SREENIVASA INSTITUTE of TECHNOLOGY and MANAGEMENT STUDIES
Department of Mechanical Engineering
(Autonomous)
R13 Course structure for B.Tech (Regular) I- year (2013-14)
(Common for all branches)

S.No	Course Code	Subject	Scheme of Instructions Periods per Week					Scheme of Examination Maximum Marks		
			L	D	T	P	C	I	E	Total
1	13HAS 101	English	2	-	-	-	4	30	70	100
2	13HAS 102	Engineering Physics	2	-	1	-	4	30	70	100
3	13HAS 103	Engineering Chemistry	2	-	1	-	4	30	70	100
4	13HAS 104	Mathematics-I	3	-	1	-	5	30	70	100
5	13HAS 105	Reasoning and Aptitude	3	-	-	-	3	30	70	100
6	13CSE 101	C Programming and Data Structures	3	-	1	-	5	30	70	100
7	13MEC 101	Engineering Drawing	-	5	-	-	5	30	70	100
8	13HAS 106	Engineering Physics Lab and Engineering Chemistry Lab	-	-	-	3	3	40	60	100
9	13HAS 107	English Language and Communication Skills Lab	-	-	-	3	3	40	60	100
10	13CSE 102	C Programming and Data Structures Lab	-	-	-	3	4	40	60	100
11	13MEC 102	Engineering and I.T. Workshop	-	-	-	3	4	40	60	100
Contact periods per week			15	5	4	12	-	-	-	-
Total periods per week			36				-	-	-	-
Total credits (7 Theory + 4 Labs)							44	-	-	-
Total Marks								370	730	1100

SREENIVASA INSTITUTE of TECHNOLOGY and MANAGEMENT STUDIES
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Course structure for B.Tech (Regular) II, III, IV year (2013-14)

B.Tech (MECH) II - I Semester

S.No	Course Code	Subject	Scheme of Instructions Periods per Week			Scheme of Examination Maximum Marks		
			L	P	C	I	E	Total
1	13HAS 211	Mathematics- II	4	-	3	30	70	100
2	13MBA 214	Business Management	4	-	3	30	70	100
3	13EEE 214	Electrical and Electronics Engineering	4	-	3	30	70	100
4	13CIV 211	Engineering Mechanics	4	-	3	30	70	100
5	13CIV 221	Fluid Mechanics – I	4	-	3	30	70	100
6	13MEC 211	Materials Science and Engineering	4	-	3	30	70	100
7	13EEE 215	Electrical Engineering Laboratory and Electronics Engineering Laboratory	-	3	2	40	60	100
8	13MEC 212	Materials Science and Engineering Laboratory	-	3	2	40	60	100
Contact periods per week			24	6				
Total periods per week			30					
Total credits (6 Theory + 2 Labs)					22			
Total marks						260	540	800

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B.Tech (MECH) II - II Semester

S.No	Course Code	Subject	Scheme of Instruction Periods per Week			Scheme of Examination Maximum Marks		
			L	P	C	I	E	Total
1	13HAS 222	Probability and Statistics	4	-	3	30	70	100
2	13HAS 213	Environmental Science	4	-	3	30	70	100
3	13CIV 314	Fluid Mechanics – II	4	-	3	30	70	100
4	13CIV 226	Mechanics of Solids	4	-	3	30	70	100
5	13MEC 221	Engineering Thermodynamics	4	-	3	30	70	100
6	13MEC 222	Machine Drawing	6*	-	3	30	70	100
7	13CIV 224	Fluid Mechanics and Hydraulic Machines Laboratory	-	3	2	40	60	100
8	13CIV 227	Mechanics of Solids Laboratory	-	3	2	40	60	100
9	13AUD 211	Professional Ethics	2	-	-	-	-	-
Contact periods per week			28	6				
Total periods per week			34					
Total credits (7 Theory + 2 Labs)					22			
Total marks						260	540	800

*- indicates drawing practice

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B.Tech (MECH) III - I Semester

S.No	Course Code	Subject	Scheme of Instruction Periods per Week			Scheme of Examination Maximum Marks		
			L	P	C	I	E	Total
1	13MEC 311	Thermal Engineering	4	-	3	30	70	100
2	13MEC 312	Automobile Technology	4	-	3	30	70	100
3	13MEC 313	Kinematics of Machinery	4	-	3	30	70	100
4	13MEC 314	Manufacturing Technology	4	-	3	30	70	100
5	13MEC 315	Design of Machine Elements-I	4	-	3	30	70	100
6	13MEC 316	Technical Case Study	4	-	3	40	60	100
7	13MEC 317	Thermal Engineering Laboratory and Automobile Technology Laboratory	-	3	2	40	60	100
8	13MEC 318	Manufacturing Technology Laboratory	-	3	2	40	60	100
Contact periods per week			24	6				
Total periods per week			30					
Total credits (6 Theory + 2 Labs)					22			
Total marks						270	530	800

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B.Tech (MECH) III - II Semester

S.No	Course Code	Subject	Scheme of Instruction Periods per Week			Scheme of Examination Maximum Marks		
			L	P	C	I	E	Total
1	13MEC 321	Operations Research	4	-	3	30	70	100
2	13MEC 322	Dynamics of Machinery	4	-	3	30	70	100
3	13MEC 323	Design of Machine Elements-II	4	-	3	30	70	100
4	13MEC 324	Refrigeration and Air-Conditioning	4	-	3	30	70	100
5	13MEC 325	Engineering Metrology and Measurements	4	-	3	30	70	100
6	13MEC 326	Machine Tools Technology	4	-	3	30	70	100
7	13MEC 327	Metrology Laboratory and Machine Tools Technology Laboratory	-	3	2	40	60	100
8	13MBA 318	Soft Skills Laboratory	-	3	2	40	60	100
Contact periods per week			24	6				
Total periods per week			30					
Total credits (6 Theory + 2 Labs)					22			
Total marks						260	540	800

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B.Tech (MECH) IV - I Semester

S.No	Course Code	Subject	Scheme of Instruction Periods per Week			Scheme of Examination Maximum Marks		
			L	P	C	I	E	Total
1	13MEC 411	Heat Transfer	4	-	3	30	70	100
2	13MEC 412	Computer Aided Design and Manufacturing	4	-	3	30	70	100
3	13MEC 413	Automation and Robotics	4	-	3	30	70	100
4	13MEC 414	Industrial Engineering and Management	4	-	3	30	70	100
5	13MEC 415 13MEC 415A 13MEC 415B 13MEC 415C	Elective–I Tool Design Geometric Modeling Total Quality Management	4	-	3	30	70	100
6	13MEC 416 13MEC 416A 13MEC 416B 13MEC 416C	Elective - II Energy Systems Gas Turbines and Jet Propulsion Industrial Tribology	4	-	3	30	70	100
7	13MEC 417	Heat Transfer Laboratory	-	3	2	40	60	100
8	13MEC 418	Computer Aided Design and Manufacturing Laboratory	-	3	2	40	60	100
9	13MEC 419	Project Seminar	2	-	3	100	-	100
Contact periods per week			26	6				
Total periods per week			32					
Total credits (7 Theory + 2 Labs)					25			
Total marks						360	540	900

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B.Tech (MECH) IV-II Semester

S.No	Course Code	Subject	Scheme of Instruction Periods per Week			Scheme of Examination Maximum Marks		
			L	P	C	I	E	Total
1	13MEC 421	Finite Element Methods	4	-	3	30	70	100
2	13MEC 422 13MEC 422A 13MEC 422B 13MEC 422C	Elective - III Power Plant Engineering Modern Manufacturing Methods Advanced I.C. Engines	4	-	3	30	70	100
3	13MEC 423 13MEC 423A 13MEC 423B 13MEC 423C	Elective - IV Computer Integrated Manufacturing Mechatronics Computational Fluid Dynamics	4	-	3	30	70	100
4	13MEC 424	Comprehensive Examination	-	-	4	100	-	100
5	13MEC 425	Project work	18	-	10	40	60	100
Contact periods per week			30	-				
Total periods per week			30					
Total credits (4 Theory)					23			
Total marks						130	270	500

L – Lecture P – Practical T – Tutorial C – Credits

I- Internal E – External D – Drawing

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I B.Tech (MECH)	**D**	**T**	**P**	**C**
	5	**-**	**-**	**5**

13MEC 101 ENGINEERING DRAWING (Common to all Branches)

UNIT - 1: Introduction to Engineering Drawing

Principles of engineering graphics and their significance - Drawing instruments and their use - Conventions in drawing - Lettering - BIS conventions.

Scales: Plain scale and diagonal scale.

Conic sections: (a) Ellipse, (b) Parabola and (c) Hyperbola (including rectangular hyperbola).

UNIT - 2: Projection of Points and Lines

Principles of orthographic projections - Conventions - First and third angle projections - Projections of points - Projections of lines inclined to one or both planes.

UNIT - 3: Projection of Planes and Solids

Projections of regular plane surfaces.

Projections of regular solids inclined to one or both planes.

UNIT - 4: Section of Solids and Development of Surfaces

Sectional planes and sectional views of right regular solids: Prism, cylinder, pyramid and cone - True shape of the sections.

Development of surfaces of right regular solids: Prism, cylinder, pyramid, cone and their sectional parts.

UNIT - 5: Isometric and Orthographic Projections

Principles of isometric projection - Isometric scale - Isometric views - Conventions - Isometric views of lines, planes, simple and compound solids - Isometric projection of objects having non-isometric lines - Isometric projections of spherical parts.

Conversion of isometric projections/views to orthographic views - Conventions.

Text books:

1. Engineering Drawing, 50/e, 2010, N.D. Bhatt, Charotar Publishing House Pvt. Ltd., Anand.
2. Engineering Drawing, 2/e, 2012, Dr.K.L. Narayana, Dr.P. Kannaiah, Scitech Publishers, New Delhi.

References books:

1. Engineering Drawing and Graphics, 2/e, 2011, K.Venugopal, New Age International (P) Ltd, Publishers, New Delhi.
2. Engineering Drawing, 4/e, 2009, K.Venkata Reddy, B.S. Publications, Hyderabad.
3. Engineering Drawing, 3/e, 2009, Jolhe, Tata McGraw-Hill Education Pvt. Ltd, Noida.
4. Engineering Drawing, 2/e, 2010, Shah and Rana, Pearson Education, New Delhi.
5. Engineering Drawing, 5/e, 2013, Basant Agarwal and CM Agarwal, Tata McGraw-Hill Education Pvt. Ltd, Noida.

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I B.Tech	**L**	**T**	**P**	**C**
	-	**-**	**3**	**4**

13MEC 102 ENGINEERING and IT WORKSHOP (Common to all Branches)

ENGINEERING WORKSHOP

Objectives:

The budding Engineermay turn out to be a technologist, scientist, entrepreneur, practitioner, consultant etc. There is a need to equip the engineer with the knowledge of common and newer engineering materials as well as shop practices to fabricate, manufacture or work with materials. Essentially he should know the labour involved, machinery or equipment necessary, time required to fabricate and also should be able to estimate the cost of the product or job work. Hence engineering work shop practice is included to introduce some common shop practices and on hand experience to appreciate the use of skill, tools, equipment and general practices to all the engineering students.

1. Trades for Exercises:

a. Carpentry - Two joints (exercises) from: Making middle T lap joint, dove tail lap joint, mortise and tenon joint and bridle T joint from out of 300 x 50 x 35 mm soft wood stock.
b. Fitting - Two joints (exercises) from: Square joint, V joint, half round joint and dove tail joint out of 50 x 50 x 5 mm M.S. flat piece.
c. Sheet metal - Three jobs (exercises) from: Tray, cylinder, open scoop and frustum of pyramid out of 22 or 20 gauge G.I. sheet.
d. House wiring - Three jobs (exercises) from: Two lamps controlled by one switch in series, two lamps controlled by one switch in parallel, one lamp controlled by 2 two way switches (stair case) and wiring for fluorescent lamp.

2. Trades for Demonstration:

a. Drilling Machine
b. Power Hacksaw
c. Grinding Machine

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B.Tech(MECH) II-ISemester	**L**	**P**	**C**
	4	**-**	**3**

13HAS 211 MATHEMATICS - II (Common to all Branches)

UNIT - 1: Solution of Algebraic, Transcendental Equations and Interpolation

Solution of algebraic, transcendental equations: Introduction - The Bisection method - The method of false position - The Iteration method - Newton-Raphson method.

Interpolation: Introduction - Finite differences - Forward differences - Backward differences - Newton's forward and backward difference formulae for interpolation - Lagrange's formula.

UNIT - 2: Numerical Differentiation, Numerical Integration and NumericalSolution of Ordinary Differential Equations

Numerical differentiation, Numerical integration: Trapezoidal rule - Simpson's $1/3^{rd}$rule - Simpson's 3/8 rule.

Numerical solution of ordinary differential equations: Solution by Taylor's series - Picard's method of successive approximations - Euler's method- Runge-Kutta methods - Predictor-Corrector method - Milne's method.

UNIT - 3: Fourier Series

Determination of Fourier coefficients - Fourier series - Even and odd functions - Fourier series in an arbitrary interval - Even and odd periodic continuation - Half-range Fourier sine and cosine expansions.

UNIT - 4: Fourier Transforms

Fourier integral theorem(only statement) - Fourier sine and cosine integrals - Fourier transform - Fourier sine and cosine transforms - Properties - Inverse transforms - Finite Fourier transforms.

UNIT - 5: Partial Differential Equations

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions - Method of separation of variables.

Text books:

1. Mathematical Methods, 2012, T. K. V. Iyengar, B. Krishna Gandhi, S. Ranganatham and M.V.S.S.N. Prasad , S. Chand & Company Pvt.Ltd., New Delhi.
2. Engineering Mathematics , Volume - II , 2013, E. Rukmangadachari, E. Keshava Reddy, Pearson Education, Chennai.

Reference books:

1. Engineering Mathematics for JNTU, 3/e, 2008, B.V. Ramana, Tata McGraw-Hill Education Pvt. Ltd., Noida.
2. Introductory Methods of Numerical Analysis, 5/e, 2005, S.S. Sastry, Prentice-Hall of India, Pvt. Ltd., New Delhi.
3. Higher Engineering Mathematics, 34/e, 1999, Dr. B. S. Grewal, Khanna Publishers, New Delhi.
4. Advanced Engineering Mathematics, 8/e, 2009, Erwin Kreyszig, Wiley India Pvt, Ltd., New Delhi.
5. Numerical Methods for Scientific and Engineering Computation, 4/e, 2004, M.K. Jain, S.R.K. Iyengar, R.K. Jain, New Age International (P) Ltd, Publishers, New Delhi.

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B.Tech (MECH) II-I Semester	**L**	**P**	**C**
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13MBA 214 BUSINESS MANAGEMENT

UNIT - 1:

Business economics: Nature and scope.

Demand analysis: Demand determinants - Law of demand.

Elasticity of demand: Types, measurement and significance of elasticity of demand.

UNIT - 2: Production and Cost Analysis

Cost concepts - Production function - Law of returns- Production management - Plant layout - Basic concepts of MIS and ERP - Total Quality Management (TQM), six sigma, business process re-engineering.

UNIT - 3: Business Organisation and Management

Business organisation:Features of business - Types of business organisations: Sole proprietorship, partnership, joint stock company and public enterprises.

Management:Nature, significance and functions of management.

UNIT - 4: HR and Marketing

HR: Introduction to HR - Functions of HR manager, (Manpower planning recruitment, selection, training and development, performance appraisal), grievances handling and negotiations.

Marketing**:** Functions of marketing - Marketing mix - Pricing methods - Promotional practices and channels of distribution - Product life cycle - Basic concepts of advertising - Marketing research - e-marketing - Marketing through social media - Pricing strategies in internet era.

UNIT - 5: Financial Management

Objectives and functions of financial management - Sources of long-term and short-term finance - Cash budgeting techniques (Payback period method, ARR, NPV, IRR).

Text books:

1. Managerial Economics and Financial Analysis, 4/e, 2011, Dr.A.R.Aryasri, Tata McGraw-Hill Education Pvt. Ltd., Noida.
2. Management Science, 1/e, 2009, Dr. G. Sreenivasa Rao, Hi-Tech Publishers, Hyderabad.
3. Management Science, 3/e, 2008, A.R.Aryasri, Tata McGraw-Hill Education Pvt. Ltd., Noida.
4. Introduction to Management Science, 1/e, 2011, P.Vijaykumar, Cengage Learning India, New Delhi.

Reference books:

1. Managerial Economics, Analysis, Problems and Cases, 17/e, 2011, P.L.Mehta, S. Chand & Company Pvt. Ltd., New Delhi.
2. Production and Operations Management, 3/e, 2011, Aswathappa .K, Himalaya Publishing House, Mumbai.
3. Marketing Management, 4/e, 2010, RajanSaxena, Tata McGraw-Hill Education Pvt. Ltd., Noida.
4. Personnel and Human Resource Management, 2009, Subba Rao, Himalaya Publishing House, Mumbai.
5. Financial Management, 2011, I.M. Pandey, Vikas Publishing House Pvt. Ltd., Noida.

6. Entrepreneurship Development, 2009, S.S.Khanka, S. Chand & Company Pvt. Ltd., New Delhi.

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B.Tech (MECH) II-I Semester	**L**	**P**	**C**
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13EEE 214 ELECTRICAL ENGINEERING and ELECTRONICS ENGINEERING

Part- A: ELECTRICAL ENGINEERING

UNIT – 1: Electrical Circuits

Basics definitions - Types of elements - Ohm's Law - Resistive networks, inductive networks, capacitive networks – Series and parallel circuits - Kirchoff's laws - Star-delta and delta-star transformation.

UNIT – 2: DC Machines

Principles of operation of DC generator – EMF equation – Types – DC motor types – Torque equation – Applications – Three point starter.

UNIT – 3: Transformers and AC Machines

Principles of operation of single phase transformers - EMF equation, losses, efficiency and regulation – Principles of operation of alternator – Regulation by synchronous impedance method – Principles of operation of induction motor – Slip – Torque characteristics – Applications.

