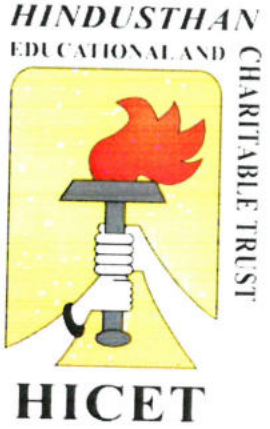
HINDUSTHAN COLLEGE OF ENGINEERING AND TECHNOLOGY

(An Autonomous Institution Affiliated to Anna University, Chennai)

(Approved by AICTE, New Delhi, Accredited by NAAC with 'A' Grade)

Coimbatore - 641 032.

B.E. BIOMEDICAL ENGINEERING



Curriculum & Syllabus

2018-2019

CHOICE BASED CREDIT SYSTEM

VISION AND MISSION OF THE INSTITUTION

VISION

To become a premier institution by producing professionals with strong technical knowledge, innovative research skills and high ethical values.

MISSION

IM1: To provide academic excellence in technical education through novelteaching methods.

IM2: To empower students with creative skills and leadership qualities.

IM3: To produce dedicated professionals with social responsibility.

VISION AND MISSION OF THE DEPARTMENT

VISION

To evolve into a center of excellence in biomedical engineering by nurturing and training interested minds in this diverse technology, thereby striving towards ensuring quality healthcare to the society.

MISSION

M1: To establish the best learning environment that helps the students to face the challenges of Biomedical Engineering field

M2: To inspire the students to drive the next generation innovation to come up with quality solutions to current healthcare needs.

Chairman BoS
BME - HiCET

ACADEMIC COUNCIL ★ HINDUSTHAN COLLEGE OF ENGG & TECH ★
Chairman

Dean (Academics)
HiCET

PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

PO 1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO 2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO 3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO 4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO 5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO 6. **The engineer and society**: Apply reasoning informed by the contextualknowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professionalengineering practice.

PO 7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmentalcontexts, and demonstrate the knowledge of, and need for sustainable development.

PO 8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO 9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports anddesign documentation, make effective presentations, and give and receive clear instructions.

PO11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Chairman BoS
BME - HiCET

Chairman

Dean (Academics)
HiCET

PROGRAM SPECIFIC OUTCOMES (PSOs)

Biomedical Engineering Graduates will have ability to:

PSO1: Design and develop biomedical devices to meet the needs of people by applying the Fundamentals of Biomedical Engineering.

PSO2. Understand and implement various software skills for accurate diagnostic and Therapeutic applications.

PSO3. Innovate new ideas and solutions for the healthcare field by integrating various Biomedical Technology.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1. To create a strong foundation in engineering and biology for solving the existing Challenges in the healthcare sector.

PEO2. To acquire knowledge in the cutting edge technologies of Biomedical Engineering field and an ability to identify, analyze and solve problems in the field.

PEO3. To instill ethical values, communicative skills, teamwork and leadership skills necessary to function productively and professionally.

Chairman BoS
BME - HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean (Academics)
HiCET

CURRICULUM

HICET

Hindusthan College of Engineering and Technology

(An Autonomous Institution, Affiliated to Anna University, Chennai
Approved by AICTE, New Delhi& Accredited by NAAC with 'A' Grade)
Coimbatore, Tamil Nadu.

TÜVRheinland CERTIFIED

DETAILS OF CHANGES CARRIED OUT IN CURRICULUM & SYLLABUS
CBCS PATTERN
UNDERGRADUATE PROGRAMMES
B.E. BIOMEDICAL ENGINEERING (UG)

REGULATION-2016

For the students admitted during the academic year 2018-2019 and onwards

SEMESTER I

S. No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
THEORY									
1	16HE1101R	Essential English for Engineers-I	3	1	0	4	25	75	100
2	16MA1101	Engineering Mathematics-I	3	1	0	4	25	75	100
3	16PH1101	Engineering Physics	3	0	0	3	25	75	100
4	16CY1101	Engineering Chemistry	3	0	0	3	25	75	100
5	16GE1103	Problem Solving & Python Programming	3	0	0	3	25	75	100
6	16GE1102	Engineering Graphics	2	0	4	4	25	75	100
PRACTICAL									
7	16PS1001	Physical Science Lab-I	0	0	2	1	50	50	100
8	16GE1004	Problem Solving & Python Programming Lab	0	0	4	2	50	50	100
9	16GE1002	Engineering Practices Laboratory	0	0	4	2	50	50	100
10	16GE1003	Value Added Course I: Language Competency Enhancement Course- I	0	0	0	1	0	100	100
		Total Credits	**17**	**2**	**14**	**27**	**300**	**700**	**1000**

