DIRECTOR
Institute of Engineering and Technology
JK Lakshmipat University
JAIPUR (Rajasthan)

Approved for implementation
10.1.2014
Vice Chancellor

JK LAKSHMIPAT UNIVERSITY
ज्ञानम् अमृतम्

JK Lakshmipat University

Laliya Ka Vas, P.O. Mahapura, Ajmer Road, Jaipur 302 026

Ph.: +91-141-7107500/504

INSTITUTE OF ENGINEERING AND TECHNOLOGY

B. Tech (2014-18)

4 Years Degree Programme

(Branch: Mechanical Engineering)

Semester – I - VIII

Curriculum, Detailed Syllabus

&

Scheme of Examination

Academic Council Meeting (23.12.2013)

JK Lakshmipat University, Jaipur
Institute of Engineering and Technology
Department of Mechanical Engineering
Course Structure for the Batch 2014-18

Semester	Courses								(L T P) Credits Hrs/Week
I	English Communication Skills	Engineering Mathematics - I	Engineering Physics	Electrical & Electronics Engineering	Workshop Practice	Engineering Drawing			(13 3 9) 20.5
	LA101 (2 1 0) 3	MA101 (3 1 0) 4	PH101 (3 1 2) 5	EE101 (3 0 2) 4	ME141 (0 0 3) 1.5	CE102 (2 0 2) 3			25
II	Professional Communication Skills	Engineering Mathematics - II	Engineering Chemistry	Environmental Studies	Engineering Mechanics	Computer Programming			(15 4 6) 22
	LA201 (1 1 2) 3	MA201 (3 1 0) 4	CH101 (3 1 2) 5	ID201 (2 0 0) 2	ME201 (3 1 0) 4	CSE201 (3 0 2) 4			25
III	Engineering Thermodynamics	Strength of Materials	Fluid Mechanics	Material Science & Engineering	Advanced Machine Drawing	Engineering Mathematics – III	Principles of Management for Engineers		(18 4 7) 25.5
	ME301 (3 1 0) 4	ME306 (3 1 2) 5	ME307 (3 1 2) 5	ME304 (3 0 0) 3	ME305 (1 0 3) 2.5	MA301 (3 1 0) 4	HS302 (2 0 0) 2		29
IV	IC Engine & Gas Turbines	Casting, Welding & Forming	Hydraulic Machines	Kinematics of Machines	Heat Transfer	Numerical and Statistical Methods			(18 0 13) 24.5
	ME409 (3 0 3) 4.5	ME405 (3 0 3) 4.5	ME406 (3 0 2) 4	ME407 (3 0 0) 3	ME408 (3 0 3) 4.5	MA402 (3 0 2) 4			31
V	**Practice School - I (PS 501) – (4 to 6 Weeks Duration) - 4 Credits**								
	Applied Thermodynamics	Design of Machine Elements – I	Production Planning & Control	Industrial Engineering and Operation Research	Dynamics of Machines	Machining, Machine-tools & Metrology			(18 2 10) 25+4
	ME509 (3 0 3) 4.5	ME504 (3 1 2) 5	ME505 (3 0 0) 3	ME506 (3 1 0) 4	ME507 (3 0 3) 4.5	ME508 (3 0 2) 4			30
VI	Refrigeration & Air-conditioning	Design of Machine Elements – II	Mechanical Vibrations & Control	Solar Energy Technology	Elective – I	Elective – II			(18 1 10) 24
	ME602 (3 0 2) 4	ME604 (3 1 2) 5	ME605 (3 0 2) 4	ME606 (3 0 2) 4	(3 0 2) 4	(3 0 0) 3			29
VII	Power Plant Engineering	CAD – CAM	Total Quality Management	Elective – III	Elective – IV	Seminar	Principles of Economics		(18 2 7) 23.5
	ME703 (3 1 0) 4	ME702 (3 0 3) 4.5	ME 704 (3 1 0) 4	(3 0 0) 3	(3 0 0) 3	SEM701 (0 0 4) 2	HS701 (3 0 0) 3		27
VIII	**Practice School - II (PS 801) - (16 Weeks Duration) - 16 Credits**								16

List of Elective Courses

Elective I	Automobile Engineering (ME 624)	Computational Fluid Dynamics (ME625)		Mechatronics (ME626)					
Elective II	Flexible Manufacturing Systems (ME627)		Non-Conventional Machining Processes (ME622)		Product Design & Development (ME628)		Engineering Optimization (MA621)		
Elective III	Fundamentals of Aerodynamics (ME721)		Industrial Pollution & Control (ME725)		Mechanical System Design (ME726)		Reliability Engineering & Maintenance Engineering (ME723)		
Elective IV	Metal Forming Analysis (ME732)	Industrial Tribology (ME735)	Robotics Engineering (ME736)	Waste Heat Recovery & Management (ME737)	Energy Management & Efficiency (ME730)				

Total Credits: 185

04/09/14

JK Lakshmipat University

Laliya Ka Vas, P.O. Mahapura, Ajmer Road, Jaipur 302026

Ph.: +91-141-7107500/504

INSTITUTE OF ENGINEERING AND TECHNOLOGY

4 Year B. Tech Programme

(Branch: Mechanical Engineering)

Batch 2014-18

SEMESTER-ONE

Detailed Syllabus

&

Scheme of Examination

Course code	Course Title	Teaching Scheme			
		L	T	P	Credits
LA 101	English Communication Skills	2	1	0	3.0

Evaluation Scheme (Theory)						Evaluation Scheme (Practical)				
Mid Term Test - I	Mid Term Test - II	End Term Test	Class Participation	Additional Continuous Evaluation*	Total Marks	Mid Term Test - I	End Term Test	Class Participation	Additional Continuous Evaluation *	Total Marks**
20	20	40	10	10	100	-	-	-	-	-

*Additional Continuous Evaluation: Quizzes/Assignments/Presentations/Practical Records/Mock Interviews/others

Syllabus (Theory)

- Definition and Characteristic Features of Effective Communication
- Barriers to Communication: Types, Ways to Overcome
- Vocabulary Extension: Roots, Prefixes and Suffixes
- Vocabulary Extension: Synonyms, Antonyms, Homophones, One Word Substitution
- Vocabulary Extension: Learning words through Situations
- Basics of English Grammar
- Applied English Grammar and Standard English Usage
- Standard English Usage, Listening Skills
- Phonetics and Spoken English: Sounds of English, Word Accent and Weak Forms in English, Intonation
- Introducing students to the rules of Word Accent and Weak Forms in English
- Reading Comprehension: Problems, Types of Reading Skills, Strategies
- Paragraph Writing: Definition, Structure of a Paragraph, Construction of a Paragraph, Unity and Coherence
- Art of Condensation: Steps Required, Strategies

Text Book(s)

1. Sanjay Kumar and Pushp Lata, *Communication Skills,* New Delhi: OUP, 2011

Reference Book(s)

1. Meenakshi Raman and Sangeeta Sharma, *Technical Communication: Principles and Practice,* Second Edition, New Delhi: OUP, 2011.
2. Krishna Mohan and Meenakshi Raman, Effective English Communication, New Delhi: Tata-McGraw Hill, 2000.
3. Krishna Mohan and N.P.Singh, Speaking English Effectively, New Delhi: Macmillan,1994.
4. V. Sasikumar and P.V. Dhamija, Spoken English: A Self-Learning Guide to Conversation Practice, Tata-McGraw Hill, 2007.
5. Norman Lewis, Word Power Made Easy, Delhi: GoyalSaab Publishers and Distributors, 1994.
6. A.J.Thomson and A.V.Martinet, A Practical English Grammar, 4th Edition, New Delhi: OUP, 1999.
7. Asha Kaul, Business Communication, Second Edition, New Delhi: PHI, 2010.
8. Edgar Thorpe and Showick Thorpe, Objective English, 2nd Edition, New Delhi: Pearson Education,
2008.

Course code	Course Title	Teaching Scheme			
		L	T	P	Credits
MA 101	Engineering Mathematics – I	3	1	0	4

Evaluation Scheme (Theory)						Evaluation Scheme (Practical)				
Mid Term Test - I	Mid Term Test - II	End Term Test	Class Participation	Additional Continuous Evaluation*	Total Marks	Mid Term Test - I	End Term Test	Class Participation	Additional Continuous Evaluation *	Total Marks
20	20	40	10	10	100	-	-	-	-	-

*Additional Continuous Evaluation: Quizzes/Assignments/Presentations/Practical Records/Mock Interviews/others

Syllabus (Theory)

Unit 1: Calculus of several variables

Functions of two or more variables, Partial Derivatives, Total derivative, chain Rule, Euler's Theorem, Jacobian and transformation, Applications to errors, Optimization using derivatives - Maxima-Minima of functions of two variables, Lagrange's method.

Unit 2: Curve Sketching

Asymptotes, Double and Triple Points, Cartesian, parametric and polar curve sketching

Unit 3: Vector function and its derivatives

Vector functions, their derivatives and integration, Arc length and unit tangent vector, Curvature and unit normal vector, Torsion and unit Bi-normal vector, Directional derivative and gradient vectors, Tangent plane, Divergence and curl of a vector field

Unit 4: Integral Calculus

Definite Integral - Integral calculus, Line integral, Arc length, Solids of revolution: Surface and volume, Multiple Integrals - Double integral: Area, change of order of integration, changing to polar coordinates, Triple integral, Volume integral, Improper Integrals - Gamma and Beta functions

Unit 5: Vector Integration

Line integral, flux, work done, circulation, Path independence, potential function and conservative fields, Green's theorem in the plane, Stoke's theorem, Divergence theorem,
Sequence and Series: Sequence, Series, Orthogonal function, Fourier Series

Text books and Reference books

1. B. S. Grewal, *Higher Engineering Mathematics*, 41st Ed., Khanna Publishers, Delhi, 2011.
2. G.B. Thomas, Jr., *Thomas' calculus*, 11th edition (Indian), Pearson education, Delhi, 2008
3. Dennis G. Zill and Warren S. Wright, *Advanced Engineering Mathematics*, Fourth Edition (Student Edition), Jones & Barlett, Viba, New Delhi, 2011
4. Rober Wrede, Spiegel M. R., *Schaum's outline of advanced calculus*, 3rd edition, Tata Mc-GrawHill, NewYork, 2011
5. Peter V. O'Neil, *Advanced Engineering Mathematics*, Seventh Indian Reprint, Cengage Learning, New Delhi, 2011.
6. Kreyszig, E., *Advanced Engineering Mathematics*, John Willey, Delhi (2011).
7. Potter M.C., Goldberg J.L., Edward F.A., *Advanced Engineering Mathematics*, 3rd Edition, Oxford University Press, 2005.

Course code	Course Title	Teaching Scheme			
		L	T	P	Credits
PH 101	Engineering Physics	3	1	2	5

Evaluation Scheme (Theory)						Evaluation Scheme (Practical)				
Mid Term Test - I	Mid Term Test - II	End Term Test	Class Participation	Additional Continuous Evaluation*	Total Marks	Mid Term Test - I	End Term Test	Class Participation	Additional Continuous Evaluation *	Total Marks**
20	20	40	10	10	100	20	40	15	25	100

*Additional Continuous Evaluation: Quizzes/Assignments/Presentations/Practical Records/Mock Interviews/others

**The ratio of weightage between Theory and Practical content will be 60%: 40%

Course Syllabi (Theory):

- **Coherence, Interference and Optical Technology**
  - Introduction to optics, Spatial Coherence, Temporal coherence, Coherence length, Coherence time and 'Q'factor for light
  - Formation of Newton's rings, Measurement of wavelength of light, Diameter of Newton's rings
  - Elementary idea of anti-reflection coating and interference filters
- **Diffraction**
  - Single slit diffraction, position of maxima / minima and width of central maximum, intensity variation.
  - Construction and theory. Formation of spectra by plane transmission grating, Determination of wavelength of light using plane transmission grating.
- **Polarization**
  - Plane, circular and elliptically polarized light on the basis of electric (light) vector, Malus law.
  - Quarter and half wave plates, construction, working and use of these in production and detection of plane, circular and elliptically polarized light.
  - Introduction and law of optical rotation, specific rotation and its measurement using the half-shade and bi-quartz device.
- **Quantum Mechanics**
  - Heisenberg's Uncertainty Principle, Wave and Particle Duality of Radiation, De-Broglie's Concept of Matter waves, Quantum Nature of Light
  - Concept of Compton Effect
  - Concept of Wave Function, Physical interpretation of wave function and its properties
  - Schrödinger's Wave Equation: Time dependent and time independent cases

- **Application of Schrodinger Equations and Band Theory of Solids**
    - Particle in one-dimensional box
    - Particle in three-dimensional boxes, Degeneracy.
    - Barrier penetration and tunnel effect, Tunneling probability
    - Sommerfeld Free Electron Gas Model of Solids.
    - Distinction between Insulators, Semiconductors and Conductors, Intrinsic and Extrinsic Semiconductors.

- **Laser and Fibre Optics**
    - Theory of Laser Action, Einstein's Coefficients, Threshold Conditions for Laser Action.
    - Theory, Design, and Applications of He-Ne Laser.
    - Theory of Semiconductor Lasers.
    - Optical Fibre, Numerical Aperture, and Maximum Angle of Acceptance.

- **Special Theory of Relativity**
    - Postulates of Special Theory of Relativity, Lorentz Transformations
    - Relativity of Length, and Time, Mass-Energy Relation, Relativistic Energy and Momentum.

- **Nuclear Radiation Detectors**
    - Characteristics of Gas Filled Detectors, Constructions, Working, and Properties of Ionization Chamber.
    - Proportional Counter, G.M. Counter, Paralysis Time, Quenching.
    - Scintillation Counter.

Course Syllabi (Practical):

1. To determine the wave length of sodium light by Newton's Ring
2. To determine the specific rotation of Glucose (Sugar) solution using a Polarimeter
3. To measure the Numerical Aperture of an Optical Fibre.
4. To determine coherent length and coherent time of laser using He-Ne Laser
5. To determine the height of object with the help of a Sextant.
6. To determine the dispersive power of material of a Prism for Violet Red and Yellow colours of Mercury light with the help of a spectrometer.
7. To determine the wave length of prominent lines of mercury by plane diffraction Grating with the help of spectrometer.
8. To study the Charge & Discharge of a condenser and hence determine time constant (Both current and voltage graphs are to be plotted).

9. To determine the high resistance by method of leakage, using a Ballistic Galvanometer.
10. To study characteristics of G.M. Counting System.
11. To determine the specific resistance of the material of a wire by Carey Fosters Bridge.
12. To convert a Galvanometer in to an ammeter of range 1.5/3 amp and calibrate it.
13. To convert a Galvanometer in to a Volt of range 1.5/3 volt and calibrate it.

Text Books:

1. G.D. Ladiwala and S. S. Sharma, "Engineering Physics-I" New Age International Publication, New Delhi, I edn. 2010.
2. G.D. Ladiwala and S. S. Sharma, "Engineering Physics-II" New Age International Publication, New Delhi, I edn. 2010.
3. Lab Manuals for Physics

Reference Books:

1. Arther Beiser, "Concept of Modern Physics" Tata McGrawHill, New Delhi, 5th edn. 1997.
2. Ajoy Ghatak, "Optics", Tata McGraw Hill, 4th edn
3. Eyvind H Wichman, "Quantum Physics" Tata McGraw Hill, Volume 4
4. Neeraj Mehta, "Applied Physics for Engineers", PHI, I edn. 2011
5. Dattu R Joshi, "Engineering Physics", Tata McGraw Hill Education Pvt. Ltd. New Delhi, I edn. 2010.

Course code	Course Title	Teaching Scheme			
		L	T	P	Credits
EE101	Electrical & Electronics Engineering	3	0	2	4

Evaluation Scheme (Theory)						Evaluation Scheme (Practical)				
Mid Term Test - I	Mid Term Test - II	End Term Test	Class Participation	Additional Continuous Evaluation*	Total Marks**	Mid Term Test - I	End Term Test	Class Participation	Additional Continuous Evaluation *	Total Marks**
20	20	40	10	10	100	20	40	15	25	100

*Additional Continuous Evaluation: Quizzes/Assignments/Presentations/Practical Records/Mock Interviews/others

**The ratio of weightage between Theory and Practical content will be 60%: 40%

Syllabus (Theory)

UNIT I

INTRODUCTION: basic physical laws, circuit elements, Source Transformation, KVL, KCL, Wye (Y) – Delta (Δ) and Delta (Δ) – Wye (Y) transformations.

UNIT II

THEOREM: Norton, Thevenin, Superposition, Max power transfer Theorem

UNIT II

AC NETWORKS: Fundamental aspects of single phase ac supply, Sinusoidal Steady State, Real/Reactive Power, Phasor, Three phase circuits, Start-delta, Two watt-meter Method, simple circuits, RMS Average value, Transients in R-L, R-C, R-L-C.

UNIT IV

TRANSFORMER & MACHINE: Basics of transformer Faraday and Lenz law, Mutual Inductance, construction, Working Principles of Transformers, AC/DC machines.

UNIT IV

INTRODUCTION TO SEMICONDUCTORS: Defining Insulator, Semiconductor, Conductors. Band gap energy and band formation, elementary idea about semiconductor behavior, conductivity, types of semiconductor, p-type and n-type, working principle, characteristics and applications of Diode and Transistor, Transistor CE, CB, CC configuration.

Syllabus (Practical)

ELECTRICAL LAB

1. Single line diagram of a power system and a distribution sub-station and basic functional study of main components used in power systems.
2. Make house wiring including earthling for 1-phase energy meter, MCB, ceiling fan, tube light, three pin socket and a lamp operated from two different positions. Basic functional study of components used in house wiring
3. Study the construction and basic working of ceiling fan, single phase induction motor and three phase squirrel cage induction motor. Connect ceiling fan along with regulator and single phase

induction motor through auto-transformer to run and vary speed.

4. (a) Basic functional study and connection of moving coil & moving iron ammeters and Voltmeters, dynamometer, wattmeter and energy meter.

   (b) Run a 3-phase squirrel cage induction motor at no load and measure its voltage, current, power and power factor. Reverse the direction of rotation.

5. Study the construction, circuit, working and application of the following lamps:

   (i) Fluorescent lamp, (ii) Sodium vapour lamp, (iii) Mercury vapour lamp, (iv) Halogen lamp and (v) Neon lamp

6. (a) Study the construction and connection of single phase transformer and auto-transformer. Measure input and output voltage and fin turn ratio.

   (b) Study the construction of a core type three phase transformer. Perform star and delta Connection on a 3-phase transformer and find relation between line and phase voltage.

ELECTRONICS LAB

7. Identification, testing and applications of resistors, inductors, capacitors, PN-diode, Zener diode,LED, LCD, BJT, FET, UJT, SCR, Photo diode and Photo transistor.
8. (a) Functional study of CRO, analog & digital multi-meters and function / signal generator.

   (b) Study the single phase half wave and bridge rectifier and effects of filters on waveform.

9. Study the BJT amplifier in common emitter configuration. Measure voltage gain, plot gain frequency response and calculate its bandwidth.
10. (a) Study the construction and basic working of SCR.

    (b) Study the single phase half wave and bridge controlled rectifier and observe the effect of firing angle on waveform.

Text Book(s)

1. S.N.Singh "Basic Electrical Engineering", Prentice-Hall of India Pvt. Ltd, 2011.
2. J. Millman and C. Halkias, Integrated Electronics, McGraw Hill,2th Edition, 6th Indian Reprint, 2011.
3. B. L. Theraja, "Electrical Technology", Vol.1, S. Chand Publication, New Delhi
4. V. K. Mehta, "Basic Electrical Engineering", S. Chand and Company Ltd., New Delhi

Reference Book(s)

1. T.K.Nagsarkar,M.S. Sukhija,"Basic Electrical Engineering", Oxford University press, 2nd edition, 2011.
2. A.S. Sedra and K.C. Smith, Microelectronic Circuits, Saunder's College Publishing, 1991.

Course code	Course Title	Teaching Scheme			
		L	T	P	Credits
ME 141	Workshop Practice	0	0	3	1.5

Evaluation Scheme (Theory)						Evaluation Scheme (Practical)				
Mid Term Test - I	Mid Term Test - II	End Term Test	Class Participation	Additional Continuous Evaluation*	Total Marks**	Mid Term Test - I	End Term Test	Class Participation	Additional Continuous Evaluation *	Total Marks**
-	-	-	-	-	-	20	40	15	25	100

*Additional Continuous Evaluation: Quizzes/Assignments/Presentations/Practical Records/Mock Interviews/others

**The ratio of weightage between Theory and Practical content will be 60%: 40%

Syllabus (Practical)

- Basics of manufacturing, types of production systems, ethics, safety in workshop.
- Metrology, quality, Least Count of a measuring Instrument, measurement with Vernier Caliper or Micrometer.
- Machining – Demonstration of Turning, Step Turning, Facing, etc.
- Casting – Demonstration of sand casting process
- Forging – Demonstration of forging operations
- Sheet metal working applications.
- Hands on practice of Sheet metal working operations using hand tools- Preparation of Funnel.
- Gas Welding, Demonstration of Gas Welding
- Hands on practice of Joining of metal parts by Arc Welding- Preparation of a Lap Joint model.
- Mechanical joining processes, Arc Welding
- Hands on practice of Joining of metal parts by Arc Welding- Preparation of a Butt Joint model.
- Introduction to wood working, Wood working Tools, Types of wood, Types of joints.
- Hands on practice of Wood working operations using hand tools- preparation of Lap Tee Joint, Mechanical joining processes, Soldering, Brazing.
- Machining – Demonstration of Shaping operations
- Hands on practice of Fitting operations using hand tools- Prepare a job in fitting shop.

Text Books:

1. H S Bawa, "Workshop Practice", TMH, New Delhi, 2nd Edition, 2011
2. B S Nagendra Parashar and R K Mittal, "Elements of Manufacturing Process", Prentice Hall of India, New Delhi, 2010 print
3. B S Raghuwanshi, "A Course in Workshop Technology", Dhanpat Rai & Co., New Delhi, Volume I & II, 2011 reprint,
4. Serope Kalpakjian and Steven R. Schmid, "Manufactuirng Engineering and Technology," Pearson Education (Low Cost Indian Edition), New Delhi, 4th Edition, 2005

Reference Books:

1. K. Venkata Reddy, "Workshop Practice Manual", BS Publications, Hyderabad,6th Edition, 2011 print
2. P. kannaiah and K. L. Narayana, "Engineering Practices Laboratory", SciTech Publications, Chennai, 2006

Course code	Course Title	Teaching Scheme			
		L	T	P	Credits
CE 101	Engineering Drawing	2	0	2	3

Evaluation Scheme (Theory)						Evaluation Scheme (Practical)				
Mid Term Test - I	Mid Term Test - II	End Term Test	Class Participation	Additional Continuous Evaluation*	Total Marks**	Mid Term Test - I	End Term Test	Class Participation	Additional Continuous Evaluation *	Total Marks**
20	20	40	10	10	100	20	40	15	25	100

*Additional Continuous Evaluation: Quizzes/Assignments/Presentations/Practical Records/Mock Interviews/others

**The ratio of weightage between Theory and Practical content will be 60%: 40%

Syllabus (Theory)

Unit I

Lines, Lettering & Dimension (Sketch Book)

Scales: Representative factor, plain scales, diagonal scales, scale of chords.

Conic sections: Construction of ellipse, parabola, & hyperbola by different methods; Engineering Curves: Cycloid, Epi-cycloid, Hypo-cycloid, Involutes, Archimedean and logarithmic spirals.

Unit II

Projection: Types of projection, orthographic projection, first and third angle projection, (Sketch Book)

Projection of points and straight lines: Line inclined to one plane, inclined with both the plane, methods for determining True Length, true Inclinations, and Traces of straight lines.

Unit III

Projection of planes and solids: Projection of Planes like circle and polygons in different positions; Projection of right and regular polyhedrons like prisms, pyramids and solids of revolutions like cylinder, cones in different positions.

