

**ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES, TIRUPATI
(Autonomous)**

**Course structure for Four Year Regular B.Tech. Degree Program
(Effective for the batches admitted from 2019-20)**

MECHANICAL ENGINEERING (ME)

II B. Tech - I Semester

S.No	Category	Course Code	Course Title	Contact Hours per week			Credits	Scheme of Examination (Max. Marks)		
				L	T	P		CIE	SEE	Total
THEORY										
1	BS	19ABS9913	Probability & Statistics, PDE and Complex Variables	3	0	0	3	30	70	100
2	HS	19AHS9903	Communicative English II	2	0	0	2	30	70	100
3	ES	19AES0302	Design Thinking & Product Innovation	2	0	0	2	30	70	100
4	PC	19APC0301	Engineering Mechanics	3	1	0	4	30	70	100
5	PC	19APC0306	Material Science and Engineering	3	0	0	3	30	70	100
6	PC	19APC0308	Thermodynamics	3	0	0	3	30	70	100
7	MC	19AMC9903	Environmental Studies	2	0	0	0	30	-	30
PRACTICAL										
8	HS	19AHS9904	Communicative English II Lab	0	0	2	1	30	70	100
9	ES	19AES0303	Design Thinking & Product Innovation Lab	0	0	2	1	30	70	100
10	PC	19APC0307	Material Science and Engineering Lab	0	0	2	1	30	70	100
11	LC	19ALC0303	Computer Aided Machine Drawing Lab	0	0	3	1.5	30	70	100
TOTAL				19	1	9	21.5	330	700	1030

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Year: II

Semester: I

Branch of Study: ME

Subject Code	Subject Name	L	T	P	Credits
19ABS9913	Probability & Statistics, PDE, Complex Variables	3	0	0	3

Course Outcomes:

- CO: 1 Apply discrete and continuous probability distributions
- CO: 2 Design the components of a classical hypothesis test
- CO: 3 Infer the statistical inferential methods based on small and large sampling tests
- CO: 4 Find the general solution of the PDEs bearing applications
- CO: 5 Differentiation and integration of complex functions used in engineering problems
To equip the students to solve application problems in their disciplines

UNIT I

Probability: probability axioms, addition law and multiplicative law of probability, conditional probability, Baye's theorem, random variables (discrete and continuous), probability distribution: Binomial - Poisson approximation to the binomial distribution and normal distribution-their properties.

UNIT II

Testing of Hypothesis: Formulation of null hypothesis, critical regions, level of significance. Large sample tests: test for single proportion, difference of proportions, test for single mean and difference of means.

Unit III: Small Sample Tests

Student t-distribution (single mean, two means and paired t-test), Testing of equality of variances (F-test), χ^2 - test for goodness of fit.

Unit IV: Applications of Partial Differential Equations

Method of separation of variables, solution of 1D-wave, 1D-heat and 2D-Laplace's equation in Cartesian coordinates.

Unit V: Complex Variables

Differentiation, Cauchy-Riemann equations, analytic functions, harmonic functions, finding harmonic conjugate. Complex integration, Cauchy theorem (without proof), Cauchy integral formula (without proof), Taylor's series, zeros of analytic functions, singularities, Laurent's series, residues, Cauchy residue theorem (without proof)

importance of ergonomics in product development, environmental considerations in design, safety considerations in design.

Text Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 43/e, 2010.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9/e, John Wiley & Sons, 2006.

References:

1. S.Chand ,Engineering Mathematics-II,III &IV by Dr.T.K.V.Iyengar, Dr.B.Krishna Gandhi, S.Ranganatham, Dr.M.V.S.S.N.Prasad

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2. W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, 9/e, Wiley India, 2009.
3. E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India, 1995.
4. J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7/e, Mc-Graw Hill, 2004.
5. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, 2008

List of COs	PO no. and keyword	Competency Indicator	Performance Indicator
CO1	PO1: Apply the knowledge of mathematics	1.1	1.1.1
CO2	PO1: Apply the knowledge of mathematics	1.1	1.1.1
CO3	PO1: Apply the knowledge of mathematics	1.1	1.1.1
CO4	PO 2: First principles of mathematics.	2.1	2.1.3
CO5	PO 2: First principles of mathematics	2.4	2.4.1

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Year: II

Semester: I

Branch of Study: ME

Subject Code	Subject Name	L	T	P	Credits
19AHS9903	Communicative English II	2	0	0	2

Course Outcomes:

- CO: 1 Prioritize information from reading texts after selecting relevant and useful points
- CO: 2 Paraphrase short academic texts using suitable strategies and conventions
- CO: 3 Make formal structured presentations on academic topics using PPT slides with relevant graphical elements
- CO: 4 Participate in group discussions using appropriate conventions and language strategies
- CO: 5 Prepare a CV with a cover letter to seek internship/ job
- CO: 6 Collaborate with a partner to make presentations and Project Reports

UNIT I

Listening: Listening for presentation strategies and answering questions on the speaker, audience, and key points.