Text books:

1. Network Analysis, 3/e, 2009, A.Sudhakar, ShyammohanS.Palli, Tata McGraw-Hill Education Pvt. Ltd., Noida.
2. Principle of Electrical Engineering, 2/e, 2009, Rohit Mehta, V.K.Mehta, S.Chand& Company Pvt. Ltd., New Delhi.

Reference books:

1. Theory and Problems of Basic Electrical Engineering, 1/e, 2009, DP Kothari and I.J. Nagrath, Prentice-Hall of India, Pvt. Ltd., New Delhi.
2. Electrical and Electronics Technology, n/e, Huges, Pearson Education, New Delhi.
3. Basic Electrical Engineering, n/e, 2011, U.A. Bakshi and V.U. Bakshi, Technical Publications, Pune.

Part-B: ELECTRONICS ENGINEERING

UNIT – 4: Junction Diode Characteristics

Energy band diagram of PN junction diode - Diode equation - V-I characteristics of diode - Zener diode - Half wave and full wave rectifiers – Filters - Simple circuit of regulator using zener diode – Simple problems.

UNIT – 5: Transistors and CRO

Transistor construction – Operation – Symbol – CB – CE - CC configurations - Input and output characteristics – Relationship between α, β and γ - Transistor as an amplifier, CE amplifier and its frequency response - Concepts of oscillators.

CRO: Principles of CRT - Deflection sensitivity - Electrostatic and magnetic deflection - Applications of CRO.

Text books:

1. Electronic Devices and Circuits, 2/e, 2005, Dr.K.Lalkishore, B.S.Publications, Hyderabad.
2. Electronic Devices and Circuits, 9/e, 2006, R.L.Boylestad and Louis Nashelsky, Pearson Education, New Delhi.

Reference books:

1. Electronic Devices and Circuits, 2/e, 2007, J.Millman, C.C.Halkias, and Satyabratha Jit, Tata McGraw-Hill Education Pvt. Ltd., Noida.

2. Electronic Devices and Circuits, 3/e, 2010, A.P.Godse, U.A.Bakshi, Technical Publications, Pune.

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B.Tech (MECH) II-I Semester	**L**	**P**	**C**
	4	**-**	**3**

13CIV 211 ENGINEERING MECHANICS

UNIT - 1: Introduction to Engineering Mechanics

Concepts - Scope of mechanics - Preview of statics - Fundamental concepts and axioms - Concept of free body diagrams - Principle of transmissibility - Force and its characteristics.

Coplanar - Concurrent forces: Resultant and Equilibrant - Composition and resolution of forces - Parallelogram law of forces - Triangle law of forces - Polygon law of forces - Components of force in two given directions - Resolved part of force in a given direction - Method of projections - Parallel and non-parallel forces.

Moment of a force - Principle of moments (Varignon's Theorem) – Resultant of (i) two parallel forces acting in the same direction and (ii) two unequal parallel forces acting in the opposite directions.

Couple - Resolution of a force in to a force and couple - Characteristics of couple - Couple and its moment - Resultant of force and couple - Equivalent system of forces – General case of parallel forces in a plane – Problems.

Equilibrium: General case of forces in a plane - Equations of equilibrium - Free body diagrams (FBD) - Equilibrium of a concurrent force system – Equilibrium of a body subjected to two forces and three forces - Lami's Theorem - Types of supports and support reactions for beams with concentrated, uniformly distributed and uniformly varying loads.

Analysis of trusses and frames – Method of joints and method of sections.

UNIT - 2: Centroids, Centre of Gravity and Moment of Inertia

Introduction - Definition of centroid and centre of gravity - Centre of gravity for flat plate - Centroids of area and lines - Importance of centroids and moment of inertia - Centroids determined by integration - Centroid of an arc of circle, area of circle, area of triangle, area of circular sector, area of parabolic segment, trapezoidal area - Centroids of composite figures - Theorems of Pappus and Guldinus.

Definition of Moment of inertia - Units and signs - Polar moment of inertia - Radius of gyration - Transfer formula for moment of inertia (Parallel axis theorem) - Moment of inertia by integration - Moment of inertia of simple and composite areas (rectangle, circle, semi circle, quarter circle, ellipse, spandrel, I-Section, T-Section, C-Section) - Product of inertia - Sign convention - Transfer formula for product of inertia - Moment of inertia with respect to inclined axis – Mohr's circle for moment of inertia - Maximum and minimum moments of inertia - Principal axes.

UNIT - 3: Friction and Virtual Work

Friction: Introduction – Dry friction – Laws of dry friction – Coefficient of friction - Angle of friction – Rolling resistance – Force of friction on a wheel – Problems.

Virtual work: Definition - Principle of virtual work - Applications – Potential energy and equilibrium - Stability of equilibrium (stable, unstable and neutral) – Problems.

UNIT - 4: Kinematics

Kinematics of rectilinear motion: Introduction - Displacement – Velocity – Acceleration - Motion with uniform acceleration – Motion with variable acceleration – Problems.

Kinematics of circular motion: Introduction – Position vector, velocity and acceleration – Components of motion (rectangular components of velocity and acceleration) – Normal and

tangential components of acceleration – Radial and transverse components of motion – Problems.

UNIT - 5: Kinetics

Kinetics of rectilinear motion - Introduction – Equations of rectilinear motion – Equations of dynamic equilibrium (D'Alembert's Principle) - Motion of lift - Motion over a smooth pulley - Motion of two weights connected by a string on a horizontal surface - Motion of two weights connected on an inclined plane - Motion of connected weights over an inclined plane – Problems.

Kinetics of circular motion - Introduction – Equations of motion in rectangular, tangential and normal components – Equations of dynamic equilibrium (D'Alembert's Principle) – Curvilinear motion – Motion of vehicles (level and banked roads).

Text books:

1. Engineering Mechanics Statics and Dynamics – 12/e, A.K. Tayal, Umesh Publications, New Delhi.

2. Engineering Mechanics, F.L. Singer, Harper and Row Publications, New Delhi.

Reference books:

1. Engineering Mechanics, 1/e, 2011, Prof.P.J. Shah, S.Chand and Company Pvt.Ltd., New Delhi.

2. Elements of Applied Mechanics, 18/e, 2013, S.B. Junnarkar and Dr.H.J.Shah, Charotar Publishing House Pvt. Ltd., Anand.

3. Engineering Mechanics (Dynamics and Statics), Dr. Sadhu Singh, Khanna Publishers, New Delhi.

4. Engineering Mechanics, 1/e, 2011, N.H. Dubey, Tata McGraw-Hill Education Pvt. Ltd, Noida,

5. Engineering Mechanics, 4/e, 2012, S.S. Bhavikatti New Age International (P) Ltd, Publishers, New Delhi.

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B.Tech (MECH) II-I Semester	**L**	**P**	**C**
	4	**-**	**3**

13CIV 221 FLUID MECHANICS - I

UNIT - 1: Properties of Fluids

Introduction - Definition of a fluid - Mass density - Specific weight - Specific gravity - Specific volume. Equation of State: The perfect gas – Viscosity - Vapour pressure - Compressibility and elasticity - Surface tension and capillarity – Problems.

Fluid statics: Variation of static pressure - Absolute and gauge pressures - Pressure measurement - Simple manometers and differential manometers - Problems.

Hydrostatic forces on plane and curved surfaces: Total pressure and centre of pressure –Total pressure on a plane surface and curved surface.

Buoyancy and floatation: Buoyancy – Meta centric height – Stability of a submerged body – Stability of a floatation body.

UNIT - 2: Kinematics of Fluid Motion

Introduction - Velocity of fluid particles - Types of fluid flow (steady and unsteady, uniform and non-uniform, three, two and one dimensional, laminar and turbulent flows) - Stream tube - Path line - Streak line - Description of the flow pattern - Basic principles of fluid flow - Continuity equation - Acceleration of fluid particle - Rotational and irrotational motions - Circulation and vorticity - Velocity potential - Stream function - Equipotential lines - Relation between stream function and velocity potential - Flow net - Methods of drawing flow nets - Uses and limitations of flow net - Problems.

UNIT - 3: Dynamics of Fluid Flow

Introduction - Forces acting on fluid in motion - Euler's equation of motion - Integration of Euler's equation - Bernoulli's equation derived from the principle of conservation of energy - Kinetic energy correction factor - Bernoulli's equation for compressible fluids - Pressure velocity relationship.

Application of Bernoulli's equation: Venturimeter - Orifice meter - Nozzle meter or flow nozzle - Rotameter – Elbow meter - Pitot tube - Free liquid Jet - Free vortex motion and Forced vortex motion – Problems.

Momentum principle: Impulse-momentum equations – Momentum correction factor – Application of momentum equation - Moment of momentum equation - Problems.

UNIT - 4: Boundary Layer Theory

Introduction - Thickness of boundary layer - Boundary layer along a long thin plate and its characteristics - Boundary layer equations - Momentum integral equation of the boundary Layer - Laminar boundary layer - Turbulent boundary layer - Laminar sub-layer - Boundary layer on rough surfaces - Separation of boundary layer - Methods of controlling the boundary layer (motion of solid boundary, acceleration of fluid in the boundary Layer, suction of the fluid from the boundary layer, streamlining of body shapes) – Problems.

UNIT - 5: Flow through Pipes

Introduction - Two types of flow - Reynold's experiment - Laws of fluid friction (for laminar and turbulent flows) - Froude's experiments - Darcy's Weisbach equation – Loss of head due to friction in pipes (Chezy's formula, Manning's formula, Hazen Williams formula) - Energy losses in pipes - Hydraulic Grade Line and Energy Grade Line - Flow through long pipes – Equivalent

pipe - Pipes in series (Compound pipe) - Pipes in parallel - Flow through a bye pass - Branched pipe - Siphon - Loss of head due to friction in tapering pipe - Loss of head due to friction in a pipe with side tappings - Time of emptying a reservoir through pipe.

Transmission of power through pipes - Flow through nozzle at the end of pipe (Maximum power available from a nozzle, Diameter of the nozzle for transmitting maximum power).

Water hammer in pipes: Definition – Causes - Gradual closure of valve - Instantaneous closure of valve and rapid closure - Pipe networks – Hydraulic analysis of pipe networks - Problems.

Text books:

1. Hydraulics and Fluid Mechanics, 18/e, 2011, Dr.P.N. Modi and Dr.S.M. Seth, Standard Book House, Delhi.
2. Fluid Mechanics, 11/e, 2012, Dr.A.K. Jain, Khanna Publishers, New Delhi.

Reference books:

1. Fluid Mechanics and Hydraulic Machinery, 4/e, 2010, R.K. Rajput, S. Chand & Company, Pvt. Ltd., New Delhi.
2. Fluid Mechanics, 5/e, 2010, J.F. Douglas, J.M. Gaserek and J.A. Swaffirld, Longman, Pearson Education, New Delhi.
3. Fluid Mechanics, 2/e, 2010, A.K. Mohanty, Prentice - Hall of India, Pvt. Ltd., New Delhi.
4. Introduction to Fluid Machines, 2/e, 2010, S.K. Som and G. Biswas, Tata McGraw-Hill Education, Pvt. Ltd., Noida.
5. Fluid Mechanics and Hydraulic Machines, 9/e, 2011, R.K. Bansal, Laxmi Publications (P) Ltd, New Delhi.

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B.Tech (MECH) II-I Semester	**L**	**P**	**C**
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13MEC 211 MATERIALS SCIENCE and ENGINEERING

UNIT - 1: Crystallography

Atomic bonding -Classification of crystals – Bravi's lattices – Miller indices – Packing factor in cubic systems – Coordination number – Crystal imperfections - Effect of grain boundaries - Grain size measurement – Crystal deformation – Slip and twinning – Alloys – Solid solutions – Electron compounds.

UNIT - : Phase Diagrams

One component system - Binary phase diagrams – Isomorphous, eutectic, eutectoid, peritectic, peritectoid and monotectic systems - Study of important of binary phase diagrams - C_u-N_i, Al-C_u, F_e-$F_{e3}C$ - Concept of ternary diagrams - Phase rule.

UNIT - 3: Ferrous and Non Ferrous Materials and their Alloys

Composition - Properties and application of ferrous and non ferrous metals and their alloys - Brief study of cast iron, steels, copper, aluminum and titanium.

UNIT - 4: Heat Treatment of Alloys

Effect of alloying elements on iron – Iron carbon system, annealing, normalizing, hardening, TTT diagrams, tempering, hardeneability, surface - hardening methods, age hardening treatment, cryogenic treatment of alloys.

Strengthening mechanisms: Strain hardening, solid solution strengthening, grain refinement, dispersion strengthening.

UNIT - 5: Non Metallic Materials

Ceramic materials: Crystalline ceramics, glasses, cermets.

Polymers: Structure of polymers,thermoplastics and thermosetting polymers - Characteristics and applications of polymers.

Composites: Properties and applications of particulate - Reinforced composites, fiber reinforced composites, laminar composites and metal matrix composites.

Material Selection and Design Consideration.

Text books:

1. Introduction to Physical Metallurgy, 2/e, 2013, Sidney H Avener, Tata McGraw-Hill Education Pvt. Ltd., Noida.
2. Materials Science and Engineering, 6/e, 2010, William and Collister, Wiley India Pvt. Ltd., New Delhi.

Reference books:

1. Material Science and Metallurgy for Engineers, 25/e, 2009, Dr. V.D. Kodgire, Everest Publishing House, Pune.
2. Material Science and Engineering, 3/e, 2012, R.K.Rajput, SK Kataria and Sons, New Delhi.
3. Introduction to Engineering Materials, 1/e, 2003, B.K.Agrawal, Tata McGraw-Hill Education Pvt. Ltd., Noida.
4. Material Science and Engineering, 5/e, 2009, V. Rahghavan, Prentice-Hall of India, Pvt. Ltd., New Delhi.
5. Elements of Material Science and Engineering, 6/e, 2002, Lawrence H.vanvlack, Pearson Education, New Delhi.

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13EEE 215 ELECTRICAL ENGINEERING LABORATORY and ELECTRONICS ENGINEERING LABORATORY

Part - A: Electrical Engineering Laboratory

The following experiments are required to be conducted as compulsory experiments:

1. Swinburne's test on D.C. shunt machine. (Predetermination of efficiency of a given D.C. shunt machine working as motor and generator).
2. OC and SC tests on single phase transformer (Predetermination of efficiency and regulation at given power factors)
3. Brake test on 3-phase induction motor (Determination of performance characteristics)
4. Regulation of alternator by synchronous impedance method.
5. Speed control of D.C. shunt motor by

a) Armature voltage control b) Field flux control method

6. Brake test on D.C shunt motor

Part - B: Electronics Engineering Laboratory

1. Study of CRO (Measurement of voltage, frequency and phase of periodic signals).
2. V-I characteristics of PN junction diode.
3. Full wave rectifier with and without capacitive filter.
4. Input and output characteristics of Common Emitter (CE) configuration.
5. Frequency response of a single stage CE amplifier.
6. Sinusoidal signal generation using RC phase shift oscillator circuit.

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13MEC 212 MATERIALS SCIENCE and ENGINEERING LABORATORY

1. Study of metallurgical microscope.
2. Preparation of specimen.
3. Study of Fe-Fe_3C diagram.
4. Study of the microstructure of mild steels, low carbon steels, high carbon steels.
5. Study of the micro structures of cast irons.
6. Study of the micro structures of Cu.
7. Study of the micro structures of brass.
8. Study of the micro structures of bronze.

9. Study of the micro structures of Al.
10. Hardeneability of steels by Jominy end quench test.
11. To find out the hardness of various treated and untreated steels.

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13HAS 222 PROBABILITY and STATISTICS (Common to CSE, IT, MECH, CE)

UNIT - 1: Probability and Random Variables

Probability: Sample space and events - Probability - The axioms of probability - Some elementary theorems - Conditional probability - Baye's theorem.

Random variables: Discrete and continuous distributions - Distribution functions.

UNIT - 2: Probability Distributions

Binomial - Poisson and Normal distributions - Related properties.

UNIT - 3: Curve Fitting

The method of least squares - Interfaces based on the least squares estimations - Curvilinear - Regression - Multiple regression.

UNIT - 4: Sampling Distribution and Estimation

Sampling distribution: Populations and samples - Sampling distributions of mean (known and unknown) - Proportions - Sums and differences.

Estimation: Point estimation - Interval estimation - Bayesian estimation.

UNIT - 5: Test of Hypothesis and Test of Significance

Test of hypothesis: Means - Hypothesis concerning one and two means - Type I and Type II errors - One tail, two-tail tests.

Test of significance: Student's t-test - F-test - Chi-square test of goodness of fit.

Text books:

1. Fundamentals of Mathematical Statistics, 10/e, 2001, S.C. Gupta, V.K. Kapoor, S. Chand & Company Pvt. Ltd., New Delhi.
2. Probability and Statistics, 2012, T.K.V. Iyengar, B. Krishna Gandhi, S. Ranganatham and M.V.S.S.N. Prasad, S. Chand & Company Pvt. Ltd., New Delhi.

Reference books:

1. Probability and Statistics, 2011, V. Ravindranath, T.S.R. Murthy, I.K. International Publishing House Pvt. Ltd, New Delhi.
2. Probability and Statistics for Engineers, 6/e, 2006, Johnson A. Richard, Miler and Fruends, Pearson Education, New Delhi.
3. Probability and Statistics, 2012, E. Rukmangadachari, E. Keshava Reddy, Pearson Education, New Delhi.

4. Probability and Statistics for Engineers, 2011, Dr. J. Ravichandran, Wiley India Pvt. Ltd., New Delhi.
5. Probability and Statistics for Engineers and Scientists, 7/e, 2002, Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers, Keying Ye, Pearson Education, New Delhi.

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13CIV 213 ENVIRONMENTAL SCIENCE (Common to all Branches)

UNIT – 1: Introduction to Environmental Science and Natural Resources

Introduction: Definition - Scope and importance of environment - Need for public awareness - Natural Resources: Forest resources: Use and over-exploitation - Deforestation - Conservation of forests.

Water resources: Use and over-utilization of surface and ground water - Floods and drought - Conflicts over water.

Mineral resources: Use and exploitation - Environmental effects of extracting mineral resources - Case studies.

Food resources: World food problems - Effects of modern agriculture - Fertilizer and pesticide effects - Water logging - Salinity - Case studies.

