SECOND SEMESTER

Sl. No.	Course Category	Course Code	Course Title	L	T	P	Contact Hours/ week	Credit	Full Marks
1.	Humanities Science - 1	HS 201	English	2	0	0	2	2	100
2.	Basic Science - 4	BS 202	Mathematics-II	3	1	0	4	4	100
3.	Basic Science - 5	BS 203	Chemistry	3	1	0	4	4	100
4.	Engineering Science - 5	ES 204	Programming for Problem Solving	3	0	0	3	3	100
5.	Engineering Science - 6	ES 205	Manufacturing Practices	1	0	0	1	1	100
6.	Humanities Science - 2	HS 206	Language Laboratory	0	0	2	2	1	100
7.	Basic Science - 6	BS 207	Chemistry Laboratory	0	0	3	3	1.5	100
8.	Engineering Science - 7	ES 208	Programming for Problem Solving Lab	0	0	4	4	2	100
9.	Engineering Science - 8	ES 209	Workshop on Manufacturing Practices	0	0	4	4	2	100
10.	Mandatory Course - 2	MC 210	Environmental Science	3	0	0	3	0	100
Total :				15	2	13	30	20.5	1000

ENGLISH

Course Code	HS 201
Course Title	English
Number of Credits	2 (L: 2, T: 0, P: 0)
Prerequisites	10+2 English
Course Category	Humanities Science (HS)
Number of classes	24 hours

Course Outcome:

At the end of the course, the student will be able to -

CO Number	CO Description	K-level
CO-1	Gain an understanding of various ways of narrating life.	K2
CO-2	Apply in their professional life specific dimensions of communication skills i.e. Reading, Writing, Listening, Thinking and Speaking.	K3
CO-3	Develop an understanding of appropriate organizational formats and channels used in business communications.	K3
CO-4	Evaluate their efficacy as fluent & efficient communicators by learning the dynamics of applied English grammar.	K5

Course Content:

Module 1: Literature: Prose, Poetry and Short Story (06 hrs)

1. Modern Improvements – John Ruskin
2. In the Bazaars of Hyderabad – Sarojini Naidu
3. The Road Not Taken – Robert Frost
4. An Astrologer's Day – R.K. Narayan

Module 2: Reading & Writing Skills (06 hrs)

Process of Reading, Reading Purposes, Characteristic of Efficient Reading, Models, Strategies, Methodologies, Reading Comprehension, Improving Comprehension Skills, Reading Activities, Elements of Effective Writing, Writing Styles, Scientific & Technical Writing, Clarity in Writing. Comprehension, Précis Writing, Essay Writing.

Module 3: Listening & Speaking Skills (06 hrs)

Meaning, Process & Types of Listening, Active and Passive Listening, Barriers to Listening, Effective Listening Skills, Feedback Skills, Role of Listening in an Organization. Skills of Effective Speaking

and Components of Effective Talk. Discussion, Meeting and Telephone: Group Discussions, Conducting a Meeting, Telephonic Communication, Oral Presentation and Role of Audio/Visual Aids.

Module 4: Basic Applied Grammar and Usage (06 hrs)

Transformation of Sentences, Word Used as Different Parts of Speech, One Word Substitution, Abbreviations, Technical Terms, Foreign Expressions, Sentence: Kinds of Sentences, Simple & Complex Sentences, Interrogative, Assertive, Affirmative & Negative, Phrases, Parts of Speech: Noun, Pronouns, Adjective, Determiners, Articles, Adverbs, Prepositions, Verbs, Auxiliaries, Conjunctions, Interjections, Tenses, Active & Passive Voice, Narration, Synonyms & Antonyms, Spotting Error in Sentences, Homophones and Homonyms.