Speaking: Formal presentations using PPT slides without graphic elements.

Reading: Reading for presenting – strategies to select, compile and synthesize information for presentation; reading to recognize academic style.

Writing: Paraphrasing; using quotations in writing; using academic style - avoiding colloquial words and phrases.

Grammar and Vocabulary: Formal/academic words and phrases.

UNIT II

Listening: Following an argument/ logical flow of thought; answering questions on key concepts after listening to extended passages of spoken academic discourse.

Speaking: Formal presentations using PPT slides with graphic elements.

Reading: Understand formal and informal styles; recognize the difference between facts and opinions.

Writing: Formal letter writing and e-mail writing (enquiry, complaints, seeking permission, seeking internship); structure, conventions and etiquette.

Grammar and Vocabulary: Phrasal prepositions; phrasal verbs.

Unit III:

Listening: Identifying views and opinions expressed by different speakers while listening to discussions.

Speaking: Group discussion on general topics; agreeing and disagreeing, using claims and examples/ evidences for presenting views, opinions and position.

Reading: Identifying claims, evidences, views, opinions and stance/ position.

Writing: Writing structured persuasive/argumentative essays on topics of general interest using suitable claims, examples and evidences.

Grammar and Vocabulary: Language for different functions such as stating a point, expressing opinion, agreeing/disagreeing, adding information to what someone has stated, and asking for clarification.

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Unit IV:

Listening: Understanding inferences; processing of information using specific context clues from the text.

Speaking: Group discussion; reaching consensus in group work (academic context).

Reading: Reading for inferential comprehension.

Writing: Applying for internship/ job - Writing one's CV/Resume and cover letter.

Grammar and Vocabulary: Active and passive voice – use of passive verbs in academic writing.

Unit V:

Listening: Understanding inferences - processing of explicit information presented in the text and implicit information inferable from the text or from previous/background knowledge.

Speaking: Formal team presentations on academic/ general topics using PPT slides.

Reading for Writing: Structure and contents of a Project Report; identifying sections in project reports; understanding the purpose of each section; significance of references.

Grammar and Vocabulary: Reinforcing learning; editing short texts; correcting common errors in grammar and usage.

***Course Materials would be compiled and provided to learners and teachers**

ReferenceBooks

1. Bailey, Stephen. *Academic writing: A handbook for international students*. Routledge, 2014.
2. Chase, Becky Tarver. *Pathways: Listening, Speaking and Critical Thinking*. Heinley ELT; 2nd Edition, 2018.
3. Skillful Level 2 Reading & Writing Student's Book Pack (B1) Macmillan Educational.
4. Hewings, Martin. *Cambridge Academic English (B2)*. CUP, 2012. Sample Web Resources Grammar/Listening/Writing 1-language.com <http://www.5minuteenglish.com/>
<https://www.englishpractice.com/>

Grammar/Vocabulary

English Language Learning Online, <http://www.bbc.co.uk/learningenglish/>,
<http://www.better-english.com/>, <http://www.nonstopenglish.com/>,
<https://www.vocabulary.com/>, BBC Vocabulary Games, Free Rice Vocabulary Game

Reading

<https://www.usingenglish.com/comprehension/>, <https://www.englishclub.com/reading/short-stories.htm>, <https://www.english-online.at/>

Listening

<https://learningenglish.voanews.com/z/3613>, <http://www.englishmedialab.com/listening.html>

Speaking

<https://www.talkenglish.com/>, BBC Learning English – Pronunciation tips, Merriam-Webster – Perfect pronunciation Exercises

All Skills

<https://www.englishclub.com/>, <http://www.world-english.org/>,
<http://learnenglish.britishcouncil.org/>, Online Dictionaries, Cambridge dictionary online, MacMillan dictionary, Oxford learner's dictionaries

References:

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1. www.pointblank7.in> News & Politics> Features dt. 15.05.2019

