		L	T	P	C
1901MA104	**MATHEMATICS –I (LINEAR ALGEBRA, CALCULUS AND PARTIAL DIFFERENTIATION)**	**3**	**2**	**0**	**4**

(Common for ECE, MECH & BME Programme)

MODULE I MATRICES **12 Hours**

Inverse and rank of a matrix - rank-nullity theorem - System of linear equations – Symmetric-skew-symmetric and orthogonal matrices – Determinants - Eigen values and Eigen vectors-Diagonalization of matrices- Cayley-Hamilton Theorem - Orthogonal transformation.

MODULE II DIFFERENTIAL CALCULUS **12 Hours**

Curvature in Cartesian co-ordinates – Centre and radius of curvature – Circle of curvature- Evolutes and involutes.

MODULE III INTEGRAL CALCULUS **12 Hours**

Double integration – Cartesian and polar coordinates – Change the order of Integration – Applications: Area of a curved surface using double integral – Triple integration in Cartesian co-ordinates – Volume as triple integral.

MODULE IV SEQUENCES AND SERIES **12 Hours**

Convergence of sequence and series-Tests for convergence - Power series - Taylor's series,
Series for exponential - trigonometric and logarithm functions.

MODULE V PARTIAL DIFFERENTIATION **12Hours**

Partial derivatives, total derivative; Maxima, minima and saddle points; Method of Lagrange multipliers.

TOTAL: 60 HOURS

REFERENCES:

1. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2018.
2. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
3. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons,2006.
4. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
5. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
6. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
7. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010

		L	T	P	C
1901PH101	**INTRODUCTION TO MECHANICS (Common for Civil and Mech Programme)**	**3**	**0**	**0**	**3**

MODULE I INTRODUCTION TO MECHANICS **9 Hours**

Forces in Nature; Newton's laws and its completeness in describing particle motion- Solving Newton's equations of motion in polar coordinates and related problems

MODULE II VECTOR MECHANICS OF PARTICLES **9 Hours**

Central forces: Conservation of Angular Momentum; Energy equation and energy diagrams - Elliptical, parabolic and hyperbolic orbits - Application: Satellite manoeuvres.

Five-term acceleration formula — Centripetal and Coriolis accelerations - Applications: Weather systems, Foucault pendulum - Harmonic oscillator - Damped harmonic motion.

MODULE III RIGID BODY MECHANICS **18 Hours**

Definition and motion of a rigid body in the plane - Rotation in the plane; Kinematics in a coordinate system rotating and translating in the plane - Angular momentum about a point of a rigid body in planar motion.

Euler's laws of motion, their independence from Newton's laws, and their necessity in describing rigid body motion – Examples - Introduction to three-dimensional rigid body motion — (a) Angular velocity vector, and its rate of change and (b) Moment of inertia tensor

MODULE IV STATICS **9 Hours**

Free body diagrams with examples on modelling of typical supports and joints; Condition for equilibrium in three- and two- dimensions; Friction: limiting and non-limiting cases.

REFERENCES:

1. Engineering Mechanics, 2nd ed. — MK Harbola
2. Introduction to Mechanics — MK Verma
3. An Introduction to Mechanics — D Kleppner & R Kolenkow
4. Principles of Mechanics — JL Synge & BA Gri*ths*
5. Mechanics — JP Den Hartog
6. Engineering Mechanics - Dynamics, 7th ed. - JL Meriam
7. Mechanical Vibrations — JP Den Hartog
8. Theory of Vibrations with Applications — WT Thomson

BASIC ELECTRICAL AND ELECTRONICS ENGINEERING **L T P C**

1901GEX01

3 0 0 3

MODULE I INTRODUCTION TO DC AND AC CIRCUITS **7 Hours**

Introduction to DC and AC circuits: Ohms law - Kirchhoff's laws - Mesh analysis - Nodal analysis - Generation of AC waveforms - Analysis of R-L, R-C, R-L-C circuits - Introduction to three phase systems - Types of connections.

MODULE II ELECTRICAL MACHINES **6 Hours**

Electrical Machines: DC Generator, DC Motor, Transformer, Induction Motor: Working principle, construction and applications.

MODULE III MEASURING INSTRUMENTS **6 Hours**

Measuring instruments: Classification of instruments; Voltmeter, Ammeter, Wattmeter, Energy meter, Multimeter, CRO: Principles and operation.

MODULE IV SEMICONDUCTOR DEVICES **7 Hours**

Semiconductor devices: V-I characteristics of PN junction diode and Zener diode; Rectifiers - Half wave and full wave rectifiers; BJT - configurations; Amplifiers & Oscillators: classification, operation and applications; SCR: Construction and V-I characteristics; Basic power converters (Block diagram approach only).

MODULE V DIGITAL SYSTEMS **6 Hours**

Digital systems: Boolean algebra - Reduction of Boolean expressions - De-Morgan's theorem - Logic gates - Implementation of Boolean expressions.

MODULE VI COMMUNICATION SYSTEMS **6 Hours**

Communication Systems: Model of communication system - Analog and digital, Wired and wireless channel - Block diagram of various communication systems - Microwave, satellite, optical fiber and cellular mobile system.

MODULE VII ELECTRICAL SAFETY AND WIRING **7 Hours**

Electrical safety and wiring: Safety measures in electrical system - Safety devices - types of wiring - Wiring accessories- staircase, fluorescent lamps and corridor wiring - Basic principles of earthing - Types of earthing - layout of generation, transmission and distribution of power (Single line diagram).

TOTAL: 45 HOURS

REFERENCES:

1. Smarajit Ghosh, "Fundamentals of Electrical and Electronics Engineering", 2nd Edition, PHI Learning, 2010.
2. R. Muthusubramaniam, S. Salaivahanan and K.A. Mureleedharan, "Basic Electrical Electronics and Computer Engineering",Tata McGraw Hill, 2004.
3. D.P. Kothari and I.J. Nagrath, "Theory and Problems of Basic Electrical Engineering", PHI learning, New Delhi, 2004
4. J.B. Gupta, "Fundamentals of Electrical Engineering and Electronics", S.K. Kataria and Sons, Reprint 2012 Edition.
5. R.L. Boylestad and L. Nashelsky, "Electronic Devices and Circuit Theory", Pearson, 11th Edition, 2013.
6. George Kennedy and Bernard Davis, "Kennedy's Electronic communication Systems", McGraw Hill Education, 5th Edition, 2011.
7. Donald P. Leach, Albert Paul Malvino and Goutam Saha, "Digital Principles and Applications", McGraw-Hill Education, 8th Edition, 2014.

1901GEX02	ENGINEERING GRAPHICS **(Common for all B.E./B.Tech. Programme)**	L	T	P	C
		2	0	2	3

MODULE I CONCEPTS AND CONVENTIONS (Not for Examination)

Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.

MODULE II PLANE CURVES AND FREE HAND SKETCHING 9 Hours

Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves.

Visualization concepts and Free Hand sketching: Visualization principles –Representation of Three- Dimensional objects – Layout of views- Free hand sketching of multiple views from pictorial views of Objects.

MODULE III PROJECTION OF POINTS, LINES AND PLANE SURFACES 9 Hours

Orthographic projection- principles-Principal Planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and traces. Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

MODULE IV PROJECTION OF SOLIDS 9 Hours

Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one of the principal planes by rotating object method.

MODULE V PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES 9 Hours

Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones.

MODULE VI ISOMETRIC AND PERSPECTIVE PROJECTIONS 9 Hours

Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions and miscellaneous problems. Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method.

TOTAL: 45 HOURS

REFERENCES:

1. Gopalakrishna K.R., “Engineering Drawing” (Vol. I&II combined), Subhas Stores, Bangalore,2016.
2. Luzzader, Warren.J. and Duff,John M., “Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
3. Shah M.B., and Rana B.C., “Engineering Drawing”, Pearson, 2nd Edition, 2015.
4. Venugopal K. and Prabhu Raja V., “Engineering Graphics”, New Age International (P) Limited, 2017.
5. Natrajan K.V., “A text book of Engineering Graphics”, Dhanalakshmi Publishers, Chennai, 2015.
6. Basant Agarwal and Agarwal C.M., “Engineering Drawing”, Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.
7. Bhatt N.D. and Panchal V.M., “Engineering Drawing”, Charotar Publishing House, 50th Edition, 2016.

1901GEX51	CAD (COMPUTER AIDED DRAFTING) LAB (Common for all B.E./B.Tech. Programme)	L 0	T 0	P 2	C 1

List of Experiments:

Basics commands of a CAD software- two-dimensional drawing, editing, layering and dimensioning - coordinate Systems-Drawing practice - orthographic views of simple solids using CAD software.

1. Study of capabilities of software for Drafting and Modeling – Coordinate systems (absolute, relative, polar, etc.) – Creation of simple figures like polygon and general multi-line figures.
2. Drawing of a Title Block with necessary text and projection symbol.
3. Drawing of curves like parabola, spiral, involute using B-spline or cubic spline.
4. Drawing of front view and top view of simple solids like prism, pyramid, cylinder, cone, etc, and dimensioning.
5. Drawing front view, top view and side view of objects from the given pictorial views (eg. V-block, Base of a mixie, Simple stool, Objects with hole and curves).
6. Drawing sectional views of prism, pyramid, cylinder, cone, etc,
7. Drawing isometric projection of simple objects.
8. Creation of 3-D models of simple objects and obtaining 2-D multi-view drawings from 3-D model.

Total: 45 Hours

References:

1. N.D. Bhatt, Machine Drawing, Charotar Publishing House Pvt. Ltd., 2014.
2. P.S. Gill, A Textbook of Machine Drawing, Katson books, 2013.
3. R.K. Dhawan, A Textbook of Machine Drawing, S. Chand,2012.
4. K.C. John, Textbook of Machine Drawing, PHI Learning Pvt. Ltd.,2009.

1901GEX53	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORY (Common for all B.E./B.Tech. Programme)	L	T	P	C
		0	0	2	1

List of Experiments:

1. Experiments related to verification of Ohm's law and Kirchhoff's laws
2. Experiments involving logic gates
3. Fan and light control using regulators
4. Design of 6V regulated power supply
5. Energy conservation demonstration experiment using energy meter
6. Waveform generation and calculation of rms and average values
7. IC 555 and IC 741 based experiments
8. Experiments in earthing
9. Staircase wiring and residential building wiring
10. Speed control of DC shunt motor

Total: 45 Hours

References:

1. Edward Hughes, " Electrical Technology,", Pearson Education
2. D.P. Kothari and Nagrath " Basic Electronics",MH Education 2013.
3. Paul Scherz and Simon Monk "Practical Electronics for inventors" Mc Graw Hill Publications 2013.

1901PHX51	ENGINEERING PHYSICS LAB (Common for all B.E./B.Tech. Programme)	L	T	P	C
		0	0	2	1

List of Experiments:

1. Determination of wavelength of various colours of mercury spectrum using Laser grating
2. Determination of velocity of liquids using ultrasonic interferometer
3. Determine the dispersive power of a prism using spectrometer
4. Determine the unknown resistance of the given wire using Carey-Foster's Bridge
5. Determine the band gap of the given semiconductor
6. Determine the acceptance angle and particle size using Laser
7. Torsional pendulum – Rigidity modulus of a steel wire
8. Thickness of a thin wire – Air Wedge
9. Measurement of Young's modulus – Uniform and Non-uniform bending
10. Thermal conductivity –Lee's Disc method

Total: 45 Hours

References:

1. 'Practical Physics', R.K. Shukla, Anchal Srivastava, New age international (2011)
2. 'B.Sc. Practical Physics', C.L Arora, S. Chand &Co. (2012)

1901HS151	COMMUNICATION SKILLSLAB (Common for all B.E./B.Tech. Programme)	L	T	P	C
		0	0	2	1

List of Experiments:

1. Activities on Fundamentals of Inter-personal Communication

Starting a conversation - responding appropriately and relevantly - using the right body language - Role Play in different situations & Discourse Skills- using visuals.

2. Activities on Reading Comprehension

General Vs Local comprehension, reading for facts, guessing meanings from context, Scanning, skimming, and inferring meaning, critical reading & effective googling.

3. Activities on Writing Skills

Structure and presentation of different types of writing - letter writing/ Resume writing/e-correspondence/ Proposal writing/Technical report writing/ Portfolio writing - planning for writing - improving one's writing.

4. Activities on Presentation Skills

Oral presentations (individual and group) through JAM sessions / seminars / PPTs and written presentations through posters/ projects/ reports/ e-mails/ assignments etc.- creative and critical thinking.

5. Activities on Soft Skills

Dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and organization of ideas and rubrics for evaluation-Concept and process, pre-interview planning, opening strategies, answering strategies, interview through tele-conference & video-conferencing and Mock Interviews-Timemanagement-stress management –paralinguistic features- Multiple intelligences – emotionalintelligence – spiritual quotient (ethics) – intercultural communication – creative and critical.

Total: 45 Hours

References:

1. Raman, Meenakshi and Sangeetha Sharma, “Technical Communication: Principles and Practice”, Oxford University Press, New Delhi, 2011.
2. Sudha Rani, D , “Advanced Communication Skills Laboratory Manual” , Pearson Education 2011.
3. Paul V. Anderson ,“Technical Communication”,. Cengage Learning pvt. Ltd. New Delhi, 2007.
4. “English Vocabulary in Use series”, Cambridge University Press 2008.
5. “Management Shapers Series” ,Universities Press (India) Pvt Ltd., Himayatnagar, Hyderabad 2008.
6. Rizvi and Ashraf M., “Effective Technical Communication”, Tata McGrawHill, New Delhi, 2005.
7. Jones, D, “The Pronunciation of English”, CUP, . Cambridge,2002.

1901MA204	ENGINEERING MATHEMATICS – II	L	T	P	C
	(Calculus, Ordinary Differential Equations and Complex Variable)	3	2	0	4

MODULE I LAPLACE TRANSFORM **12 Hours**

Laplace Transform – Conditions for existence – Transform of Elementary Functions – Basic Properties – Transform of Unit step function and Impulse function – Transform of Periodic function – Inverse Laplace Transform – Convolution Theorem (excluding Proof) – Initial and Final value Theorems – Solution of Linear ODE of Second order with constant coefficient using Laplace Transform techniques.

MODULE II VECTOR CALCULUS **12 Hours**

Gradient, Divergence and Curl – Directional derivative – Irrotational and solenoidal vector fields – Vector integration: Green‟s theorem in a plane, Gauss divergence theorem and Stokes‟ theorem (excluding proofs) – Applications of the above theorems to find surface area of a closed region and volume of cube and parallel piped.

MODULE III ORDINARY DIFFERENTIAL EQUATIONS **12 Hours**

Second order linear differential equations with variable coefficients, method of variation of parameters.

MODULE IV COMPLEX VARIABLE – DIFFERENTIATION **12 Hours**

Cauchy-Riemann equations, analytic functions, harmonic functions, finding harmonic conjugate; Conformal mappings, Mobius transformations.

MODULE V COMPLEX VARIABLE– INTEGRATION **12 Hours**

Contour integrals, Cauchy Integral formula (without proof), Taylor‟s series, zeros of analytic functions, singularities, Laurent‟s series; Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine, Evaluation of certain improper integrals using the Bromwich contour.

TOTAL: 60 Hours

REFERENCES:

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
3. W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, 9th Edn., Wiley India, 2009.
4. S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984.
5. J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7th Ed., McGraw Hill, 2004.
6. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
7. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.

1901CH203	MATERIALS CHEMISTRY	L	T	P	C
		3	0	0	3

MODULE I WATER TECHNOLOGY **9 Hours**

Boiler -Boiler Types, boiler compounds - boiler troubles- Sources, hard & soft water-Degree of hardness and its estimation (EDTA method)– Water Quality Parameters. Boiler feed water-requirements - softening of hard water -external treatment –demineralization, Zeolite process internal treatment- desalination of sea water – reverse osmosis- Domestic water treatment.

MODULE II THERMODYNAMICS **9 Hours**

Thermodynamics -Introduction – terms, Entropy as a thermodynamic quantity, entropy changes in isothermal expansion of an ideal gas, reversible and irreversible processes, physical transformations, work & free energy functions, Helmholtz and Gibbs free energy functions, Gibbs-Helmholtz equation, Clapeyron-Clausius equation & its applications, Van't Hoff isotherm and applications.

MODULE III CORROSION AND PROTECTIVE COATING **9 Hours**

Corrosion And Protective Coating - Corrosion – types-chemical, electrochemical corrosion (galvanic, differential aeration) - Factors influencing corrosion -corrosion control – material selection and design aspects - electrochemical protection – sacrificial anode method and impressed current cathodic method. Protective coatings: Thermal Spray, Electroplating of gold and electroless plating of nickel. Paints - Constituents and Functions. Estimation of iron.

MODULE IV ALLOYS AND PHASE RULE **9 Hours**

Alloys And Phase Rule -Introduction- Definition- properties of alloys- significance of alloying, functions and effect of alloying elements- Nichrome and stainless steel (18/8) – heat treatment of steel. Phase rule: Introduction, definition of terms with examples, one component system -water system - reduced phase rule - thermal analysis and cooling curves - two component systems - lead-silver system - Pattinson process

MODULE V FUELS AND ENGINEERING MATERIALS **9 Hours**

Fuels And Engineering Materials-Fuel-Introduction- classification of fuels, carbonization- manufacture of metallurgical coke (Otto Hoffmann method)-Refining of petroleum- manufacture of synthetic petrol (Bergius process)- natural gas- compressed natural gas (CNG)- producer gas- water gas. Combustion- calorific value - Flue gas analysis (ORSAT Method). Fundamentals of nano chemistry, nano materials, synthesis, properties and application. Lubricants –types- application.

TOTAL: 45 Hours

REFERENCES:

1. Dara S.S, Umare S.S, ―Engineering Chemistry‖, S. Chand & Company Ltd., New Delhi 2010.
2. Sivasankar B., ―Engineering Chemistry‖, Tata McGraw-Hill Publishing Company, Ltd., New delhi 2010
3. Jain and Jain, ―Engineering Chemistry‖, Sixteenth edition, Dhanpatrai publications, 2012.
4. https://www.ccdc.cam.ac.uk/solutions/csd-system/components/csd/
5. onlinelibrary.wiley.com/doi/10.1002/9780470661345.smc107/pdf
6. https://books.google.co.in/books?isbn=008053239X

1901GEX03	PROGRAMMING FOR PROBLEM SOLVING	L	T	P	C
		3	0	0	3

MODULE I INTODUCTION TO PROGRAMMING **9 Hours**

Components of Computers and its Classifications- Generations of Computers- Number System- Problem Solving Techniques – Algorithm Design– Flowchart–Pseudocode-Algorithm to program, Compilation and Execution.

