector method- cavitation - industrial applications- ultrasonic drilling- ultrasonic welding- ultrasonic soldering and ultrasonic cleaning-Non- destructive Testing-Pulse echo system, through transmission and resonance system.

UNIT-V VACUUM SCIENCE

(9)

Introduction - Importance of vacuum in industries - Properties of Design procedure of a vacuum Pump - Schematic diagram of a vacuum system - Pumping speed and throughput - Types of pumps-Rotary vane type Vacuum pump(oil sealed), Diffusion Pump and Turbo Molecular Pump - Measurement of High Vacuum-McLeod Gauge-Pirani Gauge-Penning Gauge.

TOTAL: 45

Text Book

1. Ganesan S. Iyandurai N, "**Applied Physics**", KKS Publishers, Chennai, 2007

Reference Books

1. Gaur R K and Gupta S L-"**Engineering Physics**", Dhanpat Raj and sons, 2002
2. Avadhanulu M N and Kshirsagar P G,"**A textbook of Engineering Physics**"S.Chand and Company Ltd, New Delhi, 2005
3. Arumugam M- "**Engineering Physics**", Anuadha Publishers, 2002
4. Jayakumar S, "**Engineering Physics**", RK Publishers, Coimbatore, 2003

12P104 BASICS OF ELECTRICAL SCIENCES*(Common to Mechanical)*

L T P C

3 0 0 3

FUNDAMENTALS OF ELECTRIC CIRCUITS

(9)

Ohm's law and Kirchoff's laws - D.C circuits-Alternating current fundamentals - Circuit elements and phasor diagram - power – Real and Reactive power - power factor - Series, Parallel circuits - loop and nodal analysis -star delta conversion simple problems.

THREE PHASE SYSTEM AND ELECTRICAL WIRING

(9)

Three phase system - star and delta connections - solutions of balanced three phase circuits - three phase power equation - power measurements - domestic and industrial wiring.

FUNDAMENTALS OF ELECTRONICS

(9)

Operating principles and characteristics of PN junction diode,Zener diode,BJT,FET,UJT,SCR.- light emitting diode - Photo diode. Rectifiers - half wave,full wave and bridge rectifiers using diodes with and without filters.

FUNDAMENTALS OF COMMUNICATION ENGINEERING

(9)

Principles of PAM, PWM, PPM-PCM - Transmitter and receiver-optical communication - Characteristics of optic fiber cable transmitter and receiver.Types of signals:Analog and Digital signals-spectrum of signals - telecommunication services - transmission paths. Modulation and Demodulation: basic principle of amplitude and frequency modulations - Generation and detection of AM and FM.

T.V AND RADAR COMMUNICATION SYSTEMS

(9)

Radio,T.V.(Black and Colour)-Interlaced systems-composite video signal - microwave, satellite,RADAR-RADAR range-pulsed RADAR system(Principles and block diagram approach only)

TOTAL: 45***Text Books***

1. Premkumar.N. '**Basic Electrical Engineering**', Anuradha Agencies Pub.,1989
2. Anokh singh,'**Principles of Communication Engineering**',S.Chand and Co.,1984
3. Arumugam.M.and Premkumar.N, '**Electric Circuit Theory**', Khanna Publishers, 1989.

Reference Books

1. Murugesh Kumar K., '**Basic Electric Science and Technology**',Vikas Publishing House Pvt Ltd,2002.
2. Ashok Raj, '**Modern Electronic Communication Theory and Systems**', Vol.1 Umesh Publications, 1990.

12P105 ENGINEERING MECHANICS

(Common to Civil, Mech, Prod, EEE and EIE)

L T P C

3 1 0 4

INTRODUCTION TO MECHANICS AND FORCE CONCEPTS (9)

Definition of mechanics – characteristics – system of forces – parallelogram, triangle and polygon law of forces – resultant of a force system – resultant of a concurrent, coplanar and parallel force system – resolution and composition of forces – Lami's theorem – moment of a force – physical significance of moment-Varignon's theorem – resolution of a force into force and couple – force in space – addition of concurrent forces in space – equilibrium of a particle in space.

FRICITION (9)

Frictional resistance – classification of friction- laws of friction – coefficient of friction-angle of friction – angle of repose – cone of friction – free body diagram-advantages-equilibrium of a body on a rough inclined plane – non-concurrent force system - ladder friction – rope friction – wedge friction. Simple machines-concept of lifting machines-law of lifting machine – efficiency– mechanical advantages – velocity ratio and their relationship.

GEOMETRICAL PROPERTIES OF SECTION (9)

Introduction – concept of first moment – definition of centroid – centroid of an area – centroid of simple figures - composite sections – bodies with cutparts-moment of inertia – theorem of moment of inertia – moment of inertia of composite sections – principal moment of inertia of plane areas- radius of gyration.

BASICS OF DYNAMICS (9)

Definition – kinematics and kinetics – displacements, velocity and acceleration- Equations of motion -Types of motion – Rectilinear motion of a particle with uniform velocity, uniform acceleration, varying acceleration – motion curves – motion under gravity – relative motion – curvilinear motion of a particle – projectiles – angle of projection – range – time of flight and maximum height.

Newton's second law of motion – linear momentum – D'Alembert's principle, Dynamics equilibrium – work energy equation of particles– law of conservation of energy – principle of work and energy.

IMPULSE MOMENTUM AND IMPACT OF ELASTIC BODIES (9)

Impulsive force – Impulse – linear impulse and momentum – Equations of momentum – principle impulse and momentum – impulsive motion – conservation of momentum.

Definition – Time of compression, restitution, collision – law of conservation of momentum – Co-efficient of restitution – types of impact – collision of elastic bodies by direct central impact and oblique impact – collision of small body with a massive body – loss of kinetic energy.

LECTURE:45 TUTORIAL: 15 TOTAL :60

Text Books

1. S.S. Bhavikatti and K.G. Rajasekarappa, **Engineering Mechanics**, New Age International (P) Ltd. 1999.
2. S.C. Natesan, **Engineering Mechanics**, Umesh Publications, 5-B north market, Naisarak, Delhi , 2002.

Reference Books

1. F.B. Beer and E.R. Johnson, **Mechanics for Engineers**, Tata Mc.Graw Hill publishing Ltd, 1996.
2. S. Timoshenko and Young, **Engineering Mechanics**, Mc.Graw Hill, 4th Edition, 1995.
3. Irving shames, **Engineering Mechanics**, Prentice Hall of India Ltd, Delhi, 1980.
4. Domkundwar V.M and Anand V. Domkundwar, **“Engineering Mechanics (Statics and Dynamics)”**, Dhanpat Rai and Co. Ltd, 1st Edition, 2006.
5. Suhas Nitsure, **“Engineering Mechanics”**, Technical Publications, Pune, 1st edition, 2006.

12P106 PROGRAMMING WITH C AND C++

(Common to Mechanical)

L T P C

3 0 0 3

C FUNDAMENTALS

(10)

Introduction – character set – identifiers and keywords – data types – variables – operators – input/output statements. Control statements – branching – looping – nested control structures.

FUNCTIONS, POINTERS, STRUCTURES AND UNION

(10)

Function definition – accessing function – function prototypes, 1D array, multi dimensional arrays - passing arrays to functions. Declaration of pointers – passing pointers. Structures and Unions.

OUTLINE OF C++ AND CLASSES AND OBJECTS

(9)

Preprocessor – header files – input/output statements. Classes – declaration of classes – member functions – objects – nested classes – constructors - destructors – inline member function – friend functions.

INHERITANCE AND OVERLOADING

(9)

Single inheritance – direct base classes – indirect base classes – types of derivation: public inheritance, private inheritance, protected inheritance – Accessing public, private and protected data. Function overloading – scoping rules for function overloading- overloading assignment operator.

POLYMORPHISM AND DATA FILE OPERATION

(7)

Polymorphism – early binding – late binding – virtual functions. Opening and closing of files – reading / writing a character from a file.

TOTAL : 45

Text Books

1. E.Balagurusamy “**Programming in ANSI C** “ TMH publications,2010.
2. D.Ravichandran “**Programming with C++**” TMH publications,2010.

Reference Books

1. Pradeep Dey and Manas Ghosh, “**Programming in C**” , Oxford University Press, New Delhi, 2011.
2. Byron Gottfried “**Programming with C**” TMH publications,2010.
3. Robert Lafore “ **Object Oriented Programming in TURBO C++**” Galgotia Publication Pvt Ltd, 2001.
4. E.Balagurusamy “**Programming with C++**” TMH publications,2010.
5. D.Ravichandran “**Programming with C**” TMH publications,2010.
6. Amitava Nag, Uday Mandal “**Numerical Methods and Programming**” TMH publications,2011

12P107 PHYSICS LABORATORY

(Common to Civil, Mechanical, Production and IBT)

(Any Eight experiments)

L T P C
0 0 3 2

1. Spectrometer - diffraction grating Normal incidence method
2. Air wedge
3. Young's modulus – cantilever bending Koenig's method
4. Particle size determination
5. Thermal conductivity of the bad conductor Lee's disc method
6. Ammeter and voltmeter calibration – low range
7. Resistance of the given coil of wire – Carey Foster's bridge
8. Torsional pendulum
9. Young's modulus - non uniform bending
10. Transistor characteristics

TOTAL :45

12P108 ENGINEERING GRAPHICS

(Common to all Branches Except IBT)

L T P C

2 0 3 4

GEOMETRICAL CONSTRUCTIONS

15

Dimensioning-Lettering-Types of Lines-Scaling conventions-Dividing a given straight line in to any number of equal parts- Bisecting a given angle- Drawing a regular polygon given one side-Special methods of constructing a pentagon and hexagon- Construction of curves like ellipse, parabola, cycloid and involute using one method.

ORTHOGRAPHIC PROJECTIONS

25

Introduction to Orthographic Projection-Projection of points-Projection of straight lines with traces- Projection of planes- Conversion of pictorial views to orthographic views-Projection of solids - Auxiliary projections.

SECTION OF SOLIDS AND DEVELOPMENT

15

Section of solids- Development of surfaces

INTERPENETRATION OF SOLIDS

10

Cylinder and cylinder, cone and cylinder only

PICTORIAL VIEWS

10

Isometric projections - Conversion of orthographic views to pictorial views (simple objects).

LECTURE:30 PRACTICAL:45 TOTAL :75

Reference Books

1. K.Vengopal,"*Engineering Graphics*", New Age International (P) Limited, 2007
2. Dhananjay.A.Jolhe, "*Engineering Drawing*", Tata McGraw Hill Publishing Co.,2007
3. K.V.Natarajan '*A text book of Engineering Graphics*', Dhanalakshmi Publishers, Chennai, 2006
4. M.B.Shah and B.C. Rana,"*Engineering Drawing*", Pearson Education,2005
5. Luzadder and Duff, "*Fundamentals of Engineering Drawing*" Prentice Hall of India Pvt Ltd, XI Edition – 2001
6. K.L.Narayana and P.Kannaiah, "*Text book on Engineering Drawing*", 2nd Ed., Scitech Publications (India) Pvt. Ltd, Cennai, 2009

12P109 C AND C++ PROGRAMMING LABORATORY

(Common to Mechanical)

L T P C
0 0 3 2

Using C / C++ languages do the following programmes.

1. Compute the integral of a function using midpoint rule.
2. Compute the integral of a function using Simpsons rule.
3. Compute the integral of a function using Trapezoidal method.
4. Compute the integral of a function using Gauss quadrature method.
5. Find the solution of a set of linear equation by LU decomposition.
6. Find the inverse of a matrix using LU decomposition.
7. Find the solution of a set of linear equations by elimination method.
8. Find the roots of a polynomial by Bairstows method.
9. Find the zero of a function $f(x)$ by the midpoint rule.
10. Find the zero of the function $f(x)$ by Newton-Raphson method .
11. Interpolate the given data using the Lagrange scheme.
12. Interpolate the given data using the Cubic Spline .
13. Interpolate the given data using Newton's divided difference method.
14. Fit a straight line through a given set of data points.
15. Find the solution of an equation by Euler's method.
16. Find the solution of the Laplace equation.
17. Find the solution of a set of linear equation by Gauss Seidal iteration method.
18. Find the solution of a set of equation by Runge Kutta simultaneous equations method.

TOTAL : 45

12P2Z1 COMMUNICATION SKILLS IN ENGLISH - II

(Common to all branches of Engineering and Technology)

L T P C

3 1 0 4

UNIT-I

(9)

Use of Relative Clauses-Noun Phrases- Listening to Conversations- Telephonic Conversational Skills Paralinguistic Communication (Articulation, Stress and Pause) – Cloze Reading-Reading to practice stress, pause etc. -Process Description- Transcoding

UNIT-II

(9)

Cause and Effect Expressions-Time and Contracted Time Statements- Listening to Narration/Speech – Extemporaneous -Instructions with Imperatives- Reading for inferring meaning: Lexical and Contextual - Understanding the organisation of the Texts -Writing Articles (Technical and General)

UNIT-III

(9)

Phrasal Verbs -American and British Vocabulary- Video Listening: Listening to Authentic Clippings in English (Movie/ Play)-Making Speeches (Introducing a Chief Guest, Delivering Welcome Address, Proposing Vote of Thanks)-Reading for understanding discourse cohesion-Logical Connectives- Minutes of the Meeting

UNIT-IV

(9)

Idiomatic Expressions -Numerical Expressions- Listening to authentic songs in English-Mock Interviews-Reading for identifying the topic sentence in each paragraph-An Introduction to Different kinds of Report-Report on an Industrial Visit-Report on an accident

UNIT-V

(9)

Abstract – foot notes-bibliography-plagiarism- Technical Style- Presentation of a **Mini Project Report** of 25 to 30 pages on one of the topics from the First Year B.E Syllabus or similar topics.

LECTURE: 45 TUTORIAL: 15 TOTAL: 60

Reference Books

1. Meenakshi Raman, Sangeetha Sharma, “**Technical Communication: English Skills for Engineers**” Oxford University Press: New Delhi, 2008
2. Rizvi Ashrav.M, “**Effective Technical Communication**” Tata McGraw Hill:New Delhi, 2005
3. Herbert, A.J, “**Structure of Technical English**”: the English Language Society
4. Authentic NET Resources

12P2Z2 ENGINEERING MATHEMATICS - II*(Common to all branches)***L T P C****3 1 0 4****UNIT-I VECTOR CALCULUS****(9)**

Gradient, Divergence, Curl – Directional derivative – Irrotational and Solenoidal fields-Vector identities - Line, Surface and Volume Integrals – Green’s Theorem in a Plane, Gauss Divergence and Stoke’s Theorems (Statements only) – Verifications and Applications.

UNIT-II ORDINARY DIFFERENTIAL EQUATIONS**(9)**

Linear equations of Second and Higher order with constant coefficients-Simultaneous first order Linear equations with constant coefficients - Linear equations of Second and Higher order with variable coefficients -Legendre type –Method of variation of parameters-method of reduction of order.

UNIT-III COMPLEX DIFFERENTIATION**(9)**

Functions of a Complex variable-Analytic functions- Cauchy Riemann equations and sufficient conditions(excluding proof)–Harmonic and orthogonal properties of analytic functions –Construction of analytic functions-Conformal mappings : $w = z + a$, az , $1/z$, z^2 , e^z , $\cos z$, $\sin z$ and Bilinear Transformation.

UNIT-IV COMPLEX INTEGRATION**(9)**

Cauchy’s integral theorem, Cauchy’s integral formula -Taylor’s and Laurent’s theorems (Statements only) and expansions – Poles and Residues – Cauchy’s Residue theorem – Contour integration – Circular and semi circular contours.

UNIT-V LAPLACE TRANSFORMATIONS**(9)**

Laplace transforms - Properties and standard transforms-Transforms of unit step, unit impulse and error functions – Transforms of periodic functions - Inverse Laplace transforms - Initial and Final value theorems –Convolution theorem (statement only) and applications- Applications to Solution of Linear y differential equations of second order with constant coefficients.

LECTURE: 45 TUTORIAL: 15 TOTAL: 60**Text Books**

1. Veerarajan.T., **“Engineering Mathematics” for Semesters I and II**, Tata McGraw Hill Publishing Co., New Delhi., 2010.
2. Dr.Kandasamy.P., Dr.Thilagavathy.K and Dr.Gunavathy.K., **“Engineering Mathematics” for First Year B.E/B.Tech**, S. Chand and Co., Ram Nagar, New Delhi, 2010.

Reference Books

1. N.P.Bali., Dr. Manish Goyal., **“A text book of Engineering Mathematics” vol. II**, University science Press, New Delhi, 2010.
2. H.C.Taneja., **“Advanced Engineering Mathematics” vol.II**, I.K.International Pub. House Pvt.Ltd., New Delhi, 2007.
3. Baburam., **“Engineering Mathematics”**, Pearson, New Delhi, 2010.
4. B.V.Ramana., **“Higher Engineering Mathematics”** Tata McGraw Hill Publishing Co., New Delhi, 2007.
5. Grewal B.S., **“Higher Engineering Mathematics”(40th Edition)** Khanna Publishers, New Delhi., 2007.

12P203 RENEWABLE ENERGY SYSTEMS

L T P C
3 0 0 3

SOLAR ENERGY

(9)

Devices for thermal collectors and storage-Thermal applications-Solar thermal power plant-Solar Photo voltaic Conversion-Solar cell-PV application

WIND ENERGY

(9)

Principles of wind Energy Conversion-Site Selection Considerations-Wind Energy Conversion system-Advantages and Disadvantages of WECS-Wind Energy Collectors-Interconnected System-Environmental Aspects.

BIO ENERGY

(9)

Biomass Conversion Technologies-Types of Bio gas plants-Bio gas from plant wastes-Site selection-Problems related to Bio gas plants-Alternative liquid fuels-Advantages and Disadvantages of Bio-logical Conversion of Solar Energy.

ENERGY FROM THE OCEANS

(9)

Ocean thermal Electric Conversion-Energy from Tides-Layout of Tidal power house-Tidal power plants-Single and Double basin Arrangement wave-Energy Conversion devices-Hybrid System.

GEOTHERMAL ENERGY AND FUEL CELLS

(9)

Hot Dry Rock Resources systems-Advantages and Disadvantages-Applications of Geothermal Energy-Fuel Cells-Classifications-Advantages and Disadvantages-Applications of Fuel cells.

TOTAL: 45

Text Books

1. Suhas P. Sukhatme, “**Solar Energy**”, Tata McGraw Hill Publishing Company Ltd., 2007.
2. G.D. Rai, “**Non Conventional Energy Sources**”, Khanna publishers, 2008.

Reference Books

1. Godfrey Boyle, “**Renewable Energy**”, Power for a Sustainable future, Oxford University Press, 1996.
2. G.N. Tiwari, “**Solar Energy – Fundamentals Design, Modelling and Applications**”, Navosa Publishing House, 2002.
3. Johnson Gavy L, “**Wind Energy Systems**”, Pentice Hall, 1985.

12P204 MATERIALS TECHNOLOGY*(Common to Civil, Mechanical, Production and IBT)***L T P C****3 0 0 3****UNIT-I CONDUCTING MATERIALS**

(9)

Introduction to Conductors – classical free electron theory of metals – Draw backs of classical theory – quantum theory - Electrical and Thermal conductivity of Metals – Derivation for Wiedemann – Franz law – Lorentz number — Fermi distribution function - effect of temperature – density of energy states – calculation of Fermi energy- carrier concentration in metals

UNIT-II SEMICONDUCTING MATERIALS

(9)

Introduction – Properties – elemental and compound semiconductors - Intrinsic and extrinsic semiconductors – properties - Carrier concentration in intrinsic Semiconductor - variation of Fermi level with temperature and carrier concentration - Electrical Conductivity – band gap determination - extrinsic semiconductors - Carrier concentration in P- type and N-type semiconductors – variation of Fermi level with temperature and impurity concentration

UNIT-III SUPERCONDUCTING MATERIALS

(9)

Introduction – Superconducting state – magnetic properties of superconductors – Current flow and magnetic fields in superconductors – High current , High field superconductors - Types of superconductors - BCS theory of superconductivity (qualitative) – characteristics of superconductors - Applications of superconductors- High T_c superconductors - SQUID, Cryotron, Magnetic levitation.

UNIT-IV DIELECTRIC MATERIALS

(9)

Introduction to dielectric materials – polar and nonpolar molecules-Various polarization mechanisms in dielectrics - electronic, ionic, orientational and space charge polarization – frequency and temperature dependent of polarization – internal field – Claussius – Mosotti relation (derivation) – dielectric loss – dielectric breakdown – Applications of dielectric materials – Ferro electricity and applications.