SEMESTER II

S. No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
THEORY									
1	16HE2102R	Essential English for Engineers-II	3	1	0	4	25	75	100
2	16MA2102	Engineering Mathematics-II	3	1	0	4	25	75	100
3	16PH2102	Physics of Materials	3	0	0	3	25	75	100
4	16CY2102	Environmental Sciences	3	0	0	3	25	75	100
5	16BM2201	Electron Devices and Circuits	3	0	0	3	25	75	100
6	16BM2202	Circuits and Networks	3	1	0	4	25	75	100
PRACTICAL									
7	16PS2001	Physical Sciences Lab-II	0	0	2	1	50	50	100
8	16BM2001	Electron Devices and Circuits Lab	0	0	4	2	50	50	100
9	16GE2001	Value Added Course II: Language Competency Enhancement Course- II	0	0	0	1	0	100	100
		Total Credits	**18**	**3**	**6**	**25**	**250**	**650**	**900**

Credit Distribution

Semester	I	II	III	IV	V	VI	VII	VIII	Total
Credits	27	25	24	23	23	25	22	18	**187**

Chairman, Board of Studies

Dean – Academics

Principal

Chairman BoS
BME - HiCET

Dean (Academics)
HiCET

PRINCIPAL
Hindusthan College of Engineering & Technology
COIMBATORE - 641 032

HINDUSTHAN ACADEMIC COUNCIL
Chairman
HINDUSTHAN COLLEGE OF ENGG & TECH

SYLLABUS

SEMESTER I

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16HE1101R	ESSENTIAL ENGLISH FOR ENGINEERS–I	3	1	0	4

Course Objective

1. It fulfills the necessary skills needed in today's global workplaces.
2. Student will be able to interpret and illustrate formal communication.
3. It empowers students in choosing right lexical techniques for effective presentation
4. It equips the learner to analyze and list out things in logical order
5. The learner develops the ability to create and integrate ideas in a professional way.

Unit	Description	Instructional Hours
I	Getting to know people – Introduction – Talking about jobs (Present Simple) – Talking about working conditions(Adverb of Frequency) - Talking about company history and structure (Past simple, Prepositions of Time) – Talking about company activities (Connectors of addition and contrast, Present Continuous) – Focus on language – Parts of Speech – Gerund and Infinitives – Instruction-**General Vocabulary**.	12
II	Vocabulary practice – (Telephoning Leaving and taking messages) – requests and obligation – Describing trends (Adjectives and Adverbs) – Talking about company performance (present perfect and past simple, Reasons and consequences) – Reading Test Practice Describing products Dimensions, (Comparatives and Superlatives, Question formation) – Talking about product development (Sequencing words, Present continuous and going to) – Articles – Prepositions- Synonyms – Antonyms- Recommendations-**Interpretation of a chart**.	12
III	Talking about business equipment (Giving Instruction) – Letter Phrases- Writing Test Practice- Talking about facilities(Asking for and giving direction)- Presentation on a general topic -Talking about traffic and transport (making predictions)-**Discussion on current affairs**– Tenses- Present –Past-Future-Forms of verbs- Word techniques- Formation-Prefixes-Suffixes.	12
IV	Talking about conference arrangement(checking and confirming) – Talking about a conference before, after, when, until etc. – Listening Test Practice- talking about production process – passive- Talking about quality control Conditional 1 (real) (Making suggestions) – Itinery- Jumbled sentences- Paragraph writing- Essay writing – Checklist- Letter to Inviting Dignitaries – Accepting invitation- Declining Invitation.	12
V	Talking about call centers, insurance and changes in working practices (future possibility/probability)- Talking about banking- Speaking Test practice – Talking about delivery services (preposition of Time)- Talking about trading (Tense review)- Talking about recruitment conditional 2 (hypothetical) – talking about job applications (indirect questions) – Reading, Writing and Listening Test – Job application Letter and Resume Writing- Permission letters.	12
	Total Instructional Hours	**60**

Course Outcome

CO1 - Recognize different parts of speech for better usage.
CO2 - Interpret and illustrate formal communication
CO3 - Choosing right lexical techniques for effective presentation.
CO4 - Analyze and list out things in logical order.
CO5 - Create and integrate ideas in a professional way.

TEXT BOOKS:

T1 - Norman Whitby, Cambridge English: Business BENCHMARK Pre-intermediate to Intermediate – 2nd Edition. 2014.
T2 - Ian Wood and Anne Willams. "Pass Cambridge BEC Preliminary", Cengage Learning press 2013.

