

Jabalpur Engineering College, Jabalpur
Semester I (Set A) Credit Based Grading System (CBGS) w.e.f. July 2017
 Scheme of Examination
 Bachelor of Technology B.Tech. (Common to all Disciplines)
 Branches (IT,EC,EE,IP)
Subject wise distribution of marks and corresponding credits

S. No.	Subject Code	Subject Name & Title	Maximum Marks Allotted						Hours / week.			Total Credits	Total Marks
			Theory			Practical							
			End Sem	Mid Sem. MST	Quiz, Assign ment	End Sem.	Lab Work		Total Marks	L	T	P	
1	BT1001	Engineering Chemistry	70	20	10	30	20	150	3	1	2	6	
2	BT1002	Mathematics-I	70	20	10	-	-	100	3	1		4	
3	BT1003	English	70	20	10	30	20	150	3	1	2	6	
4	BT1004	Basic Electrical Engineering	70	20	10	30	20	150	3	1	2	6	
5	BT1005	Engineering Graphics	70	20	10	30	20	150	3	1	2	6	
6	BT1006	Workshop Practice	-	-	-	30	20	50	-	-	2	2	
Total			350	100	50	150	100	750	15	5	10	30	750

MST: Minimum of two mid semester tests to be conducted.

L: Lecture **T:** Tutorial **P:** Practical

B.TECH. I SEMESTER SET-A (IT, EC, EE, IP)

ENGINEERING CHEMISTRY

Course	Subject Title	Subject Code	Grade for End Sem.		CGPA at the end of every even semester
			T	P	
B.E.	Engineering Chemistry	BT1001	Min. "D"	Min. "D"	5.0

Branch: Common to all branches

Course Objective:

The objective of this course is to develop general familiarity and understanding with the following areas in engineering chemistry: The course also intended to make students work effectively and safely in the laboratory working environment. Last portion of curriculum addresses critical thinking and numerically analyzing the chemical problems.

Unit –I: Water Analysis & Treatment:

Sources, Impurities, Hardness, alkalinity & their determination by EDTA ,Soap titration & O.Hehner's method . Industrial water requirement & characteristics, Boiler trouble (carry over, scale and sludge, caustic embrittlement boiler corrosion) , causes, effect & remedies, Softening of water, internal treatments to boiler feed water, external treatments by various methods (L.S.,Zeolite, ion exchange resin.). Characteristics of municipal water & its treatment (reverse osmosis) . Related numerical problems.

Unit –II: Fuels & Combustion:

Fossil fuels & classification, Calorific value, Determination of calorific value by Bomb calorimeter. Proximate and Ultimate analysis of coal and their significance, calorific value Computation based on ultimate analysis data, Carbonization, Manufacturing of coke & recovery of byproducts. Cracking of higher Hydrocarbons & mechanism of cracking, Knocking, relationship between knocking & structure of hydrocarbon, improvement of anti knocking characteristics of IC engine fuels, Diesel engine fuels, Octane number, Cetane number, combustion and its related numerical problems. Gaseous and bio fuels.

Unit –III: Lubricants & Cement:

(A) Introduction, Mechanism of lubrication, Classification of lubricants, Lubricating oils, grease & semisolid lubricants, solid lubricants, synthetic lubricants, Properties and Testing of lubricating oils, (Viscosity & Viscosity index, flash and fire points, cloud and pour point, Aniline value, Steam Emulsification Number, Neutralization Number, Saponification value, Iodine value, Carbon residue); Numerical problems based on Viscosity Index.

(B)Portland Cement, Manufacturing, ISI specification, Setting & Hardening, Plaster of Paris (Preparation properties & uses), Brief idea about the cement analysis.

Unit –IV: Special Materials:

(A)**Polymers:** Introduction, types and classification of polymerization, Free radical Reaction Mechanism, Plastics, types of plastics – (Thermosetting and Thermoplastic) Preparation, Properties & uses of the following – Phenolic resin(Bakelite), amino resin (urea formaldehyde), polyester (glyptal, Dacron) silicon, epoxy vinyl resin(PE, PS, PVC, PMMA, Teflon, , PVA);Amide resin (Nylon6,Nylon 6:6, Kevlar,) Cellulose resin(Cellulose acetate, Cellulose nitrate), Fiber- (Saran, vinyon, orlon). Rubber Natural & Synthetic Rubber(Butyl rubber , Neoprene,Buna N, Buna S, Thikol, Poly urethane) , Vulcanization of Rubber.

