



B.M.S. COLLEGE OF ENGINEERING (Autonomous), BENGALURU-19
DEPARTMENT OF INDUSTRIAL ENGINEERING & MANAGEMENT

Department Vision

To emerge as an excellent center for imparting quality higher education and generating highly proficient technical manpower to adopt to the constantly changing global scenario with professional and ethical values.

Department Mission

- Providing excellent education in curricular, co- curricular and extra-curricular activities to students.
- Facilitating to continue their education through research activities
- Catering to the needs of the Industry and society.
- Nurturing and mentoring students to acceptance by stake holders

Program Outcomes (POs)

PO 1	An ability to apply knowledge of science, computing, mathematics, and industrial engineering fundamentals appropriate to the discipline.
PO 2	An ability to analyze a problem, and identify and formulate the industrial engineering principles appropriate to its solution
PO 3	An ability to design, implement, and evaluate a computer-based industrial engineering system or/and process to meet desired needs with appropriate consideration for public health and safety, cultural, societal and environmental considerations
PO 4	An ability to design and conduct experiments using IE models and IT tools , to analyze and interpret data leading to feasible solutions
PO 5	An ability to use current techniques, modern tools and skills necessary for industrial engineering practice
PO 6	An ability to analyze the local and global impact of industrial engineering solutions on individuals, organizations, and society
PO 7	Develop a Knowledge of contemporary issues and solutions
PO 8	Develop an understanding of security, professional, ethical, legal, and social issues and responsibilities of an industrial engineer
PO 9	An ability to function effectively, individually and in a team, in diverse and multi-disciplinary environments to accomplish a common goal
PO 10	Develop an ability to communicate effectively with a range of audiences in all situations
PO 11	An understanding of engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects in a multidisciplinary environment
PO 12	Recognize the need for and an ability to engage in continuing professional development



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NOTATIONS

AY	Academic Year
AAT	Alternative Assessment Tools
BOE	Board of Examiners
BOS	Board of Studies
CBCS	Choice Based Credit System
CGPA	Cumulative Grade Point Averages
CIE	Continuous Internal Evaluation
DC	Departmental Core
GC	Group Core
HSS	Humanity and Social Science Courses
IC	Institutional Core
IE	Institutional Elective
IL	Institutional Lab.
LTPS	Lecture – Tutorial-Practical-Self Study
NFTE	Not Fit for Technical Education
PCC	Professional Core Courses
PEC	Professional Elective Courses
SEE	Semester End Examination
SGPA	Semester Grade Point Average
ST	Studio
SS	Self Study
CO	Course Outcome
PO	Program Outcome
PEO	Program Educational Objectives



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SCHEME OF INSTRUCTIONS FOR THIRD SEMESTER

Sl No	Course Code	Course Title	Credits				
			L	T	P	S	Total
1	15MA3DCMIE	HIGHER ENGINEERING MATHEMATICS	3	1	0	0	4
2	15IM3DCPT1	PRODUCTION TECHNOLOGY-I	3	0	1	2	6
3	15IM3DCSOM	STRENGTH OF MATERIALS	3	0	0	0	3
4	15IM3DCMMM	MECHANICAL MEASUREMENTS & METROLOGY	3	0	1	0	4
5	15IM3DCEES	ELEMENTS OF ENERGY SYSTEMS	3	0	0	0	3
6	15IM3GCCMD	COMPUTER AIDED MACHINE DRAWING	1	0	2	2	5
		Total	16	1	4	4	25



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III SEMESTER

Course Name	Higher Engineering Mathematics	Course Code	15MA3DCHEM
Credits	04	L – T –P–S	3-1-0-0

Prerequisites: Matrices, concepts of Trigonometry and Trigonometric formulas, methods of differentiation, methods of integration, partial derivatives, solution methods of ordinary differential equations.

Course Outcomes:

On completion of the course, the student will have the ability to:

- CO 1 Compute solution of a system of algebraic equations
- CO 2 Demonstrate an understanding to Fourier series and Fourier transforms.
- CO 3 Formulate boundary value problems involving one dimensional heat and wave equation.
- CO 4 Employ analytical techniques to solve partial differential equations with appropriate boundary conditions
- CO 5 Apply Z- transforms techniques to solve difference equations
- CO 6 Obtain the extremal of a functional.