UNIT-V MODERN ENGINEERING MATERIALS

(9)

Metallic glasses- preparation of metallic glasses- properties – applications of the metallic glasses - Shape Memory Alloys (SMA) - Characteristics, properties of NiTi alloy - applications of the Shape memory alloys - advantages and disadvantages of SMA - Nanomaterials-synthesis –chemical vapour deposition – Sol Gels – ball Milling – properties of nanoparticles and applications of nanoparticles - Carbon Nanotubes(CNT)–structure–properties-applications of the CNTs

TOTAL: 45**Text Books**

1. Ganesan S. Iyandurai N, “**Engineering Physics II**”, Gems Publishers,Coimbatore 2009.

Reference Books

1. Jayakumar S, “**Materials Science**”, RK Publishers, Coimbatore, 2004

2. William D Callister Jr, “**Materials Science and Engineering – An Introduction**”, John Wiley and Sons Inc.,6th edition, New York, 2003

3. James F Shackelford, S “**Introduction to materials Science for Engineers**”, 6th Macmillan Publishing Company, New York, 2004

12P205 ENGINEERING CHEMISTRY

(Common to Civil, Mechanical and Production)

L T P C

3 0 0 3

UNIT-I POLYMERS

(9)

Monomers-functionality, Degree of polymerization-Coordination polymerization Zeigler-Natta catalyst, Polymers, structure, properties and their end uses of Polycarbonate, PVC, Polyamide, PET, Polyester, Teflon, Epoxy resin, Polyurethane, PMMA. Compounding of plastics- ingredients and functions, Fabrication-compression molding-Injection moulding-blow moulding and Extrusion moulding -Conducting polymers, poly acetylene, mechanism of conduction-natural rubber-vulcanization of rubber- Biodegradable polymers- polylactide, cellulose, and starch.

UNIT-II CORROSION

(9)

EMF and Galvanic series, Corrosion, Pilling Bedworth rule, mechanism- dry or oxidation corrosion- wet or electrochemical corrosion, types of corrosion, galvanic corrosion, stress corrosion, water line corrosion, microbial corrosion, factors influencing corrosion, corrosion control, Proper designing, cathodic protection, protective coating, metallic anodic, cathodic, and organic coating, cleaning before deposition, electro plating, paints, constituent and functions, mechanism of drying of oil, varnishes, enamels special paint, fire retardant paint, luminous paint, heat resistant paint.

UNIT-III FUELS AND COMBUSTION

(9)

Calorific value-Gross and net calorific value- Dulong Petits law - Coal, types, proximate and ultimate analysis, combustion calculation, manufacture of metallurgical coke by Otto Hoffman byproduct method, Fractional distillation of petroleum, petrol-knocking, octane number, synthetic petrol, Fischer-Tropsch synthesis, Bergius process - Diesel, Cetane number, colloidal fuels, benzol, power alcohol- Water gas, Producer gas, CNG and biogas- Combustion – theoretical air calculation by mass and volume – simple problems only.

UNIT-IV ENGINEERING MATERIALS

(9)

Refractory, classification, characteristics, manufacture of silica, magnesia refractory-Lubricants, mechanism of lubrication, semi solid lubricant- Greases, solid lubricants -graphite, molybdenum sulphide, selection of lubricants- Adhesives, mechanism of adhesion, examples- Ceramics - major components - clays, silica, feldspar, methods of fabrication of ceramic ware-soft mud process, stiff mud process, dry pressing, hot pressing, slip casting, drying of ceramic ware, firing, ceramic products, structural clay products, white wares, earthen wares and store wares, chemicals stoneware glazes, porcelain and vitreous enamels.

UNIT-V WATER TECHNOLOGY AND PHASE RULE

(9)

Water – sources – Impurities – Hardness of water – types – expression – ppm, mg/L –estimation by EDTA method-problems - Boiler feed water – troubles- internal treatment of water – external treatment – lime soda process – problems - ion exchange process- desalination – reverse osmosis -Potable water – removal of suspended impurities and disinfection-physical and chemical methods –chlorination- break point chlorination.

Phase rule, one component system – water system - thermal analysis, reduced phase rule, two component Ag-Pb system, Cu-Ni alloy system and Fe-C system, uses and limitations of phase rule.

TOTAL : 45

Text Books

1. Ramadevi A. and Vairam S., **Engineering Chemistry**, 1 Edn, Gem publishers, Coimbatore. (2011).
2. Jain P.C and Jain. M., **Engineering Chemistry**, 17th Edn., Dhanpat Rai publications (p) Ltd, New Delhi. (2008).

Reference Books

1. Puri Br, Sharma, Lr, Pathania M.S., **Principles of Physical Chemistry**, Vishal Publications Co (2008).
2. Dara.S.S., **Engineering Chemistry**, S. Chand and Co (2008)
3. **Engineering Chemistry, A text book of Chemistry for Engineers**, Wiley India Pvt . Ltd, (2011).

12P206 MANUFACTURING TECHNOLOGY - I

(Common to Mechanical)

L T P C

3 0 0 3

METAL CASTING PROCESSES

9

Introduction to Concepts of Manufacturing Process -Sand casting – Sand moulds -Type of patterns – Pattern materials – Pattern allowances – Types of Moulding sand –Properties – Core making – Methods of Sand testing – Moulding machines – Types of moulding machines - Melting furnaces – Sand Casting defects – Inspection methods

JOINING PROCESS

10

Fusion welding processes – Types of Gas welding – Equipments used – Flame characteristics – Filler and Flux materials - Arc welding equipments - Electrodes –Coating and specifications – Principles of Resistance welding – Spot/butt, seamwelding – Percussion welding - Gas metal arc welding – Flux cored – Submerged arc welding – Electro slag welding – TIG welding- Adhesives : Types and applications- Brazing and soldering process.

BULK DEFORMATION PROCESSES

9

Hot working and cold working of metals – Forging processes – Open and close die forging – Types of Forging Machines – Typical forging operations – Rolling of metals – Flat strip rolling – Types of Rolling mills – Tube piercing – Principles of Extrusion – Types of Extrusion – Hot and Cold extrusion – Principle of rod and wire drawing.

SHEET METAL FORMING AND PLASTIC COMPONENTS

9

Typical shearing operations, bending and drawing operations – Formability of sheet metal – Metal spinning – Magnetic pulse forming – Super plastic forming – Types and characteristics of plastics- Moulding of Thermoplastic-Working principle and application of Injection moulding, compression moulding and transfer moulding.

METAL CUTTING (TURNING) PROCESS

8

Various types of lathe- CNC lathe, Turing centre- Construction details of centre Lathe-Work holding devices: self centering three jaw chuck, independent four jaw chuck, collets, face plates, dog carriers, centers and mandrels- Lathe operations.

TOTAL : 45

Text Books

1. Kalpakjian, S., “*Manufacturing Engineering and Technology*”, Pearson Education India Edition, 2006.
2. Sharma, P.C., *A Text book of Production Technology*, S. Chand and Co. Ltd.,2004.

Reference Books

1. Hajra Choudhury, SK “*Elements of Workshop Technology, Vol. I and II*”, Media Promoters Pvt Ltd., Mumbai, 2001
2. P.N. Rao, *Manufacturing Technology Foundry, Forming and Welding*, TMH-2003; 2ndEdition, 2003
3. Roy. A. Lindberg, *Processes and Materials of Manufacture*, PHI / Pearson Education, 2006

12P207 WORKSHOP

(Common to all Branches)

L T P C
0 0 3 2

1. Introduction to use of tools and equipments in Carpentry, Welding, Foundry and Sheet metal
2. Safety aspects in Welding, Carpentry and Foundry
3. Half lap Joint and Dovetail Joint in Carpentry
4. Welding of Lap joint, Butt joint and T-joint
5. Preparation of Sand mould for cube, conical bush, pipes and V pulley
6. Fabrication of parts like tray, frustum of cone and square box in sheet metal

TOTAL : 45

12P208 CHEMISTRY LABORATORY

(Common to Civil, Mechanical, and IBT)

L T P C
0 0 3 2

1. Estimation of hardness by EDTA method
2. Estimation of chloride by argentometric method
3. Determination Dissolved oxygen by Winkler's method
4. Estimation of available chlorine in bleaching powder
5. Estimation of copper and zinc in brass sample
6. Estimation of manganese in steel sample.
7. Surface area of activated carbon by adsorption technique using acetic acid
8. Estimation of calcium and magnesium in magnesite ore
9. Estimation of manganese in pyrolusite ore
10. Conduct metric titration of mixture of strong and weak acids using strong base
11. Potentiometric titration (Ferrous iron versus potassium dichromate)
12. Estimation of sodium or potassium using flame photometer
13. Estimation nickel using spectrophotometer
14. Estimation of iron by spectrophotometer.

(Any twelve experiments only)

TOTAL : 45

Reference Books

1. A.O.Thomas, ***Practical Chemistry***, 6th Edn, Scientific book centre, Kannanore (1995)
2. Arthur I. Vogel, ***Quantitative Inorganic Analysis***, 3rd Edn, ELBS (1970)

12P209 ENGINEERING GRAPHICS AND DRAFTING LABORATORY

(Common to Mechanical)

	L	T	P	C
	0	0	3	2
OBJECT CONSTRUCTION			(2)	
Page layout – Layers and Line types – Creating, Editing and selecting the Geometric Objects.				
MECHANICS			(3)	
Viewing, Annotating, Hatching and Dimensioning the drawing –Creating Blocks and Attributes.				
DRAFTING			(20)	
Create 2D drawing for machine components –Knuckle Joint, Cotter joint, Flange Coupling, Bearings and Cam Profile.				
INTRODUCTION TO 3D MODELING			(15)	
Creating and Editing 3D objects –Creating 3D Models for simple machine components Springs, Gears, Screw threads, Bolts and Nuts – Generating 2D drawings from 3D models – Different views, Auxiliary / Sectional views.				
Importing and exporting files to other CAE packages.				
				TOTAL : 45

Reference Books

1. Sham Tickoo - *AutoCAD 2008–A problem Solving Approach* –Auto Desk Press 2007
2. James D.Bethune Boston University- *Engineering Graphics with AutoCAD 2002* – Pearson Education
3. Alan Kalameja – *AutoCAD 2008: A tutor for Engineering Graphics* – Auto Desk Press 2007
4. James Leach - *AutoCAD 2008 Instructor* McGraw Hill – 2007
5. Ron House, Paul W. Richaardson, John Brooks, Dylan Vance – *Special Edition using AutoCAD 2002* – Prentice Hall of India Pvt.Ltd. – 2000.
6. CAD Software manuals of latest version.

12P3Z1 ENGINEERING MATHEMATICS - III

(Common to all branches)

L T P C

3 1 0 4

PARTIAL DIFFERENTIAL EQUATIONS (9)

Formation of PDE by elimination arbitrary constants and functions – Solutions of standard first order partial differential equations – Lagrange’s equation – Linear partial differential equations of second and higher order with constant coefficients-homogeneous and non homogeneous types.

FOURIER SERIES (9)

Dirichlet’s Conditions – General Fourier Series – Odd and even functions- Half range Sine and Cosine series – Parseval’s Identity – Harmonic Analysis.

FOURIER TRANSFORMS (9)

Statement of Fourier integral Theorem – Fourier transform pair – Fourier Sine and Cosine Transforms – Properties – Transforms of Simple functions- Convolution Theorem – Parseval’s Identity-Finite Fourier transforms

BOUNDARY VALUE PROBLEMS (9)

Method of separation of variables – One dimensional wave equation – One dimensional heat equation – Unsteady and Steady state conditions – Fourier series solution.

Z TRANSFORMS (9)

Z-transforms - Elementary properties-Inverse Z-transform - Initial and Final value theorems - Convolution theorem - Formation of difference equations - Solution to difference equations of second order with constant coefficients using Z - transform.

LECTURE: 45 TUTORIAL:15 TOTAL :60

Text Books

1. Veerarajan.T., “**Transforms and partial Differential equations**”, Tata McGraw Hill Publishing Co., New Delhi, 2010.

Reference Books

1. N.P.Bali., Dr. Manish Goyal., “**Transforms and partial Differential equations**”, University science Press, New Delhi, 2010.
2. Dr.Kandasamy.P., Dr.Thilagavathy.K and Dr.Gunavathy.K., “**Engineering Mathematics**” for Third Semester B.E/B.Tech, S. Chand and Co., Ram Nagar, New Delhi, 2010.
3. B.V.Ramana., “**Higher Engineering Mathematics**” Tata McGraw Hill Publishing Co., New Delhi, 2007.
4. Grewal B.S., “**Higher Engineering Mathematics**” (40th Edition) Khanna Publishers, New Delhi., 2007.
5. Glyn James, “**Advanced Modern Engineering Mathematics**” (8th Edition) Wiley India , New Delhi., 2007.

12P302 ENVIRONMENTAL SCIENCE AND ENGINEERING*(Common to all branches)*

L T P C

3 0 0 3

ENVIRONMENTAL RESOURCES (9)

Earth structure, Internal and external earth processes, plate tectonics, erosion, weathering, deforestation, anomalous properties of water, hydrological cycle, effect of modern agriculture, fertilizers, pesticides, eutrophication, biomagnifications, land degradation, minerals, rocks, rock cycle, mining, types of mining, desertification, soil erosion, methods of conservation of soil erosion, renewable energy resources, wind, solar, geothermal, tidal, OTEC.

ECO SYSTEM AND BIODIVERSITY (9)

Weather and climate, ocean current, upwelling, EL Nino, Ecology, ecosystem, biomes, physical and chemical components of ecosystem, biological components of ecosystem, forest ecosystem, desert ecosystem and pond ecosystem, Energy flow in ecosystem, nitrogen cycle, carbon dioxide cycle, phosphorous cycle, food pyramid, Ecological succession, types, biodiversity, need for biodiversity, values of biodiversity, hot spots of biodiversity, endangered and endemic species, conservation of biodiversity insitu-exitu conservation.

ENVIRONMENTAL POLLUTION (9)

Air pollution, classification of air pollutants gaseous particulars, sources effects and control of gaseous pollutants SO₂, NO₂, H₂S, CO, CO₂ and particulates, control methods, cyclone separator, electrostatic precipitator, catalytic combustion-water pollution-classification of water pollutants, inorganic pollutants, sources, effects and control of heavy metals, organic pollutants, oxygen demanding wastes, aerobic and anaerobic decomposition, soil pollution, Noise pollution, sources, effects, decibel scale.

ENVIRONMENTAL THREATS (9)

Acid rain, green house effect, global warming, disaster management, flood, drought, earthquake, tsunami, threats to biodiversity, destruction of habitat, habit fragmentation- hunting, over exploitation – man- wildlife conflicts, The IUCN red list categories, status of threatened species.

SOCIAL ISSUES AND ENVIRONMENT (9)

Sustainable development- sustainable technologies, need for energy and water conservation, rain water harvesting, water shed management, waste land reclamation, Air act, Wild life protection act, forest conservation act, population growth, exponential and logistic growth, variation in population among nations, population policy, women and child welfare programs, Role of information technology in human and health, HIV/AIDS, effects and preventive measures.

TOTAL: 45**Text Books**

1. Sharma J.P., '*Environmental Studies*', 3rd Edn, University Science Press, New Delhi (2009)
2. Anubha Kaushik and C.P.Kaushik, '*Environmental Science and Engineering*', 3rd Edn New age International Publishers, New Delhi (2008)

Reference Books

1. R.K.Trivedi, '**Hand book of Environmental laws, Rules, Guidelines, Compliances and Standards**', Vol.I andII, Environ Media. (2006)
2. G.Tyler Miller, J_R '**Environmental Science**', Tenth Edition, Thomson BROOKS/COLE (2004)
3. Gilbert M.Masters, '**Introduction to Environmental Engineering and Science**', 2nd Edition Pearson Education (2004).

12P303 FLUID MECHANICS AND MACHINERY*(Common to Mechanical)*

L T P C

3 1 0 4

FLUID PROPERTIES (9)

Units and Dimensions – Fluid properties – Density, Specific gravity, Viscosity, Surface tension, capillarity, compressibility and bulk modulus – Pascal’s Law – pressure measurements – manometers- Fluid statics - Total pressure and centre of pressure on submerged surfaces.

FLUID KINEMATICS AND DYNAMICS (9)

Types of fluid flow – Types of flow line – control volume – continuity equation – one-dimensional and three dimensional – velocity potential and stream function- Energy equation – Euler and Bernoulli’s equations – Applications-Orifice meter, venturimeter and pitot tube.

FLOW THROUGH PIPES AND BOUNDARY LAYER CONCEPT (9)

Laminar flow through circular pipes and parallel plates-Hagen Poissuille equation-Turbulent flow-Darcy Weisbach equation-Boundary layer- Definition- Boundary layer on a flat plate-Thickness and classification- Displacement, energy and momentum thickness.

MOMENTUM PRINCIPLE (9)

Impulse momentum principle-Application of momentum principle-Impact of Jet - Force exerted by a jet on normal, inclined and curved surfaces for stationary and moving cases-Angular momentum principle-construction of velocity vector diagrams.

HYDRAULIC TURBINES AND PUMPS (9)

Classification – construction, working principles and design of Pelton wheel and Francis Turbines-head, losses, work done and efficiency - specific speed - operating characteristics - Governing of Turbines-Classification of pumps-centrifugal pump-working principle - discharge, work done and efficiencies.

LECTURE: 45 TUTORIAL:15 TOTAL :60**Text Books**

1. Rajput.R.K., “*A text Book of Fluid Mechanics*”, S.Chand and Company, New Delhi , 2002.
2. Ramamrutham.S and Narayanan.R., “*Fluid Hydraulics and Fluid Machines*”, Dhanpat rai Publishing House (P) Ltd , New Delhi, 2000.
3. Modi.P.N. and Seth.S.M., “*Hydraulics and Fluid mechanics, including Hydraulic machines*”, Standard book house,Delhi, 2002

Reference Books

1. Streeter, Victor L . and Wylie, E. Benjamin, “*Fluid Mechanics*” , McGraw Hill Ltd., 2nd reprint, 2010.
2. Natarajan.M.K., “ *Fluid Machines*”, Anuradha Agencies, Vidyal Karuppur, Kumbakonaam, 1995.
3. Kumar.K.L., “*Engineering Fluid Mechanics*”, Eurasia Publishing House (P) Ltd., New Delhi, 2000.

12P304 ENGINEERING METALLURGY

(Common to Mechanical)

L T P C

3 0 0 3

CONSTITUTION OF ALLOYS AND PHASE DIAGRAMS (9)

Constitution of alloys – Solid solutions, substitutional and interstitial – phase diagrams, Isomorphous, eutectic, peritectic, eutectoid and peritectoid reactions, Iron – Iron carbide equilibrium diagram.

HEAT TREATMENT AND SURFACE TREATMENT (9)

Definition – Full annealing, process annealing, stress relief, recrystallisation - spheroidizing –normalising, hardening and tempering of steels – austempering, martempering - Isothermal transformation diagrams – cooling curves superimposed on I.T diagram- CCR - hardenability, Jominy end quench test. Case hardening, carburising, nitriding, cyaniding, carbonitriding – Flame and Induction hardening.

FERROUS AND NON FERROUS METALS (9)

Plain carbon steels – alloy steels - Effect of alloying elements (Mn, Si, Cr, Mo, V , Ni,Ti and W) on properties of steel - stainless and tool steels – Gray, White malleable, Spheroidal graphite - alloy cast irons –heat resistant steels and die steels. Copper, Aluminium, Nickel, Magnesium, Titanium, Lead, Tin - Important alloys - their composition, properties and applications.

FOUNDRY AND POWDER METALLURGY (9)

Solidification of pure metals and alloys – melting – super heating – fluxing – micro and macro segregation – hot tears – heat transfer and structural change. Production of powders , mixing, blending, compacting , sintering and hot pressing – secondary operations- application of powder metallurgy – advantages and limitations.

WELDING METALLURGY AND TESTING OF MATERIALS (9)

Weldability – heat distribution during welding and thermal effects on parent metals – HAZ – factors affecting HAZ- hardening, cracking, distortion and residual stresses – stress relief treatment of welds –Mechanical tests - tension, compression, impact, hardness. Non Destructive Testing basic principles and testing method for Radiographic testing, Ultrasonic testing, Magnetic Particle inspection and Liquid penetrant inspection test Eddy current testing.

TOTAL: 45

Text Books

1. Higgins R.A., “*Engineering Metallurgy*”, Viva books (p) ltd.,6th edition, 1998.
2. O.P.Khanna “*Material Science And Metallurgy*”, Dhanpat RaiPublication ,2011
3. Sydney H.Avner “*Introduction to Physical Metallurgy*”, Tata McGraw Hill Book Company,26th reprint, 2009.

Reference Books

1. William D Callsber "**Material Science and Engineering**", Wiley India pvt Ltd 2007.
2. Lakhtin Yu., "**Engineering Physical Metallurgy and Heat Treatment**", Mir Publisher,1985.
3. Kenneth G.Budinski and Michael K.Budinski "**Engineering Materials**" Prentice-Hall of India Private Limited, 7th Indian Reprint 2004.
4. Richerson D.W., '**Modern Ceramic Engineering**', Marcel Dekker,1992.
5. GUY.A.G., "**Elements of Physical Metallurgy**", Oxford andIBH Pub.Co,1990.

12P305 MANUFACTURING TECHNOLOGY - II

(Common to Mechanical)

L T P C

3 0 0 3

THEORY OF METAL CUTTING (9)

Mechanism of metal cutting – types – cutting force – chip formation – Merchant's circle diagram – calculations – tool geometry – machinability – tool wear – tool life – cutting tool materials – cutting fluids – types.