Recommended Books:

1. Phoenix: A text Book of compulsory English for Foundation Courses of BA/BSc/BCom-Orient Blackswan.
2. English for All- Nilanjana Gupta
3. Spoken English, R. K. Bansal & . J.B. Harrison Orient Longman Hyderabad.
4. A Comprehensive English Grammar, C. E.Eckersley, Orient Longman Hyderabad.
5. Cambridge Grammar of English. Ronald Carter and Michael McCarthy, Cambridge University Press, Cambridge.
6. Business Communication - Concepts, Cases & Applications. P.D.Chaturvedi & Mukesh Chaturvedi. Pearson Publications.
7. Practical English Usage. Michael Swan. Oxford University Press.
8. Word Power Made Easy by Norman Lewis, W.R. Goyal Pub. & Distributors, 2009, Delhi.
9. English Grammar & Composition by Wren & Martin, S.Chand & Co. Ltd., New Delhi.

Justification for Proposing this Syllabus:

This syllabus is modified considering guidelines provided by Executive committee of B.Tech syllabus upgradation committee. Considering AICTE model curriculum for B.Tech program (2018), existing English curriculum taught under Tripura University and English curriculum taught in premier institutions of engineering studies across the country, this syllabus is framed. Given the present day need of industry, this syllabus is moulded to cater to the needs of making students industry –ready.

Mathematics - II

Course Code	BS 202
Course Title	Mathematics - II
Number of Credits	4 (L: 3, T: 1, P: 0)
Prerequisites	10+2 Mathematics
Course Category	Basic Science (BS)
Number of classes	48 hours

Course Outcome:-

After completion of the course, students will be able to:

CO No	CO Description	K-level
CO-1	Compute partial and directional derivatives, multiple integrals of multivariable functions.	K2
CO-2	Determine analyticity & power series expansion of a complex function and evaluate complex integrals, singularities and residue of a complex function;	K3
CO-3	Evaluate improper integrals using special functions;	K3
CO-4	Apply Gauss, Green's and Stoke's theorem.	K4

Course Content:-

Module 1: Multivariable Calculus (14 Lectures)

Limit, continuity and partial derivatives, directional derivatives, total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers;

Multiple Integration: Double integrals (Cartesian), change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: areas and volumes, Center of mass and Gravity (constant and variable densities); Triple integrals (Cartesian), orthogonal curvilinear coordinates.

Module 2: Complex Numbers (14 Lectures)

Complex Variables: Limit, continuity, differentiability and analyticity of functions, Cauchy-Riemann equations, line integrals in complex plane, Cauchy's integral theorem, independence of path, existence of indefinite integral,

Cauchy's integral formula, derivatives of analytic functions, Taylor's series, Laurent's series, Zeros and singularities, Residue theorem, evaluation of real integrals.

Module 4: Beta, Gamma Function (10 Lectures)

Evaluation of improper integrals; Beta and Gamma functions and their properties; Bessel's differential equation and function (first and second kind), Legendre differential equation and polynomials; some applications.

Module 4: Vector Analysis (10 Lectures)

Dot, Cross & Triple product; Jacobian, Gradient, Curl, Divergence and Laplacian; Scalar and Vector fields, Irrotational and Conservative field;

Statement & Applications of Gauss-divergence theorem, Green's theorem and Stokes' theorem;

References / Suggested Learning Resources:-

1. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 1965.
2. Rajnish Verma & H.K. Dass, Higher Engineering Mathematics, S Chand, 2014.
3. G. B. Thomas, Jr. and R. L. Finney, Calculus and Analytic Geometry, Pearson India, 9th Edition, 2006
4. Erwyn Kreyszig, Advanced Engineering Mathematics, John Wiley and Sons, 8th Edition, 2008.
5. Dennis G. Zill, Complex Analysis, Jones & Bartlett, 2015.
6. G. B. Thomas, Jr. and R. L. Finney, Calculus and Analytic Geometry, Pearson India, 9th Edition, 2006