REFERENCE BOOKS :

R1 - Meenakshi Raman and Sangeetha Sharma. "Technical Communication-Principles and Practice", Oxford University Press, 2009.
R2 - Rizvi, Ashraf. M. Effective Technical Communication. Tata McGraw-Hill, New Delhi, 2005.
R3 - Kamalesh Sadanan "A Foundation Course for the Speakers of Tamil-Part-I &II", Orient Blackswan, 2010.

Chairman BoS
BME - HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG. & TECH. * Chairman

Dean (Academics)
HiCET

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16MA1101	ENGINEERING MATHEMATICS – I (MATRICES AND CALCULUS) (COMMON TO ALL BRANCHES)	3	1	0	4

Course Objective

1. Develop the skill to use matrix algebra techniques that is needed by engineers for practical applications.
2. Find curvature, evolutes and envelopes using the concept of differentiation.
3. Solve ordinary differential equations of certain types using Wronskian technique.
4. Familiarize the functions of several variables which are needed in many branches of engineering.
5. Understand the concept of double and triple integrals.

Unit	Description	Instructional Hours
I	**MATRICES** Eigen values and Eigen vectors of a realmatrix– Properties of Eigen values and Eigen vectors (without proof)– Cayley - Hamilton Theorem (excluding proof)– Orthogonal matrices–Diagonalization of matrices by orthogonal transformation–Reduction of a quadratic form to canonical form by orthogonal transformation.	12
II	**DIFFERENTIAL CALCULUS** Curvature in cartesian co-ordinates – Radius and Centre of curvature - Circle of curvature – Involutes and Evolutes (parabola, ellipse, cycloid, asteroid) – Envelopes - single parameter and two parameter family of curves.	12
III	**ORDINARYDIFFERENTIALEQUATIONS** Second and higher order linear differential equations with constant coefficients and with RHS of the form e^{ax} , x^n, sinax or cosax , $e^{ax}f(x)$ and $xf(x)$ where $f(x)$ is sinbx or cosbx– Method of variation of parameters – Linear differential equations with variable coefficients (Euler's equation)	12
IV	**FUNCTIONS OF SEVERAL VARIABLES** Total differentiation (excluding implicit functions) - Partial derivatives of composite functions - Taylor's series for functions of two variables- Maxima and minima of functions of two variables - Lagrange's method of undetermined multipliers – Jacobians.	12
V	**MULTIPLEINTEGRALS** DoubleintegralsinCartesiancoordinates–Changeoforderofintegration–Area enclosed by the plane curves (excluding surface area)– Triple integrals in Cartesian co-ordinates – Volume of solids using Cartesian co-ordinates.	12
	Total Instructional Hours	**60**

Course Outcome

CO1: Calculate Eigen values and Eigen vectors for a matrix which are used to determine the natural frequencies (or Eigen frequencies) of vibration and the shapes of these vibrational modes

CO2: Apply the concept of differentiation to find the radius, centre and circle of curvature of any curve

CO3: Develop sound knowledge of techniques in solving ordinary differential equations that mode engineering problems

CO4: Identify the maximum and minimum values of surfaces.

CO5: Computation of area of a region in simpler way by changing the order of integration and evaluation of triple integrals to compute volume of three dimensional solid structures

TEXT BOOKS:

T1- Ravish R Singh, Mukul Bhatt, "Engineeing Mathematics", McGraw Hill education (India) Private Ltd.,Chennai,2017.
T2- Veerarajan T, "Engineering Mathematics–I", McGraw Hill Education(India) Pvt Ltd, New Delhi, 2016

REFERENCE BOOKS :

R1-BaliN.P &ManishGoyal,"ATextbookofEngineeringMathematics",8th Edition, Laxmi Pub. Pvt. Ltd. 2011.
R2- Grewal B.S, "Higher Engineering Mathematics", 42nd Edition, Khanna Publications, Delhi, 2012.
R3- Peter V. O'Neil, "Advanced Engineering Mathematics", 7th Edition, Cengage learning,2012.
R4-Sivarama Krishna Das P and Rukmangadachari E., "Engineering Mathematics" Vol I, Second Edition, Pearson publishing, 2011.
R5- Wylie & Barett, "Advanced Engineering Mathematics", McGraw Hill Education, 6th edition, 2003

Chairman BoS
BME - HiCET

HINDUSTHAN ACADEMIC COUNCIL Chairman HINDUSTHAN COLLEGE OF ENGG & TECH

Dean (Academics)
HiCET

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16PH1101	ENGINEERING PHYSICS	3	0	0	3

Course Objective

1. Illustrate the fundamental knowledge in mechanical properties of matter and thermal physics.
2. Gain knowledge about laser and their applications.
3. Conversant with principles of optical fiber, types and applications of optical fiber.
4. Discuss the architectural acoustics and applications of Ultrasonics.
5. Extend dual nature of matter and the Necessity of quantum mechanics to explore the behavior of sub atomic particles.

