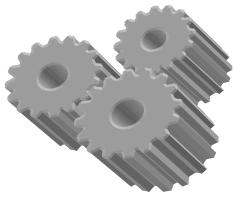


CURRICULUM

FOR

FIRST YEAR
UNDERGRADUATE DEGREE COURSES

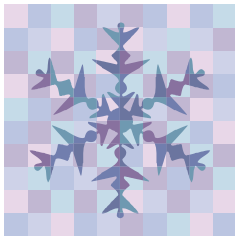
IN

ENGINEERING & TECHNOLOGY

Jharkhand University of Technology

Ranchi, India

2020



COURSE STRUCTURE

SEMESTER I (FIRST YEAR]

Table 1: Branch/Course Common to all branches of UG Engineering & Technology

Sl. No.	Category	Course Code	Course Title	Hours Per Week			Credit	Marks		
				L	T	P		**IA**	ESE	Total
Theory										
1	Basic Science Course	BSC101	Physics I	3	1	0	4	30	70	100
2	Basic Science Course	BSC103	Mathematics – I	3	1	0	4	30	70	100
3	Engineering Science Courses/ Basic Science Course	ESC101/ BSC102	Basic Electrical Engineering/ Chemistry I	3	1	0	4	30	70	100
			Total(A)				**12**	90	210	300
Practical/Drawing/Design										
4	Engineering Science Courses	ESC102	Engineering Graphics & Design	1	0	4	3	25	25	50
5	Basic Science Course	BSC101P	Physics Lab	0	0	3	1.5	25	25	50
6	Engineering Science Courses/ Basic Science Course	ESC101P/ BSC102P	Basic Electrical Engineering Lab / Chemistry Lab	0	0	2	1	25	25	50
			Total(B)				**5.5**	**75**	**75**	**150**
			Grand Total(A+B)				**17.5**	**165**	**285**	**450**

L-Lecture, T-Tutorial, P-Practical

IA- Internal Assessment, ESE-End Semester Examination

SEMESTER II (FIRST YEAR]

Table 2: Branch/Course: Common to all branches of UG Engineering & Technology

Sl. No.	Category	Course Code	Course Title	Hours Per Week			Credit	Marks		
				L	T	P		**IA**	ESE	Total
Theory										
1	Basic Science Course	BSC105	Physics II	3	1	0	4	30	70	100
2	Engineering Science Courses/ Basic Science Course	ESC101/ BSC102	Basic Electrical Engineering/ Chemistry I	3	1	0	4	30	70	100
3	Basic Science Course	BSC104	Mathematics – II	3	1	0	4	30	70	100
4	Engineering Science Courses	ESC103	Programming for Problem Solving	3	1	0	4	30	70	100
5	Humanities and Social Sciences including Management Courses	HSMC101	English	2	0	2	3	30	70	100
						Total(A)	**19**	150	350	500
Practical/Drawing/Design										
6	Engineering Science Courses	ESC104	Workshop/ Manufacturing Practices	1	0	4	3	25	25	50
7	Engineering Science Courses/ Basic Science Course	ESC101P/ BSC102P	Basic Electrical Engg. Lab / Chemistry Lab	0	0	2	1	25	25	50
8	Engineering Science Courses	ESC103P	Programming for Problem Solving	0	0	2	1	25	25	50
						Total(B)	**5**	**75**	**75**	**150**
						Grand Total(A+B)	**24**	**225**	**425**	**650**

L-Lecture, T-Tutorial, P-Practical,
IA- Internal Assessment, ESE-End Semester Examination

SEMESTER I

COURSE CONTENTS

JHARKHAND UNIVERSITY OF TECHNOLOGY, RANCHI

Course Code	**BSC 103**				
Category	**Basic Science Course**				
Course Title	**Mathematics-I**				
Scheme & Credits	**L**	**T**	**P**	**Credit**	**Semester I**
	3	**1**	**0**	**4**	

Mathematics I: New Syllabus JUT for All Branches except CSE and IT

Module1: Function of one variable: Successive Differentiation, Leibnitz Theorem, Expansion of a function into Taylors and Maclaurin's . Series. Function of two or more variables: Partial derivatives; Euler's Theorem; Taylor's Expansion. Maxima & Minima of a function of two variables, Lagrange's method of undetermined multipliers. (**10 L/ 2.5Q)**

Module 2: Reduction formula for integrals. Improper integrals and its convergence; Beta and Gamma functions and their properties. Differentiation under integral sign. Applications of integrals as length, area, volume and surface area of revolution. **(8 L/ 1.5Q)**

Module 3: Matrices- Rank of a matrix (Echelon form and Normal form), System of linear equations; consistency and inconsistency, Eigen values and eigenvectors; Diagonalization of square matrices; Cayley-Hamilton Theorem. (**8L/ 1Q)**

Module 4: First order ordinary Differential Equations: Exact, Linear and Bernoulli's equations, Euler's equations, Equations not of first degree: equations solvable for equations solvable for y, equations solvable for x and Clairaut's type. **(8 L/ 1Q)**

Module 5: Infinite Series: Convergence of series; Comparison test, P Test, Cauchy's nth Root test, D Alembert's Ratio Test, Rabies Test, Logarithmic test. **(6 L/ 1Q)**

Note:- Question no. 1 will be objective type and compulsory comprising of the whole syllabus with seven sub-parts.

Mathematics I: New Syllabus JUT for CSE and IT Students

Module 1: Functions of one variable: Successive Differentiation, Leibnitz Theorem, Expansion of function into Taylors and Maclaurin's Series. Functions of two or more variable: Partial derivatives; Euler's Theorem; Taylor's Expansion. Maxima, minima of function of two variables. Lagrange method of undetermined multipliers. **(10 L/ 2Q)**

Module 2: Reduction formula for integrals. Improper integrals and its convergence; Beta and Gamma functions and their properties. Differentiation under integral sign. Applications of integrals as length, area, volume and surface area of revolution. **(8 L/ 1Q)**

Module 3: Vector Space: Vector addition and scalar multiplication, linear dependence and independence of vectors, basis, dimension; Linear transformations , range and kernel of a linear mapping, rank and nullity, Inverse of a linear transformation, rank nullity theorem, composition of linear maps, Matrix associated with a linear mapping. **(10 L/ 2Q)**

Module 4: Matrices: Rank of a matrix, solution of system of linear equations, consistency and inconsistency, Eigen values and eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem. Inner product spaces, Gram-Schmidt orthogonalization. **(8 L/ 1Q)**

Module 5: First order ordinary Differential Equations: Exact, Linear and Bernoulli's equations, Euler's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type. **(6 L/ 1Q)**

Note:- Question no. 1 will be objective type and compulsory comprising of the whole syllabus with seven sub-parts.