Chemistry

Course Code	BS 203
Course Title	Chemistry
Number of Credits	4 (L: 3, T: 1, P: 0)
Prerequisites	H.S(+2 stage) Chemistry
Course Category	Basic Science (BS)
Number of classes	48 hours

Course Outcome:

At the end of the course, the student will be able to

CO Number	CO Description	K-level
CO-1	Conceptualize the fundamentals of molecular structure, drug and spectroscopic technique.	K3
CO-2	Understand the types of molecules, organic reactions and nanomaterials.	K4
CO-3	Analyze the various types of inorganic and organic molecules, electromagnetic radiations and nanoparticles.	K3
CO-4	Apply the uses of drugs, properties of various nano materials in the field of catalysis, medicine and energy science.	K3

Course Content:

Module 1: *Periodic properties (**12 Lectures**)*

Electronic configurations Effective nuclear charge, variations of s, p, d and f orbital energies of atoms in the periodic table, , atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, double salts, coordination compounds, ligands, coordination numbers and geometries.

Module 2*: Organic reactions and synthesis of a drug molecule (**12 lectures**)*

Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings, Cannizzaro reaction, Diels-Alder reaction, Synthesis and used of drug molecule (paracetamol, aspirin).

Module 3: Spectroscopy ***(12 lectures)***

Electromagnetic spectrum and radiation Absorption law, UV-Visible spectroscopy(Theory, instrumentation), concepts of chromophore and auxochrome, IR spectroscopy(Theory, instrumentation) Theory of NMR, number of signals, Chemical shift, Application and use of IR, UV, NMR for structure determination

Module 4: Nanoscience and Technology ***(12 lectures)***
Nanomaterials - Synthesis and characterization, Fullerenes, carbon nanotubes (types, properties and uses), nanowires, graphite, grapheme, composite materials, general application of nanomaterials (nanotechnology) in medicine, catalysis, environmental technology and energy science.

References / Suggested Learning Resources:

1. Shashi Chawla ,A Text Book of Enginerring Chemistry, Dhanapat Rai Publishing Co.
2. Chemistry for Engineers, Dr. Amsika singh, Dr. S. Vairam, Dr. S. Ramesh- publishers Willey-India.
3. Engineering Chemistry,(3e), Prasanta Rath, CENGAGE Learning.
4. Engineering Chemistry, O. G. Palanna, Mc. Graw hill.
5. A text book of Engineering Chemistry, Dr. Sunita Ratan Prof. S. K. Katari & sons.
6. Engineering Chemistry, A text book of Chemistry for Engineers, Willey India.

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Programming for Problem Solving

Course Code	ES 204
Course Title	Programming for Problem Solving
Prerequisites	Basic knowledge of Mathematics.
Course Category	Engineering Science (ES)
Number of classes	38 hours
Number of credits	03(L: 3, T: 0, P: 0)

Course Outcome:

At the end of the course, the student will be able to

CO Number	CO Description	K-level
CO-1	F**ormulate** simple algorithms for arithmetic and logical problems.	K5
CO-2	T**ranslate** the algorithms to programs (in C language).	K2
CO-3	T**est and execute** the programs and correct syntax and logical errors.	K4
CO-4	I**mplement** conditional branching, iteration and recursion.	K3

COURSE CONTENT

Module 1: Introduction to Programming (10 lectures)

Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.) - (1 lecture). Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/ Pseudo code with examples. (1 lecture) From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code- (3 lectures)

Arithmetic expressions and precedence (2 lectures) Conditional Branching and Loops (4 lectures) Writing and evaluation of conditionals and consequent branching (3 lectures) Iteration and loops (2 lectures)

Module 2: Basic data structure and algorithm (08 lectures)

Arrays (6 lectures) Arrays (1-D, 2-D), Character arrays and Strings , Basic Algorithms (6 lectures) Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)

Module 3: Functions, structures and pointers (08 lectures)

Function (3 lectures) Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference, Recursion (3 lectures) Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Structure (3 lectures) Structures, Defining structures and Array of Structures, Pointers (3 lectures) Idea of pointers, Defining pointers, Use of Pointers in self-referential structures

Module 4: Introduction to Python Programming (12 lectures)

Introduction to Anaconda, Installation of Anaconda, Introduction to spyder IDE (3 lectures), I/O statement in Python, understanding variables in Python, executing sequence of instructions in console (3 lectures), conditional statements, importance of syntax and indentation, introduction to working of loops in python (6 lectures), basic arithmetic operations through programming, list and arrays(6 lectures).