(B) Refractory: Definition, Classification and important properties of refractories.

Unit- V: Instrumental Techniques In Chemical Analysis:

(A) Analytical Techniques - Principle and Applications of chromatography (TLC & GC).

(B) Basic concepts of spectroscopy: - Principle and Applications of IR, UV & Visible spectroscopy .

(C) Potentiometry

Course Outcomes:

Student after successful completion of course must possess skills to think critically and analyze chemical problems. They must also feel confident to work in teams as well as independently. Students are also expected to learn solving chemistry problems with an engineering purview. Laboratory work is intended for students to learn conducting experiments and analyze experimental data.

Reference Books:

1. J.C. Kuriakose and J. Rajaram, "Chemistry in Engineering and Technology", Vol.1 & 2, Tata Mcgraw Hill Publishing Company (P) Ltd., New Delhi.
2. Engineering Chemistry – Gopalan Venkappayya, Vikash Publication.
3. 3000 solved problems in Chemistry – Goldberg, TMH
4. Engineering Chemistry –B.K.Sharma, Krishna Publication.
5. A Text Book of Engineering Chemistry – S.Ş.Dara & A.K.Singh, S. Chand Publication.
6. Applied Chemistry – Theory and Practice, O.P.Viramani, A.K.Narula, New Age Pub.
7. Polymer Science – Ghosh, Tata McGraw Hill.
8. Engineering Chemistry –Jain & Jain
9. Engineering Chemistry –Shashi Chawla

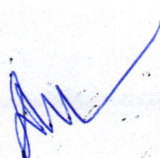
Engineering Chemistry Practical

Note: At least 10 of the following core experiments must be performed during the session.

1. Water Testing:

- (i) Determination of Total hardness by Complexometric Titration method.
- (ii) Determination of mixed alkalinity (a) OH^- & CO_3^{2-} (b) CO_3^{2-} & HCO_3^-
- (iii) Chloride ion estimation by Argentometric method.

2. Fuels & lubricant Testing :

- (i) Flash & fire points determination by
 - (a) Pensky Martin Apparatus,
 - (b) Abel's Apparatus,
 - (c) Cleveland's open cup Apparatus.
 - (d) Calorific value by bomb calorimeter
 - (ii) Viscosity and Viscosity index determination by
 - (a) Redwood viscometer No.1
 - (b) Redwood viscometer No.2
 - (iii) Proximate analysis of coal
 - (a) Moisture content
 - (b) Ash content
 - (c) Volatile matter content
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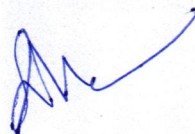
(d) Carbon residue

(iv) Steam emulsification No & Aniline point determination

(v) Cloud and Pour point determination of lubricating oil

3. Alloy Analysis :

- (i) Determination of percentage of Fe in a iron alloy by redox titration using N-Phenyl anthranilic acid as internal indicator.
- (ii) Determination of Cu and or Cr in alloys by Iodometric Titration.



B.TECH. I SEMESTER SET-A (IT, EC, EE, IP)

MATHEMATICS-I

Course	Subject Title	Subject Code	Grade for End Sem.		CGPA at the end of every even semester
			T	P	
B.E.	Mathematics-I	BT1002	Min. "D"	Min. "D"	5.0

Course Outcomes:

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

CO 1	Expand the functions by Maclaurin's and Taylor's theorem and to apply in Engineering problems.
CO 2	Differentiate the function under Integral sign and to apply in Engineering problems.
CO 3	Estimate the maxima and minima of multivariable functions
CO4	Evaluate the Area and Volume of surfaces using double and triple integrals, and its application in various in Engineering problems.
CO5	Solve any given first order ordinary differential equation and its application in various in Engineering problems.
CO6	Solve any higher order linear ordinary differential equation with constant coefficients and its application in various in Engineering problems.
CO7	Solve linear system equation
CO8	Determine the Eigen values and vectors of a matrix
CO9	Understand the concept of Mathematical logic and graphs and their application in Hardware and Software problems.