Unit IV

Section of Solids: Section of right solids (like Prism, Pyramid, Cylinder and Cone) by normal and inclined planes in different positions; Intersection of cylinders.

Development of Surfaces: Parallel line and radial-line method for right, regular solids.

Unit V

Isometric Projections: Isometric scale, Isometric axes, Isometric Projection of solids from orthographic drawing.

Computer Aided Drafting (CAD): Introduction, benefit, software's basic commands of drafting entities like line, circle, polygon, polyhedron, cylinders; transformations and editing commands like move, rotate, mirror, array; Draw Toolbar, Object & Modify toolbar; solution of projection problems on CAD.

Syllabus (Practical)

Sketching and drawing of geometries and projections on Sketch Book & on AutoCAD based on above syllabus

Text Books:

1. Kulkarni D M, Rastogi A P, Sarkar A K, Engineering Graphics with AutoCAD, PHI Learning Pvt. Ltd., New Delhi, India, Fourth Printing (Revised Edition), 2012.
2. Bhatt N D, Engineering Drawing, Charotar Book Stall, Anand, India.

Reference Books:

1. Jolhe D A, Engineering Drawing with an introduction to AutoCAD, TMH, New Delhi, India.
2. Gill P S, Engineering Drawing (Geometrical Drawing), S K Kataria & Sons, Delhi, India
3. Jeyopoovan T.; Engineering drawing & Graphics Using AutoCAD; Vikas publishers.
4. Engineering Drawing, Basant Agarwal & CM Agarwal, Tata McGraw Hill.
5. Shah MB and Rana BC; Engg.drawing; Pearson Education
6. Luzadder WJ and Duff JM; Fundamental of Engg Drawing; PHI
7. Dhananjay A Jolhe; Engg. Drawing an Introduction; Tata McGraw Hill.
8. Visvesvaraya Tech. University; A Premier on Computer Aided Engg drawing; VTU Belgaum
9. Venugopal K.; Engineering Graphics; New Age

Reference Book(s)

1. Meenakshi Raman and Sangeeta Sharma, *Technical Communication: Principles and Practice*, Second Edition, New Delhi: OUP, 2011.
2. Krishna Mohan and Meenakshi Raman, *Effective English Communication*, New Delhi: Tata-McGraw Hill, 2000.
3. Krishna Mohan and N.P.Singh, *Speaking English Effectively,* New Delhi: Macmillan,1994.
4. V. Sasikumar and P.V. Dhamija, *Spoken English: A Self-Learning Guide to Conversation Practice*, Tata-McGraw Hill, 2007.
5. Norman Lewis, *Word Power Made Easy,* Delhi: GoyalSaab Publishers and Distributors, 1994.
6. A.J.Thomson and A.V.Martinet, *A Practical English Grammar,* 4th Edition, New Delhi: OUP, 1999.
7. Asha Kaul, *Business Communication,* Second Edition, New Delhi: PHI, 2010.
8. Edgar Thorpe and Showick Thorpe, *Objective English*, 2nd Edition, New Delhi: Pearson Education, 2008.

Course code	Course Title	Teaching Scheme			
		L	T	P	Credits
MA 201	Engineering Mathematics – II	3	1	0	4

Evaluation Scheme (Theory)						Evaluation Scheme (Practical)				
Mid Term Test - I	Mid Term Test - II	End Term Test	Class Participation	Additional Continuous Evaluation*	Total Marks	Mid Term Test - I	End Term Test	Class Participation	Additional Continuous Evaluation *	Total Marks
20	20	40	10	10	100	-	-	-	-	-

*Additional Continuous Evaluation: Quizzes/Assignments/Presentations/Practical Records/Mock Interviews/others

Syllabus (Theory)

Unit 1: Ordinary Differential equation

Differential equation of first order, Differential equation of higher order with constant coefficients, Differential equation of second order with variable coefficients, Solution in series.

Unit 2: Partial differential equation

Partial Differential Equations of First Order, Variable separable technique for solving PDE, Boundary value problems: Heat equation, wave equation, Laplace equation

Unit 3: Matrix Algebra

Matrices, Rank of a Matrix, System of Linear Algebraic Equations, Linear Independence and Dependence, Eigen Values and Eigen Vectors, Diagonalization, Cayley Hamilton Theorem

Unit 4: Linear Algebra

Unit Vector Space, Subspaces, Bases and Dimensions, Coordinates, Row Equivalence and Computations concerning Subspaces, Linear Transformations, The Algebra of Linear Transformations, Representation by matrices

Unit 5: Linear Programming Problems

Introduction to LP Problems, LP formulations, Graphical Methods, Convex Sets, Simplex Methods

Text books and Reference books

1. B. S. Grewal, *Higher Engineering Mathematics*, 41st Ed., Khanna Publishers, Delhi, 2011.
2. Dennis G. Zill and Warren S. Wright, *Advanced Engineering Mathematics*, Fourth Edition (Student Edition), Jones & Barlett, Viba, New Delhi, 2011.
3. B.V.Ramana, *Higher Engineering Mathematics*, Tata Mc-graw Hill.
4. Peter V. O'Neil, *Advanced Engineering Mathematics*, Seventh Indian Reprint, Cengage Learning, New Delhi, 2011.
5. Kreyszig, E., *Advanced Engineering Mathematics*, John Willey, Delhi (2011).
6. Potter M.C., Goldberg J.L., Edward F.A., *Advanced Engineering Mathematics*, 3rd Edition, Oxford University Press, 2005.
7. G.B. Thomas, *Jr., Thomas' Calculus*, 11th edition (Indian), Pearson education, Delhi, 2008.

Course code	Course Title	Teaching Scheme			
		L	T	P	Credits
CH 101	Engineering Chemistry	3	1	2	5

Evaluation Scheme (Theory)						Evaluation Scheme (Practical)				
Mid Term Test - I	Mid Term Test - II	End Term Test	Class Participation	Additional Continuous Evaluation*	Total Marks**	Mid Term Test - I	End Term Test	Class Participation	Additional Continuous Evaluation *	Total Marks*
20	20	40	10	10	100	20	40	15	25	100

*Additional Continuous Evaluation: Quizzes/Assignments/Presentations/Practical Records/Mock Interviews/others

**The ratio of weightage between Theory and Practical content will be 60%: 40%

Syllabus (Theory)

UNIT-I Water Chemistry

Introduction, common Impurities in water, Hardness of water, Determination of hardness by Clark's test and complexometric (EDTA) method. Removal of hardness by Lime Soda, Zeolite and Ion exchange process.

Boiler feed water: troubles their causes, disadvantages and prevention, Scale & Sludge Carry over (Priming and Foaming), Boiler Corrosion and Caustic embrittlement.

UNIT-II Polymers

Introduction to Polymer, Classification of polymers. Methods of Polymerization, Plastics: Thermosets and Thermoplastic. Preparation, properties and uses of Vinyl resins, Bakelite, Polyesters and Nylons. Rubbers: Natural rubber, vulcanization, synthetic rubbers e.g. Buna-S, Buna-N, Butyl, Thiokol and Neoprene rubbers.

UNIT-III Corrosion &Lubricants

Definition and its significance, Theories of corrosion: Dry corrosion theory, Wet (Electrochemical) theory, Passivity, Types of electrochemical corrosion. Factors influencing rate of corrosion.

Introduction, classification and uses of lubricants. Types of lubrication. Viscosity & viscosity index, Flash point Fire point, cloud and pour point, steam emulsification number, precipitation number and neutralization number.

UNIT-IV Solid State Chemistry

Solid State, Types of solids, Space Lattice and Unit cell, Types of unit cell, Cubic System – Number of atoms per unit cell, Atomic Radius, Density Calculation of unit cell. Bragg's Law X-ray studies of Crystals.

Graphite – Structure, Properties and applications.

Liquid Crystal: Liquid Crystalline state, Classification of liquid crystal and their applications.

UNIT-V Engineering Materials

Cement: Definition, Composition basic constituents and their significance, manufacturing of Portland cement by Rotary Klin technology. Setting and hardening of cement and role of gypsum.

Nanotechnology and Nano materials: Fullerenes and Carbon Nano tubes - Introduction, Structural properties, preparation and their applications.

Syllabus (Practical)

1. To determine the hardness of water by complex metric method using EDTA.
2. To determine the strength of NaOH and Na_2CO_3 in given alkali mixture.
3. To determine the strength of copper sulphate with the help of Hypo solution.
4. Measurement of conductivity of given sample by conductivity meter.
5. Measurement of pH of given sample by pH meter.
6. Determination of Barium as barium sulphate gravimetrically.
7. Measurement of Fluoride in water sample.
8. Determination of Na/K/Ca by Flame photometer in a given sample.
9. To determine the amount of free chlorine in given sample.
10. To determine the viscosity of a given sample of lubricant oil at various temperature.
11. To determine flash and fire point of a given lubricant using Pensky-Martin's apparatus.
12. Measurement of Nitrate and Oxygen in water sample.
13. To determine cloud and pour point of a given sample of lubricating oil using Cloud and Pour point apparatus.

Text Book

1. Engineering Chemistry by Jain & Jain (Dhanpat Rai publication)

Reference Book(s)

1. Engineering Chemistry by B Sivasankar, (Mc-Graw Hill publication).
2. Engineering Chemistry by O.G. Palanna, (Mc-Graw Hill publication).
3. Engineering Chemistry (Wiely India publication).
4. Introduction to Nanotechnology by Poole Owens (Wiley)
5. Nanotechnology by Shah&Shah (Wiley)
6. *Chemistry* in *Engineering* & Technology by J. C. Kuriacose and J. *Rajaram*,, Vol. 1&2
7. The Physics and Chemistry of Solids by Elliott (Wiley)
8. Engineering Chemistry (Wiely India publication).
9. Polymer Chemistry by Stevens (Oxford)
10. Polymer Science and Technology by Ghosh (Tata Mc-Graw Hill publication)
11. Polymer Science and Technology by Fried (PHI publication)
12. Text book of Polymer Science by Billmeyer (Wiely)

Course code	Course Title	Teaching Scheme			
		L	T	P	Credits
ID 201	Environmental Studies	2	0	0	2

Evaluation Scheme (Theory)						Evaluation Scheme (Practical)				
Mid Term Test - I	Mid Term Test - II	End Term Test	Class Participation	Additional Continuous Evaluation*	Total Marks**	Mid Term Test - I	End Term Test	Class Participation	Additional Continuous Evaluation *	Total Marks**
20	20	40	10	10	100	-	-	-	-	-

*Additional Continuous Evaluation: Quizzes/Assignments/Presentations/Practical Records/Mock Interviews/others

Course Syllabi (Theory):

- Understanding environment, The global crisis, Basic Concepts
- Forest and Grassland ecosystems, Desert Ecosystems, Aquatic Ecosystems
- Introduction to Biodiversity, Biodiversity Conservation
- Water Resources, Energy Resources, Forest Resources
- Land, Food, and Mineral Resources
- Air and Noise Pollution, Water, Soil, and Marine Pollution
- Solid Waste Management and Disaster Management
- Population Growth, Environment and Human Health, Sustainable Development
- Global Warming, Acid Rain, and Ozone Depletion
- Different types of laws and regulations

Text Books:

1. Rajagopalan, R., "Environmental Studies: From Crisis to Cure", Oxford University Press, New Delhi, 2e, 2011

Reference Books:

1. Ranjit Daniels & J. Krishnaswamy "Environmental Studies", Wiley India
2. Davis & Cornwell "Environmental Engineering", Mc Graw Hill

Course code	Course Title	Teaching Scheme			
		L	T	P	Credits
ME 201	Engineering Mechanics	3	1	0	4

Evaluation Scheme (Theory)						Evaluation Scheme (Practical)				
Mid Term Test - I	Mid Term Test - II	End Term Test	Class Participation	Additional Continuous Evaluation*	Total Marks**	Mid Term Test - I	End Term Test	Class Participation	Additional Continuous Evaluation *	Total Marks**
20	20	40	10	10	100					

*Additional Continuous Evaluation: Quizzes/Assignments/Presentations/Practical Records/Mock Interviews/others

Syllabus (Theory)

- Fundamentals of engineering mechanics, Laws of Motion, Equilibrium, Conditions for equilibrium, Equations of equilibrium.
- **Statics of Particles and Rigid Bodies:** System of forces, Resultant force, Resolution of force, Moment and Couples.
- **Trusses:** Truss analysis, analysis of frames and machines.
- **Friction:** Types of Friction, Laws of friction, Angle of friction, Angle of repose, Applications of Friction.
- **Lifting Machines:** Mechanical advantage, Velocity Ratio, Efficiency of machine, Ideal machine, Ideal effort and ideal load, Reversibility of machine, Law of machine, Lifting machines; System of Pulleys, Simple wheel and axle, Wheel and differential axle, Weston's differential pulley block, Worm and worm wheel.
- **Properties of Plane Surfaces:** Centroids & Centre of Mass, area of moments, principle moments of inertia, Second moment of mass.
- **Virtual work:** Principle of Virtual Work, Active forces and active force diagram.
- **Kinematics of Particles and Rigid Bodies:** Velocity, Acceleration, Types of Motion, Equations of Motion, Rectangular components of velocity and acceleration, Angular velocity and Angular acceleration, Radial and transverse velocities and accelerations, Projectiles motion on plane and Inclined Plane, Relative Motion.
- **Kinetics of Particles and Rigid Bodies**: Equation of motion in rectangular coordinate, radial and transverse components, Equation of motion in plane for a rigid body.
- **Work, Energy and Power:** Work of a force, weight, spring force and couple, Power, Efficiency, Energy, Kinetic energy of rigid body, Principle of work and energy, Conservative and Non-conservative Force, Conservation of energy.

- **Impulse and Momentum:** Linear and angular momentum, Linear and angular impulse, Principle of momentum for a particle and rigid body, Principle of linear impulse and momentum for a particle and rigid body, Principle of angular momentum and Impulse, Conservation of angular momentum, Angular momentum of rigid body.

Text Books:

1. Meriam and Kraige, **"Engineering Mechanics-STATICS"**, John Wiley & Sons, Fifth Edition, 2010
2. Meriam and Kraige, **"Engineering Mechanics-DYNAMICS"**, John Wiley & Sons, Fifth Edition, 2010

Reference Books:

1. Engineering Mechanics, Basudeb Bhattacharyya, Oxford University Press
2. Vector Mechanics for Engineers, Beer and Johnston, Tata McGraw-Hill., Ninth Edition, 2009.
3. Engineering Mechanics, Hibbeler, Pearson Education, Sixth Edition, 2010
4. Engineering Mechanics, Andrew Pytel & Kiusalas, Cengage Learning, Third Edition, 2010.
5. Engineering Mechanics, Timoshenko and Young, Tata McGraw-Hill, Fourth Edition, 2006.
6. Engineering Mechanics- Statics and Dynamics, Shames, Pearson Education.
7. Engineering Mechanics, Boresi and Schmidt, CL-Engineering, First Edition, 2008.

Course code	Course Title	Teaching Scheme			
		L	T	P	Credits
CSE201	Computer Programming	3	0	2	4

Mid Term Test - I	Mid Term Test - II	End Term Test	Class Participation	Additional Continuous Evaluation*	Total Marks**	Mid Term Test - I	End Term Test	Class Participation	Additional Continuous Evaluation *	Total Marks **
20	20	40	10	10	100	20	40	15	25	100

*Additional Continuous Evaluation: Quizzes/Assignments/Presentations/Practical Records/Mock Interviews/others

**The ratio of weightage between Theory and Practical content will be 60%: 40%

Course Syllabi (Theory):

- Introduction: Stored Program Architecture of Computers, Evolution of Processors (In terms of word length & Speed only), Storage Device- Primary Memory and Secondary Storage, Working Principle of Primary Storage devices- RAM, ROM, PROM, EPROM, EEPROM, Random, Direct, Sequential access methods. Language Translators – Concept of High-Level, Assembly and Low Level programming languages. Working of Assembler, Interpreter and compiler. Representing Algorithms through flow chart, pseudo code, step by step etc.
- Number System: Data Representation, Concept of radix and representation of numbers in radix r with special cases of r=2, 8, 10 and 16 with conversion from radix r1 to radix r2. R's and (r-1)'s complement. Representation of Integer in sign-magnitude, signed 1's and 2's complement, Floating point representation. Concept of bias and normalization. Representation of alphabets, Binary Codes: Binary arithmetic, Addition and subtraction of Integers and floating point Numbers.
- Programming in C: Structure of C Program, Concept of Preprocessor, Macro Substitution, Intermediate code, Object Code, Executable Code. Compilation Process, Basic Data types, Importance of braces ({ }) in C Program, enumerated data type, Identifiers, Scope of Variable, Storage Class, Constants, Expressions in C, Type Casting, Control Statements, printf( ), scanf ( ), reading single character, Command Line arguments.
- Functions in C, Passing Parameters (By value & Reference), using returned data, Passing arrays, structures, array of structures, pointer to structures etc., passing characters and strings, The void pointer.
- Arrays in C, Pointers, Using pointers to represent arrays, Dynamic Memory allocation, structures, using typedef,
- Pointers: What is a Pointer? - How do you Define a Pointer? - Pointer Indexing - Pointer
- Arithmetic - Function data return with a Pointer - A pointer to a Function, Arrays of Structures & pointers,
- File Handling (Opening in different modes & closing of file, fscanf & fprintf only).

Course Syllabi (Practical):

1. Simple OS Commands, compiling program, compiler options, linking libraries.
2. Simple input output program integer, real character and string. (Formatted & Unformatted)
3. Conditional statement programs (if, if-else-if, switch-case)
4. Looping Program. (for, while, do-while)
5. Program based on array (one, two and three dimensions)

6. Program using Function (with and without recursion)
7. Simple programs using pointers.
8. File handling. Program using Structure and Union

Text Books:

1. Reema Thareja "*Computer Fundamentals and Programming in C*" Oxford Education, first.2012
2. Balagurusamy, "*Programming in ANSI C*" Tata Mcgraw Hill, sixth, 2012.

Reference Books:

1. Yashwant Kanetkar, "Let us C" BPB publication, fifth, 2012

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INSTITUTE OF ENGINEERING AND TECHNOLOGY

4 Year B. Tech Programme

(Branch: Mechanical Engineering)

Batch 2014-18

SEMESTER-THREE

Detailed Syllabus

&

Scheme of Examination

Course code	Course Title	Teaching Scheme			
		L	T	P	Credits
ME 301	Engineering Thermodynamics	3	1	0	4

Evaluation Scheme (Theory)						Evaluation Scheme (Practical)				
Mid Term Test - I	Mid Term Test - II	End Term Test	Class Participation	Additional Continuous Evaluation*	Total Marks	Mid Term Test - I	End Term Test	Class Participation	Additional Continuous Evaluation *	Total Marks
20	20	40	10	10	100	-	-	-	-	-

*Additional Continuous Evaluation: Quizzes/Assignments/Presentations/Practical Records/Mock Interviews/others

Syllabus (Theory)

UNIT-I

Basic Concepts: Macroscopic and Microscopic Approach, Thermodynamic Systems, Surrounding and Boundary, Thermodynamic Property, Thermodynamic Equilibrium, State, Path, Process and Cycle, Quasistatic, Reversible and Irreversible Processes, Concept of Thermodynamic Work and Heat, Equality of Temperature, Zeroth Law of Thermodynamic and its utility.

Ideal and Real Gases: Concept of an Ideal Gas, Basic Gas Laws, Characteristic Gas Equation, Avagadro's law and Universal Gas Constant, P-V-T surface of an Ideal Gas..

UNIT-II

Vander Waal's Equation of state, Reduced Co-ordinates, Compressibility factor and law of corresponding states, Mixture of Gases, Bass, Mole and Volume Fraction, Gibson Dalton's law, Gas Constant and Specific Heats, Entropy for a mixture of Gases.

First Law of Thermodynamics: Energy and its Forms, Energy and 1^{st} law of Thermodynamics, Internal Energy and Enthalpy, 1^{st} Law Applied to Non-Flow Process, Steady Flow Process and Transient Flow Process, Throttling Process and Free Expansion Process.

UNIT-III

Second Law of Thermodynamics: Limitations of First Law, Thermal Reservoir Heat Source and Sink, Heat Engine, Refrigerator and Heat Pump, Kelvin- Planck and Clausius Statements and their Equivalence, Perpetual Motion Machine of Second Kind. Carnot Cycle, Carnot Heat Engine and Carnot Heat Pump, Carnot's Theorem and its Corollaries.

Entropy: Clausius Inequality and Entropy, Principle of Entropy Increase, Temperature Entropy Plot, Entropy Change in Different Processes, Introduction to Third Law of Thermodynamics.

UNIT-IV

Availability, Irreversibility and Equilibrium: High and Low Grade Energy, Availability and Unavailable Energy, Loss of Available Energy Due to Heat Transfer Through a Finite Temperature Difference, Availability of a Non-Flow or Closed System, Availability of a Steady Flow System, Helmholtz and Gibb's Functions, Effectiveness and Irreversibility.

Thermodynamic Relations: Tds Relations, Enthalpy and Internal Energy as a Function of Independent Variables, Specific Heat Capacity Relations, Clapeyron Equation, Maxwell Relations

UNIT-V

Pure Substance: Pure Substance and its Properties, Phase and Phase Transformation, Vaporization, Evaporation and Boiling, Saturated and Superheat Steam, Solid – Liquid – Vapour Equilibrium, T-V, P-V and P-T Plots during Steam formation, Properties of Dry, Wet and Superheated Steam, Property Changes during Steam Processes, Temperature – Entropy (T-S) and Enthalpy – Entropy (H-S) Diagrams, Throttling and Measurement of Dryness Fraction of Steam.

Text Book(s)

1. Thermal Science and Engineering – D S Kumar, S K Kataria and Sons
2. Fundamentals of Engineering Thermodynamics, Yadav R., 8th edition, 2004, (Formerly, Thermodynamics and Heat Engines, Vol I), Central Publishing House, Allahabad
3. Engineering Thermodynamics – C P Arora, Tata McGraw Hill
4. Engineering Thermodynamics, Nag P.K., 2nd edition, 1995, Tata McGraw Hill Publishing co. Ltd, New Delhi.
5. Engineering Thermodynamics – Congel & Boles, Tata McGraw Hill
6. Thermodynamics, Holman, J.P., 4th ed., McGraw-Hill book Co. New York

Reference Book(s)

1. Fundamentals of Thermodynamics, Van Wylen, G.J. and Sonntag, R.E., John Wiley & Sons Inc, New York, 2000
2. Engineering Thermodynamics, Spalding, D.B. and Cole, E.H., Edward Arnold.
3. Engineering Thermodynamics: Work and Heat transfer – G F C Rogers Maghew Y R Long man

Course code	Course Title	Teaching Scheme			
		L	T	P	Credits
ME 306	Strength of Materials	3	1	2	5

Evaluation Scheme (Theory)						Evaluation Scheme (Practical)				
Mid Term Test - I	Mid Term Test - II	End Term Test	Class Participation	Additional Continuous Evaluation*	Total Marks**	Mid Term Test - I	End Term Test	Class Participation	Additional Continuous Evaluation*	Total Marks**
20	20	40	10	10	100	20	40	15	25	100

*Additional Continuous Evaluation: Quizzes/Assignments/Presentations/Practical Records/Mock Interviews/others
**The ratio of weightage between Theory and Practical content will be 60%: 40%

Syllabus (Theory)

UNIT I

Simple Stresses & Strains: Composition and resolution of Forces, Equilibrium of Forces, Poisson's ratio, Elastic Constants & their Relationship, Compound bars, Stress-Strain diagram, Temperature stresses, Numerical.

Compound Stress & Strain: Volumetric Strain, Principal Stress and Strain, Mohr's Circle of stresses.

UNIT II

Torsion: Torsion of hollow and solid Circular Shaft within elastic limit, Thin Shaft, Tapered Shaft, Composite Shaft, Torque and Horse power, angle of twist, Torsion equation, Assumptions, Numerical.

