Gondwana University, Gadchiroli

First Year Engineering

Model Curriculum

I/II Semesters

Syllabus

Board of Studies in Science & Humanities

Mandatory Induction Program

(Please refer **Appendix-A** for guidelines).
[Induction program for students to be offered right at the start of the first year.]

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**

AUDIT HEADS

The students shall be required to qualify in minimum 10 (TEN) Audit Heads from the available list. The Students shall be at the liberty to acquire assigned FIVE (05) non-academic Credits by the time s/he appears for the first ESE of VI semester of the Program. The Colleges shall send list of Ten Audit Heads qualified (Q) by the student and their single composite Grade Point (G) by that time. The Audit Heads shall be considered only if undertaken during the tenure of this program, during its first three years. For qualifying, the student has to secure minimum Grade Point of '5' in TEN different Audit Heads.

The Audit Course Credits shall not be counted for calculation of GPA.

The Audit Heads Grade Point shall be shown in the Grade Sheet of VI semester B.E. in all the programs. If the composite Grade Points (G) is not sent from the college side till the above prescribed time, then such student shall be shown 'F'(Fail) in the Grade Sheet of VI semester. The College shall send consolidated list of all the students in the Program and their 'Composite Grade Point' in respect of Audit Heads qualified by them in the prescribed format 'Form-AHCI', appended with this direction as Appendix –B

The following Audit Heads shall be available to the students :

A	National Social Service(NSS)	**H**	National Cadet Corps(NCC)	**O**	Blood Donation
B	Paper Presentation	**I**	Quiz Competition	**P**	Debate Competition
C	Computer/Software/ Campus Recruitment courses (3-5 days)	**J**	Office Bearer in Departmental or higher Students Body/Professional Society (College level)	**Q**	Soft skills Development Course (3-5 days)
D	Hardware/Software Competition participation	**K**	Volunteer in minimum inter collegiate activities	**R**	Sports Team Participation
E	YOGA/Meditation Training Certificate (Minimum Three Days)	**L**	Cultural Activity Competition, National , State, District level Essay Competition.	**S**	Certificate of Noteworthy participation in National event like SWACHCHHA BHARAT ABHIYAAN, TREE PLANTATION
F	Certificate of service to the Home for the Aged/Orphans/Differently enabled (1-3 days)	**M**	Membership of any registered Non-Government Organization(NGO)	**T**	Plant/Industrial Visit
G	Certificate of Appreciation by local Civic/District /State/ National level Government Authority/Organizations	**N**	Certificate of Noteworthy participation in Environment Day/AKSHAY URJA Day or such other programs of national importance/Environmental day, Science day, Engineers Day, Teachers day etc.	**U**	Participation in 3 to 5 days youth Seminars on Social, Environmental, Wellbeing, Consciousness Programs.

The Audit Heads may be appended/revised/changed from time to time and shall be notified by the University.

APPENDIX-B
FORM - AHCI

GONDWANA UNIVERSITY, GADCHIROLI
FACULTY OF SCIENCE & TECHNOLOGY
COMPOSITE GRADE SHEET FOR AUDIT HEADS

NAME OF THE COLLEGE: _____

NAME OF THE STUDENT	PRN NUMBER	SEMESTER	BRANCH

AUDIT HEAD CODE	TITLE OF THE AUDIT HEAD	GRADE POINT SCORED (OUT OF 10)	COMPOSITE AUDIT GRADE POINT (CAGP) AVERAGE
A	National Social Service (NSS)		
B	Paper Presentation		
C	Computer/Software/ Campus Recruitment courses (3-5 days)		
D	Hardware / Software Competition participation		
E	YOGA/MEDITATION Training Certificate (Minimum 3 DAYS)		
F	Certificate of Service to the Home for the Aged / Orphans/Differently Enabled.		
G	Certificate of Appreciation by local Civic/ District/ State/ National level Government Authority / Organizations		
H	National Cadet Corps (NCC)		
I	Quiz Competition		
J	Office Bearer in Students Body / Professional Society (College level)		
K	Volunteer in minimum inter collegiate activities		
L	Cultural Activity Competition, National, State, District level **Essay Competition.**		
M	Membership of any registered Non-Government Organization (NGO)		
N	Certificate of Noteworthy participation in Environment Day/ AKSHAY URJA Day or such other programs of national importance/ Environmental day, Science day, Engineers Day, Teachers day etc.		
O	Blood Donation		
P	Debate Competition		
Q	Soft Skills Development Course (3-5 days)		
R	Sports Team Participation		
S	Certificate of Noteworthy participation in National Day event like SWACHCHHA BHARAT ABHIYAAN/TREE PLOANTATION		
T	Plant/ Industrial Visit		
U	Participation in 3 to 5 days youth Seminars/Conferences/Workshops on Social, Environmental, Wellbeing, Consciousness Programs.		