Unit	Description	Instructional Hours
I	**PROPERTIES OF MATTER AND THERMAL PHYSICS** Elasticity – Hooke's law – Stress-strain diagram - Relation between three modulii of elasticity (qualitative) — Poisson's ratio – Bending moment – Depression of a cantilever – Derivation of Young's modulus of the material of the beam by Uniform bending – I-shaped girder. Modes of heat transfer – Thermal conductivity – Newton's law of cooling - Lee's disc method - Conduction through compound media (series and parallel).	9
II	**LASER AND APPLICATIONS** Spontaneous emission and stimulated emission – Population inversion – Pumping methods – Derivation of Einstein's coefficients (A&B) – Types of lasers – Nd:YAG laser, CO2 laser, Semiconductor lasers:(homojunction and heterojunction) – Laser Applications – Industrial applications: laser welding, laser cutting, laser drilling – Holography – Construction and reconstruction of images.	9
III	**FIBER OPTICS AND APPLICATIONS** Principle and propagation of light through optical fibers – Derivation of numerical aperture and acceptance angle – Classification of optical fibers (based on refractive index, modes and materials) – Crucible-crucible technique for fiber fabrication – Sources (LED and LASER) and detectors (p-i-n photodiode and avalanche photodiode) for fiber optics - Fiber optical communication link –Fiber optic sensors – Temperature and displacement sensors.	9
IV	**ACOUSTICS AND ULTRASONICS** Classification of sound – Weber–Fechner law – Sabine's formula (no derivation) - Absorption coefficient and its determination –Factors affecting acoustics of buildings and their remedies. Ultrasonic Production – Magnetostrictive generator – Piezoelectric generator – Determination of velocity using acoustic grating – Non destructive testing – Ultrasonic pulseecho system.	9
V	**QUANTUM PHYSICS AND APPLICATIONS** Black body radiation – Planck's theory (derivation) –Compton effect experimental verification only - Matter waves – Physical significance of wave function – Schroedinger's wave equations – Time independent and time dependent wave equations –Particle in a box (One dimensional) – Scanning electron microscope – Transmission electron microscope.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Enhance the fundamental knowledge in Properties of Matter and Thermal Physics.
CO2: Uunderstand the advanced technology of LASER in the field of Engineering and medicine.
CO3: Exposed the fundamental knowledge of Optical fiber in the field of communication Engineering.
CO4: Understand the production of ultrasonics and its applications in NDT.
CO5: Impart the fundamental knowledge on Quantum Physics.

TEXT BOOKS:

T1 - Rajendran V, Applied Physics, Tata McGraw Hill Publishing Company Limited, New Delhi, 2011.
T2- Gaur R.K. and Gupta S.L., Engineering Physics, 8th edition, Dhanpat Rai Publications (P) Ltd., New Delhi, 2013.

REFERENCE BOOKS:

R1 - Arthur Beiser "Concepts of Modern Physics" Tata McGraw Hill, New Delhi – 2010
R2 - M.N Avadhanulu and PG Kshirsagar "A Text Book of Engineering physics" S. Chand and Company ltd., New Delhi 2014
R3 - Dr. G. Senthilkumar "Engineering Physics – I" VRB publishers Pvt Ltd., 2013

Chairman BoS
BME - HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean (Academics)
HiCET

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CY1101	ENGINEERING CHEMISTRY	3	0	0	3

Course Objective

1. The student should be conversant with boiler feed water requirements, related problems and water treatment techniques.
2. The student should be conversant with the principles of polymer chemistry and engineering applications of polymers and composites
3. The student should be conversant with the principles and generation of energy in batteries, nuclear reactors, solar cells, wind mills and fuel cells.
4. To acquaint the student with important concepts of spectroscopy and its applications.
5. To acquaint the students with the basics of nano materials, their properties and applications.