2. Learning English a Communication Approach by Orient Longman Pvt Ltd. Hyderabad , 2005

List of COs	PO no. and keyword	Competency Indicator	Performance Indicator
CO1	PO10-Able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	10.1	10.1.1 10.1.2
CO2	PO10-Able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	10.3	10.3.1 10.3.2
CO3	PO10-Able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	10.2	10.2.2
CO4	PO9-Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	9.2	9.2.1 9.2.2 9.2.3
CO5	PO10-Able to comprehend and write effective reports and design documentation.	10.3	10.3.1 10.3.2

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Year: II

Semester : I

Branch of Study : ME

Subject Code	Subject Name	L	T	P	Credits
19AES0302	Design Thinking and Product Innovation	2	0	0	2

Course Outcomes:

- CO: 1 Summarize the importance of basic sciences in product development
- CO: 2 Explain the historical developments in mechanical, electrical, communications and computational engineering
- CO: 3 Apply systematic approach to innovative designs
- CO: 4 Identify new materials and manufacturing methods in design
- CO: 5 Explain and study of Product Development

UNIT I

Engineering Design: What is designing?, The process of design by evolution, the morphology of design, identification and analysis of need, true need, specifications, standards of performance, use of checklists, morphological analysis, brainstorming, measure of physical realizability, economic and financial feasibility, designing for shipping, handling and installation, design for maintainance, detailed design.

UNIT II

Science to Engineering: Job of engineers, engineering units and measurement, elements of engineering analysis, forces and motion, energy, kinematics and motion, conversion of linear motion to rotary and vice versa, motion transmission.

Physics to Engineering: Application of Newton laws, Pascal's law, Bouncy, Bernoulli's theorem, Ohm's law, electrical induction in engineering products.

UNIT III

Systematic approach to product development: Design Thinking, Innovation, Empathize Design Thinking as a systematic approach to Innovation, brainstorming, visual thinking, design challenges, innovation, art of Innovation, strategies for idea generation, creativity, teams for innovation. Solution finding methods: Conventional, intuitive, discursive, methods for combining solution, decision making for new design.

UNIT IV

Reverse engineering in product development: Reversing engineering methods, identifying the bad features in a product, reduction in size and weight, usage of new materials, 3D printing, study of introducing electrical and electronic controls to the old products, importance of ergonomics in product development, environmental considerations in design, safety considerations in design.

UNIT V

Study of Product Development- Agriculture, development of machines for separation of corn seeds, peeling of groundnut shells, husk removing from paddy. Electrical: Design of burglar alarm, speedometer, water level indicator, smart gates, smart lights. Design of electrical vehicles, unmanned vehicles, design principles in drones.

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Reference Books:

1. Philip Kosky, Robert T. Balmer, William D. Keat, George Wise, "Exploring Engineering: An Introduction to Engineering and Design", 4/e, Elsevier, 2016.
2. David Ralzman, "History of Modern Design", 2/e, Laurence King Publishing Ltd., 2010
3. An AVA Book, "Design Thinking", AVA Publishing, 2010.
4. G. Pahl, W.Beitz, J. Feldhusen, KH Grote, "Engineering Design: A Systematic Approach", 3/e, Springer, 2007.
5. Tom Kelley, Jonathan Littman, "Ten Faces in Innovation", Currency Books, 2006
6. Fundamentals of Design and Manufacturing by G. K. Lal, Vijay Gupta, and N. Venkata Reddy, Narosa Publishing House.

List of COs	PO no. and keyword	Competency Indicator	Performance Indicator
CO: 1	PO3: Design/development of solutions	3.1	3.1.1
CO: 2	PO 1: Engineering knowledge	1.3	1.3.1
CO: 3	PO 1: Engineering knowledge	1.3	1.3.1
CO: 4	PO3: Design/development of solutions	3.1	3.1.1
CO: 5	PO 1: Engineering knowledge	1.3	1.3.1

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Year: II

Semester : I

Branch of Study : ME

Subject Code	Subject Name	L	T	P	Credits
19APC0301	Engineering Mechanics	3	1	0	4

Course Outcomes:

- CO: 1 Resolve forces and moments in mechanical systems.
- CO: 2 Identify the frictional forces and its influence on equilibrium.
- CO: 3 Find the centre of gravity and moment of inertia for various geometric shapes
- CO: 4 Demonstrations of equilibrium of ideal systems and estimation of the work done by the force and the couple
- CO: 5 Determine the displacement, velocity and acceleration relations in dynamic systems

UNIT I

Introduction to Engineering Mechanics: Composition and resolution of forces, parallelogram law, principle of transmissibility, types of force systems - concurrent and concurrent coplanar forces, resultant of coplanar force systems couple, moment of a force Varignon's theorem, concept of free body diagrams, concept of equilibrium of coplanar force systems.