CODES (IN ALPHABETIC ORDER) OF AUDIT HEADS QUALIFIED BY THE STUDENT									

DIRECTOR,

PHYSICL EDUCATION/
PRINCIPAL

HEAD OF THE DEPARTMENT

Semester I (First year) **GROUP-A***

Branch/Course Common to **GROUP-A** branches of UG Engineering & Technology

S. No.	Category	Course Code	Course Title	Hours per week			Credits
				L	T	P	
1	Basic Science course	BSC101	Physics	3	1	2	5
2	Basic Science course	BSC103	Mathematics –I	3	1	0	4
3	Engineering Science Courses	ESC101	Basic Electrical Engineering	3	1	2	5
4	Engineering Science Courses	ESC102	Engineering Graphics & Design	1	0	4	3
5	Humanities and Social Sciences including Management courses	HSMC102	Soft Skill	2	0	0	2
						Total credits	19

Semester I (First year) **GROUP-B***

Branch/Course Common to **GROUP-B** branches of UG Engineering & Technology

S. No.	Category	Course Code	Course Title	Hours per week			Credits
				L	T	P	
1	Basic Science course	BSC102	Chemistry-I	3	1	2	5
2	Basic Science course	BSC103	Mathematics –I	3	1	0	4
3	Engineering Science Courses	ESC103	Programming for Problem Solving	3	0	2	4
4	Engineering Science Courses	ESC104	Workshop/ Manufacturing Practices	1	0	4	3
5	Humanities and Social Sciences including Management courses	HSMC101	English	2	0	2	3
						Total credits	19

Semester II (First year) **GROUP-A***

Branch/Course Common to **GROUP-A** branches of UG Engineering & Technology

S. No.	Category	Course Code	Course Title	Hours per week			Credits
				L	T	P	
1	Basic Science course	BSC102	Chemistry-I	3	1	2	5
2	Basic Science course	BSC104	Mathematics – II	3	1	0	4
3	Engineering Science Courses	ESC103	Programming for Problem Solving	3	0	2	4
4	Engineering Science Courses	ESC104	Workshop/ Manufacturing Practices	1	0	4	3
5	Humanities and Social Sciences including Management courses	HSMC101	English	2	0	2	3
						Total credits	19

Semester II (First year) **GROUP-B***

Branch/Course Common to **GROUP-B** branches of UG Engineering & Technology

S. No.	Category	Course Code	Course Title	Hours per week			Credits
				L	T	P	
1	Basic Science course	BSC101	Physics	3	1	2	5
2	Basic Science course	BSC104	Mathematics –II	3	1	0	4
3	Engineering Science Courses	ESC101	Basic Electrical Engineering	3	1	2	5
4	Engineering Science Courses	ESC102	Engineering Graphics & Design	1	0	4	3
5	Humanities and Social Sciences including Management courses	HSMC102	Soft Skill	2	0	0	2
						Total credits	19

Note :- Example –

GROUP – A * : Electrical Engg., Mechanical Engg. And Instrumentation Engg.

GROUP – B * Civil Engg., Computer Science & Engg. And Electroncs & Telecommunication Engg.

1) GROUP – B Subject Applied Mechanics will be in 3rd SEM.
2) GROUP – A subject Applied Mechanics will be in 4th SEM.

I/II Semester B.E. (Common for all branches)

Course Code : BSC101

Title of the Course : Physics

Course Scheme					Evaluation Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Duration of paper, hrs	MSE	IE	ESE	Total
3	1	2	4+2	5	3	10	10	80	100

Course Outcomes: After completion of the course, the student will be able to:

1. Apply engineering physics concepts, which form the basis of modern engineering.
2. Elaborate the general nature of concepts learnt and possibility of their cross-disciplinary application.
3. Gain fundamental knowledge in areas like quantum mechanics, semiconductors, dielectrics, and optics.
4. Solve numerical problems on areas covered.
5. Implement concepts of elementary physics in understanding of engineering applications.

Units	Contents	Hours
1	**Quantum Physics** Dual nature of matter, De-Broglie's concept of matter waves , Davisson-Germer experiment, wave packet concept, wave function interpretation, Heisenberg's uncertainty principle and its experimental illustrations, Schrodinger's wave equations, applications : Motion of free particle, particle in infinite potential well, linear harmonic oscillator.	08
2	**Semiconductor Physics** Formation of energy bands in solids, Classification of solids based on band theory, Energy band diagram of germanium & silicon, Probability distribution function Fermi energy-its dependence on temp and doping concentration, conductivity of semiconductors, energy band structure of p-n junction diode and transistors, junction voltage equation.	08
3	**Dielectrics** Introduction, Dielectric constant, energy stored in a capacitor, polarization, field vectors, induced dipoles, permanent dipoles, nonpolar and polar dielectrics, types of polarization, internal field, ferroelectric and piezoelectric materials, applications of dielectrics.	08
4	**Wave optics & Electron ballistics** Interference due to thin films of uniform and non uniform thickness, Newton's ring, Antireflection coating applications, Motion of electron in uniform electric and magnetic fields, Concept of crossed fields. Electron refraction, electric and magnetic focusing devices - CRT, CRO and its applications, Bainbridge Mass spectrograph.	08
5	**Lasers and fibre optics** Interaction of radiation with matter, population inversion and pumping, Spatial and temporal coherence of light waves, optical resonator, types of laser; Gas laser (He-Ne), solid state laser (Ruby) and semiconductor laser, characteristics and applications. Introduction to optical fibre structure, principle, modes of propagation, acceptance angle, Numerical aperture, fractional refractive index, types and classifications of optical fibre, V – number, attenuation & its different mechanisms, distortion, applications as sensors and detectors. advantages of optical fibre in communication	08
		40

Text Book:

1. Avadhanulu & Kshirsagar, *Engineering Physics,* S. Chand Prakashan.

Reference Books:

1. A. Beiser, *Concept of modern Physics*, TMH Edition
2. S. L. Gupta & S. Gupta, *Concept of modern Physics*,
3. David Halliday, Robert Resnik And Jerle Walker, *Fundamentals of Physics*, John Wiley & Sons
4. Ajay Ghatak, Optics, Mc Grow Hill Publication
5. B. B. Laud, *Lasers and Non Linear Optics*, New Age Publications
6. John Allison, *Electronic Engineering Material & Devices*, TMH Edition
7. K. C. Nandi, *Applied Physics*, Tech. Max. Pune

Title of the Course : Physics Laboratory

Course Outcome: After completion of the course, the student will be able to:

1) Understand and analyse the theoretical concepts in physics through experimentation
2) Learn and use the proper methods while gathering experimental data.
3) Get familiar with the proper use of basic instruments in physics laboratories.