AUTOMATS, SHAPING AND PLANING MACHINES (9)

Capstan and turret lathes – construction - indexing mechanism - operations - working principle of single and multi-spindle automats – shaping and planing machines – types – construction - mechanism – principle of operation – different shaping operations - work holding devices.

DRILLING, BROACHING AND GRINDING MACHINES (9)

Drilling machines – specifications, types - feed mechanism, operations – drill tool nomenclature –broaching –specifications, types, tool nomenclature, broaching operations – grinding – types of grinding machines – grinding wheels, specifications – bonds –mounting and reconditioning of grinding wheels.

MILLING AND GEAR GENERATING MACHINES (9)

Milling – specifications – types - cutter nomenclature – types of cutters – milling processes – indexing – gear forming in milling – gear generation - gear shaping and gear hobbing – specifications - cutters – cutting spur and helical gears - bevel gear generators – gear finishing methods.

NON-TRADITIONAL MACHINING (9)

Classification of machining processes – process selection - ultrasonic machining – abrasive jet machining – water jet machining - laser beam machining – electron beam machining – plasma arc machining.

TOTAL: 45

Text Books

1. Hajra Choudhry S.K. and Bose S.K., “**Workshop Technology Vol II**”, Media Promoters and Publishers Pvt. Ltd., Bombay, 12th edition, 2007.
2. Sharma P.C., “**A Text Book of Production Technology**”, S.Chand and Company Ltd., New Delhi, 10th Revised edition, 2010.
3. Vijay k. jain., “**Advanced Machining Process**”, Allied publishers private limited., 2010.

Reference Books

1. Serope Kalpakjian and Steven R.Schmid, “**Manufacturing Engineering and Technology**”, Addison Wesley Longman (Singapore) Pte Ltd, Delhi, 2009
2. Jain R.K. and Gupta S.C., “**Production Technology**”, Khanna Publishers, New Delhi, 1999
3. HMT, “**Production Technology**”, Tata McGraw Hill publishing co. ltd., 1st edition, 2008.

12P306 STRENGTH OF MATERIALS*(Common to Mechanical)*

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STRESS AND STRAIN**(9)**

Stress and strain at a point-Tension, compression, shear stresses - Hooke's law - Compound bars –lateral strain-Poisson's ratio-Volumetric strain- Bulk modulus-Relationship among elastic constants –stress strain diagrams for mild steel, cast iron-Ultimate stress-Yield stress-Factor of safety-Thermal stresses-Thin cylinders -Strain energy due to axial force-Resilience- Stress due to gradual load, suddenly applied load and Impact load.

SHEAR FORCE AND BENDING MOMENT**(9)**

Beams – Types of Beams - Types of loads, supports - Shear force – Bending moment – shear forces and bending moment diagrams for cantilever, simply supported and over hanging beams with concentrated, uniformly distributed and uniformly varying load-Relationship between rate of loading, shear force, bending moment- Point of contra flexure.

THEORY OF BENDING AND COMPLEX STRESSES**(9)**

Theory of bending-Bending equation-Section Modulus-Stress distribution at a cross section due to bending moment and shear force for cantilever, simply supported beams with point, UDL loads(Rectangular, circular, I and T sections only)-strain energy due to bending-combined direct and bending stresses, Kernel of section (Rectangular, Circular Sections only).

2D State of stress- 2D Normal and shear stresses on any plane-Principal stresses and Principal planes-Principal Strains and direction-Mohr's circle of stress.

DEFLECTION OF BEAMS AND THEORY OF LONG COLUMNS**(9)**

Determinations of deflection curve – Relation between slope, deflection and radius of curvature – Slope and deflection of beam at any section by Moment area method and Macaulay's method –Concept of Conjugate beam method (Theory only no problems)- Euler's theory of long Columns- Expression of crippling load for various end conditions-Effective length-Slenderness ratio-limitations of Euler equation-Rankine formula for columns.

THEORY OF TORSION**(9)**

Torsion of shafts – Torsion equation –Polar modulus- Stresses in Solid and Hollow circular shafts - Torsional rigidity - Power transmitted by the shaft – Importance of angle of Twist - Strain energy due to Torsion-Modulus of rupture – Torsional resilience – Combined bending and Torsion- Stresses in helical springs-Deflection of helical spring-Leaf springs.

LECTURE:45 TUTORIAL: 15 TOTAL :60**Text Books**

1. Sadhu Singh, "**Strength of Materials**", Khana Publishers, New Delhi, 2000.
2. Rajput.R. K ., "**Strength Of Materials**", S. Chand and Company Ltd., New Delhi 1999.
3. James M.Gere , "**Mechanics Of Materials**", Thomson India, Brooks/cole, 2006

Reference Books

1. *Dr.B.C. Punmia, Ashok Kumar Jain and Arun Kumar Jain., “Mechanics of Materials”, Lakshmi Publications Pvt Ltd, New Delhi, 2002.*
2. *Kazimi, “Solid Mechanics”, Tata McGraw Hill, New Delhi, First revised edition, 26th reprint, 2006.*
3. *Robert L.Mott, “Applied Strength of Materials”, PHI Learning Pvt. Ltd, New Delhi,2009*
4. *Rayhulse,Keith Sherwin,Jackcain, “Solid Mechanics”, Palgrave Mcmillan,2002*
5. *Ramamrutham S and Narayan R, “Strength of Materials”, Dhanpat Rai and Sons, New Delhi, 16th edition, 2008.*
6. *Jindal U C, “Textbook on Strength of Materials”, Asian Books Pvt. Ltd., 2007.*

12P307 MACHINE DRAWING

(Common to Mechanical)

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CONVENTIONS, ABBREVIATIONS AND SYMBOLS

(6)

Interrupted views- partial views of symmetrical objects- conventional representation of intersection curves- square ends and openings, adjacent parts- common machine elements.

FITS AND TOLERANCES

(9)

Description of tolerances and grades- types of fits and their description- hole basis system- selection of fits from standard tables- fits for different applications- examples- geometrical tolerances- surface finish conventions.

PREPARATION OF ASSEMBLY DRAWINGS AND/OR COMPONENT DRAWINGS

(30)

Cotter joint, knuckle joint, flange coupling, universal coupling, foot step bearing, plummer block, connecting rod ends, cross heads, screw jack, lathe tailstock, stop valves, non-return valve.

LECTURE: 15 PRACTICAL: 45 TOTAL: 60

Text Books

1. Gopalakrishna K.R., "Machine Drawing", Subhas Publishers, Bangalore, 2004.
2. Bhatt.N.D, "Machine Drawing", Chorotar Publishing House, 2001.

Reference Books

1. Gill.P.S., "Text Book of Machine Drawing", S.K.Kataria and Sons, Publishers and Distributors, Delhi, 1998.
2. PSG College of Technology, Faculty of Mechanical Engineering, Design Data Book. M/S. DPV Printers, 2004.
3. Narayana K.L., Kanniah.P., Venkatareddy.K., "Machine Drawing", New Age International Publishers, 2004.

**12P308 STRENGTH OF MATERIALS AND FLUID MECHANICS AND
MACHINERY LABORATORY**
(Common to Mechanical)

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STRENGTH OF MATERIALS LABORATORY

LIST OF EXPERIMENTS:

- Tension Test on steel rods using Universal Testing Machine.
- Bending Test on rolled steel Joist Beam.
- Double shear test on mild steel rod.
- Torsion Test on Mild steel rod
- Tension and Compression Test on Springs
- Deflection test on simply supported aluminium beam
- Deflection Test on Cantilever Beam
- Hardness tests on metals like Mild Steel, Brass, Copper and aluminium
- Bend Test on Steel rod
- Compression Test

FLUID MECHANICS AND MACHINERY LABORATORY

LIST OF EXPERIMENTS:

- Determination of Darcy's friction factor.
- Calibration of Flow Meters.
- Flow through Mouth Piece / Orifice.
- Performance study on Centrifugal pump
- Performance study on reciprocating pump
- Performance study on Submersible Pump.
- Performance study on Gear Pump
- Load test on Pelton Wheel

TOTAL : 45

12P401 PROBABILITY AND STATISTICS*(Common to Mechanical)*

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Probability and Random variables**(9)**

Sample spaces – Events - Probability Axioms – Conditional Probability – Independent Events – Baye’s Formula. Random Variables : Distributions Functions – Marginal Distributions – Conditional Distributions – Expectation – Conditional Expectation and Conditional Variance – Moments - Moment Generating Functions.

Probability distribution**(9)**

Binomial, Poisson, Geometric, Uniform, Exponential, Normal, Gamma, Weibull (Mean, Variance and Simple problems) Chebyshev’s inequality (Simple problems).

Test of Hypothesis**(9)**

Tests for Means , Variances and proportions – Tests for Means , Variances and Attributes using t , F , Chi – Square distribution – Interval estimation for mean , Standard deviation – Proportion.

Analysis of Variance**(9)**

One way classification, Two way classification and Latin square design (Only problems).

Statistical Quality Control and Correlation Analysis**(9)**

Statistical basis for control charts – Control limits – Control charts for variables : \bar{X} , R Charts – Control chart for defective : p , np Chart - Control chart for defects : c charts. Correlation – Regression – Multiple and Partial Correlation – Partial Regression (Problems Only)

LECTURE : 45 TUTORIAL : 15 TOTAL : 60**Text Books**

1. S.C. Gupta and V. K. Kapoor, *Fundamentals of Mathematical Statistics*, Sultan Chand and Sons, New Delhi, 11th revised edition, 2002..
2. S. P. Gupta, *Statistical Methods* , Sultan Chand and Sons , New Delhi, 1999.

Reference Books

1. K. S. Trivedi, *Probability and Statistics with Reliability, Queuing and Computer Science Applications*, John Wiley and Sons, Second edition, New Delhi. 2002.
2. T. Veerarajan, *Probability , Statistics and Random Process* , Tata McGraw Hill Publishing Company Ltd., New Delhi – 2003.
3. P. Kandasamy, , K.Thilagavathy and K.Gunavathy, *Probability and Random Process*, S.Chand and Co. Ltd., New Delhi – 2007.
4. A.O.Allen,’ *“Probability, Statistics and queueing Theory with Computer Applications”* Elsevier, Second Edition, 2005.
5. Hwei Hsu, *“Schaum’s outline of Theory and Problems of Probability, Random Variables and Random Processes”*, Tata McGraw Hill Publishing Company Ltd., New Delhi – 2004.

12P402 METROLOGY AND MEASUREMENTS

(Common to Mechanical)

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METROLOGY: LINEAR AND ANGULAR MEASUREMENTS (9)

Length Standards- Length Measuring instruments - Vernier instruments - micrometer, height gauge, dial indicators, Bore gauges, Slip gauges, Comparators -Mechanical, Electrical, Optical and Pneumatic, Optical Projector. Angle measuring instruments - Bevel protractor, Spirit level, Sine bar, Autocollimator, Angle dekkor, Interferometry.

FORM MEASUREMENT (9)

Screw thread terminology- Measurement of effective diameter by two wire and three wire methods - errors in threads- Measurement of pitch, profile errors and total composite errors, Gear tooth terminology-Methods of measurements of runout, pitch, profile, lead, backlash, tooth thickness-composite method of inspection - parkinson gear tester, Measurement of surface finish - Stylus probe instruments - profilometer-Tomlinson and Talysurf instrument-Straightness, Flatness and Roundness measurement.

MEASURING MACHINES AND ADVANCES IN METROLOGY (9)

Tool maker's microscope - Computer controlled CMM - Universal measuring machine - Automatic and multidimensional inspection machine - Computer aided inspection -Machine vision-Laser interferometer.

MEASUREMENTS : STRAIN, FORCE, TORQUE AND PRESSURE MEASUREMENTS (9)

Electrical, Metallic Resistance Strain Gauge – Strain Gauge Ballast / Bridge circuit - Load cells - hydraulic and pneumatic systems - Pressure measuring transducers - Elastic and diaphragms – Mechanical, Hydraulic, Electric and Transmission Dynamometers.

TEMPERATURE, FLUID FLOW (9)

Bi-Metallic strips - pressure thermometers, thermo couples, optical and radiation pyrometer. Flow measurement - Obstruction meters - Pitot tubes- Rotameters - Turbine – type meters magnetic flow meters- hot wire anemometer -Vibrometers and accelerometers – seismic accelerometers.

TOTAL : 45

Text Books

1. Jain.R.K., “*Engineering Metrology*”, Khanna Publishers, Delhi, 2010.
2. Thomas G. Beckwith, Roy D, Marangoni, John H.Lienhard V., “*Mechanical Measurements*”, Addison Wesley Publishing Company, 2004.

Reference Books

1. Gupta. I.C., “*A text book of Engineering Metrology*”, Dhanpat Rai and Sons, Delhi, 2003
2. Holman J P. , “*Experimental Methods for Engineers*” McGrawHill Book Company, 2004
3. Jain R K, “*Mechanical and Industrial Measurements*”, Khanna Publishers, Delhi, 2004.

12P403 APPLIED ELECTRONICS AND MICROPROCESSOR*(Common to Mechanical)*

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ELECTRONIC CIRCUITS (9)

Biasing of BJT and FET-DC load line-Types of Biasing-Fixed and Self biasing of BJT,FET,MOSFET-RC coupled and Transformer coupled amplifiers -Power amplifiers - Class A Power amplifier - Class B pushpull amplifier - Distortion in amplifiers. Oscillators - Barkhausen criterion -RC phase shift oscillator-Hartley Oscillator-Colpitts Oscillator.

DIGITAL ELECTRONICS (9)

Combinational circuits - Adders and subtractors - A/D and D/A converters - weighted resistor DAC -R-2R ladder DAC - servo tracking A/D - successive approximation A/D converter -Dual slope ADC-Sequential Circuits-Flip flops-RS flip flop-JK,RS,D,T flip flops -Memories - ROM - EPROM -EEPROM-RAM.Operational amplifier-applications of opamp as adder,subtractor,Differentiator,Integrator.

MICROPROCESSOR STRUCTURE AND PROGRAMMING (9)

Architecture of 8085A microprocessor - Instruction formats - addressing modes -instruction set of 8085A Instruction cycle - machine cycle - OP code fetch cycle -Timing diagram-Memory and I/O read cycle - memory and I/O write cycle - interrupt acknowledge machine cycle - Wait, Hold and Halt states- simple assembly language programs for 8085A .

MICROPROCESSOR INTERRUPTS AND DATA TRANSFER SCHEMES (9)

Software interrupts - Hardware Interrupts - Vectored Interrupts - Non-vectored interrupts – Priority interrupts - Data transfer schemes - synchronous transfer, asynchronous transfer, interrupt driven transfer and DMA transfer

MICROPROCESSOR INTERFACING AND APPLICATIONS (9)

Interfacing - interfacing A/D converters - interfacing D/A converters - applications –Temperature control - traffic light control - stepper motor control.

TOTAL: 45***Text Books***

1. Ramesh S. Goankar, **“Microprocessor Architecture and Programming and Applications 8085 / 8080a”**, Penram International Publishing (India) 2004 .
2. Mathur S.P., Kulshreshtha D.C., Chadha P.R. **“Electronic Devices and Applications and Integrated Circuits”**, Umesh Publications, 2004.
3. Morris Mano M., **“Digital Design”**, Prentice Hall Of India Pvt. Ltd. 2008.

Reference Books

1. Mathur A.P., **“Introduction to Microprocessor”**, Tata Mcgraw Hill, New Delhi 2003.
2. Ajit Pal, **“Microprocessor Principles and Applications”**, Tata Mcgraw Hill, New Delhi 1999.
3. D.Roychoudhury, Shail Jain, **“Linear Integrated Circuits”**, Wiley Eastern Ltd. 2008.

12P404 ELECTRICAL MACHINES AND DRIVES*(Common to Mechanical)*L T P C
3 0 0 3**DC MACHINES**

(10)

Construction – Generator Principle – EMF equation – Characteristics of different types of DC generators – Motor principle – Torque equation – Characteristics of different types DC motors – Starters – Speed control – Electric braking – Swinburne’s test – Brake test.

SYNCHRONOUS MACHINES

(9)

Alternators – Types and constructional features – EMF equation – Voltage regulation – Synchronous motor principle – V and inverted V curves – Hunting – Methods of starting – Applications.

INDUCTION MACHINES

(10)

Construction of three-phase induction motors – Principle of operation – Torque-slip characteristics – Starting and speed control methods – Single phase induction motor – Types – Methods of starting – Applications – Universal motor.

SOLID STATE SPEED CONTROL (Power circuits and Qualitative treatment only)

(8)

Control of DC drives using rectifiers and choppers – Control of three phase induction motor using stator voltage control – V/f control – Slip power recovery schemes – Rotor resistance control.

SELECTION OF DRIVES AND SPECIAL MOTORS

(8)

Types of electrical drives – Factors influencing the choice of electric drives – Loading conditions and classes of duty – Determination of power rating – Selection of motor for steel rolling mills, paper mills, sugar mills, textile mills, and machine tool applications – DC and AC servomotors – Stepper motors.

TOTAL: 45***Text Books***

1. Theraja B.L and Theraja A.K., ‘*A Test book of Electrical Technology*’, volume – II, S.Chand and Co., 2010.
2. Pillai S.K., ‘*A first course on Electrical Drives*’, New Age International Publishers., New Delhi, 2nd Edition (Reprint) 2011.

Reference Books

1. De N.K and Sen P.K., ‘*Electric Drives*’, PHI, 2010.
2. Deshpande M.V., ‘*Electric motors application and control*’, PHI, 2010.
3. Sugandhi R.K. and Sugandhi K.K., ‘*Thyristors: Theory and applications*’, New Age International Publishers, 2nd edition (reprint) 2005.
4. Dubey G.K., ‘*Fundamentals of Electric Drives*’, Alpha Science International Ltd., 2001.
5. Vedam Subramaniam., ‘*Electric Drives: Concepts and Applications*’, McGraw Hill, 2010.

12P405 MECHANICS OF MACHINES

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MECHANISMS**(9)**

Machine structure-Kinematic link, pair and chain-Constrained motion- Degree of freedom- Slider crank and crank rocker mechanisms-inversion-applications-Kinematic Analysis of Simple Mechanism-Determination of velocity and acceleration-Grublers criteria.

FRICTION**(9)**

Friction in pivot and collar-Thrust bearing - Plate and disc clutches - Belt (flat and V) and Rope drive-Ratio of tensions-Effect of centrifugal and initial Tension- Condition for maximum power transmission. Open and crossed belt drive.

GEARING AND CAMS**(9)**

Gear profile and geometry-Nomenclature of spur and helical gears-Law of gearing- Interference - Requirement of minimum number of teeth in gears-Gear trains-Simple and compound gear trains-Determination of speed and torque in epicyclic gear train-Cam profile-Different types of followers.

BALANCING**(9)**

Static and dynamic balancing - Single and several masses in different planes - Primary and secondary balancing of reciprocation masses - Single and multi cylinder engines.

VIBRATION**(9)**

Free, forced and damped vibration of single degree of freedom systems - Force Transmitted to supports - Vibration isolation-Vibration absorption - Torsional vibration of shaft – Single and multi rotor systems-Critical speed of shaft.

LECTURE : 45 TUTORIAL:15 TOTAL:60 hours

Text Books

1. Ballaney, P.L., *“Theory of Machines”*, Khanna Publishers, NewDelhi, 1998
2. Singh, V.P., *“Theory of Machines”*, Khanna Publishers, New Delhi,1998.

Reference Books

1. Rao,J.S. and Dukkupati, R.V. *“Mechanism and Machine Theory”*, Second Edition, Willey Eastern Ltd., 1992.
2. Malhotra, D.R. and Gupta, H.C.,: *“Theory of Machines”*, Satya Prakashan, Tech India Publications, 1999.
3. Gosh, A., and Mallick,A.K., *“Theory of Machines and mechanisms”*, Affiliated East West Press, 3rd edition, 2003.
4. Sigley,J.E. and Uicker (K), J.J., *“ Theory of Machines and mechanisms”*, McGraw Hill 1986.
5. Burton Paul, *“Kinematic and Dynamic of Planer Machinery”*, Prentice Hall, 1979.

12P406 THERMAL SCIENCES

L T P C
3 1 0 4

BASIC THERMODYNAMIC CONCEPTS

(9)

Basic concepts - concept of continuum, macroscopic approach, thermodynamic systems - closed, open and isolated. Property, state, path and process, quasi-static process, work, modes of work, Zeroth law of thermodynamics –First law of thermodynamics – application to closed and open systems, internal energy, specific heat capacities, enthalpy.

Second law of thermodynamics – Kelvin’s and Clausius statements of second law. Reversibility and irreversibility. Carnot cycle, efficiency, COP. Concept of entropy, Carnot theorem, absolute entropy.

AIR STANDARD CYCLES AND IC ENGINES

(9)

Otto, Diesel, Dual, Brayton cycles, Calculation of mean effective pressure and air standard efficiency, Classification of IC engine, IC engine components and functions. Valve timing diagram and port timing diagram. Comparison of two stroke and four stroke engines. Fuel supply systems, Ignition Systems, Performance calculation. Comparison of petrol and diesel engine. Lubrication system and cooling system.