Energy resources: Conventional energy resources - Coal - Petroleum - Natural gas and Nuclear fuels - Non-conventional energy resources - Solar energy - Wind energy - Tidal energy - Geothermal energy and Biogas energy - Use of alternate energy sources - Case studies.

UNIT – 2: Ecosystem and Biodiversity

Ecosystem: Concept of an ecosystem - Structure and function of an ecosystem - Producers - Consumers and decomposers - Energy flow in the ecosystem - Ecological succession - Food chains - Food webs - Ecological pyramids - Introduction - Types - Characteristic features - Structure and function of the (a) Forest ecosystem (b) Grassland ecosystem (c) Desert ecosystem (d) Aquatic ecosystems (Ponds - Streams - Lakes - Rivers - Oceans - Estuaries).

Biodiversity: Introduction to biodiversity - Genetic - Species and ecosystem diversity - Bio-geographical classification of India - Value of biodiversity: Consumptive value - Productive value - Social value - Ethical value - Aesthetic and option values - India as a mega-diversity nation - Hot spots of biodiversity.

Threats to biodiversity: Habitat loss - Poaching of wildlife - Man-wildlife conflicts - Endangered and endemic species of India - Conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.

UNIT – 3: Pollution and Waste Management

Definition - Causes - Effects - Control measures of pollution.

Air Pollution: Types of pollutants - Their sources and impacts - Air pollution meteorology - Air pollution control - Air quality standards and limits.

Noise Pollution: Impacts of noise - Permissible limits of noise pollution - Measurement of noise - Control of noise pollution.
Solid waste management: Characteristics - Generation - Collection and transportation of solid wastes - Engineered systems for solid waste management (reuse, recycle, energy recovery, treatment and disposal).
Marine Pollution: Pollution due to organic wastes - Control measures.
Soil Pollution: Causes of soil degradation - Excessive use of fertilizers - Problems with pesticide use - Excess salt and water.

UNIT – 4: Social Issues and the Environment

Water conservation measures: Rain water harvesting and water shed management - Resettlement and rehabilitation of people - Its problems and concerns - Case studies - Role of NGO's - Climate change - Global warming - Acid rain - Ozone layer depletion - Nuclear accidents.
Sustainable development: Definition - Objectives - Environmental dimensions of sustainable development - Environmental audit for sustainable development.

UNIT– 5: Environmental Legislation and Human Population

Environmental Acts: The water (Prevention and control of pollution) Act - The air (Prevention and control of pollution) Act - The wild life (protection) Act - The forest conservation Act - The environmental protection Act.
International conventions: Stockholm conference 1972 - Earth summit 1992 and Copenhagen conference 2009 - Case studies: Chipko movement - Narmada bachaoandolan - Silent valley project - Chernobyl nuclear disaster - Ralegaon siddhi (Anna Hazare) and Bhopal gas tragedy.
Population growth: Variation among nations - Population explosion - Family welfare programmes - Environment and human health - Human rights - Value education - HIV/AIDS - Women and child welfare - Role of information technology in environment and human health - Case studies.

Field Work

Visit to a local area to document environmental assets: River/ Forest/ Grasslands/ Mountains
Visit to local polluted site: Urban/ Rural/ Industrial/ Agriculture
Study of simple ecosystems: Pond/ River/ Hill slope etc.

Text books:

1. Text book of Environmental Studies, 4/e, 2012, C.P. Kaushik and Anubha Kaushik, New Age International (P) Ltd, New Delhi.
2. Text book of Environmental Studies, 1/e, 2008, ErachBharucha, University Press (India) Private Ltd. Hyderabad.

Reference books:

1. Environmental Studies-From Crisis to Cure, 2/e, 2012, R. Rajagopalan, University Press (India) Private Ltd. Hyderabad.
2. A Text Book of Environmental Science and Technology, 1/e, 2008, Dr.M.Anji Reddy, B.S. Publications, Hyderabad.
3. Principles of Environmental Science and Engineering, 1/e, 2005, Keerthinarayana and Daniel Yesudiam, Hi-Tech Publications, Chennai.
4. Glimpses of Environment, 1/e, 2005, Dr. KVSG Murali Krishna, Environmental Protection Society, Kakinada, India.
5. Environmental Studies, 1/e, 2009, AninditaBasak, Pearson Education, New Delhi.

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13CIV 314 FLUID MECHANICS - II

UNIT - 1: Dimensional Analysis and Hydraulic Modelling

Introduction - Dimensions - Dimensional homogeneity - Methods of dimensional analysis (Rayleigh Method, Buckingham π-Method) - Outline of procedure for Buckingham method - Number of Dimensionless groups in a complete set of variables - Superfluous and omitted variables - Use of dimensional analysis in presenting experimental data - Model investigation.

Similitude – Types of similarities (Geometric, kinematic and dynamic similarities) - Force ratios - Dimensionless numbers - Similarity laws or model laws - Types of models - Merits and limitations of distorted models - Scale effect in models - Application of dynamic similarity to specific model investigations (submerged and partially submerged objects, model of rivers) - Problems.

UNIT - 2: Fluid Flow under Submerged Bodies

Introduction - Types of drag- Dimensional analysis of drag and lift - Drag on a sphere -Drag on a cylinder - Drag on a flat plate - Drag on an airfoil - Effect of free surface on drag - Effect of compressibility on drag - Development of lift on immersed bodies (lift on S circular cylinder, lift on an airfoil, effect of fluid compressibility on the lift on an airfoil) - Induced drag on an Airfoil of finite length - Polar diagram for lift and drag of an airfoil - Problems.

UNIT - 3: Flow Measurements

Measurement of discharge from tanks and reservoirs - Steady and unsteady flow through orifices and mouthpieces - Small and large orifices - Different types of mouth pieces – C_d, C_v, C_c - Discharge from tanks through drowned orifices - Time of emptying tanks - Discharge from a tank with inflow - Kinematics of free jet - Vortex motion and radial flow.

Flow measurement in open channels - Flow over weirs and notches - Sharp crested and broad crested weirs - Weirs with and without end contractions - Ventilation of weirs - Triangular notches - Cipolletti weir.

UNIT - 4: Flow in Open Channels

Introduction - Types of flow in channels - Geometrical properties of channel section- Velocity distribution in a channel section.

Uniform flow: The Ganguillet-Kutter formula - The Bazin's formula - Manning's formula - Most economical section of channel (rectangular, trapezoidal, triangular and circular channel sections) - Open channel section for constant velocity at all depths of flow - Computation of uniform flow.

Non-uniform flow: Specific energy – Specific energy curve – Critical flow – Critical flow in rectangular channel - Critical slope – Discharge curve – Dimensionless specific energy and discharge curves – Applications of specific energy.

Gradually varied flow: Equation of GVF - Dynamic equation for GVF in wide rectangular channel – Relation between water surface slopes and channel bottom slopes – Classification of channel bottom slopes – Classification of surface profiles – Characteristics of surface profiles - Length of surface profile – Control section.

Hydraulic jump: Loss of energy in a hydraulic jump – Elements and characteristics of a hydraulic jump – Types of jump – Location of hydraulic jump - Problems.

UNIT - 5: Hydraulic Turbines and Pumps

Turbines:Layout of a typical hydropower installation - Heads and efficiencies -Classification of turbines - Pelton wheel - Francis turbine - Kaplan turbine – Working proportions - Velocity diagrams - Work done and efficiency - Hydraulic design – Runaway speed - Draft tube theory – Functions of draft tube and efficiency.
Governing of turbines - Surge tanks - Unit quantities and specific speed – Performance characteristics - Geometric similarity - Cavitation, causes and effects.
Pumps: Pump installation details – Classification - Heads – Losses and efficiencies - Limitation of suction lift - Work done - Minimum starting speed - Specific speed - Multistage pumps - Pumps in parallel - Performance of pumps - Characteristic curves - Net positive suction head – Priming devices - Cavitation.

Text books:

1. Hydraulics and Fluid Mechanics including Hydraulic Machines, 19/e, 2013, Dr. P.N. Modi and Dr.S.M. Seth, Standard Book House, Delhi.
2. Fluid Mechanics, 11/e, 2012, Dr.A.K.Jain, Khanna Publishers, New Delhi.

Reference books:

1. Fluid Mechanics and Fluid Power Engineering, 7/e, 2009, D.S.Kumar, Kataria& Sons, Delhi.
2. Fluid Mechanics and Hydraulic Machinery, 4/e, 2010, R.K. Rajput, S. Chand & Company Pvt.Ltd., New Delhi.
3. Flow in Open Channels, 3/e, 2010, K, Subramanya, Tata McGraw-Hill Education, Pvt. Ltd., Noida.
4. Flow through Open Channels, 7/e, 2009, Ranga Raju, Tata McGraw-Hill Education, Pvt. Ltd., Noida.
5. Open Channel Flow, 1996, V.T .Chow, Tata McGraw-Hill Education, Pvt. Ltd., Noida.

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13CIV 226 MECHANICS of SOLIDS

UNIT – 1: Simple Stresses and Strains

Elasticity and plasticity – Types of stresses & strains – Hooke's law – Stress-strain diagram for mild steel – Working stress – Factor of safety – Lateral strain, poisson's ratio, volumetric strain – Elastic moduli and the relationship between them – Bars of varying section – Composite bars – Thermal stresses – Analysis of stress - Strain energy – Resilience – Gradual, sudden, impact and shock loadings.

UNIT – 2: Shear Force and Bending Moment

Definition of beam – Types of beams – Concept of shear force and bending moment – S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads, U.D.L, uniformly varying loads and combination of these loads – Point of contra flexure – Relation between S.F., B.M and rate of loading at a section of a beam.

UNIT – 3: Bending Stresses and Shear Stresses

Bending stresses: Theory of simple bending – Assumptions – Derivation of bending equation: M/ I = f/y = E/R Neutral axis – Determination of bending stresses – Section modulus of rectangular, circular (solid and hollow), I,T, angle and channel sections – Design of simple beam sections.

Shear stresses: Derivation of formula – Shear stress distribution across various beams sections like rectangular, circular, triangular, I, T and angle sections.

UNIT – 4: Torsion of Circular Shafts and Deflection of Beams

Torsion of circular shafts: Theory of pure torsion - Derivation of torsion equations; $T/J = q/r = N_\theta/l$ – Assumptions made in the theory of pure torsion - Torsional moment of resistance - Polar section modulus.

Deflection of beams: Bending into a circular arc – Slope, deflection and radius of curvature – Differential equation for the elastic line of a beam – Double integration and Macaulay's methods – Determination of slope and deflection for cantilever and simply supported beams subjected to point loads, U.D.L, uniformly varying load. Mohr's theorems – Moment area method – Application to simple cases including overhanging beams.

UNIT – 5: Columns, Thin and Thick Cylinders

Columns: Modes of failure of columns – Euler's theory – Rankine's theory.

Thin cylinders: Thin seamless cylindrical shells – Derivation of formula for longitudinal and circumferential stresses – Hoop, longitudinal and volumetric strains – Changes in diameter and volume of thin cylinders – Riveted boiler shells – Thin spherical shells.

Thick cylinders: Lame's equation – Cylinders subjected to inside and outside pressures – Compound cylinders.

Text books:

1. Mechanics of Materials, 12/e, 2012, B.C.Punmia, Dr.Arun Kumar Jain, Er.Ashok Kumar Jain, Laxmi Publications (P) Ltd., New Delhi.
2. Strength of Materials, 17/e, 2011, S. Ramamrutham and R.Narayanan, Dhanpat Rai Publishing Company (P) Ltd., New Delhi.

Reference books:

1. Strength of Materials, 5/e, 2012, R.K.Bansal, Laxmi publications (P) Ltd., New Delhi.
2. Strength of Materials, 3/e, 2012, Bhavikatti, Lakshmi Publications, New Delhi.
3. Mechanics of Materials, 6/e, 2007, R.C.Hibbeler, Pearson Education, New Delhi.
4. An Introduction to Mechanics of Solids, 3/e, 2012, Thomas Lardner, Norman Dahl, Tata McGraw-Hill Education Pvt. Ltd., Noida.
5. Strength of Materials, 5/e, 2006, R.K.Rajput, S. Chand & Company Pvt. Ltd., New Delhi.

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L	P	C
4	-	3

13MEC 221 ENGINEERING THERMODYNAMICS

UNIT – 1: Basic Concept and First Law of Thermodynamics

Basic concepts - Concept of continuum – Microscopic and macroscopic approach - Thermodynamic systems: Closed, open and isolated – Property - State, path and process – Quasi static process – Work - Modes of work - Zeroth law of thermodynamics – Measurement of temperature.

First law of thermodynamics: Internal energy - Specific heat capacities – Enthalpy – Energy of an isolated system - Application of non-flow and steady flow processes.

UNIT – 2: Second Law of Thermodynamics and Entropy

Second law of thermodynamics: Kelvin's and Clausius statement – Refrigerator and heat pump – Equivalence of Kelvin-Plank and Clausius statement – Reversibility and irreversibility – Helmholtz and Gibbs function - Carnot cycle - Reversed Carnot heat engine - Carnot theorem - Thermodynamic temperature scale.

Entropy: Concept of entropy - Clausius theorem – T-S plot - Clausius inequality – Entropy change in an irreversible process – Entropy principle and its applications – Entropy generation in a closed and open system.

UNIT – 3: Properties of Pure Substance

Properties of pure substances: Definition – Phase change of a pure substance – p-V, p-T, T-S, h-S diagrams for a pure substance – PVT surfaces – Dryness fraction – Steam tables- Measurement of steam quality.

UNIT – 4: Properties of Gasesand Thermodynamic Relations

Properties of gases: Avogadro's Law - Equation of state – Van der Waal's equation - Viral expansions - Compressibility chart – Dalton's law of partial pressure of gases and vapour mixtures.

Thermodynamic relations: Exact differential - Maxwell's relations – Tds equations –Difference in heat capacities - Joule –Thomson effect - ClausiusClaperyon equation – Change in thermodynamic properties with variable specific heat - Isentropic expansion with variable specific heat.

UNIT – 5: Psychrometry

Concepts – Definitions – Psychrometric relations - Psychrometers – Psychrometry charts - Psychrometric processes.

Text books:

1. Engineering Thermodynamics, 5/e, 2013, PK Nag, Tata McGraw-Hill Education Pvt. Ltd., Noida.
2. Thermodynamics-An Engineering Approach, 4/e, 2004, YunusCengel and Boles, Tata McGraw-Hill Education Pvt. Ltd., Noida.

Reference books:

1. Fundamentals of Engineering Thermodynamics, 6/e, 2010, Howard N. Shapiro, Michael J. Moran, Wiley India Pvt, Ltd, New Delhi.
2. Engineering Thermodynamics, 1/e, 2009, J.B. Jones and R.E.Dugan, Prentice-Hall of India, Pvt. Ltd., New Delhi.
3. Basic Engineering Thermodynamics, 1/e, 2007, A. Venkatesh, University Press (India) Private Ltd. Hyderabad.

4. Basic Engineering Thermodynamics, 5/e, 2008, Rayner Joel, Pearson Education, New Delhi.
5. Engineering Thermodynamics, 3/e, 2012, D.S.Kumar, S.K.Kataria and Sons, New Delhi.
Note: Use of standard thermodynamic tables, Mollier diagram, Psychometric chart and Refrigerant property tables are permitted.

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		6*	**-** **3**

13MEC 222 MACHINE DRAWING

I. Machine Drawing Conventions

Need for drawing conventions – Introduction to IS conventions

- Conventional representation of materials - Common machine elements and parts such as screws, nuts, bolts, keys, gears, webs, ribs.
- Types of sections – Selection of section planes and drawing of sections and auxiliary sectional views.
- Methods of dimensioning - General rules for sizes and placement of dimensions for holes, centers, curved and tapered features.
- Title boxes – Size - Location and details – Common abbreviations and their liberal usage.
- Types of drawings – Working drawings for machine parts.

II. Drawing of Machine Elements and Simple Parts

Selection of views - Additional views for the following machine elements and parts with every drawing proportions.

- Popular forms of screw threads, bolts, nuts, stud bolts, tap bolts, set screws.
- Keys, cotter joint and knuckle joint.
- Rivetted joints for plates.
- Shaft coupling, spigot and socket joint.
- Journal and foot step bearings.

III. Assembly Drawings

Drawings of assembled views for the part drawings of the following using conventions and easy drawing proportions.

- Engine parts: Stuffing box, cross heads, eccentrics, connecting rod and piston assembly.
- Other machine parts: Screw jack, plummer block and tailstock.

Note:First angle projection to be adopted. The student should be able to provide working drawings of actual parts.

Text books:

1. Machine Drawing, 4/e, 2012, K.L.Narayana, P.Kannaiah and K. Venkata Reddy, New Age International (P) Ltd. Publishers, New Delhi.
2. Machine Drawing, n/e, 2012, P.S.Gill, S.K Kataria and Sons, New Delhi.

Reference books:

1. A Text Book of Machine Drawing in First Angle, 1/e 2009, R.K.Dhawan, S. Chand & Company Pvt.Ltd., New Delhi.
2. Machine Drawing, n/e, 2012, Goel, S.K.Kataria and Sons, New Delhi.
3. Machine Drawing, 48/e, 2013, N.D.Butt and V.M.Panchal, Charotar Publishing House Pvt. Ltd., Anand.
4. Machine Drawing (With Auto CAD), 2/e, 2012, Ajit Singh, Tata McGraw-Hill Education Pvt. Ltd., Noida.
5. Fundamentals of machine Drawing, 2/e, 2012, P.L.Sah Sadhu Singh, Prentice-Hall of India, Pvt. Ltd., New Delhi.

Note:

- The end exam will be for 4 hrs in the following format.
- All answers should be on the drawing sheet only. Answers on the drawing sheet only will valued.
- Q1 – Questions set on section I and II of the syllabus 2 out of 3 or 2 out of 4 to be answered with a weightage of 4 marks each – 08 marks.
- Q2 – Questions set on section II of the syllabus 2 out of 3 to be answered with a weightage of 10 marks each – 20 marks.
- Q3 – drawing of assembled views of section III items of syllabus with a weightage of 42 marks.