UNIT-1

MATRICES

[9 hours]

Introduction: Elementary row transformations, Echelon form of a matrix, rank of a matrix by elementary row transformations. Consistency of system of linear equations and solution.

Solution of a system of non-homogenous equations: Gauss elimination method, LU decomposition method, Gauss-Seidel method. Eigenvalues and eigenvectors of matrices.

Reduction of a matrix to diagonal form. **(7L + 2T)**

Suggested Reading: Inverse of a matrix using Gauss-Jordan method. Largest eigenvalue and corresponding eigenvector using Rayleigh power method.

UNIT-2

FOURIER SERIES

[9 hours]

Introduction: Periodic function, Dirchlet's conditions, statement of Fourier Theorem, Fourier series of a periodic function of period $2l$, Fourier series of functions having points of discontinuity.



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Applications: Fourier series of typical waveforms -saw toothed waveform, triangular waveform, square waveform, half-wave rectifier, full wave rectifier and modified saw tooth waveform. Practical harmonic analysis. **(7L + 2T)**

Suggested Reading: Half range Fourier series, Fourier series of discrete functions, Complex Fourier series.

UNIT-3

FOURIER TRANSFORMS

[10 hours]

Infinite Fourier transform, Fourier Sine and Cosine transforms, properties, Inverse transforms, Fourier transforms of derivatives. **(7L + 3T)**

Suggested Reading: Convolution theorem, Parseval's identities and physical significance of Parseval's identities.

UNIT-4

PARTIAL DIFFERENTIAL EQUATIONS

[10 hours]

Formation of Partial differential equations-elimination of arbitrary constants, elimination of arbitrary functions. Equations of first order- The linear equation $Pp + Qq = R$ (Lagrange's partial differential equation).

Applications: One-dimensional heat equation and wave equation (without proof), various possible solutions of these by the method of separation of variables. **(7L + 3T)**

Suggested Reading: Direct integration method, method of separation of variables, D'Alembert's solution of wave equation.

UNIT-5

Z -TRANSFORMS AND CALCULUS OF VARIATIONS

[10 hours]

Z-transforms: Definition, Properties, Transforms of standard functions, Inverse transforms.

Applications: Solution of difference equations using Z- transforms.

Calculus of variations: Variation of a functional, Euler's equation, variational problems.

Applications: Hanging cable problem, Geodesics on a right circular cylinder, Brachistochrone problem. **(8L + 2T)**

Suggested Reading: Minimal surface of revolution, Geodesics of a right circular cone and sphere.

Mathematics Lab

- Solution of system of algebraic equations using Gauss Seidel method
- LU decomposition of matrices.
- Eigenvalues and eigenvectors of matrices.
- Largest and smallest eigenvalue and corresponding eigenvector of a matrix.
- Diagonalisation of matrices
- Z-transforms



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Bibliography

Text Books

1. “Advanced Engineering Mathematics”, Erwin Kreyszig, 10th edition Vol.1 and Vol.2, 2014, Wiley-India.
2. “Advanced Engineering Mathematics”, Dennis G. Zill and Cullen, 4th edition, 2011, Jones and Bartlett India Pvt. Ltd.

Reference Books:

1. “Higher Engineering Mathematics”, B.V. Ramana, 6th edition, 2007, Tata McGraw Hill.
2. “Higher Engineering Mathematics”, B.S. Grewal, 43rd edition, 2013, Khanna Publishers.

E books and online course materials

- (1) Engineering Mathematics, [K. A. Stroud](#), [Dexter J. Booth](#), Industrial Press, 2001
http://books.google.co.in/books/about/Engineering_Mathematics.html?id=FZncL-xB8dEC&redir_esc=y.
- (2) Advanced Engineering Mathematics, P. V. O’Neil, 5th Indian reprint, 2009, Cengage learning India Pvt. Ltd.