BOILERS AND POWER PLANTS

(9)

Steam Boilers and Cycles – Fuel and Ash Handling, Combustion Equipment for burning coal, Mechanical Stokers, Pulveriser, Electrostatic Precipitator, Draught – different types, Surface Condenser Types, Cooling Towers; Turbines - Impulse and reaction principles, compounding, velocity diagrams for simple and multistage turbines, speed regulations-governors and nozzle governors.

REFRIGERATION AND AIR-CONDITIONING

(9)

Vapour compression Refrigeration cycle – super heat, sub cooling, performance calculations. Working principle of vapour absorption system. Comparison between vapour compression and absorption systems. Psychrometry, Psychrometric chart – processes. Air conditioning systems (Descriptive treatment only).

HEAT TRANSFER AND AIR COMPRESSORS

(9)

Mechanism of Heat Transfer – Conduction, Convection and Radiation – General Differential equation of Heat Conduction – Cartesian Coordinates – One Dimensional Steady State Heat Conduction – Conduction through Plane Wall and Cylinders.

Classification and working principle of air compressor, work of compression with and without clearance. Volumetric efficiency, Isothermal efficiency and isentropic efficiency of reciprocating air compressors. Multistage air compressor and inter cooling (Descriptive treatment only).

TOTAL: 45 hours

Text Books

1. Kothandaraman.C.P., Domkundwar.S. and A.V.Domkundwar., “A course in Thermal Engineering”, Dhanpat Rai and Sons., 5th edition, 2000.
2. Ballaney.P.L., “Thermal Engineering”, Khanna Publishers, New Delhi,1998.

Reference Books

1. Cengel, **“Thermodynamics” An Engineering Approach**, Tata Mc Graw Hill, New Delhi., 4th edition, 2004.
2. Nag.P.K., **“Engineering Thermodynamics”**, Tata McGraw-Hill, New Delhi, 2007.
3. Holman.J.P., **“Thermodynamics”**, 3rd Edition, McGraw-Hill, 2007.
4. Rogers, Meyhew, **“Engineering Thermodynamics”**, ELBS, 1992.
5. Arora.C.P., **“Refrigeration and Air conditioning”**, TMH, 1994.
6. Holman J.P **“Heat and Mass Transfer”** Tata McGraw-Hill, 2000.
7. Nag P.K, **“Power plant Engineering”**, Tata McGraw-Hill, 1998.
8. T.Morse Frederick, **“Power Plant Engineering”**, Prentice Hall of India, 1998.

12P407 ELECTRICAL ENGINEERING LABORATORY

(Common to Mechanical)

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LIST OF EXPERIMENTS

1. O.C.C and load-test on separately Excited DC generator
2. O.C.C and load-test on DC shunt generator
3. Swinburne's test
4. Speed control of DC shunt motor
5. Load test on DC shunt motor
6. Load test on DC compound motor
7. Load test on DC series motor
8. Mechanical and iron losses of 3-phase induction motor
9. Load test on 3-phase induction motor
10. Load test on 1-phase induction motor
11. Regulation of 3-phase alternator EMF and MMF methods
12. Load test on 3-phase alternator
13. Study of induction motor starters

TOTAL: 45

08P408 THERMAL ENGINEERING LABORATORY

L T P C
0 0 3 2

LIST OF EXPERIMENTS

- Valve timing and Port timing diagrams for I.C. engines.
- Engine performance evaluation using D.C generator as loading device.
- Performance evaluation using Rope Brake dynamometer.
- Performance evaluation of engine using Swinging field dynamometer.
- Estimation of frictional power by fuel consumption measurement and
- Verification by retardation test.
- Estimation of economical load and economical speed of engine.
- Heat balance on engine using air measurement method.
- Heat balance on engine by using exhaust gas calorimeter.
- Heat balance on engine by assuming volumetric efficiency.
- Heat balance by exhaust gas analysis.
- Test on multi cylinder petrol engine.
- Test on reciprocating air compressor.
- Test on constant speed air blower.
- Fan laws verification on variable speed air blower

TOTAL: 45 hours

12P409MICROPROCESSORLABORATORY

(Common to Mechanical)

L T P C
0 0 3 2

LIST OF EXPERIMENTS

1. Addition and subtraction of two 16- bit numbers
2. Sorting a series of numbers in Ascending and Descending order
3. Conversion of Binary number to BCD
4. Conversion of BCD to Binary
5. Implementation of Block-Data transfer
6. Controlling stepper motor using Microprocessor
7. Verification of Logic gates
8. Design of adders and subtractors
9. Multiplexer and Demultiplexer
10. Applications of an OPAMP
11. Characteristics of common emitter transistor
12. Transfer and Drain Characteristics of FET amplifier.

TOTAL: 45

12P501 ENGINEERING ECONOMICS AND MANAGEMENT*(Common to Mechanical)*

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INDUSTRIAL ECONOMICS**(9)**

Nature and scope of Economics- Importance of study of Economics for Engineers. Demand and Supply- Elasticity, cost concepts- cost and output relationship in the short and long run-Equilibrium of the firm. Pricing policies and methods.

MONEY BANKING AND TRADE**(9)**

Nature and functions of money- value of money- Inflation and deflation- Functions of commercial and reserve banking. Global trade- importance- foreign exchange- Balance of Payments- International Monetary institutions.

ELEMENTS OF MANAGEMENT**(9)**

Evaluation of scientific management- Functions of management- planning, organizing, co-ordinating- directing and controlling- Production and productivity- Factors affecting productivity- plant location and plant layout- Work study.

FINANCIAL MANAGEMENT**(9)**

Concept and Definition- Venture capital- CRISIL rating- Purpose of investment- Types of capital- Sources of Finance- Financial statements- Stock exchange- commodity exchange- Cash flow statements- Break even analysis.

MARKET MANAGEMENT AND PSYCHOLOGY**(9)**

Sales and market management- Management of sales- Advertisement- Market research- Sales Forecasting. Psychology- Definition- Industrial psychology- Individual vs group behavior- Attitude- Motives- Morale- Fatigue- Accidents.

TOTAL: 45***Text Books***

1. Dwivedi D.N., "**Managerial Economics**", Vikas Publishing House Private Limited, New Delhi, 2009.
2. Bhusan Y.K., "**Fundamentals of Business Organization and Management**", Sultan Chand and Sons, New Delhi, 2001.
3. Robbins S.P., "**Organizational Behaviour**", and Prentice Hall of India Ltd., New Delhi, 2009.

Reference Books

1. Harold Koontz, Heinz Weihrich, "**Essentials of Management**", McGraw Hill, 2003.
2. Sundharam K.P.M., "**Money, Banking and International Trade**", Sultan Chand Sons, New Delhi, Reprint 2002.
3. Fred Luthans, "**Organizational Behaviour**", Tata McGraw Hill, Singapore 2006.

12P502 MACHINE ELEMENTS DESIGN

(Use of Approved Data Book is Permitted)

L T P C
3 1 0 4

PRINCIPLES OF DESIGN (9)

Selection of materials. Factor of safety. Stresses under direct loads, variable and cyclic loads, endurance limit. Stress concentration. Failure theories principal stresses. Combined bending and shear. Combined shear and axial loads. Shaft size based on critical speed.

JOINTS, COUPLING AND SPRINGS (9)

Design of welded joints, Bolted joints (brackets), Cotter and knuckle joints. Design of flange couplings. Design of helical and leaf springs.

BEARING (9)

Study of Hydrodynamic and Hydrostatic Bearings. Design of Journal Bearings - Sommerfeld number, and dimensionless parameters. Selection of ball and roller bearings. Selection of packing and oil seals.

DRIVES (9)

Selection of flat and V belts and pulleys. Roller chains.

GEARS (9)

Design of spur, helical, bevel and worm gears.

LECTURE: 45 TUTORIAL: 15 TOTAL: 60 HOURS

Text Books

1. Shigley, J.E., and Mischke, C.R., *Mechanical Engg. Design*, McGraw-Hill Book Co., 8th edition, 2008.
2. S.Md. Jalaludeen, *A Text Book of Machine Design*, Anuradha Publications, 3rd edition, 2006.

Reference Books

1. Khurmi, R.S., and Gupta, J.K., *A Text book of Machine Design*, S.Chand and Company Ltd.
2. Dobrovolsky, V., and others, *Machine Elements A Text Book*, MIR Publishers.
3. Spotts, M.F., *Design of Machine Elements (6th ed.)*, Prentice Hall of India Pvt.Ltd.
4. Sharma, P.C., Aggarwal, D.K., *A Text Book of Machine Design*, Kataria and sons.

12P503 FLUID POWER DRIVES AND CONTROLS

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BASIC PRINCIPLES**(9)**

Hydraulic Principles, Hydraulic pumps – Characteristics, Pump Selection. Pumping Circuits. Hydraulic Actuators – Linear, Rotary; Selection, Characteristics. Hydraulic Valves – Pressure, Flow, Direction Controls. Applications. Hydraulic Fluids. Symbols.

HYDRAULIC CIRCUITS**(9)**

Hydraulic circuits – Reciprocating, Quick return, Sequencing, Synchronizing. Accumulator circuits. Safety circuits. Press, Milling Machine, Planner, Fork Lift, etc.

DESIGN and SELECTION OF HYDRAULIC CIRCUITS**(9)**

Design of Hydraulic circuits. Regenerative circuits. Pressure intensifier circuits. Double pump hydraulic system. Mechanical hydraulic servo system. Selection of components. Trouble shooting of fluid power circuits.

PNEUMATIC SYSTEMS**(9)**

Pneumatic fundamentals. Control Elements. Logic Circuits. Position. Pressure Sensing Switching. Electro Pneumatic. Electro Hydraulic Circuits. Robotic Circuits.

DESIGN AND SELECTION OF PNEUMATIC CIRCUITS**(9)**

Design of Pneumatic circuits – Classic, Cascade, Step counter, Combination methods. PLC, Microprocessors - Uses. Selection criteria for Pneumatic components. Installation and Maintenance of Hydraulic and Pneumatic power packs. Fault finding. Case studies.

TOTAL: 45 HOURS***Text Books***

1. Antony Esposito, *Fluid Power with Applications*, Prentice Hall, 6th edition, 2009.
2. Andrew Parr, *Hydraulics and Pneumatics (HB)*, Jaico Publishing House, 3rd edition, 2011.

Reference Books

1. Dudley, A. Pease and Hohn J. Pippenger, *Basic Fluid Power*, Prentice Hall, 1987.
2. John J Pippenger and Tyler G Hicks, *Industrial Hydraulics*. Mc Graw Hill Book Co.
3. Stewart H L and Storer J.M., *Pneumatics and Hydraulics*, D B Taraporevala Sons.
4. J. Michael, Pinches and Hohn G.Ashby, *Power Hydraulics*, Prentice Hall, 1989.

12P504 THEORY OF METAL CUTTING

L T P C
3 1 0 4

TOOL STEREOMETRY

(10)

Machining Fundamentals – Metal Cutting – Geometry of Single Point Turning tool – significance of Rake Angle, relief Angle, cutting edge Angle and Nose Radius – Tool Angle Specification : British, American, German and ISO System – Interrelations of rake Angle Between American and German – Nomenclature of Multi Point cutting Tools : Drills, Milling Cutters and broaches – Chip Breakers – Specifications for Inserts and Tool Holders.

MECHANICS OF METAL CUTTING

(10)

Mechanism of Chip formation – Classification of Chips – Chip curl – Orthogonal Vs Oblique Cutting – Shear Plane Angle – Cutting Force and Velocity relationships – Merchant circle diagram – Stress and Strain in the chip – Ernst and Merchant's Upper bound solution – Merchant's Second solution and "Machining Constant" – Energy considerations in machining – Dynamometers for measuring forces during turning Process.

THERMODYNAMICS OF CHIP FORMATION AND CUTTING FLUIDS

(8)

Source of Heat – Shear Plane Temperature – Experimental Determination of Chip Tool interface Temperatures – Theoretical Estimation of cutting tool Temperature – Tool life equation. Effects of Cutting fluids – Functions – Characteristics – Methods of applying Cutting Fluids – Types and Selection of Cutting Fluids – Cutting Fluids for machining of various metals.

TOOL MATERIALS, TOOL WEAR, TOOL LIFE AND MACHINABILITY

(10)

Requirements of Tool Materials – HSS, Carbides, Ceramic, Composites and Diamond – Properties, Advantages and Limitations.

Causes of Wear – Wear Mechanisms : Diffusion Wear, Adhesive Wear, Abrasive wear – Flank wear and Crater Wear – Measurement of Tool Wear.

Machinability – Tool Failure criteria - Taylor's Tool Life equation – Effect of process parameters on Tool life.

ECONOMICS OF METAL MACHINING

(7)

Economic tool life – Gilbert's model – Analysis for Optimum Cutting Speed – Optimum Cutting Speed for Maximum production – Optimum cutting Speed for Minimum cost with cost as objective criterion – Theory of Chatter in machining.

LECTURE: 45 TUTORIAL: 15 TOTAL: 60 HOURS

Text Books

1. Juneja B.L., Sekhon G.S., *Fundamentals of Metal Cutting and Machine Tools*, New Age International (P) Ltd., 2nd edition, 2005.
2. Bhattacharya A., *Metal Cutting – Theory and Practice*, New Central Book Agency (P) Ltd., Calcutta, 1984

Reference Books

12P505 CNC MACHINES AND CONTROL SYSTEMS

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INTRODUCTION TO CONTROL SYSTEMS**(9)**

Introduction – control systems – open loop control systems – closed loop control systems - transfer function – analog and digital control systems – classifications of control systems. Microprocessor based control : microprocessor system hardware – operation – interfacing a microprocessor controller – basics of controller programming – microprocessor based controllers.

OPERATIONAL AMPLIFIERS AND SIGNAL CONDITIONING**(9)**

Operational amplifiers – special interface circuits – signal transmission. Switches, relays and semi conductors: Switches – toggle switches, Push button switches, and other switches. Relays – electromechanical relays – solid state relays. Power Transistors – silicon controlled rectifiers – Triacs, Trigger devices.

COMPUTER NUMERICAL CONTROL**(9)**

Basic theory of numerical control – advantages of numerical control, open - closed loop system, classification of CNC machine tools, position control - continuous path control. Drives and control systems – feed back devices - Principles of displacement Measurement. Types of CNC machine tools. Constructional features. Applications and economics of usage of NC machines –Integration of CNC machines in computer integrated manufacturing environment.

CNC PART PROGRAMMING**(9)**

Manual and computer aided part programming – G function, M Function, canned cycles, Basics of APT-APT programming for simple parts - Description of the system geometry definition – Geometry modification - machining – Tool definition – Three dimensional geometry – multi axis machining DNC link– output

TOOLING AND AUTOMATION FOR CNC MACHINES**(9)**

Tooling in CNC machines - Interchangeable tooling systems – preset and qualified tools - Automatic tool changer, Automatic pallet changer, features of CNC systems for lathes and machining center. Direct Numerical control, FMS, – robotics – computer integrated manufacturing – Basic concepts of AI and expert systems for manufacturing automation. Use of CNC machines for Rapid proto typing and manufacturing.- Internet based manufacturing.

TOTAL: 45 hours**Text Books**

1. Kilian, *Modern Control Technology Components And Design* , 2nd edition, Delmar Publication Ltd., 2008.
2. P.Radhakrishnan, *Computer numerical control machines*, New central book agency, 1996.

Reference Books

1. Sivanandam S.N., *Control Systems Engineering*, vikas Publishing House Pvt.Ltd., New Delhi, 2001
2. P.C. Sharma, *Production Engineering*, S.Chand and Company Ltd, 1993
3. Michael P. Groover, *Automation , Production systems and Computer Aided Manufacturing*, Prentice Hall , 1980.
4. SME, *Manufacturing Engineering , Hand Books*, 1994
5. S.Krar, *CNC technology and programming*, McGraw Hill 1990
6. Kundra T.K. , Rao P.N and Tiwari N.K., *CNC machine tools and computer aided manufacturing*, Tata McGraw Hill, 1991.
7. Yoram Koren., *Computer control of Manufacturing systems*, Tata McGraw Hill edition, 2nd reprint, 2006.

12P506 PROCESS PLANNING AND COST ESTIMATION

(Common to Mechanical)

L T P C
3 0 0 3

DESIGN AND CONCEPTS OF PROCESS PLAN (9)

Introduction- Place of process planning-economics- Process and Production Planning, Process Planning and Concurrent Engineering- Types of production- standardization- Production design and selection: Selection of processes, tools, cutting parameters and machine tools- Jigs and Fixtures - Grouping of processes- Sequencing of operations- Selecting primary manufacturing processes for rough and refined needs- Process capability, Process Charts.

MANUAL AND COMPUTER AIDED PROCESS PLANNING (9)

Retrieval type/variant approach, group technology – generative approach, logics decision trees and tables, axiomatic approach – AI expert systems – feature recognition – applications -Estimating and Costing - Concepts, differences, different costing methods – classification of costs – cost grid-problems

DIRECT AND INDIRECT COST COMPONENTS (9)

Labour cost–direct, indirect– estimation– labour norms–time study rating – labour cost variances - material cost–direct, indirect–estimation–material issue valuation – material cost variances–problems. Overhead cost - Elements – factory, administrative, sales and distribution expenses–methods of absorbing overheads – Direct Labour, Direct Material, Machine Hour Rate methods – depreciation – methods –accounting for service department expenses – problems.

COST CALCULATIONS (9)

Machined components–welded components, forged components, powder metallurgy parts, calculation of sales cost, case studies, use of computers in cost estimation, cost of rejection- Optimum Machining Conditions: Taylors equation, deriving the equation for optimum economic cutting velocity– selection of cutting speed for optimum cost, problems process capability analysis.

BREAK EVEN ANALYSIS AND COST MANAGEMENT (9)

Concept, make or buy decision, assumptions, merits and demerits of break even analysis. Applications - Linear, multi product break-even analysis - Cost Management - Learning curves, product life cycle cost analysis -Tools and techniques – activity based costing - concepts, cost drivers; introduction to target costing - need and applications.

TOTAL: 45

Text Books

1. Kannappan D, “*Mechanical Estimating and Costing*”, Tata McGraw Hill, New Delhi, 2003.
2. Frederic C Jelen and James H Black, “*Cost and Optimization Engineering*”, McGraw Hill Inc., New York, 1983.

Reference Books

1. Thomas E.Vollmann et all, “*Manufacturing Planning and Control Systems*”, Galgotia Publications Pvt. Ltd., New Delhi, 1998.
2. Gideon Halevi and Roland D.Weill,” *Principles of Process Planning* “, Chapman and Hall, UK,1995.

3. Samuel Eilon, "**Elements of Production Planning and Control**", MacMillan, London, 1985.
4. Haslehurst M, "**Manufacturing Technology**", ELBS, 1985.
5. Kesavon R "**Process Planning and Cost Estimation**", New Age International Pvt. Ltd., Chennai, 2008.
6. Banga T R and Sharma S C, "**Mechanical Estimating and Costing**", Khanna Publishers, New Delhi,

12P507 COMPUTER AIDED DESIGN LABORATORY

L T P C
0 0 3 2

CAD - Fundamentals of CAD

Create, Edit and Dimension the Sketch – Constraints – Datum Planes – Construction aids

Modeling

Extrude, sweep, Swept blend features

Assembly Modeling

Creating Top-down and Bottom-up assemblies – Assembling the components – Editing the components – Adding Geometric Tolerance – Analyze the assembly for interference – Simulating the motion of components – Bill of Materials – Generate, Edit, Modify and dimension the different Drawing Views.

Surface Modeling

Creating Extruded, Revolved, Sweep, Blended, Swept Blend and Helical Sweep Surface – Surface Editing – Copying, Mirroring, Moving and Trimming the Surfaces – Fill Surfaces – Create Intersect Curves – Offset Surfaces – Convert a Surface to a Solid.

3D VISUALIZATION

Exercises on modeling of mechanical components using packages like AutoCAD / Mechanical Desktop/Inventor/IDEAS/ Pro Engineer/CATIA/Unigraphics etc...

- Simple two dimensional geometry creations and modification using drafting module.
- Detailing and documentation of a typical production drawing
- Attributes and data extraction from a drawing
- Creation of simple solid models using CSG and B-rep Approach
- Surface Modeling
- Interfacing a Programming Language with Drafting Module
- External database connection
- Generation of working drawings of components and preparation of assembly models of
 - ✓ Fixture assembly
 - ✓ Bench vice assembly
 - ✓ Blower assembly
 - ✓ Tool head of shaper
 - ✓ Radial engine sub-assembly
 - ✓ Pulley support assembly
 - ✓ Box type drill jig assembly by using the following techniques...
- Generation of surfaces of revolution
- Generation of surfaces of extrusion
- Generation of surfaces by skinning operation
- Generation of solid models using constructive solid geometry, method shading and rendering.

12P508 MANUFACTURING TECHNOLOGY LABORATORY-I

(Common to Mechanical)

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Study of construction details of different types of lathes and tools

Study of various accessories used in lathe.