JHARKHAND UNIVERSITYOF TECHNOLOGY, RANCHI

Course Code	**BSC 101**				
Category	**Basic Science Course**				
Course Title	**Physics-I**				
Scheme & Credits	**L**	**T**	**P**	**Credit**	**Semester I**
	3	**1**	**0**	**4**	
Pre-requisites	Mathematics course with vector calculus, differential equations and linear algebra; Physics course up to 10+2 level				

Module 1:Harmonic Oscillation **6 Lectures**

Simple harmonic motion, damped and forced simple harmonic oscillator with examples, damped harmonic oscillator – heavy, critical and light damping, Amplitude and energy decay in a damped harmonic oscillator. Forced oscillation and resonance condition.

Module 2: Wave optics **8 Lectures**

Superposition of waves, Interference, thin film interference and Newton's ring, Diffraction of light, Diffraction due to single slit, double slits, Unpolarized& Polarized light, Polarization of wave, Production of polarized wave: Brewster's law, Malus' law, Double refraction, Retardation plate, Analysis of polarization.

Module 3: Vector Calculus **6 Lectures**

Scalar & Vector field, Gradient of scalar field, Divergence & Curl of Vector field, Gauss' Divergence theorem, Stokes' theorem.

Module 4: Electrostatics **7 Lectures**

Laplace's and Poisson's equations for electrostatic potential, Uniqueness theorem. Electric polarization; Relation between **D**, **E** and **P** Electric displacement and boundary conditions; Dielectric sphere in uniform electric field.

Module 5: Magnetostatics **7 Lectures**

Biot-Savart's law and applications, Three magnetic vector **B**, **H** and **M** andrelation between them; Boundary conditions on **B** and **H**. magnetic susceptibility, diamagnetic, paramagnetic and ferromagnetic materials. Hysteresis loop Hysteresis loss and its application.

Module 6: Maxwell's equations & EMW **8 Lectures**

Continuity equation for current densities; Ampere's law and its modification, Differential and integral forms of Maxwell's equation, Maxwell's equation in vacuum and non-conducting medium; The wave equation; Plane electromagnetic waves in vacuum, transverse character, relation between electric and magnetic fields of an electromagnetic wave; Energy in an electromagnetic field and Poynting theorem.

Text Book:

- Introduction to Electrodynamics, D.J. Griffiths, 3rd Edn., 1998, Benjamin Cummings.

Reference books:

- Fundamentals of Physics Electricity and Magnetism, Halliday and Resnick, tenth edition (published 2013).
- Electricity, magnetism and light, W. Saslow, 1st edition
- Electromagnetic Theory, Singh and Prasad, I. K. International Publication, 1/e
- Electricity, Magnetism & Electromagnetic Theory, S. Mahajan and Choudhury, 2012, Tata McGraw
- Elements of Electromagnetics, M.N.O. Sadiku, 2010, Oxford University Press.
- Fundamentals of Optics, F.A. Jenkins and H.E. White, 1981, McGraw-Hill
- Principles of Optics, Max Born and Emil Wolf, 7th Edn., 1999, Pergamon Press.
- Optics, AjoyGhatak, 2008, Tata McGraw Hill
- Waves: Berkeley Physics Course, vol. 3, Francis Crawford, 2007, Tata McGraw-Hill.
- Engineering physics, Gaur and Gupta, DhanpatRai Publications
- Modern engineering physics, A. S. Vasudeva, S Chand & Company Ltd

COURSE OUTCOMES

Students to get familiarize with the knowledge of harmonic oscillation and wave optics.

To make student understand the basic of electrostatics and magneto statics in vacuum and in material medium.

Students to get familiarized with the vector calculus and Maxwell's equation leading to the application of EMW in vacuum and in media.……
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PHYSICS LABORATORY **Code: BSC101P**

Course Code	**BSC 101P**				
Category	**Basic Science Course**				
Course Title	**Physics Lab**				
Scheme & Credits	**L**	**T**	**P**	**Credit**	**Semester I**
	0	**0**	**3**	**1.5**	

Choice of 08-10 experiments from the following:

- Experiments on electromagnetic induction and electromagnetic breaking;
- Study of LCR circuits
- Magnetic field from Helmholtz coil
- Coupled oscillators
- Experiment on moment of inertia measurement
- Experiments with gyroscope
- Resonance phenomena in mechanical oscillators
- Frank-Hertz experiment
- Photoelectric effect experiment
- Diffraction (from ordinary light or laser pointers)
- interference experiment (from ordinary light or laser pointers)
- Minimum deviation, refractive index and dispersive power of material of a prism
- Study of variation of resistance due to heating effect
- Study of variation of magnetic field along the axis of current carrying coil.
- Use of Carey-Foster bridge
- Measurement of numerical aperture of optical fibre

Text Book:

- Text Book of Practical Physics, Dr. S. K. Ghosh, New Central Book Agency (P.) Ltd., 2000.

Reference books:

- Laboratory Manual in Applied Physics, Hannah Sathyaseelam, New Age International Pvt. Ltd.
- B.Sc. Practical Physics, C.L. Arora, S. Chand Publication.
- Practical optics, NattalyMenn, Elsevier Publication

LABROTARY OUTCOMES

Students to have hands on experience with experiments on the basic laws and principles of Physics in the field of Mechanics, Optics, Electricity, Magnetism, Modern Physics, etc.

Course Code	ESC 101				
Category	Engineering Science Course				
Course Title	Basic Electrical Engineering				
Scheme & Credits	L	T	P	Credit	Semester I
	3	1	0	4	
Pre-requisites	Intermediate level Electricity				

BASIC ELECTRICAL ENGINEERING 40 Lectures

Module 1 : DC Circuits **7 Lectures**

Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits.

Module 2: AC Circuits **7 Lectures**

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three phase balanced circuits, voltage and current relations in star and delta connections.