UNIT II

Friction: Laws of friction, types of friction, equilibrium of force systems involving frictional forces, wedge friction, screw friction. Free body diagrams involving frictional forces.

Analysis of Structures: Introduction to plane trusses, analysis of plane trusses by method of joints.

UNIT III

Properties of Surfaces and Volumes: Centroid and center of gravity, derivation of centroids from first moment of area, centroids of composite sections, center of gravity of common volumes - cylinder, cone, sphere, theorem of Pappus-guldinus.

Moment of Inertia: Area moment of inertia of plane and composite shapes, parallel axis theorem, perpendicular axis theorem, polar moment of inertia, mass moment of inertia of common volumes -thin plates, thin rod, cylinder, cone, sphere, rectangular prism, radius of gyration

UNIT IV

Virtual Work: Equilibrium of ideal systems, work done by a force, work done by a couple, principle of virtual work.

Kinematics: Equations of motion for rigid bodies, constant and variable acceleration, rectilinear and curvilinear motion and motion under gravity -projectile motion, use of rectangular coordinates, tangential and normal coordinates, radius of curvature, rotation of a rigid body about a fixed axis, introduction to plane motion.

UNIT V

Kinetics: Principles of dynamics - Newton's Laws of motion, D'Alembert's principle in rectilinear translation, principle of work and energy.

Ideal Systems: Principle of conservation of energy, concept of power, conservation of linear and angular momentum, principle of momentum and impulse, impact - types of impact.

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Text Books:

1. N H Dubey, Engineering Mechanics: Statics and Dynamics, McGraw Hill, 2014.
2. S Timoshenko, DH Young, JV Rao, Sukumar Pati, Engineering Mechanics (in SI units), 5/e, McGraw Hill, 2013.
3. S S Bhavikatti, Engineering Mechanics, 4/e, New Age International, 2008.

Reference Books:

1. Basudeb Bhattacharya., Engineering Mechanics, 2/e, Oxford University Press (India), 2015.
2. Irving Shames, G K M Rao, Engineering Mechanics: Statics and Dynamics, 4/e, Pearson, 2009.
3. K L Kumar, Veenu Kumar, Engineering Mechanics, 4/e, Tata McGraw Hill, 2010.
4. Kalathur Kumar, VVN Bhaskar. Engineering Mechanics, Sri Krishna publications. (2015)

List of COs	PO no. and keyword	Competency Indicator	Performance Indicator
CO: 1	PO1: Engineering knowledge	1.3	1.3.1
CO: 2	PO2: Modern tool usage	2.1	2.1.3
CO: 3	PO4: Conduct investigations of complex problems	4.1	4.1.2
CO: 4	PO2: Problem analysis	2.1	2.1.2
CO: 5	PO7: Environment and sustainability:	7.1	7.1.2

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Semester : I

Branch of Study : ME

Subject Code	Subject Name	L	T	P	Credits
19APC0306	Material Science and Engineering	3	0	0	3

Course Outcomes:

- CO: 1 Explain the principles of binary phases
- CO: 2 Apply heat treatment to different applications
- CO: 3 Select steels and cast irons for a given application
- CO: 4 Utilize nonferrous metals and alloys in engineering
- CO: 5 Choose composites for various applications. Assess the properties of nano-scale materials and their applications

UNIT I

Structure of Metals: Crystal Structures: Unit cells, Metallic crystal structures, Imperfection in solids: Point, Line, interstitial and volume defects; dislocation strengthening mechanisms and slip systems, critically resolved shear stress.

Constitution of Alloys: Necessity of Alloying, substitutional and interstitial solid solutions-Phase diagrams: Interpretation of binary phase diagrams and microstructure development; Iron-Iron-carbide diagram and microstructural aspects of ferrite, cementite, austenite, ledeburite, and cast iron.

UNIT II

Heat Treatment of Steels: Annealing, tempering, normalizing and spheroidizing, Continuous cooling curves and interpretation of final microstructures and properties- austempering, martempering, case hardening, carburizing, nitriding, cyaniding, carbo-nitriding, flame and induction hardening

UNIT III

Steels: Plain carbon steels, use and limitations of plain carbon steels. AISI & BIS classification of steels. Classification, Micro structure, properties and applications of alloy steels and tool steels.