References / Suggested Learning Resources:

(i) Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
(ii) E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill
(iii) Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India
(iv) www.nptel.ac.in

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Manufacturing Practices

Course Code	ES 205
Course Title	Manufacturing Practices
Number of Credits	1 (L: 1, T: 0, P: 0)
Prerequisites	---
Course Category	Engineering Science (ES)
Number of classes	12 hours

Course Outcome:-

After completion of the course, students will be able to:

CO No	CO Description	K-level
CO-1	Demonstrate the workshop safety rules.	K2
CO-2	Identify Lathe, Drilling Machine, Shaper Machine, Planner Machine, Milling Machine and Grinding Machine.	K2
CO-3	Prepare joints like Half Lap Joint, Mortise & Tenon Joint, Single Bracket, Dovetail Joint and T-Lap joint.	K4
CO-4	Demonstrate the concept of cold & hot working process.	K3
CO-5	Differentiate welding, brazing and soldering.	K2

Course Content:-

Module 1: Introduction to Manufacturing Practices. (Contact Hour: 4Hrs.)
Introduction - Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods
Machine Shop - Study of Different types of General Purpose Machines (Lathe, Drilling Machine, Shaper Machine, Planner Machine, Milling Machine, Grinding Machine) and their operation. Safety awareness, Safety rules & Safety equipments.

Module 2: Fitting Shop: (Contact Hour: 2Hrs.)
Introduction to different types of fitting shop tools and equipments. Familiarization with metal cutting, dimensioning, marking, filing, thread cutting etc. Safety awareness, rules & equipments.

Module 3: **Carpentry Shop: (Contact Hour: 2Hrs.)**
Introduction to different types of carpentry tools and equipments. Preparation of different joints like Half Lap Joint, Mortise & Tenon Joint, Single Bracket, Dovetail Joint, T-Lap joint, etc. Safety awareness, rules & equipments.

Module 4: Smithy Shop and Welding Shop: (Contact Hour: 4Hrs.)
Smithy Shop - Introduction to different types of Smithy tools and equipments. Concept of cold & hot working process. Safety awareness, rules & equipments.

Welding Shop - Introduction to common welding instruments & equipments, Familiarization with different welding processes, Preparation of Single butt weld joint with Manual Metal Arc Welding process / Gas Welding process. Introduction to Soldering & Brazing. Safety awareness, rules & equipments.

References/ Suggested Learning Resources:-

1. Instruction sheet with sketch/drawing provided from shop – in- charge.

2. NPTEL web or video courses on related shop activities.

3. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited,Mumbai.

4. Kalpakjian S. and Steven S. Schmid, "Manufacturing Engineering and Technology", 4th edition, Pearson Education India Edition, 2002.

5. Gowri P. Hariharan and A. Suresh Babu,"Manufacturing Technology – I" Pearson Education, 2008.

6. Roy A. Lindberg, "Processes and Materials of Manufacture", 4th edition, Prentice Hall India,1998.

7. Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata McGrawHill House,

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Language Laboratory

Course Code	HS 206
Course Title	Language Laboratory
Number of Credits	1 (L: 0, T: 0, P: 2)
Prerequisites	10+2 English
Course Category	Humanities Science (HS)
Number of classes	20 hours

Course Outcome:

At the end of the course, the student will be able to -

CO Number	CO Description	K-level
CO-1	Develop proper listening skills; articulate and enunciate speech sounds, words and sentences clearly and efficiently.	K3
CO-2	Increase confidence in their ability to read, comprehend, organize, and retain written information.	K3
CO-3	Deliver effective speeches that are consistent with and appropriate for the audience and purpose.	K3
CO-4	Choose the correct and relevant technical style of communication & presentation at their work place and become able to apply techniques for developing interpersonal communication skills and positive attitude leading to their professional competence.	K4

Course Content:

List of Activities: (Minimum 06 activities to be performed)

1. **Introduction to Phonetics**: Organs of Speech, Mechanism of Sound Production, Different Kinds of Sounds, Consonant Sounds, Place of Articulation, Manner of Articulation, Vowels Sounds, Syllable Division and Word Stress- Rules of Stress, Intonation- Pitch, Tone Shapes, Rising Tone, Falling Tone. Activity- Production of speech sounds and identifying the corresponding phonetic consonant and vowel symbols.
2. **Comprehension Skills** based on Reading and Listening. Activity- Comprehend a text on reading/listening the given text.
3. **Common Everyday Situations**: Conversations and Dialogues. Activity – Role play on given everyday situation.
4. **Speaking skills**: Fluency & Accuracy in speech- positive thinking, Improving Self expression Developing persuasive public speaking skills. Activity – Individual Speech Delivery/Extempore Speech

Delivery.

5. **Written Communication at Workplace:** Job application, Business letters, Email writing. Activity – Writing Job application/ Business letters/email using correct grammatical patterns and following principles of effective communication.
6. **Group Discussion:** Understanding group dynamics; GD strategies-activities to improve GD skills. Activity - Participating in group discussions.
7. **Interview Skills:** Interview Etiquette-dress code, body language. Activity – Attending mock job interviews.
8. **Formal Presentations:** Presentation Skills for Technical Paper/Project Reports/ Professional Reports/Appropriate topics based on proper stress and intonation mechanics. Activity – Making power point presentations on given topics.

Recommended Books:

1. Manual of Practical Communication by L.U.B. Pandey; A.I.T.B.S. Publications India Ltd.; Krishan Nagar, 2013, Delhi.
2. A Course in Phonetics and Spoken English, Sethi & Dhamija:, Prentice Hall
3. English for Technical Communication by N P Sudharshana & C Savitha Cambridge University Press, 1st edition, 2018.
4. Communication Skills A Workbook by Sanjay Kumar; PushpLata,Oxford Publication.
5. English Language Communication Skills: Lab Manual cumWorkbook by Rajesh Kumar, Cengage Learning, Ist edition, 2014.
6. Practical English Usage.Michael Swan, Oxford University Press.
7. Effective Business Communication, M. V., Rodriques Concept Publishing Company New Delhi, 1992 reprint (2000)
8. Handbook of Practical Communication Skills, Chrissie Wright. Jaico Publishing House. Mumbai

Chemistry Laboratory

Course Code	BS-207
Course Title	Chemistry Laboratory
Number of Credits	1.5 (L: 0, T: 0, P: 3)
Prerequisites	10+2 Chemistry
Course Category	Basic Science (BS)-06
Number of classes	30 hours

Course Outcome:

(COs): At the end of the course, the student will be able to

CO Number	CO Description	K-level
CO-1	Estimate the hardness and alkalinity of water, chloride content of water, etc	K4
CO-2	Measure conductance of solutions acid value and saponification of oil	K3
CO-3	Analyse a salt sample	K4
CO-4	Apply the knowledge of thin layer chromatography technique for separation of organic mixture	K4

Course Content:

List of Experiments ***(Minimum 8 experiments to be performed). Use of virtual laboratory to perform few experiments may be explored if available.***