Module 3: Transformers **6 Lectures**

Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.

Module 4: Electrical Machines **8 Lectures**

Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components and efficiency, starting and speed control of induction motor. Single-phase induction motor. Construction, working, torque-speed characteristic and speed control of separately excited dc motor. Construction and working of synchronous generators.

Module 5: Power Converters **6 Lectures**

DC-DC buck and boost converters, duty ratio control. Single-phase and three-phase voltage source inverters; sinusoidal modulation.

Module 6: Electrical Installations **6 Lectures**

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

Suggested Text / Reference Books

- D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
- D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009.
- L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
- E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
- V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.

Course Outcomes

- To understand and analyze basic electric and magnetic circuits.
- To study the working principles of electrical machines and power converters.
- To introduce the components of low voltage electrical installations.

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BASIC ELECTRICAL ENGINEERING LABORATORY Code: ESC101P

List of experiments/demonstrations:

- Basic safety precautions. Introduction and use of measuring instruments – voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors.
- Measuring the steady-state and transient time-response of R-L, R-C, and R-L-C circuits to a step change in voltage (transient may be observed on a storage oscilloscope). Sinusoidal steady state response of R-L, and R-C circuits – impedance calculation and verification. Observation of phase differences between current and voltage. Resonance in R-L-C circuits.
- Transformers: Observation of the no-load current waveform on an oscilloscope (non sinusoidal wave-shape due to B-H curve nonlinearity should be shown along with a discussion about harmonics). Loading of a transformer: measurement of primary and secondary voltages and currents, and power.
- Three-phase transformers: Star and Delta connections. Voltage and Current relationships (line-line voltage, phase-to-neutral voltage, line and phase currents).Phase-shifts between the primary and secondary side. Cumulative three-phase power in balanced three-phase circuits.
- Demonstration of cut-out sections of machines: dc machine (commutator-brush arrangement), induction machine (squirrel cage rotor), synchronous machine (field winging - slip ring arrangement) and single-phase induction machine.
- Torque Speed Characteristic of separately excited dc motor.
- Synchronous speed of two and four-pole, three-phase induction motors. Direction reversal by change of phase-sequence of connections. Torque-Slip Characteristic of an induction motor. Generator operation of an induction machine driven at super synchronous speed.
- Synchronous Machine operating as a generator: stand-alone operation with a load. Control of voltage through field excitation.
- Demonstration of (a) dc-dc converters (b) dc-ac converters – PWM waveform (c) the use of dc-ac converter for speed control of an induction motor and (d) Components of LT switchgear.

LABORATORY OUTCOMES

Get an exposure to common electrical components and their ratings.

Make electrical connections by wires of appropriate ratings.

Understand the usage of common electrical measuring instruments.

Understand the basic characteristics of transformers and electrical machines.

Get an exposure to the working of power electronic converters.

Course Code	ESC 102				
Category	Engineering Science Course				
Course Title	Engineering Graphics & Design (Theory & Lab)				
Scheme & Credits	L	T	P	Credit	Semester I
	1	0	4	3	
Pre-requisites	Basic knowledge of Computer and Solid Geometry				

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ENGINEERING GRAPHICS & DESIGN

Lecture - 10 hours & Lab - 60 hours

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Traditional Engineering and Computer Graphics: **10 Lectures**

Principles of Engineering Graphics; Orthographic Projection; Descriptive Geometry; Drawing Principles; Isometric Projection; Surface Development; Perspective; Reading a Drawing; Sectional Views; Dimensioning & Tolerances; True Length, Angle; intersection, Shortest Distance.

Engineering Graphics Software; -Spatial Transformations; Orthographic Projections; Model Viewing; Co-ordinate Systems; Multi-view Projection; Exploded Assembly; Model Viewing; Animation; Spatial Manipulation; Surface Modeling; Solid Modeling; Introduction to Building Information Modeling (BIM)

(Lab modules also include concurrent teaching)

Lab Module 1: Introduction to Engineering Drawing **5 Lectures**

Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid and Involute; Scales – Plain, Diagonal and Vernier Scales;

Lab Module 2: Orthographic Projections **5 Lectures**

Principles of Orthographic Projections-Conventions - Projections of Points and lines inclined to both planes; Projections of planes inclined Planes - Auxiliary Planes;

Lab Module 3: Projections of Regular Solids **5 Lectures**

those inclined to both the Planes- Auxiliary Views; Draw simple annotation, dimensioning and scale. Floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc.

Lab Module 4: and Sectional Views of Right Angular Solids **5 Lectures**

Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids, objects from industry and dwellings (foundation to slab only)

Lab Module 5: Isometric Projections **6 Lectures**

Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions;

Lab Module 6: Overview of Computer Graphics **8 Lectures**

listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids];

Lab Module 7: Customization & CAD Drawing **8 Lectures**

consisting of set up of the drawing page and the printer, including scale settings, Setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerancing; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles;

Lab Module 8: Annotations, layering & other functions **9 Lectures**

applying dimensions to objects, applying annotations to drawings; Setting up and use of Layers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print ommand; orthographic projection techniques; Drawing sectional views of composite right regular geometric solids and project the true shape of the sectioned surface; Drawing annotation, Computer-aided design (CAD) software modeling of parts and assemblies. Parametric and non-parametric solid, surface, and wireframe models. Part editing and two-dimensional documentation of models. Planar projection theory, including sketching of perspective, isometric, multiview, auxiliary, and section views. Spatial visualization exercises. Dimensioning guidelines, tolerancing techniques; dimensioning and scale multi views of dwelling;

Lab Module 9: Demonstration of a simple team design project **9 Lectures**

Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; meshed topologies for engineering analysis and tool-path generation for component manufacture; geometric dimensioning and tolerancing; Use of solid-modeling software for creating associative models at the component and assembly levels; floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc. Applying colour coding according to building

drawing practice; Drawing sectional elevation showing foundation to ceiling; Introduction to Building Information Modelling (BIM).