Mapping of Course outcomes with program outcomes:

Course Out come	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	2			1				2
CO2	2			1				2
CO3	2			-				2
CO4	2			-				2
CO5	2	1		1	1	1		2
CO6	2	1	1	-		1		2
CO7	2			1				2
CO8	2			1				2
CO9	2			2				2

Unit-I:

Expansion of functions by Maclaurin's and Taylor's theorem, Partial differentiation, total differential coefficients, homogeneous functions, Euler's theorem, approximations and errors, differentiation under Integral sign. Maxima and Minima of two variables, Curve tracing (Cartesian and Polar curve), Curvature, Radius of Curvature.

Unit-II:

Definite integral as limit of a sum, Application in summation of series, Double integrals, Change of order of integrals, Triple integrals, Length of curves, Area and Volume of surfaces using double and triple integrals, Beta and Gamma functions.

Unit-III:

Ordinary differential equations of first order (linear and higher degree), Linear higher order differential equations with constant coefficients, Homogeneous linear differential equations, Simultaneous differential equations.

Unit-IV:

Rank of Matrix, Solution of simultaneous equations by elementary Transformation & consistency of equations, Eigen values and Eigen Vectors, Cayley Hamilton theorem and its application to find the Inverse of matrix, Diagonalisation of matrices.

Unit-V:

Binomial, Poisson and Gaussian (Normal) Distribution and their properties. Boolean algebra, Algebra of logic, Principle of Duality and basic theorems, Boolean expressions and functions Introduction to Graph and Sub Graphs, degree and distance, Tree, Cycles and matrix representation of graphs.

Course Outcomes:

The curriculum of the Department is designed to satisfy the diverse needs of students. Coursework is designed to provide students the opportunity to learn key concepts of differentiations, Integration, differential equations, matrices, Boolean algebra, Graph theory, probability distributions and their applications.

Books References:

1. Higher Engineering Mathematics by B.V. Ramana, TMH.
2. Higher Engineering Mathematics by B.S. Grewal, Khanna Publishers.
3. Advanced Engineering Mathematics by Erwin Kreyszig, John Willey & Sons.
4. Differential calculus by Gorakh Prasad, Pothi Shala Publication.
5. Integra calculus by Chandrika Prasad, Pothi Shala Publication.
6. Introduction to theory of Statistics by Mood, TMH.
7. Graph Theory with Application to Engineering and Computer Science by Narsingh Deo, Prentice-Hall, Inc, Englewood cliffs, N. J.

B.TECH. I SEMESTER SET-A (IT, EC, EE, IP)

ENGLISH

Course	Subject Title	Subject Code	Grade for End Sem.		CGPA at the end of every even semester
			T	P	
B.E.	English	BT1003	Min. "D"	Min. "D"	5.0

Pre-requisites: None

Course outcomes: At the end of the course the student will be able to :

	Understand basic grammar principles
	Write clear and coherent passages
	Write effective official letters
	Students will be able to learn the four major skills of communication i.e LSRW (Listening, Reading, Writing and Speaking)
	Students will be able to write effective job applications to show the employers that they deserve to be shortlisted for an interview
	Prepare technical reports and develop presentation skills
	Develop confidence in oral and interpersonal communication
	Develop the skills of reading and listening effectively

Unit -I :

Words, morphemes, phrase, clause, kinds of sentences ; Review of Basic Grammar: tenses, narration, active passive voice, prepositions articles, gerunds, subject-verb agreement; punctuation marks; Paragraph writing, Precise writing, Comprehension passage, Technical Description of simple engineering objects, Writing Bibliography and references.

Unit -II:

Business Correspondence: Letter Components and Layouts, Principles of Effective Letter Writing, Applications, Enquiry Letters, Quotation Letters, Order and Complaint Letters, adjustments letters; Job Application: Cover Letter, Resume writing, Difference between Bio-data, CV and Resume; Note writing.

Unit -III:

Meaning and Process of Communication, Barriers to Communication, Verbal and Nonverbal Communication.

Job Interview Skills: Pre-interview Preparation Techniques, Facing the Interview.

Group Discussion: Selection Group Discussion Strategies.

Presentation Skills: Defining Purpose, Organizing Contents, Preparing outline, Audio Visual Aids, Nuances of Delivery, Audience awareness.

Listening Skills : Importance of listening, Types of listening, Difference between listening and hearing; Interpersonal Skills.