Unit	Description	Instructional Hours
I	**WATER TECHNOLOGY** Hard water and soft water- Disadvantages of hard water- Hardness: types of hardness, calculations, estimation of hardness of water – EDTA method - scales and sludges – boiler corrosion – priming and foaming – caustic embrittlement; Conditioning methods of hard water – External conditioning - demineralization process- Internal conditioning - domestic water treatment: screening, sedimentation, coagulation, filtration, disinfection – chlorine – UV method; desalination: definition, reverse osmosis.	9
II	**POLYMER & COMPOSITES** Polymerization – types of polymerization – addition and condensation polymerization – mechanism of free radical addition polymerization – copolymers – plastics: classification – thermoplastics and thermosetting plastics, preparation, properties and uses of commercial plastics – PVC, Teflon – moulding of plastics (extrusion and compression); rubber: vulcanization of rubber, synthetic rubber – butyl rubber, SBR; composites: definition, types of composites – polymer matrix composites – FRP.	9
III	**ENERGY SOURCES AND STORAGE DEVICES** Introduction- nuclear energy- nuclear fission- controlled nuclear fission- nuclear fusion differences between nuclear fission and fusion- nuclear chain reactions- nuclear reactor power generator- classification of nuclear reactor- light water reactor- breeder reactor- solar energy conversion- solar cells- wind energy. Batteries and fuel cells: Types of batteries- alkaline battery lead storage battery- nickel-cadmium battery- lithium battery- fuel cell H_2 -O_2 fuel cell applications.	9
IV	**ANALYTICAL TECHNIQUES** Beer-Lambert's law – UV-visible spectroscopy and IR spectroscopy – principles– instrumentation (block diagram only) – estimation of iron by colorimetry – flame photometry – principle – instrumentation (block diagram only) – estimation of sodium by flame photometry – atomic absorption spectroscopy – principles – instrumentation (block diagram only) – interferences - estimation of nickel by atomic absorption spectroscopy.	9
V	**NANOMATERIALS** Basics - distinction between molecules, nanoparticles and bulk materials; size-dependent properties. Nanoparticles: definition, carbon nanotubes (CNT), types of carbon nano tubes – single walled and multi walled carbon nanotubes – synthesis of carbon nanotubes: chemical vapour deposition – laser ablation – arc-discharge method; properties of CNT: mechanical, electrical, thermal and optical properties; applications of carbon nanotubes in chemical field, medicinal field, mechanical field and current applications.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Illustration of the basic parameters of water, different water softening processes and effect of hard water in industries.
CO2: Knowledge on basic properties and application of various polymers and composites as an engineering material.
CO3. Summarize the various energy sources and energy storage devices
CO4. Analyze various analytical skills in handling various machines, instruments, apart from understanding the mechanism involved.
CO5. Describe the basic properties and application of nanomaterials.

TEXT BOOKS

T1 - P.C.Jain and Monica Jain, "Engineering Chemistry" Dhanpat Rai Pub, Co., New Delhi (2015).
T2 - O.G.Palanna, "Engineering chemistry" McGraw Hill Education India (2017).

REFERENCES

R1 - B.Sivasankar "Engineering Chemistry" Tata McGraw-Hill Pub.Co.Ltd, New Delhi (2008).
R2 - B.K.Sharma "Engineering Chemistry" Krishna Prakasan Media (P) Ltd., Meerut (2005).
R3 - S.S.Dara "A Text book of Engineering Chemistry" S.Chand & Co.Ltd., New Delhi (2010).

Chairman BoS
BME - HiCET

ACADEMIC COUNCIL Chairman HINDUSTHAN COLLEGE OF ENGINEERING

Dean (Academics)
HiCET

Programme	Course Code	Name of the course	L	T	P	C
B.E.	16GE1103	PROBLEM SOLVING AND PYTHON PROGRAMMING	3	0	0	3

Course Objective

1. To know the basics of algorithmic problem solving
2. To read and write simple Python programs.
3. To develop Python programs with conditionals and loops.
4. To define Python functions and call them.
5. To use Python data structures – lists, tuples, dictionaries.
6. To do input/output with files in Python.

Unit	Description	Instructional Hours
I	**ALGORITHMIC PROBLEM SOLVING** Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudocode, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems:To find the greatest among three numbers, prime numbers,find minimum in a list, Towers of Hanoi.	9
II	**DATA, EXPRESSIONS, STATEMENTS** Python interpreter and interactive mode; values and types: int, float, boolean, string, and list;variables, expressions, statements, tuple assignment, precedence of operators, comments; modules and functions, function definition and use, flow of execution, parameters and arguments; Illustrative programs: exchange the values of two variables, compute Simple interest for a given amount, Factorial of a given number ,distance between two points.	9
III	**CONTROL FLOW, FUNCTIONS** Conditionals: Boolean values and operators, conditional (if), alternative (if -else), chained conditional (if –elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values,parameters, local and global scope, function composition, recursion; Strings: string slices,immutability, string functions and methods, string module; Lists as arrays. Illustrative programs:square root, gcd, exponentiation, sum an array of numbers, linear search,binary search.	9
IV	**LISTS, TUPLES, DICTIONARIES** Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing -list comprehension; Illustrative programs: selection sort, insertion sort,histogram.	9
V	**FILES, MODULES, PACKAGES** Files and exception: text files, reading and writing files, format operator; command line arguments,errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count,copy file.	9
	Total Instructional Hours	**45**