Online Courses and Video Lectures:

- (1) <http://ocw.mit.edu/courses/mathematics/> (online course material)
- (2) <http://nptel.ac.in/courses.php?disciplineId=111>
- (3) <https://www.khanacademy.org/>
- (4) E-learning: www.vtu.ac.in
- (5) <https://www.class-central.com/subject/math> (MOOCS)

On completion of the course students will be able to:

Course Code	CO#	COURSE OUTCOME (CO)	PO	Bloom’s level
	CO 1	Compute solution of a system of algebraic equations.	2, 3	2, 3
	CO 2	Determine whether a given system is stable or unstable.	2, 3	2, 3
	CO 3	Express given functions to form Fourier series.	2, 3, 4	2, 3, 4
	CO 4	Demonstrate an understanding of Fourier transforms techniques	2, 3, 4	2, 3, 4
	CO 5	Employ analytical techniques to solve partial differential equations with appropriate boundary conditions	2, 3, 4	2, 3, 4
	CO 6	Apply Z- transforms techniques to solve difference equations.	2, 3	2, 3
	CO 7	Use calculus of variations to find the extremal of a functional	2, 3	2, 3



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Question Paper Pattern

1. Each unit consists of one full question.
2. Each full question consists of three or four subdivisions.
3. Five full questions to be answered.
4. Internal choice in unit-3 and unit-5

Assessment:

- Each unit consists of one full question.
- Each full question consists of three or four subdivisions.
- Five full questions to be answered.
- To set one question from Units 1, 2, 5 and two questions from Unit 3 and Unit 4

Questions for CIE and SEE will be designed to evaluate the various educational components (Blooms taxonomy) such as:

- Remembering and understanding the course contents (weightage: 40%)
- Applying the knowledge acquired from the course (weightage: 35%)
- Analyzing various engineering problems (weightage: 15%)
- Understanding of various system models (weightage: 5%)



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III SEMESTER

Course	PRODUCTION TECHNOLOGY - I	Course Code	15IM3DCPT1
Credits	06	L -T – P-S	3 -0- 1-2

PRE-REQUISITES: NIL

Unit- 1

Theory of Metal Cutting:

Single point cutting tool nomenclature, Merchant's circle diagram and analysis, Ernst Merchant's solution, shear angle relationship, problems of Merchant's analysis, tool wear and tool failure, tool life, effects of cutting parameters on tool life, tool failure criteria, Taylor's tool life equation, problems on tool life evaluation.

07Hrs.

Cutting tool materials:

Types of cutting tool materials HSS, carbides coated carbides, ceramics

02Hrs.

Cutting fluids:

Desired properties, types and selection, Heat generation in metal cutting, factors affecting heat generation, Heat distribution in tool and W/P, Measurement of tool tip temperature.
Desired properties of Cutting tool materials

02Hrs.

Unit-2

Production Lathe: Classification of Lathes, Capstans & Turret lathes-Constructional features. Tool and work holding devices, Tool layout. **04Hrs.**

Shaping, Slotting and planning machines:

Classification, constructional features of shaping m/c, slotting m/c, planning m/c. driving mechanisms of shaping, slotting and planning machines. Operations done on shaping machine, slotting machine and planning machine. Calculation of machining time. **04Hrs.**

Drilling machines:

Classification, constructional features of Drilling Machines. Drilling & related operations, types of drill & drill bit nomenclature, drill materials. Calculation of machining time.

03Hrs.

Unit- 3

Milling machines:

Classification, constructional features, milling cutters nomenclature. Milling operations, up milling and down milling concepts. Calculation of machining time. **02Hrs.**

Indexing:

Simple, compound, differential and angular indexing calculations, Simple numerical on indexing. **04Hrs.**

Unit- 4

Grinding:

Types of abrasives, bonding process, classification, constructional features (cylindrical and surface grinding, center less grinding), selection of grinding wheel. **01Hr.**



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Laping and Honing:

Construction, applications, Principles of operation.

01Hr.

Non-traditional machining processes:

Principle, need, equipment, operation and LBM, plasma arc machining, Electro chemical machining, ultrasonic machining, abrasive let machining, water jet machining.