Unit -IV:

Report Writing: Basics of Report Writing, Structure of a Report; Types of report: Informational and Analytical Report, Routine and Special Report, Formal and Informal Reports; Formats of Report:

Printed Forms, Letter Format and Memo Format; Process of Report Writing, E-mail etiquettes, notice, agenda , minutes

Unit –V:

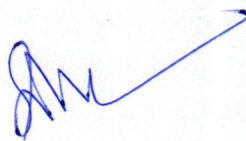
Techniques of Reading; Tryst with Destiny by Jawaharlal Nehru, Portrait of a Lady by Kushwant Singh, Where the Mind is Without Fear by Rabindranath Tagore, Lord Ullins Daughter by T.C Campbell, A Letter to God by G.L Fuentes, How Much Land does a Man Need by Leo Tolstoy.

Topics of Language lab:

1. Introduction to the sounds of English: Phonetics symbols and Pronounciation, speech mechanism, Organs of Speech
2. Basic Grammar
3. Interview
4. Group Discussion
5. Presentation Skill
6. Students are trained in the four basic skills viz. speaking, listening, reading and writing
7. Elocution

Books References:

1. English Grammar & Composition, Wren and Martin.
2. Effective Technical Communication, M Ashraf Rizwi, Tata McGraw- Hill, New Delhi.
3. Essentials of Business Communication, Rajendra Pal & J.S Korlahalli, Sultan Chand & Sons, New Delhi.
4. Business Correspondence and Report Writing, R.C Sharma & Krishna Mohan, McGraw Hill, New Delhi.
5. Technical Communication : Principles and Practice, Meenakshi Raman and Sangeeta Sharma, Oxford University Press, New Delhi.
6. Business Communication, Lesikar and Petit, McGraw Hill, New Delhi.
7. Living English Structure, W.S Longman, Oxford University Press, New Delhi



B.TECH. I SEMESTER SET-A (IT, EC, EE, IP)

BASIC OF ELECTRICAL ENGINEERING

Course	Subject Title	Subject Code	Grade for End Sem.		CGPA at the end of every even semester
			T	P	
B.E.	Basic of Electrical Engineering	BT1004	Min. "D"	Min. "D"	5.0

Unit-I: Fundamentals of Electrical Technology

Electricity, Electric Potential, electric Current, laws of electrical engineering, Resistance, Conductance, Electromotive Force, Electrical Energy, Electrical power, DC circuits, series circuits, parallel circuits, series-parallel circuits, Electric Network, voltage and current sources, source transformation, Kirchoff's laws, maxwell's mesh current method (loop analysis), nodal analysis, Delta-star and star-delta transformation, superposition theorem, Thevenin's theorem, Norton's theorem. *Steady state response of circuits*-Steady state response of series R-L, R-C, R-L-C circuits, complex impedances, average and effective values of periodic functions, series and parallel resonance, Various responses of RL, RC, RLC circuits.

Unit-II: AC circuits

1-phase AC Circuits-Generation of sinusoidal AC voltage, definition of average value, R.M.S. value, form factor and peak factor of AC quantity, Concept of phasor, Concept of Power factor, Concept of impedance and admittance, Active, reactive and apparent power.

3-phase AC Circuits-Necessity and advantages of three phase systems, Meaning of Phase sequence, balanced and unbalanced supply and loads. Relationship Between line and phase values for balanced star and delta connections. Power in balanced & unbalanced three - phase system and their measurements.

Unit-III: Magnetic Circuits:

Basic definitions, magnetization curves of Ferro magnetic materials, magnetic circuit concepts and analogies, self-inductance and mutual inductance, energy in linear magnetic systems, magnetic field and force calculation of a current carrying conductor.

Unit IV: Single phase transformer:

General construction, theory of operation, equivalent circuits, phasor diagram, voltage regulation, losses and efficiency, open circuit and short circuit test, all day efficiency, Auto transformer.

Unit V: Electrical Machines:

Construction and overview of DC machine, induction machine and synchronous machine.