MODULE II BASICS OF C PROGRAMMING **9 Hours**

Structure of C program - C programming: Data Types – Storage classes - Constants – Enumeration Constants - Keywords – Operators: Precedence and Associativity - Expressions - Input/output statements, Assignment statements – Decision making statements - Switch statement - Looping statements – Pre-processor directives

MODULE III ARRAYS AND STRINGS **9 Hours**

Introduction to Arrays: Declaration, Initialization – One dimensional array – Example Program: Computing Mean, Median and Mode - Two dimensional arrays – Example Program: Matrix Operations (Addition, Scaling, Determinant and Transpose) - String operations: length, compare, concatenate, copy – Selection sort, linear and binary search.

MODULE IV FUNCTIONS AND POINTERS **9 Hours**

Introduction to functions: Function prototype, function definition, function call, Built-in functions (string functions, math functions) – Recursion – Example Program: Computation of Sine series, Scientific calculator using built-in functions, Binary Search using recursive functions – Pointers – Pointer operators – Pointer arithmetic – Arrays and pointers – Array of pointers – Example Program: Sorting of names – Parameter passing: Pass by value, Pass by reference – Example Program: Swapping of two numbers and changing the value of a variable using pass by reference

MODULE V STRUCTURES & FILE PROCESSING **9 Hours**

Structure - Nested structures – Pointer and Structures – Array of structures – Example Program using structures and pointers – Dynamic memory allocation - Singly linked list -Files – Types of file processing: Sequential access, Random access – Sequential access file - Example Program: Finding average of numbers stored in sequential access file - Random access file - Example Program: Transaction processing using random access files – Command line arguments.

TOTAL: 45 Hours

REFERENCES:

1. Paul Deitel and Harvey Deitel, —C How to Program, Seventh edition, Pearson Publication
2. Juneja, B. L and Anita Seth, —Programming in C, CENGAGE Learning India pvt. Ltd., 2011
3. Pradip Dey, Manas Ghosh, —Fundamentals of Computing and Programming in C, First Edition, Oxford University Press, 2009.
4. Anita Goel and Ajay Mittal, —Computer Fundamentals and Programming in C, Dorling Kindersley (India) Pvt. Ltd., Pearson Education in South Asia, 2011.
5. Byron S. Gottfried, "Schaum's Outline of Theory and Problems of Programming with C",McGraw-Hill Education, 1996.

1901EN101	ENGLISH FOR ENGINEEERS	L	T	P	C
		2	0	0	2

MODULE I FOCUS ON LANGUAGE (Vocabulary and Grammar) 6 Hours

Vocabulary -The Concept of Word Formation - prefixes- suffixes- Synonyms - Antonyms.
Grammar -Articles-Preposition- Adjective-Adverb-connectives -Tenses (present, past & future)- Impersonal passive voice - Wh- Questions.

MODULE II LISTENING SKILLS 6 Hours

Listening- listening intently-arousing and sustaining interest-listening to short or longer texts- formal and informal conversations- telephonic etiquettes- narratives from different sources.-listening and Note taking-correlative verbal and non verbal communication-listening to TOEFL & IELTS programs .

MODULE III SPEAKING SKILLS 6 Hours

Speaking - stress and intonation –persuasive speaking -Describing person, place and thing - sharing personal information — greetings –taking leave -Individual and Group Presentation-impromptu presentation-public speaking-Group Discussion.

MODULE IV READING SKILLS 6 Hours

Reading– comprehending general and technical articles -cloze reading - inductive reading- short narratives and descriptions from newspapers – Skimming and scanning-reading and interpretation-critical reading-interpreting and transferring graphical information- sequencing of sentences.

MODULE V WRITING SKILLS 6 Hours

Writing- Precise writing –Summarizing- interpreting visual texts (pie chart, bar chart, picture, advertisements etc., -Proposal writing -report writing-job application-e-mail drafting- letter writing(permission, accepting and decaling)-instructions –recommendations –checklist.

TOTAL: 30 Hours

REFERENCES:

1. Raman, Meenakshi and Sangeetha Sharma. (2011). Technical Communication: Principles and Practice. New Delhi: Oxford University Press.
2. Rizvi and Ashraf M. (2005). Effective Technical Communication. New Delhi: Tata McGraw-Hill.
3. G. Radhakrishna Pillai. English for Success- Central Institute of English and Foreign Languages, Hyderabad: Emerald Publishers.
4. Jones, D. (2002).The Pronunciation of English. Cambridge: CUP; rpt in facsimile in Jones.
5. English for Engineers - Regional Institute of English (2006) .New Delhi: Cambridge University Press.
6. Rutherford and Andrea. (2001). Basic Communication Skills for Technology. New Delhi: Pearson.
7. Viswamohan A. (2008). English for Technical Communication. New Delhi: Tata McGraw-Hill.

1901GE201	ENGINEERING EXPLORATION	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

- Build mindsets & foundations essential for designers
- Learn about the Human-Centered Design methodology and understand their real-world applications
- Use Design Thinking for problem solving methodology for investigating ill defined problems.
- Undergo several design challenges and work towards the final design challenge
- **Apply Design Thinking on the following Streams to**
  Project Stream 1: Electronics, Robotics, IOT and Sensors
  Project Stream 2: Computer Science and IT Applications
  Project Stream 3: Mechanical and Electrical tools

Project Stream4: Eco-friendly solutions for waste management, infrastructure, safety, alternative energy sources, Agriculture, Environmental science and other fields of engineering.

HOW TO PURSUE THE PROJECT WORK?

- The first part will be learning-based-masking students to embrace the methodology by exploring all the phases of design thinking through the wallet/ bag challenge and podcasts.
- The second part will be more discussion-based and will focus on building some necessary skills as designers and learning about complementary material for human- centered design.
- The class will then divide into teams and they will be working with one another for about 2 – 3 weeks. These teams and design challenges will be the basis for the final project and final presentation to be presented.
- The teams start with **Design Challenge** and go through all the phases more in depth from coming up with the right question to empathizing to ideating to prototyping and to testing.
- Outside of class, students will also be gathering the requirements, identifying the challenges, usability, importance etc
- At the end, Students are required to submit the final reports, and will be evaluated by the faculty.

TASKS TO BE DONE:

Task 1: Everyone is a Designer

- Understand class objectives & harness the designer mindset

Task 2: The Wallet/Bag Challenge and Podcast

- Gain a quick introduction to the design thinking methodology
- Go through all stages of the methodology through a simple design challenge
- Podcast: Observe, Listen and Engage with the surrounding environment and identify a design challenge.

Task 3: Teams & Problems

- Start Design Challenge and learn about teams & problems through this
- Foster team collaboration, find inspiration from the environment and learn how to identify problems

Task 4: Empathizing

- Continue Design Challenge and learn empathy
- Learn techniques on how to empathize with users
- Go to the field and interview people in their environments
- Submit Activity Card

Task 5: Ideating

- Continue Design Challenge and learn how to brainstorm effectively
- Encourage exploration and foster spaces for brainstorming
- Submit Activity Card

Task 6: Prototyping

- Continue Design Challenge and learn how to create effective prototypes
- Build tangible models and use them as communication tools
- Start giving constructive feedback to classmates and teammates
- Submit Activity Card

Task 7: Testing

- Finish Design Challenge and iterate prototypes and ideas through user feedback
- Evolve ideas and prototypes through user feedback and constructive criticism
- Get peer feedback on individual and group performance
- Submit Activity Card

Task 8:

- Final Report Submission and Presentation

- **Method of Evaluation: Same as Mini project category. Project exhibition may be conducted.**

REFERENCES:

1. Tom Kelly, *The Art of Innovation: Lessons in Creativity From IDEO, America's Leading Design Firm* (Profile Books, 2002)
2. Tim Brown, Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation (HarperBusiness, 2009)
3. Jeanne Liedtka, Randy Salzman, and Daisy Azer, Design Thinking for the Greater Good: Innovation in the Social Sector (Columbia Business School Publishing, 2017)

OTHER USEFUL DESIGN THINKING FRAMEWORKS AND METHODOLOGIES:

1. Human-Centered Design Toolkit (IDEO); https://www.ideo.com/post/design-kit
2. Design Thinking Boot Camp Bootleg (Stanford D-School); https://dschool.stanford.edu/resources/the-bootcamp-bootleg
3. Collective Action Toolkit (frogdesign); https://www.frogdesign.com/wpcontent/uploads/2016/03/CAT_2.0_English.pdf
4. Design Thinking for Educators (IDEO); https://designthinkingforeducators.com/

1901CHX51 **ENGINEERING CHEMISTRY LAB**

L	T	P	C
0	0	2	1

List of Experiments:

1. Determination of total, temporary & permanent hardness of water by EDTA method
2. Determination of strength of given hydrochloric acid using pH meter
3. Estimation of iron content of the given solution using potentiometer
4. Estimation of sodium present in water using flame photometer
5. Corrosion experiment – weight loss method
6. Determination of molecular weight of a polymer by viscometer method
7. Conductometric titration of strong acid Vs strong Base
8. Estimation of dissolved oxygen in a water sample/sewage by Winkler‘s method.
9. Comparison of alkalinities of the given water samples
10. Determination of concentration of unknown colored solution using spectrophotometer
11. Determination of percentage of copper in alloy
12. Determination of ferrous iron in cement by spectrophotometry method
13. Adsorption of acetic acid on charcoal
14. Determination the flash point and fire point of a given oil using pen skyMartine closed cup apparatus
15. Determination the calorific value of solid fuels
16. Determination the structural of the compound using chemo software.

Total: 30 Hours

References:

1. Furniss B.S. Hannaford A.J, Smith P.W.G and Tatchel A.R., –Vogel‟s Textbook of practical organic chemistry‖, LBS Singapore (1994).
2. Jeffery G.H., Bassett J., Mendham J.and Denny vogel‟s R.C, –Text book of quantitative analysis chemical analysis‖, ELBS 5th Edn. Longman, Singapore publishers, Singapore, 1996.
3. aniel R. Palleros, –Experimental organic chemisry‖ John Wiley & Sons, Inc., New Yor (2001).
4. Kolthoff I.M., Sandell E.B. et al. –Quantitative chemical analysis‖, Mcmillan, Madras 1980.

1901GE253 **BASIC WORKSHOP LAB**

L	T	P	C
0	0	2	1

List of Experiments

1. Forming of simple object in sheet metal using suitable tools (Example: Dust Pan, Soap Box, Aluminum Cup, etc).
2. Prepare V (or) Half round (or) Square (or) Dovetail joint from the given mild Steel flat.
3. Prepare simple components using arc and gas weldings
4. Making a simple component using carpentry power tools. (Example: Electrical switch Box/Tool box/ Letter box.
5. Construct a household pipe line connections using pipes, Tee joint, Four way joint, elbow, union, bend, Gate way and Taps (or) Construct a pipe connections of house application centrifugal pump using pipes, bend, gate valve, flanges and foot valve.
6. Rapid Prototyping

REFERENCES: Lab manual

1901GEX52	COMPUTER PROGRAMMING LAB	L	T	P	C
		0	0	2	1

List of Experiments:

1. Working with word and style sheets
2. Write a C program to implement basic concepts
3. Write a C program to implement Decision Making and Branching statements
4. Write a C program to implement looping statements
5. Write a C program to implement Arrays
6. Write a C program to implement Strings
7. Write a C program to implement pointers
8. Write a C program to implement Structures
9. Write a C program to work with files in C

Total: 30 Hours

References:

1. Paul Deitel and Harvey Deitel, ―C How to Program‖, Seventh edition, Pearson Publication
2. Juneja, B. L and Anita Seth, ―Programming in C‖, CENGAGE Learning India pvt. Ltd., 2011
3. Pradip Dey, Manas Ghosh, ―Fundamentals of Computing and Programming in C‖, First Edition, Oxford University Press, 2009.
4. Anita Goel and Ajay Mittal, ―Computer Fundamentals and Programming in C‖, Dorling Kindersley (India) Pvt. Ltd., Pearson Education in South Asia, 2011.
5. Byron S. Gottfried, "Schaum's Outline of Theory and Problems of Programming with C",McGraw- Hill Education, 1996.

1901HSX51	COMMUNICATION SKILLS LAB	L	T	P	C
		0	0	2	1

List of Experiments:

1. **Activities on Fundamentals of Inter-personal Communication**

Starting a conversation - responding appropriately and relevantly - using the right body language - Role Play in different situations & Discourse Skills- using visuals.

2. **Activities on Reading Comprehension**

General Vs Local comprehension, reading for facts, guessing meanings from context, Scanning, skimming, and inferring meaning, critical reading & effective googling.

3. **Activities on Writing Skills**

Structure and presentation of different types of writing - letter writing/ Resume writing/e-correspondence/ Proposal writing/Technical report writing/ Portfolio writing - planning for writing - improving one's writing.

4. **Activities on Presentation Skills**

Oral presentations (individual and group) through JAM sessions / seminars / PPTs and written presentations through posters/ projects/ reports/ e-mails/ assignments etc.- creative and critical thinking.

5. **Activities on Soft Skills**

Dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and organization of ideas and rubrics for evaluation-Concept and process, pre-interview planning, opening strategies, answering strategies, interview through tele-conference & video-conferencing and Mock Interviews-Timemanagement-stress management –paralinguistic features- Multiple intelligences – emotionalintelligence – spiritual quotient (ethics) – intercultural communication – creative and critical.

Total: 30 Hours

References:

1. Raman, Meenakshi and Sangeetha Sharma, ―Technical Communication: Principles and Practice‖, Oxford University Press, New Delhi, 2011.
2. Sudha Rani, D , ―Advanced Communication Skills Laboratory Manual‖ , Pearson Education 2011.
3. Paul V. Anderson ,―Technical Communication‖,. Cengage Learning pvt. Ltd. New Delhi, 2007.
4. ―English Vocabulary in Use series‖, Cambridge University Press 2008.
5. ―Management Shapers Series‖ ,Universities Press (India) Pvt Ltd., Himayatnagar, Hyderabad 2008.
6. Rizvi and Ashraf M., -Effective Technical Communication‖, Tata McGrawHill, New Delhi, 2005.
7. Jones, D, -The Pronunciation of English‖, CUP, . Cambridge,2002.

1901GE252	ENGINEERING INTELLIGENCE II	L	T	P	C
		0	0	2	1

MODULE I VOCABULARY BULIDING **6 hours**

Parts of Grammar- SVA- Art of Writing- word building activities

MODULE II COMMUNICATION WORKSHOP **6 Hours**

Story Telling- Newspaper Reading-Extempore

MODULE III INTERPERSONAL SKILLS **6 Hours**

Personality Development - Creativity and innovation –Critical Thinking and Problem Solving – Work Ethics-Technical Skill Vs Interpersonal Skills

MODULE IV LEADERSHIP& EMPLOYABILITY SKILLS **6 Hours**

Levels of Leadership-Making of a leader-Type of leadership-Transactions Vs Transformational Leadership –Exercises - Industry Expectations & Career Opportunities- Recruitment patterns.

MODULE V RESUME BUILDING **6 Hours**

Importance of Resume- Resume Preparation - introducing onself

TOTAL: 30 Hours

REFERENCES:

1. Barun K. Mitra; (2011), *"Personality Development & Soft Skills*‖, First Edition; Oxford Publishers.
2. Raymond Murphy, Essential English Grammar in Use, Cambridge University press, New Delhi, Third Edition , 2007
3. Arun Sharma and Meenakshi Upadhyav, How to Prepare for Verbal Ability and Reading Comprehension for CAT, McGrawHill Publication, Seventh Edition 2017

B.E. Mechanical Engineering | E.G.S. Pillay Engineering College | Regulations 2019
Approved in IV Academic Council Meeting held on 25-05-2019

1902ME301	ENGINEERING MECHANICS	L	T	P	C
		3	2	0	4

MODULE I BASIC CONCEPTS AND FORCE SYSTEM 12 Hours

Introduction to mechanics - idealization of mechanics - laws of mechanics - principle of transmissibility - vector - addition, subtraction and product. Force- types - system of forces - resultant forces - composition of forces - resolution of force-free body diagram for real world systems.

MODULE II STATICS OF PARTICLES AND FORCE SYSTEM 12 Hours

Equilibrium of particle in space, moment of couple-equilibrant Moment about point and specific axis-moment at couple- simplification of force and couple systems.

MODULE III STATICS OF RIGID BODIES 12 Hours

Equilibrium of rigid bodies in two and three dimensions - beams - types of loads, supports and their reactions Two and three force Members-Static determinacy.

MODULE IV PROPERTIES OF SURFACES AND SOLIDS 12 Hours

Determination of centroid of areas, volumes and mass - Pappus and Guldinus theorems - moment of inertia of plane and areas Parallel axis theorem radius of gyration of area- product of inertia- mass moment of inertia.

MODULE V DYNAMICS OF PARTICLES AND FRICTION 12 Hours

Displacement, Velocity and Acceleration their relationship – Relative Motion – Curvilinear motion - Introduction - mechanism of friction-types -laws of friction - friction on horizontal and inclined planes, ladder and wedge friction - rolling resistance.

TOTAL: 60 HOURS

REFERENCES:

1. F.P. Beer, and Jr. E.R Johnston, Vector Mechanics for Engineers - Statics and Dynamics, Tata McGraw-Hill Publishing Company, New Delhi, 2007.
2. N.H. Dubey, Engineering Mechanics- Statics and Dynamics, Tata McGraw-Hill Publishing Company, New Delhi, 2013.
3. Irving H. Shames, Engineering Mechanics - Statics and Dynamics, Pearson Education Asia Pvt. Ltd., 2006.
4. R.C. Hibbeller, Engineering Mechanics: Combined Statics & Dynamics, Prentice Hall, 2009.
5. D. P. Sharma, Engineering Mechanics, Dorling Kindersley (India) Pvt. Ltd., New Delhi, 2010.
6. S. Rajasekaran and G. Sankarasubramanian, Fundamentals of Engineering Mechanics, Vikas Publishing House Pvt. Ltd., New Delhi, 2005.
7. https://nptel.ac.in/courses/112/106/112106286/

1902ME302	MANUFACTURING TECHNOLOGY – I	L	T	P	C
		3	0	0	3

MODULE I CASTING PROCESSES 09 Hours

Introduction to production processes and its classifications - Pattern - Types, Materials and Allowances. Moulding sand - Types, Properties and Testing. Moulding machines and its types. Melting furnaces - Cupola and Induction. Fettling and cleaning. Sand casting defects. Special casting processes - Shell moulding, Die casting, Centrifugal casting and Investment casting.

MODULE II METAL JOINING PROCESSES 09 Hours

Introduction to welding processes and its classifications - Principle of Gas welding and its flames - Principle of arc welding - Electrodes, Fluxes and filler materials. Principle of Resistance welding - Spot, butt and seam. Principle of Gas metal arc welding, Submerged arc welding, Tungsten Inert Gas welding, Plasma arc welding, Thermit welding, Electron beam welding and Friction welding - Weld defects - Brazing and soldering.

MODULE III BULK DEFORMATION PROCESSES 09 Hours

Introduction - Hot and cold working of metals - Forging processes - Open and close die forging, Forging equipment and operations. Rolling - Types of Rolling mills, shape rolling operations, Tube piercing and Defects. Principle of Extrusion and its types. Principle of rod and wire drawing.