Suggested Text/Reference Books:

- Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engg Drawing, Charotar Pub House
- Shah, M.B. & Rana B.C. (2008), Engg Drawing & Comp. Graphics, Pearson Education
- Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication
- Narayana, K.L. & P Kannaiah (2008), Text book on Engg Drawing, Scitech Publishers
- Corresponding set of CAD Software Theory and User Manuals

COURSE OUTCOMES

All phases of manufacturing or construction require the conversion of new ideas and design concepts into the basic line language of graphics. Therefore, there are many areas (civil, mechanical, electrical, architectural and industrial) in which the skills of the CAD technicians play major roles in the design and development of new products or construction. Students prepare for actual work situations through practical training in a new state-of-the-art computer designed CAD laboratory using engineering software. This course is designed to address:

- To prepare you to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
- To prepare you to communicate effectively
- To prepare you to use the techniques, skills, and modern engineering tools necessary for engineering practice The student will learn :
- Introduction to engineering design and its place in society
- Exposure to the visual aspects of engineering design
- Exposure to engineering graphics standards
- Exposure to solid modeling
- Exposure to computer-aided geometric design
- Exposure to creating working drawings
- Exposure to engineering communication

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SEMESTER II
COURSE CONTENTS

Course Code	**BSC 104**				
Category	**Basic Science Course**				
Course Title	**Mathematics-II**				
Scheme & Credits	**L**	**T**	**P**	**Credit**	**Semester II**
	3	**1**	**0**	**4**	

Mathematics II: New Syllabus JUT for All Branches except CSE & IT

Module 1: Multivariable Integral Calculus: Double and Triple integrals, Evaluation of double integrals, change of order of integration, change of variables, Evaluation of Triple integrals, Simple applications involving areas, volumes. **(8 L/ 1Q)**

Module 2: Vector Calculus: Scalar and Vector point functions. Directional derivative, Gradient, divergence and curl. Line integrals, Surface integrals, Volume integrals, Green's theorem, Stokes theorem and Gauss divergence theorem (without proofs). **(10 L/ 2Q)**

Module 3: Higher order linear differential equations with constant and variable coefficients, Method of variation of parameters, Cauchy's and Legendre's linear equations, Simultaneous linear equations, Series solutions of differential equations, Bessel and Legendre's equations and its solution(without proof). Elementary properties of Bessel function and Legendre's polynomial. **(10 L/ 2Q)**

Module 4: Complex Variable - Differentiation:

Differentiation, Cauchy-Riemann equations, Analytic functions, Harmonic functions, finding harmonic conjugate; Conformal mappings, Mobius transformations and their properties.

(6 L/ 1Q)

Module 5: Complex Variable - Integration:

Contour integrals, Cauchy Integral Theorem, Cauchy Integral formula (without proof)and for derivatives also, zeros of analytic functions, singularities, Taylor's seriesLaurent's series;

Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine. **(8 L/ 1Q)**

Note :- Question no. 1 will be objective type and compulsory comprising of the whole syllabus with seven sub-parts.

Mathematics II: New Syllabus JUT for CSE and IT Students

Module 1: Multivariable Integral Calculus: Double and Triple integrals, Evaluation of double integrals, change of order of integration, change of variables, Evaluation of Triple integrals, Simple applications involving areas, volumes. **(8 L/ 1Q)**

Module 2: Vector Calculus: Scalar and Vector point functions. Directional derivative, Gradient, divergence and curl. Line integrals, Surface integrals, Volume integrals, Green's theorem, Stokes theorem and Gauss divergence theorem (without proofs). **(10 L/ 2Q)**

Module 3: Ordinary differential equations of higher orders: Higher order linear differential equations with constant and variable coefficients, Cauchy's and Legendre's linear equations. Method of variation of parameters. Simultaneous linear equations. **(6 L/ 1Q)**

Module 4: Probability and Statistics: Random variables: Discrete and continuous random variables, probability mass function, probability density function and commutative distribution functions. Mathematical expectation, variance, moment and moment generating function. Binomial, Poisson, Normal and Exponential distributions.

(8 L/ 1.5Q)

Module 5: Complex Variable - Differentiation: Differentiation, Cauchy-Riemann equations, Analytic functions, Harmonic functions, finding harmonic conjugate;

Complex Variable - Integration: Contour integrals, Cauchy Integral Theorem, Cauchy Integral formula(without proof) and for derivatives also, zeros of analytic functions, singularities, Taylor's series, Laurent's series; Residues, Cauchy Residue theorem (without proof). **(6 L/ 1.5Q)**

Note :- Question no. 1 will be objective type and compulsory comprising of the whole syllabus with seven sub-parts.

Course Code	BSC 105				
Category	Basic Science Course				
Course Title	Physics II				
Scheme & Credits	L	T	P	Credit	Semester II
	3	1	0	4	
Pre-requisites	Mathematics course on differential equations and linear algebra; Introduction to Modern Physics				

Physics-II

Module 1: Basic Quantum Mechanics **08 Lectures**

Inadequacy of Classical Mechanics, Introduction to quantum physics, black body radiation; explanation using the photon concept; photoelectric effect: Stopping Potential, Work Function, Einstein's photo electric equation, Compton Effect: Compton Shift.

Module 2:Wave particle duality and bound states **10 Lectures**

de Broglie hypothesis, wave-particle duality, Bragg's Law, Davision and Germer's experiment; Phase velocity, group velocity and relation between phase, group and particle velocity, uncertainty principle- mathematical Illustration, Determination of minimum energy of harmonic oscillator, Non existence of electron within a nucleus.

Wave function and Born's interpretation of the wave function, Schrodinger wave equa time dependent and independent form, eigen value and eigen function, normalization of wave function, particle in a box- one and three dimensional box, Linear harmonic oscillator.

Module 3: Theory of relativity **08 Lectures**

Frame of reference, inertial and non-inertial frames, postulates of special theory of relativity, Galilean Transformation, Michelson Morley experiment, Lorentz transformation, length contraction, time dilation, relativistic variation of mass, addition of velocity, mass-energy equivalence

Module 4: Fibre Optics **08 Lectures**

Introduction of optical fibre as a dielectric wave guide: total internal reflection, numerical aperture and various fibre parameters, losses associated with optical fibres, step and graded index fibres, application of optical fibres.

Module 5: **Lasers** 0**8 Lectures**

Introduction to interaction of radiation with matter, Stimulated and spontaneous emission, Einstein's coefficient, principles and working of laser: population inversion, pumping, various modes, threshold population inversion, three levels and four level laser, types of laser: Ruby laser and He- Ne laser; application of lasers.

