RKDF UNIVERSITY, BHOPAL

New Scheme of Examination as per AICTE Flexible Curricula

W.E.F. JULY 2020

Subject wise distribution of marks

B.E. I Semester (All Branches)

S. No.	Subject Code	Category	Subject Name	Theory Slot						Practical Slot						Total Marks	Contact Hours per Week			
				Theory		Mid Sem		Quiz Assignment		Practical		Lab Work		Lab Quiz						
				Max. Marks	Min. Marks	Max. Marks	Min. Marks	Max. Marks	Min. Marks	Max. Marks	Min. Marks	Max. Marks	Min. Marks	Max. Marks	Min. Marks		L	T	P	Total Credits
1	BE-1011	BSC-1	Engineering Chemistry	70	25	20	10	10	5	30	15	10	5	10	5	150	3	-	2	4
2	BE-1021	BSC-2	Engineering Mathematics-I	70	25	20	10	10	5	-	-	-	-	-	-	100	3	1	-	4
3	BE-1031	HSMC-1	English	70	25	20	10	10	5	30	15	10	5	10	5	150	3	-	2	4
4	BE-1041	ESC-1	Basic Electrical & Electronics Engineering	70	25	20	10	10	5	30	15	10	5	10	5	150	2	-	2	3
5	BE-1051	ESC-2	Engineering Graphics & Design	70	25	20	10	10	5	30	15	10	5	10	5	150	2	-	2	3
6	BE-1061	ESC-3	Workshop/Manufacturing Practices	-	-	-	-	-	-	15	8	5	3	5	3	25	-	-	2	1
7	BE-1071	DLC-2	Swachh Bharat Summer Internship Unnat Bharat Abhiyan (100Hrs)/ Rural Outreach	-	-	-	-	-	-	15	8	5	3	5	3	25	-	-	4	2
			Total	**350**	**-**	**100**	**-**	**50**	**-**	**150**	**-**	**50**	**-**	**50**	**-**	**750**	**13**	**1**	**14**	**21**

1 Hour Lecture = 1 Credit
1 Hour Tutorial = 1 Credit
2 Hour Practical = 1 Credit

RKDF UNIVERSITY, BHOPAL

New Scheme of Examination as per AICTE Flexible Curricula

W.E.F. JULY 2020

Subject wise distribution of marks

B.E. II Semester (All Branches)

S. No.	Subject Code	Category	Subject Name	Theory Slot						Practical Slot						Total Marks	Contact Hours per Week			
				Theory		Mid Sem		Quiz Assignment		Practical		Lab Work		Lab Quiz						
				Max. Marks	Min. Marks	Max. Marks	Min. Marks	Max. Marks	Min. Marks	Max. Marks	Min. Marks	Max. Marks	Min. Marks	Max. Marks	Min. Marks		L	T	P	Total Credits
1	BE-2011	BSC-3	Engineering Physics	70	25	20	10	10	5	30	15	10	5	10	5	**150**	2	1	2	4
2	BE-2021	BSC-4	Engineering Mathematics-II	70	25	20	10	10	5	-	-	-	-	-	-	**100**	3	1	-	4
3	BE-2031	ESC-4	Basic Mechanical Engineering	70	25	20	10	10	5	30	15	10	5	10	5	**150**	3	-	2	4
4	BE-2041	ESC-5	Basic Civil Engineering & Engineering Mechanics	70	25	20	10	10	5	30	15	10	5	10	5	**150**	3	-	2	4
5	BE-2051	ESC-6	Programming for Problem Solving	70	25	20	10	10	5	30	15	10	5	10	5	**150**	3	-	2	4
6	BE-2061	HSMC-2	Language Laboratory	-	-	-	-	-	-	30	15	10	5	10	5	**50**	-	-	2	1
7	BE-2071	DLC-1	Internship-I (60 Hrs Duration) at the Institute Level	**To be completed during II semester. Its evaluation/ credit will be added in III semester**																
			Total	**350**	**-**	**100**	**-**	**50**	**-**	**150**	**-**	**50**	**-**	**50**	**-**	**750**	**14**	**2**	**10**	**21**

1 Hour Lecture = 1 Credit
1 Hour Tutorial = 1 Credit
2 Hour Practical = 1 Credit

R.K.D.F. UNIVERSITY, BHOPAL

B.E. (Common For All Branches)

New Scheme Based On AICTE Flexible Curricula

Semester – I

Course Content

Branch	Subject Title	Subject Code
B.E. Common	**Engineering Chemistry**	**B.E.- 1011**

Course Outcomes:

CO1 Gain knowledge about types of boiler problems, various physical and chemical techniques for water treatment and its analysis, desalination process used to produce potable water from brackish water.

CO2 Differentiate between air and water pollution. Possess the knowledge about their adverse effect on the environment and their preventive measures.

CO3 Gain chemical knowledge on concepts of polymers, their structural properties and molding techniques required for solving interdisciplinary problems in polymer industries.

CO4 Gain basic knowledge about biomolecules, nanomaterial's, fullerenes, super conductors, and brass alloy, and also able to apply them in multi-disciplinary engineering branches.