UNIT III

Bending and Shearing stresses in beam: Types of beams, types of loading, Moments and their applications, Parallel Forces and Couples, Support Reactions, Relation between Rate of loading the Shear force and Bending Moment, Numerical.

Theory of simple bending, Flexure formula, Section Modulus, Composite beam in Circular, Rectangular, I, T, & Channel Section, Shear stress Distribution, Combined Stresses in beam, Numerical.

Slope & Deflection : Relationship between bending moment, slope & deflection, Mohr's theorem, moment area method, method of integration, Macaulay's method, calculations for slope and deflection of (i) cantilevers and (ii) simply supported beams with or without overhang under concentrated load, Uniformly distributed loads or combination of concentrated and uniformly distributed loads, Numerical.

UNIT IV

Columns & Struts: Column under axial load, concept of instability and buckling, slenderness ratio, derivation of Eulers formulae for the elastic buckling load, Eulers, Rankine, Gordom's formulae Johnson's empirical formula for axial loading columns and their applications, eccentric compression of a short strut of rectangular & circular sections, Numerical.

UNIT V

Thin Cylinders & Spheres: Hoop & Longitudinal stresses & strains in cylindrical & spherical vessels & their derivations under internal pressure, wire would cylinders, Numerical.

Springs: Stresses in open coiled helical spring subjected to axial loads and twisting couples, leaf springs, flat spiral springs, concentric springs, Numerical Problems.

Syllabus (Practical)

1. Universal Testing Machine UTE-20.
2. Impact Tester, IT-30.
3. Torsion Testor, TTE-10.
4. Rockwell Hardness Tester.
5. Brinell Hardness Tester.
6. Vickers Hardness Tester, VM-50.
7. Strain Measurement Module.
8. Fatigue Testing machine, FTG 8(D).
9. Bending Stress in a Beam, STR 5.
10. Thin Cylinder, SM 1007.

Text Book(s)

1. Pytel, A., and Jaan Kiusalaas, **"Mechanics of Materials",** CL Engineering, 2nd edition, 2011
2. Hibbeler, R.C., **"Mechanics of Materials SI",** 6th SI edition, Prentice Hall
3. Ryder, G.H., **"Strength of Materials",** Palgrave Macmillan,1969
4. Beer, F.P., Johnston, E.R., DeWolf, J.T., "**Mechanics of Materials**", McGraw Hill, 4th edition,
5. Craig, R.R., "**Mechanics of Materials**", John Wiley and Sons, 2nd edition, 1999
6. Rattan, S.S., **"Strength of Materials**", McGraw Hill, New Delhi, 2nd edition

Reference Book(s)

1. Strength of Materials – G.H.Ryder, Third Edition in SI UNITs 1969 Macmillan India
2. Strength of Materials – Andrew Pytel and Fredinand L.Singer, Fourth Edition, Int. Student Ed. Addison – Wesley Longman
3. Strength of Materials – Popov, PHI, New Delhi.
4. Strength of Materials – Sadhu Singh, Khanna Publications
5. Strength of Materials – Dr. R. K. Rajput, Luxmi Publications
6. Strength of Materials – Dr. R. K. Bansal, Luxmi Publications
7. Strength of Materials- A Rudimentary Apprach – M.A. Jayaram

Course code	Course Title	Teaching Scheme			
		L	T	P	Credits
ME307	Fluid Mechanics	3	1	2	5

Mid Term Test - I	Mid Term Test - II	End Term Test	Class Participation	Additional Continuous Evaluation*	Total Marks**	Mid Term Test - I	End Term Test	Class Participation	Additional Continuous Evaluation *	Total Marks**
20	20	40	10	10	100	20	40	15	25	100

*Additional Continuous Evaluation: Quizzes/Assignments/Presentations/Practical Records/Mock Interviews/others
**The ratio of weightage between Theory and Practical content will be 60%: 40%

Syllabus (Theory)

UNIT I

Fluid Properties and Fluid Statics: Concept of fluid and flow, ideal and real fluids, continuum concept, properties of fluids, Newtonian and non-Newtonian fluids. Pascal's law, hydrostatic equation, hydrostatic forces on plane and curved surfaces, stability of floating and submerged bodies, relative equilibrium. Problems.

UNIT II

Fluid Kinematics: Eulerian and Lagrangian description of fluid flow; stream, streak and path lines; types of flows, flow rate and continuity equation, differential equation of continuity in cylindrical and polar coordinates, rotation, vorticity and circulation, stream and potential functions, flow net. Problems.

Fluid Dynamics:- Concept of system and control volume, Euler's equation, Bernoulli's equation, Pitot tube, venturimeter, orificemeter, flow through orifices & mouthpieces, Kinetic and momentum correction factors, potential flow: uniform and vortex flow, free & forced vortex, flow past a Rankine half body, flow past a cylinder with and without circulation.

UNIT III

Compressible Fluid Flow: Introduction, continuity momentum and energy equation, sonic velocity, propagation of elastic waves due to compression of fluid, propagation of elastic waves due to disturbance in fluid, stagnation properties, isentropic flow, effect of area variation on flow properties, isentropic flow through nozzles, diffusers, injectors, Problems.

Viscous Flow:- Flow regimes & Reynolds number, Relationship between shear stress and pressure gradient, uni-directional flow between stationary and moving parallel plates, movement of piston in a dashpot, power absorbed in bearings.

UNIT IV

Flow through pipes:-Hagen-Poiseuilli Law, hydraulic gradient and total energy lines, major and minor losses in pipes. Power transmission though pipes, branched pipes- parallel and series.

Boundary Layer Analysis:- Boundary layer concept, displacement, momentum and energy thickness of boundary layer. Laminar and turbulent boundary layer flows, drag on a flat plate, boundary layer separation and control, streamline and bluff bodies, lift and drag on a cylinder and an airfoil.

UNIT V

Turbulent flow: - Shear stress in turbulent flow, Prandtl mixing length hypothesis, hydraulically smooth and rough pipes, velocity distribution in pipes, friction coefficients for smooth and rough pipes, Problems.

Syllabus (Practical)

1. To determine the coefficient of impact for vanes.
2. To determine coefficient of discharge of an orificemeter.
3. To determine the coefficient of discharge of Notch (V and Rectangular types).
4. To determine the friction factor for the pipes.
5. To determine the coefficient of discharge of venturimeter.
6. To determine the coefficient of discharge, contraction & velocity of an orifice.
7. To verify the Bernoullis Theorem.
8. To find critical Reynolds number for a pipe flow.
9. To determine the meta-centric height of a floating body.
10. To determine the minor losses due to sudden enlargement, sudden contraction and bends.
11. To show the velocity and pressure variation with radius in a forced vertex flow.
12. To verify the momentum equation.

Text Books:

1. Hydraulics and Fluid Mechanics, Dr. Lal Jagadish, Metropolitan Book.
2. Fluid Mechanics and Fluid Power Engineering – D S Kumar, S K Kataria and Sons
3. Hydraulics & Fluid Mechanics – Modi & Seth, Pub. - Standard Book House, N.Delhi
4. Fluid Mechanics and Hydraulic Machines – S S Rattan, Khanna Publishers

Reference Books:

1. Fluid Mechanics – Streeter V L and Wylie E B, Mc Graw Hill
2. Mechanics of Fluids – I H Shames, Mc Graw Hill
3. Introduction to Fluid Mechanics and Fluid Machines – S K Som and G Biswas, Tata McGraw Hill

Course code	Course Title	Teaching Scheme			
		L	T	P	Credits
ME304	Materials Science & Engineering	3	0	0	3

Evaluation Scheme (Theory)						Evaluation Scheme (Practical)				
Mid Term Test - I	Mid Term Test - II	End Term Test	Class Participation	Additional Continuous Evaluation*	Total Marks**	Mid Term Test - I	End Term Test	Class Participation	Additional Continuous Evaluation *	Total Marks**
20	20	40	10	10	100	20	40	15	25	100

*Additional Continuous Evaluation: Quizzes/Assignments/Presentations/Practical Records/Mock Interviews/others

Course Syllabi (Theory):

UNIT I

Crystallography: Review of crystal structure, space lattice, crystal planes and crystal directions, co-ordination number, number of atoms per unit cell, atomic packing factor, Numerical related to crystallography

UNIT II

Imperfection in metal crystals: Crystal imperfections and their classifications, point defects, line defects, edge & screw dislocations, surface defects, volume defects & effects of imperfections on metal properties.

Solid solutions and phase diagram: Introduction to single and multiphase solid solutions and types of solid solutions, importance and objectives of phase diagram, cooling curves, unary & binary phase diagrams, Gibbs's phase rule, Lever rule, eutectic and eutectoid systems, peritectic and peritectoid systems, iron carbon equilibrium diagram and TTT diagram.

UNIT III

Heat Treatment: Principles, purpose, classification of heat treatment processes, annealing, normalizing, stress relieving, hardening, tempering, hardenability, carburizing, nitriding, cyaniding, flame and induction hardening. Allotropic transformation of iron and steel, Properties of austenite, ferrite, pearlite, martensite.

UNIT IV

Deformation of Metal: Elastic and plastic deformation, mechanism of plastic deformation, twinning, conventional and true stress strain curves for polycrystalline materials, yield point phenomena, strain ageing, work hardening, Bauschinger effect, season cracking. Recovery, re-crystallization and grain growth

Failures of metals: Process of fracture, types of fracture, fatigue failure, characteristics of fatigue, fatigue limit, mechanism of fatigue, factors affecting fatigue, failure analysis.

UNIT V

Creep and Corrosion: Definition and concept, creep curve, mechanism of creep, impact of time and temperature on creep, creep fracture, creep testing and prevention against creep. Corrosion: Mechanism, types of corrosion, effect of corrosion, prevention of corrosion.

Engineering alloys: Heat resistant, corrosion resistant, super alloys, carbon and alloys tool steels and high-speed steels, ceramics: preparation and applications

Text Books:

1. Mechanical Metallurgy, George E. Dieter
2. Material Science & Engineering –V. Raghvan, Prentice Hall of India Pvt. Ltd, New Delhi
3. Material Science - Narula, Narula and Gupta. New Age Publishers
4. A Text Book of Material Science & Metallurgy – O.P. Khanna, Dhanpat Rai & Sons

Reference Books:

1. Material Science and Engineering-An Introduction - Callister; W.D., John Wiley & Sons, Delhi.
2. Engineering Materials: Kenneth G. Budinski, Prentice Hall of India, New Delhi

Course code	Course Title	Teaching Scheme			
		L	T	P	Credits
ME305	Advanced Machine Drawing	1	0	3	2.5

Evaluation Scheme (Theory)						Evaluation Scheme (Practical)				
Mid Term Test - I	Mid Term Test - II	End Term Test	Class Participation	Additional Continuous Evaluation*	Total Marks**	Mid Term Test - I	End Term Test	Class Participation	Additional Continuous Evaluation *	Total Marks**
20	20	40	10	10	100	20	40	15	25	100

*Additional Continuous Evaluation: Quizzes/Assignments/Presentations/Practical Records/Mock Interviews/others

**The ratio of weightage between Theory and Practical content will be 60%: 40%

Syllabus (Theory)

- Introduction to Bureau of Indian Standards (BIS) of engineering drawing, Limits fits and tolerances (linear and geometric tolerances), surface finish symbols and their elements.
- Gears: Gear terminology, IS conventions, representation of assembly of spur gears, helical gears, bevel gears, worm and worm wheel.
- **Fasteners:** Various types of screw threads, types of nuts and bolts, screwed fasteners, welding joints and riveted joints.
- Orthographic views from isometric views of machine parts / components, exercises on Couplings, Cotter and knuckle joint, Riveted Joints and Welded Joints.
- **Assemblies drawing with sectioning and bill of materials from given detail:**

  a) Couplings: Solid or rigid Coupling, Protected type flange coupling, Pin type flexible coupling, muff coupling, Oldham, universal coupling, claw coupling, cone friction clutch, free hand sketch of single plate friction clutch.

  b) Lathe tail stock, Machine vice, Pedestal Bearing, Steam stop Valve, Drill Jigs and milling fixtures.

  c) Pipe and Pipe fittings: flanged joints, spigot and socket joint, union joint, an expansion joint

  d) IC Engine Parts: Piston, connecting rod

  e) Boiler Mountings: steam stop valve, feed check valve, safety valve, blow off cock.

  f) Bearings: swivel bearing, thrust bearing, Plunger block, angular plumber block

  g) Miscellaneous: Screw Jack, Drill Press Vice, Crane hook.

Course Syllabi (Practical):

Assemblies drawing with sectioning and bill of materials from given detail:

a) Couplings: Solid or rigid Coupling, Protected type flange coupling, Pin type flexible coupling, muff coupling, Oldham, universal coupling, claw coupling, cone friction clutch, free hand sketch of single plate friction clutch.

b) Lathe tail stock, Machine vice, Pedestal Bearing, Steam stop Valve, Drill Jigs and milling fixtures.

c) Pipe and Pipe fittings: flanged joints, spigot and socket joint, union joint, an expansion joint

d) IC Engine Parts: Piston, connecting rod

e) Boiler Mountings: steam stop valve, feed check valve, safety valve, blow off cock.

f) Bearings: swivel bearing, thrust bearing, Plunger block, angular plumber block

g) Miscellaneous: Screw Jack, Drill Press Vice, Crane hook.

Text Books:

1. Basudeb Bhattacharyya, *"Machine Drawing including AutoCAD Supplements,"* Oxford University Press, 2012, Second Impression
2. Ajeet Singh, *"Machine Drawing: Includes AutoCAD,"* TMH, 2nd edition

Reference Books:

1. Yarwood, Alf. *"Introduction to Auto – CAD 2011 2D and 3D Design"*, Elsevier, 1st edition, 2010
2. Ellen Finkelstein, *"Auto-CAD 2011 & Auto-CAD LT 2011 Bible,"* Wiley India Edition
3. Bhatt, N.D. *"Machine Drawing"*, Charotar Pulisher, 38th edition, 2003
4. James E Fuller, *"Using Auto-CAD,"* Denmark Publishing Co.
5. Dhawan, R.K. "*Machine Drawing*", S. Chand and Co, 2005
6. Radhakrishnan, P., *"Computer Graphics and Design"*, Dhanpatrai and Sons

Course code	Course Title	Teaching Scheme			
		L	T	P	Credits
MA 301	Engineering Mathematics – III	3	1	0	4

Evaluation Scheme (Theory)						Evaluation Scheme (Practical)				
Mid Term Test - I	Mid Term Test - II	End Term Test	Class Participation	Additional Continuous Evaluation*	Total Marks	Mid Term Test - I	End Term Test	Class Participation	Additional Continuous Evaluation *	Total Marks
20	20	40	10	10	100	-	-	-	-	-

*Additional Continuous Evaluation: Quizzes/Assignments/Presentations/Practical Records/Mock Interviews/others

Course Syllabi (Theory):

Unit 1: Integral Transforms

Laplace transform and its properties, Fourier Transform.

Unit 2: Applications of Transform Calculus

Integral transform method for solving differential equations, Systems of Linear Differential Equations

Unit 3: Special Functions

Legendre and Bessel functions, series representations and recurrence relations

Unit 4: Calculus of variations

Extremal function, Euler Equation, Isoperimetric problems

Unit 5: Complex Analysis

Functions of complex variables and its derivatives, Integration in complex planes, Series, Singularities and Residues, Evaluation of Real Integrals, Conformal mappings, Schwarz-Christoffel Transformations

Text books and Reference books

8. Dennis G. Zill and Warren S. Wright, *Advanced Engineering Mathematics*, Fourth Edition (Student Edition), Jones & Barlett, Viba, New Delhi, 2011
9. Peter V. O'Neil, *Advanced Engineering Mathematics*, Seventh Indian Reprint, Cengage Learning, New Delhi, 2011.
10. Erwin Kreyszig, *Advanced Engineering Mathematics*, Wiley 9th Edition.
11. B. S. Grewal, *Higher Engineering Mathematics*, 41st Ed., Khanna Publishers, Delhi, 2011.
12. H. K. Dass, *Advanced Engineering Mathematics*, 12th editions with corrections, S. Chand and Company, Meerut, 2004
13. B. V. Ramana, *Higher Engineering Mathematics*, Tata Mcgraw Hill.
14. Potter M.C., Goldberg J.L., Edward F.A., *Advanced Engineering Mathematics*, 3rd Edition, Oxford University Press, 2005

Course code	Course Title	Teaching Scheme			
		L	T	P	Credits
HS 302	Principles of Management for Engineers	2	0	0	2

Mid Term Test - I	Mid Term Test - II	End Term Test	Class Participation	Additional Continuous Evaluation*	Total Marks**	Mid Term Test - I	End Term Test	Class Participation	Additional Continuous Evaluation *	Total Marks**
20	20	40	10	10	100	20	40	15	25	100

*Additional Continuous Evaluation: Quizzes/Assignments/Presentations/Practical Records/Mock Interviews/others

Course Syllabi (Theory):

- **Concepts of management:** Functions and Responsibilities of managers, Principles of management and visiting various, Schools of management Thoughts in developing, Excellent managers
- **Planning:** Nature and purpose of planning, Planning process and principles, Types of planning, Advantages and disadvantages of planning, Concept of objectives and types of objectives, Case analysis
- **Organizing:** Nature and purpose of organizing, Process of organizing, Span of management and determination of span of management, Principles of organizing, Departmentalization, delegation and, Decentralization. Case analysis
- **Directing and leading:** Requirements of Effective directions, Giving orders, motivation, Nature of leadership, leadership and management, Recapitulation and case discussion
- **Controlling:** concept and process, Need for controlling and types of control methods, Essentials of effective control, Benefits and problems in control systems. Case analysis
- Social responsibilities of business: Meaning, Social responsibility of business towards different groups, Social performance of business in India, Social audit, Business ethics and corporate governance

Text Books:

1. Tripathy, P.C. and Reddy, P. N. "Principles of Management". . McGraw Hill, New Delhi.4th ed. 2008.

Reference Books:

1. Koontz, Herold and Weihrich, Heinz. "Management". McGraw Hill, New York. 9th ed. 1988.

2. Stoner, James A. F. and Freeman, R Edward. "Management". Prentice Hall of India, New Delhi. 6th e, 1989.
3. Bateman, T. S. and Snell, S. A. "Management: Leading and Collaborating in a Competitive World", McGraw Hill Irwin. 8th edition,2009.
4. Draft, R. L. "Principles of Management". Cengage learning.2009
5. Schermerhron, J. R. "Introduction to Management", 10th edition, Wiley India. 2009

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INSTITUTE OF ENGINEERING AND TECHNOLOGY

4 Year B. Tech Programme

(Branch: Mechanical Engineering)

Batch 2014-18

SEMESTER-FOUR

Detailed Syllabus

&

Scheme of Examination

Course code	Course Title	Teaching Scheme			
		L	T	P	Credits
ME 409	I. C. Engine & Gas Turbines	3	0	3	4.5

Evaluation Scheme (Theory)						Evaluation Scheme (Practical)				
Mid Term Test - I	Mid Term Test - II	End Term Test	Class Participation	Additional Continuous Evaluation*	Total Marks**	Mid Term Test - I	End Term Test	Class Participation	Additional Continuous Evaluation *	Total Marks**
20	20	40	10	10	100	20	40	15	25	100

*Additional Continuous Evaluation: Quizzes/Assignments/Presentations/Practical Records/Mock Interviews/others

**The ratio of weightage between Theory and Practical content will be 60%: 40%

Syllabus (Theory)

Air Standard Cycles: Internal and external combustion engines; classification of I.C. Engines, Cycles of operation in four stroke and two stroke I.C. Engines, Wankel Engines, Assumptions made in air standard cycle; Otto cycle; diesel cycle, dual combustion cycle, comparison of Otto, diesel and dual combustion cycles; sterling and Ericsson cycles; air standard efficiency, specific work output, specific weight; work ratio; mean effective pressure; deviation of actual engine cycle from ideal cycle. Problems.

Carburetion, fuel Injection and Ignition systems: Mixture requirements for various operating conditions in S.I. Engines; elementary carburetor, Requirements of a diesel injection system; types of inject systems; petrol injection, Requirements of ignition system; types of ignition systems ignition timing; spark plugs. Problems.

Combustion in I.C. Engines: S.I. engines; Ignition limits; stages of combustion in S.I. Engines; Ignition lag; velocity of flame propagation; detonation; effects of engine variables on detonation; theories of detonation; octane rating of fuels; pre-ignition; S.I. engine combustion chambers, Stages of combustion in C.I. Engines; delay period; variables affecting delay period; knock in C.I. engines, Cetane rating; C.I. engine combustion chambers.

Lubrication and Cooling Systems: Functions of a lubricating system, Types of lubrication system; mist, wet sump and dry sump systems; properties of lubricating oil; SAE rating of lubricants, engine performance and lubrication, Necessity of engine cooling; disadvantages of overcooling; cooling systems; air-cooling, water cooling; radiators.

Engine Testing and Performance: Performance parameters: BHP, IHP, mechanical efficiency, brake mean effective pressure and indicative mean effective pressure, torque, volumetric efficiency; specific fuel consumption (BSFC, ISFC), thermal efficiency; heat balance; Basic engine measurements; fuel and air consumption, brake power, indicated power and friction power, heat lost to coolant and exhaust gases; performance curves. Problems.

Air pollution from I.C. Engine and Its remedies: Pollutants from S.I. and C.I. Engines, Methods of emission control; alternative fuels for I.C. Engines; the current scenario on the pollution front.

Rotary Compressors: Root and vane blowers; Static and total head values; Centrifugal compressors- Velocity diagrams, slip factor, ratio of compression, pressure coefficient, pre-whirl; Axial flow compressor- Degree of reaction, polytropic efficincy, surging, choking and stalling, performance characteristics, Problems.

Gas Turbines: Brayton cycle; Components of a gas turbine plant; open and closed types of gas turbine plants; Optimum pressure ratio; Improvements of the basic gas turbine cycle; multi stage compression with inter-cooling; multi stage expansion with reheating between stages; exhaust gas heat exchanger, Applications of gas turbines. Problems.

Syllabus (Practical)

1. To study the constructional details & working principles of two-stroke/ four stroke petrol engine.
2. To study the constructional detail & working of two-stroke/ four stroke diesel engine.
3. Analysis of exhaust gases from single cylinder/multi cylinder diesel/petrol engine by Orsat Apparatus.
4. To prepare heat balance sheet on multi-cylinder diesel engine/petrol engine.
5. To find the indicated horse power (IHP) on multi-cylinder petrol engine/diesel engine by Morse Test.
6. To prepare variable speed performance test of a multi-cylinder/single cylinder petrol engine/diesel engine and prepare the curves (i) bhp, ihp, fhp, vs. speed (ii) volumetric efficiency & indicated specific fuel consumption vs. speed.
7. To find fhp of a multi-cylinder diesel engine/petrol engine by Willian's line method & by motoring method.
8. To perform constant speed performance test on a single cylinder/multi-cylinder diesel engine & draw curves of (i) bhp vs fuel rate, air rate and A/F and (ii) bhp vs mep, mech efficiency & sfc.
9. To measure CO & Hydrocarbons in the exhaust of 2- stroke / 4-stroke petrol engine.
10. To find intensity of smoke from a single cylinder / multi-cylinder diesel engine.
11. To draw the scavenging characteristic curves of single cylinder petrol engine.
12. To study the effects of secondary air flow on bhp, sfc, Mech. Efficiency & emission of a two-stroke petrol engine

Text Book(s)

1. Internal Combustion Engines & Air pollution- Obert E.F, Pub.-Hopper & Row Pub., New York
2. Internal Combustion Engines Fundamentals- John B. Heywood, Pub.-McGraw Hill, New York
3. Fundamentals of Internal Combustion Engines-H.N. Gupta, PHI, New Delhi
4. Internal combustion engines, M. L. Mathur, R. P. Sharma, Dhanpat Rai Publ., 2005

Reference Book(s)

1. Internal Combustion Engines –V. Ganesan, Pub.-Tata McGraw-Hill.
2. Gas Turbines - V. Ganesan, Pub.- Tata McGraw Hill.
3. Engineering fundamental of the I.C.Engine – Willard W. Pulkrabek Pub.-PHI,India

Course code	Course Title	Teaching Scheme			
		L	T	P	Credits
ME 405	Casting, Welding & Forming	3	0	3	4.5

Evaluation Scheme (Theory)						Evaluation Scheme (Practical)				
Mid Term Test - I	Mid Term Test - II	End Term Test	Class Participation	Additional Continuous Evaluation*	Total Marks	Mid Term Test - I	End Term Test	Class Participation	Additional Continuous Evaluation	Total Marks
20	20	40	10	10	100	-	-	-	-	-

*Additional Continuous Evaluation: Quizzes/Assignments/Presentations/Practical Records/Mock Interviews/others
**The ratio of weightage between Theory and Practical content will be 60%: 40%

Syllabus (Theory)

UNIT I

Metal Casting Process: Introduction, **Foundry:** Introduction to Casting Processes, Basic Steps in Casting Processes. **Pattern:** Types of Pattern and Allowances. Gating Systems,

Elements of Sand Mould Casting; Sand Properties and Types; Sand Properties, Constituents and Preparation. Sand Testing; Mould & Core making with assembly and its Types. Moulding Methods; Design of Patterns and Cores; Design of Gating Systems; Melting of Metal, Furnaces like Cupola, Metal Pouring, Fettling, Casting Treatment, Inspection and Quality Control,. Solidification of Castings; Design and Placement of Risers. Sand Casting Defects & Remedies, Inspection of Casting.