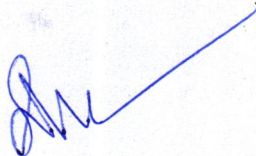
Books Reference Books :

1. Fundamentals of Electricity and Magnetism by A F Kip
2. A Textbook of Electrical Technology : Basic Electrical Engineering (Volume - 1) By A.K. The raja and B.L. The raja.
3. Basic Electrical Engineering S K Sahdev, Pearson
4. Vincent Del Toro, "Electrical Engineering Fundamentals", Published by Prentice Hall
5. Electrical Technology by H Cotton 2nd Edition McGraw Hill

BASIC OF ELECTRICAL ENGINEERING

List of Experiments:

1. AC Analysis of RL , RC and series RLC circuit.
2. Active, Reactive power and apparent power calculation in an AC circuit.
3. Open Circuit and Short Circuit test on single phase transformer.
4. Voltage regulation calculation of a single phase transformer.
5. Study of DC Machine.



B.TECH. I SEMESTER SET-A (IT, EC, EE, IP)

ENGINEERING GRAPHICS

Course	Subject Title	Subject Code	Grade for End Sem.		CGPA at the end of every even semester
			T	P	
B.E.	Engineering Graphics	BT1005	Min. "D"	Min. "D"	5.0

Course Objectives:

1. To familiarize with the construction of geometrical figures.
2. To familiarize with the projection of 1d, 2d, 3d elements.
3. To familiarize with the sectioning of solids and development of surfaces.
4. To familiarize with preparation and interpretation of building drawings.

Course Contents:

Unit-I:

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

Conic sections: Construction of ellipse, parabola, hyperbola by different methods; Normal and Tangent.

Special Curves: Cycloid, Epi-cycloid, Hypo-cycloid, Involute, Archimedean and logarithmic spirals.

Unit-II: Projection:

Types of projection, orthographic projection, first and third angle projection, Projection of points and lines, Line inclined to one plane, inclined with both the plane, True Length and True Inclination, Traces of straight lines.

Unit-III: Projection of planes and solids:

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

Unit-IV:

Section of Solids: Section of right solids by normal and inclined planes; Intersection of cylinders.

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

Unit-V:

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

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

Books References:

1. Visvesvaraya Tech. University; A Premier on Computer Aided Engg drawing; VTUBTlgaum
2. Bhatt N.D.; Engineering Drawing, Charotar
3. VenugopalK.; Engineering Graphics; New Age
4. John KC; Engg. Graphics for Degree; PHI.
5. Gill P.S.; Engineering Drawing; kataria
6. Jeyopoo van T.; Engineering drawing & Graphics Using AutoCAD; Vikas

7. Agrawal and Agrawal; Engineering Drawing; TMH
8. Shah MB and Rana BC; Engg. drawing; Pearson Education
9. Luzadder WJ and Duff JM; Fundamental of Engg Drawing; PHI
10. Jolhe DA; Engg. Drawing an Introduction; TMH
11. Narayana K.L.; Engineering Drawing; Scitech

Course Outcome: At the end of the course, the student will be able to:

CO1	Learned about different standard conventions used in drawing.
CO2	Capable to construct different scales and curves used in drawings.
CO3	Able to do orthographic projection of various drawing entities.
CO4	Skilled to produce section of solids, development of surfaces.
CO5	Able to draw isometric projections and their importance in product design.
CO6	Prepare a given drawing on computer aided drafting software packages.

Mapping of Course outcomes (COs) with Program Outcomes (POs):

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	1	-	-	-	-	-	-	-
CO2	-	1	2	-	-	-	-	-
CO3	-	2	-	-	-	-	-	-
CO4	1	-	-	-	-	-	-	-
CO5	-	-	-	2	1	-	-	-
CO6	-	-	1	-	-	-	-	-

List of Practical:

Sketching and drawing of geometries and projections based on above syllabus.

Evaluation:

Evaluation will be continuous an integral part of the class followed by the final examination as well as through external assessment.

Term work:

A min. of 30 hand drawn sketches (on size A4 graphic sketch Book) plus 5CAD-printouts on size A4 sheets plus 10 sheets of size A2 or 6 sheets of size A1, (50% marks toBT allotted for this record + 25% marks for attendance +25%marks for Teachers Assessment.

Practical Marks to be allotted based on written test and viva.

Note: To cover above syllabus, Institute must have CAD software and a computer lab (6to 12 hrs/month/student).