Study of different types of tools used in lathe and the measuring instruments

Exercises on models using conventional Lathes :

- Facing, plain turning, step turning and parting
- Groove cutting, knurling and chamfering.
- Form turning and Taper turning
- Thread cutting (Internal and external -Vee and square)
- Eccentric turning
- Drilling, reaming and counter sinking

TOTAL: 45 HOURS

12P601 MECHATRONIC SYSTEMS

L T P C
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MECHATRONICS SYSTEMS

(9)

Introduction to Mechatronics- Basics of actuating systems . Mechanical, pneumatic, hydraulics, electrical systems- control systems- measurements systems- Mechatronics approach.

SENSORS AND TRANSDUCERS

(9)

Introduction- performance terminology- displacement, position and proximity- velocity and motion- fluid pressure- temperature sensors- light sensors- selection of sensors- signal processing.

8085 MICROPROCESSOR

(9)

Introduction- architecture- pin configuration- instruction set- programming of microprocessors using 8085 instructions- interfacing input and output devices- interfacing D/A converters and A/D converters- applications- temperature controls- stepper motor control- traffic light controller.

PROGRAMMABLE LOGIC CONTROLLERS

(9)

Introduction- basic structure- input/output processing- programming- Mnemonics- timers, internal relays And counters- data handling- analog input/output- selection of a PLC.

DESIGN OF MECHATRONICS

(9)

Stages in designing Mechatronics systems- Traditional and Mechatronics design- Possible design- solutions- case studies of Mechatronics systems- pick and place robots- automatic car park systems- engine management systems.

TOTAL: 45 HOURS

Text Books

1. W.Bolton, *Mechatronics, Pearson education., Second Edition, 2007.*
2. Ramesh S. Gaonkar, *.Microprocessor Architecture. , Programming and Applications, Wiley Eastern, 1991.*

Reference Books

1. Michel B. Histan and David G. Alciatore, *.Introduction to Mechatronics and measurement systems., McGraw Hill International Editions.*
2. HMT Ltd, *.Mechatronics., Tata McGraw Hill publishing Co. Ltd.*
3. D.A.Bradley, D. Dawson, N.C. Buru and A.J. Loader. *.Mechatronics., Chapman and Hall.*
4. K. Ram, *.Fundamentals of Microprocessors and Microcomputers., Dhampat rai publications.*
5. Dan Neculescu, *“Mechatronics”, Pearson Education Asia. (Indian reprint)*

12P602 ROBOTICS AND MACHINE VISION SYSTEM

L T P C

3 0 0 3

FUNDAMENTALS OF ROBOT (9)

Robotics – Introduction – Basic structure – Classification of robot and Robotic systems – laws of robotics – work space, precision movement. Drives and Controls systems: Hydraulic systems, power supply – servo valve – hydraulic motor – DC servo motors – stepper motors – operation – selection of system – control system – servo control.

ROBOT MOTION ANALYSIS (9)

Kinematics of Robot : Introduction, Matrix Representation, homogeneous transformation, forward and inverse kinematics, Inverse kinematics Programming, Degeneracy, dexterity, velocity and static forces, Basics of trajectory planning.

GRIPPERS AND SENSORS (10)

Robot end effectors: Types of end effectors – Mechanical grippers – Types of Gripper mechanisms – Grippers force analysis – Other types of grippers – Vacuum cups – Magnetic grippers – Adhesive grippers – Robot end effectors interface. Sensors : Position sensors – Potentiometers, encoders, - LVDT, Velocity sensors, Acceleration Sensors, Force, Pressure and Torque sensors, Touch and Tactile sensors, Proximity, Range and sniff sensors.

PROGRAMMING AND APPLICATION (8)

Types of programming – programming languages sample program for different types of robots – Industrial Applications: Application of robots in processing operations – Assembly and inspections – Material handling – Loading and unloading – AI and Robotics.

MACHINE VISION (9)

Introduction – image processing Vs image analysis, image acquisition, digital images – sampling and quantization – image definition, levels of computation. Image processing Techniques: Data reduction – Windowing, digital conversion. Segmentation – Thresholding, Connectivity, Noise reduction, Edge detection, Segmentation, Region growing and Region splitting, Binary morphology and grey morphology operation – feature extraction.

TOTAL: 45 HOURS**Text Books**

1. Saeed B.Niku, *Introduction to Robotics: Analysis, Systems, Applications, 2nd edition, Pearson Education India, PHI 2003 (ISBN 81-7808-677-8)*
2. M.P.Groover, *Industrial Robotics – Technology, Programming and Applications, McGraw- Hill, USA, 1986*

Reference Books

1. Janakiraman P.A., *Robotics and image processing, Tata McGraw Hill, 1995.*
2. YoremKoren, *Robotics for Engineers, McGraw-Hill, USA, 1992.*
3. Richard D.Klafter, Thomas A.Chmielewski and Michael Negin, *Robotic Engineering – An Integrated Approach, Prentice Hall Inc, Englewoods Cliffs, NJ, USA, 1989.*
4. Ramesh Jam, Rangachari Kasturi, Brain G.Schunck, *Machine Vision, Tata McGraw Hill*

12P603 FINITE ELEMENT TECHNIQUES

L T P C
3 1 0 4

RELEVANCE OF FEM (9)

Historical background - Basic concept of FEM - Discrete and continuous models - Boundary and initial value problems - Discretization - Convergence requirements - Gradient and divergence theorems.

FORMULATION OF ELEMENT CHARACTERISTIC MATRICES and LOAD VECTORS (9)

One dimensional governing equations - structural and heat transfer problems - variational method - variational calculus - functionals - Weighted residual methods. Galerkins method - Ritz method - generalized coordinates approach - Principle of minimization of potential energy.

ONE DIMENSIONAL PROBLEMS (9)

Derivative of shape functions - shape function characteristics - Problems in axial load members, trusses, beams, heat transfer through composite walls and fins - Gauss elimination and Cholesky's method of solving equations.

TWO DIMENSIONAL PROBLEMS (9)

Linear triangular and rectangular elements - Constant strain triangles (CST). Derivation of shape functions for triangular and rectangular elements - Pascal.s triangle - Concept of plane stress and plane strain. Solution of simple problems in structural and heat transfer models.

HIGHER ORDER ELEMENTS (9)

Applications of higher order elements - Isoparametric elements - Lagrangian and serendipity elements - Jacobian transformation.

TUTORIAL (15)

(Usage of FEM Software Packages:Not for Examination)

FEM Packages - preprocessor, solution and post processor, Tutorials, solution of simple 1D, 2D and 3D components using ANSYS.

LECTURE: 45 TUTORIAL: 15 TOTAL: 60 HOURS

Text Books

1. Larry J. Segerlind, *Applied Finite Element Analysis, John Wiley and Sons., 2nd edition, 1984.*
2. Singiresu.S.Rao, *The Finite Element Method in Engineering, Butterworth Heinemann., 5thedition, 2011.*
3. David V. Hutton, *Fundamentals of Finite Element Analysis, tata McGraw Hill edition, 2005.*

Reference Books

1. J.N.Reddy, *An Introduction to Finite Element Method, McGraw Hill, Intl, 3rd edition, 2006.*
2. Tirupathi R. Chandrupatala and Ashok D. Belegundu, *Introduction to Finite Elements in Engineering , Pearson Education., 4th edition, 2011.*
3. Chandrakant.S.Desai, *Elementary Finite Element Method, Prentice Hall Inc., 1979.*

12P604 AUTOMATION AND CIM

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FUNDAMENTALS OF AUTOMATION AND CIM**(9)**

Concept of automation - Basic Elements of Automated system and Classification – Levels of Automation – Ten Strategies for Automation, Concept of automation in industry - mechanization and automation, classification. Evolution of CIM - CIM Hardware and Software – Data base Requirement of CIM – “Concurrent engineering” – Principles – Design and development. Automated Modelling systems – Production economics – Simulation software.

AUTOMATION IN MANUFACTURING**(9)**

Automation in machine tools - Mechanical feeding and tool changing - machine tool control transfer automaton, automated flow lines - Methods of work part transport transfer - Transfer line-monitoring system (TLMS) using Line Status - Line efficiency. Simulation in assembly line - Analysis of Automated flow lines - General terminology and analysis of transfer lines - without and with buffer storage, partial automation, Implementation of automated flow lines. Buffer stock - Mechanical buffer storage control function - design and fabrication.

PRODUCTION PLANNING AND CONTROL SYSTEM**(9)**

Process planning – Logical; Design of a process plan – Selection of machining process and tools – work piece holders – Sequencing of operations – selection of detailed method of production – CAPP – Retrieval and Generative systems – aggregate production planning – Production Schedules – Material Requirements Planning (MRP) – Capacity planning – Shop floor control – Computer aided Quality Control.

GROUP TECHNOLOGY AND FMS**(9)**

Group Technology – Part families – Part Classification and Coding – Production flow Analysis – Cellular manufacturing – Cell design – Application considerations in Group Technology. Introduction – Concepts of FMS – Comparison with Conventional Manufacturing – Economic Justification – Basic Components of FMS – Types of Flexibility – FMS Applications and Benefits – Automated Material Handling and Storage.

CONTROL SYSTEMS**(9)**

Process model formulation – control actions – Optimal control structure model of a manufacturing process – Steady state optimal control – Adaptive control – Sequence control and Programmable controllers – computer process control – computer process interface – interface Hardware – Direct Digital control.

TOTAL: 45 Hours**Text Books**

1. Mikell P Groover, “Automation, Production Systems and Computer Integrated Manufacturing”, Pearson education (Singapore) Pvt. Ltd., New Delhi, 2008
2. Radhakrishnan P and Subramaniyan S, “CAD/CAM/CIM”, New Age International (P) Ltd., 2008.

Reference Books

1. Davi J Parish, “Flexible Manufacturing”, Butterworth – Heinemann Ltd, Cambridge, 1990.

2. *James A Rehg and Henry W Kraebber, "Computer Integrated Manufacturing", Pearson Education (Singapore) Pvt. Ltd., New Delhi, 2005.*
3. *Chris McMahon, and Jimmie Browne, "CAD/CAM Principles, Practice and manufacturing Management", Addison Wesley Longman Ltd, England, 1998.*
4. *Kant Vajpayee .S, "Principles of Computer Integrated Manufacturing", Prentice Hall of India Limited, 2005.*
5. *Paul G Rankey. "Computer Integrated Manufacturing". Prentice Hall, 2004.*

12P605 PRODUCTION OF AUTOMOTIVE COMPONENTS

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AUTOMOTIVE COMPONENTS**(9)**

Automotive engines - basic principles - cylinder blocks. Materials - production methods - dry and wet liners - cylinder head. Types, materials - production methods - production of oil pan - engine mountings.

ENGINE PARTS**(9)**

Piston parts - Functions - materials manufacturing methods - Piston rings - Types. Functions -production and testing methods. Piston pin types - materials. Manufacturing methods - production of connecting rod and crankshaft

VALVES AND ACCESSORIES**(9)**

Valve – types – Mechanisms - Materials - production methods - production of push rod, rocker arm and tappets. Camshaft-manufacturing methods - production of carburetors - king pins and propeller shaft.

FUEL AND TRANSMISSION SYSTEM**(9)**

Fuel system for petrol and diesel engines - production of carburetors - fuel pumps - fuel injection pumps -multipoint fuel injection systems - transmission system - gear box - clutch system - differential .steering components.

BRAKES, SUSPENSION AND ENGINE MANAGEMENT SYSTEMS**(9)**

Braking system - Types- manufacturing methods- suspension methods- leaf spring and shock absorbers- Manufacturing details - Construction details of wheel mounting - Application of sensors and actuators – Mechatronics in automobile - Use of robots in assembly line – Use of plastics in automobile components.

TOTAL: 45 HOURS***Text Books***

1. Kirpal Singh, *Automobile Engineering, Vol I and II, Standard Publishers., 12th edition, 2011.*
2. William H.Crouse and Anglin, *.Automotive Mechanics, McGraw Hill Book Co., 10th edition, 2008.*
3. Helt P.M., *High speed combustion engines, Oxford and IBM Publishers Co. 1990.*

Reference Books

1. Newton and Steels, *.The motor vehicle. ELBS, 12th edition, 1998.*
2. Narang G.B.S, *Automobile Engineering, Khanna Publishers, 1991.*

12P607 AUTOMATION AND COMPUTER AIDED MANUFACTURING LABORATORY

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PROGRAMMABLE LOGIC CONTROLLER

- Study of Programmable Logic Controller

EXERCISES IN PLC

1. Multi cycle automation multiple cylinders using cascade method (sequence of motion: A+ B+ B- A-)
2. Operate an electrical switch to make a double acting cylinder to attain FWD stroke. (Use double solenoid valve to operate the cylinder). RET stroke should be automatic as soon as it reaches the FWD end position
3. Two Double Acting Cylinder are to be Electro pneumatically operated and their sequence is A+ B+ B- A-
4. Continuous operation of a DAC
5. Sequential operation: A+ B+ A- B-
6. Sequential multicycle operation: A+ A- B+ B-
7. Sequential multicycle operation with timer and counter: A+B+C+C-B-A-

STUDY OF CNC MACHINES & CNC PROGRAMMING

- Study of Basic Components of CNC
 - CNC Programming:
 - Manual part programming
 - Computer aided part programming
1. Programming and machining of parts involving facing, cleaning cut, reduction in diameter by CNC Lathe.
 2. Programming and machining of parts involving longitudinal, taper and transverse turning operations in CNC Lathe.
 3. Part program involving circular interpolation for machining of curved surface.
 4. Part programming for milling machine operations.
 5. Applications of Standard fixed cycles / Canned cycles
 6. Applications of Non – Standardized fixed cycles.
 7. Applications of Macros

12P608 MODELING AND SIMULATION LABORATORY

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Finite Element Modeling and Analysis

- ◆ Exercises on Modeling and Meshing.
- ◆ Exercises on Solution and Post processing.
- ◆ Various types of Analysis: Structural, Elasticity, Fluid Flow, Heat Transfer, Casting, Weld assembly - Metal cutting problem.
- ◆ Kinematic Analysis of Simple Mechanisms
- ◆ Exercises on Transient analysis
- ◆ Exercises on Coupled Field analysis
- ◆ Introduction to Ansys Parametric Design Language (APDL)

References :

http://www.mastercam.com	: MASTERCAM Software
http://www.autodesk.com	: AutoCAD Mechanical Software
http://www.ansys.com	: ANSYS Software
http://usa.autodesk.com/mouldflow/	: Mould Flow Software
http://www.procast.com	: Pro-Cast software
http://www.automationstudio.com	: AUTOMATION STUDIO Software
http://www.igrafx.com	: iGrafx PROCESS 2003–Process Management software

12P701 RESOURCE MANAGEMENT TECHNIQUES

(Use of Approved Statistical Table is permitted)

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LINEAR MODELS (9)

The phase of an operation research study . Linear programming . Graphical method. simplex Algorithm . Duality- dual simplex method . Transportation problems - Assignment problems.

NETWORK MODELS (9)

Network models. shortest route. Minimal spanning tree. Maximum flow models. Project network - PERT and CPM networks. Critical path scheduling. Sequencing models.

INVENTORY MODELS (9)

Inventory models. Economic order quantity models. Buffer stock. Reorder level. Quantity Discount models. Stochastic inventory models.

QUEUING THEORY (9)

Queuing models. Queuing systems and structures. Notation parameter. Single server and Multi server models. Poisson input. Exponential services. Simulation - Monte Carlo Technique. Use of random number.

DECISION MODELS (9)

Decision models. Game theory. Two person zero sum games. Graphic solution. Replacement Models. Models based on service life. Economic life. Markov analysis for solving marketing Problems. Equilibrium market share.

TUTORIAL: 15 LECTURER: 45 TOTAL: 60 HOURS

Text Books

1. P.K. Gupta and D.S. Hira, . *Problems in Operations Research (Principles and Solutions)* S.Chand and Co. Ltd., 2003.
2. Sharma,S.D. . *Operation Research. Kedarnath Ram Nath and Co. Meerut.*

Reference Books

1. H.A. Taha, *Operation Research, Prentice Hall of India Pvt. Ltd.*
2. Don. T. Phillips, Ravindren, A and James solberg . *Operations Research . John Wiley and Sons.*

12P702 DESIGN OF JIGS, FIXTURES AND PRESS TOOLS*(Common to Mechanical)*

[Use of Approved Data Book is permitted]

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3 0 0 3

LOCATING AND CLAMPING PRINCIPLES (9)

Tool design objectives - tool design in manufacturing - planning the design - principles of supporting and locating elements - referencing, basic rules of locating - planes of movement -locating from a flat surface - locating from internal and external diameter - external profile -ejectors - principles of clamping and work holding – types - non mechanical clamping - clamping accessories - materials used in jigs and fixtures.

DESIGN OF JIGS (9)

Drill bushes – different types of jigs – plate, latch, channel, box, angle plate, post, turnover, pot jigs - Automatic drill jigs - Rack and pinion operated, air operated jigs - design and development of jigs for simple components.

DESIGN OF FIXTURES (9)

General principles of milling boring, lathe and broaching fixtures - Grinding, planning and shaping fixtures, assembly, Inspection and welding fixtures- modular fixtures - design and development of fixtures for simple component – quick change fixtures.

PRESS ELEMENTS AND CUTTING DIE DESIGN (9)

Press working terminology – types - presses and accessories - tonnage requirements - strip lay out calculations - shearing action - die and punch elements - strippers, knockouts, stops, pilots, selection of standard die sets - design and development of progressive and compound dies for blanking and piercing operations.

DESIGN OF BENDING, FORMING, DRAWING AND MISCELLANEOUS DIES (9)

Bending– forming and drawing dies – types - design and development of above dies - design considerations in forging - extrusion –recent trends in tool design – computer aids for sheet metal forming analysis – basic introduction.

TOTAL : 45 HOURS**Text Books**

1. Kempster, *“Jigs and Fixtures Design”*, The English Language Book Society, 1998.
2. Joshi P.H, *“Jigs and Fixtures”*, Tata McGraw-Hill Publishing Company Limited, New Delhi 2004.
3. Donaldson C, *“Tool Design”*, Tata McGraw-Hill, New Delhi, 2003.
4. Elanchezhian, B. Vijayaramnath, T. Sunder selwya, *“Design Of Jigs, Fixtures and press tools”*, The Science and Tech Book Publishers, Chennai, 2005.

Reference Books

1. K.Venkataraman, *“Design of Jigs, Fixtures & Press tools”*, Tata McGraw-Hill Publishing Company Limited, New Delhi 2005.
2. Edward G Hoffman, *“Jigs and Fixture Design”*, Thomson – Delmar Learning, Singapore, 2004.
3. Hiram E Grant, *“Jigs and Fixture”* Tata McGraw Hill, New Delhi, 2003.
4. *“Fundamentals of Tool Design”*, CEEE Edition, ASTME, 1983.

12P703 TOTAL QUALITY MANAGEMENT

(Common to Mechanical, ECE, EEE)

L T P C
3 0 0 3

INTRODUCTION (9)

Definition of quality, dimensions of quality, quality planning, quality costs concepts - basic concepts of total quality management, principles of TQM, leadership concepts - quality council, quality statements, strategic planning-steps in strategic planning- Deming philosophy, barriers to TQM implementation.

TQM PRINCIPLES (9)

Customer satisfaction - customer perception of quality - customer retention, employee involvement - motivation, empowerment, performance appraisal, continuous process improvement – Juran trilogy, PDSA cycle, 5S concept, kaizen, supplier partnership - supplier rating – performance measures- Malcom Balridge National Quality Award

STATISTICAL PROCESS CONTROL (SPC) (9)

Seven old and new tools of quality - statistical fundamentals - population and sample – normal curve - control charts for variables and attributes- state of control and out of control - process capability - concept of six sigma.

TOOLS AND TECHNIQUES (9)

Benchmarking - benchmarking process - quality function deployment (QFD) - house of quality - Taguchi quality loss function - total productive maintenance (TPM)- pillars of TPM - Failure Mode Effective Analysis (FMEA)- Failure rate- types of FMEA - stages of FMEA.

QUALITY SYSTEMS (9)

Need for ISO 9000 and other quality system - ISO 9000:2008 quality system – elements - implementation of quality system - documentation - quality auditing - QS 9000, ISO 14000 - concept, requirements and benefits- integrating ISO 14000 with ISO 9000.

TOTAL: 45

Text Books

1. Dale H.Besterfield, et al., “*Total Quality Management*”, Pearson Education Asia, 3rd edition, Indian reprint, 2008.
2. Subburaj Ramasamy, “*Total Quality Management*”, Tata McGraw Hill, 2008.

Reference Books

1. James R.Evans and William M.Lindsay, “*The Management and Control of Quality*”,(5thEdition), South-Western (Thomson Learning), 2010 .
2. Feigenbaum.A.V. “*Total Quality Management*”, McGraw-Hill, 1991.
3. Zeiri. “*Total Quality Management for Engineers*” Wood Head Publishers, 1991.