MODULE IV SHEET METAL FORMING AND SPECIAL FORMING PROCESSES 09 Hours

Introduction - Shearing, bending and drawing operations - Stretch forming operations - Principle of special forming processes - Hydro forming, Rubber pad forming, Metal spinning, Explosive forming, Magnetic pulse forming, Peen forming and Super plastic forming.

MODULE V MOULDING AND FORMING OF PLASTICS 09 Hours

Introduction to plastics - Moulding of Thermoplastics - Principle and applications of Injection moulding and its types, Blow moulding, Rotational moulding, Thermoforming and Extrusion. Moulding of Thermosets - Principle and applications of Compression moulding and Transfer moulding Bonding of Thermoplastics - Fusion and solvent methods

TOTAL: 45 HOURS

REFERENCES:

1. P. N. Rao, Manufacturing Technology vol. I, Tata McGraw-Hill Publishing Company rivate Limited, New Delhi, 2010.

2. SeropeKalpakjian, Steven R. Schmid, Manufacturing Engineering and Technology, Pearson Education Limited, New Delhi, 2013

3. J. P. Kaushish, Manufacturing Processes, Prentice Hall of India Learning Private Limited, New Delhi, 2013

4. P.C. Sharma, Manufacturing Technology - I, S Chand and Company Private Limited, New Delhi, 2010

5. S K HajraChoudhury, Elements of Workshop Technology - Vol. I, Media Promoters & Publishers Private Limited, Mumbai,2013.

6. http://nptel.ac.in/courses/112107144/1.

1902ME303	FLUID MECHANICS AND MACHINES	L	T	P	C
		2	2	0	3

MODULE I INTRODUCTION TO FLUID AND FLUID MOTION 07 Hours

Fluid- Fluid mechanics -Laws of Fluid Mechanics-Properties of fluid and its Application-Types of fluid - Types of fluid Flow-Measurement of Pressure-U-tube and differential manometer- Measurement of velocity using Discharge -Flow characteristics-Momentum -continuity equation.

MODULE II FLUID DYNAMICS AND FLUID FLOW OVER CONDUITS 11 Hours

Forces acting on a fluid element- Eulers and Bernoulli theorem Application in internal and external flows measuring instruments - Major losses and Minor losses in pipes using standard charts and tables pipes in series and pipes in parallel. - Darcy Weisbach equation. Identification of laminar and turbulent flow in closed conduits, flow in circular pipe.

MODULE III DIMENSIONAL AND MODEL ANALYSIS 09 Hours

Need for dimensional analysis - dimensional analysis using Buckingham pi theorem – Similitude - types of similitude - Dimensionless parameters- application of dimensionless parameters - Model analysis through Reynolds and Froudes Model law.

MODULE IV HYDRAULIC TURBINES 09 Hours

Definition of turbine - Classification -Types of head and efficiencies of turbine-Impulse turbine - Reaction turbine-Francis turbine, Kaplan turbine - working principles and velocity triangle- Work done by water on the runner Specific speed - unit quantities performance curves.

MODULE V HYDRAULIC PUMPS 09 Hours

Definition -Centrifugal pump Classification Construction working principle and velocity Triangle Definition of heads-Losses and efficiencies-Multistage Centrifugal pump-Specific speed - Priming and cavitation effects of centrifugal pump. Reciprocating pump Classification Working Principle Coefficient of discharge and slip-Indicator diagram (Descriptive treatment only).

TOTAL: 45 HOURS

REFERENCES:

1. R.K.Bansal, A Textbook of Fluid Mechanics and Machinery, Laxmi Publications Ltd., New Delhi, Revised Tenth edition, 2018.
2. Bruce R Munson , Donald F Young, Theodore H Okiishi and Wade W. Huebsch, Fundamentals of Fluid Mechanics, John Wiley & Sons, Sixth edition 2009.
3. Pijush K Kundu and Ira M Cohen, Fluid Machines, Academic Press, Burlington, United states of america, 2010.
4. YunusCengel and John Cimbala, Fluid Mechanics Fundamentals and Application, Tata McGraw Hill Publishing Company Pvt. Ltd., New Delhi 2009.
5. Robert and W Fox, Introduction to Fluid Machines, John Wiley Eastern Pvt. Ltd., New Delhi, 6th edition ,2006.
6. http://nptel.ac.in/courses/112105182/

1902ME304	STRENGTH OF MATERIALS	L	T	P	C
		3	2	0	4

MODULE I STRESS, STRAIN AND DEFORMATION OF SOLIDS 12 Hours

Introduction to material properties. Stresses and strains due to axial force, shear force, impact force and thermal effect-stepped and composite bars-uniformly varying cross section. Stress-strain curve for ductile and brittle materials Hooke-law - Factor of safety Poisson-ratio. Elastic constants and their relationship.

MODULE II ANALYSIS OF STRESSES IN TWO DIMENSIONS 12 Hours

State of stresses at a point- Normal and shear stresses on inclined planes - Principal planes and stresses Plane of maximum shear stress - Mohrs -circle for biaxial stress with shear stress. Hoop and longitudinal stresses in thin cylindrical and spherical shells - Changes in dimensions and volume.

MODULEIII LOADS AND STRESSES IN BEAMS 12 Hours

Types of beams- Supports and Loads, Shear force and Bending Moment in beams, Cantilever, simply supported and overhanging beams - Point of contra flexure. Theory of simple bending - bending and shear stress - stress variation along the length and section of the beam, Section modulus.

MODULE IV DEFLECTION OF BEAMS AND COLUMNS 12 Hours

Slope and Deflection of cantilever, simply supported ,Double integration method and Macaulay‟s method. Columns- types- Equivalent length Euler and Rankine formulae- Slenderness.

MODULE V TORSION IN SHAFT AND HELICAL SPRING 12 Hours

Analysis of torsion of circular solid and hollow shafts-stepped shaft-compound shaft- Shear stress distribution, angle of twist and torsional stiffness. Closed coil helical spring- stresses and deflection under axial load- Maximum shear stress in spring section.

TOTAL: 60 HOURS

REFERENCES:

1. Egor P. Popov, Engineering Mechanics of Solids, Prentice Hall of India Learning Pvt. Ltd, New Delhi, 2010.
2. S.S. Rattan, Strength of Materials, Tata McGraw Hill, Delhi, Second Edition, 2011.
3. D. K. Singh, Mechanics of Solids, Pearson Education New Delhi, 2006.
4. F. P. Beer and R. Johnston, Mechanics of Materials, Tata McGraw Hill Publishing Company Pvt Ltd., New Delhi, Third edition,2002.
5. B. K. Sarkar, Strength of Materials, Tata McGraw Hill Publishing Company Pvt. Ltd, New Delhi, Second Reprint, 2007.
6. http://www.nptel.ac.in/courses/Webcourse-contents/IIT

1902ME305	THERMODYNAMICS	L	T	P	C
		3	2	0	4

MODULE I INTRODUCTION AND ZEROTH LAW OF THERMODYNAMICS 12 Hours

Macroscopic and Microscopic approaches, Definitions and concepts- heat, work, thermodynamic equilibrium, system and types, surroundings, Properties- intensive and extensive properties, Path and point functions, Energy- macroscopic and microscopic modes of energy, Thermodynamic processes and cycle, State postulate, Zeroth law of thermodynamics- temperature scale, perfect gas scale.

MODULE II FIRST LAW OF THERMODYNAMICS 12 Hours

First law of thermodynamics, I law for Closed systems - constant pressure process, constant volume process, constant temperature process, adiabatic process, polytropic process, throttling process. I law for open systems - Steady state flow processes, Steady flow energy equation (SFEE), Application of SFEE-turbines and compressors, nozzles and diffusers, throttling valves, heat exchangers.

MODULE III SECOND LAW OF THERMODYNAMICS 12 Hours

Limitations of I law of thermodynamics, Second law of thermodynamics- Kelvin - Planck and Clausius statements, Heat Engine, heat pump and refrigerator, Reversibility and irreversibility- irreversible and reversible processes, Carnot's principles, Carnot cycle, Carnot engine, Thermodynamic temperature scale, Clausius inequality, Entropy- principle of entropy increase, Availability & irreversibility – Introduction about third law of thermodynamics.

MODULE IV PROPERTIES OF PURE SUBSTANCES 12 Hours

Thermodynamic properties of fluids. Pure substance-phases - Phase change processes, Property diagrams - pressure-volume (P-v), pressure-temperature (P-T), temperature volume (T-v), temperature entropy (T-s) and enthalpy-entropy (h-s) diagrams. Steam tables - Problems on flow and non-flow processes.

MODULE V GAS MIXTURES AND PSYCHROMETRIC PROPERTIES 12 Hours

Thermodynamics of ideal gas mixture- mixture of ideal gas, mixture of perfect gases, Dalton's law of partial pressure, Amagat's law, Thermodynamics properties, Ideal gas – equation of state, Van derWaals equation and compressibility chart. Psychrometric properties and processes – Psychrometric chart.

TOTAL: 60 HOURS

REFERENCES:

1. R.K.Rajput, “A Text Book Of Engineering Thermodynamics “, Fifth Edition, 2017.
2. Y. Cengel and Boles, Thermodynamics - An Engineering Approach, Tata McGraw Hill Publishing Company Pvt. Ltd, New Delhi,2003.
3. R.S. Khurmi, Steam table with Psychometric chart, S. Chand Publications, New Delhi,2009.
4. J.P. Holman, Thermodynamics, Tata McGraw Hill Publishing Company Pvt Ltd., New Delhi,2002.
5. P.K. Nag, Engineering Thermodynamics, Tata McGraw-Hill, New Delhi, 2007.
6. C.P. Arora, Thermodynamics, Tata McGraw Hill Publishing Company Pvt. Ltd., New Delhi,2003
7. https://onlinecourses.nptel.ac.in/noc18_ae05/preview.
8. https://onlinecourses.nptel.ac.in/noc18_ch03/preview.

1902ME351	FLUID MECHANICS AND MACHINES LAB	L	T	P	C
		0	0	2	1

LIST OF EXPERIMENTS:

1. Experimental verification of Bernoulli‟s theorem in a pipe flow.
2. Measurement of flow rate using venturimeter and calculate the coefficient of discharge.
3. Measurement of flow rate using orificemeter and calculate the coefficient of discharge.
4. Performance test on tangiantial flow impulse (Pelton wheel) turbine against constant head.
5. Performance test on Francis turbine against constant head.
6. Performance test on reaction (Kaplan) turbine against constant head.
7. Performance characteristics of a reciprocating pump.
8. Performance characteristics of a gear pump.
9. Performance test on centrifugal pump.
10. Performance test on submersible pump.
11. Determination of loss of head indifferent pipes (major loss) and fittings (minor loss) for various flow rates.

Total: 30 Hours

REFERENCES:

1. www.cs.cf.ac.uk/Dave/C/
2. http://www.lysator.liu.se/c/bwk-tutor.html
3. http://en.wikibooks.org/wiki/Data_Structures/Introduction
4. http://www.eskimo.com/~scs/cclass/notes/top.html

1902ME352	STRENGTH OF MATERIALS LAB	L	T	P	C
		0	0	2	1

LIST OF EXPERIMENTS:

1. Find the hardness of the material using Rockwell hardness tester.
2. Calculate the hardness of the material using Brinell hardness tester.
3. Experimentally calculate the strain energy of a material subjected to impact loading.(Izod testing)
4. Experimental analysis of an axial bar under tension to obtain the stress strain curve and the strength.
5. Determine the Young-modulus and stiffness of a metal beam through load deflection curve.
6. Experimentally calculate the compressive strength of the materials.
7. Experimentally calculate the double shear strength of the materials.
8. Experimentally calculate the strain energy of a material subjected to impact loading.(charpy testing)
9. Determination of spring constant through load vs deflection curve.
10. Experimental analysis of a bar under torsion to obtain stiffness and angle of twist.

Total: 30 Hours

REFERENCES:

1. Joseph A. Unfener, Robert L. Mott, “A Text Book Of Applied Strength of Materials“, sixth Edition.
2. S.S.Bhavikatti, “A Text Book Of Strength of Materials“.
3. Esor P. popov, “A Text Book Of Strength of Materials“

1902ME353	MANUFACTURING TECHNOLOGY- I LAB	L	T	P	C
		0	0	2	1

LIST OF EXPERIMENTS:

Taper Turning using Tailstock set over method

Taper Turning using Compound rest method

External Thread cutting

Internal Thread Cutting

Eccentric Turning

Knurling

Push fit

Clearance fit

Force fit

Measurement of cutting forces in turning process

Simple turning using capstan lathe.

Total: 30 Hours

REFERENCES:

1. P. N. Rao, Manufacturing Technology vol. I, Tata McGraw-Hill Publishing Company rivate Limited, New Delhi, 2010.
2. Serope Kalpakjian, Steven R. Schmid, Manufacturing Engineering and Technology, Pearson Education Limited, New Delhi, 2013.
3. J. P. Kaushish, Manufacturing Processes, Prentice Hall of India Learning Private Limited, New Delhi, 2013.
4. P.C. Sharma, Manufacturing Technology - I, S Chand and Company Private Limited, New Delhi, 2010.
5. S K Hajra Choudhury, Elements of Workshop Technology - Vol. I, Media Promoters & Publishers Private Limited, Mumbai,2013.
6. http://nptel.ac.in/courses/112107144/1.

1904GE351	LIFE SKILLS: SOFT SKILLS	L	T	P	C
		0	0	2	1

MODULE I INTRODUCTION TO SOFT SKILLS 06 Hours

Soft Skills an Overview - Basics of Communication – Body Language – Positive attitude –Improving Perception and forming values – Communicating with others.

MODULE II TEAM VS TRUST 06 Hours

Interpersonal skills – Understanding others – Art of Listening - Group Dynamics –Essential of an effective team - Individual and group presentations - Group interactions – Improved work Relationship

MODULE III SELLING ONESELF 06 Hours

How to brand oneself – social media – job hunting – Resume writing – Group Discussion – Mock G.D - .Interview skills – Mock Interview

MODULE IV PROPERTIES OF PURE SUBSTANCES 06 Hours

What is Etiquette – Key Factors – Greetings – Meeting etiquette – Telephone etiquette – email etiquette – Dining etiquette – Dressing etiquette

MODULE V GAS MIXTURES AND PSYCHROMETRIC PROPERTIES 06 Hours

1. My family. Myself. 2. Meeting people. Making Contacts. 3. A city. Getting about town. 4. Our flat. Home life. 5. Travelling. Going abroad. 6. Going through Customs.7. At a hotel. 8. Shopping. 9. Eating out.10. Making a phone call.11.A modern office.12. Discussing business.

TOTAL: 30 HOURS

REFERENCES:

1. Dr.k.Alex, "soft skills "Third Edition, S.Chand& Publishing Pvt Limited, 2009
2. Arunakoneru, „Professional Communication" Second Edition, Tata McGraw-Hill Education, 2008
3. D.K.Sarma,"You & Your Career „First Edition Wheeler Publishing & Co Ltd, 1999
4. Shiv Khera „You Can Win" Third Edition Mac Millan Publisher India Pvt Limited, 2005

1901MCX01	ENVIRONMENTAL SCIENCE	L	T	P	C
	(Common to all Branches of B.E/ B.Tech)	2	0	0	0

MODULE I ECOSYSTEMS AND BIODIVERSITY 10 Hours

Concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers- Oxygen cycle and Nitrogen cycle – energy flow in the ecosystem – ecological succession processes – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity. Documentation of the medicinal plants in your native place

MODULE II NATURAL RESOURCES 10 Hours

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and overutilization of surface and ground water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and nonrenewable energy sources, use of alternate energy sources. Energy Conversion processes – Biogas – production and uses, anaerobic digestion; case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles.

Documentation of the effect of modern Agriculture in your nearby Village

MODULE III ENVIRONMENTAL POLLUTION 9 Hours

Definition – Source, causes, effects and control measures of: (a) Air pollution - Mitigation procedures- Control of particulate and gaseous emission, Control of SO_X, NO_x, CO and HC) -Technology for capturing CO_2 (metallo organic frame works)(b) Water pollution – Waste water treatment processes. (c) Soil pollution - soil waste management: causes, effects and control measures of municipal solid wastes – (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards–role of an individual in prevention of pollution – pollution case studies.

Documentation study of local polluted site – Urban / Rural / Industrial / Agricultural

MODULE IV SOCIAL ISSUES AND THE ENVIRONMENT 8 Hours

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management -environmental ethics: Issues and possible solutions – 12 Principles of green chemistry – consumerism and waste products – environment protection act – Air act – Water act – Wildlife protection act – Forest conservation act – The Biomedical Waste (Management and Handling) Rules; 1998 and amendments- scheme of labeling of environmentally friendly products (Ecomark) central and state pollution control boards- disaster management: floods, earthquake- Public awareness. Analyze the recent steps taken by government of India to prevent pollution (Green India and Clean India)

MODULE V HUMAN POPULATION AND THE ENVIRONMENT 8 Hours

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare – Environmental impact analysis (EIA) -GIS-remote sensing-role of information technology in environment and human health – Case studies.

Documentation study of the Human health and the environment in nearby Hospital (Statistical report)

TOTAL: 45 HOURS

REFERENCES:

1. Trivedi.R.K., "Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards", Vol. I and II, Enviro Media, 3rd edition, BPB publications, 2010.
2. Cunningham, W.P. Cooper, T.H. Gorhani, "Environmental Encyclopedia", Jaico Publ., House, Mumbai, 2001.
3. Dharmendra S. Sengar, "Environmental law", Prentice hall of India PVT LTD, New Delhi,2007.
4. Rajagopalan, R, "Environmental Studies-From Crisis to Cure", Oxford University Press, 2005.
5. Benny Joseph, "Environmental Science and Engineering", Tata McGraw-Hill, New Delhi, 2006
6. Ravikrishnan“Environmental Science and Engineering” Sri Krishna Hi-tech Publishing Company Pvt
7. https://en.wikipedia.org/wiki/Carbon_capture_and_storage

1901MA402

ENGINEERING MATHEMATICS III **L T P C**

3 2 0 4

MODULE I FOURIER SERIES **12 Hours**

Dirichlet‟s conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Parseval‟s identity – Harmonic analysis.

MODULE II FOURIER TRANSFORMS **12 Hours**

Statement of Fourier integral theorem – Fourier transform pair – Fourier sine and cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval‟s identity

MODULE III APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS **12 Hours**

Classification of PDE – Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two dimensional equation of heat conduction.

MODULE IV NUMERICAL DIFFERENTIATION **12 Hours**

Approximation of derivatives using interpolation polynomials-Taylor‟s series method – Euler‟s method - Modified Euler‟s method - Fourth order Runge-Kutta method for solving first order equations

MODULE V NUMERICAL INTEGRATION **12 Hours**

Numerical integration using Trapezoidal, Simpson‟s 1/3 rule – Romberg‟s method - Two point and three point Gaussian quadrature formulae – Evaluation of double integrals by Trapezoidal and Simpson‟s 1/3 rules.