1) Total hardness of water
2) Lattice structures and packing of sphere
3) Determination of chloride content of water
4) Determination of carbonate and non carbonate hardness of water sample
5) Determination of alkalinity of water sample
6) Thin layer chromatography
7) Determination of cell constant and conductance of solutions
8) Saponification value of oil
9) Acid value of an oil
10) Preparation of aspirin
11) Preparation of Nylon 66 polymer
12) Chemical analysis of a salt

References / Suggested Learning Resources:*1. Shashi Chawla ,A Text Book of Enginerring Chemistry, Dhanapat Rai Publishing Co.*

2. Chemistry for Engineers, Dr. Amsika singh, Dr. S. Vairam, Dr. S. Ramesh- publishers Willey-India.

3. Engineering Chemistry,(3e), Prasanta Rath, CENGAGE Learning.

4. Engineering Chemistry, O. G. Palanna, Mc. Graw hill.

5. Systematic experimental physical chemistry; S.W. Rajbhoj, Dr. T. K. Chonddhekar; Anjali pub.

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Programming for Problem Solving Lab

Course Code	ES 208
Course Title	Programming for Problem Solving Lab
Prerequisites	Theoretical knowledge of programming language
Course Category	Engineering Science (ES)
Number of classes	30 hours
Number of credits	02(L: 0, T: 0, P: 4)

Course Outcome:

At the end of the course, the student will be able to

CO Number	CO Description	K-level
CO-1	Correct syntax errors as reported by the compilers.	K3
CO-2	Identify and correct logical errors encountered at run time	K3
CO-3	Represent data in arrays, strings and structures and manipulate them through a program	K4
CO-4	Declare pointers of different types and use them in defining self referential structures.	K1

List of Experiments ***(Minimum 10 experiments to be performed). Use of virtual laboratory to perform few experiments may be explored if available.***

Lab1: Familiarization with programming environment

Lab 2: Simple computational problems using arithmetic expressions

Lab 3: Problems involving if-then-else structures

Lab 4: Iterative problems e.g., sum of series

Lab 5: 1D Array manipulation

Lab 6: Matrix problems, String operations

Lab 7: Simple functions

Lab 8 and 9: Programming for solving Numerical methods problems

Lab 10: Recursive functions

Lab 11: Pointers and structures

Lab 12: Installation of Python IDE and familiarization with Python programming environment.

Lab13: Working with Spyder IDE or any other Python IDE.

Lab 14: Executing sequence of instructions in console

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Workshop on Manufacturing Practices

Course Code	ES 209
Course Title	Workshop on Manufacturing Practices
Number of Credits	2 (L: 0, T: 0, P: 4)
Prerequisites	---
Course Category	Engineering Science (ES)
Number of classes	40 hours

Course Outcome:-

After completion of the course, students will be able to:

CO No	CO Description	K-level
CO-1	Acquire skills in basic engineering practice to identify, select and use various marking, measuring, and holding, striking and cutting tools & equipment's and machines	K2
CO-2	Understand job drawing and complete jobs as per specifications in allotted time	K2
CO-3	Inspect the job for the desired dimensions and shape	K3
CO-4	Operate, control different machines and equipment's adopting safety practices	K4

List of Experiments ***(Minimum 10 experiments/jobs to be performed). Use of virtual laboratory to perform few experiments may be explored if available.***

Sl. No.	**Practical Exercises**	Approx. Hrs.
1	Demonstration of different fitting tools and drilling machines and power tools	04
2	Demonstration of different operations like chipping, filing, drilling, tapping, sawing, cutting etc.	04
3	One simple fitting job involving practice of chipping, filing, drilling, tapping, cutting etc	04
4	To make a pin from a mild steel rod in a lathe.	04
5	To make rectangular and v-slot in a block of cast iron or mild steel in a shaping machine.	04
6	To make rectangular and v-slot in a block of cast iron or mild steel in a milling machine.	04
7	To make a Gauge from MS plate.	04
8	Demonstration on Arc Welding, Gas Welding, MIG, MAG welding, gas cutting and rebuilding of broken parts with welding.	04
9	Demonstration of different wood working processes, like plaining, marking, chiseling, grooving, turning of wood etc.	04