12P704 NEWER PRODUCTION PROCESSES*(Common to Mechanical)*

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MODERN MACHINING PROCESSES**(9)**

Need of modern machining processes – classification and selection of technology – mechanical processes – abrasive jet machining (AJM), water jet machining (WJM), ultrasonic machining (USM).

ELECTROCHEMICAL AND CHEMICAL METAL REMOVAL PROCESSES**(9)**

Electrochemical machining (ECM), electrochemical grinding (ECG), electrochemical deburring and honing – chemical machining (CHM).

THERMAL METAL REMOVAL PROCESSES**(10)**

Electric discharge machining (EDM), wire cut electric discharge machining (WEDM). Plasma arc machining (PAM), Electron beam machining (EBM), Laser beam machining (LBM), Ion beam machining (IBM).

FORMING PROCESSES AND FOUNDRY TECHNIQUES**(10)**

Explosive forming, Electro – hydraulic forming, electro – magnetic forming, dynapak machine-high pressure moulding, squeeze casting, vacuum castings.

RAPID PROTOTYPING**(12)**

Introduction – advantages – limitations – principle – rapid prototyping systems – stereo- lithography(SLA), selective laser sintering(SLS), fused deposition modeling(FDM), laminated object manufacturing (LOM), solid ground curing (SGC), three dimensional printing. Application of reverse engineering in rapid prototyping.

TOTAL: 45***Text Books***

1. P.C.Pandey, “**Modern machining processes**”, Tata McGraw Hill publishing company Ltd. 2007.
2. P.C.Sharma, “**A text book of Production Technology**”, S.Chand & Company Ltd. 2007.
3. V.K.Jain, “**Advanced Machining Process**”, Allied Publishers PVT Ltd 2007

Reference Books

1. Bhattacharya, “**New Technology**”, Institution of Engineers, 1997.
2. CMTI, “**Electrochemical machining**”, Bangalore, 1978.
3. Gary.F.Benedict, “**Nontraditional machining Processes**”, Marcell Dekker Inc, 2001
4. HMT, “**Production Technology**”, Tata McGraw Hill Publishers, 1992.
5. Ronenthal. C “**Principles of Metal Castings**”, Tata McGraw Hill Publishing co. Ltd, 1996.

12P707 METROLOGY AND QUALITY CONTROL LABORATORY

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LIST OF EXPERIMENTS:

- Study and use of Measuring Instruments.
- Calibration of Dial Gauge, Micrometer and Vernier.
- Measurement of Angles and Internal / External tapers using Sine bar, Bevel protractor, rollers and spheres.
- Measurement of gear tooth thickness using gear tooth caliper.
- Measurement of effective diameter and pitch of screw thread using 3-wire method and pitch gauge.
- Checking straightness and flatness.
- Measurement of run out and concentricity.
- Measurement of various dimensions of the given component using Profile Projector.
- Measurement of various dimensions of given component using Tool makers microscope.

QUALITY CONTROL

- Construction of Graphs like Histogram, Probability plot, Time series plot, Scatter plot, 3D Surface plot, etc.,
- Construction of Run chart, Pareto chart and Cause and effect diagram
- Regression analysis
- Performing an analysis of variance
- Construction of control charts for variables and attributes
- Performing Process Capability analysis.

TOTAL: 45 HOURS

References:

1. <http://www.minitab.com>: MINITAB – Statistical Software
2. <http://www.spss.com>: SPSS – Statistical Software

12P708 MANUFACTURING TECHNOLOGY LABORATORY – II

(Common to Mechanical)

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LIST OF EXERCISES

- V- groove cutting in shaping machine.
- Drilling, tapping and surface grinding using surface grinder and Radial drilling machine
- External cylindrical grinding of shaft
- Spur gear milling
- Helical gear milling
- Gear shaping
- Gear hobbing
- Polygonal milling
- Making hexagonal hole using slotting machine
- Letter cutting in vertical milling machine.
- Turning using Capstan and Turret lathes
- Study Exercises on CNC Machines.
- Study of non-conventional machining through video simulation.

TOTAL : 45 HOURS

12P6E0 MANAGEMENT INFORMATION SYSTEMS

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MIS AND RELATED CONCEPTS

(8)

Definition, Meaning and role of Management Information Systems (MIS) - System approach to planning and control- Creative thinking and problem solving-evolution of MIS-structure of MIS-MIS for different levels and their functions and requirements-MIS organization within the company-Global business environment and MIS-role of MIS to face increased complexity of business and management-Review of Information Technology and trends.

PLANNING, DESIGNING, IMPLEMENTATION AND EVALUATION OF INFORMATION SYSTEMS

(12)

Strategic and Project Planning-Business Planning-Grid analysis-methodologies and tools Reviewing MIS planning-sequence planning-Master program schedule-budgeting Reporting and controlling techniques-detailed design-overview of different methods and selection criteria-Structure System Analysis and Design-SLDC approach for SSAD- ER diagram-DFD-Implementation methods-evaluation-Cost/Benefit analysis-availability and control of information-security-reliability-CASE tools.

INFORMATION TECHNOLOGY AND MIS

(8)

Comparison of manual and computer based information systems-Types of computer based Application in MIS-conceptual design of computer integrated security management Information system-Modern communication-Video conferencing, Super Highway-system Configuration and selection-application of multimedia, internet and intranet technologies in MIS.

INFORMATION SYSTEMS IN BUSINESS AND MANAGEMENT

(10)

Data/Traction processing-online/real time system-batch processing-MIS for control and Decision making functions- Programmed and non programmed decision-MIS for making Programmed decisions-Integrated MIS-Office automation system-Decision support system-AI and Expert system.

DBMS PACKAGES

(7)

Information to RDBMS-core concepts of RDBMS-Introduction to packages (or any other

Front end tool)-Introduction to Client/Server computing-Projection Development-Selection of Applications-Selection of CASE tools-Evaluation of design issues-Design and developments of applications.

TOTAL: 45 HOURS

Text Books

1. James A. O .Brien, *Management Information Systems*, Galgotia Publications, fourth edition, 2010.
2. Robert G Murdict, *Information Systems for Modern Management*, Prentice Hall of India,1998

Reference Books

1. Henry C Lucas Jr., *The Analysis, Design and Implementation of Information Systems*, McGraw hill Company, New York, 4th edition, 1992.

2. *Burch J.E., Strater F.R. and Grudnikshi G., Information Systems: Theory and Practice, John Wiley and Sons, New York, 1987.*
3. *Davis G.B., Management and Information Systems: Conceptual foundation Structure and Development, McGraw Hill New York, 1984.*
4. *Mcloed J.R.R., Management Information Systems, Maxwell Macmillan Intl., 4th edition, 1993.*
5. *Kroenke D, Management Information Systems- An Introduction, McGraw Hill, 1993.*

12P6E1 NUMERICAL METHODS

(Common to CIVIL,EEE,EIE,CSE,IT,Mechanical branches)

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SOLUTIONS OF EQUATIONS AND EIGEN VALUE PROBLEMS (9)

Iterative method – Newton – Raphson Method for single variable and for simultaneous equations with two variables – Solutions of Linear system by Gauss elimination, Gauss – Jordan, Crout’s and Gauss Seidel Methods – Relaxation Method – Eigen value of a Matrix by Power Method.

INTERPOLATION (9)

Operators – Relation between the operators – Newton’s divided difference formula – Lagrange’s and Hermite’s Polynomials – Newton Forward and Backward difference formulae – Stirlings and Bessel’s Central difference formulae.

NUMERICAL DIFFERENTIATION AND INTEGRATION (9)

Numerical differentiation with Interpolation Polynomials – Numerical Integration by Trapezoidal and Simpson’s (Both $1/3^{\text{rd}}$ and $3/8^{\text{th}}$) rules – two and three point Gaussian quadrature formula – Double integrals using Trapezoidal and Simpson’s Rules – Difference equation.

INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS (9)

Single step methods – Taylor series, Euler and Modified Euler, Runge – Kutta method of order four for first order differential equations – Multistep methods – Milne and Adam – Bashforth predictor and Corrector methods.

BOUNDARY VALUE PROBLEMS FOR ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS (9)

Finite difference solutions for the second order ordinary differential equations – Finite difference solutions for one dimensional Heat equation (Both Implicit and Explicit) – One dimensional Wave equation -Two dimensional Laplace and Poisson equations.

LECTURE: 45 TUTORIAL: 15 TOTAL: 60

Text Book

1. Dr.Kandasamy. P, Dr.Thilagavathy . K, Dr. Gunavathy . K., “**Numerical methods**”, S. Chand and Co.New Delhi, 2010.

Reference Books

1. Veerarajan. T and Ramachandran. T., “**Numerical Methods with Programming in C**”, Tata Mc.Graw Hill Publishers, New Delhi, 2007.
2. Balagurusamy .E. “**Numerical Methods**”, Tata McGraw Hill Publishers, New Delhi, 1999, reprint 2007.
3. Grewal. B. S. and Grewal. J.S., “**Numerical Methods in Engineering and Science**”, Khanna Publishers, New Delhi, 2004.

4. *Gerald.C.F. and Wheatley. P.O., “Applied Numerical Analysis”, (Sixth Edition), Pearson Education,Asia, New Delhi, 2006.*
5. *Sankar Rao K, “Numerical Methods for Scientists and Engineers”, (Third edition), Prentice Hall of India, New Delhi , 2007.*
6. *Dr.Manish Goyal , “Statistics and Numerical methods”, University Science Press, New Delhi, 2010.*
7. *Dr.J.S.Chitode, “Numerical Methods “, Technical Publications, Pune, 2010.*

12P6E2 MODERN CONTROL TECHNOLOGY

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INTRODUCTION TO CONTROL SYSTEMS

(9)

Introduction – control systems – open loop control systems – closed loop control systems - transfer function – analog and digital control systems – classifications of control systems. Microprocessor based control : microprocessor system hardware – operation – interfacing a microprocessor controller – basics of controller programming – microprocessor based controllers.

OPERATIONAL AMPLIFIERS AND SIGNAL CONDITIONING

(9)

Operational amplifiers – special interface circuits – signal transmission. Switches, relays and semi conductors: Switches – toggle switches, Push button switches, and other switches. Relays – electromechanical relays – solid state relays. Power Transistors – silicon controlled rectifiers – Triacs, Trigger devices.

MECHANICAL SYSTEMS AND ACTUATORS

(9)

Behavior of mechanical components – energy – response of the whole mechanical system – gears – clutches and brakes – other power transmitting techniques. Electrical linear actuators – hydraulic systems – pneumatic systems – flow control valves.

CONTROL SYSTEM COMPONENTS

(9)

Potentiometer – error detector – magnetic amplifier – hydraulic elements – synchros – stepper motors – tachogenerators – servomechanisms – modulators and demodulators – PID controllers – servo motors.

FEED BACK AND LOGIC CONTROL SYSTEMS

(9)

On – off controllers – fuzzy logic controllers – Programmable logic controller: overview of PLC systems – input and output modules – power supplies – general PLC programming procedures – auxiliary commands and functions – ladder diagrams – timer functions – counter functions.

TOTAL: 45 HOURS

Text Books

1. Kilian, *Modern Control Technology Components And Design* , 2nd edition, Delmar Publication Ltd., 2008.
2. Sivanandam S.N., *Control Systems Engineering*, vikas Publishing House Pvt.Ltd., New Delhi, 2001

Reference Books

1. Gopal M., *Control Systems – Principles and Design* , 2nd edition, Tata McGraw Hill Publishing Co.Ltd., New Delhi, 2006.
2. John.W.Webb and Ronald A.Reis, *Programmable Logic Controllers – Principles and Applications*, Prentice Hall Inc., New Jersey, 2003.

12P6E3 PRODUCTION MANAGEMENT

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BASICS OF PRODUCTION MANAGEMENT**(9)**

History and development of Manufacturing Management - Nature, Scope, Importance and Functions. Work Study - Industrial Engineering – Historical Background. Contributions by

F. W. Taylor, Frank Gilbreth. - Basic Techniques involved. Method Study - Symbols used in charting, various charts, Questioning Technique, Process Improvements. Time Study - Work Measurement, Work / Activity Sampling - Predetermined Time Standards, MTM-1, MOST – Introduction to Mini MOST and Maxi MOST.

MANAGEMENT FUNCTIONS**(9)**

Evolution of Management Theory - Management approach to Planning - Analysis and Control functions involved in a Production System; Production cycles - planning functions; Organisation and policies in respect of production planning and control; Product design and development - Forecasting techniques; Scheduling - Sequencing and plant loading for optimal utilization; Queuing models and line balancing - Materials Planning and Control,; Value Analysis - Productivity Analysis, Mechanics of production control.

ORGANIZATIONAL BEHAVIOUR AND ERGONOMICS**(9)**

Organizational Behaviour -Definition - Importance - Fundamental Concepts of OB - 21st Century corporate - Different models of OB - autocratic, custodial, supportive, collegial Personality and Attitudes - Meaning of personality - Development of personality Nature and dimensions of attitude - Job Satisfaction - Organizational Commitment. Ergonomics - Definition and importance - Human Machine Systems – interfaces. Anthropometry Need, Important Body Dimensions. Applied Anthropometry and Work Space Design and Seating.

MOTIVATION AND LEADERSHIP THEORIES**(9)**

Motivation - Motives - Characteristics - Classification of motives - Primary Motive, Secondary motives - Morale - Definition and relationship with productivity – Morale Indicators; Theories of Work Motivation - Maslow's theory of need hierarchy Herzberg's theory of job loading. Leadership - Definition -Importance - Leadership Styles - Models and Theories of Leadership Styles.

CONCURRENT ENGINEERING**(9)**

Principal concept and need. Review of Engineering Problem Solving methods, - Description of methods of Analysis - Decision Making - Creativity and Information processing and their role in engineering. Discussion of Emerging engineering strategies of Total Design, Design for Manufacturing and Assembly - Quality Function Deployment, and Constraint networks. Integrating concurrent approaches with those of conventional. Implementation of concurrent engineering in industrial environment especially those of IT and high speed computation.

TOTAL: 45 HOURS*Text Books*

1. Eilon S: *Elements Of Production Planning And Control*. Universal Publishing Bombay, 2001.
2. Tompkins J A and White J A: *Facilities Planning*, New York, John Wiley and Sons., 4th edition, 1984.
3. Andrew Kusiak, *Concurrent Engineering: automation, tools and techniques*, John Wiley and Sons. Inc., 1993.

Reference Books

1. *Maynard, Industrial Engineering Handbook, Mc Graw Hill Book Company.*
2. *M. S. Sanders and Ernest J. McCormick, Human Factors Engineering and Design, McGraw Hill Inc.,*
3. *Khanna O. P., Industrial Engineering and Management, Dhanapat Rai Publications, New Delhi.*
4. *Gopalkrishnan P. and Sudarshan, Materials Management, Prentice Hall India Ltd., 2006.*
5. *Arnold J R I: Intro to Materials Management. (2) Prentice Hall Inc New Jercey, 6th edition, 2010.*

12P6E4 PRODUCTION PLANNING AND CONTROL

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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 and specialization-Break even analysis-Economics of a new design.

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.

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.

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.

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 HOURS**Text Books**

1. Martand Telsang, "**Industrial Engineering and Production Management**", S. Chand and Company, First edition, 2011.
2. Samson Eilon, "**Elements of production planning and control**", Universal Book Corpn,1999.
3. Stephen N. Chapman, "**The fundamentals of production planning and control**", Pearson education, 2009.

Reference Books

1. Elwood S.Buffa, and Rakesh K.Sarin, "**Modern Production / Operations Management**", 8th Ed. John Wiley and Sons, 2000.
2. K.C.Jain and L.N. Aggarwal, "**Production Planning Control and Industrial Management**", Khanna Publishers, 1990.
3. N.G. Nair, "**Production and Operations Management**", Tata McGraw-Hill, 1996.
4. S.N.Chary, "**Theory and Problems in Production and Operations Management**", Tata McGraw Hill, 1995

12P7E0 STATISTICAL QUALITY CONTROL AND RELIABILITY ENGINEERING

(Use of approved statistical table permitted in the examination)

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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 cost-Variation in process- factors – process capability – process capability studies and simple problems – Theory of control chart- uses of control chart – Control chart for variables – X chart, R chart and σ chart.

PROCESS CONTROL FOR ATTRIBUTES (08)

Control chart for attributes –control chart for proportion or fraction defectives – p chart and np chart – control chart for defects – C and U charts, State of control and process out of control identification in charts.

ACCEPTANCE SAMPLING (09)

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.

LIFE TESTING - RELIABILITY (09)

Life testing – Objective – failure data analysis, Mean failure rate, mean time to failure, mean time between failure, hazard rate, system reliability, series, parallel and mixed configuration – simple problems. Maintainability and availability – simple problems. Acceptance sampling based on reliability test – O.C Curves.

QUALITY AND RELIABILITY (09)

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 HOURS

Text Books

1. Grant, Eugene.L “Statistical Quality Control”, McGraw-Hill, 7th edition, 2008..
2. L.S.Srinath, “Reliability Engineering”, Affiliated East west press, 1991.

Reference Books

1. Monohar Mahajan, “Statistical Quality Control”, Dhanpat Rai and Sons, 2001.
2. R.C.Gupta, “Statistical Quality control”, Khanna Publishers, 1997.
3. Besterfield D.H., “Quality Control”, Prentice Hall, 1993.
4. Sharma S.C., “Inspection Quality Control and Reliability”, Khanna Publishers, 1998.
5. Danny Samson, “Manufacturing and Operations Strategy”, Prentice Hall, 1991
6. Connor, P.D.T.O., “Practical Reliability Engineering”, John Wiley, 1993.

12P7E1 BASIC FRENCH AND INITIATIVE TO GERMAN LANGUAGE*(Common to Mechanical)*

L T P C

3 0 0 3

BASIC FRENCH DOSSIER O**(5)**

Rencontres, presentations , nationalities - saluer, vous excuser, vous presenter - demander et donner votre identite - computer et peeler des mots - les verbes etre, avoir et s' appeler, au present (singulier) des noms et des adjectives au singulier - C'est + nom ou pronom - // est + adjective - La negation ne... pas - Des phrases interrogative.

DOSSIER 1**(5)**

l' arrivee en France - une inscription (a un club de cyclotourisnce) - ce qu' on dit en classe (consignes) - Vous informer sur l' identite d'une personne - distinguer les formes – familiares et les formes de politesse - des articles et des adjectives possessifs, au singulier - des mots interrogatifs: quell (adjective), qui (pronoun) ou, comment (adverbs) - des noms de professions.

DOSSIER 2**(5)**

La famille - quelques personagers celebres - presener votre famille et des amis - dire ou sont les gens et d'ou ils viennent - les verbes en-er, etre, avoir, faire et venire au present - le plural des noms, des adjectives, des articles et des adjectives possessifs - la negation ne ... pas de + nom - l' interrogation avel est – ce que - a, an et de + nouns de villes et de pays.

DOSSIER 3**(10)**

Maisons et appartements - demenagements, locations, petites annonces – monuments parisiens - situer des meubles et des objects (la localisation) - indiquer la possession - donner des orders et des interdictions - exprimer l' accord et le refus-les verbes en-er, faire, prendre et nettre, au present et a l' imperative - le pronom on - les pronoms toniques après preposition - les adjectives demonstratifs - les adjectives ordinaux - la response si - il ya ... un / des.

INITIATIVE TO GERMAN LANGUAGE INTRODUCTION**(10)**

Alphabets, Greetings, Vocabulary, Grammar – Pronouns, Verbs and their conjugations, Articles, Question words, Statements and questions, Negation, Countries, Nationalities and Languages. Simple dialogues, Exercises.

POSSESSIVE PRONOUNS**(10)**

Family, Professions, the verb 'sein', Number system, Nouns – singular and plural. Imperative statements. A small text and dialogues related to family. Exercises

More irregular verbs, Accusative and dativ declensions of pronouns and articles. Modal verbs and their related grammatical structure. Dialogues and usages of modal verbs. Exercises.

Time and time related particles. Daily routines, related verbs and question words. Related vocabulary and grammar. Sample dialogues and exercises.

Separable and inseparable verbs and their related usage pattern. Invitations and telephone conversations. Exercises.

FINAL EXAM – Hearing, Oral and Written)

TOTAL: 45

Text Books

1. *Capelle, Guy and Gidon, Noelle. Le Nouvel Escapes. Paris: Hachette Livre, 1998.*
2. *Tangram Aktuell 1 (Deutsch als Fremdsprache) - Rosa - Maria Dallapiazza, Eduard von Jan, Til Schönherr - Max Hueber Verlag, 2004.*
3. *Lernziel Deutsch - Wolfgang Hieber - Max Hueber Verlag, 1983*
4. *Grundkurs Deutsch - Roland Schäpers, Renate Luscher , Manfred Glück, 1980*

12P7E2 DESIGN FOR MANUFACTURE AND ASSEMBLY

L T P C

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DESIGN PRINCIPLE**(9)**

Economics of process selection – general design principles of manufacturability – proper material selections – strength and mechanical factors – Geometric tolerances – Design for serviceability – Tolerance Charting Techniques. General aspects of the designers work - design factors – systematic working plan – basic design.