Total: 60 Hours

References:

1. Veerarajan. T., “Transforms and Partial Differential Equations”, Second reprint, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2012.
2. Grewal. B.S., “Higher Engineering Mathematics”, 42nd Edition, Khanna Publishers, Delhi, 2012.
3. Narayanan.S.,ManicavachagomPillay.T.K and Ramanaiah.G “Advanced Mathematics for Engineering Students” Vol. II & III, S.Viswanathan Publishers Pvt Ltd. 1998.
4. Grewal B.S and Grewal J.S, Nummerical methods in Engineering and Science, 6th edition,Khanna puplishers,2004
5. Ramana.B.V., “Higher Engineering Mathematics”, Tata Mc-GrawHill Publishing Company Limited, New Delhi, 2008.
6. Glyn James, “Advanced Modern Engineering Mathematics”, 3rd Edition, Pearson Education, 2007.
7. Erwin Kreyszig, “Advanced Engineering Mathematics”, 8th Edition, Wiley India, 2007.
8. Ray Wylie. C and Barrett.L.C, “Advanced Engineering Mathematics” Tata McGraw Hill Education Pvt Ltd, Sixth Edition, New Delhi, 2012.
9. nptel.ac.in/courses/111105035, www.nptelvideos.in/2012/11/Mathematics.html
10. www.learnerstv.com/Free-maths-video lectures - ltv348-page1.html

1902ME401	ENGINEERING METROLOGY & MEASUREMENTS	L	T	P	C
	`	3	0	0	3

MODULE I CONCEPT OF MEASUREMENT 9 Hours

Introduction: Definition, Objectives, Elements of Measuring System, Accuracy and Precision - Units and Standards - Characteristics of measuring instrument: Sensitivity, Stability, Interchangeability, Range of accuracy, Readability, Reliability, Backlash, Repeatability and Reproducibility – Calibration - Errors in Measurement: Static and dynamic errors - Care of Measuring Instruments

MODULE II LINEAR AND ANGULAR MEASUREMENTS 9 Hours

Linear Measurements: Vernier Caliper, Vernier Height and Depth Gauges, Micrometer and depth micrometer, Slip gauge, limit gauge and its classification - Comparator: Mechanical, Pneumatic and Electrical types - Angular Measurements: Bevel protractor, Sine bar, Angle Decker, Autocollimator.

MODULE III FORM MEASUREMENT 9 Hours

Thread Measurement: Terminologies, Errors - External Thread Measurement: Pitch Gauge, Tool Maker's microscope, Floating Carriage micrometer with One, Two and Three wires - Internal Thread Measurement: Taper Parallels and Rollers method. Gear Measurement: Terminologies, Errors, Gear Tooth Vernier caliper, Profile Projector, Base pitch measuring instrument, Involutes tester, Parkinson Gear Tester - External and Internal Radius measurements - Roundness measurement: Circumferential confining gauge, Assessment using V block and Rotating centres.

MODULE IV LASER AND ADVANCES IN METROLOGY 9 Hours

Interferometer: NPL Flatness, Laser, Michelson - Computer Aided Inspection - Digital Devices - Machine Vision System - Coordinate Measuring Machine: Basic concept, Types, Constructional features, Probes, Accessories - Surface Roughness Measurement - Straightness Measurement - Squareness Measurement - Machine Tool Metrology.

MODULE V MEASUREMENT OF MECHANICAL PARAMETERS 9 Hours

Measurement of Force - Principle, analytical balance, platform balance, proving ring. Torque - Prony brake, hydraulic dynamometer. Measurement of Power: Linear and Rotational - Pressure Measurement: Principle, use of elastic members, Bridgeman gauge, Mcleod gauge, Pirani gauge - Temperature Measurement: bimetallic strip, thermocouples, metal resistance thermometer, pyrometers.

Total: 45 Hours

References:

1. Jain R.K. “Engineering Metrology”, Khanna Publishers, 2005.
2. Gupta. I.C., “Engineering Metrology”, Dhanpatrai Publications, 2005.
3. Charles Reginald Shotbolt, “Metrology for Engineers”, 5th edition, Cengage Learning EMEA, 1990.
4. Backwith, Marangoni, Lienhard, “Mechanical Measurements”, Pearson Education, 2006.
5. https://nptel.ac.in/courses/112106179/

1902ME402	THERMAL ENGINEERING	L	T	P	C
	`	3	2	0	4

MODULE I GAS POWER CYCLES 12 Hours

Otto, Diesel, Dual, Brayton cycles, Calculation of mean effective pressure, and air standard efficiency - Comparison of cycles.

MODULE II INTERNAL COMBUSTION ENGINES 12 Hours

Classification - Components and their function. Valve timing diagram and port timing diagram - actual and theoretical p-V diagram of four stroke and two stroke engines. Simple and complete Carburettor.MPFI, Diesel pump and injector system.Battery and Magneto Ignition System - Principles of Combustion and knocking in SI and CI Engines.Lubrication and Cooling systems.Performance calculation.

MODULE III STEAM NOZZLES AND TURBINE 12 Hours

Flow of steam through nozzles, shapes of nozzles, effect of friction, critical pressure ratio, supersaturated flow.Impulse and Reaction principles, compounding, velocity diagram for simple and multi-stage turbines, speed regulations –Governors.

MODULE IV AIR COMPRESSOR 12 Hours

Classification and working principle of various types of compressors, work of compression with and without clearance, Volumetric efficiency, Isothermal efficiency and Isentropic efficiency of reciprocating compressors, Multistage air compressor and inter cooling –work of multistage air compressor

MODULE V REFRIGERATION AND AIR CONDITIONING 12 Hours

Refrigerants - Vapour compression refrigeration cycle- super heat, sub cooling – Performance calculations - working principle of vapour absorption system, Ammonia –Water, Lithium bromide – water systems (Description only) .Air conditioning system - Processes, Types and Working Principles. - Concept of RSHF, GSHF, ESHF- Cooling Load calculations.

Total: 60 Hours

REFERENCES:

1. Rajput. R. K., “Thermal Engineering” S.Chand Publishers, Ninth edition
2.Sarkar, B.K,”Thermal Engineering” Tata McGraw-Hill Publishers, 2007
3. Arora.C.P, ”Refrigeration and Air Conditioning ,” Tata McGraw-Hill Publishers 1994
4. Ganesan V..” Internal Combustion Engines” , Third Edition, Tata Mcgraw-Hill 2007
5.Rudramoorthy, R, “Thermal Engineering “,Tata McGraw-Hill, New Delhi,2003

1902ME403	MANUFACTURING TECHNOLOGY -II	L	T	P	C
		3	0	0	3

MODULE I METAL CUTTING THEORY 9 Hours

Introduction - Orthogonal, Oblique Cutting and types of chip formation. Mechanisms of metal cutting - Shear plane, Stress, Strain and cutting forces. Merchants Circle - Deriving the forces, calculations. Cutting tool - Properties, materials, wear, single point tool nomenclature, tool life and its calculations. cutting fluids - Types and its properties.

MODULE II LATHE, SEMI AUTOMATS AND AUTOMATS 9 Hours

Introduction - Types- Centre Lathe - Construction, specification, operations. Mechanisms - Head stock driven using all geared type and thread cutting. Work holding devices - Centres, chucks, carrier with catch plate and face plates. Calculation of machining time - Capstan and turret lathes - Introduction, turret indexing and bar feeding mechanism. Automats - single spindle, multi spindle and their types.

MODULE III MILLING MACHINE AND GEAR CUTTING MACHINES 9 Hours

Milling - Introduction, types, up milling, down milling, operations, and nomenclature of plain milling cutter. Indexing - simple and differential indexing methods. Gear cutting-gear milling, gear shaper and gear hobber.

MODULE IV RECIPROCATING MACHINES, DRILLING AND BORING MACHINES 9 Hours

Shaper, Planer and Slotter - Introduction, types, specification and quick return mechanisms. Drilling - Introduction, types, construction of universal drilling machine, specification, types of drills and nomenclature of twist drill. Introduction to horizontal boring machine.

MODULE V BROACHING AND FINISHING PROCESSES 9 Hours

Broaching - Introduction, types and tool nomenclature. Finishing processes - Grinding -Introduction, types, grinding wheel- specification, selection, glazing, loading, dressing and truing. Fine finishing processes - Honing, lapping, polishing, buffing and super finishing.

Total 45 Hours

References:

1. J. P. Kaushish, Manufacturing Processes, Prentice Hall India Learning Private Limited., New Delhi, 2013.
2. SeropeKalpakjian and Steven R Schmid, Manufacturing Engineering and Technology, Pearson Education Limited., New Delhi, 2013.
3. P. N. Rao, Manufacturing Technology- Metal Cutting and Machine Tools, Tata McGraw Hill Publishing Company Private Limited., New Delhi, 2013
4. S. K. HajraChoudhury, Elements of Workshop Technology. Vol. II, Media Promoters & Publishers Private Limited., Mumbai, 2013.
5. P.C Sharma, Manufacturing Technology - II, S. Chand & Company Limited. New Delhi, 2012.
6. http://nptel.ac.in/courses/112105126

1901ME404	BIOLOGY FOR ENGINEERS	L	T	P	C
	`	3	0	0	3

Module I Biology Introduction and its Classification **7 Hours**

Introduction to Biology, fundamental differences between science and engineering by drawing a comparison between eye and camera, Bird flying and aircraft. Exciting aspect of biology - need to study biology- Discussion about biological observations of 18th Century - major discoveries. Examples from Brownian motion and the origin of thermodynamics - original observation of Robert Brown and Julius Mayor.

Classification - morphological, biochemical or ecological. Hierarchy of life forms at phenomenological level. classification based on (a) cellularity- Unicellular or multicellular (b) ultrastructure- prokaryotes or eucaryotes. (c) energy and Carbon utilization -Autotrophs, heterotrophs, lithotropes (d) Ammonia excretion – aminotelic, uricoteliec, ureotelic (e) Habitata- acquatic or terrestrial (e) Molecular taxonomy- three major kingdoms of life. Model organisms for the study of biology- E.coli, S.cerevisiae, D. Melanogaster, C. elegance, A. Thaliana, M. musculus

Module II Genetics and Macromolecular analysis **10 Hours**

Genetics - Newton's laws to Physical Sciences"- Mendel's laws, Concept of segregation and independent assortment. Concept of allele. Gene mapping, Gene interaction, Epistasis. Meiosis and Mitosis - part of genetics. Concepts of recessiveness and dominance. Concept of mapping of phenotype to genes. Single gene disorders in humans. Complementation using human genetics.

Macromolecular analysis: analyses of biological processes at the reductionistic level Proteins- structure and function. Hierarch in protein structure. Primary secondary, tertiary and quaternary structure. Proteins as enzymes, transporters, receptors and structural elements.

Module III Biomolecules and Enzymes **10 Hours**

Biomolecules - Molecules of life. monomeric units and polymeric structures. Sugars, starch and cellulose. Amino acids and proteins. Nucleotides and DNA/RNA. Two carbon units and lipids.

Enzymes - monitor enzyme catalyzed reactions. Enzyme catalyzereactions. Enzyme classification. Mechanism of enzyme action -two examples. Enzyme kinetics and kinetic parameters. RNA catalysis.

Information Transfer - The molecular basis of coding and decoding genetic information - universal Molecular basis of information transfer. DNA - genetic material. Hierarchy of DNA structure- from single stranded to double helix to nucleosomes. Concept of genetic code. Universality and degeneracy of genetic code. Gene in terms of complementation and recombination.

Module IV Metabolism and Microbiology **8 Hours**

Metabolism: principles of energy transactions. Thermodynamics to biological systems. Exothermic and endothermic versus endergonic and exergoinc reactions. Concept of Keq and its relation to standard free energy. Spontaneity. ATP - energy currency. Breakdown of glucose to CO2 + H2O (Glycolysis and Krebs cycle) - synthesis of glucose from CO2 and H2O (Photosynthesis). Energy yielding and energy consuming reactions. Concept of Energy charge

Microbiology Concept of single celled organisms. Concept of species and strains. Identification and classification of microorganisms. Microscopy. Ecological aspects of single celled organisms. Sterilization and media compositions. Growth kinetics.

Module V Bio-inspired Engineering **10 Hours**

Introduction to biologically-inspired designs (BID for Biomedical and Non-biomedical applications): Human-organs-on-chips; Muscular Biopolymers; Bio-optics; Nanostructures for Drug Delivery; Genetic Algorithms; Artificial neural networks; Swarm intelligence algorithms; Biosensors: role in medical diagnostics (Sensium digital plaster); environmental monitoring; Bio-filters; Bio-robotics; 3D Bio-printing; Self healing concrete.

Total: 45 Hours

REFERENCES:

1. Biology for Engineers, Rajiv Singal , CBS Publishers and Distributors Pvt Ltd; First Edition edition (4 June 2019).
2. Biology for Engineers, Wiley Editorial, Wiley (2018).
3. Principles of Soft Computing, S. N. Sivanandam, S. N. Deepa, Wiley; Third edition (2018).
4. Computational Medicine: Tools and Challenges, Zlatko Trajanoski, Springer; 2012 edition (19 September 2012).
5. Health Informatics - E-Book: An Interprofessional Approach, Ramona Nelson, Nancy Staggers, Elsevier; 2 edition (December 8, 2016).
6. Biology for Engineers, G.K..Suraishkumar, Oxford University Press
7. Biology for Engineers, Arthur T. Johnson, CRC Press

1902ME451	THERMAL ENGG. LABORATORY	L	T	P	C
		0	0	2	1

LIST OF EXPERIMENTS:

1. Port timing and valve timing diagram of IC engines.
2. Determination of flash point and fire point of the given oil sample.
3. Determination of dynamic viscosity of the given oil sample using Red wood viscometer
4. Performance on 4-Stroke diesel engine with mechanical loading.
5. Performance on 4-Stroke diesel engine with electrical loading
6. Performance on 4-Stroke diesel engine with hydraulic loading.
7. Heat balance test on 4-Stroke diesel engine with mechanical loading.
8. Morse test on multi-cylinder petrol engine.
9. Retardation test on 4-Stroke diesel engine with mechanical loading.
10. Performance of two stage reciprocating air compressor.
11. Determination of Coefficient of Performance of refrigeration system
12. Determination of Coefficient of Performance of Air-conditioning system.

Total:30 Hours

REFERENCES:

1. Rajput. R. K., “Thermal Engineering” S.Chand Publishers, Ninth edition
2. Sarkar, B.K,”Thermal Engineering” Tata McGraw-Hill Publishers, 2007
3. Kothandaraman.C.P., Domkundwar.S,Domkundwar. A.V., “A course in thermal engineering,”Dhanpat Rai &sons ,Fifth edition, 2002
4. Arora.C.P, ”Refrigeration and Air Conditioning ,” Tata McGraw-Hill Publishers 1994

1902ME452	MANUFACTURING TECHNOLOGY LABORATORY – II	L	T	P	C
		0	0	2	1

LIST OF EXPERIMENTS:

1. Contour milling using vertical milling maching.
2. Spur gear cutting in milling machine
3. Gear generation in hobbing machine
4. Gear generation in gear shaping machine
5. Horizontal surface grinding
6. Cylindrical grinding
7. Tool angle grinding with tool and Cutter Grinder
8. Measurement of cutting forces in Milling.
9. Square Head Shaping
10. Hexagonal Head Shaping
11. Vertical surface grinding
12. Make a v-block using planner machine.
13. Nomenclature of cutting tool using Tool makers microscope

Total:30 Hours

REFERENCES:

1. P. N. Rao, Manufacturing Technology vol. I, Tata McGraw-Hill Publishing Company rivate Limited, New Delhi,2010.
2. SeropeKalpakjian, Steven R. Schmid, Manufacturing Engineering and Technology, Pearson Education Limited, New Delhi,2013.
3. J. P. Kaushish, Manufacturing Processes, Prentice Hall of India Learning Private Limited, New Delhi,2013.
4. P.C. Sharma, Manufacturing Technology - I, S Chand and Company Private Limited, New Delhi,2010.
5. http://nptel.ac.in/courses/112107144/1.

1902ME453	ENGINEERING METROLOGY & MEASUREMENTS LABORATORY	L	T	P	C
		0	0	2	1

LIST OF EXPERIMENTS:

1. Comparing the accuracy of Vernier Caliper, Vernier Height Gauge, Vernier Depth Gauge and Micrometer to check the various dimensions of a given specimen.
2. Checking the dimensional limits of ten similar components using Mechanical Comparator.
3. Measurement of taper angle of a given specimen by using Sinebar.
4. Measurement of screw thread specifications by Floating Carriage Micrometer.
5. Measurement of gear tooth specifications by using Gear Tooth VernierCalliper.
6. Measurement of gear tooth specifications by using Tool Maker‟s Microscope
7. Differentiate the work piece by its Surface Roughness value
8. Measurement of Straightness of a given job by using Autocollimator
9. Temperature measurement by using Thermocouple.
10. Measurement of force using Force Measuring Setup.
11. Measurement of Torque using Torque Measuring Setup
12. Measurement of Displacement using LVDT.
13. Measurement of bore diameter using Telescopic Gauge

Total:30 Hours

REFERENCES:

1. Jain R.K., “Engineering Metrology”, Khanna Publishers, 2005
2. Alan S. Morris, “The Essence of Measurement”, Prentice Hall of India, 1997
3. Beckwith, Marangoni, Lienhard, “Mechanical Measurements”, Pearson Education,2006.
4. Donald Deckman, “Industrial Instrumentation”, Wiley Eastern, 1985.

1904GE451	LIFE SKILLS : VERBAL ABILITY	L	T	P	C
		0	0	2	1

MODULE I VOCABULARY USAGE **6 Hours**

Introduction - Synonyms and Antonyms based on Technical terms – Single word Substitution – Newspaper, Audio and video listening activity.

MODULE II COMPREHENSION ABILITY **6 Hours**

Skimming and Scanning – Social Science passages – Business and Economics passages – latest political and current event based passages – Theme detection – Deriving conclusion from passages.

MODULE III BASIC GRAMMAR AND ERROR DETECTION **6 Hours**

Parallelism – Redundancy – Ambiguity – Concord - Common Errors – Spotting Errors – Sentence improvement – Error Detection FAQ in Competitive exams.

MODULE IV REARRANGEMENT AND GENERAL USAGE **6 Hours**

Jumble Sentences – Cloze Test - Idioms and Phrases – Active and passive voice – Spelling test.

MODULE V APPLICATION OF VERBAL ABILITY **6 Hours**

Business Writing - Business Vocabulary - Delivering Good / Bad News - Media Communication - Email Etiquette – Report Writing - Proposal writing – Essay writing– Indexing –Market surveying.