Course Outcome

Upon completion of the course, students will be able to

CO1:Develop algorithmic solutions to simple computational problems
CO2:Structure simple Python programs for solving problems.
CO3:Decompose a Python program into functions.
CO4:Represent compound data using Python lists, tuples, dictionaries.
CO5:Read and write data from/to files in Python Programs.

TEXT BOOKS:

T1 –Ashok Namdev Kamthane ,Amit Ashok Kamthane ," Programming and Problem solving with Python" McGrawHill Education

T2-Sheetal Taneja, "Python Programming A Modular Approach With Graphics,Database,Mobile and Web Applications, PEARSON.

REFERENCE BOOKS:

R1 - Reema Thareja " Python Programming Using Problem Solvimg Approach " OXFORD.

R2-E.Balagurusamy, "Problem solving and Python Programming" McGrawHill Education.

Chairman BoS
BME - HiCET

HINDUSTHAN COLLEGE OF ENGG & TECH ACADEMIC COUNCIL Chairman

Dean (Academics)
HiCET

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16GE1102	ENGINEERING GRAPHICS	2	0	4	4

Course Objective

1. To provide drafting skills for communicating the Engineering concepts and ideas.
2. To expose to BIS and International standards related to engineering drawings.

Unit	Description	Total Hours
I	**PLANE CURVES** Importance of engineering drawing, drafting instruments, drawing sheets – layout and folding, Lettering and dimensioning, BIS standards and scales. Geometrical constructions, Construction of ellipse, parabola and Hyperbola by eccentricity method, construction of cycloids and involutes of square and circle – Drawing of tangents and normal to the above curves.	15
II	**PROJECTIONS OF POINTS, LINES AND PLANE SURFACES** Introduction to Orthographic projections- Projection of points. Projection of straight lines inclined to both the planes, Determination of true lengths and true inclinations by rotating line method. Projection of planes (polygonal and circular surfaces) inclined to both the planes by rotating object method (First angle projections only).	15
III	**PROJECTIONS OF SOLIDS** Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is perpendicular and inclined to one plane and objects inclined to both the planes by rotating object method.	15
IV	**SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES** Sectioning of simple solids with their axis in vertical position when the cutting plane is inclined to one of the PRINCIPAL /DEAN ACADEMICS planes and perpendicular to the other – Obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids, cylinder and cone. Development of lateral surfaces of truncated solids. Intersection of solids-cylinder vs cylinder.	15
V	**ISOMETRIC AND ORTHOGRAPHIC PROJECTIONS** Isometric views and projections of simple and truncated solids such as - Prisms, pyramids, cylinders, cones-combination of two solid objects in simple vertical positions. Free hand sketching of multiple views from a pictorial drawing. Perspective projection of solids in simple position using visual ray method.	15
	Total Instructional Hours	**75**

Course Outcome

CO1: Draw the orthographic and isometric views of regular solid objects including sectional views.
CO2:Recognize the International Standards in Engineering Drawing practices.

TEXT BOOKS:

T1 - K.Venugopal, V.Prabu Raja, "Engineering Drawing, AutoCAD, Building Drawings", 5th Edition New Age International Publishers, New delhi 2016.
T2 - K.V.Natarajan, "A textbook of Engineering Graphics", Dhanalaksmi Publishers, Chennai.

REFERENCE BOOKS:

R1 - BasantAgrawal and C.M.Agrawal, "Engineering Drawing", Tata McGraw Hill Publishing Company Limited,New Delhi 2008.
R2 - K. R. Gopalakrishnan, "Engineering Drawing" (Vol. I & II), Subhas Publications, Bangalore, 1998.
R3 - M.B.Shah and B.C.Rana, "Engineering Drawing", Pearson Education, India, 2005.
R4 - N.S. Parthasarathy, Vela Murali, "Engineering Drawing", Oxford University press, India 2015.