CO5 Acquire knowledge on dyes and drugs, methods of dyeing, color theory, synthesis of antimalarial and antibiotic drugs.

CO6 Perform the experiments on pH-metry, Potentiometry, Conductometry, Colorimetry and chromatography as well as to analyze and interpret the data to address issues related to engineering problems.

CO7 Acquire the knowledge of various types of Corrosion, their significance and preventive measures.

CO8 Acquire the basics of non-conventional sources of energy and green chemistry.

Course Contents:

Unit-I

WATER ANALYSIS TREATMENT AND ITS INDUSTRIAL APPLICATIONS:

Sources, Impurities, Hardness & its different units, Degree of Hardness, Softening of water by Zeolite and Ion exchange method, Boiler trouble causes (Sludge and Scale), Characteristics of municipal water & its treatment, determination of DO, BOD and COD, Numerical problems based on above techniques.

Unit- II

A. LUBRICANTS AND LUBRICATION:

Introduction, Classification of lubricants, Significance, Flash and Fire point determination, Definition of Viscosity and Viscosity Index.

B. MANUFACTURING OF PORTLAND CEMENT (SETTING AND HARDENING):

Unit –III

FUELS & COMBUSTION:

Classification of the fuel and its characteristics, Calorific value, HCV, LCV, Determination of calorific value by Bomb calorimeter, Proximate and Ultimate analysis of coal and their significance, Colloids, Lyophillic & Lyophobic Colloids, Tyndall effect, Brownian movement, Hardy Schuzle rule.

Unit –IV

POLYMER AND POLYMERIZATION:

Introduction, types and classification of polymerization (addition & co-polymerization), preparation, property &

uses of PVC, Teflon, Nylon 6, Nylon 66, Decoran & Vulcanization of Rubber.

ELECTRO-CHEMISTRY:
pH, Buffer solution, Ostwald' dilution law

PHOTO-CHEMISTRY:

Unit- V

Thermal & photo-chemical reaction, Einstein photo-chemical reaction, Lambert's and Beer's Law,

Principle and application of Spectroscopy of IR & UV

CHROMOTOGRAPHY:
Types of Chromatography & its application, Rf

PHASE RULE:
Gibbs phase rule, Phase diagram of 1 component system (water).

*** Engineering Chemistry Practical**

(A) Water Testing

1 Determination of Total hardness by Complexometric titration method.
2 Determination of mixed alkalinity
   (a) OH-& C03
   (b) C03- - & HCO3

(B) lubricant and Fuel testing:

* Flash & fire points determination by
3 Pensky Martin Apparatus,
4 Abel's Apparatus,
5 Cleveland's open cup Apparatus.
* Viscosity and Viscosity index determination by
6 Redwood viscometer No.1
7 Redwood viscometer No.2
8 Cloud and Pour point determination of lubricating oil
9 Determination of percentage of carbon
10 Proximate analysis of coal
   (a) Moisture content
   (b) Ash content
   (c) Volatile matter content
   (d) Carbon residue

(C) Alloy Analysis and PH Meter -

11 Determination of Cu and or Cr in alloys by Iodometric Titration
12 Find out the strength of HCl Solution using PH meter.

Reference Books :

1 Chemistry in Engineering and Technology - Vol.1 & 2 Kuriacose and Rajaram, McGraw Hill Education
2 Fundamental of Molecular Spectroscopy C.N. Banwell , McGraw Hill Education
3 Engineering Chemistry – B.K. Sharma, Krishna Prakashan Media (P) Ltd., Meerut.
4 Basics of Engineering Chemistry – S.S. Dara & A.K. Singh, S. Chand &Company Ltd., Delhi.
5 Applied Chemistry – Theory and Practice, O.P. Viramani, A.K. Narula, New Age International Pvt. Ltd. Publishers, New Delhi.
6 Elementary Spectroscopy ,Y .R. Sharma , S. Chand Publishing
7 Polymer Science, Vasant R. Gowariker, N. V. Viswanathan, Jayadev Sreedhar, New Age International Pvt. Ltd
8 Advanced Inorganic Chemistry, G.R. Chatwal, Goal Publishing house
9 Engineering Chemistry (NPTEL Web-book) B.L. Tembe, Kamaluddin and M.S. Krishna

R.K.D.F. UNIVERSITY, BHOPAL

B.E. (Common For All Branches)

New Scheme Based On AICTE Flexible Curricula

Semester – I

Course Content

Branch	Subject Title	Subject Code
B.E. Common	**Engineering Mathematics-I**	**B.E.- 1021**

Course Outcomes:

CO1 Develops skill of higher derivative, expansion of functions in ascending power of variable & value of the function in neighbored of some points.

CO2 Able to determine limits of indeterminate function. Applicable to already word problems & Engineering Problems.

CO3 Gain the knowledge to solve differential equation arising in different Engineering branch and able to form mathematical & physical interpretation of its solution which place important role in all branches of Engineering.

CO4 Learn the evaluation policy of some special function like gamma & Beta function. & their relation which is helpful to evaluate some definite integral arising in various branch of Engineering.