TOTAL: 30 HOURS

REFERENCES:

1. Arun Sharma and MeenakshiUpadhyav, How to Prepare for Verbal Ability and Reading Comprehension for CAT, McGrawHill Publication, Seventh Edition 2017
2. R S Aggarwal and VikasAggarwal , Quick Learning Objective General English ,S.Chand Publishing House, 2017
3. Dr.K.Alex , Soft Skills, S.Chand Publishing House, Third Revise Edition, 2014
4. Raymond Murphy, Essential English Grammar in Use, Cambridge University press, New Delhi, Third Edition , 2007

1901MCX02	CONSTITUTION OF INDIA (Common to All Branches - Mandatory Course)	L	T	P	C
		2	0	0	0

UNIT I EVOLUTION OF THE INDIAN CONSTITUTION **6 Hours**

1909 Act, 1919 Act and 1935 Act. Constituent Assembly: Composition and Functions; Fundamental features of the Indian Constitution.

UNIT II UNION , STATE AND LOCAL GOVERNMENT **6 Hours**

Union Government: Executive-President, Prime Minister, Council of Minister
State Government: Executive: Governor, Chief Minister, Council of Minister
Local Government: Panchayat Raj Institutions, Urban Government

UNIT III RIGHTS AND DUTIES: **6 Hours**

Fundamental Rights, Directive principles, Fundamental Duties

UNIT IV F **RELATION BETWEEN FEDERAL AND PROVINCIAL UNITS:** **6 Hours**

Union-State relations, Administrative, legislative and Financial, Inter State council, NITI Ayog, Finance Commission of India

UNIT V STATUTORY INSTITUTIONS: **6 Hours**

Elections-Election Commission of India, National Human Rights Commission, National Commission for Women

REFERENCES:

1. D.D. Basu, Introduction to the constitution of India, Lexis Nexis, New Delhi.
2. SubhashKashyap, Our Parliament, National Book Trust, New Delhi.
3. PeuGhosh, Indian Government &Politics, Prentice Hall of India, New Delhi.
4. B.Z. Fadia&KuldeepFadia, Indian Government &Politics, Lexis Nexis, New Delhi.

1902ME501	HEAT AND MASS TRANSFER	L	T	P	C
		3	2	0	4

MODULE I CONDUCTION **12 Hours**

General Differential equation of Heat Conduction– Cartesian and Polar Coordinates – One Dimensional Steady State Heat Conduction — plane and Composite Systems – Conduction with Internal Heat Generation – Extended Surfaces – Unsteady Heat Conduction – Lumped Analysis – Semi Infinite and Infinite Solids –Use of Heisler‟s charts.

MODULE II CONVECTION **12 Hours**

Free and Forced Convection - Hydrodynamic andThermal Boundary Layer. Free and ForcedConvection during external flow over Plates and Cylinders and Internal flow through tubes .

MODULE III PHASE CHANGE HEAT TRANSFER AND HEAT EXCHANGERS **12 Hours**

Nusselt‟s theory of condensation - Regimes of Pool boiling and Flow boiling. Correlations in boiling and condensation. Heat Exchanger Types - Overall Heat Transfer Coefficient – Fouling Factors - Analysis – LMTD method - NTU method.

MODULE IV RADIATION **12 Hours**

Black Body Radiation – Grey body radiation - Shape Factor – Electrical Analogy – Radiation Shields. Radiation through gases.

MODULE V MASS TRANSFER **12 Hours**

Basic Concepts – Diffusion Mass Transfer – Fick‟s Law of Diffusion – Steady state Molecular Diffusion– Convective Mass Transfer – Momentum, Heat and Mass Transfer Analogy –Convective Mass Transfer Correlations.

1. Frank P. Incropera and David P. Dewitt, "Fundamentals of Heat and Mass Transfer", John Wiley & Sons, sixth edtion 2018.
2. Venkateshan. S.P., "Heat Transfer", Ane Books, New Delhi, 2004.
3. Ghoshdastidar, P.S, "Heat Transfer", Oxford, 2004,
4. Nag, P.K., "Heat Transfer", Tata McGraw Hill, New Delhi, 2002
5. Holman, J.P., "Heat and Mass Transfer", Tata McGraw Hill, 2000

1902ME502	DESIGN OF MACHINE ELEMENTS	L	T	P	C
		3	2	0	4

MODULE I STEADY AND VARIABLE STRESSES **12 Hours**

Introduction to the design process - Design of straight and curved beams – „C" Frame and Crane hook. Stress concentration - Design for variable loading - Soderberg, Goodman, Gerber methods and combined stresses - Theories of failure.

MODULE II DESIGN OF SHAFTS AND COUPLINGS **12 Hours**

Design of shafts based on strength, rigidity and critical speed. Design of rigid flange coupling - Design of flexible coupling.

MODULE III DESIGN OF JOINTS **12 Hours**

Design of bolted joints - stresses due to static loading, eccentrically loading. Design of welded joints - Butt and Fillet welded Joints - Strength of parallel and traverse fillet welded Joints

MODULE IV DESIGN OF SPRINGS **12 Hours**

Types, End connections and design parameters. Design of helical springs - Circular and noncircular wire - Concentric springs. Design of leaf and torsional springs under constant and varying loads

MODULE V DESIGN OF BEARINGS **12 Hours**

Types and selection criteria - Design of journal bearings - Design of rolling contact bearing Ball and roller bearing.

REFERENCES

TOTAL: 60 HOURS

. V. B. Bhandari, Design of Machine Elements, Tata McGraw-Hill Publishing Company Pvt. Ltd., New Delhi, 2010.
2. Faculty of Mechanical Engineering, PSG College of Technology, Design Data Book, M/s.KalaikathirAchchagam, 2013.
3. J. E. Shigley and C. R. Mischke, Mechanical Engineering Design, Tata McGraw-Hill Publishing Company Pvt. Ltd., New Delhi, 2011.
4. R. C. Juvinall and K. M. Marshek, Fundamentals of Machine Component Design, John Wiley & Sons, New Delhi, 2011.
5. R. L. Norton, Design of Machinery, Tata McGraw-Hill Publishing Company Pvt. Ltd., New Delhi, 2004.
6. http://nptel.ac.in/courses/112105124/

1902ME503	KINEMATICS OF MACHINES	L	T	P	C
		3	2	0	4

MODULE I FUNDAMENTALS OF MECHANISMS **12 Hours**

Basic Terminology - Kinematic link, Pair, joints, Structure, Machine, Degree of freedom, Grubler & Kutzbach Criterion - Inversions of four bar mechanism, Mechanical advantage - Transmission Angle, Inversion of single slider and double slider crank mechanisms. Common Mechanisms - Straight line mechanism, Dwell mechanism.

MODULE II KINEMATIC ANALYSIS OF MECHANISMS **12 Hours**

Relative velocity of kinematic link, Rubbing Velocity of kinematic pair, Construction of velocity and acceleration diagram by graphical method (Relative Velocity Method), Four bar mechanism, slider crank mechanisms and complex mechanism.

MODULE III CAM AND FOLLOWER MECHANISMS **12 Hours**

Introduction - Terminology, Classifications, Types of follower motion - Uniform Velocity Motion, Simple Harmonic Motion, Uniform Acceleration and Retardation Motion and Cycloidal Motion- Construction of cam profile - Knife edge follower, Roller and flat faced follower.

MODULE IV GEAR AND GEAR TRAIN **12 Hours**

Gears - Terminology, Law of gearing, Length of path of contact, Length of arc of contact, contact ratio- Interference and undercutting. Gear trains- Speed ratio, train value. Simple gear train, compound gear train, Epicyclic gear train- speed calculation by tabular method.

MODULE V FRICTION DRIVES **12 Hours**

Introduction-Friction clutch, types -single plate, Multi plate and cone clutch. Flat Belt Drives Velocity, slip, creep and Centrifugal effect of belt, length of open and cross belt drives, Maximum power transmitted, ratio of driving tension in flat belt drives - V Belt drives.

TOTAL: 60 HOURS

REFERENCES:

1. S. S. Rattan, Theory of Machines, Tata McGraw Hill Publishing Company Pvt. Ltd, New Delhi,2014.
2. J. J. Uicker, G. R. Pennock and J. E. Shigley, Theory of Machines and Mechanisms, Oxford University Press, New York,2011.
3. Ballaney P L, Theory of Machines and Mechanisms, Khanna Publishers, New Delhi,2005.
4. Sadhu Singh, Theory of Machines, Pearson Education, Second Edition,2012.
5. Rao J S and Dukkipati, Mechanism and Machine Theory, Wiley- Eastern Ltd., New Delhi,2006.
6. http://nptel.ac.in/courses/112104121/1

1902ME504	CAD	L	T	P	C
		3	0	0	3

MODULE I FUNDAMENTALS OF COMPUTER GRAPHICS 09 Hours

Product cycle, Sequential and Concurrent Engineering, CAD - Architecture, Tools, applications - Coordinate systems - Two and Three-dimensional Transformations - Translation - Scaling - Reflection - Rotation, Windowing - clipping and Viewing.

MODULE II GEOMETRIC MODELING 09 Hours

Representation of curves - Hermite, Bezier, B-Spline and rational curves - Surface Modeling - surface patch - Bezier and B spline surface. Solid Modelling - Boundary representation(B-Rep) and Constructive Solid Geometry(CSG)

MODULEIII VISUAL REALISM 09 Hours

Hidden line removal algorithm - Priority and Area oriented algorithms. Hidden Surface removal algorithm - Depth buffer and Warnock's algorithms. Hidden solid removal algorithm, Ray Tracing algorithm, Shading and Coloring - types. Computer Animation.

MODULE IV ASSEMBLY OF PARTS 09 Hours

Assembly modeling - Interference of Positions and orientations - CAD Tolerance Analysis - geometrical Mass Properties - degree of freedom - Constraints and Simulation concepts.

MODULE V CAD STANDARDS 09 Hours

Standards for computer graphics- Graphical kernel system (GKS)- Standards for exchange images- Open Graphics Library(OpenGL)-Data exchange standards- IGES,STEP,CALS,etc.- communication standards.

TOTAL: 45 HOURS

REFERENCES:

1. Ibrahim Zied, CAD/CAM-Theory and Practice, Tata McGraw Hall Publishing CompanyPvt. Ltd., New Delhi, 2009.
2. Donald Hearn, M. Pauline Baker, Computer Graphics, Prentice Hall of India, New Delhi, 2014.
3. Richard M. Lueptow, Graphics Concepts for Computer-Aided Design, Pearson EducationIndia, 2006.
4. William M. Neumann, Robert F. Sproul, Principles of Computer Graphics, Tata McGraw Hall Publishing Company Pvt Ltd., New Delhi, 2005.
5. Mikell P. Groover, Emory W. Zimmers, CAD/CAM Computer-Aided Design and Manufacturing, Prentice Hall of India, New Delhi, 2007.

1903ME001	Non - traditional machining processes	L	T	P	C
		3	0	0	3

UNIT I UNCONVENTIONAL MACHINING PROCESS 9 Hours

Introduction - Need - Classification - Energies employed in the processes - Brief overview of Abrasive jet machining(AJM), Water jet machining(WJM), Ultrasonic machining(USM), Electric discharge machining(EBM), Electro-chemical machining(ECM), Electron beam machining(EBM), Laser beam machining(LBM), Plasma arc machining(PAM).

UNIT II MECHANICAL ENERGY BASED PROCESSES 9 Hours

Abrasive Jet Machining, Water Jet Machining and Ultrasonic Machining - Working Principles, Equipment, Process parameters, Material removal rate, Applications.

UNIT III ELECTRICAL ENERGY BASED PROCESSES 9 Hours

Electric Discharge Machining - Working Principles, Equipment, Process Parameters, Material removal rate, Electrode / Tool, Power Circuits, Tool Wear, Dielectric, Flushing, Wire cut EDM - Applications.

UNIT IV CHEMICAL AND ELECTRO-CHEMICAL ENERGY BASED PROCESSES 9 Hours

Chemical machining - Etchants, Maskants - techniques. Electro-chemical machining – Working principle, Equipment, Process Parameters, Material removal rate, Electrical circuit. Electro-chemical grinding - Electro-chemical honing - Applications.

UNIT V THERMAL ENERGY BASED PROCESSES 9 Hours

Laser Beam machining, Plasma Arc Machining - Principles, Equipment. Electron Beam Machining - Principles, Equipment, Types, Beam control techniques, Material removal rate - Applications.

Total:45 Hours

Reference(s)

1. P. K. Mishra, Non-Conventional Machining, Narosa Publishing House, New Delhi, 2007.
2. P. C. Pandey and H.S. Shan, Modern Machining Processes, Tata McGraw Hill Publishing Company Pvt Ltd., New Delhi, 2008.
3. Joao Paulo Davim, Nontraditional Machining Processes: Research Advances, Springer, New York, 2013.
4. Paul De Garmo, J.T. Black, and Ronald.A. Kohser, Material and Processes in Manufacturing, Prentice Hall of India Pvt. Ltd., New Delhi, 2011.
5. Vijaya Kumar Jain, Advanced Machining Processes, Allied Publishers Pvt. Ltd., New Delhi, 2005.
6. Hassan El-Hofy, Advanced Machining Processes: Nontraditional and Hybrid Machining Processes, McGraw-Hill

1902ME551	COMPUTER AIDED DESIGN AND ANALYSISLABORATORY	L	T	P	C
		0	0	2	1

LIST OF EXPERIMENTS:

Creation of 3D assembly model of following machine elements

EXPERIMENT 1 **3 hours**

Flange Coupling

EXPERIMENT 2 **3 hours**

Knuckle joint

EXPERIMENT 3 **3 hours**

Screw Jack

EXPERIMENT 4 **3 hours**

Universal Joint

EXPERIMENT 5 **3 hours**

Stuffing box

EXPERIMENT 6 **3 hours**

Connecting rod

Creation of model and Analysis using software

EXPERIMENT 7 **2 hours**

Stress and deflection analysis in beams with different support conditions.

EXPERIMENT 8 **2hours**

Stress analysis of bracket.

EXPERIMENT 9 **2 hours**

Thermal stress analysis of mixed boundary.

EXPERIMENT 10 **2 hours**

Model analysis of Beams.

EXPERIMENT 11 **2 hours**

Harmonic analysis of simple systems.

EXPERIMENT 12 **2 hours**

Stress analysis of 3D beam.

Total: 30 hours

REFERENCES:

1. Ibrahim Zeid, CAD/ CAM Theory and Practice, McGraw Hill, 2007
2. Mikell P. Groover and Emory W. Zimmer, CAD/ CAM – Computer aided design and manufacturing, Pearson Education,1987
3. T. R. Chandrupatla and A. D. Belagundu, Introduction to Finite Elements in Engineering, Pearson Education, 2012
4. Finite Element Analysis Theory and Applications with Ansys, SaeedMoaveni, Pearson Education, 2014.

1902ME552	HEAT AND MASS TRANSFER LABORATORY	L	T	P	C
		0	0	2	1

LIST OF EXPERIMENTS:

Determination of thermal conductivity of insulating powder.

Determination of thermal conductivity of guarded hot plate.

Determination of thermal conductivity of materials in lagged pipe.

Determination of heat transfer co-efficient through composite wall.

Determination of heat transfer co-efficient by natural convection.

Determination of heat transfer co-efficient by forced convection

Determination of heat transfer co-efficient in a parallel and counter flow heat exchanger.

Determination of heat transfer co-efficient and effectiveness from Pin-Fin by natural convection.

Determination of heat transfer co-efficient and effectiveness from Pin-Fin by forced convection.

Determination of Stefan-Boltzmann constant.

Determination of emissivity using emissivity apparatus.

Determination of performance in a fluidized bed cooling tower

Total: 30 Hours

REFERENCES:

1. Frank P. Incropera and David P. Dewitt, "Fundamentals of Heat and Mass Transfer", John Wiley & Sons, 1998.
2. Kothandaraman, C.P., "Fundamentals of Heat and Mass Transfer", New Age International, New Delhi, 1998.
3. Nag, P.K., "Heat Transfer", Tata McGraw Hill, New Delhi, 2002
4. Ozisik, M.N., "Heat Transfer", McGraw Hill Book Co., 1994.
5. R.C. Sachdeva, “Fundamentals of Engineering Heat & Mass transfer”, New Age International Publishers, 2009

1902MCX03	ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE	L	T	P	C
		2	0	0	0

MODULE I INTRODUCTION TO CULTURE **6**

Hours Culture, civilization, culture and heritage, general characteristics of culture, importance of culture in human literature, Indian Culture, Ancient India, Medieval India, Modern India

MODULE II INDIAN LANGUAGES, CULTURE AND LITERATURE **6**

Hours Indian Languages and Literature-I: the role of Sanskrit, significance of scriptures to current society, Indian philosophies, other Sanskrit literature, literature of south India Indian Languages and Literature-II: Northern Indian languages & literature

MODULE III RELIGION AND PHILOSOPHY **6**
Hours

Religion and Philosophy in ancient India, Religion and Philosophy in Medieval India, Religious Reform Movements in Modern India (selected movements only)

MODULE IV FINE ARTS IN INDIA (ART, TECHNOLOGY& ENGINEERING) **6**
Hours

Indian Painting, Indian handicrafts, Music, divisions of Indian classic music, modern Indian music, Dance and Drama, Indian Architecture (ancient, medieval and modern), Science and Technology in India, development of science in ancient, medieval and modern India

MODULE V EDUCATION SYSTEM IN INDIA **6**
Hours

Education in ancient, medieval and modern India, aims of education, subjects, languages, Science and Scientists of
Ancient India, Science and Scientists of Medieval India, Scientists of Modern India.

TOTAL 30 Hours

REFEREN CES:

1. KapilKapoor, “Text and Interpretation: The India Tradition”,ISBN: 81246033375, 2005

2. “Science in Samskrit”, SamskritaBharti Publisher, ISBN 13: 978-8187276333, 2007

3. NCERT, “Position paper on Arts, Music, Dance and Theatre”, ISBN 81-7450 494-X, 200

4. S. Narain, “Examinations in ancient India”, Arya Book Depot, 1993

5. SatyaPrakash, “Founders of Sciences in Ancient India”, Vijay Kumar Publisher, 1989

6. M. Hiriyanna, “Essentials of Indian Philosophy”, MotilalBanarsidass Publishers, ISBN 13: 978- 8120810990, 2014

1904GE551	LIFE SKILLS: APTITUDE – 1	L	T	P	C
		0	0	2	1

MODULE I INTRODUCTION TO NUMBER SYSTEM, BASIC SHORTCUTS OF ADDITION, MULTIPLICATION, DIVISION 6 Hours

Classification of numbers – Types of Numbers - Divisibility rules - Finding the units digit - Finding remainders in divisions involving higher powers - LCM and HCF Models - Fractions and Digits – Square, Square roots – Cube, Cube roots – Shortcuts of addition, multiplication, Division.