UNIT II

Expendable Mould Casting Processes: Shell Mould Casting, Vacuum Moulding; Investment Casting; Plaster and Ceramic Mould casting; Non-Expandable Mould Casting Processes - Die Casting; Centrifugal Casting; Slush Casting, Vacuum and Low Pressure Casting.

UNIT III

Shaping of Metal Powders: Production of powders, Compacting and Sintering, Manufacturing of Powder products

Shaping of Plastics: Screw Extrusion, Injection Moulding, Compression and Transfer Moulding, Blow And Rotational Moulding; Calendaring and Thermoforming

Shaping of Composites: Layup, Compression, Transfer and Injection Moulding; Filament Winding.

UNIT IV

Welding: Introduction to Welding, Classification of Welding Processes, Gas Welding, Oxy-Acetylene Welding, Resistance Welding; Spot and Seam Welding, Arc Welding, Metal Arc, TIG & MIG Welding, Submerged arc welding (SAW), resistance welding principles, electrode types and selection, thermit welding, electro slag welding, electron beam welding, laser beam welding, forge welding, friction welding, Welding Defects and remedies, brazing & soldering.

UNIT V

Forming Processes: Basic Principle of Hot & Cold Working, Hot & Cold Working Processes, Rolling, Extrusion, Forging, Drawing, Wire Drawing and Spinning. Sheet Metal Operations: Measuring, Layout marking, Shearing, Punching, Blanking, Piercing, Forming, Bending and Joining.

Course Syllabi (Practical):

1. Perform moisture test, permeability test, clay content test, Strength test (compressive, Tensile, Shear Transverse etc. in green and dry conditions) and Hardness Test (Mould and Core).
2. Study the welding defects and suggests their remedies after testing of Welding joint.
3. To design and fabricate welding and drilling jigs.
4. To design and fabricate welding and drilling fixtures.
5. To make a pattern for a given casting with all the necessary allowances, parting line, running system details. Prepare the mold and make the casting. Investigate the casting defects and suggest the remedial measures.
6. To make a component involving horizontal and vertical welding using gas welding, TIG and MIG welding.
7. Development and manufacture of complex sheet-metal components such as funnel etc.
8. Modeling of 3D runner system and creation of drawing for manufacturing of the casting patterns.

Text Book(s)

1. Manufacturing science, Ghosh and Malik, E.W. Press
2. Modern machining processes, Pandey and Shan, Tata McGraw Hill Publications
3. Manufacturing Technology: Foundry, Forming and Welding by P.N.Rao, TMH.
4. Principles of Manufacturing Materials and Processes, James S.Campbell, TMH.
5. Welding Metallurgy by G.E.Linnert, AWS.

Reference Book(s)

1. Manufacturing analysis, Cook, Adisson-Wesley
2. Metal cutting principles, Shaw, MIT Press Cambridge
3. Principles of metal cutting, Sen and Bhattacharya, New Central Book.
4. Manufacturing Engineering Technology, R. K. Jain, Pearson Education
5. Production Engineering Sciences by P.C.Pandey and C.K.Singh, Standard Publishers Ltd.
6. Manufacturing Science by A.Ghosh and A.K.Mallick, Wiley Eastern

Course code	Course Title	Teaching Scheme			
		L	T	P	Credits
ME 406	Hydraulic machines	3	0	2	4

Evaluation Scheme (Theory)						Evaluation Scheme (Practical)				
Mid Term Test - I	Mid Term Test - II	End Term Test	Class Participation	Additional Continuous Evaluation*	Total Marks**	Mid Term Test - I	End Term Test	Class Participation	Additional Continuous Evaluation *	Total Marks**
20	20	40	10	10	100	20	40	15	25	100

*Additional Continuous Evaluation: Quizzes/Assignments/Presentations/Practical Records/Mock Interviews/others

**The ratio of weightage between Theory and Practical content will be 60%: 40%

Course Syllabi (Theory):

UNIT I

Introduction: Definition of fluid machinery, classification (positive displacement type machine, Turbo-machine and others); energy transfer in fluid machines – application of linear and angular momentum equations.

Impact of free jets: Impulse – momentum principle, jet impingement - on a stationary flat plate, inclined plate and a hinged plate, at the center of a stationary vane, on a moving flat plate, inclined plate, a moving vane and a series of vanes, Jet striking tangentially at the tip of a stationary vane and moving vane(s), jet propulsion of ships. Problems

UNIT II

Impulse Turbines: Classification – impulse and reaction turbines, water wheels, component parts, construction, operation and governing mechanism of a Pelton wheel, work done, effective head, available head and efficiency of a Pelton wheel, design aspects, speed ratio, flow ratio, jet ratio, number of jets, number of buckets and working proportions, Performance Characteristics, governing of impulse turbines. Problems

Francis Turbines: Component parts, construction and operation of a Francis turbine, governing mechanism, work done by the turbine runner, working proportions and design parameters, slow, medium and fast runners, degree of reaction, inward/outward flow reaction turbines, Performance Characteristics, Problems.

Propeller and Kaplan turbines: Component parts, construction and operation of a Propeller, Kaplan turbine, differences between the Francis and Kaplan turbines, draft tube - its function and different forms, Performance Characteristics, Governing of reaction turbine, Introduction to new types of turbine, Deriaz (Diagonal), Bulb, Tubular turbines, Problems.

UNIT III

Dimensional Analysis and Model Similitude: Dimensional homogeneity, Rayleigh's method and Buckingham's-theorem, model studies and similitude, dimensionless numbers and their significance. Unit quantities, specific speed and model relationships for turbines, scale effect, cavitations – its causes, harmful effects and prevention, Thomas cavitation factor, permissible installation height, Problems.

UNIT IV

Centrifugal Pumps: Classification, velocity vector diagrams and work done, manometric efficiency, vane shape, head capacity relationship and pump losses, pressure rise in impeller, minimum starting speed, design considerations, multi-stage pumps. Similarity relations and specific speed, net positive suction head, cavitation and maximum suction lift, performance characteristics. Brief introduction to axial flow, mixed flow and submersible pumps, Problems.

Reciprocating Pumps: Construction and operational details, discharge coefficient, volumetric efficiency and slip, work and power input, effect of acceleration and friction on indicator diagram (pressure – stroke length plot), separation, air vessels and their utility, rate of flow into or from the air vessel, maximum speed of the rotating crank, characteristic curves, centrifugal vs reciprocating pumps, brief introduction to screw, gear, vane and radial piston pumps, Problems.

UNIT V

Hydraulic systems: Function, construction and operation of Hydraulic accumulator, hydraulic intensifier, hydraulic crane, hydraulic lift and hydraulic press, Fluid coupling and torque converter, Hydraulic ram, Problems.

Course Syllabi (Practical):

1. To study the constructional details of a Pelton turbine and draw its fluid flow circuit.
2. To draw the following performance characteristics of Pelton turbine-constant head, constant speed and constant efficiency curves.
3. To study the constructional details of a Francis turbine and draw its fluid flow circuit.
4. To draw the constant head, constant speed and constant efficiency performance characteristics of Francis turbine.
5. To study the construction details of a Kaplan turbine and draw its fluid flow circuit.
6. To draw the constant head, speed and efficiency curves for a Kaplan turbine.
7. To study the constructional details of a Centrifugal Pump and draw its characteristic curves.
8. To study the constructional details of a Reciprocating Pump and draw its characteristics curves.
9. To study the construction details of a Gear oil pump and its performance curves.
10. To study the constructional details of a Hydraulic Ram and determine its various efficiencies.
11. To study the constructional details of a Centrifugal compressor.
12. To study the model of Hydro power plant and draw its layout.

Text Books:

1. Hydraulics & Fluid Mechanics – Modi & Seth, Pub. - Standard Book House, N.Delhi
2. Hydraulic Machines – Jagdish Lal, Metropolitan
3. Fluid Mechanics and Hydraulic Machines – S S Rattan, Khanna Publishers

Reference Books:

1. Introduction to Fluid Mechanics and Fluid Machines – S K Som and G Biswas, Tata McGraw Hill
2. Fluid Mechanics and Fluid Power Engineering – D S Kumar, S K Kataria and Sons

Course code	Course Title	Teaching Scheme			
		L	T	P	Credits
ME 407	Kinematics of machines	3	0	0	3

Evaluation Scheme (Theory)						Evaluation Scheme (Practical)				
Mid Term Test - I	Mid Term Test - II	End Term Test	Class Participation	Additional Continuous Evaluation*	Total Marks**	Mid Term Test - I	End Term Test	Class Participation	Additional Continuous Evaluation *	Total Marks**
20	20	40	10	10	100					

*Additional Continuous Evaluation: Quizzes/Assignments/Presentations/Practical Records/Mock Interviews/others

Course Syllabi (Theory):

- Kinematics, Kinematic pairs, Kinematic chain, Mechanism, Machine, Structure, Types of links,Types of consrained Motions,Types of joints in a chain, Inversions of: Four-bar chain, Single and double slider crank chain, Quick return mechanisms.
- Velocity determination; Relative velocity methods, Instantaneous center method, Kennedy's Theorem, Space centroid and body centroid.
- Centripetal and tangential accelerations, Acceleration determination by graphical method using velocity polygons, Coriolis component of acceleration, Klein's construction Introduction to analysis and synthesis of mechanisms, Introduction to function generation, Path generation and rigid bodied guidance.Analytical methods to find velocity and acceleration of four –link mechanism (Freudenstein's equation), slider crank mechanism, To Coordinate angular displacements of input and output links, least square technique.

Text Book:

1. Theory of machines: S. S. Rattan, Tata McGraw Hill Publications.
2. Theory of Mechanism and Machines: Jagdish Lal, Metropolitan Book Co.
3. Theory of Machines: P.L.Ballaney, Khanna Publisher.
4. Theory of Machines: Thomas Bevan.
5. Theory of Machines and Mechanisms: Shigley.
6. Theory of Machines and Mechanisms: Ghosh and Mullick.

Reference Books:

1. Mechanism synthesis and analysis: A.H. Soni, McGraw Hill Publications.
2. Mechanism: J.S. Beggs.
3. Mechanics of Machines: P.Black, Pergamon Press.

Course code	Course Title	Teaching Scheme			
		L	T	P	Credits
ME 408	Heat Transfer	3	0	3	4.5

Evaluation Scheme (Theory)						Evaluation Scheme (Practical)				
Mid Term Test - I	Mid Term Test - II	End Term Test	Class Participation	Additional Continuous Evaluation*	Total Marks**	Mid Term Test - I	End Term Test	Class Participation	Additional Continuous Evaluation *	Total Marks**
20	20	40	10	10	100	20	40	15	25	100

*Additional Continuous Evaluation: Quizzes/Assignments/Presentations/Practical Records/Mock Interviews/others

**The ratio of weightage between Theory and Practical content will be 60%: 40%

Syllabus (Theory)

UNIT I

Introduction to Heat Transfer Processes: Conduction and radiation, Fourier's law of heat conduction, thermal conductivity, thermal conductivity of solids, liquids and gases, effect of temperature on thermal conductivity, Newton's law of cooling, definition of overall heat transfer coefficient, general parameters influence the value of heat transfer coefficient. Conduction : General 3-Dimensoinal conduction equation in Cartesian, cylindrical and spherical coordinates, different kinds of boundary conditions, nature of differential equations, one dimensional heat conduction with and without heat generation, electrical analogy, heat conduction through composite walls, critical thickness of insulation.

UNIT II

Heat Transfer from Finned Surfaces: fin efficiency and effectiveness, two dimensional steady state heat conduction using analytical and numerical methods, periodic heat conduction. Convection: Review of Navier–Stokes and energy equation, hydrodynamic and thermal boundary layers, laminar boundary layer equations, forced convection appropriate non dimensional members, effect of prandtl number, empirical relations for flow over a flat plate and flow through pipes.

UNIT III

Natural Convection: Dimensional analysis, grashoff number, boundary layers in external flows (flow over a flat plate only), boundary layer equations and their solutions, heat transfer correlations. Heat Transfer with Change of Phase: Nature of vaporization phenomena, different regimes of boiling heat transfer, correlations for saturated liquid vaporization, condensation on flat plates, correlation of experimental results, drop wise condensation.

UNIT IV

Heat Exchanger: Different types of heat exchangers, arithmetic and logarithmic mean temperature differences, heat transfer coefficient for parallel, counter and cross flow type heat exchanger, effectiveness of heat exchanger, N.T.U. method, fouling factor, constructional and manufacturing aspects of Heat Exchangers.

UNIT V

Thermal Radiation: Plank distribution law, Kirchhoff's law, radiation properties, diffuse radiations, Lambert's law, radiation intensity, heat exchange between two black bodies heat exchanger between gray bodies, shape factor, electrical analogy, reradiating surfaces heat transfer in presence of reradiating surfaces.

Syllabus (Practical)

1. To Determine Thermal Conductivity of a Good Conductor of Heat (Metal Rod).
2. To Measure the thermal Conductivity of Liquid.
3. To determine the transfer Rate & Temperature Distribution for a Pin Fin.
4. To Measure the Emmissivity of the Test plate Surface.
5. To Determine Stefan Boltzman Constant of Radiation Heat Transfer.
6. To Determine the Surface Heat Transfer Coefficient for Heated Vertical Cylinder in Natural Convection.
7. Determination of Heat Transfer Coefficient in Drop Wise & Film Wise condensation.
8. To Study Performance of Simple Heat Pipes.
9. To Study and Compare LMTD and Effectiveness in Parallel and Counter Flow Heat Exchangers.
10. To Find the Heat transfer Coefficient in Forced Convection in a tube.

Text Book(s)

1. Heat Transfer, Holman J.P., Tata McGraw-Hill, New Delhi.
2. Heat and Mass Transfer, Cengel, Tata McGraw-Hill, New Delhi.
3. Fundamentals of Heat and Mass Transfer- Incropera and Dewitt

Reference Book(s)

1. Heat and Mass Transfer, Kumar D.S., Kataria and Sons.
2. Heat Transfer, Sharma and Lal, Vardhan Publisher Jaipur.
3. Heat and Mass Transfer, Nag P.K., Tata McGraw-Hill, New Delhi.
4. Fundamental of Heat and Mass Transfer, Thirumaleshwar M., Pearson Education.
5. Heat Transfer, Rajput R.K., S. Chand Publication.

Course code	Course Title	Teaching Scheme			
		L	T	P	Credits
MA 402	Numerical and Statistical Methods	3	0	2	4

Evaluation Scheme (Theory)						Evaluation Scheme (Practical)				
Mid Term Test - I	Mid Term Test - II	End Term Test	Class Participation	Additional Continuous Evaluation*	Total Marks	Mid Term Test - I	End Term Test	Class Participation	Additional Continuous Evaluation *	Total Marks**
20	20	40	10	10	100	20	40	15	25	100

*Additional Continuous Evaluation: Quizzes/Assignments/Presentations/Practical Records/Mock Interviews/others

**The ratio of weightage between Theory and Practical content will be 60%: 40%

Syllabus (Theory)

- **Modeling, Computers, and Error Analysis:** Mathematical Modeling and solution using Programming and Software, Computer Arithmetic and Errors: Approximations and Round-Off Errors, Truncation Errors and the Taylor Series
- **Transcendental and polynomial equation:** Solution of non-linear Equations: Bisection Method, *Regula-falsi* Method, Secant Method, Newton Raphson Method
- **Linear Algebraic Equations:** LU Decomposition Method, Gauss Elimination Method, Gauss Jordan Elimination Method, Iterative methods for solving system of linear equations.
- **Interpolation and approximation:** Netwon Formula for forward and backward interpolation, Sterling Central difference interpolation, Lagrangian Interpolation
- **Numerical Differentiation and Integration:** Numerical Differentiation and Integration, Newton-Cotes Integration Formulae.
- **Ordinary Differential Equations:** Picard Method, Euler Method, Modified Euler Method, Runge-Kutta 4^{th} order Method, Milne Predictor-Corrector Method
- **Random Variables and probability distributions:** Introduction to probability, Discrete and continuous random variables, Probability Distributions: Binomial, Possion, Exponential, Normal distributions, Mathematical expectation, Chebyshev's inequality, Discrete and continuous probability distributions
- **Sampling distributions:** Sampling, Types of sampling, sampling errors, sampling distribution of means, variance and proportions for normal population, The Central Limit Theorem, Chi-Square, t and F distributions
- **Estimation:** Estimators, Point and interval estimation, confidence intervals for parameters in one sample and two sample problems of normal populations, confidence intervals for proportions
- **Testing of Hypotheses:** Null and alternative hypotheses, the critical and acceptance regions, two types of error, Parametric Tests, Chi-square goodness of fit test, Contingency tables.
- **Correlation and regression:** Types of Relationships, Scatter Diagrams, Regression Line, Coefficients of Determination and Correlation

Syllabus (Practical)

Numerical Methods using MATLAB and Statistical Analysis using SPSS in Computer Labs that includes:

1. Numerical solution of algebraic and transcendental equations.
2. Numerical solution of system of linear equations.
3. Interpolation.
4. Numerical differentiation.
5. Numerical integration.
6. Numerical solution of differential equations.
7. Data Analysis using Correlation and Regression
8. Test of Hypothesis

Text books and Reference books

1. K. E. Atkinson, *Introduction to Numerical Analysis*, John Wiley and Sons.
2. M.K. Jain, S. R. K. Iyengar, R. K. Jain, *Numerical Methods For Scientific And Engineering Computation*, New age International publishers, New Delhi.
3. Steven C Chapra, Raymond P Canale, *Applied Numerical Methods with MATLAB for Engineers and Scientists*, 3rd Editions, Tata Mc Graw Hill, New Delhi, 2012.
4. Srimanta Pal, *Numerical Methods: Principles, Analyses and Algorithms*, Oxford University Press, New Delhi.
5. Cheney and Kincaid, *Numerical Methods and Applications*, Cengage Publications, New Delhi.
6. Cleve B. Moler, *Numerical Computing with MATLAB*, Prentice Hall of India, New Delhi .
7. Rishard A. Johnson, *Miller and Freund's probability and Statistics for Engineers*, PHI, 8th Ed.
8. Ravichandran J., *Probaility and statistics for Engineers*, Wiley India, New Delhi.
9. Douglas C. Montgomery and George C. Runger, *Applied Statistics and Probability for Engineers*, John Wiley & Sons, Inc., 3rd Edition (2004).
10. Prem S. Mann, *Introductory Statistics*, Wiley publication, 7th edition.

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INSTITUTE OF ENGINEERING AND TECHNOLOGY

4 Year B. Tech Programme

(Branch: Mechanical Engineering)

Batch 2014-18

SEMESTER-FIVE

Detailed Syllabus

&

Scheme of Examination

Course code	Course Title	Teaching Scheme			
		L	T	P	Credits
ME 509	Applied Thermodynamics	3	0	3	4.5

Evaluation Scheme (Theory)						Evaluation Scheme (Practical)				
Mid Term Test - I	Mid Term Test - II	End Term Test	Class Participation	Additional Continuous Evaluation*	Total Marks**	Mid Term Test - I	End Term Test	Class Participation	Additional Continuous Evaluation *	Total Marks**
20	20	40	10	10	100	20	40	15	25	100

*Additional Continuous Evaluation: Quizzes/Assignments/Presentations/Practical Records/Mock Interviews/others

**The ratio of weightage between Theory and Practical content will be 60%: 40%

Syllabus (Theory)

UNIT-I

Vapour power cycle: Review of Carnot and Rankine cycle, Effect of operating conditions on thermal efficiency of Rankine cycle, Principle methods of increasing thermal efficiency, Deviation of actual cycle from theoretical cycle, Efficiencies, Requirement of ideal working fluid, Binary vapour cycle, Regenerative feed heating cycles, Calculation of mass of bled steam, Optimum feed water temperature, temperature distribution in feed heaters, Deaerators, Effect of flow of wet Steam in nozzles and blades, Erosion and corrosion of blades and its prevention, Reheating and regenerative cycles, Practical feed heating systems.

UNIT-II

Flow through nozzles and diffusers: Classification of nozzles and diffusers. Steady flow energy equation through nozzles, momentum equation. Nozzle and diffuser efficiencies, mass flow rate through nozzle under isentropic flow condition, critical in nozzle flow, physical explanation of critical pressure for a given initial velocity under isentropic and actual flow conditions, general relationship, between area, velocity and pressure in nozzles and diffuser, design of nozzles and diffusers, supersaturated flow through nozzles, effect of variation of back pressure in nozzle.

UNIT-III

Steam turbines: Principles of working of steam turbines, classification comparison, and velocity diagram for impulse and reaction turbines. Velocity and pressure compounding, degree of reaction for reaction turbine, Power output, axial thrust diagram efficiency; energy lost by impulse and reaction turbines. Optimum value of blade-speed ration in impulse and reaction turbines, losses in steam turbines, state point locus and reheat factor, need of governing, throttle governing, nozzle governing and by pass governing speeder and anticipatory gear, governing of reheat turbines, direct digital control, governing characteristics, steam turbine auxiliary systems.

UNIT-IV

Boilers: Purpose, Classification of boilers, Fire tube and water tube boilers, Mountings and accessories, description of Lancashire, Locomotive, Babcock Wilcox boilers, boiler performance, draught, design of natural draught chimney, artificial draught, mechanical draught, efficiency of boiler and heat balance, safety devices, natural, forced, induced and balanced drafts.

UNIT-V

Condensers and Cooling Towers: Function of condenser, condensing system, surface and jet condensers, mass of circulating water, condenser and vacuum efficiency, Cooling tower: construction details and analysis.

One Dimensional Gas Dynamics: Speed of sound, adiabatic and isentropic steady flows, Mach number, Mach angle, Area velocity relationship, normal shock wave, flow through converging diverging nozzle. Jet propulsion, turbo jet, rams jet, turbo- prop.

Syllabus (Practical)

1. To study low pressure boilers and their accessories and mountings.
2. To study high pressure boilers and their accessories and mountings.
3. To prepare heat balance sheet for given boiler.
4. To study the working of impulse and reaction steam turbines.
5. To find dryness fraction of steam by separating and throttling calorimeter.
6. To find power output & efficiency of a steam turbine.
7. To find the condenser efficiencies.
8. To study and find volumetric efficiency of a reciprocating air compressor.
9. To study cooling tower and find its efficiency.
10. To find calorific value of a sample of fuel using Bomb calorimeter.
11. Calibration of Thermometers and pressure gauges.