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13CIV 224 FLUID MECHANICS and HYDRAULIC MACHINES LABORATORY

1. Calibration of venturimeter and orificemeter.
2. Determination of coefficient of discharge for small orifice by a constant head method.
3. Determination of coefficient of discharge for an external mouth piece by variable head method.
4. Calibration of contracted rectangular notch and triangular notch.
5. Determination of coefficient of loss of head in a sudden contraction and friction factor.
6. Verification of Bernoulli's theorem.
7. Impact of jet on vanes.
8. Turbine flow meter.
9. Study of hydraulic jump.
10. Performance test on turbine.
    i. Pelton wheel turbine.
    ii. Francis turbine
    iii. Kaplan turbine
11. Efficiency test on centrifugal pump.
    i. Single stage centrifugal pump.

ii. Multi stage centrifugal pump.

12. Efficiency test on reciprocating pump.

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B.Tech (MECH) II - II Semester	**L**	**P**	**C**
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13CIV 227 MECHANICS of SOLIDS LABORATORY

1. Tension test on mild/high yield strength deformed bars.
2. Compression test on wood (parallel and perpendicular to grains).
3. Torsion test.
4. Spring test.
5. Brinell's and Rockwells hardness tests.
6. Charpy and Izod impact tests.
7. Double shear test on mild steel specimen.
8. Load-deflection test on simply supported beam.
    I. Load at centre and deflection at centre.
    II. Load at centre and deflection at quarter span.
    III. Load at centre and deflection at one-third span.
9. Load-deflection test on cantilever beam.
10. Verification of Maxwell's reciprocal theorem.

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	2	**-**	**-**

13AUD 211 PROFESSIONAL ETHICS

(No credits and No examination but attendance will be reckoned)

OBJECTIVE

- To create an awareness on engineering ethics and human values
- To understand social responsibility of an engineer
- To appreciate ethical dilemma while discharging duties in professional life.

UNIT - 1: Human Values

Morals, values and ethics – Integrity – Work Ethic –Honesty – courage – Empathy – Self-confidence – Character.

UNIT - 2: Engineering Ethics

Senses of 'Engineering Ethics' – Variety of moral issued – 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 – Valuing time – Co-operation – Commitment.

UNIT - 3: Engineering as Social Experimentation

Engineers as responsible experimenters – Codes of ethics – A balanced outlook on law – The challenger case study.

UNIT - 4: Safety, Responsibility and Rights

Safety and risk – Assessment of safety and risk – Risk benefit analysis – The Three Mile Island and Chernobyl case studies.

UNIT - 5: Global Issues

Multinational corporations – Environmental ethics - Computer ethics – Weapons development – Engineers as managers – Engineers as expert witnesses and advisors – Moral leadership.

Text books:

1. A Textbook on Professional Ethics and Human Values, 1/e, 2006, Naagarazan R.S., New Age International (P) Ltd, Publishers, New Delhi.
2. Professional Ethics and Human Values, S. Dinesh Babu, Laxmi Publications (P) Ltd, New Delhi.

Reference books:

1. Engineering Ethics, 2004, M. Govindarajan, S. Natarajan, V.S.Senthil Kumar, Prentice - Hall of India, Pvt. Ltd., New Delhi.
2. Engineering Ethics, 2004, Charles D. Fleddermann, Pearson Education/ Prentice- Hall, New Jersey (Indian reprint now available).
3. Engineering Ethics- Concepts and Cases, 2000, Charles E Harris, Michael S. Protchard and Michael J Rabins, Wadsworth Thompson Leaning, United States (Indian reprintnow available).
4. Ethics in Engineering, Mike Martine and Roland Schinzinger, Tata McGraw- Hill Education, Pvt. Ltd.,Noida.
5. Ethics and the Conduct of Business, 2003, John R Boatright, Pearson Education,New Delhi.
6. Fundamentals of Ethics for Scientists and Engineers, 2001, Edmund G Seebauer and Robert L Barry, Oxford University press, Oxford.

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13MEC 311 THERMAL ENGINEERING

UNIT – 1: Power Cycles

Gas power cycles: Definitions - Air standard cycles – Carnot cycle - Otto cycle – Diesel cycle – Dual combustion cycle – Atkinson cycle – Ericsson cycle - Brayton cycle.

Steam power cycles: Rankine cycle – Reheat cycle - Regenerative cycle – Binary vapour cycle.

UNIT – 2: Internal Combustion Engines

Classification of IC engines - Components and their function - Valve timing diagram and port timing diagram - Comparison of two stroke and four stroke engines – S.I and C.I engines - Carburetors system – Fuel pump and injector system - Comparison of S.I. and C.I engine - Battery and magneto ignition system - Lubrication system and cooling system – Governing of I.C. engine.

Performance of IC engines: Parameters of performance – Indicated power - Morse test - Brake power – Efficiencies of I.C. engines - Air consumption - Heat balance sheet.

UNIT – 3: Boilers and Draught

Boilers: Classification of steam boilers – Modern high pressure boilers – Fluidised bed combustion system – Boiler mountings and accessories – Methods of feed water treatment - Equivalent evaporation - Boiler efficiency – heat losses in a boiler - Heat balance sheet.

Draught: Classification – Natural draught: Chimney height and diameter - Condition for maximum discharge through a chimney - Efficiency of chimney – Artificial draught: Forced draught, Induced draught and balanced draught.

UNIT – 4: Steam Nozzles, Turbines and Condensers

Steam Nozzles: Introduction - Steam flow through nozzles – Nozzle efficiency - Supersaturated flow in a nozzle.

Steam Turbines: Classifications – Compounding - Velocity diagrams for impulse and reaction turbine blade – Governing and control.

Steam Condensers: Requirements of steam condensing plant – Classification of condensers – Sources of air in condensers – Effects of air leakage in a condenser - Vacuum measurement - Vacuum efficiency and condenser efficiency – Air pump - Cooling towers.

UNIT – 5: Air Compressor

Classification of air compressors – Reciprocating compressor – Workdone by single stage reciprocating air compressor with and without clearance volume – Efficiencies of reciprocating compressors - Multistage air compressor and inter cooling – Types of rotary air compressors – Workdone by a rotary air compressors.

Text books:

1. Thermal Engineering, 8/e, 2010, R.K Rajput, Laxmi Publications (P) Ltd, New Delhi.
2. Basic and Applied Thermodynamics, 2/e, 2009, P.K. Nag, Tata McGraw-Hill Education Pvt. Ltd., Noida.

Reference books:

1. Internal Combustion Engines, 4/e, 2012, V. Ganesan, Tata McGraw-Hill Education Pvt. Ltd., Noida.
2. IC Engines, 1/e, 2010, Mathur and Sharma, Dhanpat Rai Publishing Company (P) Ltd., New Delhi.

3. Thermal Engineering, 15/e, 2012, Rudramoorthy, Tata McGraw-Hill Education Pvt.Ltd., Noida.
4. I .C. Engines, 1/e, 1998, Heywood, Tata McGraw-Hill Education Pvt.Ltd., Noida.
5. Thermal Engineering, 5/e, 2008, R.S.Khurmi and J.K.Gupta, S Chand & CompanyPvt. Ltd., New Delhi.

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13MEC 312 AUTOMOBILE TECHNOLOGY

UNIT – 1: Vehicle Structure and Engines

Components of a automobile - Vehicle construction and different layouts - Rear wheel drive, front wheel drive and 4 wheel drive - Chassis, frame and body - Resistances to vehicle motion - Types of automobile engines - Components of engine and their forms - Functions and materials.

UNIT – 2: Fuel and Cooling System

S.I. engine: Fuel supply systems - Mechanical and electrical fuel pump – Filters – Carburettor – Types – Air filters – Gasoline injection.

C.I. engines: Requirements of diesel injection systems - Types of injection systems - Fuel pump, nozzle spray formation, injection timing - Testing of fuel pumps.

Cooling system: Cooling requirements - Air cooling and water cooling – Radiators.

UNIT – 3: Electrical and Lubrication System

Electrical system: Function of an ignition system - Spark plugs – Distributor - Battery ignition system - Magneto coil ignition system - Electronic ignition system - Alternator, cutout, charging circuit – Current-voltage regulator – Starting system - Bendix drive - Mechanism of solenoid switch - Lighting systems – Horn – Wiper - Fuel gauge – Oil pressure gauge - Engine temperatureindicator.

Lubrication system:Various lubricating systems for I.C.engines.

UNIT – 4: Power Transmission System

Clutch: Principle - Types: Single plate clutch, multi plate clutch, cone clutch, magnetic and centrifugal clutches and fluid fly wheel.

Gear box: Types: Sliding mesh, constant mesh, synchromesh, epi-cyclic, over drive, torque converter - Propeller shaft - Differential.

UNIT – 5: Steering, Suspension and Braking System

Steering geometry: Camber, castor, king pin rake, combined angle toe-in, center point steering - Types of steering mechanism – Ackerman steering mechanism - Davis steering mechanism - Steering gears – Types - Steering linkages.

Suspension system: Objects of suspension systems – Rigid axle suspension system - Torsion bar - Shock absorber - Independent suspension system.

Brakingsystem:Mechanical, hydraulic, pneumatic and vacuum brake systems.

Text books:

1. Automobile Engineering-Vol.1 and Vol.2, 7/e, 2007, Kirpal Singh, Standard Book House, New Delhi.
2. Automotive Mechanics, 10/e, 2006, William Crouse, Tata McGraw-Hill Education Pvt. Ltd., Noida.

Reference books:

1. Automobile Engineering, 1/e, 2007, R.K.Rajput, Laxmi Publications (P) Ltd., New Delhi.
2. Automobile Engineering, 2/e, 2003, K.K. Ramalingam, Scitech Publishers, Chennai.
3. Automobile Engineering-Vol-I and II, 1/e, 2006, R.K.Mohanty, Standard Book House, New Delhi.
4. Internal Combustion Engines, 4/e, 2012, V.Ganesan, Tata McGraw-Hill Education Pvt. Ltd., Noida.
5. Automobile Engineering: Vol-I, 2011, P.S.Gill, S.K.Kataria and Sons Publications, New Delhi.

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13MEC 313 KINEMATICS of MACHINERY

UNIT – 1: Mechanism and machines

Mechanism: Elements or links – Classification – Rigid Link, flexible and fluid link – Types of kinematic pairs – Sliding, turning, rolling, screw and spherical pairs – Lower and higher pairs – Closed and open pairs – Constrained motion – Completely, partially or successfully constrained and incompletely constrained .

Machines: Mechanism and machines – Classification of machines – Kinematic chain – Inversion of mechanism – Inversions of quadric cycle, chain – Single and double slider crank chains.

UNIT – 2: Straight Line Motion Mechanisms

Exact and approximate copiers and generated types – Peaucellier, Hart and Scott Russell mechanisms – Grasshopper mechanisms – Watt T. TChebicheff and Robert mechanisms and straight line motion - Pantograph.

UNIT – 3: Kinematics

Velocity and acceleration – Motion of link in machine – Determination of velocity and acceleration diagrams – Graphical method – Application of relative velocity method for four bar chain.

Analysis of mechanisms: Analysis of slider crank chain for displacement, velocity and acceleration of slider – Acceleration diagram for a given mechanism - Kleins construction.

Plane motion of body: Instantaneous center of rotation, centroids and axodes – Relative motion between two bodies – Three centres in line theorem – Graphical determination of instantaneous centre - Diagrams for simple mechanisms and determination of angular velocity of points and links.

UNIT – 4: Steering Mechanisms

Conditions for correct steering – Davis steering gear - Ackermans steering gear – Velocity ratio.

Hooke's joint: Single and double Hooke's joint – Universal coupling – Application – Problems.

Cam: Definitions of cam and followers – Types of followers and cams – Terminology – Types of follower motion - Uniform velocity – Simple harmonic motion and uniform acceleration - Maximum velocity and maximum acceleration during outward and return strokes.
Analysis of motion of followers: Roller follower – Circular cam with straight, concave and convex flanks.

UNIT – 5: Gears and Gear Trains

Classification of gears – Gear tooth terminology - Fundamental law of toothed gearing and involute gearing – Length of path of contact and contact ratio - Interference and undercutting - Gear trains – Simple, compound and epicyclic gear trains - Differentials.

Text books:

1. Theory of Machines and Mechanisms, 3/e, 2009, S.S.Rattan, Tata McGraw-Hill Education Pvt.Ltd., Noida.
2. Theory of Machines, 14/e, 2013, R.S Khurmi and J.K Gupta, S.Chand& Company Pvt. Ltd., New Delhi.

Reference books:

1. Theory of Machines, 3/e, 2009, Thomas Bevan, Pearson Education, New Delhi.
2. Theory of Machines, 5/e, 2010, R.K Bansal, Lakshmi Publications, New Delhi.
3. Theory of Machines, 3/e, 2011, Sadhu Singh, Pearson Education, New Delhi.
4. The Theory of Machines, 3/e, 2009, Shiegley, Oxford University Press, New Delhi.
5. Theory of machines, 25/e, 2011, PL. Ballaney, Khanna Publishers, New Delhi.

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13MEC 314 MANUFACTURING TECHNOLOGY

UNIT – 1: Casting and Melting

Steps involved in making a casting – Types of patterns - Patterns and Pattern making – Materials used for patterns, pattern allowances and their construction - Principles of gating - Gating ratio and design of gating systems - Risers – Types, function and design - Casting design considerations - Concept of solidification of pure metal and alloys, short and long freezing range alloys - Special casting processes: Centrifugal, die investment and slush.
Methods of melting: Crucible melting and cupola operation - Steel making processes.

UNIT – 2: Welding and Cutting

Welding: Classification of welding process - Types of welds and welded joints and their characteristics - Design of welded joints - Heat affected zones in welding - Forge welding - Gas welding - Arc welding – Submerged arc welding, TIG and MIG welding - Resistance welding - Friction welding - Thermit welding - Plasma welding – Induction welding - Explosive welding - Laser welding - Soldering and brazing - Welding defects – Causes and remedies – Destructive and nondestructive testing of welds.
Cutting: Oxy-Acetylene gas cutting - Water plasma - Cutting of ferrous and non-ferrous metals.

UNIT – 3: Hot and Cold Working

Strain hardening - Recovery, recrystallisation and grain growth - Cold and hot working processes and comparison - Rolling fundamentals – Theory of rolling - Types of rolling mills and products - Forces in rolling and power requirements - Blow and injection moulding.

Extrusion of metals:Basic extrusion process and its characteristics - Hot extrusion and cold extrusion - Forward extrusion and backward extrusion – Impact extrusion - Hydrostatic extrusion.

Drawing: Types of drawing methods – Wire drawing and tube drawing – Coining – Hot and cold spinning.

UNIT – 4: Forging and Sheet Metal Processes

Forging processes: Principles of forging – Tools and dies – Types: Smith forging, drop forging, roll forging and rotary forging - Forging hammers – Forging defects.

Sheet metal processes: Stamping - Forming and other cold working processes - Blanking and piercing – Bending and forming.

UNIT – 5: Powder Metallurgy

Powder metallurgy process - Preparation of powders - Characteristics of metal powders - Mixing - Compacting – Sintering – Designing for powder metallurgy – Applications.

Text books:

1. Manufacturing Technology, 3/e, 2012, P.N. Rao, Tata McGraw-Hill Education Pvt. Ltd., Noida.
2. Manufacturing Technology, 4/e, 2002, Kalpak Jain, Pearson Education, New Delhi.

Reference books:

1. Production Technology, 17/e, 2011, R.K. Jain, Khanna publishers, New Delhi.
2. Process and Materials of Manufacturing, 4/e, 2008, Lindberg, Pearson Education, New Delhi.
3. Manufacturing Technology, 1/e, 2007, R.K. Rajput, Laxmi Publications (P) Ltd., New Delhi.
4. A Text book of Manufacturing Technology – II, 1/e, 2008, P.C.Sharma, S.Chand& Company Pvt. Ltd., New Delhi.
5. Powder Metallurgy, 2009, Angelo P.C., Subramanian.R, Pearson Education, New Delhi.

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13MEC 315 DESIGN OF MACHINE ELEMENTS – I

UNIT – 1: Introduction and Stresses in Machine Members

General considerations of design, design process - Selection of engineering materials - Properties – Manufacturing considerations in the design - BIS codes of materials - Preferred numbers.

Stresses in machine members: Simple stresses – Combined stresses – Torsional and bending stresses – Impact stresses – Stress-Strain relation – Various theories of failure – Factor of safety – Design for strength and rigidity - Concept of stiffness in tension, bending, torsion and combined cases.

UNIT – 2: Strength of Machine Elements

Stress concentration – Notch sensitivity – Design for fluctuating stresses – Endurance limit – Estimation of endurance strength – Goodman's line – Soderberg's line.

UNIT – 3: Riveted and Welded Joints

Types of riveted joints - Design of riveted joints - Boiler shell riveting - Eccentric loading - Welded joints.

UNIT – 4: Bolted Joints, Cotter and Knuckle Joints

Bolted joints: Forms of screw threads - Stresses in screw fasteners - Design of bolts with pre-stresses – Design of joints under eccentric loading – Bolts of uniform strength.

Cotter and knuckle joints: Design of cotter joints: Spigot and socket, sleeve and cotter, gib and cotter joints - Knuckle joints.

UNIT – 5: Shafts, Keys and Couplings

Shafts: Design of solid and hollow shafts for strength and rigidity – Design of shafts for combined bending and axial loads – Shaft sizes – BIS code – Splines.

Keys and couplings: Design of rigid couplings: Muff, split muff and flange couplings - Flexible couplings.

Text books:

1. Machine design, 18/e, Pandya and Shah, Charotar Publishing House Pvt. Ltd. Anand.
2. Introduction to Machine Design, 2/e, 2013, V.B.Bhandari, Tata McGraw-Hill Education Pvt. Ltd., Noida.

Reference books:

1. Machine design, 9/e, 2011, J.E. Shigley, Tata McGraw-Hill Education Pvt. Ltd., Noida.
2. Machine Design, 2/e, 1968, Alfred Hall, A.Holowenko, H.Lanphlin, Schaum Series, Tata McGraw-Hill Education Pvt. Ltd., Noida.
3. Design of Machine Elements-I, 2/e, 2010 T. Krishna Rao, I.K. International Publishing House Pvt. Ltd., New Delhi.
4. Machine Design, 12/e, 2009, P.Kannaiah, Scitech Publishers, Chennai.
5. Machine Design, 11/e, 1996, R.S.Khurmi and J.K.Gupta, S.Chand& Company Pvt. Ltd., New Delhi.