Cast irons: Micro structure, properties and applications of white cast iron, malleable cast iron, grey cast iron, nodular cast iron and alloy cast irons.

UNIT IV

Non-ferrous Metals and Alloys: Micro structure, properties and applications of copper and its alloys, aluminium and its alloys. Study of Al-Cu phase diagram, precipitation hardening. Micro structure, properties and applications of titanium and its alloys

UNIT V

Ceramics, Polymers and Composites: Structure, properties and applications of ceramics, polymers and composites. Introduction to super alloys and nanomaterials.

Text Books:

1. Sydney H. Avner, Introduction to Physical Metallurgy, 2/e, Tata McGraw- Hill, 1997.
2. George E. Dieter, Mechanical Metallurgy, 3/e, McGraw-Hill, 2013.

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Reference Books:

1. V. Raghavan, Material Science and Engineering, 5/e, Prentice Hall of India, 2004.
2. R. Balasubramaniam, Callister's Material Science and Engineering, 2/e, Wiley India, 2014.
3. Y. Lakhtin, Engineering Physical Metallurgy, University Press of the Pacific, 2000.
4. L. H. Van Vlack, Elements of Material Science and Engineering, 6/e, Pearson Education, 2008.

List of COs	PO no. and keyword	Competency Indicator	Performance Indicator
CO: 1	PO 1: Engineering knowledge	1.3	1.3.1
CO: 2	PO 5: Modern tool usage	5.2	5.2.2
CO: 3	PO 5: Modern tool usage	5.2	5.1.2
CO: 4	PO 5: Modern tool usage	5.2	5.2.2
CO: 5	PO 1: Engineering knowledge	1.6	1.3.1
	PO 7: Environment and sustainability	7.4	7.2.1

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Semester : I

Branch of Study : ME

Subject Code	Subject Name	L	T	P	Credits
19APC0308	Thermodynamics	3	0	0	3

Course Outcomes:

- CO: 1 Explain the importance of thermodynamic properties related to conversion of heat energy into work.
- CO: 2 Apply the laws of thermodynamics to boilers, heat pumps, refrigerators, heat engines, compressors and nozzles.
- CO: 3 To understand concept of Entropy and Availability of system
- CO: 4 Utilize steam properties to design steam based components.
- CO: 5 Compare thermodynamic relations and air standard cycles.

UNIT I

Introduction: Basic Concepts: Macroscopic and microscopic viewpoints, definitions of thermodynamic terms, quasi – static process, point and path function, forms of energy, ideal gas and real gas, Zeroth law of thermodynamics.

Properties of Steam and use of Steam Tables: Pure Substances, P-V-T surfaces, T-s and h-s diagram, Mollier chart, dryness fraction, property tables, analysis of steam undergoing various thermodynamic processes using Mollier chart– steam calorimetry

UNIT II

First law of Thermodynamics: Joule’s experiment - first law of thermodynamics, corollaries-perpetual motion machines of first kind, first law applied to non-flow and flow process-limitations of first law of thermodynamics.

Second Law of Thermodynamics: Kelvin - Planck statement and Clausius statement and their equivalence, corollaries - perpetual motion machines of second kind - reversibility and irreversibility, cause of irreversibility - Carnot cycle, heat engine, heat pump and refrigerator, Carnot theorem, Carnot efficiency

UNIT III

Entropy: Clausius inequality - Concept of Entropy- entropy equation for different processes and systems

Availability and Irreversibility: Definition of exergy and energy, expressions for availability and irreversibility. Availability in steady flow, non-flow processes and irreversibility.

UNIT IV

Avogadro’s law, equation of state, ideal gas equation, Vander Waal’s equation, reduced properties, law of corresponding states, compressibility chart. Gibbs-Dalton law, volumetric analysis of gas mixture, apparent molecular weight and gas constant, specific heat of a gas mixture, adiabatic mixing of perfect gases, gas and vapour mixtures.

UNIT V

Thermodynamic Relations: Maxwell relations, TdS equations, difference in heat capacities, ratio of heat capacities, Energy equation, Joule Thompson coefficient, Clausius-Clapeyron equation. Reactive mixture of gases

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Text Books:

1. P. K. Nag, Engineering Thermodynamics, 5/e, Tata McGraw Hill, 2013.
2. Yunus A. Cengel, Michael A. Boles, Thermodynamics, 7/e, Tata McGraw Hill, 2011.