Text Book(s)

1. Theory of Steam Turbine by W.J.Kearton
2. Thermodynamics and Heat Engines Vol II – R. Yadav, Central Publishing House
3. Heat Engineering – V.P.Vasandani and D.S.Kumar, Metropolitan Book Co. Pvt. Ltd.
4. I.C.Engines - M.L.Mathur and Sharma Dhanpat Rai & Sons

5. Thermal Engineering - P.L.Balaney Khanna Publisher

Reference Book(s)

1. Steam & Gas turbines and Power Plant Engineering, 7TH ed., 2004, Central Publishing House Allahabad.
2. Turbines, Compressors and Fans by S.M.Yahya
3. Power Plant Technology by M.M. El-wakil, McGraw Hill, Internal Edition.
4. Power Plant Enginering by Domkundwar and Arora, Dhanpat Rai and Sons.
5. Power Plant system Design by K.W. Li and B. P. Priddy, John Wiley, 1985

Course code	Course Title	Teaching Scheme			
		L	T	P	Credits
ME 504	Design of Machine Elements -I	3	1	2	5

Evaluation Scheme (Theory)						Evaluation Scheme (Practical)				
Mid Term Test - I	Mid Term Test - II	End Term Test	Class Participation	Additional Continuous Evaluation*	Total Marks**	Mid Term Test - I	End Term Test	Class Participation	Additional Continuous Evaluation *	Total Marks**
20	20	40	10	10	100	20	40	15	25	100

*Additional Continuous Evaluation: Quizzes/Assignments/Presentations/Practical Records/Mock Interviews/others
**The ratio of weightage between Theory and Practical content will be 60%: 40%

Syllabus (Theory)

- **Design Philosophy:** Problem identification- problem statement, specifications, constraints, Feasibility study technical feasibility, economic & financial feasibility, societal & environmental feasibility, Generation of solution field (solution variants), Brain storming, Preliminary design, Selection of best possible solution, Detailed design, Selection of Fits and tolerances and analysis of dimensional chains.
- **Selection of Materials:** Classification of Engg. Materials, Mechanical properties of the commonly used engg. Materials, hardness, strength parameters with reference to stress-strain diagram, Factor of safety.
- **Mechanical Joints:** ISO Metric Screw Threads, Bolted joints in tension, Eccentrically loaded bolted joints in shear and under combined stresses, Design of power screws, Design of various types of welding joints under different static load conditions.
- **Riveted Joints, Cotter & Knuckle Joints:** Design of various types of riveted joints under different static loading conditions, eccentrically loaded riveted joints, design of cotter and knuckle joints.
- **Belt rope and chain drives:** Design of belt drives, Flat & V-belt drives, Condition for Transmission of max. Power, Selection of belt, design of rope drives, design of chain drives with sprockets.
- **Keys, Couplings & Flywheel:** Design of Keys – Flat, Kennedy Keys, Splines, Couplings design – Rigid & Flexible coupling, turning Moment diagram, coefficient of fluctuation of energy and speed, design of flywheel – solid disk & rimmed flywheels.
- **Clutches:** Various types of clutches in use, Design of friction clutches – Disc. Multidisc, Cone & Centrifugal, Torque transmitting capacity.
- **Brakes:** Various types of Brakes, Self-energizing condition of brakes, Design of shoe brakes – Internal & external expanding, band brakes, Thermal Considerations in brake designing.

Syllabus (Practical)

1. Selection of material & IS coding
2. Selecting fit & assigning tolerances
3. Examples of Production considerations.

Problems on

1. Knuckle & Cotter joints
2. Torque : Keyed joints & shaft couplings
3. Design of screw fastening
4. Bending : Beams, Levers etc.
5. Combined stresses : Shafts, brackets, eccentric loading.
6. Design for rigidity (Transverse / Torsional)

Text Book(s)

1. Mechanical Engg. Design- Joseph Edward Shigley-Mc Graw Hill Book Co.
2. Design of Machine Elements – V.B. Bhandari – Tata McGraw Hill, New Delhi
3. PSG Design Data Book - PSG College of Engg - PSG Publication

Reference Book(s)

1. Engineering design – George Dieter, McGraw Hill, New York.
2. Product Design and Manufacturing –: A.K.Chitale and R.C.Gupta, PHI, New Delhi.
3. Machine Design An Integrated Approach: Robert L.Norton,Second Edition –Addison Wisley Longman
4. Machine Design: S.G. Kulkarni , TMH , New Delhi.

Course code	Course Title	Teaching Scheme			
		L	T	P	Credits
ME 505	Production planning and Control	3	0	0	3

Evaluation Scheme (Theory)						Evaluation Scheme (Practical)				
Mid Term Test - I	Mid Term Test - II	End Term Test	Class Participation	Additional Continuous Evaluation*	Total Marks	Mid Term Test - I	End Term Test	Class Participation	Additional Continuous Evaluation *	Total Marks
20	20	40	10	10	100	-	-	-	-	-

*Additional Continuous Evaluation: Quizzes/Assignments/Presentations/Practical Records/Mock Interviews/others

Course Syllabi (Theory):

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

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

UNIT V

INVENTORY CONTROL AND RECENT TRENDS IN PPC: Inventory control-Purpose of holding stock-Effect of demand on inventories-Ordering procedures. Two bin system -Ordering cycle system-Determination

of Economic order quantity and economic lot size-ABC analysis-Recorder procedure-Introduction to computer integrated production planning systems-elements of JUST IN TIME SYSTEMS-Fundamentals of MRP II and ERP.

Text Books:

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

Reference Books:

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

Course code	Course Title	Teaching Scheme			
		L	T	P	Credits
ME 506	Industrial Engineering and Operation Research	3	1	0	4

Evaluation Scheme (Theory)						Evaluation Scheme (Practical)				
Mid Term Test - I	Mid Term Test - II	End Term Test	Class Participation	Additional Continuous Evaluation*	Total Marks	Mid Term Test - I	End Term Test	Class Participation	Additional Continuous Evaluation *	Total Marks
20	20	40	10	10	100	-	-	-	-	-

*Additional Continuous Evaluation: Quizzes/Assignments/Presentations/Practical Records/Mock Interviews/others

Course Syllabi (Theory):

UNIT I

Introduction: Definition and scope of industrial engineering, Role of an industrial engineering
Plant Layout and Material handling: Necessity, plant Location Analysis, site selection process, cost economics, Plant Layout, classification of production, types of layout, design & development of a process layout, development a layout, Group Technology. Material handling: principles of material handling and material handling equipment.

UNIT II

Method Study and Work Simplification: basic concepts, productivity, Method Study: Objectives and procedure for methods analysis: Select, Record, Examine, Develop, Define, Install and Maintain. Recording techniques,
Principles of Motion Economy: introduction, Micro motion and macro-motion study: Principles of motion economy, Normal work areas and work place design.

UNIT III

Work Measurement: Objectives, Work measurement techniques - time study, work sampling, pre-determined motion time standards (PMTS) Determination of time standards. Observed time, basic time, normal time, rating factors, allowances and standard time.
Job Evaluation: introduction, job rating, merit rating, financial benefits.
Value Engineering: introduction, concept of value engineering, phases/functions of value engineering studies, application of value engineering.

UNIT IV

Project management through PERT/CPM: introduction, work breakdown structure, network construction. Problem solution.

UNIT V

Linear Programming: Introduction & Scope, Problem formulation, Simplex methods, primal & dual problem dual Simplex, sensitivity analysis

Text Books:

1. Production and Operations Management by N G Nair, Tata McGraw Hill, New Delhi
2. Modern Production and Operation Management, E. S. Buffa, Willey.

Reference Books:

1. Industrial Engineering by M. I. Khan, New Age International.

Course code	Course Title	Teaching Scheme			
		L	T	P	Credits
ME 507	Dynamics of machines	3	0	3	4.5

Evaluation Scheme (Theory)						Evaluation Scheme (Practical)				
Mid Term Test - I	Mid Term Test - II	End Term Test	Class Participation	Additional Continuous Evaluation*	Total Marks**	Mid Term Test - I	End Term Test	Class Participation	Additional Continuous Evaluation *	Total Marks**
20	20	40	10	10	100	20	40	15	25	100

*Additional Continuous Evaluation: Quizzes/Assignments/Presentations/Practical Records/Mock Interviews/others

**The ratio of weightage between Theory and Practical content will be 60%: 40%

Course Syllabi (Theory):

- Types of cams and followers, various motions of the follower, Construction of cam profiles, Analysis for velocities and accelerations of tangent and circular arc cams with roller and flat –faced followers.
- Open and crossed belt drives, velocity ratio, slip, material for belts, crowning of pulleys, law of belting, types of pulleys, length of belts, ratio of tensions, centrifugal tension, power transmitted by belts and ropes, initial tension, creep, chain drive, chain length, classification of chains.
- Gyroscope, Gyroscopic couple and its effect on craft, naval ships during steering, pinching and rolling, Stability of an automobile (2-wheeers), Introduction, open and closed loop control, terms related to automatic control, error detector, actuator, amplification, transducers, lag in responses, damping, block diagrams, system with viscous damped output, transfer functions, relationship between open –loop and closed loop transfer function.
- Types of gears, terminology, condition for correct gearing, cyclical and involutes profiles of gear teeth, pressure angle, path of contact, arc of contact, Interference, undercutting, minimum number of teeth, number of pairs of teeth in contact, helical, spiral, worm and worm gear, bevel gear. Gear trains; simple, compound, reverted, and epicyclical, Solution of gear trains, sun and planet gear, bevel epicyclical gear, compound epicyclical gear, preselective gear box, differential of automobile, torque in gear taints.
- Types of brakes, friction brakes, external shoe brakes, band brakes, band and block brakes, internal expanding shoe brake, dynamometers; absorption, and tensional. Types of governors; watt, Porter, Proell, spring loaded centrifugal, Inertia,, Sensitiveness, Stability, Isochronism's, Hunting, Effort and power of governor, controlling force, Static and dynamic balancing of rotating parts, balancing of I. C. Engines, balancing of multi-cylinder engine; V-engines and radial engines, balancing of machines.

Course Syllabi (Practial):

1. Governor apparatus
2. Gyroscope apparatus
3. Static and dynamic balancing machine
4. Balancing of reciprocating masses
5. Journal bearing apparatus
6. Universal vibration apparatus
7. Whirling of shaft apparatus
8. Various commonly used mechanisms and its inversions in machines
9. Standard rotor kit with crank shaft simulator
10. Lower and higher pairs
11. CAM and Follower

Text Book:

7. Theory of machines: S. S. Rattan, Tata McGraw Hill Publications.
8. Theory of Mechanism and Machines: Jagdish Lal, Metropolitan Book Co.
9. Theory of Machines: P.L.Ballaney, Khanna Publisher.
10. Theory of Machines: Thomas Bevan.
11. Theory of Machines and Mechanisms: Shigley.
12. Theory of Machines and Mechanisms: Ghosh and Mullick.

Reference Books:

4. Mechanism synthesis and analysis: A.H. Soni, McGraw Hill Publications.
5. Mechanism: J.S. Beggs.
6. Mechanics of Machines: P.Black, Pergamon Press.

Course code	Course Title	Teaching Scheme			
		L	T	P	Credits
ME 508	Machining, Machine Tools and Metrology	3	0	2	4

Evaluation Scheme (Theory)						Evaluation Scheme (Practical)				
Mid Term Test - I	Mid Term Test - II	End Term Test	Class Participation	Additional Continuous Evaluation*	Total Marks	Mid Term Test - I	End Term Test	Class Participation	Additional Continuous Evaluation *	Total Marks
20	20	40	10	10	100	20	40	15	25	100

*Additional Continuous Evaluation: Quizzes/Assignments/Presentations/Practical Records/Mock Interviews/others

**The ratio of weightage between Theory and Practical content will be 60%: 40%

Course Syllabi (Theory):

- **Design of Cutting Tools:** Geometry & design of single point tool, geometry & design of milling cutters, geometry of drills, broachers, Essential steps in design of machine tools, design of machine tool drives, tool structures, slide ways, Guide-ways and automatic lubrications etc.
- **Design of Jigs & Fixtures:** Definition and importance of jigs and fixtures in production, principles of location and clamping, essential requirements of jigs/fixtures, types of jigs and fixtures, drill jigs, jig bushes and their materials, milling, grinding & broaching fixtures.
- **Design of Press Tool:** Design of Press Tool with full details.
- **Metal Cutting & Tool Life:** Basic tool geometry, single point tool nomenclature, chips-various types and their characteristics, mechanism of chip formation, orthogonal and oblique metal cutting, metal cutting theories, relationship of velocities, forces and power consumption. Tailor equation of tool life, tool material and mechanism. Economics of Metal Machining: elements of machining cost, tooling economics, machining, economics and optimization, geometry of twist, drills and power calculation in drills.
- **Multi edged tools:** Broach tools –types, materials and applications, geometry of twist drills, thrust torque and power calculation in drills, form tools-application.
- **Machine tools:** Introduction, constructional features, specialization, operations and devices of basic machine tools such as lathe, shaper, planner, drilling machining, and milling machine, indexing in milling operation, working principles of capstan and turret lathes.
- **Metrology:** Measurement, linear and angular simple measuring instruments, various clampers, screw gauge, sine bar, auto-collimator, comparator- mechanical, electrical, optical, surface finish and its measurements, micro and macro deviation, factors influencing surface finish and evaluation of surface finish.

Syllabus (Practical)

1. Study of single point cutting tool geometry & grind the tool as per given tool geometry.
2. Study the milling machine, milling cutters, indexing heads and indexing methods.
3. Prepare a gear on milling machine.
4. Prepare a hexagonal / octagonal nut using indexing head on milling m/c and to cut BSW/METRIC internal threads on lathe.
5. To cut multi-start square / metric threads.
6. To cut external metric threads & to meet it with the nut
7. To prepare the job by eccentric turning on lathe machine.
8. To prepare a job on shaper from given MS rod.
9. Study of capstan lathe and its tooling and prepare a tool layout & job as per given drawing.
10. To prepare a job on surface grinder/cylindrical grinder and measure the various parameters of the finished piece.
11. Leveling of machine tools and testing their accuracy.
12. Disassembly and assembly of small assemblies such as tail stock, bench vice, screw jack etc.
13. Multi slot cutting on milling machine by indexing.
14. Drilling and boring of a bush

Text Books:

1. Manufacturing Technology: Foundry, Forming and Welding by P.N.Rao, TMH.
2. Principles of Manufacturing Materials and Processes, James S.Campbell, TMH.
3. Welding Metallurgy by G.E.Linnert, AWS.

Reference Books:

1. Manufacturing analysis, Cook, Adisson-Wesley
2. Metal cutting principles, Shaw, MIT Press Cambridge
3. Principles of metal cutting, Sen and Bhattacharya, New Central Book.
4. Manufacturing Engineering Technology, R. K. Jain, Pearson Education
5. Production Engineering Sciences by P.C.Pandey and C.K.Singh, Standard Publishers Ltd.
6. Manufacturing Science by A.Ghosh and A.K.Mallick, Wiley Eastern
7. Fundamentals of Tool Design – ASTME
8. Tool Design-Donaldson

Course code	Course Title	Teaching Scheme			
		L	T	P	Credits
PS501	Practice School – I				4

Evaluation Scheme

S. No.	Evaluation Component	Marks (100) (Weightage %)
1	Quiz-I	4
2	Quiz-II	4
3	Group Discussion-I	4
4	Group Discussion-II	4
5	Seminar-I	4
6	Seminar-II	4
7	Diary-I	4
8	Diary-II	4
9	Observation-I	4
10	Observation- II	4
11	Mid Term Evaluation (Project Report and Presentation/Viva)	20
12	Final Evaluation (Project Report and Presentation/Viva)	40

Course Syllabi:

This course is for 6 weeks at the end of 4th semester during summer term of 4 year full time B. Tech. and 5 year Integrated Dual degree (B.Tech + M.Tech, B.Tech + MBA) programs in all the engineering disciplines. The objective of this programme is to provide the students an understanding of working of corporate world in various functions associated with an Industry/Organization. During this programme, they will observe and learn various real world applications of their curricula and develop an understanding of vast engineering operations and its various facets such as inventory, productivity, management, information systems, human resource development, data analysis etc. The general nature of PS-1 assignments is of study and orientation.

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INSTITUTE OF ENGINEERING AND TECHNOLOGY

4 Year B. Tech Programme

(Branch: Mechanical Engineering)

Batch 2014-18

SEMESTER-SIX

Detailed Syllabus

&

Scheme of Examination

Course code	Course Title	Teaching Scheme			
		L	T	P	Credits
ME 602	Refrigeration & Air-conditioning	3	0	2	4

Evaluation Scheme (Theory)						Evaluation Scheme (Practical)				
Mid Term Test - I	Mid Term Test - II	End Term Test	Class Participation	Additional Continuous Evaluation*	Total Marks	Mid Term Test - I	End Term Test	Class Participation	Additional Continuous Evaluation *	Total Marks
20	20	40	10	10	100	20	40	15	25	100

*Additional Continuous Evaluation: Quizzes/Assignments/Presentations/Practical Records/Mock Interviews/others
**The ratio of weightage between Theory and Practical content will be 60%: 40%

Syllabus (Theory)

Introduction: Definition of refrigeration & air conditioning; Necessity; Methods of refrigeration; Unit of refrigeration; Coefficient of performance (COP), Fundamentals of air-conditioning system; Refrigerants-Definition, Classification, Nomenclature, Desirable properties, Comparative study, secondary refrigerants, Introduction to eco-friendly Refrigerants; Introduction to Cryogenics.

Air Refrigeration System: Carnot refrigeration cycle. Temperature Limitations; Brayton refrigeration or the Bell Coleman air refrigeration cycle; Necessity of cooling the aero plane; Air craft refrigeration systems, Simple cooling and Simple evaporative types, Boot strap and Boot strap evaporative types, Regenerative type and Reduced Ambient type system, Comparison of different systems, problems.

Vapour Compression (VC) Refrigeration Systems: (A) Simple Vapour Compression (VC) Refrigeration systems-Limitations of Reversed Carnot cycle with vapour as the refrigerant; Analysis of VC cycle considering degrees of sub cooling and superheating; VC cycle on p-v, t-s and p-h diagrams; Effects of operating conditions on COP; Comparison of VC cycle with Air Refrigeration cycle.

Multistage Ref. Systems- Necessity of compound compression, Compound VC cycle , Inter-cooling with liquid sub –cooling and / or water inter cooler: Multistage compression with flash inter-cooling and / or water inter-cooling; systems with individual or multiple expansion valves; Individual compression system with individual or multiple expansion valves; Individual compression systems with individual or multiple expansion valves but with and without intercoolers.

Other Refrigeration Systems: (A) Vapour Absorption Refrigeration Systems – Basic Systems, Actual COP of the System, Performance, Relative merits and demerits; Properties of aqua ammonia; Electrolux Refrigeration; Problems. Steam Jet Refrigerating System- Introduction, Analysis, Relative merits and demerits, Performance Applications, Problems.

Psychrometry of Air & Air Conditioning Processes: Properties of moist Air-Gibbs Dalton law, Specific humidity, Dew point temperature, Degree of saturation, Relative humidity, Enthalpy, Humid specific heat, Wet bulb temp., Thermodynamics wet bulb temp., Psychrometric chart; Psychrometry of air-

conditioning processes, Mixing Process, Basic processes in conditioning of air; Psychrometric processes in air washer, Problems.

Air- Conditioning Load Calculations: Outside and inside design conditions; Sources of heating load; Sources of cooling load; Heat transfer through structure, Solar radiation, Electrical applications, Infiltration and ventilation, Heat generation inside conditioned space; Apparatus selection; Comfort chart, Problems.

Air Conditioning Systems with Controls & Accessories: Classifications, Layout of plants; Equipment selection; Air distribution system; Duct systems Design; Filters; Refrigerant piping; Design of summer air-conditioning and Winter air conditioning systems; Temperature sensors, Pressure sensors, Humidity sensors, Actuators, Safety controls; Accessories; Problems.

Refrigeration and Air Conditioning Equipments: Type of compressors and their performance curves; Types of Condensers, Heat transfer in condensers; Types of expansion devices; types of evaporators, Cooling and Dehumidifying coils, Problems.

Syllabus (Practical)

1. To study the vapour compression Refrigeration System and determine its C.O.P. and draw P-H and T-S diagrams.
2. To Study the Mechanical heat pump and find its C.O.P.
3. To study the Air and Water heat pump and find its C.O.P.
4. To study the cut- sectional models of Reciprocating and Rotary Refrigerant compressor.
5. To study the various controls used in Refrigerating & Air Conditioning systems.
6. To study the Ice- plant, its working cycle and determine its C.O.P and capacity.
7. To study the humidification, heating, cooling and dehumidification processes and plot them on Psychrometric charts.
8. To determine the By-pass factor of Heating & Cooling coils and plot them on Psychrometric charts on different inlet conditions.
9. To determine sensible heat factor of Air on re-circulated air-conditioning set up.
10. To study the chilling plant and its working cycle

Text Book(s)

1. Refrigeration & Air conditioning –R.C. Jordan and G.B. Priester, Prentice Hall of India.
2. Refrigeration & Air conditioning –C.P. Arora, TMH, New Delhi

Reference Book(s)

1. Refrigeration & Air conditioning –W.F. Stocker and J.W. Jones, TMH, New Delhi.
2. Refrigeration & Air conditioning- Manohar Prasad Wiley Estern limited, New Delhi.

Course code	Course Title	Teaching Scheme			
		L	T	P	Credits
ME 604	Design of machine elements-II	3	1	2	5

Evaluation Scheme (Theory)						Evaluation Scheme (Practical)				
Mid Term Test - I	Mid Term Test - II	End Term Test	Class Participation	Additional Continuous Evaluation*	Total Marks	Mid Term Test - I	End Term Test	Class Participation	Additional Continuous Evaluation*	Total Marks
20	20	40	10	10	100	20	40	15	25	100

*Additional Continuous Evaluation: Quizzes/Assignments/Presentations/Practical Records/Mock Interviews/others

**The ratio of weightage between Theory and Practical content will be 60%: 40%

Syllabus (Theory)

- **Design for Production;** Erogonomic and value engineering considerations in design, Role of processing in design, Design considerations for casting, forging and machining.
- **Variable Loading:** Different types of fluctuating/ variable stresses, Fatigue strength considering stress concentration factor, surface factor, size factor, reliability factor etc., Fatigue design for finite and infinite life against combined variable stresses using Goodman and Soderberg's Criterion, Fatigue design using Miner's equation, Problems.
- **Shafts**: Detailed design of shafts for static and dynamic loading, Rigidity and deflection consideration.
- **Springs:** Types of springs, Design for helical springs against tension and their uses, compression and fluctuating loads, Design of leaf springs, Surging phenomenon in springs, Design Problem. Design of Cylinder, Design of Piston, Design of Crank shaft, Design of connecting rod, Design of Crane Hook, Design of Flywheels
- **Bearings:** design of pivot and collar bearing , Selection of ball and roller bearing based on static and dynamic load carrying capacity using load-life relationship, Selection of Bearings from manufacturer's catalogue, types of Lubrication – Boundary, mixed and hydrodynamic lubrication, Design of journal bearings using Raimondi and Boyd's Charts, Lubricants and their properties, Selection of suitable lubricants, Design Problems.
- **Gears:** Classification, Selection of gears, Terminology of gears, Force analysis, Selection of material for gears, Beam & wear strength of gear tooth, Form or Lewis factor for gear tooth,
- **Dynamic load on gear teeth** –Barth equation and Buckingham equation and their comparison, Design of spur, helical, bevel & worm gear including the Consideration for maximum power transmitting capacity, Gear Lubrication, Design Problems.