- Machine Tool Design hand Book, 1/e, 2001, Central Machine Tool Institute, Tata McGraw-Hill Education Pvt. Ltd., Noida.
- Note: Design data books are not permitted in the examinations. The design must not only satisfy strength criteria but also rigidity criteria.

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13MEC 316 TECHNICAL CASE STUDY

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13MEC 317 THERMAL ENGINEERING LABORATORY and AUTOMOBILE TECHNOLOGY LABORATORY

Thermal Engineering Laboratory

1. Valve timing diagram of an I.C. engines.
2. Port timing diagram of an I.C. engines.
3. Performance test on 4 -stroke diesel engines.
4. Performance test on 2-stroke petrol engine.
5. Evaluation of engine friction by conducting Morse test on 4-stroke multi cylinder engine.
6. Retardation and motoring test on 4- stroke engine
7. Heat balance of an I.C. engine.
8. Air/Fuel ratio and volumetric efficiency of an I.C. engines.
9. Performance test on variable compression ratio engines and economical speed test.
10. Performance test on reciprocating air compressor unit.
11. Study of boilers.

Automobile Technology Laboratory

1. Study, dismantling and assembling of multi cylinder petrol engine.
2. Study, dismantling and assembling of multi cylinder diesel engine.
3. Study of petrol engine fuel system.
4. Study of diesel engine fuel system.
5. Study and measurement of heavy commercial vehicle frame.
6. Study, dismantling and assembling of front and rear axles.
7. Study, dismantling and assembling of differential.
8. Study, dismantling and assembling of clutch.
9. Study, dismantling and assembling of gear box.
10. Study of steering system.
11. Study of breaking system.

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13MEC 318 MANUFACTURING TECHNOLOGY LABORATORY

A. Metal Casting:

1. Pattern design and making for one casting drawing.
2. Sand properties testing exercise for strengths and permeability.
3. Moulding: Melting and casting.

B. Welding:

1. ARC welding lap and butt joint.
2. Spot welding.
3. TIG welding.

C. Mechanical Press Working:

1. Study of simple, compound and progressive press tool.
2. Blanking and piercing operation.
3. Hydraulic press: Deep drawing and extrusion operation.
4. Bending and other operations.

D. Processing of Plastics:

1. Injection moulding.
2. Blow moulding.

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13MEC 321 OPERATIONS RESEARCH

UNIT – 1: Linear Programming Models

Development – Definition - Characteristics and phases - Types of models and applications - Linear programming problem formulation - Graphical solution - Simplex method and duplex method- Artificial variables techniques - Two–phase method - Big-M method – Duality principle - Economic interpretation of duality.

UNIT – 2: Transportation, Assignment and Sequencing

Transportation: Formulation – Optimal solution - Unbalanced transportation problem – Degeneracy.

Assignment: Formulation – Optimal solution - Variants of assignment problem - Traveling salesman problem.

Sequencing: Introduction – Flow – Shop sequencing – ‘n’ jobs through two machines – ‘n’ jobs through three machines – Job shop sequencing – Two jobs through ‘m’ machines.

UNIT – 3: Network Models

Shortest route – Minimal spanning tree - Maximum flow models – Project network - CPM and PERT network - Critical path scheduling.

UNIT – 4: Queuing Theory

Queuing models – Queuing systems and structures – Notation – Parameter – Single server and multiserver models – Poisson input – Exponential service – Constant rate service – Infinite population.

UNIT – 5: Theory of Games

Introduction – Minimax (maximin) – Criterion and optimal strategy – Solution of games with saddle points – Rectangular games without saddle points – 2 X 2 games – Dominance principle – m X 2 and 2 X n games - Graphical method.

Text books:

1. Operations Research-An Introduction, 9/e, 2012, Taha, Prentice-Hall of India, Pvt. Ltd., New Delhi.
2. Introduction to Operations Research, 9/e, 2011, Hiller, Libermann, Tata McGraw-Hill Education Pvt. Ltd., Noida.

Reference books:

1. Operations Research, 7/e, 2011, A.M. Natarajan, P.Balasubramani, A. Tamilarasi, Pearson Education, New Delhi.
2. Operations Research, 2/e, 2003, Richard Bronson, GovindasamiNaadimuthu, Tata McGraw-Hill Education Pvt. Ltd., Noida.
3. Operations Research, 3/e, 2010 J.K. Sharma, Mac Milan, New Publishers, New York.
4. Operations Research, 2/e, 2011, R.Panneerselvam, Prentice-Hall of India, Pvt. Ltd., New Delhi.
5. Operations Research, 2/e, 2009, Wagner, Prentice-Hall of India, Pvt. Ltd., New Delhi.

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13MEC 322 DYNAMICS of MACHINERY

UNIT – 1: Precession and Friction

Precession: Gyroscopes - Effect of precession motion on the stability of moving vehicles such as motor car, motor cycle, aero planes and ships.

Friction:Inclined plane - Friction of screw and nuts, pivot and collar - Uniform pressure, uniform wear, friction circle and friction axis - Lubricated surfaces - Boundary friction - Film lubrication.

UNIT – 2: Clutches, Brakes and Dynamometers

Clutches: Friction clutches - Single disc or plate clutch, multiple disc clutch, cone clutch and centrifugal clutch.

Brakes: Simple block brakes - Internal expanding brake and band brake of vehicle. Dynamometers: Absorption and transmission types - General description and methods of operation.

UNIT – 3: Turning Moment Diagram and Fly Wheels

Turning moment diagrams for steam engine, I.C. Engine and multi cylinder engine - Crank effort - Coefficient of fluctuation of energy - Coefficient of fluctuation of speed – Fly wheels and their design.

UNIT – 4: Governors and Balancing

Governors: Watt, Porter and Proell governors - Spring loaded governors – Hartnell and Hartung governors with auxiliary springs - Sensitiveness, isochronism and hunting – Effort and power of a governor.

Balancing:

Rotating masses: Balancing of rotating masses - Single and multiple planes, single and different planes.

Reciprocating masses:Primary, secondary and higher balancing of reciprocating masses - Analytical and graphical methods - Unbalanced forces and couples – V, multi cylinder, in-line and radial engines for primary and secondary balancing - Locomotive balancing – Hammer blow, swaying couple - Variation of tractive force.

UNIT – 5: Vibration

Free vibration of mass attached to vertical spring – Oscillation of pendulums - Centers of oscillation and suspension - Transverse loads - Vibrations of beams with concentrated and distributed loads - Dunkerly's method - Raleigh's method - Whirling of shafts - Critical speeds - Torsional vibrations - Two and three rotor systems - Simple problems on forced, damped vibration - Vibration isolation and transmissibility

Text books:

1. Theory of Machines and Mechanisms, 3/e, 2009, S.S.Rattan, Tata McGraw-Hill Education Pvt.Ltd., Noida.
2. Theory of Machines, 14/e, 2013, R.S Khurmi and J.K Gupta, S.Chand& Company Pvt. Ltd. New Delhi.

Reference books:

1. Theory of Machines, 3/e, 2009, Thomas Bevan, Pearson Education, New Delhi.
2. Theory of Machines, 5/e, 2010, R.K Bansal, Lakshmi Publications, New Delhi.
3. Theory of Machines, 3/e, 2011, Sadhu Singh, Pearson Education, New Delhi.
4. The Theory of Machines, 3/e, 2009, Shiegley, Oxford University Press, New Delhi.
5. Theory of machines, 25/e, 2011, PL. Ballaney, Khanna Publishers, New Delhi.

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13MEC 323 DESIGN of MACHINE ELEMENTS - II

UNIT – 1: Engine Parts

Pistons - Forces acting on piston – Construction design and proportions of piston, cylinder, cylinder liners - Connecting Rod - Thrust in connecting rod – Stress due to whipping action on connecting rod ends – Cranks and crank shafts - Strength and proportions of over hung cranks.

UNIT – 2: Mechanical Springs and Design of Power Screws

Mechanical springs: Stress and deflections of helical springs - Springs for fatigue loading – Natural frequency of helical springs - Energy storage capacity - Helical torsion springs - Leaf springs - Coaxial springs.

Design of power screws: Design of screw – Square, ACME and buttress screws - Efficiency of the screw - Design of nut, compound screw, differential screw, ball screw - Possible failures.

UNIT – 3: Power Transmissions Systems

Introduction - Types of belt and rope drives - Materials used for belt and rope drives - Design of flat belt drives, V-belt drives and rope drives - Classification of chains - Design procedure for chain drives.

UNIT – 4: Bearings

Types of journal bearings – Lubrication – Bearing modulus – Bearing materials – Design of journal bearing, ball bearing and roller bearing – Static loading of ball and roller bearings - Bearing life – Failure of bearings.

UNIT – 5: Spur and Helical Gears

Spur gears - Helical gears – Load concentration factor – Dynamic load factor - Surface compressive strength – Bending strength – Design analysis of spur gears – Estimation of centredistance, module and face width - Check for plastic deformation - Check for dynamic and wear considerations.

Text books:

1. Machine design, 9/e, 2011, J.E. Shigley, Tata McGraw-Hill Education Pvt.Ltd., Noida.
2. Machine design, 18/e, Pandya and Shah, Charotar Publishing House Pvt. Ltd. Anand.

Reference books:

1. Machine Design an Integrated Approach, 2/e, 2002, Robert L.Norton, Pearson Education, New Delhi.
2. Introduction to Machine Design, 2/e, 2013, V.B.Bhandari, Tata McGraw-Hill Education Pvt. Ltd., Noida.
3. Design of Machine Elements-II, 2/e, 2011, T. Krishna Rao, I.K. International Publishing House Pvt. Ltd., New Delhi.
4. Machine Design, 12/e, 2009, P.Kanniah, Scitech Publishers, Chennai.
5. Machine Design, 11/e, 1996, R.S. Khurmi and J.K.Gupta, S.Chand& Company Pvt. Ltd., New Delhi.

- Machine Tool Design Hand Book, 1/e, 2001, Central Machine Tool Institute, Tata McGraw-Hill Education Pvt.Ltd., Noida.
- Data Books: (i) P.S.G. College of Technology (ii) BalaveerSwamy and Mahadevan

Tables/Codes: Design data book to be supplied in end exam.

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13MEC 324 REFRIGERATION and AIR CONDITIONING

UNIT – 1: Introduction to Refrigeration

Necessity and applications – Unit of refrigeration and C.O.P. – Different refrigeration methods - Air refrigeration: Ideal and actual cycles - Open and dense air systems – problems – Refrigeration needs of air crafts - Heat Pump – Heat sources – Different heat pump circuits.

UNIT – 2: Vapor Compression Refrigeration

Basic cycle - Working principle and essential components of the plant – COP – Representation of cycle on T-S and P-h charts – Expander Vs throttling - Effect of sub cooling and super heating – Cycle analysis – Actual cycle- Influence of various parameters on system performance – Construction and use of P-h charts – Numerical problems.

UNIT – 3: Vapor Absorption Refrigeration

Description and working of NH_3 – Water system and Li Br – Water (two shells and four shells) system - Calculation of maximum COP - Principle of operation of three fluid absorption system.

UNIT – 4: Refrigerants

Desirable properties – Classification of refrigerants used – Nomenclature - Secondary refrigerants - Lubricants – Ozone depletion – Global warming - Newer refrigerants.

Steam jet refrigeration system: Working principle and basic components - Estimation of motive steam required - Principle and operation of: Thermo-electric refrigerator and vortex tube or Hilsch tube.

UNIT – 5: Air Conditioning

Psychrometric properties and processes - Characterization of sensible and latent heat loads - Need for ventilation - Consideration of infiltrated air - Heat load concepts: RSHF, GSHF - Problems.

Air conditioning equipment: Humidifiers – Dehumidifiers – Air filters, fans and blowers - Requirements of human comfort and concept of effective temperature - Comfort chart – Comfort air conditioning - Summer, winter and year round air conditioning - Simple problems – Duct design.

Text books:

1. Refrigeration and Air Conditioning, 3/e, 2008, CP Arora, Tata McGraw-Hill Education Pvt. Ltd., Noida.
2. Refrigeration and Air Conditioning, 7/e, 2012, P.L.Ballaney, Khanna Publishers, New Delhi.

Reference books:

1. Refrigeration and Air Conditioning, 2/e, 2003, Manohar Prasad, New Age International (P) Ltd, Publishers, New Delhi.
2. Principles of Refrigeration, 4/e, 2007, Dossat, Pearson Education, New Delhi.
3. Refrigeration and Air Conditioning, 2/e, 2010, R.C.Arora, Prentice-Hall of India, Pvt. Ltd., New Delhi.
4. Basic Refrigeration and Air-Conditioning, 4/e, 2013, Ananthanarayanan, Tata McGraw-Hill Education Pvt. Ltd., Noida.
5. Modern Refrigeration and Air Conditioning, 2/e, 1995, P.S.Desai, Khanna Publishers, New Delhi.

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13MEC 325 ENGINEERING METROLOGY and MEASUREMENTS

UNIT – 1: Systems of Limits, Fits and Tolerances

Introduction - Definitions - Fits and their types – Unilateral and bilateral tolerance system, hole and shaft basis systems – Interchangeability and selective assembly - Indian standard institution system – International standard system for plain and screwed work.

UNIT – 2: Linear, Angular Measurement and Comparators

Linear measuring instruments: Vernier, micrometer, slip gauges, dial indicator and micrometers.

Angular measurements: Sine bar, sine center, bevels protractor, sprit level and angle decker.

Comparators: Mechanical, pneumatic, optical and electrical comparators and applications.

UNIT – 3: Optical Measuring Instrument, Flatness Measurement and Limit Gauges

Tool maker's microscope – Collimators, optical projector, optical flats and their uses – Interferometer –Interferometer – NPL interferometer – Gauge length interferometer.

Flatness measurement: Measurement of flatness of surfaces – Straight edges – Surface plates – Optical flat and auto collimator.

Limit gauges: Plug, ring, snap, gap, taper profile and position gauges – Taylor's principle.

UNIT - 4: Surface Roughness and Screw Thread Measurement

Differences between surface roughness and surface waviness - Numerical assessment of surface finish – R.M.S Values – R_a , R_z, R_t values - Methods of measurement of surface finish – Profilograph – Talysurf - BIS symbols for indication of surface finish.

Screw thread measurement: Elements of measurement – Errors in screw threads – Measurement of effective diameter (two wire and three wire method), angle of thread and thread pitch - Profile thread gauges.

UNIT- 5: Gear Measurement and Machine Tool Alignment Tests

Gear measurement: Gear measuring instruments - Measurement of gear tooth profile diameter, pitch, pressure angle and tooth thickness.

Machine tool alignment tests: Requirements of machine tool alignment tests - Alignment tests on lathe, milling, drilling machine tools - Preparation of acceptance charts.

Text books:

1. Engineering Metrology, 6/e, 2012, Mahajan, Dhanpat Rai Publishing Company (P) Ltd., New Delhi.
2. Engineering Metrology, 3/e, 2012, R.K. Jain, Khanna Publishers, New Delhi.

Reference books:

1. The Essence of Measurement, 1/e, 1997, Alan S. Morris, Prentice Hall of India Pvt. Ltd., New Delhi.
2. A Textbook of Engineering Metrology, 4/e, 2009, I.C.Gupta, Dhanpat Rai Publishing Company (P) Ltd., New Delhi.

3. Surface Engineering with Lasers, 6/e, 2001, Jeff Th M. Dehosson, Springer (India) Pvt. Ltd., Bangalore.
4. Surface Engineering for corrosion and wear resistance, n/e, 2001, JR Davis, ASM International, State of Ohio.
5. Mechanical Measurements, 6/e, 2009, John H. Lienhard V, Thomas G.Beckwith, Roy D. Marangoni, Pearson Educations, New Delhi.

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13MEC 326 MACHINE TOOLS TECHNOLOGY

UNIT – 1: Elementary Treatment of Metal Cutting Theory
Elements of cutting process – Geometry of single point tool and angles - Chip formation and types of chips – Built up edge and its effects - Chip breakers - Cutting forces – Cutting speeds, feed, depth of cut, tool life, coolants and machinability – Tool materials.

UNIT – 2: Engine Lathe
Principle of working - Specification of lathe – Types of lathes – Work holders - Tool holders – Box tools - Taper turning, thread turning - Attachments for lathes - Turret and capstan lathes – Collet chucks – Tool layout - Principal features of automatic lathes – Classification – Single spindle and multi-spindle automatic lathes – Tool layout of automatic lathes.

UNIT – 3: Shaping, Slotting, Planning and Milling Machine
Shaping, slotting and planning machines: Principles of working - Principal parts – Specification – Classification - Operations performed - Kinematic scheme of the shaping, slotting and planning machines - Machining time calculations.
Milling machine: Principles of working – Specifications – Classifications of milling machines – Principal features of horizontal, vertical and universal milling machines – Machining operations - Types and geometry of milling cutters – Methods of indexing.

UNIT – 4: Drilling and Boring Machines
Principles of working – Specifications – Types - Operations performed – Tool holding devices – Twist drill - Fine boring machines – Jig boring machine - Deep hole drilling machine - Kinematics scheme of the drilling and boring machines.

UNIT – 5: Grinding, Lapping, Honing and Broaching Machines
Grinding machine: Theory of grinding – Classification of grinding machine – Cylindrical and surface grinding machine – Tool and cutter grinding machine – Special types of grinding machines – Grinding wheel - Different types of abrasives – Bonds - Specification and selection of a grinding wheel.
Lapping, honing and broaching machines: Constructional features of lapping, honing and broaching machine - Comparison of grinding, lapping and honing - Machining time calculations.

Text books:

1. Production Technology, 5/e, 2005, R.K. Jain and S.C. Gupta, Khanna Publishers, New Delhi.
2. Workshop Technology-Vol II, 2/e, 2006, B.S. Raghuvamshi, S.Chand& Company Pvt. Ltd., New Delhi.