Chairman - BoS
BME - HiCET

ACADEMIC COUNCIL * SINGHAL * SATHYABAMA COLLEGE OF ENGG & TECH * Chairman

Dean (Academics)
HiCET

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16PS1001	PHYSICAL SCIENCE LAB – I	0	0	2	1

PHYSICS LAB - I

Course Objective

1. Evaluate the particle size of micro particles and acceptance angle of fibres.
2. Employ instrumental method to determine Young's modulus of a beam of metals.
3. Apply the concept of diffraction and getting ability to calculate the wavelength of the mercury spectrum

Expt. No.	Description of the Experiments
1.	Determination of Wavelength, and particle size using Laser.
2.	Determination of acceptance angle and numerical aperature in an optical fiber.
3.	Determination of velocity of sound and compressibility of liquid – Ultrasonic Interferometer.
4.	Determination of wavelength of mercury spectrum – spectrometer grating.
5.	Determination of thermal conductivity of a bad conductor – Lee's Disc method.
6.	Determination of Young's modulus by Non uniform bending method.
7.	Determination of specific resistance of a given coil of wire – Carey Foster's Bridge.
8.	Post office box Measurement of an unknown resistance.

TOTAL PRACTICAL HOURS 30

Course Outcome

CO1: Point out the particle size of micro particles and acceptance angle of fibres using diode laser.
CO2: Assess the Young's modulus of a beam using non uniform bending methods.
CO3: Illustrate the concept of diffraction and getting ability to calculate the wavelength of the mercury spectrum using spectrometer.
CO4: Identify the velocity of ultrasonic's in the given liquid.
CO5: Illustrate phenomena of thermal conductivity of a bad conductor.

CHEMISTRY LAB-I

Course Objective

1. Acquire practical skills in the determination of water quality parameters.
2. Acquaint the students with the determination of molecular weight of a polymer by viscometry.
3. Acquaint the students with the estimation of chemical substances using instrumental analysis techniques.

Expt. No.	Description of the Experiments
1.	Preparation of molar and normal solutions and their standardization.
2.	Estimation of total, permanent and temporary hardness of Water by EDTA
3.	Determination of chloride content of water sample by argentometric method.
4.	Determination of available chlorine in bleaching powder.
5.	Conductometric titration of strong acid vs strong base (HCl vs NaOH).
6.	Conductometric titration (Mixture of weak and strong acids)
7.	Conductometric precipitation titration using $BaCl_2$ and Na_2SO_4
8.	Determination of molecular weight and degree of polymerization using viscometry.
9.	Estimation of iron content of the water sample using spectrophotometer.(1,10 phenanthroline / thiocyanate method).

Total Practical Hours 30

Course Outcome

CO1: Estimate the different types of hardness in a water sample.
CO2: Determine the chloride content of water sample.
CO3: Calculate the strength of acid using conductometric titrations.
CO4: Calculate the strength of strong and weak acid using conductometric titrations.
CO5: estimate the amount of salt using conductometric precipitation titrations.

Chairman BoS
BME - HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean (Academics)
HiCET

Programme	Course code	Name of the course	L	T	P	C
B.E.	16GE1004	PROBLEM SOLVING AND PYTHON PROGRAMMING LAB	0	0	4	2

Course Objective

1. To write, test, and debug simple Python programs.
2. To implement Python programs with conditionals and loops.
3. Use functions for structuring Python programs.
4. Represent compound data using Python lists, tuples, dictionaries.
5. Read and write data from/to files in Python.

Ex.No.	Description	Total instructional hours
1	Compute the GCD of two numbers.	3
2	Find the square root of a number	3
3	Exponentiation (power of a number)	3
4	Find the factorial of a given number	3
5	Print prime numbers from 1 to n numbers	3
6	Find the maximum of a list of numbers	3
7	Linear search , Binary search	3
8	Selection sort, Insertion sort	3
9	First n prime numbers	3
10	Multiply matrices	3
11	Programs that take command line arguments(word count)	3
12	Find the most frequent words in a text read from a file	3
13	Simulate bouncing ball using Pygame	3
	TOTAL INSTRCTIONAL HOURS	**45**

Course Outcome

CO1: Write, test, and debug simple Python programs.
CO2: Implement Python programs with conditionals and loops.
CO3: Develop Python programs step-wise by defining functions and calling them.
CO4: Use Python lists, tuples, dictionaries for representing compound data.
CO5: Read and write data from/to files in Python.

PLATFORM NEEDED: Python 3 interpreter for Windows/Linux

Chairman BoS
BME - HiCET

Chairman

Dean (Academics)
HiCET

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16GE1002	ENGINEERING PRACTICES LABORATORY	0	0	4	2

Course Objective To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.