Course Syllabi (Practical):

1. Fatigue loading
2. Helical compression, tension and torsional springs design
3. Curved Beams
4. Preloaded bolts and bolts subjected to variable stresses
5. Belt, Rope and Chain drive system
6. Gear Design
7. Sliding contact bearing design
8. Anti-friction bearing selection

Text Book(s)

1. Mechanical Engg. Design- Joseph Edward Shigley-Mc Graw Hill Book Co.
2. Design of Machine Elements – V.B. Bhandari – Tata McGraw Hill, New Delhi
3. PSG Design Data Book - PSG College of Engg - PSG Publication

Reference Book(s)

1. Engineering design – George Dieter, McGraw Hill, New York.
2. Product Design and Manufacturing –: A.K.Chitale and R.C.Gupta, PHI, New Delhi.
3. Machine Design An Integrated Approach: Robert L.Norton,Second Edition –Addison Wisley Longman
4. Machine Design: S.G. Kulkarni , TMH , New Delhi.

Course code	Course Title	Teaching Scheme			
		L	T	P	Credits
ME 605	Mechanical Vibrations and Control	3	0	2	4

Evaluation Scheme (Theory)						Evaluation Scheme (Practical)				
Mid Term Test - I	Mid Term Test - II	End Term Test	Class Participation	Additional Continuous Evaluation*	Total Marks**	Mid Term Test - I	End Term Test	Class Participation	Additional Continuous Evaluation *	Total Marks**
20	20	40	10	10	100	20	40	15	25	100

*Additional Continuous Evaluation: Quizzes/Assignments/Presentations/Practical Records/Mock Interviews/others
**The ratio of weightage between Theory and Practical content will be 60%: 40%

Syllabus (Theory)

UNIT I

Fundamentals: Importance of Study of Vibrations, Classifications of Vibrations, Free and Forced, Undamped and Damped, Linear and Non-linear, Deterministic and Random, Harmonic Motion, Vector and Complex Number Representations, Definitions and Terminology, Periodic Functions, Harmonic Analysis, Fourier Series Expansion.

UNIT II

Free and Damped Vibrations: Single Degree of Freedom system, D'Alemberts Principal, Energy Methods, Rayleighs Method, Application of these Methods, Damped Free Vibrations, Logarithmic Decrement, Under Damping, Critical and Over Damping, Coulomb Damping.

UNIT III

Harmonically Excited Vibrations: Forced Damped Harmonic Vibration of Single Degree of Freedom Systems, Rotating Unbalance, Rotor Unbalance, Critical Speeds and Whirling of Rotating Shafts, Support Motion, Vibration Isolation, Energy Dissipated by Damping, Equivalent, Viscous Camping, Structural Damping Sharpness of Resonance, Vibration Measuring Instruments.

Transient Vibrations: Impulse Excitation, Arbitrary Excitation, Response to Step Excitions, Base Excitation Solution by Laplace Transforms, Response Spectrum, Runge-Kutta Method.

UNIT IV

Two Degrees of Freedom Systems: Introduction to Multi-Degree of Freedom Systems, Normal Mode Vibrations, Coordinate Coupling, Principal Coordinates, Free Vibrations in Terms of Initial Conditions, Forced Harmonic Vibrations, Vibration Absorber, Centrifugal Vibration Absorber, Vibration Damper.

Multi degrees of Freedom Systems and Numerical Methods: Introduction, Influence Coefficients, Stiffness Matrix, Flexibility Matrix, Natural Frequencies and Normal Modes, Orthogonality of Normal

Modes, Dunkerley's Equation, Method of Matrix Iteration, The Holzer Type Problem, Geared and Branched Systems, Beams.

UNIT V

Measurements Techniques and condition monitoring: Vibration Monitoring, Vibration parameters, Vibration Instrumentation for its Measurement. Introduction to condition monitoring of machinery, Condition monitoring technique.

Normal Mode Vibration of Continuous System: Vibrating String, Longitudinal Vibrations of Rod, Torsional Vibrations of Rod, Lateral Vibrations of Beam.

Syllabus (Practical)

1. To study undamped free vibrations of equivalent spring mass system and determine the natural frequency of vibrations.
2. To study the free vibration of system for different damper settings. Draw decay curve and determine the log decrement and damping factor. Find also the natural frequency.
3. To study the torsional vibration of a single rotor shaft system and to determine the natural frequency.
4. To determine the radius of gyration of given bar using bifilar suspension.
5. To verify the dunker ley's rule.
6. To study the forced vibration of system with damping. Load magnification factor vs. Frequency and phase angle vs frequency curves. Also determine the damping factor.
7. To study the pressure distribution of a journal bearing using a journal bearing apparatus.
8. To determine the rate of wear of a metallic pin from the plot of displacement vs time curves by using friction and wear monitor apparatus.
9. To determine abrasion index of a material with the help of dry abrasion test rig.
10. To evaluate the load wear index and the weld point of a lubricant with the help of a four ball stream pressure tester.
11. To determine the two frequencies of torsional spring type double pendulum & compare them with theoretical values.
12. To determine the radius of gyration of a compound pendulum.
13. To determine the radius of gyration of disc using trifilar suspension.

Text Book(s)

1. Theory of Vibrations with Applications W.T. Thomson, Prentice Hall of India
2. Mechanical Vibration : G.K. Grover and S.P. Nigam, Nem Chand and Sons
3. Introduction Course on Theory and Practice of Mechanical Vibration by J.G. Rao & Gupta, New Age International Publishers, New Delhi.

Reference Book(s)

1. Introductory course to mechanical vibrations – By Rao and Gupta; Wiley Eastern
2. Mechanical vibration - By G.K. Grover; Nemchand Chand and Sons
3. Mechanical Vibration – By Thomson; Prentice Hall
4. Mechanical Vibration - By Den Hartog; Mc Graw Hill

Course code	Course Title	Teaching Scheme			
		L	T	P	Credits
ME 606	Solar Energy Technology	3	0	2	4

Evaluation Scheme (Theory)						Evaluation Scheme (Practical)				
Mid Term Test - I	Mid Term Test - II	End Term Test	Class Participation	Additional Continuous Evaluation*	Total Marks**	Mid Term Test - I	End Term Test	Class Participation	Additional Continuous Evaluation *	Total Marks**
20	20	40	10	10	100	20	40	15	25	100

*Additional Continuous Evaluation: Quizzes/Assignments/Presentations/Practical Records/Mock Interviews/others

**The ratio of weightage between Theory and Practical content will be 60%: 40%

Syllabus (Theory)

Introduction: Man and Energy, world production and reserve of conventional energy sources, Indian production and reserves, Energy alternatives (Renewable). Form and characteristics of renewable energy sources.

Solar radiation: Solar radiation, its measurement and prediction. Origin, nature and availability of solar radiation, estimation of solar radiation date. Effects of receiving surface location and orientation.

Solar energy collectors: Characteristics of materials and surfaces used in solar energy absorption. Devices for thermal collection and storage.

Flat plate collectors: liquid and air type. Design consideration and performance of different types of solar thermal collectors. Basic theory of flat plate collectors, concentrating collectors, advanced collectors, optical design of concentrators, selective coatings,

Solar energy storage: Energy storage devices such as water storage systems, packed Bed storage systems, phase change storage systems. Active and passive solar heating of buildings, solar still, solar water heaters, solar driers;

Thermal storage: conversion of heat energy into mechanical energy, solar thermal power generation systems.

Application: systems for space heating, solar water pumps, solar pond, Solar Thermal Power plants, solar distillation, Solar Refrigeration and solar air conditioning. Solar PV systems.

Syllabus (Practical)

1. Monitoring Insolation data and validation
2. Influence of Albedo on the overall efficiency and performance
3. Effect of module cleaning process on the plant performance
4. Technology options and choices for Receivers
5. Viability Analysis of CSP in the current context

6. Economically viable stand-alone system based on LCPV and Solar Water Heating Technology
7. Based on real time PV cell/ module or system level performance and sustainability studies.
8. Performance studies of 1 MW PV power generation plant.
9. Issues on thermal energy storage
10. R & D on collectors

Text Book(s) & Reference Book(s)

1. Power Generation through Renewable Source of Energy, Rai and Ram Prasad, Tata McGraw-Hill, New Delhi.
2. Renewable Energy Sources and Conversion Technology, Bansal, Kleemann and Meliss, Tata McGraw Hill, New Delhi.
3. Kothari D.P., Renewable energy resources and emerging technologies, Prentice Hall of India Pvt. Ltd.
4. Solar Energy: Fundamental and Applications, H. P. Garg J Prakash, Tata McGraw-Hill.
5. Solar Energy: Principles of Thermal Collection and Storage, S P Sukhatme, Tata McGraw-Hill.

Course code	Course Title	Teaching Scheme			
		L	T	P	Credits
ME 624 (Elective-I)	Automobile Engineering	3	0	2	4

Evaluation Scheme (Theory)						Evaluation Scheme (Practical)				
Mid Term Test - I	Mid Term Test - II	End Term Test	Class Participation	Additional Continuous Evaluation*	Total Marks**	Mid Term Test - I	End Term Test	Class Participation	Additional Continuous Evaluation *	Total Marks**
20	20	40	10	10	100	20	40	15	25	100

*Additional Continuous Evaluation: Quizzes/Assignments/Presentations/Practical Records/Mock Interviews/others
**The ratio of weightage between Theory and Practical content will be 60%: 40%

Syllabus (Theory)

- Frame and Body: Layout of chassis, types of chassis frames and bodies, their constructional features and materials.
- Transmission System: Clutch, single plate, multi plate, cone clutch, semi centrifugal, electromagnetic, vacuum and hydraulic clutches, Fluid coupling.
- Gear Boxes: Sliding mesh, constant mesh, synchromesh and epicyclic gear boxes, automatic transmission system, Hydraulic torque converter, overdrive, propeller shaft, universal joints, front wheel drive, differential, Rear axle drives, hotchkiss and torque tube drives; rear axle types, Two wheel and four wheel drive.
- Running Gear: Types or wheels and tyres, Tyre construction, tyre inflation pressure, tyre wear and their causes, re-treading of the tyre, steering system, steering gear boxes, steering linkages, steering mechanism, under and over steering, steering geometry, effect of camber, caster, king pin inclination, toe in and toe out, power steering, integral and linkage types suspension system, objects and requirements, suspension spring, front and rear suspension systems, Independent suspension system shock absorber.
- Brakes: Classification and function, mechanical, hydraulic, vacuum air and self-engineering brakes, brake shoes and lining materials.
- Automotive Electrical System: Battery construction, charging and testing, battery types, starting and battery charging system, starter motor construction, types of drive, alternator construction, regulation and rectification.
- Ignition System: Magneto and coil ignition systems, system components and requirements.
- Automotive Lighting: Wiring systems, electrical instruments, head lamp, electric horn, fuel level indicator.
- Automotive Air Conditioning: Introduction, loads, air conditioning system components, refrigerants, fault diagnosis.

- Automotive Safety: Safety requirements, Safety Devices, Air bags, belts, radio ranging, NVS (Night Vision System) GPS (Global Positioning System) etc

Syllabus (Practical)

11. Valve refacing and valve seat grinding and checking for leakage of valves.
12. Trouble shooting in cooling system of an automotive vehicle.
13. Trouble shooting in the ignition system, setting of contact breaker points and spark plug gap.
14. Demonstration of steering system and measurement of steering geometry angles and their impact on vehicle performance.
15. Trouble shooting in braking system with specific reference to master cylinder, brake shoes, overhauling of system and the adjusting of the system and its testing.
16. Fault diagnosis in transmission system including clutches, gear box assembly and differential.
17. Replacing of ring and studying the method of replacing piston after repair.

Text Book(s)

1. Automobile Engineering, Sharma R.P., Dhanpat Rai & Sons.
2. Automobile Engineering, Gupta R.B., Satya Prakashan.

Reference Book(s)

1. Vehicle and Engine Technology, Heniz Heisler, Elsvier Publication.
2. Automobile Engineering (Vol. 1 & 2), Kohli P.L., Tata McGraw Hill.
3. Automatic Transmission, Brejcha M.F., Prentice Hall India.

Course code	Course Title	Teaching Scheme			
		L	T	P	Credits
ME 625 (Elective-I)	Computational Fluid Dynamics	3	0	2	4

Evaluation Scheme (Theory)						Evaluation Scheme (Practical)				
Mid Term Test - I	Mid Term Test - II	End Term Test	Class Participation	Additional Continuous Evaluation*	Total Marks**	Mid Term Test - I	End Term Test	Class Participation	Additional Continuous Evaluation *	Total Marks**
20	20	40	10	10	100	20	40	15	25	100

*Additional Continuous Evaluation: Quizzes/Assignments/Presentations/Practical Records/Mock Interviews/others

**The ratio of weightage between Theory and Practical content will be 60%: 40%

Course Syllabi (Theory):

- **Mathematical modeling:** Governing equations of fluid flow and heat transfer; Introduction to discretization methods: Finite difference and finite volume methods for heat transfer problems; Time stepping methods for unsteady problems; Solution techniques for system of algebraic equations; Grid generation techniques; Solution techniques for Navier-Stokes equation; Finite element method for heat transfer and fluid flow problems; Turbulence modeling.
- **Introduction:** Conservation equation; mass; momentum and energy equations; convective forms of the equations and general description.
- **Classification and Overview of Numerical Methods:** Classification into various types of equation; parabolic elliptic and hyperbolic; boundary and initial conditions; over view of numerical methods.
- **Finite Difference Technique:** Finite difference methods; different means for formulating finite difference equation; Taylor series expansion, integration over element, local function method; treatment of boundary conditions; boundary layer treatment; variable property; interface and free surface treatment; accuracy of f.d. method.
- **Finite Volume Technique:** Finite volume methods; different types of finite volume grids; approximation of surface and volume integrals; interpolation methods; central, upwind and hybrid formulations and comparison for convection-diffusion problem.
- **Finite Element Methods:** Finite element methods; Rayleigh-Ritz, Galerkin and Least square methods; interpolation functions; one and two dimensional elements; applications.
- **Methods of Solution:** Solution of finite difference equations; iterative methods; matrix inversion methods; ADI method; operator splitting; fast Fourier transform.
- **Time integration Methods:** Single and multilevel methods; predictorcorrector methods; stability analysis; Applications to transient conduction and advection-diffusion problems.

- **Numerical Grid Generation:** Numerical grid generation; basic ideas; transformation and mapping.
- **Navier-Stokes Equations:** Explicit and implicit methods; SIMPLE type methods; fractional step methods.
- **Turbulence modeling:** Reynolds averaged Navier-Stokes equations, RANS modeling, DNS and LES.

Course Syllabi (Practical):

1. Numerical Solutions of Parabolic Equation using FDM.
2. Circular Grid Generation
3. Supersonic Flow over an infinite wing using ANSYS-CFX
4. Subsonic Flow over an airfoil using ANSYS-FLOTRAN
5. Laminar pipe flow with convection

Text Books:

1. Richard Pletcher, John Tannehill and Dale Anderson, `Computational Fluid Mechanics and Heat Transfer 3e', CRC Press, 2012
2. H.K. Versteeg and W. Malalasekera, `An introduction to computational fluid dynamics: The finite volume method 3e', Pearson Education, 2007.
3. Charles Hirsch, `Numerical Computation of Internal and External Flows', Vol.1 (1988) and Vol.2 (1990), John Wiley & Sons.

Reference Books:

1. J. H. Fergiger, M. Peric, `Computational Methods for Fluid Dynamics 3e', Springer, 2002.
2. T. J. Chung `Computational Fluid Dynamics 2e', Cambridge University Press, 2010.
3. C. A. J. Fletcher, `Computational Techniques for Fluid Dynamics Vol. 1 and 2 2e', Springer, 1991.
4. S.V. Patankar, `Numerical Heat Transfer and Fluid Flow', Hemisphere, 1980.
5. J. D. Anderson Jr., `Computational Fluid Dynamics', McGraw-Hill International Edition, 1995.
6. Anderson, D.A., Tannehill, J.C. and Pletcher, R.H. (1997). Computational Fluid Mechanics and Heat Transfer. Taylor & Francis.

Course code	Course Title	Teaching Scheme			
		L	T	P	Credits
ME 626 (Elective-I)	Mechatronics	3	0	2	4

Evaluation Scheme (Theory)						Evaluation Scheme (Practical)				
Mid Term Test - I	Mid Term Test - II	End Term Test	Class Participation	Additional Continuous Evaluation*	Total Marks**	Mid Term Test - I	End Term Test	Class Participation	Additional Continuous Evaluation *	Total Marks**
20	20	40	10	10	100	20	40	15	25	100

*Additional Continuous Evaluation: Quizzes/Assignments/Presentations/Practical Records/Mock Interviews/others

**The ratio of weightage between Theory and Practical content will be 60%: 40%

Course Syllabi (Theory):

- Introduction about Mechatronics: scope of Mechatronics, application, process control automation and N/c Machines.
- Sensors and Transducers: Introduction, classification, specification, characteristics of transducers, type of transducers displacement, strain, vibration pressure, flow, temperature, force and torque, tactile.
- Hydraulic Pneumatic and Electrical actuators: Pumps and Compressors, control valves and accessories, actuators, fluid power symbols, fluid power systems, switching devices, solenoids, motors.
- Data Acquisition and Control System: Introduction, Quantitizing theory, Analog to Digital Conversion, Digital to Analog (D/A) conversation, transfer function, transient response and frequency response and frequency response, stability criteria.
- Design of Mechatronic systems: Introduction, Automatic front and book and cutting in steel rolling mill, lift control system, CNC lathe, temperature control of a heat treatment furnace, EOT crane control panel, Grey grain separators, electrode arm control in electric arc furnace.

Course Syllabi (Practical):

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

10. Computerized data logging system with control for process variables like pressure flow and temperature.

Text Books:

1. Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering, Bolton, W., Pearson Education
2. Mechatronics: Principles, Concepts and applications, Mahalik N.P., Tata McGraw Hill.
3. Mechatronics, HMT Hand Book, Tata McGraw Hill.

Reference Books:

1. Mechatronics, Singh and Joshi, Prentice Hall of India.
2. Mechatronics: Integrated Technologies for Intelligent Machines, Smaili and Mrad, Oxford.
3. Introduction to Mechatronics and Measurement Systems, Alciatore and Histand, Tata McGraw Hill.
4. Mechatronics: Integrated Mechanical, Balasundaram, Wiley India.

Course code	Course Title	Teaching Scheme			
		L	T	P	Credits
ME 627 (Elective-II)	Flexible Manufacturing Systems	3	0	0	3

Evaluation Scheme (Theory)						Evaluation Scheme (Practical)				
Mid Term Test - I	Mid Term Test - II	End Term Test	Class Participation	Additional Continuous Evaluation*	Total Marks	Mid Term Test - I	End Term Test	Class Participation	Additional Continuous Evaluation*	Total Marks
20	20	40	10	10	100	-	-	-	-	-

*Additional Continuous Evaluation: Quizzes/Assignments/Presentations/Practical Records/Mock Interviews/others

Syllabus (Theory)

- Introduction to FMS - scope - types - benefits - major elements - Types of flexibility - FMS application and flexibility - optimization - Single product, N - product, single batch, N - Batch scheduling problem -Knowledge based scheduling system.
- Introduction - Composition of FMS - Hierarchy of computer control - Computer control of work center and assembly lines - FMS supervising computer control -Types of software specification and selection - trends.
- Application of simulation-model of FMS-simulation software - limitation -manufacturing data systems-data flow-FMS database systems-planning for FMS database.
- Introduction - matrix formulation - Mathematical Programming formulation – Graph Formulation - Knowledge based system for group technology - Application of possibility distributions in FMS systems justification.
- FMS application in aerospace machining sheet metal fabrication, prismatic component production - FMS development towards factories of the future - Artificial intelligence and Expert systems in FMS - Design Philosophy and Characteristics for Future.

Text Book(s)

1. Jha, N.K. "Handbook of Flexible Manufacturing Systems ", Academic Press Inc., 1991.

Reference Book(s)

1. Radhakrishnan P. and Subramanyan S., "CAD / CAM / CIM ", Wiley Eastern Ltd., New Age International Ltd., 1994.
2. Raouf, A. and Ben-Daya, M., Editors, "Flexible manufacturing systems: recent development", Elsevier Science, 1995.
3. Groover M.P., "Automation, Production Systems and Computer Integrated Manufacturing ", Prentice-Hall of India Pvt. Ltd., New Delhi, 1996.
4. Kalpakjian, "Manufacturing Engineering and Technology ", Addison-Wesley Publishing Co., 1995.
5. Taiichi Ohno, Toyota, "Production System Beyond Large-Scale production ", Productivity Press (India) Pvt. Ltd., 1992.

Course code	Course Title	Teaching Scheme			
		L	T	P	Credits
ME 622 (Elective-II)	Non-Conventional Machining Processes	3	0	0	3

Evaluation Scheme (Theory)						Evaluation Scheme (Practical)				
Mid Term Test - I	Mid Term Test - II	End Term Test	Class Participation	Additional Continuous Evaluation*	Total Markss	Mid Term Test - I	End Term Test	Class Participation	Additional Continuous Evaluation *	Total Marks
20	20	40	10	10	100	-	-	-	-	-

*Additional Continuous Evaluation: Quizzes/Assignments/Presentations/Practical Records/Mock Interviews/others

Syllabus (Theory)

- **Introduction:** Classification of non-traditional Machining Processes, considerations in process selection.
- **Mechanical Processes:** Ultrasonic machining. Elements of USM, Mechanics of cutting, effect of parameters on material removal rate and surface finish, economic considerations, applications and limitations, recent developments; Abrasive Jet Machining, variables affecting material removal rate, applications advantages and limitations;
- **Electro-Chemical and Chemical Processes:** Electro-Chemical Machining: Elements of the process, Electrolytes and their properties. Chemistry of the process, metal removal rate; advantages, applications and limitations of the process.
- **Chemical Machining:** Elements of the process, Resists and Etchants, Advantages and applications.
- **Thermal Processes:** Electric Discharge machining: Mechanism of metal removal, EDM Equipment, Dielectric fluids, selection of electrode material, accuracy and surface finish applications.
- **Plasma Arc Machining:** Mechanism of Metal Removal, PAM parameters. Economics and applications of Plasma jets.
- **Electron Beam Machining:** Generation and control electron beam, Theory of Electron Beam Machining Process capabilities and limitations.
- **Laser Beam Machining:** Principles of working. Thermal aspects, material removal, Advantages and Limitations.

Text Book(s)

1. Manufacturing science, Ghosh and Malik, E.W. Press
2. Modern machining processes, Pandey and Shan, Tata McGraw Hill Publications

Course code	Course Title	Teaching Scheme			
		L	T	P	Credits
ME 628 (Elective-II)	Product Design & Development	3	0	0	3

Evaluation Scheme (Theory)						Evaluation Scheme (Practical)				
Mid Term Test - I	Mid Term Test - II	End Term Test	Class Participation	Additional Continuous Evaluation*	Total Markss	Mid Term Test - I	End Term Test	Class Participation	Additional Continuous Evaluation *	Total Marks
20	20	40	10	10	100	-	-	-	-	-

*Additional Continuous Evaluation: Quizzes/Assignments/Presentations/Practical Records/Mock Interviews/others

Syllabus (Theory)

Introduction: Significance of product design, product design and development process, sequential engineering design method, the challenges of product development, Product Planning and Project Selection: Identifying opportunities, evaluate and prioritize projects, allocation of resources.

Identifying Customer Needs: Interpret raw data in terms of customers need, organize needs in hierarchy and establish the relative importance of needs,

Product Specifications: Establish target specifications, setting final specifications,

Concept Generation: Activities of concept generation, clarifying problem, search both internally and externally, explore the output, Industrial Design: Assessing need for industrial design, industrial design process, management, assessing quality of industrial design, Concept Selection: Overview, concept screening and concept scoring, methods of selection.

Theory of inventive problem solving (TRIZ): Fundamentals, methods and techniques, General Theory of Innovation and TRIZ, Value engineering Applications in Product development and design, Model-based technology for generating innovative ideas Concept Testing: Elements of testing: qualitative and quantitative methods including survey, measurement of customers' response, Intellectual Property: Elements and outline, patenting procedures., claim procedure, Design for Environment: Impact, regulations from government, ISO system.