Minimum eight (8) experiments are to be performed from the list given below.

List of Experiments:

1. Determination of resistivity of a semiconductor by four probe method.
2. A study of transistor characteristics in common base configuration.
3. Determination of the radius of curvature of a plano-convex lens using Newton's rings.
4. Determination of thickness of a thin foil using air wedge.
5. A study of the static characteristics of germanium and silicon diodes.
6. A study of the static characteristics of Zener Diode.
7. A study of transistor characteristics in common emitter configuration.
8. Determination of activation energy of a thermister.
9. Determination of wavelength of Laser light using plane transmission grating.
10. To measure the divergence of laser beam.
11. Determination of numerical aperture and acceptance angle, attenuation in optical fibre.
12. Determination of refractive index of glass prism.
13. Determination of refractive index of quartz/calcite prism

I/II Semester B.E. (Common for all branches)

Course Code : BSC102

Title of the Course : Chemistry-I

Course Scheme					Evaluation Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Duration of paper, hrs	MSE	IE	ESE	Total
3	1	2	4+2	5	3	10	10	80	100

Unit	Contents	Hours
1	**Water Conditioning :** Impurities in water, Hardness of water, units of hardness, ill effect of hard water in boilers, Boiler corrosion, caustic embrittlement, Priming and foaming, Scale and sludge formation Boiler beed water treatment : 1) Internal treatment - Calgon, Colloidal and phosphate conditioning, 2) External treatment : a) Lime – Soda process (only reaction), b) Zeolite process, c) ion exchange method, Numerical based on Lime – soda and zeolite process Desalination of brackish water/Purification of water by reverse osmosis and Electrodialysis	10
2	**Corrosion and Battery Science :** Cause and Consequences of corrosion, chemical and electro – Chemical Corrosion, Mechanisms of electro chemical corrosion, Pilling Bedworth rule, Differential aeration theory of corrosion, Types corrosion – Pitting, Intergranular, stress. Waterline Corrosion, corrosion prevention : a) Dlsign and material selection, b) cathodic and anodic protection. Battery :Secondory – Nickel – cadmium, Fuel cells- Alkaline fuel cell, Phosphoric, acid fuel cell, polymer electrolyte membrane fuel cell construction, applications, advantages and limitations.	10
3	**Fuels and Combustion :** Definition, Calorific values, HCV and LCV, Determination – Bomb Colorimeter, Boy's Calorimeter, Numericals, Solid fuel- significance of proximate and Ultimate analysis, Numerical (Dulong's Formula) Liquid fuels – Petroleum – composition and bubble tower fractional distillation of crude oil, Knocking in IC and compression engine, octane number of petrol, Cetane Number of Diesel, Poer alcohol, Biodiesel, Doping agent (Antiknodcing , Antioxidants, enticing), fisher – tropsch process for manufacture of synthetic gasoline, Gaseous fuel - composition, properties and applications of CNG, LPG Combustion: Chemical reactions, Calculations for air required, Numericals.	10
4	**Green Chemistry :** Defimition, goals of green chemistry, efficiency parameters need of green chemistry, Major uses traditional and green pathways of synthesis of adipic acid, polycarbonate, indigo dye, principles, concept of carbon credits.	5
5	**Synthetic Organic Polymer :** Introduction functionality of monomer, Polymerisation – fre radical mechanism and step growth polymerization concept and significance of – Average molecular Weight Crystalinity in Polymers, Tm and Tg, Thermoplastic and thermosetting polymers, compounding of plastics, Techniques of Polymerisation, Preparation, properties and engineering application of Polyethylene (LDPE and HDPE) and epoxy resin, Elastomers – Natural rubber – processing and Vulcanization by sulphur, Synthetic rubbers – SBR,	10

	Specialty polymer : Engineering thermoplastics – Polycarbonate, biodegradable polymers – Poly (Hydroxyburate, Hydroxyvalanate) Conducting polymers – Polyacetylene, Polyaniline, Electroluminscent polymers – polyphenylenevinylene, Liquid crystaline polymers – Kevlar, Polymer Composites – fiber reinforced plastic (FRP)	

List of book to be referred : Text Books:

1. Text Book of Engineering Chemistry, S.S.Dara, S. Chandand Company Ltd., NewDelhi.
2. Text book of Engineering Chemistry, P.C.Jain and Monica Jain, Dhanpat Rai and Sons, NewDelhi.
3. Text book of Engineering Chemistry, S.N.Narkhede, R.T.Jadhav, A.B.Bhake, A.U.Zadgaonkar, Das Ganu Prakashan, Nagpur.
4. Applied Chemistry,A.V.Bharati and Walekar, TechMax Publications, Pune.
5. Engineering Chemistry, Arty Dixit, Dr.Kirtiwardhan Dixit, Harivansh Prakashan, Chandrapur.