MODULE II RATIO AND PROPORTION, AVERAGES 6 Hours

Definition of Ratio - Properties of Ratios - Comparison of Ratios - Problems on Ratios - Compound Ratio - Problems on Proportion, Mean proportional and Continued Proportion Definition of Average - Rules of Average - Problems on Average - Problems on Weighted Average - Finding average using assumed mean method.

MODULE III PERCENTAGES, PROFIT AND LOSS 6 Hours

Introduction Percentage - Converting a percentage into decimals - Converting a Decimal into a percentage - Percentage equivalent of fractions - Problems on percentages - Problems on Profit and Loss percentage- Relation between Cost Price and Selling price - Discount and Marked Price - Two different articles sold at same Cost Price - Two different articles sold at same Selling Price - Gain% / Loss% on Selling Price.

MODULE IV CODING AND DECODING, DIRECTION SENSE 6 Hours

Coding using same set of letters - Coding using different set of letters - Coding into a number - Problems on R-model - Solving problems by drawing the paths - Finding the net distance travelled - Finding the direction - Problems on clocks - Problems on shadows - Problems on direction sense using symbols and notations.

MODULE V NUMBER AND LETTER SERIES NUMBER AND LETTER ANALOGIES, ODD MAN OUT 6 Hours

Difference series - Product series - Squares series - Cubes series - Alternate series - Combination series - Miscellaneous series - Place values of letters - Definition of Analogy - Problems on number analogy - Problems on letter analogy - Problems on verbal analogy - Problems on number Odd man out - Problems on letter Odd man out - Problems on verbal Odd man out

TOTAL 30 Hours

REFERENCES:

1. Arun Sharma, „How to Prepare for Quantitative Aptitude for the CAT", 7th edition, McGraw Hills publication, 2016.
2. Arun Sharma, „How to Prepare for Logical Reasoning for CAT", 4th edition, McGraw Hills publication, 2017.
3. R S Agarwal, „A modern approach to Logical reasoning", revised edition, S.Chand publication, 2017.
4. R S Agarwal, „Quantitative Aptitude for Competitive Examinations", revised edition, S.Chand publication, 2017.
5. Rajesh Verma, "Fast Track Objective Arithmetic", 3rd edition, Arihant publication, 2018.
6. B.S. Sijwalii and InduSijwali, "A New Approach to REASONING Verbal & Non-Verbal", 2nd edition, Arihnat publication, 2014.

ASSESSMENT PATTERN :

1. Two tests will be conducted (25 * 2) - 50 marks
2. Five assignments will be conducted (5*10) - 50 Marks.

1902ME601	MATERIALS SCIENCE AND METALLURGY	L	T	P	C
		3	0	0	3

MODULE I PHASE DIAGRAMS AND CONSTITUTION OF ALLOYS 9 Hours

Alloys, Solid solutions - Phase diagram, phase rule, lever rule, Binary phase diagram -Isomorphous, eutectic, peritectic, eutectoid reactions - Iron-Carbon phase diagram - Metallography, microstructure.

MODULE II ENGINEERING METALS AND ALLOYS 9 Hours

Classification of Engineering materials - Ferrous metals -Plain carbon steel (low, medium and high carbon steels), microstructure/composition, properties, applications - Alloy steels, effect of alloying additions on steels - stainless steels, High Strength Low Alloy Steels (HSLA), maraging, tool steels - Cast iron - grey, white, malleable, spheroidal graphite cast iron, microstructure, properties, applications – Non-ferrous metals - Nickel, Copper, Titanium, Aluminium, Magnesium, Zinc alloys, properties and applications - Bearing materials.

MODULE III HEAT TREATMENT OF STEELS 9 Hours

Purpose of heat treatment - Annealing (stress relief, recrystallization, spheroidizing) -Normalizing - Hardening and Tempering, Isothermal transformation diagrams (T-T-T diagrams), Cooling curves superimposed on T-T-T diagrams (martensite and bainite phase formation) -Hardenability, Jominy end quench test, Case hardening processes, carburizing, nitriding, carbontiriding, cyaniding, flame hardening, induction hardening.

MODULE IV INTRODUCTION TO POLYMERS AND ENGINEERING CERAMICS 9 Hours

Polymers - Plastics and elastomers - Thermoplasts and thermosets, properties and applications (polyethylene, polypropylene, polyurethane, polystyrene, poly vinylchloride, polymethyl methacrylate, polyethylene terapthalate, polycarbonate, polyamide, acrylonitrile butadiene styrene, polyamide, polyamideimide, polypropyleneoxide, polypropylene sulphide, polyetheretherketone, polytetrafluroethylene, urea formaldehyde, phenol formaldehyde, polyester, nylon, epoxy) – Rubber and its types - Types of Ceramics and applications.

MODULE V MECHANICAL PROPERTIES AND MATERIALS TESTING 9 Hours

Elastic and plastic deformation, slip and twinning - Tensile test, stress-strain behavior of ductile and brittle materials - Stress-strain behaviour of elastomers - Viscoelasticity - Compression test – Hardness and testing methods -Impact test - Fatigue test, Stress vs number of cycles (S-N) curve, endurance limit, factors affecting fatigue - Creep test, creep curves -Types of fracture - Fracture toughness – Three crack propagation modes.

FOR FURTHER READING – SEMINAR – CPS Total: 45 Hours

Review on Super alloys, Shape memory alloys, Composite Materials, Case studies in Metallurgical failure analysis.

Reference(s)

1. William D Callister Jr., Materials Science and Engineering: An Introduction, 7th Edition, John Wiley & Sons Inc., New York, 2007.
2. G. E. Dieter, Mechanical Metallurgy, McGraw Hill, 2007.
3. V. Raghavan, Materials Science and Engineering, Prentice Hall of India, Delhi, 2009.
4. William Smith and Javed Hashemi, Foundations of Materials Science and Engineering, 5th Edition, McGraw Hill, New York, 2009.
5. G. Murray, C. White and W. Weise, Introduction to Engineering Materials, 2nd Edition, Chemical Rubber Company (CRC) Press, Taylor & Francis Group, Florida, 2007.
6. https://onlinecourses.nptel.ac.in/noc18_mm05/preview

1902ME602	DESIGN OF TRANSMISSION SYSTEMS	L	T	P	C
		3	2	0	4

MODULE I **DESIGN OF FLEXIBLE ELEMENTS** **12 Hours**

Design of Flat es and pulleys –
Design of Trans

MODULE II **SPUR GEARS AND PARALLEL AXIS HELICAL GEARS** **12 Hours**

Speed ratios and strength Factor of safety -
ear conside ations – Pressure
s

MODULE III **BEVEL, WORM AND CROSS HELICAL GEARS** **12 Hours**

Straight bevel g th. Estimati the dimensions
of pair of straigh capacity, ma terials-forces and
stresses, efficien y-helix angl es-Estimating the

MODULE IV **GEAR BOXES** **12 Hours**

Geometric progr iding mesh gear box - Design
educer unit. – Variable speed

MODULE V **CAMS, CLUTCHES AND BRAKES** **12 Hours**

Cam Design: Types-pressure angle and under cutting base circle determination-forces and resses. Design of
plate clutches – . Band and Block
brakes - externa

FOR FURTHER READING **TOTAL :60 Hours**

Design of Machine Tool Structures: Functions of Machine Tool Structures and their Requirements, Design for Strength,

Reference(s)

1. Bhandari V, “Design of Machine Elements”, 3rd Edition, Tata McGraw-Hill Book Co, 2010.
2. Joseph Shigley, Charles Mischke, Richard Budynas and Keith Nisbett “Mechanical Engineering Design”, 8th Edition, Tata McGraw-Hill, 2008.
3. Prabhu. T.J., “Design of Transmission Elements”, Mani Offset, Chennai, 2000.
4. C.S.Sharma, Kamlesh Purohit, “Design of Machine Elements”, Prentice Hall of India, Pvt. Ltd., 2003.
5. Bernard Hamrock, Steven Schmid, Bo Jacobson, “Fundamentals of Machine Elements”, 2nd Edition, Tata McGraw-Hill Book Co., 2006.
6. http://nptel.ac.in/courses/108102047/

1902ME603	DYNAMICS OF MACHINES	L	T	P	C
		3	2	0	4

MODULE I **DYNAMIC FORCE ANALYSIS OF MECHANISMS** **12 Hours**

Principle of superposition, Condition for dynamic analysis, Dynamic analysis of four bar & slider crank mechanism - Engine force analysis. Turning moment diagram for steam & IC Engine. Energy stored in flywheel, Dimension of flywheel rim, Flywheel in punching press.

MODULE II **BALANCING** **12 Hours**

Introduction - Static balancing and dynamic balancing, Balancing of Rotating mass several masses in same and different plane. Balancing of reciprocating mass Swaying couple, Tractive force, Hammer Blow. Balancing of coupled locomotives.

MODULE III **GOVERNOR AND GYROSCOPE** **12 Hours**

Governor Terminology, working principle, Types - Watt, Porter and Proell governor, Characteristics of Governor-sensitiveness, Hunting, Ichoronisn, Stability. Gyroscope- Gyroscopic effect, gyroscopic couple, gyroscopic effect on aero planes and naval ships.

MODULE IV **FUNDAMENTAL OF VIBRATION** **12 Hours**

Introduction-Terminology, Classification, elements of vibration, free undamped vibration, Free Damped vibration (Viscus Damping) - Damping ratio and logarithmic decrement. Force damped vibration - Magnification factor. Vibration isolation and transmissibility.

MODULE V **TRANSVERSE AND TORSIONAL VIBRATION** **12 Hours**

Transverse vibration of shafts and beams Shaft carrying several loads, whirling of shafts. Torsional vibration- effect of inertia on torsional vibration-Torsionally equivalent Shaft, single rotor, two rotors and three rotors system.

TOTAL 45 Hours

Reference(s)

1. Uicker, J.J., Pennock G.R and Shigley, J.E., “Theory of Machines and Mechanisms” ,3rd Edition, Oxford University Press, 2009.
2. Rattan, S.S, “Theory of Machines”, 3rd Edition, Tata McGraw-Hill, 2009
3. Thomas Bevan, "Theory of Machines", 3rd Edition, CBS Publishers and Distributors, 2005.
4. 2. Cleghorn. W. L, “Mechanisms of Machines”, Oxford University Press, 2005
5. 3. Benson H. Tongue, ”Principles of Vibrations”, Oxford University Press, 2nd Edition, 2007
6. http://nptel.ac.in/12106166.

1903ME018 GAS DYNAMICS AND JET PROPULSION L T P C
3 0 0 3

UNIT I BASIC CONCEPTS AND ISENTROPIC FLOW 9

Energy and momentum equations of compressible fluid flows – Stagnation states, Mach waves and Mach cone – Effect of Mach number on compressibility – Isentropic flow through variable ducts – Nozzle and Diffusers

UNIT II FLOW THROUGH DUCTS 9

Flows through constant area ducts with heat transfer (Rayleigh flow) and Friction (Fanno flow) – variation of flow properties.

UNIT III NORMAL AND OBLIQUE SHOCKS
9

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

UNIT IV JET PROPULSION
9

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

UNIT V SPACE PROPULSION 9

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

FOR FURTHER READING **Total 45 Hours**

Case Study: Advanced Aircraft Engines, select Fuel for Air-craft engines.

Reference(s)

1. Patrick H. Oosthuizen and William E. Carscallen, Introduction to Compressible Fluid Flow, 2nd edition, CRC Press, Taylor & Francis Group, Florida,2014.
2. Robert D. Zucker, Fundamentals of Gas Dynamics, 2nd edition, John Wiley & Sons Inc., New York,2002.
3. George P. Sutton and Oscar Biblarz, Rocket Propulsion Elements, 9th edition, John Wiley &Sons Inc., New York,2016.
4. S. M. Yahya, Fundamentals of Compressible Flow with Aircraft and Rocket Propulsion, 6th edition, New Age International private Limited,2018.

1901MGX03	OPERATIONS RESEARCH	L	T	P	C
		3	0	0	3

UNIT I INTRODUCTION TO LINEAR PROGRAMMING (LPP) 9 Hours

Introduction to Applications of Operations Research in functional areas of Management. Linear Programming-Formulation, Solution by Graphical and Simplex methods (Primal - Penalty, Two Phase), Dual simplex method. Principles of Duality.

UNIT II TRANSPORTATION AND ASSIGNMENT MODELS 9 Hours

Transportation Models – Initial Basic feasible solution by N-W Corner Rule, Least cost and Vogel‟s approximation methods. Solution by MODI-Assignment Models- Solution by Hungarian method- Travelling Salesman problem.

UNIT III NETWORKS AND INVENTORY MODELS 9 Hours

Scheduling by PERT and CPM - Inventory Models – EOQ and EBQ Models (With and without shortages), Quantity Discount Models.

UNIT IV GAME THEORY AND REPLACEMENT MODELS 9 Hours

Game Theory-Two person Zero sum games-Saddle point, Dominance Rule, Methods of matrices, graphical and LP solutions. Replacement Models-Individuals replacement Models (With and without time value of money) – Group Replacement Models.

UNIT V QUEUING THEORY MODELS 9 Hours

Queuing Theory - single and Multi-channel models – infinite number of customers and infinite calling source. (M/M/1):(∞/FCFS), (M/M/S):(∞/FCFS), (M/M/1):(N/FCFS), (M/M/S):(N/FCFS)- Simple Problems.

TOTAL: 45 HOURS

FOR FURTHER READING/SEMINAR/CBS

1. Sensitivity analysis, Transshipment problems.
2. Decision making under uncertainty, IPP.

REFERENCES:

1. Hamdy A Taha, Introduction to Operations Research, Pearson, 9th Edition, 2014.
2. Paneerselvam R., Operations Research, Prentice Hall of India, Fourth Print, 2008.
3. G. Srinivasan, Operations Research – Principles and Applications, PHI, 2007.
4. Kalavathy S, Operations Research, Second Edition, Vikas Publishing House, 2004.
5. N. D Vohra, Quantitative Techniques in Management, Tata McGraw Hill, 2010.
6. nptel.ac.in/courses/112106134/1

1903ME010 INDUSTRIAL ROBOTICS

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UNIT I FUNDAMENTAL OF ROBOTICS 6 Hours

Robot -Definition -scope of industrial robot - Robotics and Automation - Law of robotics -Robot Anatomy - Co-ordinate Systems, Work Envelope, classification - Specifications - Pitch, Yaw, Roll, Joint Notations, Speed of Motion, Pay Load - Need for Robots.

UNIT II ROBOT DRIVE SYSTEM AND END EFFECTORS 9 Hours

Pneumatic Drives, Hydraulic Drive, Mechanical Drives and Electrical Drives. End Effectors – Grippers-Pneumatic gripper, Hydraulic Grippers, Magnetic Grippers, Vacuum Grippers, and Mechanical Grippers - Two Fingered and Three Fingered Grippers; Internal Grippers and External Grippers.

UNIT III SENSORS AND MACHINE VISION SYSTEMS 12 Hours

Sensors - types - tactile sensors, proximity and range sensors, contact and non contact sensors, velocity sensors, touch and slip sensors, force and torque sensors. Robotic vision systems, imaging components, image representation, picture coding, object recognition and categorization, visual inspection.

UNIT IV ROBOT KINEMATICS AND ROBOT PROGRAMMING 12 Hours

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

UNIT V IMPLEMENTATION AND APPLICATION 6 Hours

Implementation of Robots in Industries - Various Steps- Application of robots in machining - Welding - Assembly - Material handling - Loading and unloading - hostile and remote environments. Inspection and future application-safety, training, maintenance and quality.

TOTAL: 45 HOURS

FOR FURTHER READING – SEMINAR

Recent trends and developments in the field of robotics (Evolutionary robots, swarm robots, nano robots, micro robots, medical robots, space robots, wearable robots, intelligent robots, autonomous robots, medical robots, space robots, wearable robots, etc.)

Reference(s)

1. M. P. Groover, Industrial Robotics Technology, Programming and Applications, Tata McGraw Hill Publishing Company Pvt. Ltd., New Delhi, 2001.
2. D. Richard, Klafter, A. Thomas, Chmielewski and Michael Negin, Robotics Engineering, An Integrated Approach, Prentice Hall of India, New Delhi, 2001.
3. K. S. Fu, R. C. Gonzalez and C. S. G. Lee, Robotics Control, Sensing, Vision and Intelligence, Tata McGraw Hill Publishing Company Pvt. Ltd., New Delhi, 2003
4. Yoram Koren, Robotics for Engineers, Tata McGraw Hill Publishing Company Pvt. Ltd., New Delhi, 2004.
5. Subir Kumar Saha, Introduction to Robotics, Tata McGraw Hill Publishing Company Pvt. Ltd., New Delhi, 2008.

1902ME651	THEORY OF MACHINES LABORATORY	L	T	P	C
		0	0	2	1

EXPERIMENT 1

Determination of mass moment of inertia of axisymmetric bodies using turn table apparatus

EXPERIMENT 2

Determine the characteristics and effort of Watt, Porter Proell and Hartnell Governors

EXPERIMENT 3

Exercise on Balancing of reciprocating masses.

EXPERIMENT 4

Exercise on Balancing of four rotating masses placed on different plane.

EXPERIMENT 5

Analyze the gyroscopic effect using Gyroscope and verify its laws.

EXPERIMENT 6

Determination of critical speed of shaft with concentrated loads by Whirling of shaft & vibration table apparatus.

EXPERIMENT 7

Determine the moment of inertia of object by Bifilar suspension, Trifilar & method of oscillation.

EXPERIMENT 8

Kinematic analysis of cam model, Epicycle gear train and differential model.

EXPERIMENT 9

Determination of natural frequency of single degree of freedom system & two rotor system

EXPERIMENT 10

Determine the frequency of forced vibration using Cantilever beam.

EXPERIMENT 11

Determination of natural frequency of Torque measurement system.

Total: 30 Hours

1904GE651

6 Hours

LIFE SKILLS: APTITUDE – II	**L**	**T**	**P**	**C**
(Common to All Branches)	**0**	**0**	**2**	**1**

MODULE I PARTNERSHIP, MIXTURES AND ALLEGATIONS, PROBLEM ON AGES, SIMPLE INTEREST, COMPOUND INTEREST

Introduction Partnership - Relation between capitals, Period of investments and Shares- Problems on mixtures - Allegation rule - Problems on Allegation – Problems on ages - Definitions Simple Interest - Problems on interest and amount - Problems when rate of interest and time period are numerically equal - Definition and formula for amount in compound interest - Difference between simple interest and compound interest for 2 years on the same principle and time period.

MODULE II BLOOD RELATIONS, CLOCKS, CALENDARS 6 Hours

Defining the various relations among the members of a family - Solving Blood Relation puzzles - Solving the problems on Blood Relations using symbols and notations - Finding the angle when the time is given - Finding the time when the angle is known - Relation between Angle, Minutes and Hours - Exceptional cases in clocks - Definition of a Leap Year - Finding the number of Odd days - Framing the year code for centuries - Finding the day of any random calendar date .