Text books

1. Ulrich K. T, and Eppinger S.D, Product Design and Development, Tata McGraw Hill
2. Otto K, and Wood K, Product Design, Pearson

Reference books

1. Engineering of creativity: introduction to TRIZ methodology of inventive Problem Solving, By Semyon D. Savransky, CRC Press.
2. Inventive thinking through TRIZ: a practical guide, By Michael A. Orloff, Springer.
3. Systematic innovation: an introduction to TRIZ ; (theory of inventive Problem Solving), By John Terninko, Alla Zusman, CRC Press.

Course code	Course Title	Teaching Scheme			
		L	T	P	Credits
MA 621	Engineering Optimization	3	0	0	3

Evaluation Scheme (Theory)						Evaluation Scheme (Practical)				
Mid Term Test - I	Mid Term Test - II	End Term Test	Class Participation	Additional Continuous Evaluation*	Total Marks	Mid Term Test - I	End Term Test	Class Participation	Additional Continuous Evaluation *	Total Marks
20	20	40	10	10	100	-	-	-	-	-

*Additional Continuous Evaluation: Quizzes/Assignments/Presentations/Practical Records/Mock Interviews/others

Syllabus (Theory)

- **Introduction:** Introduction to Optimization and its scope, Formulating a Mathematical Model, Deriving Solutions from the Model
- **Linear Programming Problems:** Revised Simplex Method, Duality Theory and Sensitivity Analysis, Dual Simplex Method, Transportation Problem, Assignment Problem
- **Non-linear Programming:** Introduction, Single variable and multi variable optimization, Constrained and unconstrained problems, Kuhn-Tucker conditions
- **Network Optimization Models:** The Terminology of Networks, Shortest-Path Problem, Minimum Spanning Tree Problem
- **Other Optimization Models:** Dynamic Programming, Integer Programming, Game Theory
- **Multi-objective optimization:** Introduction to various multi-objective optimization techniques and its scope, Linear Goal Programming and Its Solution

Text books and Reference books

1. Hillier F.S. and Lieberman G.J., *Introduction to Operations Research: Concepts and Cases*, Tata Mc Graw Hill, 8th Ed., (Indian Adapted Edition), 2005.
2. Taha. H. A, *Operations Research: An Introduction*, Pearson Education, 7th ed., 2003.
3. Ronald L. Rardin, *Optimization in Operations Research*. Pearson Education, First Indian Reprint 2002.
4. Pant.J.C., *Introduction to Optimization: Operations Research*, Jain Brothers, 5th Ed., 2000.
5. Sharma. S. D., *Operations Research*, Kedarnath Ramnath & Co., 15th Edition, 2006.
6. Kalyanmoy Deb, Optimization for Engineering Design: Algorithms and Examples, PHI.
7. Kasana H.S. and Kumar K.D., Introductory Operations Research: Theory and Applications, Springer.

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INSTITUTE OF ENGINEERING AND TECHNOLOGY

4 Year B. Tech Programme

(Branch: Mechanical Engineering)

Batch 2014-18

SEMESTER-SEVEN

Detailed Syllabus

&

Scheme of Examination

Course code	Course Title	Teaching Scheme			
		L	T	P	Credits
ME 703	Power plant Engineering	3	1	0	4

Evaluation Scheme (Theory)						Evaluation Scheme (Practical)				
Mid Term Test - I	Mid Term Test - II	End Term Test	Class Participation	Additional Continuous Evaluation*	Total Marks**	Mid Term Test - I	End Term Test	Class Participation	Additional Continuous Evaluation*	Total Marks**
20	20	40	10	10	100	-	-	-	-	-

*Additional Continuous Evaluation: Quizzes/Assignments/Presentations/Practical Records/Mock Interviews/others

Syllabus (Theory)

- **Introduction to power plants & boilers:** Layout of Steam, Hydel, Diesel, MHD, Nuclear and Gas Turbine Power Plants - Combined Power Cycles - Comparison and Selection, Load Duration Curves. Steam Boilers and Cycles - High Pressure and Super Critical Boilers - Fluidised Bed Boilers.
- **Steam power plant:** Fuel and Ash Handling, Combustion Equipment for burning coal, Mechanical Stokers, Pulveriser, Electrostatic Precipitator, Draught - different types, Surface Condenser Types, Cooling Towers.
- **Nuclear and hydel power plants:** Nuclear Energy - Fission, Fusion Reaction, Types of Reactors, pressurized water reactor, Boiling Water Reactor, Waste Disposal and safety. Hydel Power Plant - Essential Elements, Selection of Turbines, Governing of Turbines- Micro Hydel developments.
- **Diesel and gas turbine power plant:** Types of Diesel Plants, Components, selection of Engine Type, Applications Gas Turbine Power Plant - Fuels - Gas Turbine Material - Open and Closed Cycles - Reheating - Regeneration and Intercooling - Combined Cycle.
- Other power plants and economics of power plants Geo thermal -OTEC - Tidel - Pumped storage - Solar thermal central receiver system. Cost of Electric Energy - Fixed and operating Costs - Energy Rates - Types of Tariffs - Economics of load sharing, comparison of economics of various power plants.

Text Book(s)

1. El- Wakil M.M, "Power Plant Technology", McGraw-Hill 1984.
2. Arora S.C and Domkundwar S, "A course in Power Plant Engineering", Dhanpatrai, 2001.
3. Nag P.K, "Power plant Engineering", Tata McGraw-Hill, 1998

Reference Book(s)

1. G.R. Nagpal, "Power Plant Engineering", Hanna Publishers, 1998.
2. K.K.Ramalingam, "Power Plant Engineering", Scitech Publications, 2002.
3. G.D.Rai, "Introduction to Power Plant Technology", Khanna Publishers, 1995.
4. R.K.Rajput, "Power Plant Engineering", Laxmi Publications, 1995.
5. Frank D.Graham "Power Plant Engineers Guide", D.B. Taraporevala Sons & Co, New Delhi, 1993.
6. T. Morse Frederick, "Power Plant Engineering", Prentice Hall of India, 1998

Course code	Course Title	Teaching Scheme			
		L	T	P	Credits
ME 702	CAD – CAM	3	0	3	4.5

Evaluation Scheme (Theory)						Evaluation Scheme (Practical)				
Mid Term Test - I	Mid Term Test - II	End Term Test	Class Participation	Additional Continuous Evaluation*	Total Marks	Mid Term Test - I	End Term Test	Class Participation	Additional Continuous Evaluation*	Total Marks
20	20	40	10	10	100	20	40	15	25	100

*Additional Continuous Evaluation: Quizzes/Assignments/Presentations/Practical Records/Mock Interviews/others

**The ratio of weightage between Theory and Practical content will be 60%: 40%

Syllabus (Theory)

- **Introduction:** CAD/CAM Definition, Computer Technology-central processing unit (CPU), types of emory, input/output, the binary number system, computer programming languages. Automation- Types of Automation, CIM, reasons for automating, automation strategies.
- **Conventional Numerical Control:** Basic components of NC system, the NC procedure, NC coordinate systems, NC motion control system, applications of numerical control, advantages and disadvantages of NC, computer controls in NC, Co-ordinate system, NC manual part programming, G & M codes, part program for simple parts, Computer assisted part programming, problems with conventional NC, NC controller technology, computer numerical control, functions of CNC, advantages of CNC, Direct numerical control, components of a DNC system, functions of DNC, advantages of DNC.
- **NC Part Programming:** Introduction, the punched tape in NC, tape coding and format, NC words, manual part programming, computer assisted part programming, the part programmer's job, the computer's job, NC part programming languages. The APT language: Geometry, statements, motion statements, post processor statements, auxiliary statements.
- **Automated Material Handling & FMS:** The material handling function, types of material handling equipment, conveyor systems, types of conveyors, automated guided vehicle systems, applications. FMS-Components, types of systems, applying FMS technology, FMS workstation, planning. Part families, Part classification and coding, product flow analysis, Machine cell Design, Advantages of GT
- Introduction, Transformation of points & line, 2-D rotation, Reflection, Scaling and combined transformation, Homogeneous coordinates, 3-D scaling, shearing, rotation, reflection and translation, combined transformations, Orthographic and perspective projections
- **Algebraic and geometric forms:** tangent & twist vectors, normal blending function, reparametrization, Sixteen point form, four Curve form, Plane surface, ruled surface Surface of revolution, tabulated cylinder Bi-cubic surface, bezier surface, B-spline surface Solid models and

representation scheme B-rep & CSG, sweep representation, Cell decomposition, spatial occupancy enumeration

- **Computer Aided Quality Control:** Introduction, terminology in Quality Control, the computer in QC, contact and non-contact inspection methods-optical and non-optical, and computer aided testing.
- Introduction, conventional process planning, Steps in variant process planning, types of CAPP, planning for CAPP

Syllabus (Practical)

1. CAD Modeling Assignments
    a. Use and learn import/export techniques and customization of software.
    b. Construction of simple machine parts and components like Coupling, Crankshaft, Pulley, Piston , Connecting rod, nuts, bolts, gears and helical springs
    c. Assembly drawing with sectioning and bill of materials from given detailed drawings of assemblies: Lathe Tail stock, Machine vice, Pedestal bearing, Drill jigs and Milling fixture.
    d. Make the part family/family table of a bolt.
2. CAM Assignments
    a. Tool path generation, Part programming, G & M codes development for machining operations, Physical interpretation of machining features and tool geometries
3. Part Programming and proving on a CNC lathe for:-
    a. Simple Turning
    b. Facing and Step Turning
    c. Taper Turning
    d. Drilling
    e. Outside Threading
4. Part Programming and Proving on a CNC Milling Machine:-
    a. Point to Point Programming
    b. Absolute Programming
    c. Incremental Programming
5. Study the constructional detail and working of CNC Machines.
6. To prepare a job on EDM.
7. To design a product and prepare it on CNC machine and find out its various co-ordinates using CMM machine.

Text Book(s)

1. Automation, Production Systems and Computer Integrated Manufacturing. Groover M.P, Prentice Hall of India.
2. CAD/CAM – Groover M.P, Zimmers E.W, Prentice Hall of India.

Reference Book(s)

1. Approach to Computer Integrated Design and Manufacturing Nanua Singh, John Wiley
2. CAD/CAM theory & practice - Ibrahim Zeid
3. Numerical control and computer aided manufacturing by RAO and Tiwari, TMG

Course code	Course Title	Teaching Scheme			
		L	T	P	Credits
ME 704	Total Quality Management	3	1	0	4

Evaluation Scheme (Theory)						Evaluation Scheme (Practical)				
Mid Term Test - I	Mid Term Test - II	End Term Test	Class Participation	Additional Continuous Evaluation*	Total Markss	Mid Term Test - I	End Term Test	Class Participation	Additional Continuous Evaluation *	Total Marks
20	20	40	10	10	100	-	-	-	-	-

*Additional Continuous Evaluation: Quizzes/Assignments/Presentations/Practical Records/Mock Interviews/others

Syllabus (Theory)

- The meaning of Quality and quality improvement, dimensions of quality, history of quality methodology, quality control, Quality of design and quality of conformance, Quality policy and objectives, Economics of quality. Modeling process quality: Describing variation, frequency distribution, continuous and discrete, probability distributions, pattern of variation, Inferences about process quality: sampling distributions and estimation of process parameters. Analysis of variance, statistical aids in limits and tolerances.
- **Statistical Quality Control:** Concept of SQC, Chance and assignable causes of variation, statistical basis of control chart, basic principles, choice of control limits, sample size and sampling frequency, analysis of patterns on control charts. The magnificent seven. Control chart for variables,: X-bar and R charts, x-bar and S charts, control chart for individual measurement. Application of variable control charts.
- **Control chart for attributes:** control chart for fraction non-conforming P-chart, np-chart, c- chart and u-chart. Demerit systems, choice between attribute and variable control chart. SPC for short production runs. Process capability analysis using histogram and probability plot, capability ratios and concept of six sigma.
- **Quality Assurance:** Concept, advantages, field complaints, quality rating, quality audit, vendor quality rating (VQR), vendor rating (VR), manufacturing planning for quality, Quality function deployment (QFD).
- Acceptance Sampling: Fundamental concepts in acceptance sampling, operating characteristics curve. Acceptance sampling plans, single, double and multiple sampling plans, LTPD, AOQL, AOQ. Introduction to Quality systems like ISO 9000 and ISO 14000
- **Design of experiments:** Strategy of experimentation; Basic principles, Guidelines for designing experiments. Simple Comparative Experiments: Basic statistical concepts, Sampling and sampling Distribution, Inferences about the Differences in means, randomized designs, Paired comparison
- Designs, Inferences about the Variances of Normal Distributions. Introduction to Taguchi Method of Design of Experiments, Quality loss function, Signal-to- Noise ratio, Orthogonal array experiments.

Text books

1. Fundamentals of Quality Control and Improvement, Amitava Mitra, 2 Edition, Prentice Hall, 1998
2. Introduction to Statistical Quality Control, Douglas C. Montgomery, 2 Edition, Wiley, 1991

Reference books

1. Quality Planning and Analysis, J.M.Juran and F.M. Gryna, McGraw Hill
2. Quality Control, Dale H. Besterfield, 8 Edition, Pearson/Prentice Hall, 2008.
3. Statistical Quality Control, E. L. Grant and Richard S. Leavenworth, Tata McGraw-Hill, 2000.
4. Design and Analysis of Experiments, 5 Edition, Douglas C. Montgomery, Wiley-India, 2007.

Course code	Course Title	Teaching Scheme			
		L	T	P	Credits
ME 721 (Elective-III)	Fundamentals of Aerodynamics	3	0	0	3

Evaluation Scheme (Theory)						Evaluation Scheme (Practical)				
Mid Term Test - I	Mid Term Test - II	End Term Test	Class Participation	Additional Continuous Evaluation*	Total Marks	Mid Term Test - I	End Term Test	Class Participation	Additional Continuous Evaluation*	Total Marks
20	20	40	10	10	100	-	-	-	-	-

*Additional Continuous Evaluation: Quizzes/Assignments/Presentations/Practical Records/Mock Interviews/others

Syllabus (Theory)

- Aerodynamic forces and moments over the body surface, concept of lift and drag, dimensionless force and moment coefficient, centre of pressure of an aerofoil, nomenclature of aerofoil, angle of attack, circulation and lift over an-aerofoil, Kutta condition, Kelvin's circulation theorem.
- Blade theory; Symmetrical and non-symmetrical aerofoil. Energy transfer in terms of lift and drag, cascade nomenclature, turbine cascade nomenclature, cascade lift and drag coefficient.
- Isentroic Flow: Velocity of sound; Mach angle; Mach number, steady isentropic flow through ducts; use of isentropic tables; condition for maximum discharge; choked flow; flow through convergent and convergent-divergent nozzle, supersaturated flow in nozzle.
- Adiabatic flow and flow with Heat Transfer: Adiabatic flow; Fanno line tables; entropy change; choking due to friction; flow through long ducts; Diabatic flow ; Rayleigh line; use of tables; change in entropy; effect of change in stagnation temperature.
- Normal Shock: Plane stationary normal shock; Ranking-Hugoniot relations; increase in entropy; Prandtl's relations; change in stagnation pressure across the shock.

Text Book(s)

1. B. R. Munson, D. F. Young and T H. Okiishi, Fundamentals of Fluid Mechanics, 4th edition, John Wiley & Sons, Inc., ISBN: 0-471-44250-X.
2. J. D. Anderson, Fundamentals of Aerodynamics, 3rd edition, McGraw-Hill Companies, 2001.

Reference Book(s)

1. Anderson, J.D., Introduction to Flight, McGraw Hill, 2008.
2. Kuethe, A.M. and Chow, C.-Y., Foundations of Aerodynamics: Bases of Aerodynamic Design, Wiley, 1998.
3. Abbott, I.H. and vonDoenhoff, A.E., Theory of Wing Sections , Dover, 1959.
4. VanDyke, M., An Album of Fluid Motion.

Course code	Course Title	Teaching Scheme			
		L	T	P	Credits
ME 725 (Elective-III)	Industrial Pollution and Control	3	0	0	3

Evaluation Scheme (Theory)						Evaluation Scheme (Practical)				
Mid Term Test - I	Mid Term Test - II	End Term Test	Class Participation	Additional Continuous Evaluation*	Total Marks**	Mid Term Test - I	End Term Test	Class Participation	Additional Continuous Evaluation*	Total Marks**
20	20	40	10	10	100	-	-	-	-	-

*Additional Continuous Evaluation: Quizzes/Assignments/Presentations/Practical Records/Mock Interviews/others

Syllabus (Theory)

- Types of emissions from chemical industries and effects of environment, environment legislation, Type of pollution, sources of wastewater, Effluent guidelines and standards,
- Characterization of effluent streams, oxygen demands and their determination (BOD, COD, and TOC), Oxygen sag curve, BOD curve mathematical, controlling of BOD curve, self purification of running streams, sources and characteristics of pollutants in fertilizer, paper and pulp industry, petroleum and petroleum industry.
- General methods of control and removal of sulfur dioxide, oxides of nitrogen and organic vapors from gaseous effluent, treatment of liquid and gaseous effluent in fertilizer industry.
- Air pollution sampling and measurement: Types of pollutant and sampling and measurement, ambient air sampling: collection of gaseous air pollutants, collection of particulate air pollutants. Stack sampling: sampling system, particulate sampling, and gaseous sampling. Analysis of air pollutants: Sulphur dioxide, nitrogen oxides, carbon monoxide, oxidants and Ozones, hydrocarbons, particulate matter.
- Air pollution control methods and equipments: Source collection methods: raw material changes, process changes, and equipment modification. Cleaning of gaseous equipments particulate emission control: collection efficiency, control equipment like gravitational settling chambers, Cyclone separators, fabric filters, ESP and their constructional details and design aspects. Scrubbers: wet scrubbers, spray towers, centrifugal scrubbers, packed beds and plate columns, venturi scrubbers, their design aspects. Control of gaseous emissions: absorption by liquids, absorption equipments, adsorption by solids, equipment and the design aspects.
- Introduction to waste water treatment, biological treatment of wastewater, bacterial and bacterial growth curve, aerobic processes, suspended growth processes, activated aerated lagoons and stabilization ponds, Attached growth processes, trickling filters, rotary drum filters, anaerobic processes.

- Methods of primary treatments: screening, sedimentation, flotation, neutralization, and methods of tertiary treatment. A brief study of carbon absorption, ion exchange, reverse osmosis, ultra filtration, chlorination, ozonation, treatment and disposal.
- Hazardous waste management: Nuclear wastes: health and environment effects, sources and disposal methods. chemical wastes: health and environmental effects, treatment and disposal: treatment and disposal by industry, off site treatment and disposal, treatment practices in various countries. Biomedical wastes: types of wastes and their control.

Text Book(s)

1. Environmental pollution and control engineering, Rao C. S. - Wiley Eastern Limited, India, 1993.
2. Pollution control in process industries by S.P. Mahajan TMH.,1985.

Reference Book(s)

1. Waste water treatment by M.Narayana Rao and A.K.Datta,Oxford and IHB publ. New Delhi.
2. Air pollution control by P.Prathap mouli and N.Venkata subbayya. Divya Jyothi Prakashan, Jodhpur.
3. "Industrial Pollution Control and Engineering." Swamy AVN, Galgotia publications, 2005. Hyderabad

Course code	Course Title	Teaching Scheme			
		L	T	P	Credits
ME 726 (Elective-III)	Mechanical System Design	3	0	0	3

Evaluation Scheme (Theory)						Evaluation Scheme (Practical)				
Mid Term Test - I	Mid Term Test - II	End Term Test	Class Participation	Additional Continuous Evaluation*	Total Marks**	Mid Term Test - I	End Term Test	Class Participation	Additional Continuous Evaluation*	Total Marks**
20	20	40	10	10	100	-	-	-	-	-

*Additional Continuous Evaluation: Quizzes/Assignments/Presentations/Practical Records/Mock Interviews/others

Syllabus (Theory)

- **Design of Cylinders and pressure vessels:** Thick and thin cylinders – Thin cylindrical and spherical vessels – Lame's equation – Clavarino's and Birnie's equations – Design of hydraulic and pneumatic cylinders – Auto frettage and compound cylinders – Gasketed joints in cylindrical vessels. Modes of failures in pressure vessels. Unfired pressure vessels – Classification of pressure vessels as per I. S. 2825 – categories and types of welded joints – weld joint efficiency – Corrosion, erosion and protection vessels, stresses induced in pressure vessels, materials of construction. Thickness of cylindrical and spherical shells and design of end closures as per code – Nozzles and Openings in pressure vessels –Reinforcement of openings in shell and end closures. Area compensation method – Types of vessel supports.
- **Optimum design:** Objectives of optimum design –Johnson's Method of Optimum Design (MOD). Adequate and optimum design. Primary, subsidiary and limit equations – Optimum design with normal specifications of simple machine elements like tension bar, transmission shaft, helical spring. – Introduction to optimum design with redundant specifications.
- **Design of Fly press:** Power calculation for fly press , Design of flywheel, Fundamental equation of motion – torque analysis – disk and rimmed flywheels – Stresses in flywheel rim and spokes – Design of disc and and rimmed flywheels for various applications. Standard dimensions of flywheels.
- **Statistical consideration in design:** Frequency distribution – Histogram and frequency polygon – Normal distribution – Units of measurement of central tendency and dispersion – Standard variable – population combinations – Design and natural tolerances –Design for assembly- Statistical analysis of tolerances – Mechanical reliability and factor of safety.
- **Aesthetic and ergonomic considerations in design of products:** Basic types of product forms – Designing for appearance – Shape, features, materials and finishes, proportions symmetry, contrast etc. – Morgan's colour code. Ergonomic considerations - Relation between Man, machine and environmental factors. Design of displays and controls.

Practical examples of products or equipments using ergonomic and aesthetic design principles.

- **Design for manufacture:** General principles of design for manufacture and assembly (DFM & DMFA). Principles of design of castings and forgings – Design for machining – Design for powder metallurgy – Design for welding.
- **Design of gear boxes for machine tool applications:** Determination of variable speed range- graphical representation of speeds- structure diagram- deviation diagram- ray diagram- selection of optimum ray diagram- difference between number of teeth of successive gears in a change gear box- analysis of twelve speed gear box- compound ray diagram.
- **Design of Material Handling System**
- **Design of belt and chain conveyors:** Power requirement, selection of belt and chain, design of tension take up unit, idler pulley
- **Term Work:** The term work shall consist of ONE design project. The design project shall consist of two imperial size sheets - one involving assembly drawing with a part list and overall dimensions and the other sheet involving drawings of individual components, manufacturing tolerances, surface finish symbols and geometric tolerances should be specified so as to make it working drawing. A design report giving all necessary calculations of the design of components and assembly should be submitted in a separate file. Projects shall be in the form of design of mechanical systems such as pressure vessel, Conveyor system, Multi speed gear box, Hoisting system.

Text Book(s)

1. Shigley J.E. and Mischke C.R., "Mechanical Engineering Design", McGraw Hill Pub. Co. Ltd.
2. M.F.Spotts – 'Mechanical design analysis' Prentice Hall Inc.
3. Bhandari V.B., "Design of Machine Elements", Tata McGraw Hill Pub. Co. Ltd.