Reference books:

1. Machine Tools, 3/e, 2005, C.Elanhezhian and M. Vijayan, Anuradha Agencies Publishers, Chennai.
2. Manufacturing Technology, 5/e, 2006, Kalpakzian, Pearson Education, New Delhi.
3. Production Technology, H.M.T. (Hindustan Machine Tools), 11/e, 2004, Khanna Publications, New Delhi.
4. Introduction to Manufacturing Technology, 2/e, 2010, Date, Jaico Publishing House, Kolkata.
5. Workshop Technology, 2/e, 2006, R.S.Khumi, S.Chand& Company Pvt. Ltd., New Delhi.

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13MEC 327 METROLOGY LABORATORY and MACHINE TOOLS TECHNOLOGY LABORATORY

Metrology Laboratory

1. Measurement of lengths, heights, diameters by vernier calipers, micrometers etc.
2. Measurement of bores by internal micrometers and dial bore indicators.
3. Use of gear tooth vernier calipers and checking the chordal addendum and chordal height of spur gear.
4. Alignment test on the lathe and milling machine.
5. Study of tool makers microscope and its application.
6. Angle and taper measurements by bevel protractor, sine bars, etc.
7. Use of spirit level in finding the flatness of surface plate.
8. Thread measurement by two wire / three wire method.
9. Surface roughness measurement by Talysurf instrument.
10. Surface wear resistances test using electro spark coating device.

Machine Tools Technology Laboratory

1. Demonstration of construction and operations of general purpose machines: Lathe, drilling machine, milling machine, shaper, planning machine, slotting machine, cylindrical grinder, surface grinder and tool and cutter grinder.
2. Job on step turning and taper turning on lathe machine.
3. Job on thread cutting and knurling on lathe machine.
4. Job on drilling and tapping.

5. Job on shaping and planning.
6. Job on slotting.
7. Job on milling.
8. Job on cylindrical surface grinding.
9. Job on grinding of tool angles.

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13MBA 218 SOFT SKILLS LABORATORY

The objective of soft skill lab is to enhance the knowledge of the students to improve their employability and career opportunities.

UNIT – 1: Just A Minute (JAM) and Debates:

Introduction – Activity types – Time management – Rules and procedure – Confidence building – Goals.

Debates: Introduction - Importance of team line - Different formats of debates - Judging the debate - Qualities of good debates.

UNIT – 2: Team Building and Creativity:

Team building: Introduction - Meaning – Definition of team – Difference between team and group – Factors of team building – Key roles – Impact of team building - Challenges and its overview.

Creativity: Introduction - Meaning – Definition - Importance of creativity and its quality – Basic Ideas of improve creativity – Techniques and tools – Creativity thinking skills – Barriers to creativity – Overview.

UNIT – 3: Resume Preparation and Seminars with PPTs:

Introduction – Necessity – Difference between resume and curriculum vitae – Types of resume writing – Tools and techniques – Preparation of effective resume writing.

Seminars with PPTs: Introduction – Collecting of data – Planning preparation – Type style and format – Use of props – Attracting audience – Voice modulation – Clarity – Body language and asking queries.

UNIT – 4: Group Discussion:

Introduction – Types – Guidelines to group discussion - Group discussion topics – Do's and Dont's of group discussion – Practical group discussion sessions.

UNIT – 5: Interview Skills:

Interviews – Types of interviews – Guide lines for interview – Tips of Interview – Do's and Dont's of interview – Mock interviews - Advancement in conducting and organizing - Practical HR interviews.

Reference books:

1. Career Planning and Development, 1/e, 2010, S.D.Naidu, N.G.naidu, Students Help Line TM Publishing Home, Hyderabad.
2. Leadership for Leaders, 2/e, 2008, Michel Willams, Viva Books, New Delhi.
3. Essentials of Business Communication, 11/e, 2009, Pal, Rajendra, Korlahalli, Sultan Chand and Sons, New Delhi.
4. Personality Development, 2/e, 2010, S.Sujana, S.Murali Krishna, Students Help Line TM Publishing Home, Hyderabad.
5. The Heart of Creative Thinking, 2/e, 2008, John Adair, Kogan Page Publications, New Delhi.
6. Effective Team Work, 1/e, 2006, Micheal West, Excel Books, New Delhi.
7. A-Z Guide to Job Searching, 1/e, 2004, AndraShavick, Kogan Page Publications, New Delhi.
8. How to Motivate People, 2/e, 2008, Patric Forsyth, Kogan Page Publications, New Delhi.

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13MEC 411 HEAT TRANSFER

UNIT – 1: Basic Concepts and Fundamental Equations of Conduction

Introduction – Heat transfer in engineering – Mechanisms – Temperature field and gradient – Conduction – Convection – Thermal Radiation – Fourier rate equation – General heat conduction equation in Cartesian, cylindrical and spherical coordinates – Initial and boundary conditions.

UNIT – 2: One Dimensional Steady State Heat Conduction

Steady state heat conduction**:** Introduction – Systems without internal heat conduction – Systems with variable thermal conductivity – Composite systems – Critical radius of insulation – Systems with heat sources – Extended surfaces (fins).

Transient heat conduction**:** Systems with negligible internal resistance – Response time of a temperature measuring instrument - Systems with negligible surface resistance - Semi-infinite body - Systems with finite surface and internal resistance - Chart solutions of transient conduction.

UNIT – 3: Convective Heat Transfer

Introduction- Convective heat transfer coefficient – Basic equations – Boundary layer concepts – Differential boundary layer equations – Boundary layer similarity parameters – Turbulence and time averaging equations – Flow through pipes – Dimensional analysis.

Forced convection**:** Parallel flowover a flat plate – Flow over cylinders and spheres – Flow across tube banks – Fully developed laminar tube flow in circular tubes – Entry region in laminar tube flow – Convection correlations for turbulent flow in tubes – Convection correlations for non-circular tubes.

Natural convection: Laminar boundary layer equations of free convection on a vertical flat plate – Integral method for free convection on a vertical flat plate – Transition and turbulence in free convection – Empirical correlations for natural convection.

UNIT – 4: Radiation Heat Transfer

Nature of thermal radiation, emissive power – Absorption, reflection, transmission – Concept of black body – Intensity of radiation (Lambert's Cosine law) – Laws (Planck's, Wien's, Rayleigh-Jeans, Stefan Boltzmann law) – Kirchhoff's law – Radiation between two black isothermal surfaces – Shape factor - Heat exchange between gray bodies – Electrical network analogy for thermal radiation – Radiation shields.

UNIT – 5: Heat Exchangers, Boiling and Condensation

Heat exchangers: Introduction – Types of heat exchangers – Overall heat transfer coefficient - Fouling factors – LMTD and NTU methods – Problems.

Boiling and condensation: Boiling heat transfer phenomena – Boiling correlations – Flow boiling – Condensation heat transfer – Laminar and turbulent film wise condensation – Filmwise condensation on horizontal tubes, inside horizontal tubes.

Text books:

1. Fundamentals of Engineering: Heat and Mass Transfer, 3/e, 2008, R.C. Sachdeva, New Age International (P) Ltd, Publishers, New Delhi.
2. Fundamentals of Heat and Mass Transfer, 1/e, 2006, M.Thirumaleswar, Pearson Education, New Delhi.

Reference books:

1. Heat Transfer, 2/e, 2010, P.K.Nag, Tata McGraw-Hill Education Pvt.Ltd., Noida.
2. Heat Transfer, 9/e, 2010, J.P. Holman, Tata McGraw-Hill Education Pvt.Ltd., Noida.
3. Fundamentals of Heat Transfer and Mass Transfer, 5/e, 2005, F. P. Incropera and D. P. Dewittt, Wiley India Pvt, Ltd., New Delhi.
4. Heat Transfer, 2/e, 2005, Ghoshdastidar, Oxford University Press, New Delhi.
5. Fundamentals of Heat and Mass Transfer, 3/e, 2012, C.P.Kothandaraman, New Age International (P) Ltd, Publishers, New Delhi.

Codes/Tables: Data book to be supplied in exams.

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13MEC 412 COMPUTER AIDED DESIGN and MANUFACTURING

UNIT – 1: Computer Graphics and Drafting

Computers in industrial manufacturing - Product cycle - CAD / CAM hardware - Basic structure – CPU, memory types, input devices, display devices, hard copy devices, storage devices - Raster scan graphics coordinate system - Database structure for graphics modeling - Transformation of geometry - 3D transformations - Geometric commands, layers, display control commands, editing and dimensioning.

UNIT – 2: Geometric Modeling

Requirements - Geometric models - Geometric construction models - Curve representation methods, surface representation methods - Modeling facilities desired.

UNIT – 3: Numerical Control

NC - NC modes - NC elements - NC machine tools - Structure of CNC machine tools - Features of machining center, turning center - CNC part programming fundamentals - Manual part programming methods - Computer aided part programming.

UNIT – 4: Group Technology

Part family - Coding and classification - Production flow analysis - Advantages and limitations - Computer aided processes planning: Retrieval type and generative type.

Types of manufacturing systems: FMS - Material handling systems - Computer control systems – JIT.

UNIT – 5: Computer Integrated Production Planning

Capacity planning**,** shop floor control, MRP-I, MRP-II, CIMS benefits.

Computer aided inspection and quality control: Terminology in quality control - Computer in QC - Contact inspection methods, non-contact inspection methods, optical non-contact inspection methods and non-optical computer aided testing - Integration of CAQC with CAD/CAM.

Text books:

1. CAD/CAM, 1/e, 2003, E Zimmers and M.P.Groover, Pearson Education, New Delhi.
2. CAD/CAM-Principles and Applications, 3/e, 2010, P.N. Rao, Tata McGraw-Hill Education Pvt. Ltd., Noida.

Reference books:

1. Automation, Production systems and Computer Integrated Manufacturing, 3/e, 2008, Groover, Pearson Education, New Delhi.
2. CAD/CAM/CIM, 3/e, 2007, V.Raju, P.Radhakrishnan and S.Subramanyam, New Age International (P) Ltd, Publishers, New Delhi.
3. CAD/CAM Theory and Practice, 2/e, 2009, R. Sivasubramaniam, Tata McGraw-Hill Education Pvt. Ltd., Noida.
4. Computer Aided Design and Manufacturing, 1/e, 2008, Lalit Narayan, Pearson Education, New Delhi.
5. Computer Aided Manufacturing, 3/e, 2008, Tien Chien Chang, Pearson Education, New Delhi.

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13MEC 413 AUTOMATION and ROBOTICS

UNIT – 1: Introduction to Automation

Basic elements of an automated system – Need – Types - Levels of automation - Hardware components for automation and process control - Mechanical feeders – Hoppers – Orienters - High speed automatic insertion devices.

UNIT – 2: Automated Flow Lines and Assembly Line Balancing

Automated flow lines: Part transfer methods and mechanisms - Types of flow lines, flow line with/without buffer storage - Qualitative analysis.

Assembly line balancing: Assembly process and systems assembly line, line balancing methods, ways of improving line balance and flexible assembly lines.

UNIT – 3: Introduction to Industrial Robots

Classification - Robot configurations - Functional line diagram - Degrees of freedom – Components - Common types of arms, joints and grippers.

UNIT – 4: Manipulator

Manipulator kinematics: Homogeneous transformations as applicable to rotation and translation - D-H notation - Forward and inverse kinematics.

Manipulator dynamics: Differential transformation – Jacobians, Lagrange-Euler and Newton-Euler formations.

Trajectory planning: Trajectory planning and avoidance of obstacles - Path planning - Skew motion - Joint integrated motion – Straight line motion.

Robot programming: Types – Features of languages and software packages.

UNIT – 5: Robot Actuators, Feed Back Components and Robot Applications

Robot actuators and feed back components: Actuators: Pneumatic, hydraulic actuators, electric and stepper motors – Comparison - Position sensors – Potentiometers, resolvers, encoders – Velocity sensors, tactile sensors and proximity sensors.

Robot application in manufacturing: Material transfer - Material handling - Loading and unloading - Processing - Spot and continuous arc welding and spray painting - Assembly and inspection.

Text books:

1. Automation, Production Systems and CIM, 3/e, 2008, M.P.Groover, Prentice- Hall of India, Pvt. Ltd., New Delhi.
2. Introduction to Robotics-Analysis, Control, Applications, 2/e, 2011, Saeed B.Niku, Wiley India Pvt, Ltd., New Delhi.

Reference books:

1. Industrial Robotics, 2/e, 2012, M.P. Groover, Tata McGraw-Hill Education Pvt. Ltd., Noida.
2. Robotics Technology and Flexible Automation, 2/e, 2009, S.R.Deb, Shankar Deb, Tata McGraw-Hill Education Pvt. Ltd., Noida.
3. Fundamentals of Robotics: Analysis and Control, 1/e, 2009, Robert J.Schilling, Prentice-Hall of India, Pvt. Ltd., New Delhi.
4. Robotics, Fundamental Concepts and Analysis, 1/e, 2006, AshitaveGhosal, Oxford University Press, New Delhi.
5. Introduction to Robotics, 3/e, 2008, John J. Craig, Pearson Education, New Delhi.

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13MEC 414 INDUSTRIAL ENGINEERING and MANAGEMENT

UNIT – 1: Concepts of Management and Organization

Functions of management – Evolution of management thought: Taylor's scientific management - Fayol's principles of management - Douglas Mc-Gregor's theory X and theory Y - Mayo's Hawthorne experiments - Hertzberg's two factor theory of motivation - Maslow's hierarchy of human needs – Systems approach to management.

UNIT – 2: Designing Organizational Structures

Basic concepts related to organization - Departmentation and decentralization - Types of mechanistic and organic structures of organization (line organization, line and staff organization, functional organization, committee organization, matrix organization, virtual organization, cellular organization, team structure, boundary less organization, inverted pyramid structure, lean and flat organization structure) and their merits, demerits and suitability.

UNIT – 3: Plant Locations and Work Study

Plant location: Definition - Factors affecting the plant location - Comparison of rural and urban sites - Methods for selection of plant - Matrix approach - Plant layout – Definition, objectives, types of production, types of plant layout – Various data analyzing forms - Travel chart.

Work study: Definition – Objectives - Method study: Definition, objectives, steps involved - Various types of associated charts - Difference between micro-motion and memo-motion studies - Work measurement: Definition - Time study: Definition, steps involved, equipment, different methods of performance rating, allowances, standard time calculation - Work Sampling: Definition, steps involved, standard time calculations, differences with time study - Applications.

UNIT – 4: Materials Management, Inspection and Quality Control

Materials management: Objectives - Inventory – Functions - Types, associated costs, inventory classification techniques - Stores management and stores records - Purchase management - Duties of purchase manager and associated forms.

Inspection and quality control: Types of inspections – Difference between inspection and quality control - Statistical quality control techniques - Variables and attributes - Assignable and non assignable causes - Variable control charts and R charts, attributes control charts, p charts and c charts - Acceptance sampling plan- Single sampling and double sampling plans - OC curves - Introduction to TQM - Quality circles, ISO 9000 series procedures.

UNIT – 5: Human Resource Management

Functions of HRM - Job evaluation - Different types of evaluation methods - Job description - Merit rating - Different methods of merit ratings - Wage incentives - Different types of wage incentive schemes – Marketing - Marketing Vs selling - Marketing mix - Product life cycle.

Text books:

1. Industrial Engineering and Management, 17/e, 2010, O.P. Khanna, Dhanpat Rai Publishing Company (P) Ltd., New Delhi.
2. Manufacturing Organization and Management, 2/e, 2004, Amrine, Pearson Education, New Delhi.

Reference books:

1. Industrial Engineering and Organization Management, 1/e, 2011, S.K.Sharma, Savita Sharma, S.K.Kataria and Sons Publications, New Delhi.
2. Industrial Engineering and Management, 2/e, 2009, RaviShankar, Galgotia Publications, New Delhi.
3. Production and Operations Management, 3/e, 2012, PanneerSelvam, Pearson Education, New Delhi.
4. Motion and Time Study: Design and Measurement of work, 7/e, 2009, Ralph M Barnes, Wiley India Pvt, Ltd., New Delhi.
5. Operations Management, 10/e, 2003, Chase, Jacobs, Aquilano, Tata McGraw-Hill Education Pvt. Ltd., Noida.

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13MEC 415A TOOL DESIGN(ELECTIVE - I)

UNIT – 1: Tooling Materials and Heat Treatment

Properties of materials - Ferrous, nonferrous, non metallic, tooling materials, heat treating - Limits, fits and tolerances - Gauges and gauge design - Coated tools and ceramic tools.

UNIT – 2: Design of Single Point and Multi Point Cutting Tools

Design of single point cutting tools: Single point cutting tools - Various systems of specifications, geometry and their inter relation - Theories of formation of chip and their effect - Design of broach.

Design ofmultipoint cutting tools: Drill geometry, design of drills, rake and relief angles of twist drill, speed, feed and depth of cut, machining time, forces - Milling cutters - Cutting speeds and feed - Machining times design - Form cutters, combination tools, reamers etc.

UNIT – 3: Design of Jigs and Fixtures

Basic principles of location and clamping - Locating methods and devices - Jigs: Definitions, types, general consideration in the design of jigs, drills bushing, methods of construction – Fixtures: Milling, boring, lathe and grinding fixtures.

UNIT – 4: Design of Sheet Metal

Blanking and piercing: Fundamentals of die cutting operating - Power press types - General press information - Material handling equipment - Cutting action in punch and die operation - Die clearance - Die design fundamentals - Blanking and piercing die construction – Pilots, striper and pressure pads, press work material, strip layout, short run tooling for piercing.

Bending, forming and drawings die: Bending dies, drawing dies, forming dies - Drawing operations - Variables that effect metal flow during drawing: Determination of blank size, drawing force, single and double action draw dies.

UNIT – 5: Tool Life and Tool Wear

Theories of tool wear - Adhesion, abrasive and diffusion wear mechanisms forms of wear, tool life criteria and mach inability index - Tool wear criterion and measurement of tool wear.

Using Plastics as Tooling Materials: Introduction - Application of epoxy plastic tools - Construction methods of plastic tooling metal forming operations with urethane dies - Calculating forces for urethane pressure pads - Economics of tooling.