MODULE III TIME AND DISTANCE, TIME AND WORK 6 Hours

Relation between speed, distance and time - Converting kmph into m/s and vice versa - Problems on average speed - Problems on relative speed - Problems on trains - Problems on boats and streams - Problems on circular tracks - Problems on races - Problems on Unitary method - Relation between Men, Days, Hours and Work - Problems on Man- Day-Hours method - Problems on alternate days - Problems on Pipes and Cisterns.

MODULE IV DATA INTERPRETATION AND DATA SUFFICIENCY 6 Hours

Problems on tabular form - Problems on Line Graphs - Problems on Bar Graphs - Problems on Pie Charts - Different models in Data Sufficiency - Problems on data redundancy

MODULE V ANALYTICAL AND CRITICAL REASONING 6 Hours

Problems on Linear arrangement - Problems on Circular arrangement - Problems on Double line-up - Problems on Selections - Problems on Comparisons - Finding the Implications for compound statements - Finding the Negations for compound statements- Problems on assumption - Problems on conclusions - Problems on inferences - Problems on strengthening and weakening of arguments.

REFERENCES:

Arun Sharma, „How to Prepare for Quantitative Aptitude for the CAT", 7th edition, McGraw Hills publication, 2016.
2. Arun Sharma, „How to Prepare for Logical Reasoning for CAT", 4th edition, McGraw Hills publication, 2017.
3. R S Agarwal, „A modern approach to Logical reasoning", revised edition, S.Chand publication, 2017.
4. R S Agarwal, „Quantitative Aptitude for Competitive Examinations", revised edition, S.Chand publication, 2017.
5. Rajesh Verma, "Fast Track Objective Arithmetic", 3rd edition, Arihant publication, 2018.
6. B.S. Sijwalii and InduSijwali, "A New Approach to REASONING Verbal & Non-Verbal", 2nd edition, Arihnat publication, 2014.

ASSESSMENT PATTERN :

1. Two tests will be conducted (25 * 2) - 50 marks
2. Five assignments will be conducted (5*10) - 50 Marks.

		L	T	P	C
1904ME652	**MINI PROJECT** (Design and fabrication Project)	**0**	**0**	**4**	**2**

GUIDELINE FOR REVIEW AND EVALUATION

The students may be grouped into 2 to 4 and work under a project supervisor. The device/ system/component(s) to be fabricated may be decided in consultation with the supervisor and if possible with an industry. A project report to be submitted by the group and the fabricated model, which will be reviewed and evaluated for internal assessment by a Committee constituted by the Head of the Department. At the end of the semester examination the project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department

Total: 60 Hours

1904ME653	INDUSTRIAL VISIT PRESENTATION	L T P C 0 0 0 1

GUIDELINE FOR REVIEW AND EVALUATION

In order to provide the experiential learning to the students, shall take efforts to arrange at least one industrial visit / field visits in a year. A presentation based on Industrial visits shall be made in this semester and suitable credit may be awarded by the Committee constituted by the Head of the Department at the end of the semester examination

1702ME701	AUTOMOBILE ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

1. To impart knowledge on the principles of operation and constructional details of various automobile components.
2. To provide knowledge on the working of fuel supply system in various automobiles.
3. To learn the function of various components in transmission and drive lines of a vehicle.
4. To study the concept and working of steering, brakes and suspension systems in automobile.
5. To impart knowledge on electrical and electronic systems of automobiles.

UNIT I VEHICLE STRUCTURE AND ENGINES 09 Hours

Types of Automobiles - vehicle construction, chassis, frame and body. Engines Supercharger, turbo chargers, engine emission control by 3 Way catalytic controller. Alternative energy resources Liquefied petroleum gas, Bio Diesel.

UNIT II FUEL SUPPLY SYSTEMS 09 Hours

Spark ignition engine Carburetor-Types simple carburettor, solex carburettor, carter carburetor. Electronic fuel injection system, mono-point and multi Point injection systems. Compression iginition Engine-Inline fuel injection system, Common rail direct fuel injection system.

UNIT III TRANSMISSION AND DRIVE LINES 09 Hours

Clutch types single plate clutch, multi plate clutch. Gearbox - synchromesh gear box, sliding mesh gear box, constant mesh gear box. Fluid flywheel, torque convertors, propeller shaft, slip joint, universal Joints, differential and rear axle hotchkiss drive and torque tube drive.

UNIT IV STEERING, BRAKES AND SUSPENSION 09 Hours

Wheels and Tyres Construction. Steering geometry and types of steering gearbox rack and pinion steering gear, recirculating ball type gear and Power steering construction and working principle. Suspension systems types rear suspension and front suspension. Braking systems-types disc brake, drum brake, hydraulic brake and air brake.

UNIT V ELECTRICAL AND ELECTRONICS SYSTEMS 09 Hours

Electrical systems, battery types, construction and working principle of lead acid battery. Generator starting motor and drives, lighting and ignition (Battery, Magneto Coil and+ Electronic type), regulators, cut outs. Common rail direct fuel injection system. Different electronic control unit used in the engine management, block diagram of the engine management system.

TOTAL: 45 HOURS

REFERENCES:

1. Kirpal Singh, Automobile Engineering Volume.1 and 2, Standard Publishers, New Delhi.2009.
2. Crouse and Anglin, Automotive Mechanism, Tata McGraw Hill Publishing Company Private Limited, New Delhi, 2003.
3. Newton, Steeds and Garet, Motor vehicles, Butterworth Publishers, 2000.
4. S. Srinivasan, Automotive Mechanics, 2003, Tata McGraw Hill Publishing Company Private Limited, New Delhi, 2003.
5. Joseph Heitner, Automotive Mechanics, East-West Press, 2006.
6. http://nptel.ac.in/syllabus/125106002/

1702ME702	MECHATRONICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

1. To introduce the concept and working of sensors used in mechatronic system.
2. To study different types of actuators used in mechatronic system.
3. To provide knowledge on feedback mechanism for improving the reliability of mechatronic system.
4. To impart knowledge on working of microcontroller in mechatronic systems
To learn the Programmable Logic Controller (PLC) used in mechatronic systems

UNIT I SENSORS **09 Hours**

Components of mechatronics system, Sensor - terminology and Mathematical equation - Potentiometer, Linear Variable differential transformer, strain gauge, Piezoelectric sensor, Optical encoder, Hall effect sensor, Thermistor, Thermo-couple, Light sensor.

UNIT II ACTUATOR **09 Hours**

Terminology, mathematical equation of Mechanical Actuation system - cam, gear, belt & chain, Ball screw, Mechanical aspects of motor selection. Pneumatic & hydraulic Actuation system. Electrical actuation system - relay & solenoid, working & control of Brush & brushless DC motor, working & control of Stepper & servo motor.

UNIT III FEEDBACK CONTROL **09 Hours**

Transfer Function, Mathematical Modeling of Mechanical & Electrical system, Electrical analogy, Electromechanical system, First order system, second order system, Proportional control, derivative control, Integral control, PID control, Controller tuning, Concept of stability.

UNIT IV MICROCONTROLLER **09 Hours**

Architecture of 8051- I/O Pins, Ports and Circuits, memory, counter, Timer, Interrupt, Instruction set- Moving data, Logical, arithmetic operation, Jump & call instruction, LCD & Keyboard Interfacing. Examples - Windscreen wiper motion, Car engine management.

UNIT V PROGRAMMABLE LOGIC CONTROLLER **09 Hours**

Basic Structure - Input / Output Processing - Programming - Mnemonics - Timers, Internal relays and counters - Shift Registers - Master and Jump Controls - Data Handling - Analogue Input / Output - Selection of PLC. Examples -Pick and place robot. Car park barrier system.

TOTAL: 45 HOURS

REFERENCES:

1. W. Bolton, Mechatronics, Pearson Education, New Delhi, 2012.
2. Butterworth-Heinemann, Mechatronics: Principles and Applications Butterworth-Heinemann Ltd, 2005.
3. Nitaigour Premchand Mahalik, Mechatronics: Principles, Concepts and Applications, Tata McGraw Hill Publishing Company Pvt. Ltd., New Delhi, 2008
4. Krishna Kant, Microprocessors & Microcontrollers, Prentice Hall of India, 2007.
5. K. P. Ramachandran, G. K. Vijayaraghavan, and M. S. Bala-Sundram, Mechatronics: Integrated Mechanical Electronic Systems, Wiley India Pvt. Ltd., New Delhi 2008.
6. http://nptel.iitm.ac.in/courses/Webcourse-contents/IIT-roorkee/industrialengineering/index.ht

1702ME703	COMPUTER AIDED MANUFACTURING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

1. To impart the knowledge on construction and working of Computer Numerical Control (CNC) Machines, maintenance and retrofitting of CNC machines.
2. To provide knowledge on interfacing, communication and control of CNC drives.
3. To introduce programming of CNC turning center
4. To provide exhaustive skill on programming of CNC machining center
5. To educate the concept, applications and emerging trends in Additive Manufacturing (AM) technologies.

UNIT I CONSTRUCTION OF CNC AND MOTION CONTROL 9 Hours

Evolution of CNC Technology - CNC machine -Concept, classification, features and applications - Constructional features and applications - Linear motion and Recirculating ball bearings - CNC controller and Interpolator -Maintenance and retrofitting

UNIT II DRIVES AND CONTROL 9 Hours

Spindle and feed drives - Sensors -Position, Encoders, Proximity, Limit switch -Interfacing system - Microcontroller and PLC based -Introduction to Graphical User interface -Communication protocol - RS232, RS 485, USB, Ethernet -PLC -Ladder diagram -Peripherals -Timer, Counter, Encoder interface, Human Machine Interface

UNIT III PROGRAMMING OF CNC LATHE 9 Hours

Coordinate system - structure of a part program -G & M Codes -Programming for FANUC and SIEMENS controller -Single pass and canned cycle -Turning, facing and threading -Multi-pass canned cycle -Rough and Finish turning, facing, pattern repeating, grooving, threading, drilling, boring, peck drilling, high speed drilling cycle -Subprogram and Macro programming -Tool length and nose radius compensation - offset -Tool, work and coordinate -Insert -Materials, Classification, Nomenclature and Selection -Tool and Work holding devices -Automatic tool changer -Turret and drum type -Tool holder nomenclature and selection -CNC part programming using CAD/CAM software and interfacing with CNC machine

UNIT IV PROGRAMMING OF CNC MACHINING CENTRE 9 Hours

Coordinate system - G & M Codes for machining centre - Programming for FANUC and SIEMENS controller -Machining cycles - Linear and circular interpolation, Contouring, rectangular and circular pocketing, drilling, peck drilling, high speed drilling, Back boring, counter boring and tapping cycle - Cutter diameter compensation -Nomenclature of multi-point cutting tool and tool holder -Tool and work holding devices -Automatic Pallet changer.

UNIT V ADDITIVE MANUFACTURING 9 Hours

Introduction to additive manufacturing - Applications of AM in Automotive, Aerospace, Business, Consumer Electronics, Die & Mould, Jewellery and Medical industries -Generic process chain - Classification - Components, working principle, Materials processed and Applications - Stereolithography (SLA), Fusion Deposition Modelling (FDM), 3D Printing (3DP), Selective Laser Sintering (SLS), Electron Beam Additive Manufacturing (EBAM)

TOTAL: 45 HOURS

FURTHER READING / CONTENT BEYOND SYLLABUS / SEMINAR :

Five Axis CNC machines - User defined cycles - Rapid Manufacturing.

REFERENCES:

1. HMT, Mechatronics, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2005.
2. P. M. Agrawal and V. J. Patel, CNC Fundamentals and Programming, Charotar Publishing House Pvt. Ltd., 2014.
3. P. Radhakrishnan, Computer Numerical Control Machines, New Central Book Agency, 2004.
4. G. E. Thyer, Computer Control of Machine Tools, Butterworth-Heinemann Ltd, 1991.
5. Mikell P. Groover, Automation, Production System and Computer Integrated Manufacturing, Prentice Hall of India, New Delhi, 2008
6. http://nptel.ac.in/courses/Webcourse-contents/IIT Delhi/ Computer %20 Aided %20 Design % 20 & %20ManufacturingII/index.htm

1701MGX02	INDUSTRIAL ECONOMICS	L	T	P	C
		3	2	0	4

COURSE OBJECTIVES:

1. To introduce the concepts of micro, macroeconomic systems and business decisions in industry.
2. To acquire knowledge on laws of demand & supply and methods of forecasting the demand
3. To emphasis the systematic evaluation of the costs, breakeven point for return on economics and diseconomies

UNIT I INTRODUCTION **9 Hours**

Introduction to Industrial economics- Micro and Macro economics - Kinds of Economic Systems - Production Possibility Frontier - Opportunity Cost - Objective of Organizations - Kinds of Organization.

UNIT II DEMAND AND SUPPLY **9 Hours**

Functions of Demand and Supply - Law of diminishing Marginal Utility - Law of Demand and Supply Elasticity of Demand - Demand Forecasting Methods - Indifference curve

UNIT III PRODUCTION AND COST **9 Hours**

Production Function - Returns to Scale - Law of Variable Proportion - Cost and Revenue concepts and Cost Curves - Revenue curves - Economies and Dis-Economies of scale - Break Even point.

UNIT IV MARKET STRUCTURE **9 Hours**

Market Structure - Perfect Competition - Monopoly - Monopolistic - Oligopoly - Components of Pricing - Methods f Pricing - Capital Budgeting IRR - ARR - NPV - Return on Investment - Payback Period.

UNIT V INTRODUCTION TO MACRO ECONOMICS AND FINANCIAL ACCOUNTING **9 Hours**

National Income - Calculation Methods - Problems - Inflation - Deflation - Business Cycle - Taxes - Direct and Indirect Taxes - Fiscal and monetary policies.

TOTAL: 45 HOURS

FURTHER READING / CONTENT BEYOND SYLLABUS / SEMINAR :

1. Nature and characteristics of Indian Economy
2. Role and functions of Central bank - LPG - GATT - WTO.

Course Outcome:

1. Understand the micro and macroeconomic environment for a favorable business environment.
2. Apply laws of demand and supply in engineering economy and forecast the demand.
3. Analyze the various costs and breakeven point for organizational profitability.
4. Discuss the concepts of equilibrium price in different market situations and Capital Budgeting methods.
5. Summarize the objectives behind micro economics, financial accounting, taxation, and Government's economic policies.

REFERENCES:

1. A Ramachandra Aryasri and V V Ramana Murthy, Engineering Economics and Financial Accounting, Tata McGraw Hill Publishing Company Limited, New Delhi, 2006.
2. R Kesavan, C Elanchezhian and T Sunder Selwyn, Engineering Economics and Financial Accounting, Laxmi Publication Ltd, New Delhi, 2005.
3. V L Samuel Paul and G S Gupta,Managerial Economics Concepts and Cases, Tata McGraw Hill Publishing Company Limited, New Delhi, 1981.
4. S N Maheswari, Financial and Management Accounting, Sultan Chand
5. V L Samuel Paul and G S Gupta, Managerial Economics-Concepts and Cases.
6. http://nptel.ac.in/courses/112107209/

1703ME018	POWER PLANT ENGINEERING	L	T	P	C
		3	0	0	3

Course Objectives

- To impart the knowledge on boilers and steam power plant.
- To learn about the various components associated with steam power plant.
- To study the working of nuclear and hydel power plant.
- To learn about the working of diesel and gas turbine power plant.
- To provide the knowledge on power plants using renewable energy and economics of power plants

UNIT I INTRODUCTION TO POWER PLANTS AND BOILERS 9 Hours

Layout of Steam power plant - Components, Selection. Steam Boilers and Cycles - High Pressure and Super Critical Boiler Bed Boilers. Combined Power Cycles. Comparison and Selection.

UNIT II STEAM POWER PLANT 9 Hours

Fuel and Ash Handling - Combustion Equipment for burning coal, Mechanical Stokers, Pulveriser, Electrostatic Precipitato Mechanical Collectors. Draught - different types. Surface Condenser types. Cooling Towers. Pollution controls.

UNIT III NUCLEAR AND HYDEL POWER PLANTS 9 Hours

Nuclear Energy - Fission, Fusion Reaction. Layout - Types of Reactors, Pressurized Water Reactor, Boiling Water Reactor Disposal and safety. Hydel Power Plant - Layout, Essential Elements, pumped storage. Selection of Turbines, Governing o

UNIT IV DIESEL AND GAS TURBINE POWER PLANTS 9 Hours

Layout of Diesel Power Plant - Components, Selection of Engine Type, applications. Gas Turbine Power Plant - Layout, F Turbine Material. Open and Closed Cycles - Reheating, Regeneration and Intercooling.

UNIT V OTHER POWER PLANTS AND ECONOMICS OF POWER PLANTS 9 Hours

Geo thermal power plant. Ocean thermal energy conversion (OTEC). Tidal power plant. Solar thermal power plant. Wind e turbines. Magneto hydrodynamic generator (MHD). Cost of Electric Energy - Fixed and operating Costs, Economics of loa

FOR FURTHER READING – SEMINAR – CPS **Total : 45 Hours**

Renovation and modernization of aged power plants - Maintenance aspects of power plants

Course Outcomes (COs)

1. Understand the working principles of boilers and steam powe plant.
2. Explain the functioning of various components in steam power plant.
3. Understand the working of nuclear and hydel power plant.
4. Expose the working of diesel and gas turbine power plant.
5. Explain the working of renewable power plants and calculate the economics of power plants.

Reference(s)

1. S. C. Arora, S. Domkundwar, A course in Power Plant Engineering, Dhanpatrai & Sons, New Delhi, 2008.
2. K.K. Ramalingam, Power Plant Engineering, Scitech Publications (India) Private Limited, 2002.
3. P. K. Nag, Power plant Engineering, Tata McGraw Hill Company Private Limited, New Delhi, 2014.
4. G. R. Nagpal, Power Plant Engineering, Khanna Publishers, New Delhi, 2002.
5. G. D. Rai, Introduction to Power Plant Technology, Khanna Publishers, New Delhi, 2013.
6. http://nptel.ac.in/courses/108105058/8

INDUSTRIAL ROBOTICS **L T P C**

1703ME011 **3 0 0 3**

Course Objectives

- To explain the fundamentals and working of robots.
- To describe the importance of drives and end effectors of robots.
- To explain the types of sensors and concept of machine vision system.
- To analyze kinematics of robots and its programming.
- To identify and explain the applications of robots in industries.

UNIT I **FUNDAMENTAL OF ROBOTICS** **6 Hours**

Robot -Definition -scope of industrial robot - Robotics and Automation - Law of robotics -Robot Anatomy - Co-ordinate Systems, Work Envelope, classification - Specifications - Pitch, Yaw, Roll, Joint Notations, Speed of Motion, Pay Load - Need for Robots.

UNIT II **ROBOT DRIVE SYSTEM AND END EFFECTORS** **9 Hours**

Pneumatic Drives, Hydraulic Drive, Mechanical Drives and Electrical Drives. End Effectors - Grippers - Pneumatic gripper, Hydraulic Grippers, Magnetic Grippers, Vacuum Grippers, and Mechanical Grippers - Two Fingered and Three Fingered Grippers; Internal Grippers and External Grippers.