Reference Book(s)

1. Black P.H. and O. Eugene Adams, "Machine Design", McGraw Hill Book Co. Inc.
2. "Design Data", P.S.G. College of Technology, Coimbatore.
3. I.S.: 2825 Code for unfired pressure vessels.
4. Johnson R.C., "Mechanical Design Synthesis with Optimization Applications", Von-Nostrand-Reynold Pub.
5. Dieter G.E., "Engineering Design", McGraw Hill Inc.
6. S.K. Basu and D.K. Pal – 'Design of machine tools' Oxford and IBH Pub. Co.
7. N.K.Mehta – 'Machine tool design' Tata McGraw Hill Pub. Co.
8. S.P. PATIL – 'Mechanical System Design' JAICO students Ed., JAICO Publishing House, Delhi
9. Rudenko – 'Material Handling Equipment' M.I.R. publishers, Moscow

Course code	Course Title	Teaching Scheme			
		L	T	P	Credits
ME 723 (Elective-III)	Reliability Engineering and Maintenance Engineering	3	0	0	3

Evaluation Scheme (Theory)						Evaluation Scheme (Practical)				
Mid Term Test - I	Mid Term Test - II	End Term Test	Class Participation	Additional Continuous Evaluation*	Total Marks**	Mid Term Test - I	End Term Test	Class Participation	Additional Continuous Evaluation*	Total Marks**
20	20	40	10	10	100	-	-	-	-	-

*Additional Continuous Evaluation: Quizzes/Assignments/Presentations/Practical Records/Mock Interviews/others

Syllabus (Theory)

- **Introduction:** Maintenance Objectives and Functions, Maintenance Organisation and Administration of Maintenance Systems, Need of planned maintenance, Maintenance policies, Breakdown, time based maintenance, Block replacement, age replacement and periodic replacement policy, Corrective and preventive maintenance, Maintenance planning, Scheduled maintenance, Cost of maintenance versus Cost of equipment and production delays.
- **Inspection:** Inspection intervals, Inspection reports, card history system.
- Predictive Maintenance: Equipment wear records, standards, Equipment used in predictive maintenance. Computerized maintenance, Total Productive Maintenance, Methods of condition monitoring, Non-destructive testing, Liquid Penetrate, Magnetic particles, Ultrasonic testing, and Vibration analysis, Oil analysis, Radiographic testing.
- **Reliability:** Definition, failure data analysis, Mean failure rate, mean time to failure (MTTF), mean time between failures (MTBF), hazard rate, Bathtub curve, Use of Weibull probability chart foe assessing characteristics life, guarantee period etc.
- **System Reliability:** Series, parallel and mixed configuration, Simple problems.
- **Reliability Improvement:** Techniques, use of Pareto analysis-Design for reliability, redundancy unit and stand by redundancy, Optimization of reliability.
- **Spare Parts Management:** Spare parts, features and categorization of spares, cost considerations, Techniques of cost reduction, Selective controls used in spare parts control, ABC analysis, FSN, XYZ, VED and other approaches, Inventory control of spares.

Text Book(s)

1. Reliability Engineering, Srinath L.S., Affiliated East West Press.
2. Maintainability Principles and Practices, Blanchand, B.S., McGraw Hill.

Reference Book(s)

1. Maintenance Management, Carder, A.S. McGraw Hill
2. Practical Reliability Engineering, Patrick D.T. O'Connor, Wiley India

Course code	Course Title	Teaching Scheme			
		L	T	P	Credits
ME 732 (Elective-IV)	Metal Forming Analysis	3	0	0	3

Evaluation Scheme (Theory)						Evaluation Scheme (Practical)				
Mid Term Test - I	Mid Term Test - II	End Term Test	Class Participation	Additional Continuous Evaluation*	Total Marks**	Mid Term Test - I	End Term Test	Class Participation	Additional Continuous Evaluation*	Total Marks**
20	20	40	10	10	100	-	-	-	-	-

*Additional Continuous Evaluation: Quizzes/Assignments/Presentations/Practical Records/Mock Interviews/others

Syllabus (Theory)

- **Introduction:** Stress/strain/strain-rate characteristics of materials, Yield criteria, classification of metal working processes, Formability and theory of sheet metal working, Friction and lubrication in metal working operation, Theories of friction and lubrication, Assessment of friction at interface.
- **Process Analysis:** Various methods of analyzing the metal working processes (slip-line field theory, Upper bound solution, stab methods).
- **Mechanics of Forming Processes:** Rolling-Determination of rolling pressure, roll separating force, driving torque and power, Power loss in bearings, Forging-Forces in strip forging and disc forging, Drawing-determination of force and power, Maximum allowable reduction, Deep drawing force analysis, Analysis of tube drawing process with fixed and moving mandrel, Tandem tube drawing, Bending- Determination of work load and spring back, Extrusion-Determination of work load from stress analysis and energy consideration, Power loss, Hydrostatic extrusion, Punching & Blanking-Mode of metal deformation and failure, 2D deformation model and fracture analysis, Determination of work force.
- **Hydrostatic Extrusion:** Comparison with conventional extrusion, Pressure required to extrude, variables affecting the process.
- **High Speed Forming:** Classification, Comparison of low and high speed forming, operation problems in high speed forming operation, Introduction to high forming process such as explosive forming, Electrical and Mechanical high speed forming techniques.

Text Book(s)

1. An Introduction to the Principles of Metal Working Rowe Arnold
2. Metal Forming Analysis Avitzur McGraw Hill

Reference Book(s)

1. Mathematical Simulation and Computer analysis of Thin Strip Rolling Mill Polukhin MIR Publications
2. Plasticity for Mechanical Engineers Johnson & Mellore Van Nostrand
3. High Velocity Working of Metals ASTME EEE
4. Manufacturing Science Ghosh & Mallik Affiliated East-West
5. Technology of Metal Forming Processes S. Kumar Prentice Hall of India

Course code	Course Title	Teaching Scheme			
		L	T	P	Credits
ME 735 (Elective-IV)	Industrial Tribology	3	0	0	3

Evaluation Scheme (Theory)						Evaluation Scheme (Practical)				
Mid Term Test - I	Mid Term Test - II	End Term Test	Class Participation	Additional Continuous Evaluation*	Total Marks**	Mid Term Test - I	End Term Test	Class Participation	Additional Continuous Evaluation *	Total Marks**
20	20	40	10	10	100	-	-	-	-	-

*Additional Continuous Evaluation: Quizzes/Assignments/Presentations/Practical Records/Mock Interviews/others

Syllabus (Theory)

- **INTRODUCTION:** Defining Tribology, Tribology in Design - Mechanical design of oil seals and gasket - Tribological design of oil seals and gasket, Tribology in Industry (Maintenance), Defining Lubrication, Basic Modes of Lubrication, Properties of Lubricants, Lubricant Additives, Defining Bearing Terminology - Sliding contact bearings - Rolling contact bearings, Comparison between Sliding and Rolling Contact Bearings
- **FRICTION and WEAR:** Friction - Laws of friction - Friction classification - Causes of friction, Theories of Dry Friction, Friction Measurement, Stick-Slip Motion and Friction Instabilities, Wear - Wear classification - Wear between solids – Wear, between solid and liquid - Factors affecting wear – Measurement of wear, Theories of Wear, Approaches to Friction Control and Wear Prevention, Boundary Lubrication, Bearing Materials and Bearing Construction.
- **LUBRICATION of BEARINGS:** Mechanics of Fluid Flow - Theory of hydrodynamic lubrication - Mechanism of pressure development in oil film, Two Dimensional Reynolds's Equation and its Limitations, Idealized Bearings, Infinitely Long Plane Fixed Sliders, Infinitely Long Plane Pivoted Sliders, Infinitely Long Journal Bearings, Infinitely Short Journal Bearings, Designing Journal Bearing - Sommerfeld number – Raimondi and Boyd method - Petroff's Solution - Parameters of bearing, design - Unit pressure - Temperature rise - Length to diameter ratio - Radial clearance - Minimum oil-film thickness
- **HYDRODYNAMIC THRUST BEARING:** Introduction - Flat plate thrust bearing - Tilting pad thrust bearing, Pressure Equation - Flat plate thrust bearing - Tilting pad thrust bearing, Load - Flat plate thrust bearing - Tilting pad thrust bearing, Center of Pressure - Flat plate thrust bearing - Tilting pad thrust bearing, Friction - Flat plate thrust bearing - Tilting pad thrust bearing
- **HYDROSTATIC and SQUEEZE FILM LUBRICATION:** Hydrostatic Lubrication - Basic concept - Advantages and limitations - Viscous flow through rectangular slot – Load carrying capacity and

flow requirement - Energy losses - Optimum design, Squeeze Film Lubrication - Basic concept - Squeeze action between circular and rectangular plates-Squeeze action under variable and alternating loads, Application to journal bearings, Piston Pin Lubrications

- **ELASTO-HYDRODYNAMIC LUBRICATION:** Principles and Applications, Pressure viscosity term in Reynolds's equation, Hertz's Theory , Ertel-Grubin equation
- Lubrication of spheres, Gear teeth bearings, Rolling element bearings.
- **GAS (AIR-) LUBRICATED BEARINGS:** Introduction, Merits, Demerits and Applications, Tilting pad bearings, Magnetic recording discs with flying head, Hydrostatic bearings with air lubrication, Hydrodynamic bearings with air lubrication, Thrust bearings with air lubrication
- **TRIBOLOGICAL ASPECTS of ROLLING MOTION:** The mechanics of tyre-road interactions, Road grip and rolling resistance, Tribological aspects of wheel on rail contact
- **FINITE BEARINGS:** Hydrostatic bearings, Hydrodynamic bearings, Thrust oil bearings, Porous Bearings, Foil bearings, Heat in bearings

Text Books:

1. Tribology by I.M. Hutchings
2. Engineering Tribology by G. Stachowiak and A.W. Batchelor (can be read on-line from the library"homepage)

Reference Books:

1. "Principles and applications of tribology", by B. Bhushan
2. Applied tribology", by M. Khonsar.

Course code	Course Title	Teaching Scheme			
		L	T	P	Credits
ME 736 (Elective-IV)	Robotics Engineering	3	0	0	3

Evaluation Scheme (Theory)						Evaluation Scheme (Practical)				
Mid Term Test - I	Mid Term Test - II	End Term Test	Class Participation	Additional Continuous Evaluation*	Total Marks**	Mid Term Test - I	End Term Test	Class Participation	Additional Continuous Evaluation *	Total Marks**
20	20	40	10	10	100	-	-	-	-	-

*Additional Continuous Evaluation: Quizzes/Assignments/Presentations/Practical Records/Mock Interviews/others

Syllabus (Theory)

UNIT I

Introduction to robotics: Classification of robots, basic robot components, robot anatomy, manipulator end effectors, controller, power unit, Sensors and Vision devices, specification of robot systems, accuracy precision and repeatability, work envelop, gripper actuators and gripper design.

Co-ordinate Systems: local frame and global frame, representation, transformations, wrist analysis. The Future Prospects, Notations.

UNIT II

Kinematics and Dynamics: Parameters of robot link, formulation of D-H matrix, Analysis of different types of robots with different degrees of freedom, kinematic chains, inverse kinematics, Dynamic analysis, Fundamental Rotation Matrices.

UNIT III

Motion planning: Different trajectories and its analysis, motion planning, trajectory planning and control

Robotic sensing devices: Position, velocity and acceleration sensors, proximity and range sensors, touch and slip sensors, tactile sensors, and force and torque sensors.

UNIT IV

Robotic sensors and vision system: The Meaning of Sensing, imaging components, picture coding, object recognition, training and vision systems, review of existing vision systems.

Robotics programming:

Methods of robot programming, types of programming, robotics programming languages, artificial intelligence.

UNIT V

Robot Applications: Industrial Applications, Material Handling, Processing Applications, Assembly Applications, Inspection Application, Principles for Robot Application and Application Planning, Justification of Robots, Robot Safety, Non-Industrial Applications. Robot applications and Economic analysis of robotics

Text and Reference Books:

1. Fundamentals of Robotics Analysis and control : Robert J. Schilling
2. Industrial robotics : Groover, Weiss nagel and odrey, Mc Graw Hill
3. Robotics engineering: klafter, Chmielwski and nagirn, Prentice hall.
4. Robotics for engineering: Yorem Korem, Mc Graw Hill.
5. Robotics: control, sensing vision and intelligence: K.S. Fu, R. C. Gonzalez, C. S. g Lee, McGraw Hill

Course code	Course Title	Teaching Scheme			
		L	T	P	Credits
ME 737 (Elective-IV)	Waste Heat Recovery and Management	3	0	0	3

Evaluation Scheme (Theory)						Evaluation Scheme (Practical)				
Mid Term Test - I	Mid Term Test - II	End Term Test	Class Participation	Additional Continuous Evaluation*	Total Marks**	Mid Term Test - I	End Term Test	Class Participation	Additional Continuous Evaluation*	Total Marks**
20	20	40	10	10	100	-	-	-	-	-

*Additional Continuous Evaluation: Quizzes/Assignments/Presentations/Practical Records/Mock Interviews/others

Syllabus (Theory)

- Patterns of energy use, potential for energy conservation, optimum use of energy resources, total energy approach. Coupled cycles, combined plants and cogeneration systems.
- Need for energy storage, thermal electrical, magnetic and chemical energy storage systems.
- Utilization of industrial waste heat; gas-to-gas, gas-to-liquid and liquid-to-liquid heat recovery systems; Recuperators and regenerators
- Heat pipes; waste heat boilers; fluidized bed heat recovery; shell and tube heat exchangers.
- Prime mover exhausts; incineration plants; heat pump systems; thermoelectric devices. Utilization of low grade reject heat from power plants.

Text Books:

1. Principles of Waste Heat Recovery, by Albert Thumann, Robert Goldstick, Fairmont Press.
2. Industrial and institutional waste heat recovery, Paul G. Stecher, Noyes Data Corp.

Course code	Course Title	Teaching Scheme			
		L	T	P	Credits
ME 730 (Elective-IV)	Energy Management and Efficiency	3	0	0	3

Evaluation Scheme (Theory)						Evaluation Scheme (Practical)				
Mid Term Test - I	Mid Term Test - II	End Term Test	Class Participation	Additional Continuous Evaluation*	Total Marks	Mid Term Test - I	End Term Test	Class Participation	Additional Continuous Evaluation*	Total Marks
20	20	40	10	10	100	-	-	-	-	-

*Additional Continuous Evaluation: Quizzes/Assignments/Presentations/Practical Records/Mock Interviews/others

Syllabus (Theory)

- Introduction: Energy sources, energy demand and supply, Energy crisis, future scenario; Energy system efficiency; energy conservation aspects; Instrumentation and measurements.
- Principles of Energy Management and Energy Audit: General principles, planning and program; Introduction to energy audit; General methodology; Site surveys; Energy systems survey, energy audit; Instrumentation; Analysis of data and results.
- Heating and Cooling Management: General principles of energy managements in HVAC systems; Human comforts and health requirements; HVAC systems; Boiler and heat sources; Chillers, fans, pumps, cooling towers, Energy management opportunities; Modelling of heating and cooling loads in buildings.
- Electrical Load and Lighting Management: General principles; Illumination and human comfort; Lighting systems;
- Equipments; Energy management opportunities; Electrical systems; Electrical load analysis; Peak load controls.
- Process Energy Management: Principles; Process heat, Combustion, Automatic fuel controls; Steam generation and
- Distribution, Hot water and pumping, Furnaces and ovens; Process electricity; Compressed air; Manufacturing process;
- Energy storage for process industries; Process control.
- Integrated Building systems: General principles; Environment conformation; Passive design considerations; Building
- Envelope design consideration, Integration of building system, Energy storage-cold storage techniques, Economic analysis.
- Economic Aspects of Energy Management: General considerations; Economic analysis methods; Life-cycle costing,
- Break even analysis, benefit cost analysis, payback period analysis, present worth analysis, equivalent annual cost analysis,
- Use of computers; Management of energy with environment aspects.

Text Book(s)

1. Rural Energy Management S Kaushik, T Verma Deep and Deep Publs.
2. Energy Management W R Murphy; G Mckay B.S. Publications

Reference Book(s)

1. Renewable Energy and Energy Management S C Patra; B C Kurse; R Kataki International Book Co.
2. Operations and Maintenance Manual for Energy.

SEMINAR

Course code	Course Title	Teaching Scheme			
		L	T	P	Credits
SEM701	Seminar	0	0	4	3

S. No.	Evaluation Component	Duration (Hours)	Marks (100)	Nature of Component
1.	Presentation	Weekly	25	Open Book
2.	Report(Soft Copy)	Weekly	25	Open Book
3.	Assignment	Continuous	10	Open Book
4.	Final Presentation		20	Open Book
5.	Final Report(Hard Copy)		20	Open Book

Syllabus (Practical)

Operation Procedure

1. Student has to devote full semester for SEM701 course.
2. Student has to report to the Supervisor regularly.
3. Seminars s evaluation has to be carried out in the presence of a two member Committee comprising.
4. Experts in the relevant area constituted by the Supervisor.

Final Seminar Report to be submitted has to be in formal hard bound cover bearing of the Institute emblem.

Reference Books:

Based on literature survey to be done with peer reviewed journals and magazines.

Course code	Course Title	Teaching Scheme			
		L	T	P	Credits
HS 701	Principles of Economics	3	0	0	3

Evaluation Scheme (Theory)					
Mid Term Test - I	Mid Term Test - II	End Term Test	Class Participation	Additional Continuous Evaluation*	Total Marks*
20	20	40	10	10	100

*Additional Continuous Evaluation: Quizzes/Assignments/Presentations /Mock Interviews/others

Course Syllabi (Theory):

- Definition of Economics and role of economics in Engineering and Technology; Basic economic terms; The economy, working of an economy, kinds of an economy and its basic problems; Laws of Demand and Supply and market Equilibrium; Elasticity of demand its measurements and application, Production function and law of Variable Proportion and Law of Returns to Scale; Concepts of cost and revenue, short run and long run cost function; Profit maximization hypothesis, Price and output determination under Perfect Competition, Monopolistic competition and Monopoly.
- Measurement of macroeconomic aggregates, National Income, Consumption, saving and investment function; Macroeconomic issues: Inflation, Unemployment and Economic growth International aspects of macroeconomics; Foreign Exchange rate and Balance of payments.

Text Books:

1. T.R. Jain and M.L. Grover, "Economics for Engineers", V. K. (India) Enterprises

Reference Books:

1. D N Dwivedi "Principles of Economics", Vikas Publishing House Pvt Ltd.
2. G. Mankiew. Economics Principles and Applications. Cengage Learning

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INSTITUTE OF ENGINEERING AND TECHNOLOGY

4 Year B. Tech Programme

(Branch: Mechanical Engineering)

Batch 2014-2018

SEMESTER-EIGHT

Detailed Syllabus

&

Scheme of Examination

Course code	Course Title	Teaching Scheme			
		L	T	P	Credits
PS801	Practice School - II	-	-	-	16

Evaluation Scheme (Theory)						Evaluation Scheme (Practical)				
Mid Term Test - I	Mid Term Test - II	End Term Test	Class Participation	Additional Continuous Evaluation	Total Marks	Mid Term Test - I	End Term Test	Class Participation	Additional Continuous Evaluation *	Total Marks
-	-	-	-	-	-	-	-	-	-	-

**** Duration for practice school is Five and a half month**

Course Syllabi:

This course is for five and half months (summer and one semester) in VII or VIII Semester. The objective of this programme is to provide the students, an opportunity to work on live projects of corporate world in various fields. During this programme, they will work on real world applications of their curricula through organizational function of their choice. The students are expected to be involved directly in problem solving efforts of specific interest to the host organization. The learning of PS-I will help them in completing PS-II successfully.

Evaluation Scheme:

S. No.	Evaluation Component	Marks (100) (Weightage %)
1	Quiz-I	4
2	Quiz-II	4
3	Group Discussion-I	4
4	Group Discussion-II	4
5	Seminar-I	4
6	Seminar-II	4
7	Diary-I	4
8	Diary-II	4
9	Observation-I	4
10	Observation- II	4
11	Mid Term Evaluation (Project Report and Presentation/Viva)	20
12	Final Evaluation (Project Report and Presentation/Viva)	40

Department of Mechanical Engineering, IET, JKLU, Jaipur

Corrigendum of Course Booklet

Programme Name: B.Tech. Mechanical Engineering

Batch: 2014-18

1. Course code of Engineering Drawing 1st semester should be read as CE102.
2. Credit of course SEM701 Seminar of 7th semester should be read as 2.
3. Semester for ME141 Workshop Practice with credit 1.5 should be read as 2.
4. Semester for ME201 Engineering Practice with credit 4 should be read as 1.
5. Syllabus for ME604 Design of Machine Element – II of 6th semester should be as given below:

Course code	Course Title	Teaching Scheme			
		L	T	P	Credits
ME604	Design of machine elements-II	3	1	2	5

Evaluation Scheme (Theory)					Evaluation Scheme (Practical)			
Mid Term Test - I	Mid Term Test - II	End Term Test	Class Participation/ Additional Continuous Evaluation*	Total Marks	Mid Term Test - I	End Term Test	Class Participation/ Additional Continuous Evaluation*	Total Marks
20	20	50	10	100	20	50	30	100

*Additional Continuous Evaluation: Quizzes/Assignments/Presentations/Practical Records/Mock Interviews/others

**The ratio of weightage between Theory and Practical content will be 60%: 40%

Syllabus (Theory)

- **Design for Production;** Erogonomic and value engineering considerations in design, Role of processing in design, Design considerations for casting, forging and machining.
- **Variable Loading:** Different types of fluctuating/ variable stresses, Fatigue strength considering stress concentration factor, surface factor, size factor, reliability factor etc., Fatigue design for finite and infinite life against combined variable stresses using Goodman and Soderberg's Criterion, Fatigue design using Miner's equation, Problems.
- **Shafts**: Detailed design of shafts for static and dynamic loading, Rigidity and deflection consideration.
- **Springs:** Types of springs, Design for helical springs against tension and their uses, compression and fluctuating loads, Design of leaf springs, Surging phenomenon in springs, Design Problem. Design of Cylinder, Design of Piston, Design of Crank shaft, Design of connecting rod, Design of Crane Hook, Design of Flywheels
- **Bearings:** design of pivot and collar bearing, Selection of ball and roller bearing based on static and dynamic load carrying capacity using load-life relationship, Selection of

Bearings from manufacturer's catalogue, types of Lubrication – Boundary, mixed and hydrodynamic lubrication, Design of journal bearings using Raimondi and Boyd's Charts, Lubricants and their properties, Selection of suitable lubricants, Design Problems.

- **Gears:** Classification, Selection of gears, Terminology of gears, Force analysis, Selection of material for gears, Beam & wear strength of gear tooth, Form or Lewis factor for gear tooth,
- **Dynamic load on gear teeth** –Barth equation and Buckingham equation and their comparison, Design of spur, helical, bevel & worm gear including the Consideration for maximum power transmitting capacity, Gear Lubrication, Design Problems.

Course Syllabi (Practical):

1. Fatigue loading
2. Helical compression, tension and torsional springs design
3. Curved Beams
4. Preloaded bolts and bolts subjected to variable stresses
5. Belt, Rope and Chain drive system
6. Gear Design
7. Sliding contact bearing design
8. Anti-friction bearing selection

Text Book(s)

1. Mechanical Engg. Design- Joseph Edward Shigley-Mc Graw Hill Book Co.
2. Design of Machine Elements – V.B. Bhandari – Tata McGraw Hill, New Delhi
3. PSG Design Data Book - PSG College of Engg - PSG Publication

Reference Book(s)

1. Engineering design – George Dieter, McGraw Hill, New York.
2. Product Design and Manufacturing –: A.K.Chitale and R.C.Gupta, PHI, New Delhi.
3. Machine Design An Integrated Approach: Robert L.Norton,Second Edition –Addison Wisley Longman
4. Machine Design: S.G. Kulkarni, TMH, New Delhi.

6. Course Name of ME407 of 4th semester with credit 3 should be read as Kinematics of Machines.

7. Course Name of ME505 of 5th semester with credit 3 should be read as Production Planning & Control.
8. Course Name of ME507 of 5th semester with credit 4.5 should be read as Dynamics of Machines.
9. Course Name of PS501 of 5th semester with credit 4 should be read as Practice School-I (4-6 Weeks).
10. Course Name of MA621 of 6th semester with credit 3 should be read as Engineering Optimization (Elective-II).
11. Course Name of ME703 of 7th semester with credit 4 should be read as Power Plant Engineering.
12. Course Name of PS801 of 8th semester with credit 16 should be read as Practice School-II (16 Weeks).

Signature