Reference Books:

1. J. B. Jones and G. A. Hawkins, Introduction to Thermodynamics, 2/e, John Wiley & Sons, 2012.
2. Moran, Michael J. and Howard N. Shapiro, Fundamentals of Engineering Thermodynamics, 3/e, Wiley, 2015
3. Claus Borgnakke Richard E. Sonntag, Fundamentals of Thermodynamics, 7/e, Wiley, 2009
4. R. K. Rajput, S. Chand & Co., Thermal Engineering, 6/e, Laxmi publications, 2010.

List of COs	PO no. and keyword	Competency Indicator	Performance Indicator
CO: 1	PO 2: Problem analysis	2.5	2.1.3
CO: 2	PO 1: Engineering knowledge PO 2: Problem analysis	2.2	2.2.3
CO: 3	PO 1: Engineering knowledge PO 2: Problem analysis	2.1	2.1.3
CO: 4	PO 1: Engineering knowledge PO 2: Problem analysis PO 3: Design/development of solutions	2.2	2.2.3
CO: 5	PO 1: Engineering knowledge PO 2: Problem analysis	2.4	2.4.3

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Semester : I

Branch of Study : ME

Subject Code	Subject Name	L	T	P	Credits
19AMC9903	Environmental Studies	3	0	0	3

Course Outcomes:

- CO: 1 Students get sufficient information that clarifies modern environmental concepts like equitable use of natural resources, more sustainable life styles etc.
- CO: 2 Students realize the need to change their approach, so as to perceive our own environmental issues correctly, using practical approach based on observation and self-learning.
- CO: 3 Students become conversant with the fact that there is a need to create a concern for our environment that will trigger pro-environmental action; including simple activities we can do in our daily life to protect it.
- CO: 4 Interpretation of different types of environmental pollution problems and designing of new solid waste management techniques usage
- CO: 5 To get knowledge on various environmental acts and to engage all the students life - long learning of rain water harvesting

UNIT I

Multidisciplinary Nature of Environmental Studies: Introduction Multidisciplinary Nature of Environmental Studies Definition, Scope and Importance – Need for Public Awareness.

Natural Resources: Renewable and non-renewable energy resources – Natural resources and associated problems.

Forest resources: Use and over – exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest and tribal people.

Water resources: Use and over utilization of surface and sub-surface – Floods, drought, conflicts over 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-pesticides problems, water logging, salinity, case studies.

Energy resources: Renewable and non-renewable energy resources

UNIT II

Ecosystems: Concept of an ecosystem. – Structure and functions of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the following ecosystem: Forest ecosystem, Grassland ecosystem, Desert ecosystem and Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).

Biodiversity And Its Conservation : Introduction- Definition: genetic, species and ecosystem diversity – Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-spots of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man wildlife conflicts Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity

UNIT III

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MECHANICAL ENGINEERING (ME)

Environmental Pollution: Definition, Causes, effects and its control measures of : Air Pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution and Nuclear hazards.

Solid Waste Management: Causes, effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone, Tsunami and landslides.

UNIT IV

Social Issues and the Environment: From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rain water harvesting and watershed management – Resettlement and rehabilitation of people Case studies – Environmental ethics: Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies–Wasteland reclamation. – Consumerism and waste products. – Environment Protection Act. – Air (Prevention and Control of Pollution) Act. – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act Public awareness.

UNIT V

Human Population and the Environment: Population growth, variation among nations. Population explosion – Family Welfare Programmed. – Environment and human health – Human Rights – Value Education – HIV/AIDS – Women and Child Welfare – Role of information Technology in Environment and human health – Case studies.

Text Books:

1. Text book of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission, Universities Press.
2. Environmental Studies by Kaushik, New Age Publishers.
3. Environmental Studies by Sri Krishna Hitech publishing Pvt. Ltd.

Reference Books:

1. Environmental studies by R.Rajagopalan, Oxford University Press.
2. Comprehensive Environmental studies by J.P.Sharma, Laxmi publications.
3. Introduction to Environmental engineering and science by Gilbert M. Masters and Wendell P. Ela - Printice hall of India Private limited.
4. Environmental studies by A. Ravi Krishnan, G. Sujatha Sri Krishna Hitech publications.