04Hrs.

Unit- 5

Rapid Prototyping:

Introduction: Need for the compression in product development, history of RP systems, Survey of applications, Growth of RP industry, and classification of RP systems.

Stereo Lithography Systems, Selective Laser Sintering and Fusion Deposition Modeling:

Principle, Process parameter, Process details, Data preparation, data files and machine details, Application.

06Hrs.

MACHINE SHOP LAB.

Preparation of three models on lathe involving: Facing, Plain turning, Taper turning, Step turning, Thread cutting, Knurling, Drilling, Boring, Internal Thread cutting and Eccentric turning.

Cutting of “V” Groove/ Dovetail / Rectangular groove: Using Shaping Machine, Cutting of Gear Teeth Using Milling Machine. Demonstration on Grinding Machine.

Text Books:

1. **Workshop Technology**, Hazra Choudhry, Vol -II, Media Promoters & Publishers Pvt. Ltd. 2004, ISBN-81-85099-15-4
2. **Production Technology**, R.K.Jain, Khanna Publications, 2003. ISBN 8174090991, 9788174090997
3. **Stereo Lithography and other RP & M Technologies** – Paul F. Jacobs – SME NY 1996.

Reference Books:

1. **Production technology**, HMT, Tata McGraw Hill, 2001.ISBN-978-0-07-096443-3
2. **Fundamentals of Metal Machining and Machine Tools**, G. Boothroyd, McGraw Hill, 2000,ISBN-13-978-57444-659-3,
3. **Workshop Technology**, N.W.A.J. Chapman ,Vol.II., CBS Publications, 2005, ISBN-10:8123904010, ISBN-13:978-8123904016

MOOCS

1. <http://nptel.ac.in/courses/112105126/>
2. <http://nptel.ac.in/courses/112105127/>
3. <https://www.class-central.com/subject/>

COURSE OUTCOMES

CO1	To understand different types of machine tools and their mechanism, types, applications and operations
CO2	Ability to solve machining time, tool life, indexing problems
CO3	Ability to understand failure criteria, heat generation & distribution, selection of cutting fluids
CO4	To understand the principles, advantages and limitations of Non-conventional machining and Rapid Prototyping



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Assessment of Self Study:

Student group of 5 members to submit following assignments on Rapid Prototyping at the end of the course.

1. Creation of CAD model of component
2. Conversion of CAD model to STL format
3. Slicing the STL file into thin cross section layers
4. Construction of the model one layer at a time
5. Cleaning and finishing the model
6. Documentation and report submission

Scheme of examination: One question from each unit and choice from Unit 1 and 2.

ASSESSMENT:

Continuous Internal Evaluation (CIE) includes mid-term tests, weekly/fortnightly class test, homework assignments, problem solving, group discussions quiz, seminar, mini-project and other Alternate Assessment Tools (AAT) prescribed by the faculty handling a course prior to beginning of the classes.

Semester End Examination(SEE)-a written examination for theory courses and practical/design examination with built-in oral part (Viva Voice).

Both CIE and SEE have equal (50:50) weightages. The student's performance in a course shall be judged individually and together based on the results of CIE and SEE.



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III SEMESTER

Course	STRENGTH OF MATERIALS	Course Code	15IM3DCSOM
Credits	03	L-T-P-S	3-0-0-0

PRE-REQUISITES : NIL

Unit – 1

Simple stress and strain: Introduction, stress, strain, mechanical properties of materials, Linear elasticity, Hooke's Law and Poisson's ratio, Stress-Strain relation – behavior in Tension for Mild steel and nonferrous metals. Extension / Shortening of a bar, bars with cross sections varying in steps, Total elongation of tapering bars of circular cross section . Principle of super position, Elongations due to self-weight for constant cross section, simple shear stress, shear strain, elastic constants and their relations, volumetric strain.

Compound bars: General Introduction, plane stress, stresses on inclined sections, General two dimensional stress system, principal stresses and maximum shear stresses, Mohr's circle for plane stress.

12Hrs.