Reference Books:

1. A Textbook of Engineering Chemistry, Shashi Chawla, Dhanpat Rai & Sons, New Delhi.
2. Applied Chemistry by N. Krishnamurthy, P.Vallinavagam., K.Jeysubramanian, TMH.
3. Applied Chemistry for Engineers, T. S. Gyngell.
4. Chemistry in Engineering, Lloyda. Munro, Prentice-hall
5. Chemistry of Advanced Materials:CNR Rao, Rsc Publication.
6. Chemistry of Cement, J.D.Lee, Mcgraw Hill Publishing Company, NewDelhi.
7. Chemistry of Engineering Materials: Robert B Leighou, McGraw Hill Book Company, New York.
8. Chemistry, Raymond Chang, Tata McGraw Hill.
9. CorrosionEngineeringbyMarsG.FontanaandNorbertD.GreenMcGrawHillBookCo. Tokyo
10. Electrochemistry, Philip H. Rieger (Chapmanand Hail)
11. EngineeringChemistry(Vol.IandII)byRajaramandKuriakose.
12. EngineeringChemistryB.K.SharmaKrishnaPrakashanmediaprivateLTD.
13. EngineeringChemistrybyGyngell,McGrawHillPublishingCompany,NewDelhi.
14. EngineeringchemistrybyR.gopalan,andothers,Vikaspublications
15. Engineering Chemistry by R.V.Gadag, A.NityanandaShetty ; I K.Inte rnational Publishing House, NewDelhi
16. EngineeringChemistry(Vol.1&2)byRajaramandKuriakose
17. EngineeringChemistry,B.S.Sivasankar,TataMcgrawHillPublishingCompany,NewDelhi.
18. EngineeringChemistry,O.G.Palan,TataMcgrawHillPublishingCompany,NewDelhi.
19. EngineeringChemistry,R.Shivakumar,TataMcgrawHillPublishingCompany,NewDelhi.
20. EngineeringChemistry,SaraswatandThakur,VikasPublication,NewDelhi.
21. EngineeringMaterials:KennethGBudinski(Prentice–HallofIndia)
22. FuelsandCombustionbyAmirCircar,OrientLongmans
23. FundamentalsofCorrosion:MichaelHenthorne,ChemicalEngineering.
24. Fundamentals of Engineering Chemistry (Theory and Practice) :S. K. Singh (NewAge Materials
25. Materialsscienceandengineeringanintroduction,WilliamD.Callister,(Jr.,Wiley.publisher)
26. Textbookofengineeringchemistry,R.N.GoyalandHarrmendraGoel,(AnebooksIndia).
27. WaterTreatment:F.I.Bilane,Mirpublisher
28. WatertreatmentforindustrialandotherusebyEskelNordell,ReinholdPublishing Corporation,NewYork

Title of the Course : Chemistry-I Laboratory

Minimum 6 - 8 experiments are to be performed from the list given below.

List of Experiments:

1. Determination of temporary and permanent hardness of water by complexometry method.
2. To estimate the amount of Ni+2 ions in a given solution by complexometric method.
3. Estimation of free chlorine in the water by iodometry.
4. Type and extent of alkalinity by Warder's method.
5. Estimation of dissolved oxygen in a water sample.
6. Determination of capacity of anion exchange resin.
7. Determination of capacity of cation exchange resin.
8. Determination of copper by lodometry.
9. To estimate the amount of ferrous and ferric ions present in the given solution or from ore.
10. Determination of hardness of water due to calcium and magnesium ions separately.
11. Determination of moisture content/volatile matter/ash content of coal.
12. Determination of molecular weight of a polymer by viscosity measurements.
13. Determination on rate of corrosion by weight loss by corrossometer.
14. Preparation of Biodiesel and its characterization.
15. Study of charging of lead acetate battery by measuring density of sulphuric acid electrolyte.
16. Determination of pH of waste water.
17. Determination of conductivity and potential difference.
18. Determination of COD in waste water.
19. Determination of calorific value of a solid fuel using bomb Calorimeter.
20. Laboratory Manual :
21. Applied Chemistry theory and practical O.P. Virmani and A. K. Narular (New Age International)
22. Laboratory Manual on Engineering Chemistry by Dr. Subdharani (Dhanpat Rai Publishing)
23. A Textbook on experiment and calculation in engineering chemistry by S. S. Dara S. Chand
24. Inorganic quantitative analysis, Vogel. (Prentice Hall)

I Semester B.E. (Common for all branches)

Course Code : BSC103

Title of the Course : Engineering Mathematics-I

Course Scheme					Evaluation Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Duration of paper, hrs	MSE	IE	ESE	Total
3	1	0	4	4	3	10	10	80	100

Course Outcomes:

The objective of this course is to familiarize the prospective engineers with techniques in differential & Integral calculus & statistics.

It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

The students will learn:

1. To apply knowledge of mathematics in formulating and solving problems analytically.
2. To deal with function of several variables that are essential in most branches of Engineering.
3. To use the knowledge of Gamma and Beta function to evaluate some definite integrals arising in various branches of engineering.
4. To use various statistical techniques to applied engineering problem.