CO5 Able to calculate rank of matrix, characteristic equation & characteristic roots & use the applicability of Caylay Hamilton Theorem to find inverse of matrix which is very important in many engineering application.

CO6 Develops the ability to trace the curve for a given equation of a curve & its nature.

CO7 Gain knowledge to find radius of curvature & torsion of given curve which is helpful in civil Engineering , Mechanical Engineering & Rods and Building Construction & it is also useful in Research & development.

Course Contents:

Module 1: Calculus: Successive Differentiation, Rolle's theorem, Mean Value theorems, Expansion of functions by Mc. Laurin's and Taylor's for one variable; Taylor's theorem for function of two variables, Partial Differentiation, Maxima & Minima (two and three variables), Method of Lagranges Multipliers.

Module 2: Calculus: Definite Integral as a limit of a sum and Its application in summation of series; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions. Multiple Integral, Change the order of the integration, Applications of multiple integral for calculating area and volumes of the curves.

Module 3: Sequences and series: Convergence of sequence and series, tests for convergence; Power series, Taylor's series, series for exponential, trigonometric and logarithm functions; Fourier series: Half range sine and cosine series, Parseval's theorem.

Module 4: Matrices: Rank of a Matrix, Solution of Simultaneous Linear Equations by Elementary Transformation, Consistency of Equation, Eigen Values and Eigen Vectors, Diagonalization of Matrices, Cayley-Hamilton theorem and its applications to find inverse.

Module 5: Boolean Algebra: Algebra of Logic, Boolean Algebra, Principle of Duality, Basic Theorems, Boolean Expressions and Functions. Elementary Concept of Fuzzy Logic Graph Theory: Graphs, Subgraphs, Degree and Distance, Tree, cycles and Network.

References:

1. 1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
3. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
4. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11thReprint, 2010.
5. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
6. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
7. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.

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B.E. (Common For All Branches)

New Scheme Based On AICTE Flexible Curricula

Semester – I

Course Content

Branch	Subject Title	Subject Code
B.E. Common	**English**	**B.E.- 1031**

Course Outcomes:

CO1 Ability to prepare and make small presentations
CO2 Ability to write effective business letters, emails, CV and reports
CO3 Comprehend answering strategies in group discussions and interviews
CO4 Ability to voice opinion in discussions and convey ideas
CO5 Comprehend different types of communication and importance of effective communication in a work place

Course Contents:

Unit I

Identifying Common errors in writing: Articles, Subject-Verb Agreement, Prepositions, Active and Passive Voice, Reported Speech: Direct and Indirect, Sentence Structure.

Unit II

Unit-II Vocabulary building and Comprehension: Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives, synonyms, antonyms, Reading comprehension, Paragraph writing, Unseen passage.

Unit III

Unit-III Communication: Introduction, Meaning and Significance, Process of Communication, Oral and Written Communication, 7 c's of Communication, Barriers to Communication and Ways to overcome them, Importance of Communication for Technical students, nonverbal communication, Types and forms of Communication, Skills of Communication.

Unit IV

Unit-IV Developing Writing Skills: Planning, Drafting and Editing, Precise Writing, Précis, Technical definition and Technical description. Report Writing: Features of writing a good Report, Structure of a Formal Report, Report of Trouble, Laboratory Report, Progress Report, Note making.

Unit V

Unit-V Business Correspondence: Importance of Business Letters, Parts and Layout; Application, Contents of good Resume, guidelines for writing Resume, Calling/ Sending Quotation, Order, Complaint, E-mail and Tender.

Books Recommended:

1. 'Technical Communication : Principles and practice', Meenakshi Raman and Sangeeta Sharma (Oxford)
2. 'Effective Business Communication', Krizan and merrier (Cengage learning)
3. 'Communication Skill, Sanjay Kumar and Pushlata, OUP2011

4. “Practical English Usage Michael Swan OUP, 1995.
5. “Exercises in spoken English Parts I-III CIEFL, Hyderabad, Oxford University Press
6. On writing well, William Zinsser, Harper Resource Book 2001.
7. Remedial English Grammar, F.T. Wood, Macmillan 2007.

R.K.D.F. UNIVERSITY, BHOPAL

B.E. (Common For All Branches)

New Scheme Based On AICTE Flexible Curricula

Semester – I

Course Content

Branch	Subject Title	Subject Code
B.E. Common	**Basic Electrical & Electronics Engineering**	**B.E.- 1041**

Course Outcomes:

CO1 Enhancement in understanding the basic concepts of Core Electrical Engineering.
CO2 Basic understanding of Electrical machines and power systems.
CO3 Analyze components associated with digital and analog electronic systems.
CO4 Demonstrate proficiency in the use of electronic equipment and devices.
CO5 Assist in the design, operation, and troubleshooting of electronic systems.
CO6 Analyzing electronics devices and circuits using computer simulations.
CO7 Solve electronic devices and systems using mathematical concepts.