Unit - 2

Bending moment and Shear force in beams: Introduction, Types of beams, loads and reactions, shear forces and bending moments, rate of loading, sign conventions, relationship between shear force and bending moments, shear force and bending moment diagrams for different beams subjected to concentrated loads, uniformly distributed load and couple for different types of beams.

06Hrs.

Unit - 3

Bending and shear stresses in beams: Introduction, theory of simple bending, assumptions in simple bending, relationship between bending stresses, radius of curvature and bending moment, moment carrying capacity of a section, Shear stress diagram for rectangular, symmetrical I and T section (composite / fletched beams not included). Derivation of Euler Bernoulli deflection equation only.

10Hrs.

Unit - 4

Torsion of circular shafts: Introduction, pure torsion, assumptions, derivation of torsional equations, polar modulus, torsional rigidity / stiffness of shafts, power transmitted by solid and hollow circular shafts.

06Hrs.

Unit - 5

Thick and thin cylinders: Stresses in thin cylinders, changes in dimensions of cylinder (diameter, length and volume), Thick cylinders subjected to internal and external pressures (Lame's equation), (compound cylinders not included).

Columns and Struts: Introduction: Euler's formula for critical load of columns for different end conditions, limitations of Euler's theory, Rankine's formula. No derivation, No Numerical.

06Hrs.

Text Books:

1. **Strength of Materials**, B.C Punmia, Ashok Jain, Arun Jain, Lakshmi Publications, New Delhi. 3rd Edition, 2002
2. **Elements of Strength of Materials**, Timoshenko and Young- Published by Affiliated East- West Press, 1962
3. **Strength of Materials**, Ramamrutham, Dhanpath Rai Publishers, 2008.



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Reference Books:

1. **Mechanics of Solids**, Mubeen, Pearson Edu. India, 2002
2. **Strength of Materials**, W.A. Nash, Schaum's Outline Series, Fourth Edition-2007
3. **Mechanics of materials**, S.I. Units, Ferdinand Beer & Russell Johnstan, TATA McGrawHill-2003.
4. **Strength of Materials**, L. S. Srinath, Prakash Desai & Ananth Ramu TMH Publishers, Chennai, 2008.
5. **Elements of Strength of Materials** Timoshenko and Young, Published by Affiliated East-West Press, 1962

E-books:

1. <http://engineeringebookstore.blogspot.in/2013/07/som-strength-of-materials.html>
2. http://free-onlineebooks.blogspot.in/2014/11/download-bc-punmia-strength-of_29.html

MOOCS:

1. <http://nptel.ac.in/courses/Webcourse-contents/IIT-ROORKEE/strength%20of%20materials/homepage.htm>
2. <http://www.onesmartclick.com/engineering/strength-of-material.html>
3. <https://www.class-central.com/subject>

Scheme of examination: One Question from Unit 2, 4, 5 & two questions from unit 1 & 3.

COURSE OUTCOMES

CO 1	Understand the concepts and principles applied to members under various loadings and the effects of these loadings
CO 2	Analyze and design structural members subjected to stresses.
CO 3	Analyze columns and pressure vessels under various loadings
CO 4	To design machine parts and structures to prevent failure.

ASSESSMENT:

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III SEMESTER

Course	MECHANICAL MEASUREMENTS AND METROLOGY	Course Code	15IM3DCMMM
Credits	04	L-T-P-S	3-0-1-0

PRE-REQUISITES: NIL

Unit- 1

Introduction to metrology: definition, types, need of inspection, terminologies, and methods of measurement, selection of instruments, measurement errors, units, measurement standards, calibration.

Comparators: Introduction, features, classification, Mechanical comparators, sigma comparators, electrical and electronic comparators, Solex pneumatic gauge, microscope.