Detailed contents:

Unit	Contents	Hours
1	**Module 1: Diffential Calculus: (8 lectures)** Successive differentiation, Leibnitz's theorem on the n th derivative of a product, Expansion of a function by using Taylor's and Maclaurian's theorem, Indetermine forms	06
2	**Module 2: Partial Differentation : (8 lectures)** Partial Derivatives, Euler's theorem on homogeneous functions, Transformation of independent variables (Chain rule)	06
3	**Module 3: Application of Partial Differntation: (10 lectures)** Jacobians, properties of Jocobians, Taylor's and Maclaurin's series for function of two variable, Maxima and Minima of functions of two variables, Lagrange's method of undermined multipliers.	10
4	**Module 4: Integral Calculus : (8 lectures)** Gamma and Beta functions, properties of gamma, beta functions, Differentiations of definite integrals under integral sign, (Leibnitz's Rule), Mean and R.M.S. value.	08
5	**Module 5: Statistics & Finite Differences: (8 lectures)** Fitting of straight line, second degree parabola & exponential curves, Coefficient of Correlation, Regression lines, Rank coefficient of correlation Finite Differences : Operator E & Delta, Fractional polynomial. Lagrange's, interpolation formula for unequal intervals of arguments.	10

Reference Books:

1. A Text book of Engineering Mathematics, Volume I and II by D. T. Deshmukh.
2. A Text book of Applied Mathematics Volume I and II by J. N. Wartikar and P. N. Wartikar.
3. N. P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi publication, Reprint, 2008.
4. Higher Engineering Mathematics by B. S. Grewal Khanna Publishers.
5. Advanced Engineering Mathematics by H. K. Dass
6. Advanced Engineering Mathematics by Erwins Kreyszig

II Semester B.E. (Common for all branches)

Course Code : BSC104

Title of the Course : Engineering Mathematics-II

Course Scheme					Evaluation Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Duration of paper, hrs	MSE	IE	ESE	Total
3	1	0	4	4	3	10	10	80	100

Course Outcomes:

The objective of this course is to familiarize the prospective engineers with techniques in differential & integral calculus & Statistics.

It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

The students will learn:

1. To apply knowledge of mathematics in formulating and solving problems analytically.
2. To develop mathematical models for various engineering system and their solution using Differential equation .
3. Use of multiple integration for calculation of area, mass, volume, centre of gravity.
4. To calculate gradient and directional derivatives of scalar point function.
5. To use Green's theorem to evaluate line integrals along simple close contours on the plane, Stoke's theorem to give physical interpretation of the curl of a vector field and the Divergence throrem to give physical interpretation of the divergence of a vector field.

Detailed contents:

Unit	Contents	Hours
1	**Module 1: Ordinary differential equation I : (8 lectures)** Solution of first order and first degree differential equations, (Exact, Linear and reducible to Linear Bernoulli's equation) & Higher order linear differential equations with constant coefficients.	10
2	**Module 2: Ordinary differential equation II: (8 lectures)** Method of variation of parameters, Cauchy's and Legendre;s differential equaltions, Differntial equation of the form, Application of differential equation to electrical circuits, Kinematics and Vibrations (Upto second order)	06
3	**Module 3: Multiple Integrals and their Applications: (8 lectures)** Elementary double integral, change of order of integration (Cartesian), Elementary Tripple Integral, Applications to Area, Volume, Mass and Centre of gravity.	08
4	**Module 4: Vector Calculus: (8 lectures)** Vector differentiation, Velocity and Acceleration, Tangential and Normal acceleration, Vector operator Del, Gradient, Directional Derivative of scalar point function.	08
5	**Module 5: Vector Calculus - II: (8 lectures)** Vector point functions, Divergence and Curl, Solenoidal and Irrotational vector fields. Scalar potential, work done and conservative vector field, Line, Surface and volume integrals. Statements without proof of Gauss Divergence theorem, Greens theorem, Stoke's theorem.	08

Reference Books:

1. A text book of Engineering Mathematics, Volume I and II by D. T. Deshmukh .
2. A text book of Applied Mathematics Volume I and II by J. N. Wartikar and P. N. Wartikar
3. Higher Engineering Mathematics by Dr. B. S. Grewal
4. Advanced Engineering Mathematics by H. K. Dass.
5. Advance Engineering Mathematics by Erwins kreyszig

I/II Semester B.E. (Common for all branches)

Course Code : ESC101

Title of the Course : Basic Electrical Engineering

Course Scheme					Evaluation Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Duration of paper, hrs	MSE	IE	ESE	Total
3	1	2	4+2	5	3	10	10	80	100

Course Outcomes:

At the end of this course, students will demonstrate the ability

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

Unit	Contents	Hours
1	**Module 1 : DC Circuits** 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.	08
2	**Module 2: AC Circuits** 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.	08
3	**Module 3: Transformers** Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency.Auto-transformer and three-phase transformer connections.	06
4	**Module 4: Electrical Machines** 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.	08
5	**Module 5: Semiconductor Diode** Construction, working and characteristics. Application of Diode as Rectifier **Module 6: Electrical Installations** Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batt eries, Important Characteristics for Batteries.Elementary calculations for energy consumption, and battery backup.	08

Text Books:

1. D. P. Kothari and I. J. Nagrath, “Basic Electrical Engineering”, Tata McGraw Hill, 2010.
2. D. C. Kulshreshtha, “Basic Electrical Engineering”, McGraw Hill, 2009.

Reference Books:

1. L. S. Bobrow, “Fundamentals of Electrical Engineering”, Oxford University Press, 2011.
2. E. Hughes, “Electrical and Electronics Technology”, Pearson, 2010.
3. V. D. Toro, “Electrical Enginee ring Fundamentals”, Prentice Hall India, 1989.

Title of the Course : Basic Electrical Engineering Laboratory

Laboratory Outcomes: The students are expected to

1. Get an exposure to common electrical components and their ratings.
2. Make electrical connections by wires of appropriate ratings.
3. Understand the usage of common electrical measuring instruments.
4. Understand the basic characteristics of transformers and electrical machines.
5. Get an exposure to the working of power electronic converters.

Minimum 6 - 8 experiments are to be performed from the list given below.