Text book:

- Eisberg and Resnick, Introduction to Quantum PhysicsPublisher New York: Wiley. Collection

Reference Books:

- Introduction to Quantum mechanics, Nikhil Ranjan Roy, 2016, Vikash Publishing House Pvt. Ltd.
- Introduction to Quantum Mechanics, David J. Griffith, 2005, Pearson Education.
- Quantum Mechanics: Theory & Applications, A.K.Ghatak&S.Lokanathan, 2004, Macmillan
- Fundamentals of Optics, F.A. Jenkins and H.E. White, 1981, McGraw-Hill
- Principles of Optics, Max Born and Emil Wolf, 7th Edn., 1999, Pergamon Press.
- Optics, Ajoy Ghatak, 2008, Tata McGraw Hill
- Introduction to Special theory of Relativity, Robert Resnick, John Wiley & Sons
- Concept of Modern Physics, Arthur Beiser,2002, McGraw-Hill
- Engineering Physics, Gaur and Gupta, DhanpatRai Publications
- Modern Engineering Physics, A. S. Vasudeva, S Chand & Company Ltd

COURSE OUTCOMES

Students to learn the basics of Quantum mechanics and its application to bound states.

To understand the wave particle duality.

To be able to understand Special theory of relativity and its consequences.

To get familiarize with fiber optics and laser, their basic concept and application in engineering**.**

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JHARKHAND UNIVERSITY OF TECHNOLOGY
SUBJECT- CHEMISTRY
SEMESTER- 1ST

Course Code	**BSC102**				
Category	**Basic Science Course**				
Course Title	**Chemistry-I** **Contents** **(i)Chemistry-I (Concepts in Chemistry for Engineering)** **(ii)Chemistry Laboratory**				
Scheme& Credits	**L**	**T**	**P**	**Credit**	**Semester I**
	3	**1**	**0**	**4**	
Pre-requisites	**Knowledge of Intermediate Level Chemistry**				

CHEMISTRY-I

CONCEPTS IN CHEMISTRY FOR ENGINEERING 42 Lectures

Module-1: Atomic and molecular structure [10Lectures]

Schrodinger equation. Particle in box solutions and their applications for conjugated molecules. Molecular orbitals of diatomic molecules and plots of the multicentre orbitals. Equations for atomic and molecular orbitals. Energy level diagrams of diatomics. Pi-molecular orbitals of butadiene and benzene and aromaticity. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Band structure of solids and the role of doping on band structures.

Module-2 : Spectroscopic techniques and applications [6 Lectures]

Principles and Applications of Electronic spectroscopy and Nuclear magnetic resonance. Vibrational and rotational spectroscopy of diatomic molecules and its applications. Fluorescence and its applications in Medicine. Surface Characterisation Techniques (Scanning Electron Microscopy and Transmission Electron Microscopy)

Module-3: Intermolecular forces [4 lectures]

Ionic, dipolar and van Der Waals interactions. Measurement of non-covalent interaction, Hydrogen bond, Equations of state of real gases and critical phenomena.

Module: 4: Use of free energy in chemical equilibria [8 Lectures]

Thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria. Corrosion: Introduction, Causes, consequences, Mechanism, Laws of Dry Corrosion, Wet Corrosion , Factors Influencing Corrosion, Protective measures against corrosion. Use of free energy considerations in metallurgy through Ellingham diagrams.

Module-5: Periodic properties and Stereochemistry [8 Lectures]

Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases.

Representations of 3 dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis.

Module-6: Polymer [6 lectures]

Classification of polymers, Mechanism of Polymerisation, structure-property relationship, conductive polymers.

Books

- University Chemistry, by B.H.Mahan
- Chemistry, Second Edition, By Prasanta Ratha and S. Chakroborty –Cengage pub
- Engineering Chemistry by Jaya Shree Anireddy, Wiley publication
- Text book of Engineering Chemistry , First Ed.2019, By Sashi Chawala, Dhanpat Rai, publication
- Chemistry: Principles and Applications, by M.J.Sienko and R.A.Plane
- Fundamentals of molecular Spectroscopy, by C.N.Banwell
- Engg Chemistry(NPTEL Web Book),by B.L.Tembe, Kamaluddin and M.S.Krishnan
- Physical Chemistry, by P.W.Atkins
- Organic Chemistry: Structure and Function by K.P.C. Volhardt and N.E. Schore, 5th Edition http://bcs.whfreeman.com/volhardtschore5e/default.asp

COURSE OUTCOMES

The concepts develops in this course will aid in quantification of several concepts in chemistry that have been introduced at the 10+2 levels in schools. Technology is being increasing based on the electronic, atomic and molecular level modifications. Quantum theory is more than 100 years old and to understand phenomena at nanometer levels; one has to base the description of all chemical processes at molecular levels. The course will enable the student to:

- Analyse microscope chemistry in terms of atomic and molecular orbitals and intermolecular forces.
- Rationalise bulk properties and processes using thermodynamics considerations.
- Distinguish the range of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscope techniques
- Rationalise periodic properties such as ionization potential, electronegativity, oxidation states and electronegativity.
- Apply the concept and mechanism of polymerization

CHEMISTRY LABORATORY Code: BSC 102P

Choice of 06-08 experiments from the following

1. Determination of surface tension and viscosity
2. Thin layer chromatography
3. Preparation of a metal complex
4. Determination of chloride content of water
5. Colligative properties using freezing point depression
6. Determination of the rate constant of a reaction
7. Determination of cell constant and conductance of solutions
8. Potentiometry - determination of redox potentials and emfs
9. Synthesis of a polymer/drug
10. Saponification/acid value of an oil
11. Chemical analysis of a salt
12. Lattice structures and packing of spheres
13. Redox-titration (Estimation of Iron using permanganometry)
14. Chemical oscillations- Iodine clock reaction

15. Determination of the partition coefficient of a substance between two immiscible liquids
16. Adsorption of acetic acid by charcoal
17. Use of the capillary viscometers to demonstrate the isoelectric point as the pH of Minimum viscosity for gelatin sols and/ or coagulation of the white part of egg.