Text books:

1. Tool Design, 4/e, 2012, Cyrill Donaldson, George H.Lecain and Goold, Tata McGraw-Hill Education Pvt. Ltd., Noida.
2. Cutting Tools for Productive Machining, 1/e, 1999, Sadasivan, T. A., and Sarathy, D., Willey (India) Pvt. Ltd, Bangalore.

Reference books:

1. Fundamentals of Machining and Machine Tools, n/e, 2011, RK Singal, I.K. International Publishing House Pvt. Ltd., New Delhi.
2. Metal Cutting Principles, 1/e, 2008, Shaw, Oxford University Press, New Delhi.
3. Machine Tool Design and Numerical Control, 3/e, 2012, N.K.Mehta, Tata McGraw-Hill Education Pvt. Ltd., Noida.
4. Press Tool Design and Construction, 1/e, 2000, Prakash H. Joshi, Wheeler Publications, New Delhi.
5. Metal Cutting and Tool Design, 2/e, 1999, B.J.Ranganath, Vikas Publishing House Pvt. Ltd. Noida.

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13MEC 415B GEOMETRIC MODELLING(ELECTIVE - I)

UNIT – 1: Introduction

Application area of computer graphics - Overview of graphic system - Video- display devices - Raster- scan systems, random scan systems - Graphics monitors and work stations and input devices.

Output primitives: Points and lines - Line drawing algorithms - Mid-point circle algorithm - Filled area primitives: Scan-line polygon fill algorithm, boundary-fill algorithm and flood-fill algorithm.

UNIT – 2: 2-D Geometrical Transformations

Translation, scaling, rotation, reflection and shear transformation matrix representations and homogeneous co-ordinates - Composite transformations - Transformations between coordinates.

UNIT – 3: 2-D Viewing

The viewing pipeline, viewing coordinate reference frame, window to view port co-ordinate transformations, viewing function, Cohen-Sutherland algorithm, Cyrus-Beck line clipping algorithms and Sutherland-Hodgeman polygon clipping algorithm.

UNIT – 4: 3-D Object Representation

Polygon surfaces, quadric surfaces, spline representation - Hermite curve, Bezier and B-spline curves - Bezier and B-spline surfaces - Basic illumination models - Shading algorithms.

3-D geometric transformations: Translation, rotation, scaling, reflection and shear transformation and composite transformations.

UNIT – 5: Visible Surface Detection Methods

Classification - Back-face detection, depth-buffer, scan-line, depth sorting - Computer animation: Design of animation sequence, general computer animation functions and raster animation - Computer animation language, key frame system and motion specification.

Text books:

1. CAD/CAM Theory, 2/e, 2009, Ibrahim Zeid, Tata McGraw-Hill Education Pvt. Ltd., Noida.
2. Elements for Computer Graphics, 2/e, 2002, David Rodgers and Adams, Tata McGraw-Hill Education Pvt. Ltd., Noida.

Reference books:

1. Computer Graphics, 2/e, 2006, Zhigand Xiang, Roy Plastock, Schaum's outlines, Tata McGraw-Hill Education Pvt. Ltd., Noida.
2. Computer Graphics, 2/e, 2001, Steven Harrington, Tata McGraw-Hill Education Pvt. Ltd., Noida.
3. Computer Graphics C version, 2/e, 1997, Donald Hearn and M.Pauline Baker, Pearson Education, New Delhi.
4. Principles of Computer Graphics, n/e, 2010, ShaliniGovil-Pai, Springer (India) Pvt. Ltd., Bangalore.
5. Geometric Modeling, 3/e, 2006, Micheal E. Mortenson, Industrial Press, New Delhi.

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13MEC 415C TOTAL QUALITY MANAGEMENT(ELECTIVE - I)

UNIT – 1: Introduction

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

UNIT – 2: TQM Principles

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

UNIT – 3: TQM Tools and Techniques-I

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

UNIT – 4: TQM Tools and Techniques-II

Quality circles – Quality function development (QFD) – Taguchi quality loss function – TPM – Concepts - Improvement needs – Cost of quality – Performance measures.

UNIT – 5: Quality Systems

Need for ISO 9000 - ISO 9000 - 2000 quality system – Elements, documentation, quality auditing - QS 9000 – ISO 14000 – Concepts, requirements and benefits – Case studies of TQM implementation in manufacturing and service sectors.

Text books:

1. Total Quality Management, 3/e, 2010, Dale.H.Besterfiled, Pearson Education, New Delhi.
2. The Management and Control of Quality, 6/e, 2005, James R.Evans and William M.Lindsay, South-Western (Thomson Learning) Publications, New Delhi.

Reference books:

1. Quality management, 1/e, 2006, KaniskhaBedi, Oxford University Press, New Delhi.
2. Total Quality Management, 4/e, 2007, SenthilArasu and J. Praveen Paul, Scitech Publishers, Chennai.
3. TQM – Text with Cases, 3/e, 2003, Oakland, J.S. Butterworth, Oxford University Press, New Delhi.
4. Total Quality Management, n/e, 2006, Suganthi,L and Anand Samuel, Prentice- Hall of India, Pvt. Ltd., New Delhi.

5. Total Quality Management-Text and Cases, n/e, 2006, Janakiraman,B and Gopal, R.K, Prentice- Hall of India, Pvt. Ltd., New Delhi.

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13MEC 416A ENERGY SYSTEMS(ELECTIVE - II)

UNIT – 1: Principles of Solar Radiation

Role and potential of new and renewable source - Solar energy option - Environmental impact of solar power, physics of the sun, the solar constant, extraterrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sun shine - Solar radiation data.

UNIT – 2: Solar Energy Collections, Storage and Applications

Solar energy collection: Flat plate and concentrating collectors - Classification of concentrating collectors, orientation and thermal analysis and advanced collectors.

Solar energy storage and applications: Different methods – Sensible heat, latent heat and stratified storage, solar ponds - Solar applications - Solar heating/cooling technique, solar distillation and drying - Photovoltaic energy conversion.

UNIT – 3: Wind Energy and Bio-Mass Energy

Wind energy: Sources and potentials, horizontal and vertical axis windmills - Performance characteristics - Betz criteria.

Bio-mass: Principles of bio-conversion - Anaerobic/aerobic digestion - Types of bio-gas digesters - Gas yield - Combustion characteristics of bio-gas - Utilization for cooking - I.C.engine operation and economic aspects.

UNIT – 4: Geo-Thermal and Ocean Thermal Energy

Geo-thermal energy: Resources - Types of wells - Methods of harnessing the energy - Potential in India.

Ocean thermal energy: Principles utilization - Setting of OTEC plants - Thermodynamic cycles - Tidal and wave energy: Potential and conversion techniques – Mini hydel power plants and their economics.

UNIT – 5: Direct Energy Conversions

Need for DEC - Carnot cycle - Limitations, principles of DEC - Thermo-electric generators - Seebeck, Peltier and Joule Thomson effects - Figure of merit, materials, applications - MHD generators, principles, dissociation and ionization, hall effect, magnetic flux - MHD accelerator - MHD engine, power generation systems - Electron gas dynamic conversion, economic aspects - Fuel cells principles - Faraday's law's - Thermodynamic aspects - Selection of fuels and operating conditions.

Text books:

1. Non-ConventionalEnergy Sources, 1/e, 2010, G.D. Rai, KhannaPublishers, New Delhi.

2. Non-Conventional Sources, 2/e, 2009, Khan, B.H., Tata McGraw-Hill Education Pvt. Ltd., Noida.

Reference books:

1. Renewable Energy Resources, 1/e, 2004, G. N. Tiwari, M K. Ghosal, Alpha Science International Ltd., UK.
2. RenewableEnergy Sources, 2/e, 2005, Twidellands Tony Weir, Taylor and Francis Group Publishers, UK.
3. Solar Power Engineering, 1/e, 1990, B.S.Magal Frank Kreith and J.F.Kreith, Tata McGraw-Hill Education Pvt. Ltd., Noida.
4. Non-ConventionalEnergy, 1/e, 2008, Ashok V Desai, ABP (P) Ltd., New Delhi.
5. Non-ConventionalEnergySystems, 2/e, 1999, K Mittal, Wheeler Publications, New Delhi.

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13MEC 416B GAS TURBINES and JET PROPULSION(ELECTIVE - II)

UNIT – 1: Basic Concepts and Isentropic Flows

Energy and momentum equations of compressible fluid flows – Stagnation states - Mach waves and Mach cone – Effect of Mach number on compressibility – Isentropic flow through variable ducts – Nozzle and diffusers – Use of gas tables.

UNIT – 2: Flow through Ducts

Flows through constant area ducts with heat transfer (Rayleigh flow) and friction (Fanno flow) – Variation of flow properties – Use of tables and charts – Generalised gas dynamics.

UNIT – 3: Normal and Oblique Shocks

Governing equations – Variation of flow parameters across the normal and oblique shocks – Prandtl-Meyer relations – Use of table and charts – Applications.

UNIT – 4: Jet Propulsion

Theory of jet propulsion – Thrust equation – Thrust power and propulsive efficiency – Operation principle, cycle analysis and use of stagnation state performance of ram jet, turbojet, turbofan and turbo prop engines.

UNIT – 5: Space Propulsion

Types of rocket engines – Propellants - Feeding systems – Ignition and combustion – Theory of rocket propulsion – Performance study – Staging – Terminal and characteristic velocity – Applications – Space flights.

Text books:

1. Gas Turbines, 3/e, 2010, V.Ganesan, Tata McGraw-Hill Education Pvt. Ltd., Noida.
2. Gas Dynamics and Jet Propulsion, 1/e, 1996, S.L. Somasundaram, , New Age International (P) Ltd, Publishers, New Delhi.

Reference books:

1. Gas Turbines, 6/e, 2008, Cohen, Rogers and SarvanaMuttooAddision Wiley and Longman, Pearson Education, New Delhi.
2. Rocket Propulsion Elements, 7/e, 2010, Oscar Biblarz, George P. Sutton, Wiley India Pvt, Ltd., New Delhi.
3. Gas Dynamics and Space Propulsion, 1/e, 2007, M.C.Ramaswamy, Jaico Publishing House, Kolkata.
4. Gas Turbine Theory, 5/e, 2001, Herb Sarvanamuttoo, Pearson Education, New Delhi.
5. Mechanics and Thermodynamics of Propulsion, 2/e, 2009, Philip G. Hill, Carl R.

Peterson, Pearson Education, New Delhi**.**

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13MEC 416C INDUSTRIAL TRIBOLOGY(ELECTIVE - II)

UNIT – 1: Surfaces and Friction

Topography of engineering surfaces - Contact between surfaces - Sources of sliding friction – Adhesion-Ploughing - Energy dissipation mechanisms - Friction characteristics of metals - Friction of non metals - Friction of lamellar solids - Friction of ceramic materials and polymers - Rolling friction - Source of rolling friction – Stick slip motion - Measurement of friction.

UNIT – 2: Wear

Types of wear - Simple theory of sliding wear mechanism of sliding wear of metals - Abrasive wear – Materials for adhesive and abrasive wear situations - Corrosive wear - Surface fatigue wear situations - Brittle fracture - Wear - Wear of ceramics and polymers - Wear measurements.

UNIT – 3: Lubricants and Lubrication Types

Types and properties of Lubricants - Testing methods - Hydrodynamic lubrication – Elasto-hydrodynamic lubrication - Boundary lubrication - Solid lubrication - Hydrostatic lubrication.

UNIT – 4: Film Lubrication Theory

Fluid film in simple shear - Viscous flow between very close parallel plates - Shear stress variation - Reynolds equation for film lubrication - High speed unloaded journal bearings - Loaded journal bearings – Reaction torque on the bearings - Virtual co-efficient of friction - Sommerfield diagram.

UNIT – 5: Surface Engineering and Materials for Bearings

Surface modifications - Transformation hardening - Surface fusion - Thermo chemical processes – Surface coatings - Plating and anodizing - Fusion processes – Vapour phase processes - Materials for rolling - Element bearings - Materials for fluid film bearings - Materials for marginally lubricated and dry bearings.

Text books:

1. Industrial Tribology, 1/e, 2012, R.B.Patil, Tech-Max Publications, Pune.
2. Applied Tribology, 2/e, 2001, M.M.Khonsari and E.R.Booser, Wiley India Pvt, Ltd., New Delhi.

Reference books:

1. Bearing Design in Machinery, 1/e, 2002, Harnoy, Avraham Harnoy, Marcel Dekker Publishers, NewYork.
2. Basic Lubrication Theory, 3/e, 1981, C.M.McEttles, A.Cameron, Ellis Horwood Publishers Ltd., U.K.
3. Tribology, Principles and Design Applications, 1/e, 1993, J. Halling, P. B. Davies, R. D. ArnellHalling J., McMillan Press Ltd., Springer (India) Pvt. Ltd., Bangalore.
4. Friction and Wear of Engineering Materials, 1/e, 1992, I.M. Hutchings, CRC Press, UK.
5. Engineering Tribology, 1/e, 2009, SahooPrasantha, Prentice-Hall of India, Pvt, Ltd., New Delhi.

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13MEC 417 HEAT TRANSFER LABORATORY

1. Thermal conductivity of insulating powder material through concentric sphere apparatus.
2. Thermal conductivity of insulating material through lagged pipe apparatus.
3. Overall heat transfer co-efficient through composite slab apparatus.
4. Thermal conductivity of metal (conductor).
5. Heat transfer in pin-fin.
6. Experiment on transient heat conduction.
7. Heat transfer coefficient in forced convection.
8. Heat transfer coefficient in natural convection
9. Experiment on parallel and counter flow heat exchanger.
10. Emissivity of a gray body through emissivity apparatus.
11. Experiment on Stefan Boltzman apparatus.
12. Heat transfer in drop and film wise condensation.
13. Experiment on critical heat flux apparatus.
14. Study of heat pipe and its demonstration.
15. Study of two – phase flow.

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13MEC 418 COMPUTER AIDED DESIGN and MANUFACTURING LABORATORY

1. **Drafting:** Development of part drawings for various components in the form of orthographic and isometric. Representation of Dimensioning and tolerances scanning and plotting. Study of script, DXE AND IGES FILES.
2. **Part Modeling:** Generation of various 3D Models through Protrusion, revolve, shellsweep.Creation of various features. Study of parent child relation. Feature based and Boolean based modeling surface and Assembly Modeling. Study of various standard Translators. Design simple components.
3.
   a. Determination of deflection and stresses in 2D and 3D trusses and beams.
   b. Determination of deflections component and principal and Von-mises stresses in plane stress, plane strain and Axisymmetric components.
   c. Determination of stresses in 3D and shell structures (at least one example in each case)
   d. Estimation of natural frequencies and mode shapes, Harmonic response of 2D beam.
   e. Steady state heat transfer Analysis of plane and Axisymmetric components.
4.
   a. Development of process sheets for various components based on tooling Machines.
   b. Development of manufacturing and tool management systems.
   c. Study of various post processors used in NC Machines.
   d. Development of NC code for free form and sculptured surfaces using CAM packages.
   e. Machining of simple components on NC lathe and Mill by transferring NC Code / from a CAM package. Through RS 232.
   f. Quality Control and inspection.

Any Six Software Packages from the following:

Use of Auto CAD, Micro Station, CATIA, Pro-E, I-DEAS, ANSYS, NISA, CAEFEM, Gibbs CAM, Master CAM etc,

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13MEC 419 PROJECT SEMINAR

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13MEC 421 FINITE ELEMENT METHODS

UNIT – 1: Fundamental Concepts

Introduction - Historical background - Analysis of 3-D stresses and strains - Stress-strain relations - Stress cubic - Principal stress calculations, temperature effects, potential energy and equilibrium - The Rayleigh-Ritz method, weighted residual method, Galerkin's method, Saint Venant's principle and Von Mises stress.

UNIT – 2: Basic Concepts of F.E.M. and One Dimensional Problem

Fundamental concepts - Finite element modeling - Coordinates and shape functions - Potential energy approach - The Galerkin approach - Assembly of the global stiffness matrix and load vector - Properties of global stiffness matrix - Finite element equations: Treatment of boundary conditions, examples of axially loaded members - Analysis of plane trusses : Introduction - Plane Trusses: Local and global coordinate systems - Element stiffness matrix, stress calculations - Example of plane truss with three members.

UNIT – 3: Two Dimensional Problems

Introduction - Plane stress and plane strain - Finite element modeling - Constant strain triangle (CST): Iso-parametric representation, potential energy approach, element stiffness, force terms, Galerkin approach, stress calculation, problem modeling and boundary conditions - Examples of plane stress and plane strain problems with three degrees of freedom using CST element - Stiffness of beam element - Definitions of iso-parametric and sub-parametric elements.

UNIT – 4: Axi-Symmetric Solids Subjected to Axi-Symmetric Loading

Introduction - Axi-symmetric formulation - FEM using triangular element, problem modeling and boundary conditions - Scalar field problems: Introduction, steady-state heat transfer, one-dimensional heat conduction, governing equation, boundary conditions, the one dimensional element, functional approach for heat conduction.

UNIT – 5: Applications in Heat Transfer and Fluid Mechanics

One dimensional heat transfer element – Application to one-dimensional heat transfer problems - Scalar variable problems in 2-D – Applications to heat transfer in 2-D – Application to problems in fluid mechanics in 2-D.

Text books:

1. Introduction to Finite Elements in Engineering, 4/e, 2011, R.Chandraputla and Ashok D.Belegundu, Prentice Hall of India Pvt. Ltd., New Delhi.
2. Finite Element Method in Engineering, 5/e, 2012, Singiresu S Rao, Elsevier India Pvt.ltd Publishers. New Delhi.

Reference books:

1. A First Course in Finite Element Method, 4/e, 2007, Daryl L Logan, Cengage Learning, UK.

2. An Introduction to Finite Element Method, 3/e, 2013, JN Reddy, Tata McGraw-Hill Education Pvt. Ltd., Noida.
3. Finite Elements Analysis, 2/e, 2008, G.Lakshminarasaiah, B.S. Publishers, Hydrabad.
4. Finite Element Method for Engineers, 4/e, 2012, Kenneth H. Huebner, Donald L. Dewhirst, Douglas E. Smith and Ted G. Byrom, Wiley India Pvt, Ltd., New Delhi.
5. Fundamentals of Finite Element Analysis, 1/e, 2012, David V Hutton, Tata McGraw-Hill Education Pvt. Ltd., Noida.