Course Contents:

UNIT I

AC & DC CIRCUITS

Circuit parameters, Ohms law, Kirchhoff's law. Average and RMS values, concept of phasor representation. RLC series circuits and series resonance, RLC parallel circuits (includes simple problems in DC & AC circuits) Introduction to three phase systems – types of connections, relationship between line and phase values. (qualitative treatment only) Voltage and current sources, dependent and independent sources, source conversion, DC circuits analysis using mesh & nodal method, star-delta transformation. 1-phase AC circuits under sinusoidal steady state, active, reactive and apparent power, physical meaning of reactive power, power factor, 3-phase balanced and unbalanced supply, star and delta connections.

UNIT II

TRANSFORMERS

Review of laws of electromagnetism, mmf, flux, and their relation, analysis of magnetic circuits. Single-phase transformer, basic concepts and construction features, voltage, current and impedance transformation, equivalent circuits, phasor diagram, voltage regulation, losses and efficiency, OC and SC test.

UNIT III

ROTATING ELECTRIC MACHINES-

Constructional details of DC machine, induction machine and synchronous machine, Working principle of DC machines, classification of DC machine, EMF equation, armature reaction, characteristic of separately excited and self excited generator. Working principle of DC motor, Importance of back EMF, Starting of DC motor, speed torque characteristic of separately excited and self excited DC motor.

UNIT IV

WIRING & LIGHTING

Types of wiring, wiring accessories, staircase & corridor wiring, Working and characteristics of incandescent, fluorescent, SV & MV lamps. Basic principles of earthling, simple layout of generation, transmission & distribution of power.

UNIT V

ELECTRONICS

Binary Number system binary addition, subtraction, multiplication and division, subtraction operation using 1's and 2's complement forms, Octal number system, hexadecimal number system conversion of number system from one number system to another number system, types of Resistor, Inductor and capacitor, color coding of resistor and capacitor P-type and N-type semiconductor, semiconductor diode its operation in forward and reverse bias, V-1 characteristics, half wave and full wave rectification, application.

References:

1. Basic Electrical & Electronics Engineering by V.N. Mittle & Arvind Mittle.
2. Vincent Del Toro, Electrical Engineering Fundamentals, PHI Learning, II Edition
3. S.Ghosh, Fundamentals of Electrical and Electronics Engineering, PHI, II Edition.
4. Millman, Halkias & Parikh, Integrated Electronics, Mc Graw Hill, II Edition
5. Nagrath & Kothari, Basic Electrical Engineering, TMH.
6. J.S. Katre, Basic Electronics Engg, Max Pub. Pune.
7. Hughes, Electrical and Electronic Technology, Pearson Education IX Edition

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B.E. (Common For All Branches)

New Scheme Based On AICTE Flexible Curricula

Semester – I

Course Content

Branch	Subject Title	Subject Code
B.E. Common	**Engineering Graphics & Design**	**B.E.- 1051**

Course Outcomes:

CO1 To read, understand and apply the knowledge of orthographic projections (production related features and instructions) in manufacturing industry, process industry and other allied engineering application.

CO2 To communicate with the globally recognized engineers and the engineers of different discipline of engineering for research and development activities.

CO3 To get knowledge of projections of different solid objects.

CO4 To perceive the idea of sectional view and advantages of it.

CO5 To apply the concept of intersections of solids for various engineering applications.

CO6 To understand and apply the concept of surface development for fabricating and manufacturing industrial devices.

CO7 To create the image of three dimensional figures with the help of isometric projections.

Course Contents:

UNIT - I

GEOMETRICAL CONSTRUCTION, USE OF INSTRUMENTS, SCALES; Representative factor, plain scales, diagonal scales, scale of chords. engineering curves; Construction of ellipse, parabola, hyperbola, Cycloid, Epi-cycloid, Hypo-cycloid, Involutes, Archimedean and logarithmic spirals.

UNIT – II

Projections of points, lines, planes and solids. Section of Solids: Section of right solids by normal and inclined planes.

UNIT III

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

Isometric Projections: Isometric scale, Isometric axes, Isometric Projection from orthographic drawing. Intersection of cylinders.

UNIT IV

Computer Graphics: Introduction to general purpose graphics software, plotting techniques, coordinate system transformations, line drawing, polygon an circle generation. Drawing entity commands of Computer drafting. Sectional and dimensional drawing using computer.

UNIT V

Working in sketcher environment, Drawing sketch, line, circle, rectangle, ellipse, arc, spline etc. Deleting & trimming sketching entities, Dimensioning the sketches ,Modifying dimension of sketches, Modifying dimension of sketches, Creating text, Transformation of sketch entiies-mirror, scale, rotate, Drawing views,

Determining visible area of the view ,Creating a cross-section views, Modifying cross-section views, Editing cross-section views, Modify the drawing views, Dimensioning & detailing the drawing views.

Text/Reference Books:

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

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B.E. (Common For All Branches)

New Scheme Based On AICTE Flexible Curricula

Semester – I

Course Content

Branch	Subject Title	Subject Code
B.E. Common	**Workshop/ Manufacturing Practices**	**B.E.- 1061**

Course Outcomes:

CO1 Acquire knowledge of the safety measures which are followed in workshop while using hand tools and general purpose machine tools.