Limits, fits and gauges: Limits, fits, tolerance and allowance, theory of limits and fits and their selection, hole basis and shaft basis system, Indian standard system of limits and fits, simple problems. Interchangeability, selective assembly, limit gauges, Taylor's principle of limit gauging, plug gauges, ring gauges. **10Hrs.**

Unit- 2

Measurement of screw threads and gears: Measurement of various elements of threads, major, minor and effective diameter, measurement of pitch, gear inspection, measurement of tooth thickness, gear tooth caliper, Parkinson's gear tester. **06Hrs.**

Unit-3

Measurement of surface finish: Representation of surface finish as per BIS- methods of measuring surface finish: comparison method and direct instrument measurement- surface inspection by comparison methods: touch inspection, visual inspection, scratch inspection, microscopic inspection, and comparison with standard specimen, surface photographs-Direct instrument measurement: stylus probe instruments. **06Hrs.**

Unit- 4

Transducers: introduction, primary and secondary transducers, classifications of transducers, mechanical transducers: thermal (thermocouple, bimetallic, temp-stik) elastic members: bourdon tube, diaphragm. Electrical transducers: active and passive transducers, piezo-electric transducers (modes of operation of piezoelectric crystals and uses) **08Hrs.**

Unit- 5

Measurement and measurement system: definition, significance of measurement, generalized measurement system, definitions and concept of accuracy, precision, calibration, threshold, sensitivity, hysteresis, repeatability, linearity, loading effect, system response-times delay. Errors in measurements, classification of errors.

Pressure measurement: elastic pressure transducers viz. Bourdon tubes, diaphragm, bellows and piezoelectric pressure sensors, high pressure measurements, bridge man gauge. Vacuum measurement: vacuum gauges viz. McLeod gauge.

Temperature measurement: electrical methods of temperature measurement resistance thermometers, thermistors and thermocouples, pyrometer. **10Hrs.**



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LAB EXPERIMENTS

1. Calibration of Pressure Gauge
2. Calibration of Thermocouple
3. Calibration of LVDT
4. Calibration of Load cell
5. Determination of modulus of elasticity of a mild steel specimen using strain gauges.
6. Measurements using Optical Projector / Toolmaker Microscope.
7. Measurements of angle using Sine Center / Sine bar / bevel protractor
8. Measurements of cutting tool forces using
 - a) Lathe tool Dynamometer
 - b) Drill tool Dynamometer.
9. Measurements of gear tooth profile using gear tooth Vernier /gear tooth micrometer.
10. Calibration of micrometer using slip gauges

Text Books:

1. **Mechanical measurements**, Beckwith Marangoni and Lienhard, Pearson Education, 6th Ed, 2006.
2. **Engineering Metrology**, R.K.Jain, Khanna Publishers, 1994.
3. **A course in Mechanical Measurements and Instrumentation**, A K Sawhney, J.C Kapur Publishers, 3rd Ed., 1989.

Reference Books:

1. **Engineering Metrology**, I.C.Gupta, DhanpatRai Publications, Delhi
2. **Measurements Systems**, Applications & Design, Ernen O Dobeblein, 5TH ed.
3. **Industrial Instrumentation**, Alsutko, Jerry. D.Faulk, Thompson Asia Pvt. Ltd.2002.
4. **Mechanical Measurements**, R.S. Shirohi& H.C. Radhakrishna, 3rd Ed., New Age Intl. Pvt Ltd.

MOOCS :

- 1) www.nptel.ac.in/courses/112106138/
- 2) www.nptel.ac.in/courses/112106139/
- 3) <https://www.class-central.com/subject/>

COURSE OUTCOMES:

CO 1	Is able to understand the concepts of metrology, various standards that are in practice and their applications. Learns about comparators and their use in different contexts, Indian standard system of limits and fits practiced in the manufacturing of products.
CO 2	will possess the knowledge of terminology of Screw threads and Gears. Will be able to measure the different elements of screw threads and gears using different instruments.
CO 3	is able to know understand the meaning of surface finish, BIS- methods of measuring surface finish, is able to use the instruments to assess the surface finish.
CO 4	will possess the knowledge transducers and their types, advantages, and usage of transducers for different applications.
CO 5	is able to understand the concept of measurement and the measurement system, error in measurement, pressure and its measurement using different instruments, temperature and its measurement using different Instruments.



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Scheme of Examination: One question from unit 2,3 & 4 and 2 questions from unit 1 & 5.