LABORATORY OUTCOMES

The chemistry laboratory course will consist of experiments illustrating the principles of chemistry relevant to the study of science and engineering. The students will learn to:

- Estimate rate constants of reactions from concentration of reactants/ products as a function of time.
- Measure molecular/ system properties such a surface tension, viscosity, conductance of solutions, redox potentials, chloride content of water, etc.
- Synthesize a small drug molecule and analyse a salt sample

Course Code	ESC 103				
Category	Engineering Science Course				
Course Title	Programming for Problem Solving				
Scheme & Credits	L	T	P	Credit	Semester II
	3	0	0	3	
Pre-requisites	Basic Knowledge of Computer and Mathematics				

PROGRAMMING FOR PROBLEM SOLVING 40 Lectures

Module 1: Introduction to Programming **6 lectures**

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

Module 2: Arithmetic expressions and precedence **12 lectures**

Conditional Branching and Loops Writing and evaluation of conditionals and consequent branching**,** Iteration and loops

Module 3: Arrays **3 Lectures**

Arrays (1-D, 2-D), Character arrays and Strings

Module 4: Basic Algorithms, Searching, Basic Sorting Algorithms **4 lectures**

(Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)

Module 5: Function and Pointers **6 lectures**

Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference

Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation).

Module 6: Recursion and Structure **9 lectures**

Recursion, as a different way of solving problems. Example programs, such as Finding, Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.

Structures, Defining structures and Array of Structures

Suggested Text Books

- Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
- E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill

Suggested Reference Books

- Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India

COURSE OUTCOMES

The student will learn

To formulate simple algorithms for arithmetic and logical problems.

To translate the algorithms to programs (in C language).

To test and execute the programs and correct syntax and logical errors.

To implement conditional branching, iteration and recursion.

To decompose a problem into functions and synthesize a complete program using divide and conquer approach.

To use arrays, pointers and structures to formulate algorithms and programs.

To apply programming to solve matrix addition and multiplication problems and searching and sorting problems.

To apply programming to solve simple numerical method problems, namely rot finding of function, differentiation of function and simple integration.

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LABORATORY - PROGRAMMING FOR PROBLEM SOLVING Code: ESC103P

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[The laboratory should be preceded or followed by a tutorial to explain the approach or algorithm to be implemented for the problem given.]

Tutorial 1: Problem solving using computers:
Lab1: Familiarization with programming environment

Tutorial 2: Variable types and type conversions:
Lab 2: Simple computational problems using arithmetic expressions

Tutorial 3: Branching and logical expressions:
Lab 3: Problems involving if-then-else structures

Tutorial 4: Loops, while and for loops:
Lab 4: Iterative problems e.g., sum of series

Tutorial 5: 1D Arrays: searching, sorting:
Lab 5: 1D Array manipulation

Tutorial 6: 2D arrays and Strings
Lab 6: Matrix problems, String operations

Tutorial 7: Functions, call by value:
Lab 7: Simple functions

Tutorial 8 & 9: Numerical methods (Root finding, numerical differentiation, numerical integration):
Lab 8 and 9: Programming for solving Numerical methods problems

Tutorial 10: Recursion, structure of recursive calls
Lab 10: Recursive functions

Tutorial 11: Pointers, structures and dynamic memory allocation
Lab 11: Pointers and structures

Tutorial 12: File handling:
Lab 12: File operations

LABORATORY OUTCOMES

To formulate the algorithms for simple problems.

To translate given algorithms to a working and correct program.

To be able to correct syntax errors as reported by the compilers.

To be able to identify and correct logical errors encountered at run time.

To be able to write iterative as well as recursive programs.

To be able to represent data in arrays, strings and structures and manipulate them through a program.

To be able to declare pointers of different types and use them in defining self referential structures.

To be able to create, read and write to and from simple text files.

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Course Code	ESC 104				
Category	Engineering Science Course				
Course Title	**Workshop/Manufacturing Practices (Theory & Lab)**				
Scheme & Credits	L	T	P	Credit	Semester II
	1	0	4	3	
Pre-requisites	Basic Knowledge of Physics, Chemistry and Mathematics				

WORKSHOP/MANUFACTURING PRACTICES 10 Lectures

1. Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods **(3 lectures)**
2. CNC machining, Additive manufacturing **(1 lecture)**
3. Fitting operations & power tools **(1 lecture)**
4. Electrical & Electronics **(1 lecture)**
5. Carpentry **(1 lecture)**
6. Plastic Moulding, glass cutting **(1 lecture)**
7. Metal casting **(1 lecture)**
8. Welding (arc welding & gas welding), brazing **(1 lecture)**

Suggested Text/Reference Books:

- 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.
- Kalpakjian S. And Steven S. Schmid, "Manufacturing Engineering and Technology", 4th edition, Pearson Education India Edition, 2002.
- Gowri P. Hariharan & A. Suresh Babu, "Mfg. Tech- I" Pearson Education, 2008.
- Roy A. Lindberg, "Processes and Materials of Manufacture", 4th edition, PHl, 1998.
- Rao P.N., "Manufacturing Technology", Vol. I & Vol. II, Tata McGrawHill House, 2017.

COURSE OUTCOMES

Upon completion of this course, the students will gain knowledge of the different manufacturing processes which are commonly employed in the industry, to fabricate components using different materials.

WORKSHOP PRACTICE **60 Lectures**

1. Machine shop **(10 hours)**
2. Fitting shop **(8 hours)**
3. Carpentry **(6 hours)**
4. Electrical & Electronics **(8 hours)**
5. Welding shop **(8 hours (Arc welding 4 hrs + gas welding 4 hrs))**
6. Casting **(8 hours)**
7. Smithy **(6 hours)**
8. Plastic Moulding & Glass Cutting **(6 hours**)

Examinations could involve the actual fabrication of simple components, utilizing one or more of the techniques covered above.

LABORATORY OUTCOMES

- Upon completion of this laboratory course, students will be able to fabricate components with their own hands.
- They will also get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.
- By assembling different components, they will be able to produce small devices of their interest.

Course Code	HSMC 101				
Category	Humanities and Social Sciences including Management Courses				
Course Title	English				
Scheme & Credits	L	T	P	Credit	Semester II
	2	0	2	3	
Pre-requisites	Basic Knowledge of English grammar and composition				

ENGLISH 38 Lectures

Module 1: Vocabulary Building **6 lecture**

The concept of Word Formation, Root words from foreign languages and their use in English, Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives, Synonyms, antonyms and standard abbreviations.