CO2 Develop creativity, craftsmanship, approach to work and planning capabilities within students.

CO3 Given a drawing of a product/part such as carpentry job, fitting job, sheet metal job, assembly of system and pipe fitting, apply the various hand tools and general purpose machine tool to make or assemble the product/part.

CO4 Select and use various measuring and gauging instrument which are required for different types of jobs.

Course Contents:

Unit I

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

Unit II

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

Unit III

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

Unit IV

Foundry: Pattern Making: Study of Pattern materials, pattern allowances and types of patterns. Core box and core print, .Use and care of tools used for making wooden patterns. Moulding: Properties of good mould & Core sand, Composition of Green, Dry and Loam sand. Methods used to prepare simple green and bench and pit mould dry sand bench mould using single piece and split patterns.

Unit V

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

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B.E. (Common For All Branches)

New Scheme Based On AICTE Flexible Curricula

Semester – II

Course Content

Branch	Subject Title	Subject Code
B.E. Common	**Engineering Physics**	**B.E.- 2011**

Course Outcomes:

CO1 Gain basic understanding of the combined effect of electric and magnetic fields their application for designing various electromagnetic and semiconductor devices.

CO2 Acquire fundamentals of Optics, especially wave nature of light (e.g., interference etc.) and its applications towards telescopes, microscopes, astronomy and fibre optics.

CO3 Develop basic knowledge on the historical development and time-to-time applications of quantum mechanics in electronic devices (e.g., Photovoltaic cell, Hall sensor etc.).

CO4 Obtain basic understanding of the particle nature of light (e.g., Photoelectric effect, Compton scattering etc.) and their applications.

CO5 Gain basic knowledge on the properties, production and applications of *X*-rays.

CO6 Understand the fundamentals of atomic structure and related theory & experiments.

CO7 Attain basic knowledge on different types of LASERs and their applications.

CO8 Develop an ability to conduct experiments, as well as to analyse and interpret data related to the Electromagnetism, Optics, Modern and Laser Physics.

Course Contents:

Unit- I

Wave Optics

Interference: Fresnel's biprism, Interference in thin films, Newton's rings and Michelson's interferometer experiments. Diffraction at single slit, double slit and n-slit. Diffraction grating. Rayleigh criterion, resolving power of a telescope, grating and prism. Concept of polarized light, Brewster's laws, Double refraction, Nicol prism, quarter & half wave plate. Idea about circularly & elliptically polarized light.

Unit- II

Nuclear Physics

Nuclear Structure & Nuclear properties, Quantitative treatment of nuclear models: liquid drop and shell models, Linear Particle accelerator, Cyclotron, Synchrotron, Synchrocyclotron, and Betatron, Nuclear cross section, chain reaction, critical size. Application of E = mc2 ,Q-Value, Nuclear fusion & fission, Nuclear reactors, Geiger- Muller Counter, Bainbridge and Auston mass Spectrograph.

Unit -III

Semiconductors & Nano-Physics

Free Electron model of solids, Qualitative Analysis of Kronig Penny model ,Effective mass, Fermi level for Intrinsic and Extrinsic Semiconductors: p-n junctions, Zener break down, photodiode, solar-cells, Hall effect. Elementary idea about Nano structures and Nano materials.

UNIT-IV

Laser and Fiber Optics

Laser: Stimulated and spontaneous emission, Einstein's A & B Coefficients, transition probabilities, active medium, population inversion, pumping, Optical resonators, characteristics of laser beam. Coherence, directionality and divergence. Principles and working of Ruby, Nd:YAG, He-Ne & Carbon dioxide Lasers with energy level diagram.. Fundamental idea about optical fiber, types of fibers, acceptance angle & cone, numerical aperture, V-number, propagation of light through step index fiber (Ray theory) pulse dispersion, attenuation, losses & various uses. Engineering uses & applications of laser and Optical Fiber

Unit- V

Quantum Physics

Origin of Quantum hypothesis, DeBroglie's hypothesis of matter wave & its experimental verification. Group and particle velocities & their relations. Uncertainty principle with elementary proof & its application to Electron microscope, Compton effect. Wave function and its physical significance, general idea and application of time dependent and time independent Schrodinger wave equation.

List of suggestive core experiments: -

1. Biprism, Newton's Rings, Michelsons Interferometer.
2. Resolving Powers –Telescope, Microscope, and Grating.
3. G.M. Counter
4. Spectrometers-R.I., Wavelength, using prism and grating
5. Optical polarization based experiments: Brewster's angle, polarimeter etc.
6. Measurements by LASER-Directionality, Numerical aperture, Distance etc.
7. Uses of Potentiometers and Bridges (Electrical)..
8. Experiments connected with diodes and transistor.
9. Measurement of energy band gap of semiconductor.
10. Other conceptual experiments related to theory syllabus.