List of Experiments:

1. Basic safety precautions. Introduction and use of measuring instruments – voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors.
2. 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.
3. Transformers: Observation of the no-load current waveform on an oscilloscope (nonsinusoidal
4. 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.
5. 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.
6. 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.
7. Torque Speed Characteristic of separately excited dc motor.
8. 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 supersynchronous speed.
9. Synchronous Machine operating as a generator: stand-alone operation with a load. Control of voltage through field excitation.
10. (a)Demonstration of Single Phase Rectifier (half wave and full wave) and (b) Components of LT switchgear.

I/II Semester B.E. (Common for all branches)

Course Code : ESC102

Title of the Course : Engineering Graphics & Design

Course Scheme					Evaluation Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Duration of paper, hrs	MSE	IE	ESE	Total
1	0	4	1+4	3	4	10	10	80	100

Course Outcomes:

1. Introduction to engineering design and its place in society
2. Exposure to the visual aspects of engineering design
3. Exposure to engineering graphics standards
4. Exposure to computer-aided geometric design
5. Exposure to creating working drawings
6. Exposure to engineering communication

(Except the basic essential concepts, most of the teaching part can happenconcurrently in the laboratory)

Units	Contents	Hours
1	Principles of Engineering Graphics and their significance, usage of Drawing instruments,lettering, Different types of lines used in drawing practices, dimensioning, Introduction to scale i.e. full size, Reducing scale and enlarging scale. Conic sections (No focus and directrix method) including the Rectangular Hyperbola;Cycloid, and Involute; Principles of Orthographic Projections, concepts of four quadrants, difference between first and third angle projection, firstangle projections, and conventions used to represent methods of orthographic projection. Projections of Points and lines inclinedto both planes(Lines in First QuadrantOnly, excluding applications of straight lines.);	
2	Projections of Planes: Projection of planes when it is parallel to one & perpendicular to other reference plane, lyingin reference plane, inclined to one & perpendicular to other reference plane, inclined to bothreference planes. Auxiliary planes - Auxiliary Inclined Plane (AIP) and Auxiliary Vertical Plane (AVP), Use ofAuxiliary Plane method for solving the problems. Projections of Solids: cube, tetrahedron, prism, pyramid, cylinder and cone, projections of above solids whenaxis perpendicular to one of the reference planes, axis inclined to one & parallel to otherreference plane, axis inclined to both the reference planes.Draw simple annotation, dimensioningand scale. Floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc.	
3	Sections and Sectional Views of Right Angular Solids : Section planes, sectional views, Draw the sectional orthographic viewsof geometrical solidslike Cube, Tetrahedron, Prism, Cylinder, Pyramid, Conecut by differentsection planes (when solid is in simple position, when axis is parallel to one & inclined toother reference plane).and to draw Sectional views of objects from industry and dwellings (foundation to slab only) Development of surfaces of Regular Solids –Cube, Tetrahedron, Prism, Pyramid, Cylinder and Cone; (No reverse development)	
4	Isometric Projections: Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions;Isometric Views of Planes, Simple and compound Solids; Conversion of IsometricViews to Orthographic Views and Vice -versa, Conventions;	
5	Overview of Computer Graphics: listing the computer technologies that impact on graphical communication, Demonstratingknowledge 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), TheCommand Line (where applicable),	

	The Status Bar, Different methods of zoom as used inCAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids]; consisting of set up of the drawing page and the printer, including scale settings, Setting upof units and drawing limits; ISO and ANSI standards for coordinate dimensioning andtolerance; 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; applying dimensions to objects, applying annotations to drawings; Setting up and use ofLayers, layers to create drawings, Create, edit and use customized layers; Changing linelengths through modifying existing lines (extend/lengthen); Printing documents to paperusing the print command; orthographic projection techniques; Drawing sectional views ofcomposite right regular geometric solids and project the true shape of the sectioned surface;Drawing annotation	

In Practical minimum 8 half imperial (A2-594 mm X 420mm) sheets based on above Syllabus are to be drawn. In each sheet minimum 4 problems are to be drawn.

Drawings of Isometric views to Orthographic views and vice-versa are to be drawn using CAD software.

Note: During external practical examination of 25 marks, Students are expected to solve One/ Two Problems on drawing sheet (or using the software on the system) OR Objective type Questions. + Oral (15+ 10 =25 marks).

Text Book:

1. Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, CharotarPublishing House
2. Shah, M.B. &Rana B.C. (2008), Engineering Drawing and Computer Graphics, PearsonEducation
3. D.N. Johle, Engineering Drawing, Tata Megraw-hill publishing Co. Ltd
4. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers
5. (Corresponding set of) CAD Software Theory and User Manuals

I/II Semester B.E. (Common for all branches)

Course Code : ESC103

Title of the Course: Computer Programming in C

Course Scheme					Evaluation Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Duration of paper, hrs	MSE	IE	ESE	Total
03	0	2	03	04	03	10	10	80	100

Unit	Contents	Hours
I	Process of programming: Editing, Compiling, Error Checking, executing, testing and debugging of programs. Using TDM GCC compliler for C Program development, Flowcharts, Algorithms.	11
II	Types, Operators and Expressions: Variable names, Data types, sizes, constants, declarations, arithmetic operators, relational and logical operators, type conversions, increment and decrement operators, bitwise operators, assignment operators and expressions, conditional expressions precedence and order of evaluation.	08
III	Control Flow: Statements and Blocks. If-else, else-if switch Loops while and for, do-while break and continue go to and Labels. Functions and Program Structure: Basic of functions, functions returning non integers external variables scope rules.	08
IV	Arrays in C: Initializing arrays, Initializing character arrays, multidimensional arrays.	09
V	Structures C: Basics of structures, structures and functions arrays of structures, Pointer in C. Pointers to integers, characters, floats, arrays, structures.	09
	Total	45