Module 2: Basic Writing Skills **6 lectures**

Sentence Structures, Use of phrases and clauses in sentences, Importance of proper punctuation, Creating coherence, Organizing principles of paragraphs in documents, Techniques for writing precisely.

Module 3: Identifying Common Errors in Writing **7 lectures**

Subject-verb agreement, Noun-pronoun agreement, Misplaced modifiers, Articles, Prepositions, Redundancies, Clichés.

Module 4: Nature and Style of sensible Writing **6 lectures**

Describing, Defining, Classifying, Providing examples or evidence, Writing introduction and conclusion

Module 5: Writing Practices **6 lectures**

Comprehension, Précis Writing, Essay Writing,

Module 6: Oral Communication **7 lectures**

(This unit involves interactive practice sessions in Language Lab)

Listening Comprehension, Pronunciation, Intonation, Stress and Rhythm, Common Everyday, Situations: Conversations and Dialogues, Communication at Workplace, Interviews, Formal Presentations.

Suggested Readings:

- Practical English Usage. Michael Swan. OUP. 1995.
- Remedial English Grammar. F.T. Wood. Macmillan.2007
- On Writing Well. William Zinsser. Harper Resource Book. 2001
- Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.
- Communication Skills. Sanjay Kumar and Pushp Lata. Oxford University Press. 2011.
- Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press

COURSE OUTCOMES

The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

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A Guide to Induction Program

Mandatory Induction Program

3 weeks duration
• Physical activity • Creative Arts • Universal Human Values • Literary • Proficiency Modules • Lectures by Eminent People • Visits to local Areas • Familiarization to Dept./Branch & Innovations

1 Introduction

(Induction Program was discussed and approved for all colleges by AICTE in March 2017.It was discussed and accepted by the Council of IITs for all IITs in August 2016. It was originally proposed by a Committee of IIT Directors and accepted at the meeting of all IIT Directors in March 2016. This guide has been prepared based on the Report of the Committee of IIT Directors and the experience gained through its pilot implementation in July 2016 as accepted by the Council of IITs. Purpose of this document is to help institutions in understanding the spirit of the accepted Induction Program and implementing it.)

Engineering colleges were established to train graduates well in the branch/department of admission, have a holistic outlook, and have a desire to work for national needs and beyond.

The graduating student must have knowledge and skills in the area of his study. However, he must also have broad understanding of society and relationships. Character needs to be nurtured as an essential quality by which he would understand and fulfill his responsibility as an engineer, a citizen and a human being. Besides the above, several meta-skills and underlying values are needed.

There is a mad rush for engineering today, without the student determining for himself his interests and his goals. This is a major factor in the current state of demotivation towards studies that exists among UG students.

The success of gaining admission into a desired institution but failure in getting the desired branch, with peer pressure generating its own problems, leads to a peer environment that is demotivating and corrosive. Start of hostel life without close parental supervision at the same time, further worsens it with also a poor daily routine.

To come out of this situation, a multi-pronged approach is needed. One will have to work closely with the newly joined students in making them feel comfortable, allow them to explore their academic interests and activities, reduce competition and make them work for excellence, promote bonding within them, build relations between teachers and students, give a broader view of life, and build character.

2 Induction Program

When new students enter an institution, they come with diverse thoughts, backgrounds and preparations. It is important to help them adjust to the new environment and inculcate in them the ethos of the institution with a sense of larger purpose. Precious little is done by most of the institutions, except for an orientation program lasting a couple of days.

We propose a 3-week long induction program for the UG students entering the institution, right at the start. Normal classes start only after the induction program is over. Its purpose is to make the students feel comfortable in their new environment, open them up, set a healthy daily routine, create bonding in the batch as well as between faculty and students, develop awareness, sensitivity and understanding of the self, people around them, society at large, and nature.

The time during the Induction Program is also used to rectify some critical lacunas, for example, English background, for those students who have deficiency in it. The following are the activities under the induction program in which the student would be fully engaged throughout the day for the entire duration of the program.

2.1 Physical Activity

This would involve a daily routine of physical activity with games and sports. It would start with all students coming to the field at 6 am for light physical exercise or yoga. There would also be games in the evening or at other suitable times according to the local climate. These would help develop team work. Each student should pick one game and learn it for three weeks. There could also be gardening or other suitably designed activity where labour yields fruits from nature.

2.2 Creative Arts

Every student would chose one skill related to the arts whether visual arts or performing arts. Examples are painting, sculpture, pottery, music, dance etc. The student would pursue it every day for the duration of the program. These would allow for creative expression. It would develop a sense of aesthetics and also enhance creativity which would, hopefully, flow into engineering design later.

2.3 Universal Human Values

It gets the student to explore oneself and allows one to experience the joy of learning, stand up to peer pressure, take decisions with courage, be aware of relationships with colleagues and supporting staff in the hostel and department, be sensitive to others, etc. Need for character building has been underlined earlier. A module in Universal Human Values provides the base.

Methodology of teaching this content is extremely important. It must not be through do's and don'ts, but get students to explore and think by engaging them in a dialogue. It is best taught through group discussions and real life activities rather than lecturing. The role of group discussions, however, with clarity of thought of the teachers cannot be over emphasized. It is essential for giving exposure, guiding thoughts, and realizing values.

The teachers must come from all the departments rather than only one department like HSS or from outside of the Institute. Experiments in this direction at IIT (BHU) are noteworthy and one can learn from them.

Discussions would be conducted in small groups of about 20 students with a faculty mentor each. It is to open thinking towards the self. Universal Human Values discussions could even continue for rest of the semester as a normal course, and not stop with the induction program.

Besides drawing the attention of the student to larger issues of life, it would build relationships between teachers and students which last for their entire 4-year stay and possibly beyond.

2.4 Literary

Literary activity would encompass reading, writing and possibly, debating, enacting a play etc.

2.5 Proficiency Modules

This period can be used to overcome some critical lacunas that students might have, for example, English, computer familiarity etc. These should run like crash courses, so that when normal courses start after the induction program, the student has overcome the lacunas substantially. We hope that problems arising due to lack of English skills, wherein students start lagging behind or failing in several subjects, for no fault of theirs, would, hopefully, become a thing of the past.