ASSESSMENT:

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Course Title	ELEMENTS OF ENERGY SYSTEMS	Course Code	15IM3DCEES
Credits	03	L -T – P-S	3 -0- 0-0

III SEMESTER

PRE-REQUISITES: NIL

UNIT - 1

BASICS OF THERMODYNAMICS

Systems, zeroth law, first law - concept of internal energy and enthalpy- applications to closed and open systems - second law - concept of entropy - Clausius inequality. **08 Hrs.**

UNIT- 2

CYCLES AND SYSTEMS

Otto, Diesel and Brayton cycles. IC engines - 4 stroke and 2 stroke engines - brake power - efficiencies - heat balance test - simple problems only. Properties of steam - use of steam tables and Mollier diagram - Rankine cycle – simple problems. **08Hrs.**

UNIT- 3

REFRIGERATION AND AIR CONDITIONING SYSTEMS

Vapour compression refrigeration systems - COP - simple problems – basics and types of air conditioning systems. Reciprocating compressors – volumetric efficiency - power required - simple problems - rotary compressors. Heat transfer - modes of heat transfer - simple problems on conduction-composite wall, cylinder and sphere - convection - flow over flat plate-and radiation. **08Hrs.**

UNIT- 4

BASICS OF FLUID MECHANICS

Introduction - properties of fluid - density, viscosity, pressure and velocity – types of fluid flow - continuity equation - energy - head of fluid - Euler's equation - Bernoulli's equation, flow through pipes - Hagen Poiseulli's law - major and minor losses. **08Hrs.**

UNIT- 5

FLUID MEASUREMENTS

Flow measurements - orifice meter, venturimeter- Rota meter and elbow meter. Pressure measurement - total and static pressure measurements using Pitot tube, manometer, mechanical gauges. Velocity measurements – different types. **08Hrs.**

TEXT BOOKS:

1. **Fluid Mechanics**, Dr.R.K.Bansal, Lakshmi Publications.
2. **Basic & Applied Thermo Dynamics**, Nag P. K. Tata McGraw Hill Co. Ltd., India, 2002.

REFERENCE BOOKS:

1. **Thermal Engineering**, Sarkar B. K, Tata McGraw Hill Co. Ltd., India, 2005.
2. **Fluid Mechanics and Hydraulic Machines**, Rajput R.K. S.Chand& Co., India 2008.
3. **Engineering Thermo Dynamics**, Nag P.K Tata McGraw Hill Co. Ltd., India, 2005.
4. **Thermal Engineering**, Rajput R.K, Laxmi Publications (P) Ltd., New Delhi, Edition. 2010.



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5. **Fluid Mechanics and Fluid Power Engineering**, Kumar D.S, S.K.Kataria & Sons Publishers, India, 6th Edition, 2003.

MOOCS :

1. https://www.edx.org/course/iitbombayx/iitbombayx-me209x-thermodynamics-1384#.U8aBL_mSx8E
2. <https://www.coursera.org/course/introthermodynamics>
3. <https://www.coursera.org/course/thermodynamics>
4. <https://www.class-central.com/subject/>

COURSE OUTCOMES

CO 1	Be able to understand the basic concepts of thermodynamics and describe energy exchange processes in terms of various forms of energies like heat and work in the systems.
CO 2	Be able to state the First Law for a closed system, open system and apply the steady flow energy equation to a system of thermodynamic components (heaters, coolers, pumps, turbines etc.) to estimate required balances of heat, work and energy flow.
CO 3	Be able understand the Second Law of Thermodynamics- Heat engines and Refrigerators, Reversible and irreversible processes, Carnot cycle and Entropy.
CO 4	Is able to acquire the knowledge of types of fluids, properties and their characteristics. Will know how to measure the pressure of a fluid at a point will have the knowledge of gauge, absolute and vacuum pressure.
CO 5	Is able to learn about the use of manometers for pressure measurement, pressure of the fluid in static condition on immersed surfaces. Will learn about the concepts of buoyancy and floatation, and the conditions for the body to be in equilibrium.
CO 6	Is able to learn about the kinematics of fluid flow, rate of discharge, and types of fluid flow.