B.TECH. I SEMESTER SET-A (IT, EC, EE, IP)

WORK SHOP PRACTICE

Course	Subject Title	Subject Code	Grade for End Sem.		CGPA at the end of every even semester
			T	P	
B.E.	Work Shop Practice	BT1006	Min. "D"	Min. "D"	5.0

Course Objectives:

1. To familiarize with the basics of tools and equipments used in fitting, carpentry, sheet metal, welding and smithy shop.
2. To familiarize with the production of simple models in the concern trades.

Course Contents:

Unit-I: Introduction:

Manufacturing Processes and its Classification, Casting, Machining, Plastic deformation and metal forming, Joining Processes, Heat treatment process, Assembly process. Powder Metallurgy, introduction to computers in manufacturing. Black Smithy Shop Use of various smithy tools. Forging operations: Upsetting, Drawing down, Fullering, Swaging, Cutting down, Forge welding, Punching and drafting. Suggested Jobs: Forging of chisel. Forging of Screw Driver

Unit –II: Carpentry Shop:

Timber: Type, Qualities of timber disease, Timbers grains, Structure of timber, Timbers, timber seasoning, timber preservation. Wood Working tools: Wood working machinery, joints & joinery. Various operations of planning using various carpentry planes sawing & marking of various carpentry joints. Suggested Jobs: Name Plate, Any of the Carpentry joint like mortise or Tennon joint

Unit –III: Fitting Shop:

Study and use of Measuring instruments, Engineer steel rule, Surface gauges caliper, Height gauges, feeler gauges, micro meter. Different types of files, File cuts, File grades, Use of surface plate, Surface gauges drilling tapping Fitting operations: Chipping filling, Drilling and tapping. Suggested Jobs: Preparation of job piece by making use of filling, sawing and chipping, drilling and tapping operations.

Unit –IV: Foundry:

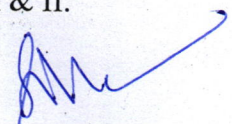
Pattern Making: Study of Pattern materials, pattern allowances and types of patterns. Core box and core print, Use and care of tools used for making wooden patterns.

Moulding: Properties of good mould & Core sand, Composition of Green, Dry and Loam sand. Methods used to prepare simple green and Bench and pit mould dry sand Bench mould using single piece and split patterns.

Unit- V: Welding:

Study and use of tools used for Brazing, Soldering, Gas & Arc welding. Preparing Lap & Butt joints using gas and arc welding methods, Study of TIG & MIG welding processes. Safety precautions.

Books Reference:

1. Bawa HS; Workshop Practice, TMH
 2. Rao PN; Manufacturing Technology- Vol.1 & 2, TMH
 3. John KC; Mechanical workshop practice; PHI
 4. Hazara Choudhary; Workshop Practices -, Vol. I & II.
 5. Jain. R.K. Production Technology.
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Evaluation:

Evaluation will be continuous an integral part of the practical class followed by examination through external assessment.

WORK SHOP PRACTICE

List of experiment:

1. Pattern making shop.
 - (a) Study of pattern allowances and pattern making tools.
 - (b) Preparing the single piece solid pattern in pattern making shop.
2. Fitting Shop.
 - (a) Study of fitting tools and operations.
 - (b) Preparing square fitting job of given size.
3. Carpentry Shop.
 - (a) Study of carpentry tools, machines and joints.
 - (b) Preparing a carpentry job cross half joint.
4. Mouldling shop.
 - (a) Study of moulding tools, moulding sand and its properties.
 - (b) Preparation of sand mould of given pattern.
5. Welding shop.
 - (a) Study of welding tools, machines and joints.
 - (b) Preparation a butt joint through electric arc welding.
6. Machine shop.
 - (a) Study of machines and tools.
 - (b) Preparing multi operation machine job as given shape and size on lathe machine.
7. Black smithy shop.
 - (a) Study of black smithy tools and machines.
 - (b) Preparing of black smithy multi operation job as given shape and size.

Course Outcomes:

	An ability to use the techniques, skill and modern engineering tools necessary for engineering practice.
	Create a given job using tools and machines.
	Prepare carpentry, fitting, welding joints.
	An ability to design and conduct experiments.

Mapping of Course outcomes (COs) with Program Outcomes (POs):

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	1	-	-	-	-	-	1	-
CO2	-	1	-	1	-	1	1	-
CO3	-	2	2	3	1	1	1	-
CO4	-	1	1	-	1	-	-	-