Reference/Text Book/s:

1. Brain W. Kernighan & Dennis Ritchie, The C Programming Language, Prentice Hall, 2nd Edition, 1988.
2. Herbert Schildit, C the Complete Reference, McGraw-Hill Publication, 2000.
3. Balguruswamy, Programming in C, PHI.
4. YashwantKanitkar, Let Us C, PHI

Course Outcomes:

The student will learn

CO1 To formulate simple algorithms for arithmetic and logical problems.
CO2 To translate the algorithms to programs (in C language).
CO3 To test and execute the programs and correct syntax and logical errors.
CO4 To implement conditional branching, iteration and recursion.
CO5 To decompose a problem into functions and synthesize a complete program using divide andconquer approach.
CO6 To use arrays, pointers and structures to formulate algorithms and programs.
CO7 To apply programming to solve matrix addition and multiplication problems and searchingand sorting problems.
CO8 To apply programming to solve simple numerical method problems, namely rot finding offunction, differentiation of function and simple integration.

Laboratory - Programming for Problem Solving [L : 0; T:0 ; P : 4 (2credits)] [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-referentialstructures.
To be able to create, read and write to and from simple text files

I/II Semester B.E. (Common for all branches)

Course Code : ESC104

Title of the Course : Workshop/ Manufacturing Process

Course Scheme					Evaluation Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Internal Assesment	MSE	IE	ESE	Total
1	0	4	1+4	3	50	0	0	0	50

Course Outcomes:
After completion of the course, the student will be able to:

1. Upon completion of this laboratory course, students will be able to fabricate components with their own hands
2. They will also get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes
3. By assembling different components, they will be able to produce small devices of their interest.
4. The students will gain knowledge of the different manufacturing processes which are commonly employed in the industry, to fabricate components using different materials.

Units	Contents (Theory)	Hours
1	Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods	3
2	Fitting operations & power tools and Carpentry	1
3	Plastic moulding, glass cutting	1
4	Metal casting	1
5	Welding (arc welding & gas welding), brazing	1
	Contents(Practicals)	
1	Introduction various shops with its tools and equipments.	2
2	One job on carpentry with minimum two types of joints (any two) with different operations like cutting, filing, planning etc.	8
3	One job on Fitting including filing, cutting, drilling etc.	10
4	One job on sheet metal with different operations like cutting, hammering, riveting/soldering etc.	8
5	One job on black smithy including heating, hammering, fullering, edging, bending, cutting, trimming etc.	8
6	Demonstrations on welding processes like arc welding, gas welding and resistance welding.	4
7	Introduction to various machine tools like lathe, drilling machine, milling machine, shaping, planning and grinding machine. Demonstrations of each machine.	4
8	Introduction to moulding practices and its tools, equipments and procedure	4
9	Introduction to Rolling, Forging and Extrusion processes.	4

Text Book:

1. HajraChoudhury S.K., HajraChoudhury 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.

Reference Books:

1. Kalpakjian S. And Steven S. Schmid, "Manufacturing Engineering and Technology", 4th edition, Pearson Education India Edition, 2002.
2. Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata McGrawHill House, 2017.

/II Semester B.E. (Common for all branches)

Course Code : HSMC101

Title of the Course : English

Course Scheme					Evaluation Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Internal Assesment	MSE	IE	ESE	Total
2	0	2	2+2	3	50	0	0	0	50

Course Outcomes

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

Units	Contents (Theory)	Hours
1	Vocabulary Building 1.1 The concept of Word Formation 1.2 Root words from foreign languages and their use in English 1.3 Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives. 1.4 Synonyms, antonyms, and standard abbreviations.	6
2	2. Basic Writing Skills 2.1 Sentence Structures 2.2 Use of phrases and clauses in sentences 2.3 Importance of proper punctuation 2.4 Creating coherence 2.5 Organizing principles of paragraphs in documents 2.6 Techniques for writing precisely.	6
3	Identifying Common Errors in Writing 3.1 Subject-verb agreement 3.2 Noun-pronoun agreement 3.3 Misplaced modifiers 3.4 Articles 3.5 Prepositions 3.6 Redundancies 3.7 Clichés	6
4	Nature and Style of sensible Writing 4.1 Describing 4.2 Defining 4.3 Classifying 4.4 Providing examples or evidence 4.5 Writing introduction and conclusion Writing Practices 4.6 Comprehension 4.7 Précis Writing 4.8 Essay Writing	6
5	Oral Communication (This unit involves interactive practice sessions in Language Lab) 5.1 Listening Comprehension 5.2 Pronunciation, Intonation, Stress and Rhythm 5.3 Common Everyday Situations: Conversations and Dialogues 5.4 Communication at Workplace 5.5 Interviews 5.6 Formal Presentations	6

Suggested Readings:

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

I/II Semester B.E. (Common for all branches)

Course Code : HSMC102

Title of the Course : Soft skill

Course Scheme					Evaluation Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Internal Assesment	MSE	IE	ESE	Total
2	0	0	2	2	50	0	0	0	50