Scheme of Examination: One question from each unit and choice in unit-1 and unit-4

ASSESSMENT:

Continuous Internal Evaluation (CIE) includes mid-term tests, weekly/fortnightly class test, homework assignments, problem solving, group discussions quiz, seminar, mini-project and other Alternate Assessment Tools (AAT) prescribed by the faculty handling a course prior to beginning of the classes.

Semester End Examination(SEE)-a written examination for theory courses and practical/design examination with built-in oral part (Viva Voice).

Both CIE and SEE have equal (50:50) weightages. The student's performance in a course shall be judged individually and together based on the results of CIE and SEE.



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III SEMESTER

Course	COMPUTER AIDED MACHINE DRAWING	Course Code	15IM3GCCMD
Credits	05	L-T-P-S	1-0-2-2

PRE-REQUISITES: NIL

Unit- 1

Sections of Solids: Sectioning, Sectional view, Representation of section plane, Hatching, Sectioning of engineering objects like: Square, Pentagonal, Hexagonal prisms, Square, Hexagonal pyramids, Cylinder, Cone and Tetrahedron (Direct and indirect method). **08Hrs.**

Unit- 2

3D Modeling from Orthographic views: Given the 2 or 3 views of a machine component, Generation of the object in 3D environment using software. (**Assignment** - Drawing sheets from industries will be supplied to the group of students and to analyze and create the product using software) **08Hrs.**

Unit- 3

Threaded Fasteners: Thread terminology, sectional views of threads.ISO Metric (Internal & External) BSW (Internal & External) square and Acme. Sellers thread, American Standard thread. Etc.

Fasteners: Hexagonal headed bolt and nut with washer (assembly), square headed bolt and nut with washer (assembly), Proportions for square and hexagonal headed bolts & nuts, simple assembly using stud bolts with nut and lock nut. Flanged nut, slotted nut, taper and split pin for locking, counter sunk head screw, grub screw, Allen screw. **04Hrs.**

Unit- 4

Joints: Assembly of Socket and Spigot cotter joint, Pin or Knuckle joint, protected type flanged coupling, Universal coupling. **08Hrs.**

Unit- 5

Assembly Drawings: Screw jack, Machine vice, Plummer block, Tail stock, Steam stop valve, Ram's bottom safety valve, and simple eccentric. **24Hrs.**

REFERENCES :

Text books:

1. **Machine Drawing**, K.R.Gopalkrishna, 20th Edition, Subhas stores, 2007.
2. **Computer Aided Machine Drawing** , K.R.Gopalkrishna, A.S.Ravindra, Revised Edition, ISBN978-93-83214-81-5,2017

Reference Book:

1. **Machine Drawing with Auto CAD**. Goutam Pohit & Goutham Ghosh, 1st Indian print Pearson Education, 2005.
2. **Auto CAD 2006, for Engineers and Designers**. Sham Tickoo Dream tech 2005.
3. **Machine Drawing**, Sri N.D.Bhat &V.M.Panchal, 42nd Edition, Charotar Publishing House, 2007



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4. **Machine Drawing**, N. Siddeshwar, P. Kanniah, V.V.S. Sastri, published by Tata McGraw Hill, 2006

MOOCS :

- 1) <http://nptel.ac.in/courses/112104172/1>,
- 2) <https://www.class-central.com/subject/>

COURSE OUTCOMES

CO 1	Able to draw different sectional views of engineering objects.
CO 2	Able to draw orthographic views of objects and assemble into 3-D views using software.
CO 3	Able to differentiate between different types of threaded fasteners and joints
CO 4	Able to assemble various engineering assembly drawings.

Scheme of Examination:

Test 1 - covering the syllabus from Unit 1 and 2.

Test 2 - covering syllabus from Unit 3, 4 and 5 (manual drafting).

SEE: One question from unit 1 for 20 marks
One question from unit 4 for 20 marks
One question from unit 5 for 60 marks

Assessment of Self Study:

2D Drawing sheets from Industry will be provided to the group of students to study and create the 3D solid models using software.

ASSESSMENT:

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