FORM DESIGN**(9)**

Factors affecting casting design - Grey iron castings, steel castings, malleable iron castings – Non ferrous alloys: Aluminium castings – Pressure die castings – factors affecting weldment design – Gas and Arc welding.

FORMED METAL COMPONENTS AND NON-METALLIC PARTS DESIGN**(8)**

Metal extrusion – cold headed parts – fine blanking – Tube and section bends – powder metal parts – thermo setting plastic parts – reinforced - plastic/composite parts.

MACHINED COMPONENTS DESIGN**(10)**

Design for machinability – design for economy – design for clampability – design for accessibility. Turned parts – drilled parts – milled parts, planned, shaped and slotted parts – Ground parts – parts produced by EDM.

TECHNOLOGY REQUIREMENT AND ASSEMBLY**(09)**

Product design requirements for group technology concepts and CNC machining – part family concept – mechanical assemblies – general recommendations - design rules for rivets, screw fasteners, gaskets and seals. Press and snap fits.

TOTAL: 45HOURS***Text Books***

1. James G.Bralla, *Hand book of product design for manufacture*, Mc Graw Hill Book Co., Second edition, 1999.
2. Robert Matousek, *engineering Design – A systematic approach*, Blackie and Son Ltd, London.
3. Geoffrey Boothroyd, Peter Dewhurst, Winston A. Knight - *Product design for manufacture and assembly*, Taylor and Francis group, 2011.

Reference Books

1. Harry Peck, *Design for manufacture*, Pitman publications, 1983.
2. Trucks H.E., *Design for Economic Production*, Society of Manufacturing engineers, Michigan 2nd Edition 1987.
3. Karl T.Ulrich and Steven D Eppinger, *Product Design and Development*, Tata McGraw Hill, 3rd edition, 2008.
4. Oliver R.Wade, *Tolerance Control in design and Manufacturing*, Industrial Press Inc., New York Publications, 1967.

12P7E3 PATENT SYSTEM FOR ENGINEERING

L T P C
3 0 0 3

BASICS OF PATENT SYSTEM

(9)

Patents as intellectual property- Trademarks –Copy rights – Trade Secrets-Patents -The evolution of a patent – 3 stages- conception to patent application-The patent application-The prosecution - The U.S. Patent System-The Canadian patent system - Importance of record-keeping .

BASIC PRINCIPLES OF PATENT SEARCHING

(9)

Patentability search-Infringement search-Validity search -Assignment search -Maintenance fee search. Searches after defining problem area -Hand search-Computer search-Literature search-Watch searches – hand searching – computer searching.

EVALUATION CRITERIA FOR PATENT SYSTEM

(9)

Patents and Innovation-**Evaluation Criteria's:** Accommodating New Technologies-Ensuring High-Quality Patents- Disseminating Technical Information- Ensuring the Timeliness and Containing the Costs of Decisions- Accessing Technologies for Research and Development- Reducing Redundancies and Inconsistencies among National Patent Systems- Maintaining a Level Field among Rights Holders.

PATENT LAW

(9)

overview: Patent – inventor benefits- patent applying procedure –approval of patent application – patent expiry –patent protection . **Definitions:** Antitrust law and patents – Bayh –Dole act – Independent and dependent claims – classification of patents – duration of patents – licensing of invention – patent application – PAD.

RECOMMENDATIONS OF PATENT SYSTEM

(9)

Seven Recommendations For A 21st-Century Patent System: Preserve a Flexible, Unitary, Open-Ended Patent System-Reinvigorate the Non-Obviousness Standard – Institute a Post-Grant Open Review Procedure-Strengthen USPTO Capabilities-Shield Some Research Uses of Patented Inventions from Infringement-Limit the Subjective Elements of Patent Litigation –Harmonize the U.S., European, and Japanese Patent

TOTAL: 45HOURS

Text Books

1. Thomas T. Gordon Arthur S. Cookfair, *Patent Fundamentals for Scientists and Engineers*, Lewis publishers, second edition, 2000.

Reference Books

1. Stephen A. Merrill, Richard C. Levin, and Mark B. Myers, *Patent system for the 21st century*.
2. Attorneys Stephen Elias and Richard Slim, *Patent Copy right and Trademark –An intellectual property Desk Reference*

12P7E4 COMPOSITE MATERIALS*(Common to Mechanical)*

L T P C

3 0 0 3

INTRODUCTION TO COMPOSITE MATERIALS (9)

Types and characteristics of composite materials-Mechanical behavior-Basic terminology and Manufacture of laminated fiber-Reinforced composite materials-Current and potential advantages-Applications of composite materials.

REINFORCEMENT AND MATRICES (9)

Different types of fibers-Properties and applications of fibers-Roll of matrix-Matrix materials, Selection of matrix-Thermoset matrix-Thermoplastic matrix, Fiber architecture.

INTRODUCTION TO COMPOSITE STRUCTURES DESIGN (9)

Elements of Design-Steps in design process-Elements of analysis in design-Analysis iterations-Design analysis stages-Material selection-Configuration selection-Laminate joints-Design requirements and design failure criteria.

MANUFACTURING OF ADVANCED COMPOSITES (9)

Bag-Molding process-Compression molding-Pultrusion-Filament winding-Liquid composite molding processes-Resin film infusion-Elastic reservoir molding-Tube rolling-Forming methods for thermoplastic matrix composites.

METAL, CERAMIC AND CARBON MATRIX COMPOSITES (9)

Metal matrix composites-Manufacturing processes-Ceramic matrix composites-Mechanical properties-Manufacturing processes-Carbon matrix composites-Fabrication methods-Applications.

TOTAL: 45***Text Books***

1. Krishnan K. Chawla , “*Composite Materials Science and Engineering*”, Springer (India) Private Limited, 2009
2. P.K.Mallick , “*Fiber Reinforced Composite materials, Manufacturing and Design*”,CRCPress,Taylor and Francis Group,Boca Raton,London,Newyork 2010
3. A.K.Bhargava, “*Engineering Materials: Polymers, ceramics and composites*”, Pentice Hall of India Limited, 2005.

Reference Books

1. Madhujit Mukhopadhyay , “*Mechanics of Composite Materials and Structures* “, Universities Press (India) Private Limited, 2009.
2. Robert M.Jones, “ *Mechanics of Composite Materials*”, Taylor & Francis Group, 2010.
3. Web Portal: Composite Materials{Nptel 3.1.2 Civil Engineering}

12P7E5 SUPPLY CHAIN MANAGEMENT

(Common to Mechanical)

L T P C

3 0 0 3

INTRODUCTION

(9)

Supply chain – Objectives, Importance, Decision phases- Process view of supply chain-Competitive and supply chain strategies-achieving strategic fit - drivers of supply chain performance - framework for structuring drivers – conceptual model of SCM-evolution of SCM-SCM approach: Traditional, modern- new corporate model.

SUPPLY CHAIN NETWORK

(9)

The role of distribution in the supply chain-Factors influencing distribution network design-Design options for a distribution network-the role of network design in the supply chain-factors influencing network design decisions-models for facility location and capacity allocation-the role of IT in network design-the impact of uncertainty on network design-discounted cash flow analysis-evaluating network design decisions using decision trees.

OPERATION, PROCUREMENT MANAGERMENTS IN SUPPLY CHAIN

(9)

Basic principles of manufacturing management-key concepts in lean manufacturing-lean manufacturing and SCM-Lean introduction to supply chain-Integration of lean manufacturing and SCM-Mass customization-SCM for mass customization-Benefits and disadvantages of mass customization-Purchasing cycle-Traditional Inventory Management-Inventory Models-EOQ-New paradigms in inventory and purchase management-Material requirements planning.

LOGISTICS MANAGEMENT

(9)

Evolution of Logistics-Elements of Logistic management-Distribution management-Inventory management-Transportation management-Fleet Management-Containerisation-Warehousing-Warehouse Automation-Warehouse management systems-3PL-4PL-Technology component of 4PL.

INFORMATION TECHNOLOGY FOR SCM

(9)

IT applications in SCM-advanced planning and scheduling-data mining-data mining tools in SCM-supply chain IT framework-customer relationship management-Internal supply chain management-supplier relationship management-Lack of supply chain Coordination and Bullwhip effect-Effect on performance of lack of Coordination-Collaborative planning, Forecasting, and Replenishment(CPFR)-Role of IT in Coordination.

TOTAL: 45

Text Books

1. Sunil Chopra., Peter Meindl., “**Supply Chain Management:Strategy,Planning,andOperation,**” Pearson Education, Inc., 3rd edition, 2007.
2. Rahul V Altekar, “**Supply Chain Management – Concepts and Cases**”, PHI., New Delhi, 2005.

Reference Books

1. Nicolas, J.N., “**Competitive Manufacturing Management – ContinuousImprovement, Lean Production, Customer focused quality**”, McGraw Hill, 1998.

2. Ayers, J.B., **“Hand book of supply chain management”**, The St. Lencie press, 2000.
3. Scharj, P, B., Lasen, T.S., **“Managing the global supply chain”**, Viva books”, New Delhi, 2000
4. Simchi – Levi Davi, Kaminsky Philip and Simchi-Levi Edith, **“Designing and Managing the Supply Chain”**, Tata McGraw Hill, New Delhi, 3rd edition, 2007.
5. Thomas E Vollman and Clay Whybark D, **“Manufacturing Planning and Control for Supply Chain Management”**, Tata McGraw Hill, New Delhi, 2005.

12P7E6 HUMAN VALUES AND PROFESSIONAL ETHICS

(Common to Mechanical)

L T P C
3 0 0 3

HUMAN VALUES (9)

Morals, Values and Ethics – Integrity – Work Ethic – Service Learning – Civic Virtue – Respect for Others – Living Peacefully – caring – Sharing – Honesty – Courage – Valuing Time – Co-operation – Commitment – Empathy – Self-Confidence – Character – Spirituality

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 – Models of Professional Roles - theories about right action - Self-interest - customs and religion - uses of ethical theories.

ENGINEERING AS SOCIAL EXPERIMENTATION (9)

Engineering as experimentation - engineers as responsible experimenters - codes of ethics - a balanced outlook on law - the challenger case study

SAFETY, RESPONSIBILITIES AND RIGHTS (9)

Safety and risk - assessment of safety and risk - risk benefit analysis and reducing risk - the three mile island and chernobyl case studies.

Collegiality and loyalty - respect for authority - collective bargaining - confidentiality - conflicts of interest - occupational crime - professional rights - employee rights - Intellectual Property Rights (IPR) - discrimination.

GLOBAL ISSUES (9)

Multinational corporations - Environmental ethics - computer ethics - weapons development - engineers as managers-consulting engineers-engineers as expert witnesses and advisors -moral leadership-sample code of Ethics like ASME, ASCE, IEEE, Institution of Engineers (India), Indian Institute of Materials Management, Institution of electronics and telecommunication engineers (IETE),India

TOTAL : 45

Text Books

1. Mike Martin and Roland Schinzinger, **“Ethics in Engineering”**, McGraw-Hill, New York, 3rd edition, reprint 2007.
2. Govindarajan M, Natarajan S, Senthil Kumar V. S, **“Engineering Ethics”**, Prentice Hall of India, New Delhi, 2004.
3. Tripathi A N, **“Human values”** , New Age international Pvt. Ltd., New Delhi, 2002

Reference Books

1. Charles D. Fleddermann, **“Engineering Ethics”**, Pearson Education / Prentice Hall, New Jersey, 2004 2. Charles E Harris, Michael S. Protchard and Michael J Rabins, **“Engineering Ethics – Concepts and Cases”**, Wadsworth Thompson Learning, United States, 2000 .
3. John R Boatright, **“Ethics and the Conduct of Business”**, Pearson Education, New Delhi, 2003.
4. Edmund G Seebauer and Robert L Barry, **“Fundamentals of Ethics for Scientists and Engineers”**, Oxford University Press, Oxford, 2001.

12P7E7 ROBUST DESIGN

L T P C

3 0 0 3

INTRODUCTION TO QUALITY BY DESIGN**(9)**

Introduction - goal post philosophy – Taguchi loss function – comparison of philosophies - basics of quality by design - Taguchi's definition of quality- -reducing loss -classification of data types - quality characteristics - selection.

DESIGN PROCESS**(9)**

Introduction - comparison of the classical and Taguchi's approach - objective of engineering design - variability due to noise factors - examples of noise - role of various quality control activities - product design and quality control - prediction of the process average under optimum condition.

ORTHOGONAL ARRAYS AND MATRIX EXPERIMENTS**(9)**

Introduction- matrix experiments - orthogonal arrays – degrees of freedom of orthogonal arrays – interaction effects - selecting an orthogonal array – prediction of the process average – sliding levels

SIGNAL-TO-NOISE RATIO**(9)**

Signal-to-noise (SN) ratio for static problems - SN ratio- operating window-Relation ship between SN ratio and quality loss and its applications - simple problems in optimisation.

CONDUCTING AN EXPERIMENT**(9)**

Introduction to analysis of variance - classification of experimental design – randomized block design – completely randomized design – two level factorial experiments - robust Design Experiment - selection of orthogonal array – planning the experiments — analysis of signal – to - noise ratios – analysis of experiments.

TOTAL: 45***Text Books***

1. Philip J Rose, *Taguchi techniques for quality engineering*, Prentice Hall, 2005.
2. Nicolo Belavendram, *Quality by Design, Taguchi techniques for Industrial experimentation*, Prentice Hall, 1995.
3. Montgomery D.C., 2001, *Design and Analysis of Experiments*, 5th Edition, John Wiley and Sons, NewYork.

Reference Books

1. Sung H Park, *Robust Design and Analysis for Quality Engineering*, Chapman and Hall, London, 1996.
2. Giani Taguchi, Elssayed A. Elsayed, Thomas C. Hsiang, *Quality Engineering in Production Systems*, Mc Graw Hill Book Company, 1989.
3. Genichi Taguchi, Subir Chowdhury and Shin Taguchi, *Robust Engineering*, McGraw Hill, New York, 2000.

12P7E8 SURFACE ENGINEERING

L T P C

3 0 0 3

FUNDAMENTALS OF SURFACE ENGINEERING.

(09)

Topography of Engineering surfaces - Importance and necessity of surface engineering - Contact between surfaces, Classification and scope of surface engineering in metals – ceramics - polymers and composites, Tailoring of surfaces of advanced materials. Surface protection (Physical) - Surface dependent engineering properties, viz., wear, friction, corrosion, fatigue, reflectivity, and emissivity. Common surface initiated engineering failures - mechanism of surface degradation.

VARIOUS SURFACE CLEANING PROCESSES.

(09)

General cleaning process for ferrous - non ferrous metals and alloys, Classification and Selection of Cleaning processes - Acid and Alkaline - Salt bath - emulsion cleaning – Ultrasonic - Mechanical cleaning - Pickling and de-scaling Process - Abrasive bath cleaning - polishing and buffing, shot peening – Applications

SURFACE TREATMENT TECHNIQUES.

(09)

Surface modification techniques - classification, principles, methods, and technology used, conventional surface engineering methods - Diffusion coatings like carburizing – nitriding – cyaniding - hot dipping – galvanizing – anodizing – Aluminizing – Phosphetising – Passivation. Thermal spraying - Vapour deposition - ion implantation, Diamond and Diamond like carbon thin films and coatings for engineering surfaces. Diffusion bonding.

THIN LAYER ENGINEERING PROCESSES.

(09)

Other processes used in surface engineering - Laser and Electron Beam hardening - Effect of process variables such as power and scan speed – Physical vapor deposition (PVD) - Chemical vapor deposition (CVD) - Thermal evaporation - Arc vaporizations - Sputtering, Coating of tools, TiC, TiN, Al₂O₃ and Diamond - coating properties and applications of thin coatings. Surface engineering problems related to substrate characteristics. Plasma enhanced surface engineering

EVALUATION, TESTING AND SELECTION OF COATINGS.

(09)

Measurement of mechanical properties of engineered surface in nano scale, Evaluation of tribological characteristics of engineered surface in macro - micro and nano scale, Surface geometry – characterization techniques, the quality plan - design - testing and inspection - thickness and porosity measurement - adhesion measurement – selection of coatings - Industrial applications of engineering coatings.

TOTAL: 45 HOURS

Text Books

1. Bharat Bhushan, “Introduction to Tribology”, JohnWiley and sons, newyork, 2002.
2. K. Chopra, L. Malhotra Thin film deposition – McGraw Hill.

Reference Books

1. Frank Philip Bowden, “The Friction and Lubrication of Solids”, Oxford Classic Texts, 2011.
2. Gwidon Stachowiak, A W Batchelor, “Engineering Tribology”, 3rd edition, Elsevierine, 2005.
3. ASM Hand Book, Vol. 5, “Surface Engineering”.
4. Tool and Manufacturing Engineers Hand book, Vol.3, ‘Materials Finishing and Coating
5. Kammeth G. Budinski, “Surface Engineering for Wear resistance” Prentice Hall,

12P7E9 PLANT LAYOUT AND MATERIAL HANDLING*(Common to Mechanical)*

L T P C

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INTRODUCTION**(09)**

Factors to be considered for location of plant layout - physical facilities - equipments required for plant operation. Capacity, serviceability and flexibility and analysis in selection of equipments space requirements, man power requirements.

PLANT LAYOUT**(09)**

Plant layout - need for layout, factors influencing product, process, fixed and combination layout - tools and techniques for developing layout, process chart, flow diagram, string diagram, template and scale models machine data. Layout planning procedure. Visualization of layout revision and improving existing layout, balancing of fabricating and assembly lines.

MATERIAL HANDLING**(09)**

Principles, importance and scope of material handling. Planning, operation and costing principles types of material handling systems, factors influencing their choice.

UTILITIES**(09)**

Industrial buildings and utilities - centralized electrical pneumatic water line systems. Types of building, lighting heating, air conditioning and ventilation utilities. Planning and maintenance, waste handling statutory requirements. Packing and storage of materials - layout for packaging packaging machinery wrapping and packing of materials, cushion materials.

ANALYSYS OF MATERIAL HANDLING EQUIPMENTS**(09)**

Analysis of material handling - factors involved, motion analysis, flow analysis, graphic analysis, safety analysis, and equipment cost analysis, analysis of operation material handling surveys.

TOTAL: 45 HOURS***Text Books***

1. James, M. Apple, *Plant layout and material handling*, Ronald, 1977.
2. Rudenko. N., "**Materials handling equipment**", ELNvee Publishers, 1970.
3. Immer, I.R. *Material Handling*, McGraw-Hill Book Co, 1953.

Reference Books

1. Shubin and Madeheim, *Plant Layout*, Prentice-Hall of India, 1965.
2. James Moore, M., *Plant Layout and Design*, the Macmillan Company, 1963.
3. Richanrd Muther, *Practical Plant Layout*, McGraw Hill Ltd, 1955.

12P8E0 RISK ANALYSIS AND RISK MANAGEMENT

L T P C

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RISK MANAGEMENT

(09)

Risk definition; Types of risk; hazards- types: Business Structures; Principles of risk management; risk factors- types; management strategies– Planning – resources- action;

IDENTIFICATION OF RISKS AND HAZARDS

(09)

Identifying Risks Factors –Identifying the hazards; Risk Assessment; Risk factors; Evaluation of Risk Occurrence; Evaluation of hazards;

CONTROL OF RISKS

(09)

Control of Risks – Control Measures Physical Controls, Behavioral Controls, Organizational And Procedural Controls- Systems Of Control - Employment Controls, Legislative Controls, Security Controls, Competitive Controls, Financial Controls ;Results Of Risks – Victims Of Hazards – Rating Of Potential Harm—Deciding Priorities For Action.

RISK ANALYSIS

(09)

Risk analysis-definition-Types; Monte Carlo Risk Analysis – Probability Risk Analysis; uses:

Economics: Applying Economic Principles to Risk: Risk–Benefit Analysis (RBA), Comparative Risk Analysis (CRA), Benefit–Cost Analysis (BCA); Uncertainty in risk analysis; advantages; limitations.

REGULATIONS AND APPLICATIONS OF RISK MANAGEMENT

(09)

Use of Formal Management System Standards (MSS) - Quality MSS, Environmental MSS, OH and S Standards. Applications- Case Studies – Health Service, Engineering, Manufacture - Strategic Considerations for Case Study Firms;

TOTAL: 45 HOURS

Text Books

1. *Risk Management 10 Principles*, Jacqueline Jeynes, Buterworth Heinmann, 2002.
2. *Fundamentals of Risk analysis and Risk management*, Vlasta Molak, Lewis Publishers, 1997.

12P8E1 ADVANCED WELDING TECHNOLOGY

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SOLID STATE WELDING PROCESSES: (9)

Fundamental principles, review of the various pressure welding processes and their applications. Friction, explosive, diffusion, and Ultrasonic welding – principles of operation, process characteristics and application.

HIGH ENERGY BEAM WELDING: (9)

Heat generation and regulation - Equipment details in typical set-up - Electron beam welding in different degrees of vacuum - advantages and disadvantages, applications.

Laser Welding: Principles of operation, advantages, and limitations, applications.

ELECTRO SLAG WELDING: (9)

Heat generation, principles of operations, wire and consumables, guide techniques, selection of current, voltage and other process variables, nature of fluxes and their selection.