Reference Books: -

1. Engineering Physics- V. S. Yadava, TMH
2. A T.B. of Optics by Brijlal and Subhraininyan.
3. Optics By Ghatak, TMH
4. Engineering physics by M.N. Avadhanulu and P.G. Kshirsagar. S. Chand & Co.
5. Fundamentals of engineering physics by P. Swarup, Laxmi Publications.
6. Atomic and Nuclear physics by Brijlal and Subraminiyan.

R.K.D.F. UNIVERSITY, BHOPAL

B.E. (Common For All Branches)

New Scheme Based On AICTE Flexible Curricula

Semester – II

Course Content

Branch	Subject Title	Subject Code
B.E. Common	**Engineering Mathematics-II**	**B.E.- 2021**

Course Outcomes:

CO1 Gain the knowledge to develops the concepts of surface Z=f(x,y) , its partial derivatives, Euler Theorem & modified Euler Theorem for homogenous function & deduction develops ability to solve problems related to partial derivatives.

CO2 Learn to expand any functions of two variables in the ascending power of variables and also develops error and approximation, extremum value of a given function related to engineering application.

CO3 Develops the ability to solve higher order & first degree linear non homogenous differential equation arising in various branch of engineering and related mathematical model develops arising to form mathematical modeling of Real World Problem with its physical interpretation.

CO4 Solve some differential equation which is not solvable in ordinary case but its series solution gives an idea of developing special function which has important role in some physical phenomena arising in engineering problems.

CO5 Develop the concepts of Laplace transformation & inverse Laplace Transform with its property to solve partial Differential equation and Ordinary Differential Equation with given boundary conditions which is helpful in all engineering & research work.

Course Contents:

Module 1: Ordinary Differential Equations I : Differential Equations of First Order and First Degree (Leibnitz linear, Bernoulli's, Exact), Differential Equations of First Order and Higher Degree, Higher order differential equations with constants coefficients, Homogeneous Linear Differential equations, Simultaneous Differential Equations.

Module 2: Ordinary differential Equations II: Second order linear differential equations with variable coefficients, Method of variation of parameters, Power series solutions; Legendre polynomials, Bessel functions of the first kind and their properties.

Module 3: Partial Differential Equations: Formulation of Partial Differential equations, Linear and Non-Linear Partial Differential Equations, Homogeneous Linear Partial Differential Equations with Constants Coefficients.

Module 4: Vector Calculus: Differentiation of Vectors, Scalar and vector point function, Gradient, Geometrical meaning of gradient, Directional Derivative, Divergence and Curl, Line Integral, Surface Integral and Volume Integral, Gauss Divergence, Stokes and Green theorems.

Module 5: Functions of Complex Variable: Functions of Complex Variables: Analytic Functions, Harmonic Conjugate, Cauchy-Riemann Equations (without proof), Line Integral, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (without proof), Singular Points, Poles & Residues, Residue Theorem, Application of Residues theorem for Evaluation of Real Integral (Unit Circle).

Textbooks/References:

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
3. W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, 9th Edn., Wiley India, 2009.
4. S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984.
5. E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India, 1995.
6. E. L. Ince, Ordinary Differential Equations, Dover Publications, 1958.
7. J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7th Ed., McGraw Hill, 2004.
8. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
9. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.

R.K.D.F. UNIVERSITY, BHOPAL

B.E. (Common For All Branches)

New Scheme Based On AICTE Flexible Curricula

Semester – II

Course Content

Branch	Subject Title	Subject Code
B.E. Common	**Basic Mechanical Engineering**	**B.E.- 2031**

Course Outcomes:

CO1 Gain knowledge about different conventional and non-conventional energy sources

CO2 Differentiate between different types of fuels and their calorific values and able to calculate the minimum mass (or volume) of air required for complete combustion of fuels

CO3 Gain knowledge about various types of boilers, the mountings and accessories and able to calculate the boiler efficiency and to design the chimney dimensions

CO4 Perform thermodynamic analysis of Otto, Diesel and Dual cycle models

CO5 Differentiate between the types and working of internal combustion engines: 2-stroke/4-stroke engines & SI and CI engines

CO6 Acquire the knowledge of the operation, construction and design of various components of thermal, hydro- and nuclear power plants

CO7 Operate the machine tools like lathe, shaper and drilling machine

CO8 Possess the knowledge about the principles of operation of various refrigeration and air conditioning systems for domestic as well as industrial purpose.

Course Contents:

UNIT I

Materials:

Classification of engineering material and their mechanical properties and their applications, composition of cast iron and carbon steels on iron-carbon diagram. stress-strain diagram, Hooks law and modulus of elasticity. Tensile, shear, hardness and fatigue testing of materials.

UNIT II

I. C. engines:

Internal combustion engines as automobile power plant – Working principle of Petrol and Diesel Engines – Four stroke and two stroke cycles – Comparison of four stroke and two stroke engines .

UNIT III

Refrigeration & air conditioning:

Terminology of Refrigeration and Air Conditioning. Principle of vapour compression and absorption system – Layout of typical domestic refrigerator – Window and Split type room Air conditioner, COP.

Power plant engineering:

Introduction, Classification of Power Plants – Working principle of steam, Gas, Diesel, Hydro-electric and Nuclear Power plants – Merits and Demerits.