2.6 Lectures by Eminent People

This period can be utilized for lectures by eminent people, say, once a week. It would give the students exposure to people who are socially active or in public life.

2.7 Visits to Local Area

A couple of visits to the landmarks of the city, or a hospital or orphanage could be organized. This would familiarize them with the area as well as expose them to the under privileged.

2.8 Familiarization to Dept./Branch & Innovations

The students should be told about different method of study compared to coaching that is needed at IITs. They should be told about what getting into a branch or department means what role it plays in society, through its technology. They should also be shown the laboratories, workshops & other facilities.

3 Schedules

The activities during the Induction Program would have an Initial Phase, a Regular Phase and a Closing Phase. The Initial and Closing Phases would be two days each.

3.1 Initial Phase

Time	*Activity*
Day 0	
Whole day	*Students arrive - Hostel allotment. (Preferably do pre-allotment)*
Day 1	
09:00 am - 03:00 pm	*Academic registration*
04:30 pm - 06:00 pm	Orientation
Day 2	
09:00 am - 10:00 am	Diagnostic test (for English etc.)
10:15 am - 12:25 pm	Visit to respective depts.
12:30 pm - 01:55 pm	*Lunch*
02:00 pm - 02:55 pm	Director's address
03:00 pm - 05:00 pm	Interaction with parents
03:30 pm - 05:00 pm	Mentor-mentee groups - Introduction within group. (Same as Universal Human Values groups)

3.2 Regular Phase

After two days is the start of the Regular Phase of induction. With this phase there would be regular program to be followed every day.

3.2.1 Daily Schedule

Some of the activities are on a daily basis, while some others are at specified periods within the Induction Program. We first show a typical daily timetable.

Sessn.	*Time*	*Activity*	*Remarks*
	Day 3 onwards		
	06:00 am	*Wake up call*	
I	06:30 am - 07:10 am	Physical activity (mild exercise/yoga)	
	07:15 am - 08:55 am	*Bath, Breakfast, etc.*	
II	09:00 am - 10:55 am	Creative Arts / Universal Human Values	Half the groups do Creative Arts
III	11:00 am - 12:55 pm	Universal Human Values / Creative Arts	Complementary alternate
	01:00 pm - 02:25 pm	*Lunch*	
IV	02:30 pm - 03:55 pm	Afternoon Session	See below.
V	04:00 pm - 05:00 pm	Afternoon Session	See below.
	05:00 pm - 05:25 pm	*Break / light tea*	
VI	05:30 pm - 06:45 pm	Games / Special Lectures	
	06:50 pm - 08:25 pm	*Rest and Dinner*	
VII	08:30 pm - 09:25 pm	Informal interactions (in hostels)	

Sundays are off. Saturdays have the same schedule as above or have outings.

3.2.2 Afternoon Activities (Non-Daily)

The following five activities are scheduled at different times of the Induction Program, and are not held daily for everyone:
1. Familiarization to Dept./Branch & Innovations
2. Visits to Local Area
3. Lectures by Eminent People
4. Literary
5. Proficiency Modules

Here is the approximate activity schedule for the afternoons (may be changed to suit local needs):

Activity	*Session*	*Remarks*
Familiarization with Dept/Branch & Innovations	IV	For 3 days (Day 3 to 5)
Visits to Local Area	IV, V and VI	For 3 days - interspersed (e.g., 3 Saturdays)
Lectures by Eminent People	IV	As scheduled - 3-5 lectures
Literary (Play / Book Reading / Lecture)	IV	For 3-5 days
Proficiency Modules	V	Daily, but only for those who need it

3.3 Closing Phase

Time	*Activity*
Last But One Day	
08:30 am - 12 noon	Discussions and finalization of presentation within each group
02:00 am - 05:00 pm	Presentation by each group in front of 4 other groups besides their own (about 100 students)
Last Day	
Whole day	Examinations (if any). May be expanded to last 2 days, in case needed.

3.4 Follow Up after Closure

A question comes up as to what would be the follow up program after the formal 3-week Induction Program is over? The groups which are formed should function as mentor mentee network. A student should feel free to approach his faculty mentor or the student guide, when facing any kind of problem, whether academic or financial or psychological etc. (For every 10 undergraduate first year students, there would be a senior student as a *student guide*, and for every 20 students, there would be a *faculty mentor*.) Such a group should remain for the entire 4-5 year duration of the stay of the student. Therefore, it would be good to have groups with the students as well as teachers from the same department/discipline. Here we list some important suggestions which have come up and which have been experimented with.

3.4.1 Follow Up after Closure – Same Semester

It is suggested that the groups meet with their faculty mentors once a month, within the semester after the 3-week Induction Program is over. This should be a scheduled meeting shown in the timetable. (The groups are of course free to meet together on their own more often, for the student groups to be invited to their faculty mentor's home for dinner or tea, nature walk, etc.)

3.4.2 Follow Up – Subsequent Semesters

It is extremely important that continuity be maintained in subsequent semesters. It is suggested that at the start of the subsequent semesters (up to fourth semester), three days be set aside for three full days of activities related to follow up to Induction Program. The students be shown inspiring films, do collective art work, and group discussions be conducted. Subsequently, the groups should meet at least once a month.

4 Summary

Engineering institutions were set up to generate well trained manpower in engineering with a feeling of responsibility towards oneself, one's family, and society. The incoming undergraduate students are driven by their parents and society to join engineering without understanding their own interests and talents. As a result, most students fail to link up with the goals of their own institution. The graduating student must have values as a human being, and knowledge and met skills related to his/her profession as an engineer and as a citizen. Most students, who get demotivated to study engineering or their branch, also lose interest in learning. The *Induction Program* is designed to make the newly joined students feel comfortable, sensitize them towards exploring their academic interests and activities, reducing competition and making them work for excellence, promote bonding within them, build relations between teachers and students, give a broader view of life, and building of character. The *Universal Human Values* component, which acts as an anchor, develops awareness and sensitivity, feeling of equality, compassion and oneness, draw attention to society and nature, and character to follow through. It also makes them reflect on their relationship with their families and extended family in the college (with hostel staff and others). It also connects students with each other and with teachers so that they can share any difficulty they might be facing and seek help.