List of COs	PO no. and keyword	Competency Indicator	Performance Indicator
CO: 1	PO1:Apply the knowledge of Basic science	1.2	1.2.1
CO: 2	PO1:Apply the knowledge of Basic science	1.2	1.2.1
CO: 3	PO1:Apply the knowledge of Basic science	1.2	1.2.1
CO: 4	PO1:Apply the knowledge of Basic science	1.2	1.2.1
CO: 5	PO1:Apply the knowledge of Basic science	1.2	1.2.1

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MECHANICAL ENGINEERING (ME)

Year: II

Semester : I

Branch of Study : Common to all

Subject Code	Subject Name	L	T	P	Credits
19AHS9904	Communicative English II Lab	0	0	2	1

Course Outcomes:

- CO: 1 Prioritize information from reading texts after selecting relevant and useful points.
 CO: 2 Make formal structured presentations on academic topics using PPT slides with relevant graphical elements.
 CO: 3 Participate in Group discussions using appropriate conventions and language strategies.
 CO: 4 Paraphrase short academic text using suitable strategies and conventions.
 CO: 5 Collaborate with a partner to make presentations and Project

UNIT I

Oral Presentation: Reading for presenting – strategies to select, compile and synthesize information for presentation; reading to recognize academic style. Listening for presentation strategies and answering questions- Formal presentations using PPT slides without graphic elements

UNIT II

Power point Presentation/Poster Presentation: Understand formal and informal styles; recognize the difference between facts and opinions. Following an argument/ logical flow of thought; answering questions, formal presentations using PPT slides with graphic elements.

UNIT III

Group discussion on general topics; agreeing and disagreeing, using claims and examples/ evidences for presenting views, opinions and position. Identifying claims, evidences, views, opinions and stance/ position. Identifying views and opinions expressed by different speakers while listening to discussions.

UNIT IV

Reading for inferential comprehension. Group discussion; reaching consensus in group work(academic context). Understanding inferences; processing of information using specific context clues from the text.

UNIT V

Formal team presentations on academic/ general topics using PPT slides-identifying sections in project reports; understanding the purpose of each section; significance of references.

Reference Books:

1. Effective Technical Communication, Rizvi, Tata McGraw-Hill Education 2007.
2. A Practical Course in Effective English Speaking skills, J.K.Gangal, PHI Learning Pvt Ltd, 2012.
3. A Course in Communication Skills, P.Kiranmai Dutt, Geetha Rajeevan, C.L.N.Prakash, 2008.
4. Technical Communication, Meenakshi Raman, Oxford University Press.
5. Professional Communication Skills, Er.A.K.Jain, Pravin S.R.Bhatia, Dr.A.M.Sheikh, S.Chand & Company Ltd, 2001.

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List of COs	PO no. and keyword	Competency Indicator	Performance Indicator
CO: 1	PO10 Able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	10.1	10.1.1 10.1.2
CO: 2	PO10 Able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	10.3	10.3.1 10.3.2
CO: 3	PO9 Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	9.2.	9.2.1 9.2.2 9.2.3
CO: 4	PO10 Able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions	10.3	10.3.1 10.3.2
CO: 5	PO10 Able to comprehend and write effective reports and design documentation.	10.3	10.3.1 10.3.2

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MECHANICAL ENGINEERING (ME)

Year: II

Semester : I

Branch of Study : Common to all

Subject Code	Subject Name	L	T	P	Credits
19AES0303	Design Thinking and Product Innovation Lab	0	0	2	1

Practice Problems use software wherever applicable.

- 1) (a) Study of mechanisms: linear motion to rotary motion and rotary motion to linear motion and their applications.
(b) Study of eccentric, cam, linear actuator.
- 2) Study of motion transmission through belts, chains and gears.
- 3) Study of mechanical advantage through pulleys and other mechanisms.
- 4) Study of different electrical equipments such as mechanical calculators, automotive devices such as wiper.
- 5) To design a device for measurement of Temperature/ pressure.
- 6) Open any mechanical part to identify bad features and improve the design.
- 7) Exercise in 3D printing of a design
Ex: Institute emblem, small toy car or any other item of student choice.
- 8) To design a device for Water Level Indicator.
- 9) Design and Simulation of a Hydraulic Shaper.
- 10) Design of simple pneumatic and hydraulic circuits using basic components.