UNIT IV

Fluids:
Fluid properties, pressure, density and viscosity; pressure variation with depth, static and kinetic energy; Bernauli's equation for incompressible fluids, viscous and turbulent flow,

Thermodynamics:
First and second law of thermodynamics; steam properties, steam processes at constant pressure, volume, enthalpy & entropy, classification and working of boilers, efficiency & performance analysis, natural and induced draught, calculation of chimney height.

UNIT V

Measurement:
Temperature, pressure, velocity, flow, strain, force and torque measurement, concept of measurement error & uncertainly analysis, measurement by Vernier caliper, micrometer, dial gauges, slip gauges, sine-bar and combination set.

Reference Books:
1- Kothandaraman & Rudramoorthy, Fluid Mechanics & Machinery, New Age.
2- Nakra & Chaudhary , Instrumentation and Measurements, TMH.
3- Nag P.K, Engineering Thermodynamics, TMH.
4- Ganesan, Internal Combustion Engines, TMH.
5- Agrawal C M, Basic Mechanical Engineering,Wiley Publication.
6- Achuthan M , Engineering Thermodynamics, PHI.

R.K.D.F. UNIVERSITY, BHOPAL

B.E. (Common For All Branches)

New Scheme Based On AICTE Flexible Curricula

Semester – II

Course Content

Branch	Subject Title	Subject Code
B.E. Common	**Basic Civil Engineering & Engineering Mechanics**	**B.E.- 2041**

Course Outcomes:

CO1 A clear appreciation and understanding of the scope of environmental engineering and the types of problems and issues that are involved

CO2 An understanding of the interdisciplinary nature of problems associated with environmental engineering and the environment, and the broad range of skills and expertise that are required

CO3 The global climate system and human interactions of major biogeochemical cycles sufficiently to critically evaluate forecasts for global change

CO4 To describe and apply the fundamentals of air and water pollution to solve basic environmental engineering problems

CO5 The objectives of water and wastewater treatment and to the most important regulations for sustainable development.

CO6 Solve for the resultants & moments of any force systems and determine equivalent force systems

CO7 Determine the internal forces in plane trusses and beams

CO8 Solve the mechanics problems associated with friction forces

CO9 Obtain the centroid, first moment and second moment of an area

CO10 Describe the motion of a particle in terms of its position, velocity and acceleration in different frames of reference and analyze the forces causing the motion of a particle

CO11 Apply work, energy, impulse and momentum relationships for a particle in motion

CO12 Understand free & forced vibration, single degree of freedom, concept of earthquake induced waves and its affect.

Course Contents:

Unit I

Building Materials & Construction

Stones, bricks, cement, lime, timber-types, properties, test & uses, laboratory tests concrete and mortar Materials: Workability, Strength properties of Concrete, Nominal proportion of Concrete preparation of concrete, compaction, curing, Low cost housing building materials.

Elements of Building Construction, Foundations conventional spread footings, RCC footings, brick masonry walls, plastering and pointing, floors, roofs, Doors, windows, lintels, staircases – types and their suitability

Unit – II

Surveying & Positioning:

Introduction to surveying Instruments – levels, thedolites, plane tables and related devices. Electronic surveying instruments etc. Measurement of distances – conventional and EDM methods, measurement of directions by different methods, measurement of elevations by Different methods and different methods of leveling.

Unit –III

Mapping & Sensing:
Mapping details and contouring, Profile Cross sectioning and measurement of areas, volumes, application of measurements in quantity computations, Survey stations, Introduction of remote sensing, GIS and GPS and its applications.

Engineering Mechanics

Unit – IV

Forces and Equilibrium: Graphical and Analytical Treatment of Concurrent and nonconcurring Co- planner forces, free Diagram, Force Diagram and Bow's notations, Application of Equilibrium Concepts: Analysis of plane Trusses: Method of joints, Method of Sections. Frictional force in equilibrium problems

Unit – V

Centre of Gravity and moment of Inertia: Centroid and Centre of Gravity, Moment Inertia of Area and Mass, Radius of Gyration, Introduction to product of Inertia and Principle Axes.
Support Reactions, Shear force and bending moment Diagram for Cantilever & simply supported beam with concentrated, distributed load and Couple.

Reference Books:

1. S. Ramamrutam & R.Narayanan; Basic Civil Engineering, Dhanpat Rai Pub.
2. Prasad I.B., Applied Mechanics, Khanna Publication.
3. Punmia, B.C., Surveying, Standard book depot.
4. Shesha Prakash and Mogaveer; Elements of Civil Engg & Engg. Mechanics; PHI
5. S.P,Timoshenko, Mechanics of stricture, East West press Pvt.Ltd.
6. Surveying by Duggal – Tata McGraw Hill New Delhi.
7. Introduction to GIS by Chang
8. Surveying and Leveling by N.M. Basak, McGraw Hill

List of suggestive core Experiments:
Students are expected to perform minimum ten experiments from the list suggested below by preferably selecting experiments from each unit of syllabus.