UNIT III **SENSORS AND MACHINE VISION SYSTEMS** **12 Hours**

Sensors - types - tactile sensors, proximity and range sensors, contact and non contact sensors, velocity sensors, touch and slip sensors, force and torque sensors. Robotic vision systems, imaging components, image representation, picture coding, object recognition and categorization, visual inspection.

UNIT IV **ROBOT KINEMATICS AND ROBOT PROGRAMMING** **12 Hours**

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

UNIT V **IMPLEMENTATION AND APPLICATION** **6 Hours**

Implementation of Robots in Industries - Various Steps- Application of robots in machining – Welding Assembly - Material handling - Loading and unloading - hostile and remote environments. Inspection and future application-safety, training, maintenance and quality.

FOR FURTHER READING – SEMINAR – CPS **Total: 45 Hours**

Recent trends and developments in the field of robotics (Evolutionary robots, swarm robots, nano robots, micro robots, medical robots, space robots, wearable robots, intelligent robots, autonomous robots, medical robots, space robots, wearable robots, etc.)

Course Outcomes (COs)

1. Understand the construction and fundamentals of robots.
2. Select a suitable drive and end effector for robots.
3. Familiarize the concept of machine vision system and sensors.
4. Understand the kinematics of robots and programming of robot.
5. Summarize the usage and applications of robots in industries.

Reference(s)

1. M. P. Groover, Industrial Robotics Technology, Programming and Applications, Tata McGraw Hill Publishing Company Pvt. Ltd., New Delhi, 2001.
2. D. Richard, Klafter, A. Thomas, Chmielewski and Michael Negin, Robotics Engineering, An Integrated Approach, Prentice Hall of India, New Delhi, 2001.
3. K. S. Fu, R. C. Gonzalez and C. S. G. Lee, Robotics Control, Sensing, Vision and Intelligence, Tata McGraw Hill Publishing Company Pvt. Ltd., New Delhi, 2003
4. Yoram Koren, Robotics for Engineers, Tata McGraw Hill Publishing Company Pvt. Ltd., New Delhi, 2004.
5. James G. Keramas, Robot Technology Fundamentals, Cengage Learning, 2011.
6. http://nptel.ac.in/downloads/112101098/

1702ME751	MECHATRONICS LABORATORY	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES:

1. To impart knowledge on modeling and simulation of mechatronics system.
2. To provide knowledge on design of fluid power circuit in mechatronic system.
3. To understand the working of microcontroller and PLC in mechatronic systems through experiments.
4. To expose knowledge on force, acceleration and displacement measurements.
5. To gain the knowledge for controlling the position, velocity and force in mechatronics system.

LIST OF EXPERIMENTS:

1. Modeling and simulation of mechatronics system using MATLAB.
2. Modeling and design of PID controller for Mechatronics system.
3. Study and simulation of various hydraulic and pneumatic components using FLUIDSIM software.
4. Design and testing of fluid power circuits for automatic opening and closing for doors and to control its velocity and direction.
5. Position and speed control of DC Motor using Microcontroller Board.
6. Speed control of Stepper Motor using Microcontroller Interface Board.
7. Measurement of force, acceleration and displacement using Virtual instrumentation.
8. Design of Programmable logic Controller based timer controller for multiple pneumatic cylinder Sequencing in assembly operations
9. Position and velocity control of pick and place robot arm for loading and unloading Application using robot Programming language.
10. Measurement and control of temperature of an application using Virtual instrumentation

TOTAL: 30 HOURS

1702ME752	COMPUTER AIDED MANUFACTURING LABORATORY	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES:

1. To provide knowledge on modeling and creating tool path of machine components using computer aided manufacturing softwares.
2. To impart part programming knowledge on CNC lathe.
3. To expose part programming knowledge on CNC milling machine.
4. To study the working of wire cut EDM for cutting various shapes.
5. To impart knowledge on developing the prototype by additive manufacturing process.

LIST OF EXPERIMENTS:

1. To make a protected type flanged coupling to transmit the power from ø20mm shaft
2. To manufacture a following component as shown below
3. To fabricate a stand as shown in figure.
4. To machine a logo of EGSPEC
5. To make a profile of the following component.
6. To make an injection molding die for simple part using CNC milling and EDM/wire cut EDM Machine
7. Exercise on reverse engineering of pump impeller using 3D scanner and printer.
8. Redesign and make an extruder assembly of a 3D printer to hold three filaments using design for additive
9. Manufacturing principles.

TOTAL: 30 HOURS

1704ME753	MINI PROJECT III (Simulation and analysis)	L	T	P	C
		0	0	2	1

Course Objectives

- To develop skills to formulate a technical project.
- To give guidance on the various tasks of the project and standard procedures.
- To teach use of new tools, algorithms and techniques required to carry out the projects.
- To give guidance on the various procedures for validation of the product and analyse the cost effectiveness.
- To provide guidelines to prepare technical report of the project.

GUIDELINE FOR REVIEW AND EVALUATION

The students may be grouped into 2 to 4 and work under a project supervisor. The device/ system/component(s) to be fabricated may be decided in consultation with the supervisor and if possible with an industry. A project report to be submitted by the group and the fabricated model, which will be reviewed and evaluated for internal assessment by a Committee constituted by the Head of the Department. At the end of the semester examination the project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department

Total: 30 Hrs

1703ME012	RENEWABLE ENERGY SOURCES	L	T	P	C
		3	0	0	3

Course Objectives

- To learn about solar radiation and solar thermal systems.
- To provide knowledge on fundamentals of Photovoltaic systems.
- To study about the working of ocean and geothermal energy sources.
- To impart the knowledge on wind energy system.
- To learn about bio mass energy sources and its utilization.

UNIT I SOLAR RADIATION AND SOLAR THERMAL SYSTEMS 9 Hours

Solar radiation at the Earth's surface, solar radiation measurements, solar radiation data, estimation of average solar radiation. Introduction to conversion of solar radiation into heat, flat plate collectors, concentrating collectors – Types.

UNIT II SOLAR PHOTOVOLTAIC SYSTEMS 9 Hours

Introduction to photovoltaic system, principle of a photovoltaic cell, Voltage current characteristics of a solar cell, interconnection of solar cells, efficiency of a solar cell, configuration of solar photovoltaic panel, photovoltaic cell technology, merits and limitations and its applications.

UNIT III UNIT III OCEAN ENERGY AND GEOTHERMAL ENERGY 9 Hours

Wave energy - Energy from waves, energy potential. Conversion devices. Tidal energy - energy potential, conversion systems. Ocean thermal energy conversion -Methodology, Applications. Geothermal energy - classification of geothermal resources, schematic of geothermal power plants, operational and environmental problems

UNIT IV WIND ENERGY 9 Hours

Basic principles of wind energy conversion - classification of wind turbines, Types of rotors. Design of windmills - wind turbine rotor, regulating system for rotor, wind power generation curves, wind data and energy estimation. Site selection considerations - Merits and demerits of wind energy systems

UNIT V BIO-ENERGY 9 Hours

Biomass resources - Conversion technologies - Biochemical conversion, Biomass gasification, Pyrolysis. Biogas - Production, factors affecting biogas production, biogas plants. Energy recovery from urban waste, power generation from liquid waste, biomass cogeneration, bio-fuels.

FOR FURTHER READING – SEMINAR – CPS Total: 45 Hours

Hydrogen energy, Solar production of hydrogen, selection of optimum wind energy generators, power generation from landfill gas, power from satellite stations

Course Outcomes (COs)

1. Estimate solar radiation and its conversion into heat using solar collectors.
2. Understand the characteristics of solar photovoltaic system.
3. Expose the working of ocean and geothermal energy sources
4. Estimate wind energy potential and design of wind energy systems.
5. Understand the bio mass energy sources and its conversion technologies.

Reference(s)

1. D. P. Kothari, K. C. Singal and Rakesh Ranjan, Renewable Energy Sources and Emerging Technologies, Prentice Hall of India, New Delhi, 2011.
2. Godfrey Boyle, Renewable energy power for sustainable future, Oxford University Press in association with the Open University, New Delhi,2012.
3. S. A. Abbasi and Naseema Abbasi, Renewable energy sources and their environmental impact Prentice Hall of India, New Delhi,2010.
4. John W. Twidell and Anthony D. Weir, Renewable energy resources, English Language Book Society (ELBS), 2015.
5. G. D. Rai, Renewable Energy Sources, Khanna Publishers, New Delhi 2004.
6. http://nptel.ac.in/courses/121106014.

1703ME015 COMPUTER INTEGRATED MANUFACTURING

Course Objectives

- To introduce the basic concepts of Computer Integrated Manufacturing (CIM).
- To provide knowledge on Group Technology and Computer Aided Process Planning.
- To impart knowledge on Shop Floor Control and Flexible Manufacturing Systems.
- To learn the various CIM implementation and data communication techniques.
- To provide knowledge on the concept of Manufacturing automation protocol, Technical office protocoland database te

UNIT I INTRODUCTION

The changing manufacturing and management scene, External communication, Islands of automation and software, dedicated and open systems, manufacturing automation protocol, introduction to CAD/CAM integration

UNIT II GROUP TECHNOLOGY AND COMPUTER AIDED PROCESSPLANNING

Classification and coding - DCLASS, MICLASS and OPITZ coding systems. Facility design using Benefits of G.T - cellular manufacturing. Process planning, role of process planning in - CAD/CAM integration- approaches tocomputer aided pro approach and generative approaches.

UNIT III SHOP FLOOR CONTROL AND FMS

Shop floor control phases -factory data collection system -automatic identification methods- Bar code technology - automated data collection system. FMS- components of FMS- types -FMS workstation- material handling andstorage systems- FM control systems-application and benefits

UNIT IV CIM IMPLEMENTATION AND DATA COMMUNICATION

System modeling tools- ICAM definition (IDEF) models, activity cycle diagram, CIM open system architecture (CIMOSA) - m wheel- CIM architecture- Product data management, implementation- software. Communication fundamentals- local area networ LAN implementations - network management and installations.

UNIT V OPEN SYSTEM AND DATABASE FOR CIM

Open systems-open system inter-connection - manufacturing automations protocol and technical office protocol- (MAP/TOP).Development of databases -database terminology- architecture of database systems- data modeling anddata associatio - database operators - advantages of data base and relational database.

FOR FURTHER READING – SEMINAR – CPS **Total :**

Paperless factory, introduction virtual reality and applications, virtual prototypingmanufacturing Instrumentation ar virtual enterprises.

Course Outcomes (COs)

1. Understand the basic concepts of CIM.
2. Infer the concepts of Group Technology and Computer Aided Process Planning.
3. Identify the suitable method on Shop Floor Control and Flexible Manufacturing Systems.
4. Familiarize the CIM implementation and data communication techniques.
5. Recognize the integration of data communication at various levels of planningmanufacturing.

Reference(s)

1. Mikell P. Groover, Automation of production systems and computer integrated manufacturing, Pearson Education, United States of America, 2008.
2. Lee Kunwoo, Principles of CAD, CAM, CAE systems, Addison Wesley, United States of America, 1999
3. Kant Vajpayee. S, Principles of Computer Integrated Manufacturing, Prentice Hall, New Delhi, 2003
4. Radhakrishnan P, Subramanyan. S and Raju. V, CAD, CAM, CIM, Second Edition New Age International Pvt. Ltd, New Delhi, 2000.
5. Lee Kunwoo, Principles of CAD, CAM, CAE systems, Addison Wesley, United States of America, 1999
6. http://nptel.ac.in/courses/112102101/

01	TOTAL QUALITY MANAGEMENT	L	T	P	C
		3	0	0	3

bjectives

- To learn concepts, dimension quality and philosophies of TQM.
- To study the TQM principles and its strategies.
- To impart knowledge on TQM tools for continuous improvement.

INTRODUCTION — 9 Hours

f Quality - Dimensions of Quality - Quality Planning - Quality costs - Analysis Techniques for Quality ic concepts of Total Quality Management - Historical Review - Quality Statements - Strategic Planning, ilosophy - Crosby philosophy - Continuous Process Improvement - Juran Trilogy, PDSA Cycle, 5S, stacles to TQM Implementation

TQM PRINCIPLES — 9 Hours

f TQM, Leadership - Concepts - Role of Senior Management - Quality Council, Customer satisfaction - erception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement n, Empowerment, Teams, Recognition and Reward, Performance Appraisal, Benefits - Supplier - Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development, Performance Basic Concepts, Strategy, Performance Measure.

STATISTICAL PROCESS CONTROL (SPC) — 9 Hours

ools of quality - Statistical Fundamentals - Measures of central Tendency and Dispersion, Population and rmal Curve, Control Charts for variables X bar and R chart and attributes P, NP, C, and u charts, samples, Process capability, Concept of six sigma - New seven Management tools

TQM TOOLS — 9 Hours

ing - Reasons to Benchmark - Benchmarking Process, Quality Function Deployment (QFD)- House QFD Process, and Benefits - Taguchi Quality Loss Function - Total Productive Maintenance (TPM) - provement Needs, and FMEA - Stages of FMEA- Case studies

QUALITY SYSTEMS — 9 Hours

equirements of ISO 9000 and Other Quality Systems - ISO 9000:2000 Quality System - Elements, tion of Quality System, Documentation, Quality Auditing, ISO 9000:2005 and 9001:2015, ISO 14000.

THER READING – SEMINAR – CPS — **Total: 45 Hours**

1. Case Study: TQM Quality and Environmental Concepts in real World Applications
2. Environment Management system

utcomes

1. Understand the concepts, dimension quality and philosophies of TQM.
2. Understand the principles of TQM and its strategies.
3. Apply seven statistical quality and management tools
4. Understand TQM tools for continuous improvement.
5. Understand the QMS and EMS

Rathakrishnan, Gas Dynamics, 5th edition, PHI Learing Private Limited, 2013.
N. Gupta and B. Valarmathi, Total Quality Management, Tata McGraw-Hill Publishing Company Pvt. Ltd., New Delhi, 2009.
S. Kumar, Total Quality Management, Laxmi Publications Ltd. New Delhi, 2006
P.N. Mukherjee, Total Quality Management, Prentice Hall of India, New Delhi, 2006.
Dale H.Besterfiled, Total Quality Management, Pearson Education Inc., New Delhi, 2003.
https://onlinecourses.nptel.ac.in/noc17_mg18/preview

1703ME014 DESIGN OF JIGS, FIXTURES AND PRESS TOOLS

Course Objectives

- To provide knowledge on design principles for desiging the jigs and fixtures.
- To impart knowledge on locating and clamping principles for designing jigs and fixtures.
- To introduce the different types of jigs for producing the part.
- To study the different types of fixtures for producing the part.
- To introduce about press working terminologies and press accessories.

UNIT I TOOL DESIGN

Objectives, Challenges and Requirements, Production and Inspection Devices. Jigs and Fixtures - Differences,Design principles, Advantages, Essential Features, Materials used. Introduction to Limits, Fits and Tolerances, International Tolerance Grades, Geometric Dimensioning and Tolerancing.

UNIT II LOCATION AND CLAMPING

Location - Principles, Basic rules, Degrees of Freedom, 3-2-1 Principle, Locating Methods, Types of Locators, Standard Parts. Clamping - Principles, Types of Mechanical Actuation Clamps, Pneumatic, Hydraulic, Magnetic,Vacuum, Electrostatic clamping, Epoxy Resin Clamping. Factors considered for Design of Jigs and Fixtures.

UNIT III JIGS

Jigs - Elements, Construction, Types and Materials for Jig Elements. Drill bushes - Types, Special Bushes, Bush Clearance. Automatic drill jig, Rack and pinion operated, Indexing, Air operated Jig components - Design of Jigs forgiven components.

UNIT IV FIXTURES

General Design Principles of Fixture. Types of Boring, Lathe, Milling and Broaching fixtures - Setting Block. Grinding, Planing and Shaping fixtures. Inspection - Gauging, Measuring and Supplement fixtures. Welding,Assembly and Modular fixtures. Design of fixtures for given component.

UNIT V PRESS TOOLS

Mechanical Presses - Working terminology, Elements, Types and Press Accessories. Types of Dies, Punches and Strippers. Pressure pad, Knockouts, Stops and Pilots. Bending, Forming, Drawing and Deep Drawing - Dies and its Types. Spring-back phenomenon and Draw Ratio. Progressive, Combination and Compound Dies. Design and Development of Dies - Blank Development, Strip Layout, Computation of capacities and tonnage requirements.

FOR FURTHER READING – SEMINAR – CPS **Total:**

Analysis of Clamping forces - Tolerance and Error Analysis - Design considerations in forging,extrusion, casting and plastic dies.

Course Outcomes (COs)

1. Understand about the design principles for designing the jigs and fixtures.
2. Identify the suitable locators and clamps.
3. Choose a suitable jig for producing a part.
4. Select a suitable fixture for producing a part.
5. Design suitable Dies and Press tools for Engineering applications.

Reference(s)

1. Edward G. Hoffman, Jig and Fixture Design, Cengage Learning, New Delhi, 2004.
2. C. Elanchezhian, Design of Jigs, Fixtures and Press Tools, Eswar Press, Chennai, 2010.
3. P. H. Joshi, Jigs & Fixtures, Tata McGraw Hill Education Private Limited, New Delhi 2012.
4. Hiram E Grant, Jigs and Fixtures, Tata McGraw Hill Education Private Limited, New Delhi, 2011.
5. C. Donaldson, G. H. Lecain and V. C. Goold, Tool Design, Tata McGraw Hill Education PrivateLimited, New Delhi, 2011.
6. http://nptel.ac.in/courses/112105126/35

		L	T	P	C
1704ME851	**PROJECT VIVA VOCE**	0	0	18	9

Course Objectives

- To develop skills to formulate a technical project.
- To give guidance on the various tasks of the project and standard procedures.
- To teach use of new tools, algorithms and techniques required to carry out the projects.
- To give guidance on the various procedures for validation of the product and analyse the cost effectiveness.
- To provide guidelines to prepare technical report of the project.

GUIDELINE FOR REVIEW AND EVALUATION

The students may be grouped into 2 to 4 and work under a project supervisor. The device/ system/component(s) to be fabricated may be decided in consultation with the supervisor and if possible with an industry. A project report to be submitted by the group and the fabricated model, which will be reviewed and evaluated for internal assessment by a Committee constituted by the Head of the Department. At the end of the semester examination the project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department

Course Outcomes (COs)

After completion of the course students will be able to

1. Formulate a real world problem, identify the requirement and develop the design solutions.
2. Identify technical ideas, strategies and methodologies.
3. Utilize the new tools, algorithms, techniques that contribute to obtain the solution of the project.
4. Perform test and validate through conformance of the developed prototype and analysis the cost effectiveness.
5. Explain the acquired knowledge through preparation of report and oral presentations.