Units	Contents (Theory)	Hours
1	**Team Building**: To know the nature of the team, To understand personal as well as professional goals of the members of the group, To work effectively in a team through building relation and interpersonal communication **Art of Negotiation:** To understand what is negotiation, Ways of negotiating and being successful in it, To understand the power of language and non-verbal communication	6
2	**Dress for Success:** To learn selection of proper attire as per the situation, How to carry one's self, How to project one's self in the right frame and spirit. **Table Manners:** To learn the manners during professional meetings over lunch/dinner, Basics of the table manner.	6
3	**Organizing Meetings:** How to call the meeting, How to organize a meeting in the smooth manner, How to design the agenda and prepare minutes of the meeting. **Stress Management:** To learn kinds of stress, To identify the right reason/s of stress, How to handle the pressure and perform efficiently in such situations, Techniques to cope with the stressful situation at aworkplace	6
4	**Telephone etiquettes:** Students learn the telephonic etiquettes; tone and pitch of the voice, How to send a voice mail, Students are also exposed to the etiquettes **Time Management:** Goal setting, To make students understand the importance of time, How to prepare the time line and allocate time to complete different tasks, How to successfully follow the prepared time-schedule.	6
5	**Presentation Skills:** To learn the skill of presentation, How to prepare thepresentation, Knowing the audience and their requirements, Effective way to deliver the presentation, How to prepare the multimedia presentation **Organizational Skills:** To understand the nature of the organization, To understand the structure and communication channel of the organization **Group Discussion**: Understanding the nature of discussion, Difference between debate and discussion. **Personal Interviews** To learn the skills of appearing in an interview and being successful in it	6

Books Recommended

1. Peggy Klaus, The Hard Truth about Soft Skills.
2. Nitin Bhatnagar. Effective Communication and Soft Skills. Pearson Education India.
3. Eric Garner. Team Building
4. Wendy Palmer and Janet Crawford. Leadership Embodiment

Appendix - A

A Guide to Induction Program

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.[1] *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.

---

[1] A Committee of IIT Directors was setup in the 152nd Meeting of IIT Directors on 6th September 2015 at IIT Patna, on how to motivate undergraduate students at IITs towards studies, and to develop verbal ability. The Committee submitted its report on 19th January 2016. It was considered at the 153rd Meeting of all IIT Directors at IIT Mandi on 26 March 2016, and the accepted report came out on 31 March 2016. The Induction Program was an important recommendation, and its pilot was implemented by three IITs, namely, IIT(BHU), IIT Mandi and IIT Patna in July 2016. At the 50th meeting of the Council of IITs on 23 August 2016, recommendation on the Induction Program and the report of its pilot implementation were discussed and the program was accepted for all IITs.

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 awarness, sensitivity and understanding of the self, people around them, society at large, and nature.[2]

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.

Induction Program as described here borrows from three programs running earlier at different institutions: (1) Foundation Program running at IIT Gadhinagar since July 2011, (2) Human Values course running at IIIT Hyderabad since July 2005, and (3) Counselling Service or mentorship running at several IITs for many decades. Contribution of each one is described next.

(1) IIT Gandhinagar was the first IIT to recognize and implement a special 5-week Foundation Program
for the incoming 1st year UG students. It took a bold step that the normal classes would start only after the five week period. It involved activities such as games, art, etc., and also science and other creative workshops and lectures by resource persons from outside.

(2) IIIT Hyderabad was the first one to implement a compulsary course on Human Values. Under it, classes were held by faculty through discussions in small groups of students, rather than in lecture mode. Moreover, faculty from all departments got involved in conducting the group discussions under the course. The content is non-sectarian, and the mode is dialogical rather than sermonising or lecturing.
Faculty were trained beforehand, to conduct these discussions and to guide students on issues of life.

(3) Counselling at some of the IITs involves setting up mentor-mentee network under which 1st year students would be divided into small groups, each assigned a senior student as a student guide, and a faculty member as a mentor. Thus, a new student gets connected to a faculty member as well as a senior student, to whom he/she could go to in case of any difficulty whether psychological, financial, academic, or otherwise.

The Induction Program defined here amalgamates all the three into an integrated whole, which leads to its high effectiveness in terms of building physical activity, creativity, bonding, and character. It develops sensitivity towards self and one's relationships, builds awareness about others and society beyond the individual, and also in bonding with their own batch-mates and a senior student besides a faculty member.

Scaling up the above amalgamation to an intake batch of 1000 plus students was done at IIT(BHU), Varanasi starting from July 2016.

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 everyday 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 dont's, 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.[3]

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.

---

[3]The Universal Human Values Course is a result of a long series of experiments at educational institutes starting from IIT-Delhi and IIT Kanpur in the 1980s and 1990s as an elective course, NIT Raipur in late 1990s as a compulsory one-week off campus program. The courses at IIT(BHU) which started from July

2014, are taken and developed from two compulsory courses at IIIT Hyderabad first introduced in July 2005.

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 faculties.

3 Schedule

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/discipline4.

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 (upto 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 metaskills 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.

---

[4]We are aware that there are advantages in mixing the students from different depts. However, in mixing, it is our experience that the continuity of the group together with the faculty mentor breaks down soon after. Therefore, the groups be from the same dept. but hostel wings have the mixed students from different depts. For example, the hostel room allotment should be in alphabetical order irrespective of dept.

References:

Motivating UG Students Towards Studies,

Rajeev Sangal, IITBHU Varanasi, Gautam Biswas, IIT Guwahati, Timothy Gonsalves,

IIT Mandi, Pushpak Bhattacharya, IIT Patna, (Committee of IIT Directors),

31 March 2016, IIT Directors' Secretariat, IIT Delhi.

Contact:

Prof. Rajeev Sangal

Director, IIT(BHU), Varanasi

(director@iitbhu.ac.in)

18 June 2017