S. No.	Title
1.	To perform traverse surveying with prismatic compass, check for local attraction and determine corrected bearings and to balance the traverse by Bowditch's rule.
2.	To perform leveling exercise by height of instrument of Rise and fall method.
3.	To measure horizontal and vertical angles in the field by using Theodolite.
4.	To determine (a) normal consistency (b) Initial and Final Setting time of a cement Sample.
5.	To determine the workability of fresh concrete of given proportions by slump test or compaction factor test.
6.	To determine the Compressive Strength of brick.
7.	To determine particle size distribution and fineness modulus of course and fine Aggregate.
8.	To verify the law of Triangle of forces and Lami's theorem.
9.	To verify the law of parallelogram of forces.
10.	To verify law of polygon of forces

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B.E. (Common For All Branches)

New Scheme Based On AICTE Flexible Curricula

Semester – II

Course Content

Branch	Subject Title	Subject Code
B.E. Common	**Programming for Problem Solving**	**B.E.- 2051**

Course Outcomes:

CO1 Demonstrate a basic understanding of computer hardware and software

CO2 Develop proficiency in writing small to medium sized programs in a procedural programming language.

CO3 Apply problem-solving skills and knowledge of computing fundamentals to a wide variety of engineering, science and technology problems

CO4 Expose, diagnose, and fix errors in a program, using systematic testing and debugging techniques

CO5 Have developed interest in the field of computers to be able to adjust to the demands of current trends and technology

Course Contents:

UNIT 1

INTRODUCTION OF COMPUTERS: Computer System, System Characteristics and capabilities, Types of Computers: Analog, Digital (Micro, Mini, Mainframe & Super Computers), Generation of Computers.

COMPUTER ORGANISATION: Block Diagram of Computer and its functional units.

UNIT 2

INPUT DEVICES: KeyBoard, Scanner, Mouse, Light Pen, Bar Code Reader, OMR, OCR, MICR., Track ball, Joystick, Touch Screen etc.

OUTPUT DEVICES: Monitors – Classification of Monitors based on Technology (CRT Monitor & Flat panel LCD Monitor), Printers – Dot Matrix Printer, Ink Jet Printer, Laser Printer and Plotters, Types of Plotters – Drum Plotter and Flat Bed Plotters, LCD Projectors.

STORAGE DEVICES: Magnetic tapes, Floppy Disks, Hard Disks, Compact Disc – CD-ROM, CD-RW, VCD, DVD, DVD-RW.

PROGRAMMING LANGUAGES: History, Classifications – Low Level, Assembly & High Level languages, Advantages & Disadvantages Programming Languages.

UNIT 3

INTRODUCTION TO PROGRAMMING: Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudocode 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.

UNIT 4

Arithmetic expressions and precedence, Conditional Branching and Loops, Writing and evaluation of conditionals and consequent branching, Iteration and loops.

PROGRAM PLANNING: Purpose of Program Planning, Steps in Program Development, Characteristics of a Good Program, Algorithms, Flow Charts through examples.

UNIT 5

TYPES OF SOFTWARE: System Software – Translators (Compilers, Interpreters, Assemblers), Operating System, Linkers, Libraries & Utilities, Application Software – Packaged & Tailored Softwares.

OPERATING SYSTEMS: Introduction, Types of O.S. – Single User, Multi User – Multi Programming, Multi Tasking, Real Time, Time Sharing, Batch Processing, Parallel Processing, Distributed Processing.

TEXT BOOK:

1. COMPUTER FUNDAMENTALS BY *P.K. SINHA*
2. OPERATING SYSTEM BY *Peterson*
3. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
4. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill

Reference Books:

1. EASY APPROACH TO COMPUTER COURSE BY *G.K. IYER*
2. COMPUTER TODAY BY *S.K. BASANDRA*
3. OPERATING SYSTEM BY *Godbole*
4. 'O' LEVEL PROGRAMMING CONCEPTS & SYSTEMS BY *V.K. JAIN*
5. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India

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B.E. (Common For All Branches)

New Scheme Based On AICTE Flexible Curricula

Semester – II

Course Content

Branch	Subject Title	Subject Code
B.E. Common	**Language Laboratory**	**B.E.- 2061**

Course Outcomes:

CO1 The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

Communicative Language Laboratory: Course objective: The language laboratory focuses on the practice of English through audio-visual aids and Computer software. It intends to enable the students to speak English correctly with confidence and intends to help them to overcome their inhibitions and self –consciousness while speaking in English.

Topics to be covered in the Language laboratory sessions:

1. Listening Comprehension
2. Pronunciation, Intonation, Rhythm
3. Practicing everyday dialogues in English
4. Interviews
5. Formal Presentation
6. Public Speaking and oral skills with emphasis on conversational practice, extempore speech, JAM (Just a minute sessions), describing objects and situations, giving directions, debate, telephonic etiquette.

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 Pushp Lata. Oxford University Press. 2011.
(vi) Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press

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

[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.

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 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.

[2] 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 facilties.

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/discipline[4].

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 meta-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

[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.

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.

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.

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18 June 2017