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13MEC 422A POWER PLANT ENGINEERING(ELECTIVE - III)

UNIT – 1: Steam Power Plant

Introduction to the sources of energy – Resources and development of power in India.

Steam power plant: Plant layout - Working of different circuits - Fuel and handling equipments: Types of coals, properties of coal, coal handling, choice of handling equipment, coal storage, ash handling systems.

Combustion process: Overfeed and underfeed fuel beds, traveling grate stokers, spreader stokers, retort stokers, pulverized fuel burning system and its components, combustion needs and draught system, cyclone furnace - Dust collectors - Cooling towers and heat rejection - Corrosion and feed water treatment.

UNIT – 2: Diesel and Gas Turbine and Hydro Power Plant

Diesel power plant: Introduction – IC Engines, types, construction – Plant layout with auxiliaries – Fuel supply system, air starting equipment, lubrication and cooling system – Super charging.

Gas turbine plant: Introduction – Classification - Construction – Layout with auxiliaries – Principles of working of closed and open cycle gas turbines - Combined cycle power plants and comparison.

Hydro electric power plant: Water power – Hydrological cycle / flow measurement – Drainage area - Characteristics – Hydrographs – Storage and pondage – Classification of dams and spill ways - Classification of hydro project and plant – Typical layouts – Plant auxiliaries – Pumped storage plants.

UNIT – 3: Nuclear Power Station

Nuclear fuel – Breeding and fertile materials – Nuclear reactor – Reactor operation - Types of reactors: Pressurized water reactor, boiling water reactor, sodium-graphite reactor, fast breeder reactor, homogeneous reactor, gas cooled reactor, radiation hazards and shielding – Radioactive waste disposal.

UNIT – 4: Power from Non-Conventional Sources

Utilization of solar – Collectors - Principle of working - Wind energy – Types: HAWT, VAWT - Tidal energy.

Direct energy conversion: Solar energy - Fuel cells - Thermo electric and thermo ionic - MHD generation.

UNIT – 5: Power Plant Economics and Environmental Considerations

Capital cost, investment of fixed charges, operating costs, general arrangement of power distribution - Load curves, load duration curve - Definitions of connected load, maximum demand, demand factor, average load, load factor, diversity factor – Related exercises - Effluents from power plants and impact on environment – Pollutants and pollution standards – Methods of pollution control.

Text books:

1. A Course in Power Plant Engineering 6/e, 2012, Arora and S. Domkundwar, Dhanpat Rai Publishing Company (P) Ltd., New Delhi.
2. Power Plant Engineering, 3/e, 2012, P.K.Nag, Tata McGraw-Hill Education Pvt. Ltd., Noida.

Reference books:

1. Text of Power Plant Engineering, 9/e, 2013, P.C.Sharma, S.K.Kataria and Sons Publications, New Delhi.
2. A Text Book of Power Plant Engineering, 4/e, 2012, Rajput. R.K., Laxmi Publications (P) Ltd., New Delhi.
3. Power Plant Engineering, 1/e, 2010, K.K.Ramalingam, Scitech Publishers, Chennai.
4. Power Plant Engineering, n/e, 2004, Nagpal G. R., Khanna Publisher, New Delhi.

5.Introduction to Power Plant Technology, 3/e, 2012, G.D.Rai, Khanna Publishers, New Delhi.

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13MEC 422B MODERN MANUFACTURING METHODS(ELECTIVE - III)

UNIT – 1: Ultrasonic, Abrasive Jet and Water Jet Machining

Introduction: Need for non-traditional machining methods - Classification of modern machining processes – Considerations in process selection materials and applications.

Ultrasonic machining: Elements of the process - Mechanics of metal removal process parameters - Economic considerations, applications, limitations and recent development.

Abrasive jet machining, water jet machining and abrasive water jet machine: Basic principles, equipments, process variables, mechanics of metal removal, MRR, application and limitations.

UNIT – 2: Electro-Chemical Processes

Fundamentals of electro-chemical: Machining, grinding and honing - Deburring process - Metal removal rate in ECM, tools, surface finish and accuracy economic aspects of ECM – Simple problems for estimation of metal removal rate.

UNIT – 3: Thermal Metal Removal Processes

General principle and applications of electric discharge machining - Electric discharge grinding - Electric discharge wire cutting processes – Power circuits for EDM, mechanics of metal removal in EDM - Process parameters, selection of tool electrode and dielectric fluids, methods surface finish and machining accuracy, characteristics of spark eroded surface and machine tool selection - Wire EDM – Principle and applications.

UNIT – 4: Electron and Laser Beam Machining

Electron beam machining: Generation and control of electron beam for machining, theory of electron beam machining, comparison of thermal and non-thermal processes.

Laser beam machining: General principle and application of laser beam machining – Thermal features, cutting speed and accuracy of cut.

UNIT – 5: Plasma and Chemical Machining

Plasma machining: Principle - Metal removal mechanism, process parameters, accuracy and surface finish Applications.

Chemical machining: Fundamentals of chemical machining – Principle - Maskants – Etchants - Advantages and applications.

Magnetic abrasive finishing: Abrasive flow finishing - Electro stream drilling, shaped tube electrolytic machining.

Rapid prototyping: Classification – Stereo lithography - Selective laser sintering and applications.

Text books:

1. Advanced Machining Processes, 1/e, 2010, VK Jain, Allied publishers, Chennai.
2. Fundamentals of Modern Manufacturing, 2/e, 2004, Mikell P. Groover, Wiley India Pvt, Ltd., New Delhi.

Reference books:

1. Modern Machining Process, 1/e, 2013, Pandey, P.C. and Shah H.S, Tata McGraw-Hill Education Pvt. Ltd., Noida.
2. Non Conventional Machining, 1/e, 2006, P.K.Mishra, Narosa Publishing House, New Delhi.
3. Manufacturing Technology Metal Cutting and Machine Tools, 3/e, 2013, P. N. Rao, Tata McGraw-Hill Education Pvt. Ltd., Noida.
4. Advanced Methods of Machining, 1/e, 2011, J.A. Mcgeough, Springer (India) Pvt. Ltd., Bangalore.
5. Material and Processes in Manufacturing, 8/e, 2001, Paul De Garmo, J.T.Black, and Ronald.A.Kohser, Prentice Hall of India Pvt. Ltd., New Delhi.

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13MEC 422C ADVANCED I.C. ENGINES(ELECTIVE - III)

UNIT – 1: Spark Ignition Engines

Air-fuel ratio requirements - Design of carburetor – Fuel jet size and venture size - Stages of combustion: Normal and abnormal combustion - Factors affecting knock - Combustion chambers - Introduction to thermodynamic analysis of SI Engine combustion process.

UNIT – 2: Compression Ignition Engines

Stages of combustion: Normal and abnormal combustion – Factors affecting knock - Direct and Indirect injection systems - Combustion chambers - Turbo charging - Introduction to thermodynamic analysis of CI engine combustion process.

UNIT – 3: Engine Exhaust Emission Control

Formation of NO_x , HC/CO mechanism - Smoke and particulate emissions - Green house effect - Methods of controlling emissions - Three way catalytic converter and particulate trap – Emission: HC, CO, NO and NO_x - Measuring equipments - Smoke and particulate measurement - Indian driving cycles and emission norms.

UNIT – 4: Alternate Fuels

Alcohols, vegetable oils, bio-diesel, bio-gas, natural gas, liquefied petroleum gas and hydrogen fuels - Properties, suitability, engine modifications, performance - Combustion and emission characteristics of SI and CI engines using these alternate fuels.

UNIT – 5: Recent Trends

Homogeneous charge compression ignition engine - Lean burn engine - Stratified charge engine - Surface ignition engine, four valve and overhead cam engines, electronic engine management, common rail direct injection diesel engine, gasoline direct injection engine - Data acquisition system – Pressure pick up - Charge amplifier PC for combustion and heat release analysis in engines.

Text books:

1. Advanced Engine Technology, 1/e, 1998, Heinz Heisler, Trafalgar Square Publishing, USA.
2. Internal Combustion Engines, 4/e, 2012, Ganesan V. Tata McGraw-Hill Education Pvt. Ltd., Noida.

Reference books:

1. Internal Combustion Engine Fundamentals, 1/e, 2011, John B Heywood, Tata McGraw-Hill Education Pvt. Ltd., Noida.
2. Fundamentals of Internal Combustion Engines, 2/e, 2013, Gupta H.N, Prentice- Hall of India, Pvt. Ltd., New Delhi.
3. IC Engines: Combustion and Emissions, 1/e, 2010, B.P.Pundir, Narosa Publishing House, New Delhi.
4. Internal Combution Engines, 2/e, 2011, Colin R.Ferguson, Allan T.Kirkpatrick, Wiley India Pvt, Ltd., New Delhi.
5. A Text Book of Internal Combustion Engines, 2/e, 2007, R.K.Rajput, Laxmi Publications (P) Ltd., New Delhi.

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13MEC 423A COMPUTER INTEGRATED MANUFACTURING(ELECTIVE - IV)

UNIT – 1: Computer Aided Design

Concept of CAD as drafting and designing facility - Desirable features of CAD package - Drawing features in CAD – Scaling, rotation, translation, editing, dimensioning, labeling, zoom, pan, redraw and regenerate - Typical CAD command structure - Wire frame modeling, surface modeling and solid modeling (concepts only) in relation to popular CAD packages.

UNIT – 2: Components of CIM

CIM as a concept and a technology - CASA/SME model of CIM, CIM II - Benefits of CIM - Communication matrix in CIM - Fundamentals of computer communication in CIM – CIM data transmission methods – Series, parallel, asynchronous, synchronous, modulation, demodulation, simplex and duplex - Types of communication in CIM – Point to point (PTP), star and multiplexing - Computer networking in CIM – Seven layer OSI model, LAN model, MAP model, network topologies – Star, ring and bus, advantages of networks in CIM.

UNIT – 3: Group Technology and Computer Aided Process Planning

History of group technology – Role of G.T in CAD/CAM integration – Part families classification and coding – DCLASS, MCLASS and OPTIZ coding systems – Facility design using G.T – Benefits of G.T – Cellular manufacturing - Process planning - Role of process planning in CAD/CAM integration – Approaches to computer aided process planning – Variant approach and generative approaches – CAPP and CMPP systems.

UNIT – 4: Shop Floor Control and Introduction to FMS

Shop floor control – Phases – Factory data collection system – Automatic identification methods – Bar code technology – Automated data collection system - FMS – Components of FMS – Types – FMS workstation – Material handling and storage system – FMS layout - Computer control systems – Applications and benefits.

UNIT – 5: Computer Aided Planning and Control and Computer Monitoring

Production planning and control – Cost planning and control – Inventory management – Material requirements planning (MRP) – Shop floor control - Lean and agile manufacturing - Types of production monitoring systems – Structure model of manufacturing – Process control and strategies – Direct digital control.

Text books:

1. Automation, Production Systems and Computer Integrated Manufacturing, 3/e, 2008, Mikell. P. Groover, Prentice Hall of India Pvt. Ltd., New Delhi.
2. CAD/CAM Principles and Applications, 3/e, 2010, P.N.Rao, Tata McGraw-Hill Education Pvt. Ltd., Noida.

Reference books:

1. CAD/CAM, 1/e, 2003, E Zimmers and M.P.Groover, Prentice Hall of India Pvt. Ltd., New Delhi.
2. CAD/CAM/CIM, 3/e, 2007, V.Raju, S.Subramanyam, P.Radhakrishnan, New Age International (P) Ltd, Publishers, New Delhi.
3. Computer Integrated Manufacturing, 2/e, 2005, James A. Regh and Henry W. Kreabber, Prentice Hall of India Pvt. Ltd., New Delhi.
4. CAD CAM Principles, Practice and Manufacturing Management, 2/e, 2005, Chris McMahon and Jimmie Browne, Prentice Hall of India Pvt. Ltd., New Delhi.
5. Computer Integrated Manufacturing, 1/e, 2008, A.Alavudeen, N.Venkateshwaran, Prentice Hall of India Pvt. Ltd., New Delhi.

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13MEC 423B MECHATRONICS(ELECTIVE - IV)

UNIT – 1: Signal Conditioning

Introduction: Definition – Trends - Control methods: Stand alone, PC Based (real time operating systems, graphical user interface and simulation) - Applications: SPM, Robot, CNC, FMS, CIM.

Signal conditioning: Introduction – Hardware - Digital I/O , Analog input – ADC , resolution , speed channels filtering noise using passive components – Resistors, capacitors - Amplifying signals using OP amps – Software - Digital signal processing – Low pass, high pass and notch filtering.

UNIT – 2: Precision Mechanical Systems and Electromechanical Drives

Precision mechanical systems: Pneumatic actuation systems, electro-pneumatic actuation systems, hydraulic actuation systems, electro-hydraulic actuation systems - Timing belts – Ball screw and nut - Linear motion guides - Linear bearings - Harmonic transmission – Bearings - Motor/Drive selection.

Electromechanical drives: Relays and solenoids - Stepper motors - DC brushed motors – DC brushless motors - DC servo motors - 4-quadrant servo drives , PWM's - Pulse width modulation – Variable frequency drives, vector drives - Drive system load calculation.

UNIT – 3: Electronic Interface Sub Systems

TTL, CMOS interfacing - Sensor interfacing – Actuator interfacing – Solenoids , motors isoation schemes - Opto coupling - Buffer IC's - Protection schemes – Circuit breakers, over current sensing, resetable fuses, thermal dissipation - Power supply - Bipolar transistors / MOSFETS.

UNIT – 4: Microcontrollers Overview

8051 microcontroller, micro processor structure - Digital interfacing - Analog interfacing - Digital to analog convertors - Analog to digital convertors – Applications - Programming – Assembly - LED blinking - Voltage measurement using ADC.

UNIT – 5: Programmable Logic Controllers

Basic structure - Programming: Ladder diagram - Timers, internal relays and counters - Shift registers - Master and jump controls - Data handling - Analog input/output - PLC selection - Applications.

Text books:

1. Mechatronics: Electronics Control Systems in Mechanical and Electrical Engineering, 4/e, 2010, W Bolton, Pearson Education, New Delhi.
2. Mechatronics, 1/e, 2009, M.D.Singh, J.G.Joshi, Prentice Hall of India Pvt. Ltd., New Delhi.

Reference books:

1. Fundamentals of Mechatronics, 1/e, 2003, C.R.Venkataramana, Sapna Book House, Bangalore.
2. Mechatronics: Integrated Mechanical Electronic Systems, 1/e, 2008, K.P.Ramachandran, M.S.Balasundram, G.K.Vijayaraghavan, Wiley India Pvt, Ltd., New Delhi.
3. A Text Book of Mechatronics, 3/e, 2012, R.K.Rajput, S.Chand& Company Pvt. Ltd., New Delhi.
4. Mechatronics: Principles, Concepts and Applications, 1/e, 2003, NitaigourPrenchandMahalik, Tata McGraw-Hill Education Pvt. Ltd., Noida.
5. Mechatronics System Design, 2/e, 2012, Devdas Shetty, Richard A.Kolk, CL Engineering, Ludhiyana.

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13MEC 423C COMPUTATIONAL FLUID DYNAMICS(ELECTIVE - IV)

UNIT – 1: Governing Equations and Boundary Conditions

Basics of computational fluid dynamics – Governing equations of fluid dynamics – Continuity, momentum and energy equations – Chemical species transport – Physical boundary conditions – Time-averaged equations for turbulent flow – Turbulent-kinetic energy equations – Mathematical behaviour of PDEs on CFD - Elliptic, parabolic and hyperbolic equations.

UNIT – 2: Finite Difference Method

Derivation of finite difference equations – Simple methods – General methods for first and second order accuracy – Solution methods for finite difference equations – Elliptic equations – Iterative solution methods - Parabolic equations – Explicit and implicit schemes – Example problems on elliptic and parabolic equations.

UNIT – 3: Finite Volume Method (FVM) for Diffusion

Finite volume formulation for steady state 1D, 2D and 3D diffusion problems - One dimensional unsteady heat conduction through explicit, Crank-Nicholson and fully implicit schemes.

UNIT – 4: Finite Volume Method for Convection Diffusion

Steady one-dimensional convection and diffusion – Central, upwind differencing schemes - Properties of discretization schemes – Conservativeness, boundedness, transportiveness, hybrid, power-law, QUICK schemes.

UNIT – 5: Calculation Flow Field by FVM

Representation of the pressure gradient term and continuity equation – Staggered grid – Momentum equations – Pressure and velocity corrections – Pressure correction equation, simple algorithm and its variants - Turbulence models, mixing length model, two equation (k-Є) models, high and low reynolds number models.

Text books:

1. Computational Fluid Dynamics, Basics with Applications, 1/e, 2012, John. D. Anderson, Tata McGraw-Hill Education Pvt. Ltd., Noida.
2. Computational Fluid Flow and Heat Transfer, 2/e, 2012, Muralidhar.K, Sundararajan,T, Narosa Publishing House, New Delhi,

Reference books:

1. Introduction to Computational Fluid Dynamics, 1/e, 2005, ProdipNiyogi, S.K.Chakkrabarty, M.K.Laha, Pearson Educations, New Delhi.
2. Fundamentals of Computational Fluid Dynamics, 1/e, 2004, Tapan K. Sengupta, University Press (India) Private Ltd., Hyderabad.
3. Introduction to Computational Fluid Dynamics, 1/e, Date, Cambridge University Press India, New Delhi.
4. Introduction to Computational Fluid Dynamics, 1/e, 2005, Anil W. Date Cambridge University Press, UK.
5. Computational Techniques for Fluid Dynamics, Vol. I to III, 1988, Flecher.C.A., Springer-Verlag Publications, Berlin.

SREENIVASA INSTITUTE of TECHNOLOGY and MANAGEMENT STUDIES
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B.Tech (MECH) IV - II Semester	**L**	**P**	**C**
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13MEC 424 COMPREHENSIVE EXAMINATION

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B.Tech (MECH) IV - II Semester	**L**	**P**	**C**
	18	**-**	**10**

13MEC 425 PROJECT WORK