Electro-gas welding: Principle and applications, Narrow gap welding,

PLASMA ARC WELDING: (9)

Special features of plasma arc- transferred and non transferred arc, key hole and puddle-in mode of operation, micro, low and high current plasma arc welding and their applications, plasma cutting, surfacing and applications.

OTHER WELDING PROCESSES: (9)

Adhesive bonding and Welding of plastics, Cold pressure welding, High frequency Welding, Stud welding, Under Water welding, Welding automation.

TOTAL : 45 HOURS**Text Books**

1. Parmer R.S., *“Welding Engineering and Technology”*, Khanna Publishers, New Delhi, 1st edition, 2008.
2. Parmer R.S., *“Welding Processes and Technology”*, Khanna Publishers, New Delhi, 1992.
3. Little R.L., *“Welding and welding Technology”*, Tata McGraw Hill Publishing Co., Ltd., New Delhi, 34th reprint, 2008.

Reference Books

1. Schwartz M.M. *“Metals Joining Manual”*. McGraw Hill Books, 1979.
2. Tylecote R.F. *“The Solid Phase Welding of Metals”*. Edward Arnold Publishers Ltd. London.
3. AWS- *Welding Hand Book. 8th Edition. Vol- 2. “Welding Process”*
4. Nadkarni S.V. *“Modern Arc Welding Technology”*, Oxford IBH Publishers, 1st edition, 2005.
5. Christopher Davis. *“Laser Welding- Practical Guide”*. Jaico Publishing House.
6. Davis A.C., *“The Science and Practice of Welding”*, Cambridge University Press, Cambridge, 1993

12P8E2 MICRO AND NANO MANUFACTURING

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INTRODUCTION TO NANO MANUFACTURING (08)

Introduction – top down approach – bottom up approach – combined approach – registration and alignment – reliability and defect control – trends in nano manufacturing – large scale surface-programmed assembly.

CARBON NANO TUBES (10)

Fabrication of singled walled nano tube fabrics – Preparation of SWNT Solutions - Wafer Coating of SWNT Fabrics - Qualification of SWNT Fabrics with CMOS Processing – applications of SWNT Fabrics. Carbon Nanotube Synthesis - Building Organized MWNT Architectures - Mechanism of Substrate Site Selectivity of Carbon Nanotubes - Building Controlled SWNT Networks on a Large Scale - Fabrication of Hierarchically Branched Carbon Nanotubes Using Controlled Nano channels in Templates.

MICRO AND NANO FABRICATION (09)

Introduction – Microfabrication. Nanofabrication - Nanofabrication Using Soft Lithography - Manipulative Techniques - Carbon Nanomaterials. Internal (Polymer–Polymer) Interface - Interfacial Instability in Nanolayer – Controlled Phase Separation in a Polymer. External (Polymer–Tool) Interface - Electric Field Effects on Polymer - Interfacial Effects in the Formation of Molded.

MICROFABRICATION USING X-RAY LITHOGRAPHY (09)

Introduction - X-Ray Lithography Synchrotron Radiation (SR) - Micro fabrication Process LIGA Process - Lithography Steps - X-Ray Lithography - X-Ray Masks - Mask Materials - Single-Layer Absorber Fabrication - Alignment of X-Ray Mask to Substrate - Masks for High-Aspect Ratio Microlithography - Choice of Resist Substrate - Resist Requirements - Methods of Resist Application - Multiple Spin Coats - Commercial PMMA Sheets - Casting of PMMA - Resist Adhesion - Stress-Induced Cracks in PMMA – Exposure - Optimal Wavelength - Deposited Dose - Stepped and Slanted Microstructures - Master Micromold Fabrication Methods. Etching - Micromachining High-Aspect Ratio Microstructures – Micromolding.

PRECISION, LASER BASED MICRO NANO FABRICATION (09)

Grinding Wheel - Conventional Grinding - Precision Grinding Processes - Ultraprecision Grinding - Nanogrinding. Laser based micro and nano fabrication : Laser Fundamentals - Beam Characteristics - Laser Optics - Laser Microfabrication.

TOTAL: 45

Text Books

1. Ahmed Bushnaina, *Nano Manufacturing Hand Book*, Taylor and Francis Group, CRC press New york, 2006.
2. Mark J. Jackson, *Microfabrication and Nanomanufacturing*, Taylor and Francis Group, CRC press, New york, 2006.

Reference Books

1. Roco, M.C., *Nanoscale science and engineering: unifying and transforming tools*, AlChE J. 2004.
2. Narasimhan, J. and Papautsky, J., *Micro mechanical, Micro engineering*, 2004.

12P8E3 INDUSTRIAL SAFETY ENGINEERING

L T P C

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SAFETY CONCEPT**(09)**

Evolution of modern safety concept- History of safety movement- influence of environmental safety –Hazards –safety policy –safety survey, safety inspection safety culture and Behavioral safety

ACCIDENT INVESTIGATION AND REPORTING**(09)**

Concept of an accident, reportable and non reportable accidents- principles of accident prevention- accident investigation and analysis- documentation of accidents- unsafe act and unsafe condition- domino sequence- role of safety committee and cost of accident.

SAFETY EDUCATION AND TRAINING**(10)**

Importance of training – training methods- method of promoting safe practice-motivation-role of government agencies and private consulting agencies in safety training- Creating awareness- safety posters, safety displays ,safety pledge, safety incentive scheme , safety campaign

SAFETY MANAGEMENT**(09)**

General concept of safety management-National Safety Council-OSHA,their roles in safety propagation-Evolution of modern safety concept-planning for safety for optimization of productivity-line and staff functions for safety-safety sampling.fault tree analysis.

SAFETY AUDIT AND SAFETY REGULATION**(08)**

Components of safety audit, types of audit, audit methodology, non conformity reporting(NCR),audit checklist and report-review of inspection, safety measures in factories act, pollution control act for water, air, land . OSHAS18001, ISO14001

TOTAL : 45 HOURS***Text Books***

1. Heinrich H.W. “Industrial accident Prevention”McGraw-Hill company,New york,1980.
2. Krishnan N.V.”safety management in Industry” jaico Puplicing House,Bombay,1997.

Reference Books

1. Dan Petersen,”Techniques of Safety Management”,Mc Graw-Hill Company,Tokyo 1981
2. “Accident Prevention Manual For Industrial Operations”,N.S.C Chicago,1982.

12P8E4 IMAGE PROCESSING IN MANUFACTURING

L T P C
3 0 0 3

COMPUTER VISION

(09)

Computer Imaging. Computer Vision and Image Processing. Human Visual Perception. Image Representation. Image Geometry. Sampling and Quantization. Levels of computation; Point level, Local level, Global level and object level. Digital Image Properties.

IMAGE ACQUISITION

(09)

Charge coupled devices: Principle, Surface channel CCD.s, Buried channel CCD.s, sensitivity and resolution, Noise and Hot Pixels, Blooming, Image Smear, Linear CCD Sensors, Image Sensors . Line scan cameras. CMOS image sensors. Video standards. Colour images: various colour models. Other Image Sources: Ultrasound imaging devices, computer tomography, Magnetic resonance imaging. Optics: Lens equation, Image resolution, Depth of field, View volume and Exposure.

IMAGE DISTRIBUTION

(09)

Frame Grabbing. Camera interfaces and protocols. Compression Techniques. Lossless compression: Run Length Encoding, Huffman coding, Arithmetic coding - Lossy compression: Discrete cosine transform, JPEG coding, Discrete wavelet transform. Image Standards: BMP, GIF, TIFF, PNG, PCX, JPG, DICOM standard.

IMAGE PROCESSING

(09)

Gray scale operations: Histogram, Look up tables. Spatial Image filtering: smoothing, Guassian, Gradient, Laplacian . Frequency Filtering: FFT, Morphology Functions: Thresholding, Binary Morphology and Gray level Morpology.

IMAGE ANALYSIS

(09)

Pixel value analysis: Line profile, Quantify areas, Centroid function, Linear averages, Edge detection and enhancement, Segmentation and labeling. Quantitative analysis: Counting objects, Measuring Distances, Complex particle measurements. Image calibration. Pattern matching techniques. Character recognition. Applications in Manufacturing.

TOTAL: 45 HOURS

Text Books

1. Ramesh Jain., Rangachar Kasthuri, Brian Gschunch, .machine Vision., McGraw Hill International Edition, 1995.
2. Thomas Klinger, .Image processing with LabView and IMAQ Vision. Prentice Hall.
3. Scott E Umbaugh, .Computer Vision and Image Processing : A Practical approach using CVIP tools., Prentice Hall International Inc.

Reference Books

1. Milan Sonka, Vaclav Hlavac, Roger Boyle, .Image Processing, Analysis and Machine Vision., PWS Publishing, 1995.
2. Rafeal C Gonzalez, Richard E Woods, .Digital Image Processing., Second Edition, Pearson Education, 1992.
3. Janaki Raman P.A., .Robotics and Image Processing., Tata McGraw Hill, 1995.

12P8E5 INTELLIGENT MANUFACTURING SYSTEMS

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COMPONENTS OF EXPERT SYSTEMS**(09)**

Expert system concept – comparisons – stages in Expert system - Knowledge Representation – Types - comparison of Knowledge Representation Schemes – Inference engine – Inference models – Forward, backward chaining - Knowledge acquisition – Optimization and Knowledge based systems

INTELLIGENT MANUFACTURING**(09)**

Machine Learning - Intelligent Manufacturing – System Components – System architecture and Data flow – System operation – Flexible Assembly Systems – Tool management.

TECHNOLOGY BASED SYSTEMS**(09)**

Design of mechanical parts – Refinement Approach – Model based approach – Design of mechanisms – Feature based design – Knowledge based design for Automated Assembly – Process planning – Feature recognition – Machining Optimization – Knowledge Based Systems.

KNOWLEDGE BASED SYSTEM FOR GROUP TECHNOLOGY**(09)**

Models and Algorithms – Cluster Analysis Method – Knowledge based systems for GT – Models and Algorithms for Machine layout – Knowledge based Systems for machine layout – scheduling - Models and Algorithms – Knowledge Based Systems.

INDUSTRIAL APPLICATION AND RECENT ADVANCES**(09)**

Industrial application of Artificial Intelligence and Expert systems – Robotic vision systems, image processing techniques – application to object recognition and inspection - Application of Artificial Neural Networks – Fuzzy Logic and Genetic Algorithms in manufacturing – ANN for tool wear monitoring – Fuzzy control of machine tools.

TOTAL: 45 HOURS**Text Books**

1. Andrew Kusiak, “*Intelligent Manufacturing Systems*”, Prentice Hall, 1998.
2. Mohammed Jamshidi, “*Design and Implementation of Intelligent Manufacturing systems*”, Prentice Hall, 1995.

Reference Books

1. Mitsugen, Runweicheng, “*Genetic Algorithms in Engineering Design*”, JohWiley, 1997
2. Elaine Rich, “*Artificial Intelligence*”, TMH, 1995.
3. Ibrahim Zeid, “*CAD/CAM Theory and Practice*”, McGraw Hill, 1998.
4. Robert Levine et al; “*A Comprehensive guide to AI and Expert Systems*”, McGraw Hill Inc, 1986.

12P8E6 PRECISION ENGINEERING

(Common to Mechanical)

L T P C

3 0 0 3

FUNDAMENTALS OF PRECISION ENGINEERING

(08)

History of precision engineering- principles and definitions of precision machine design-prototyping and full production from ultra precision machining through micro-engineering-microelectronics and molecular manipulation- application of displacement transducers to machines and instruments- tolerance technology.

ULTRAPRECISION AND MICROMACHINING PROCESSES

(10)

Atomic structure- electrical and physical properties of atoms- diamond turning, grinding and polishing- effects of tooling, material and the environment on the surface characteristics of workpieces - material removal using electron, photon, ion beams - molecular beam epitaxy, chemical and physical vapour deposition- advanced sputtering and ion-implantation-deposition techniques- process controls and film characteristics.

PRECISION MECHANISM DESIGN

(10)

Fundamental concepts in designing precision machinery - metrological instrumentation, ultra-precision motion generators and precision assembly- flexure mechanisms for precision engineering- mechanics of contact, kinetic coupling, vibration isolation and material selection- actuators and sensors to control mechanisms- manufacturing of micron scale machinery and structures using non- conventional processes.

OPTICAL ENGINEERING

(09)

Coherent optics - fibre optics - geometrical optics - paraxial optics, monochromatic and chromatic aberrations- computer evaluation of optical systems, spot diagrams, MTF- light sources, detectors and imaging systems- industrial laser applications and optical systems- optical interferometry - applications to precision measurement.

PRECISION OF NUMERICAL CONTROL SYSTEMS

(08)

Errors due to numerical interpolation and displacement measurement system – periodic errors - errors due to velocity lags - transient response slide ways friction - feed drive stiffness – zero stability.

TOTAL: 45

Text Books

- 1.Raman. R “*Elements of Precision Engineering*” Oxford and I B H Publishing Co. 1984
- 2.Murty. R.L. “*Precision Engineering in Manufacturing*” New Age International Publishers, 1996.
- 3.Gary. F. Benedict “*Non-traditional Manufacturing Processes*” Marcel Dekker, Inc. New York, 1992.

Reference Books

- 1.Kovan.V, “*Fundamentals of Process Engineering*”, Foreign Languages Publishing House (FLPH), Moscow, 1986.
- 2.Gopel, “*Sensors – A comprehensive Survey*” Vol I to Vol VIII, Second Edition, BCH Publisher, New York, 1999.
- 3.Davidson, “*Handbook of Precision Engineering*”, Vol. 1 and 2, McMillan, 1972.
- 4.Mark J Madou, “*Fundamentals of Micro Fabrication*”, CRC Press, 2002.

12P8E7 PROJECT MANAGEMENT

L T P C
3 0 0 3

PROJECT INTEGRATION MANAGEMENT**(08)**

Project Attributes - Project Management Framework - Project Management Processes and Process Groups - Implementing Project Integration Management - Developing Project Plan - Project Constraints - Managing Change Control – Project Scope Management - Project Scope Vs Product Scope - Planning, Creating, Verifying and Protecting the Project Scope - Tools and Techniques.

PROJECT TIME AND PROJECT COST MANAGEMENT**(10)**

Project Time Management: Defining the Project Activities - Mapping the activities – Project Network Diagrams (PND): Precedence Diagramming method, Arrow Diagramming method, Conditional Diagramming method - Activity Duration Estimates - Developing the Project Schedule - Creating the Project Schedule: PERT, GERT, CPM, Calculating Float in a PND - Controlling the Project Schedule. Project Cost Management: Project Resources and Identifying Resource Requirements - Estimating and analysing of the Project Cost - Project Cost Baseline: S Curve - Implementing Cost Control - Cost Performance Index - Earned Value Management.

PROJECT QUALITY MANAGEMENT**(10)**

Quality Management - Quality Vs Grade - Kaizen technology - Quality Policy - Cost / Benefit Analysis - Cause and Effect Diagram - Process Flow Chart - Quality Management Plan - Quality Assurance - Quality Audit - Quality Control - Control Chart - Pareto Diagrams - Trend Analysis.

PROJECT RISK MANAGEMENT**(10)**

Planning for Risk Management - Stakeholder Tolerance - Work Breakdown Structure - Creating Risk Management Plan - Identifying Risks - Risk Categories - Delphi Technique - SWOT Analysis - Diagramming Techniques - Qualitative Risk Analysis - Probability Impact matrix - Quantitative Risk Analysis - Decision tree Analysis - Risk Responses - Risk Monitoring and Control.

PROJECT PROCUREMENT**(07)**

Project Human Resource Management - Organisational Planning - Maslow's hierarchy - Herzberg's Theory of motivation - McGregor's Theory of X and Y - Ouchi's Theory Z - Staff Management - Organizational Chart - Project Team Management. Project Communications Management - Communication Skills - Communication Matrix - Project Performance - Administrative Closure. Project Procurement - Planning for Procurement - Solicitation Planning - Contract Administration - Contract Closeout.

TUTORIALS**(15)**

Using Project Management Software : Create New Project Plan - Set Non working days - Project Properties - Create and Edit the Task list - Organizing Tasks into Phases - Setup Resources and Costs - Gantt Chart - Track the Progress on Tasks - Review the current tasks of the project - Create Reports.

TOTAL: 45 HOURS

Text Books

1. Joseph Phillips, "**Project Management Professional Study Guide**", McGraw-Hill, USA, 3rd edition, 2010.
2. Claudia Baca, Patti Jansen, *.Project Management Professional Workbook.*, Shreff Publishers.

Reference Books

1. Ralph L. Kleim and Irwin S. Ludin, "*Project Management Practitioners Handbook*"
2. Prasanna Chandra, *.Projects.*, Tata McGraw Hill., 4th edition, 1997.
3. Choudry S., *.Project Management.*, Tata McGraw Hill., 27th edition, 2006.
4. Tim Pyron, *.Special Edition Using Microsoft Office Project 2007"*, Que,
5. Carl Chatfield and Timothy Johnson, "*Microsoft Office Project 2007 Step by Step*", Microsoft Press.
6. Website: <http://www.pmi.org>

12P8E8 LEAN MANUFACTURING*(Common to Mechanical)*

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INTRODUCTION (9)

Objectives of lean manufacturing-key principles and implications of lean manufacturing- traditional Vs lean manufacturing – Lean benefits.

LEAN MANUFACTURING CONCEPTS (9)

Value creation and waste elimination- Major kinds of waste- pull production-different models of pull production-continuous flow-continuous improvement / Kaizen- Worker involvement Part family- Production flow analysis – Composite part concept – Machine cell design -Case studies.

LEAN MANUFACTURING TOOLS AND METHODOLOGIES (9)

Standard work -communication of standard work to employees -standard work and flexibility -visual controls-quality at the source- 5S principles -preventive maintenance-total quality management-total productive maintenance -changeover/setup time -batch size reduction.

VALUE STREAM MAPPING (9)

The as-is diagram-the future state map-application to the factory simulation scenario-line balancing -poke yoka-Kanban – overall equipment effectiveness -JIT - elements of JIT - Kanban system.

IMPLEMENTING LEAN (9)

Road map-senior management Involvement-best practices- reconciling lean with other systems -Toyota production system-lean six sigma-lean and ERP-lean with ISO9001: 2000

TOTAL: 45***Text Books***

1. Michael L George, David T Rowlands, Bill Kastle, “**What is Lean Six Sigma**”, McGraw Hill Inc., New York, 2004.
2. Askin R.G, Goldberg J.B, “**Design and Analysis of Lean Production Systems**”, John Wiley and Sons, New York, 2003.

Reference Books

1. Joseph A De Feo, William W Bearnard Juran Institute **Six Sigma Break Through and Beyond**”, Tata McGraw Hill, New Delhi, 2004.
2. Richard B Chase F Robert Jacobs and Nicholas J Aquilano, “**Operations Management for Competitive Advantage**”, McGraw Hill Inc., New York, Tenth Edition, 2003.
3. Poka - Yoke, “**Improving Product Quality by Preventing Defects**”, Productivity Press, Portland, Oregon, 1993.
4. Micheal Wader, “**Lean Tools: A Pocket guide to Implementing Lean Practices**”, Productivity and Quality Publishing Pvt Ltd, 2002.

12P8E9 PRODUCT DESIGN AND PROCESS ENGINEERING

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PRODUCT ENGINEERING (9)

Nature and scope of product engineering- creative and organizing for product innovation criteria for product success in life cycle of a product, maintainability engineering.

MODELLING AND SIMULATION (9)

Modeling and simulation - The role of models in product design mathematical modeling similitude relations- Weighted property index.

MATERIAL SELECTION (9)

Material selection- Problems of material selection - Performance characteristics of materials- the materials selection process - economics of materials - Cost versus performance relations - Weighted property index.

DESIGN CONSIDERATIONS (9)

Functional and production design - form design - influence of basis design, mechanical loading and material on form design - form design of gray castings, malleable iron castings - Aluminum castings - Pressure die-castings, plastic moulding, welded fabrications, forging and manufacture by machining methods.

AESTHETIC AND ERGONOMIC CONSIDERATIONS (9)

Influence of space, size, weight, etc, on form design, aesthetic and ergonomic considerations -Dimensioning and tolerancing a product - functional production and inspection datum-Tolerance analysis.

TOTAL: 45 HOURS

Text Books

1. Dieter, G.E., *.Engineering design, McGraw Hill, 2012.*
2. Robert Matousek, *.Engineering Design, Blacke and Sons Ltd.*

Reference Books

1. Jones J., *.Design Methods. interscience.*
2. Buhl,H.R *.Creative Engineering design. Iowa state university press, 1960.*
3. Niebel.B.W. and Draper,A.B., *.Product Design and process Engineering, McGraw Hill.*
4. Harry peck, *.Designing for Manufacturing, Sir Issac Pitman and Sons Ltd.*
5. Gladman, C.A., *.Manual for Geometric Analysis of Engineering Designs, Australian Trade publications Ltd.*
6. Oliver R Wade, *Tolerance Control in Design and Manufacture, Industrial Press, Newyork publications, 1967.*