Sl. No.	Practical Exercises	Approx. Hrs.
10	One simple job involving any one joint like mortise and tenon dovetail, bridle, half lap etc.	04
11	To join two thick MS plates by manual metal arc welding.	04
12	To join two thin mild steel plates or sheets by gas welding	04
13	One/ two green sand moulds to prepare, and a casting be demonstrated.	04
14	A simple job of making a square rod from a round bar or like.	04
15	Demonstration of different sheet metal operations like sheet cutting, bending, edging, end curling, lancing, soldering, brazing, and riveting.	04
16	One simple job involving sheet metal operations and soldering and riveting	04

References/ Suggested Learning Resources:-

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited,Mumbai.

2. Kalpakjian S. and Steven S. Schmid, "Manufacturing Engineering and Technology", 4th edition, Pearson Education India Edition, 2002.

3. Gowri P. Hariharan and A. Suresh Babu,"Manufacturing Technology – I" Pearson Education, 2008.

4. Roy A. Lindberg, "Processes and Materials of Manufacture", 4th edition, Prentice Hall India,1998.

5. Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata McGrawHill House,

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Environmental Science

Course Code	MC 210
Course Title	Environmental Science
Number of Credits	0 (L:3 T:0 P:0)
Prerequisites	nil
Course category	MC

Course Outcomes:

After completion of this course the student will be able to:

CO number	CO Description	K-level
CO1	Explain renewable and non-renewable resources.	K2
CO2	Express about biodiversity and conservation of ecosystem.	K2
CO3	Discuss about causes of various environmental pollution and remedial measures.	K2
CO4	Explain sustainable development.	K2

Module 1: **Introduction to Environment** **9 hrs**

Introduction and Natural Resources: Multidisciplinary nature and public awareness, Renewable and nonrenewal resources and associated problems, Forest resources, Water resources, Mineral resources, Food resources, Energy resources, Land resources, Conservation of natural resources and human role. Ecosystems: Concept, Structure and function, Producers, composers and decomposers, Energy flow, Ecological succession, Food chains webs and ecological pyramids, Characteristics structures and functions of ecosystems such as Forest, Grassland, Desert, Aquatic ecosystems.

Module 2: Biodiversity **9 hrs**

Biodiversity and Conservation: Definition, Genetic, Species, and Ecosystem diversity, Biogeographical classification of India, Value of biodiversity at global, national, local levels, India as a mega diversity nation, Hot sports of biodiversity, Threats to biodiversity, Endangered and endemic species of India, In-situ and ex-situ conservation of biodiversity.

Module3: Environmental Pollution **9hrs**

Environmental Pollution- Definition, Causes, effects and control of air pollution, water pollution, soil pollution, marine pollution, noise pollution, thermal pollution, nuclear hazards, human role in prevention of pollution, Solid waste management, Disaster management, floods, earthquake, cyclone and landslides.

Module4: Social issues and Environment **9hrs**

Social issues and Environment- Unsustainable to sustainable development, Urban problems related to energy, Water conservation and watershed management, Resettlement and rehabilitation, Ethics, Climate change, Global warming, Acid rain, Ozone layer depletion, Nuclear accidents, Waste land reclamation, Consumerism and waste products, Environment protection act, Wildlife protection act, Forest conservation act, Environmental issues in legislation, Population explosion and family welfare

program, Environment and human health, EIA, Role of information technology in environment and human health.

References:

1. Agarwal, K.C., Environmental Biology, Nidi Publication Ltd., Bikaner, 2001.
2. BharuchaErach, Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmadabad, 2002.
3. Clark, R.S., Marine Pollution, Clanderson Press, Oxford, 2002.
4. Cunningham, W.P., et al. , Environmental Encyclopedia, Jaico Publishing House, Mumbai, 2003.