List of COs	PO no. and keyword	Competency Indicator	Performance Indicator
CO: 1	PO1: Engineering knowledge	1.3	1.3.1
CO: 2	PO2: Modern tool usage	2.1	2.1.3
CO: 3	PO4: Conduct investigations of complex problems	4.1	4.1.2
CO: 4	PO2: Problem analysis	2.1	2.1.2
CO: 5	PO7: Environment and sustainability:	7.1	7.1.2

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MECHANICAL ENGINEERING (ME)

Year: II

Semester : I

Branch of Study : ME

Subject Code	Subject Name	L	T	P	Credits
19APC0307	Material Science and Engineering Lab	0	0	2	1

Course Outcomes:

- CO: 1 Identify various microstructures of steels and cast irons.
 CO: 2 Visualize grains and grain boundaries
 CO: 3 Evaluate hardness of treated and untreated steels.
 CO: 4 Summarize the importance of hardening of steels.
 CO: 5 Study the Micro structure of Heat treated steels.

List of Experiments:

1. Study of microstructure of pure metals – Iron, copper and aluminum.
2. Study of microstructure of low carbon steel, mild steel and high carbon steel.
3. Study of microstructure of cast irons.
4. Study of microstructure of non-ferrous alloys – aluminum, copper, titanium, nickel and their alloys.
5. Study hardenability of steels by Jominy End Quench Test.
6. Study of microstructure of heat treated steels.
7. Find hardness of various untreated and treated steels.
8. Study of microstructure of ceramics, polymeric materials.

List of COs	PO No. and keyword	Competency Indicator	Performance Indicator
CO: 1	PO 5: Modern tool usage	5.5	5.5.2
CO: 2	PO 4: Conduct investigations of complex problems	4.1	4.1.2
CO: 3	PO 4: Conduct investigations of complex problems	4.3	4.3.1
CO: 4	PO 4: Conduct investigations of complex problems	4.1	4.1.4
CO: 5	PO 5: Modern tool usage	5.5	5.5.2

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MECHANICAL ENGINEERING (ME)

Year: II

Semester : I

Branch of Study : ME

Subject Code	Subject Name	L	T	P	Credits
19ALC0303	Computer Aided Machine Drawing Lab	0	0	3	1.5

Course Outcomes:

- CO: 1 Demonstrate the conventional representations of materials and machine components
- CO: 2 Model riveted, welded and key joints using CAD system
- CO: 3 Create solid models and sectional views of machine components
- CO: 4 Generate solid models of machine parts and assemble them
- CO: 5 Create manufacturing drawing with dimensional and geometric tolerances

The following contents are to be done by any 2D software package

Unit – I

Conventional representation of materials and components:

Detachable joints: Drawing of thread profiles, hexagonal and square-headed bolts and nuts, bolted joint, bolted joint with washer and locknut, stud joint, screw joint.

Riveted joints: Drawing of rivet, lap joint, butt joint with single strap, single riveted, double riveted double strap joints.

Unit – II

Welded joints: Lap joint and T joint with fillet, butt joint with conventions.

Keys: Taper key, sunk taper key, round key, saddle key, feather key, woodruff key. Shaft coupling, bushed pin-type flange coupling, universal coupling, Oldhams' coupling.

Unit – III

The following contents to be done by any 3D software package

Sectional views: Creating solid models of complex machine parts and create sectional views.

Unit – IV

Assembly drawings: (Any four of the following using solid model software)

Lathe tool post, tool head of shaping machine, tail stock, machine vice, gate valve, carburettor, piston, connecting rod, eccentric, screw jack, plumber block, axle bearing, pipe vice, clamping device, Geneva cam, universal coupling,

Unit – V

Manufacturing drawing: Representation of limits, fits and tolerances for mating parts. Use any four parts of above assembly drawings and prepare manufacturing drawing with dimensional and geometric tolerances.

Text Books:

1. K. L. Narayana, P. Kannaiah, A text book on Engineering Drawing, SciTech Publications, 2014
2. N. D. Bhatt, Machine Drawing, Charotar, 50/e, 2014.

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1. Cecil Jensen, Jay Helsel and Donald D.Voisinet, Computer Aided Engineering Drawing, Tata McGraw-Hill, NY, 2000.
2. James Barclay, Brain Griffiths, Engineering Drawing for Manufacture, Kogan Page Science, 2003.
3. K.L.Narayana, Production Drawing, NewAge International Publishers, 3/e, 2014

List of COs	PO No. and keyword	Competency Indicator	Performance Indicator
CO: 1	PO 3: Design/development of solutions	3.4	3.4.2
CO: 2	PO 2: Problem analysis	2.1	2.1.2
CO: 3	PO 3: Design/development of solutions	3.3	3.3.1
CO: 4	PO 5: Modern tool usage	5.1	5.1.2
CO: 5	PO 1: Engineering knowledge	1.1	1.1.2