GROUP A (CIVIL & MECHANICAL)

Expt. No. **Description of the Experiments**

I CIVIL ENGINEERING PRACTICE

Study of plumbing and carpentry components of Residential and Industrial buildings.

(A) PLUMBING WORKS:

1. Study on pipe joints, its location and functions: Valves, taps, couplings, unions, reducers, elbows in household fittings.
2. Study of pipe connection requirements for pumps.
3. Preparation of plumbing line sketches for water supply and sewage works.
4. Hands-on-exercise:
   - Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.
5. Demonstration of plumbing requirements of high-rise buildings.

(B) CARPENTRY USING POWER TOOLS ONLY:

1. Study of the joints in roofs, doors, windows and furniture.
2. Hands-on-exercise in wood works by sawing, planning and cutting.

IIMECHANICAL ENGINEERING

(A) Welding:

1. Preparation of arc welding of Butt joints, Lap joints and Tee joints

(B) Machining:

1. Practice on Simple step turning and taper turning
2. Practice on Drilling Practice

(C) Sheet Metal Work:

1. Practice on Models– Trays, cone and cylinder.

DEMONSTRATION

(D) Smithy

- Smithy operations: Upsetting, swaging, setting down and bending.
- Demonstration of – Production of hexagonal headed bolt.

(E) Gas welding

(F) Foundry Tools and operations.

GROUP B (ELECTRICAL & ELECTRONICS)

S.No.	Description of the Experiments
	ELECTRICAL ENGINEERING PRACTICES
1	Residential house wiring using switches, fuse, indicator, lamp and energy meter.
2	Fluorescent lamp wiring
3	Stair case wiring.
4	Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit.
5	Measurement of energy using single phase energy meter.
	ELECTRONICS ENGINEERING PRACTICES
1	Study of Electronic components and equipments – Resistors - colour coding
2	Measurement of DC signal - AC signal parameters (peak-peak, RMS period, frequency) using CRO.
3	Study of logic gates AND, OR, NOT and NAND .
4	Soldering practice – Components Devices and Circuits – Using general purpose PCB.
5	Measurement of average and RMS value of Half wave and Full Wave rectifiers.
	Total Practical Hours **45**

Course Outcome

CO1: Fabricate wooden components and pipe connections including plumbing works.
CO2: Fabricate simple weld joints.
CO3: Fabricate electrical and electronics circuits.

Chairman BoS
BME - HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean (Academics)
HiCET

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16GE1003	LANGUAGE COMPETENCY ENHANCEMENT COURSE- I	0	0	2	1

Course Objective

1. To enhance student language competency
2. To train the students in LSRW skills
3. To develop student communication skills
4. To empower the trainee in business writing skills.
5. To train the students to react to different professional situations

Unit	Description	Instructional Hours
I	**Listening** Listening to technical group discussions and participating in GDs.listening to TED talks. Listen to Interviews & mock interview. Listening short texts and memos.	3
II	**Reading** Reading articles from newspaper, magazine. Reading comprehension. Reading about technical inventions, research and development. Reading short texts and memos.	3
III	**Writing** E-mail writing: Create and send email writing (to enquire about some details, to convey important message to all, to place an order, to share your joy and sad moment). Reply for an email writing.	3
IV	**Speaking** To present a seminar in a specific topic (what is important while choosing or deciding something to do). To respond or answer for general questions (answer for your personal details, about your family, education, your hobbies, your aim etc.,).	3
V	**Speaking** Participate in discussion or interactions (agree or disagree express your statement with a valid reason, involve in discussion to express your perspective on a particular topics).	3
	Total Instructional Hours	**15**

Course Outcome

CO1- Trained to maintain coherence and communicate effectively.
CO2- Practiced to create and interpret descriptive communication.
CO3- Introduced to gain information of the professional world.
CO4- acquired various types of communication and etiquette.
CO5- Taught to improve interpersonal and intrapersonal skills.

TEXT BOOKS:

T1- Norman Whitby, "Business Benchmark-Pre-intermediate to Intermediate", Cambridge University Press, 2016.

T2- Raymond Murphy, "Essential English Grammar", Cambridge University Press, 2019.

REFERENCE BOOKS :

R1- Meenakshi Raman and Sangeetha Sharma. "Technical Communication- Principles and Practice", Oxford University Press, 2009.

Chairman BoS
BME - HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG. & TECH * Chairman

Dean (Academics)
HiCET

SEMESTER II

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16HE2102R	ESSENTIAL ENGLISH FOR ENGINEERS – II	3	1	0	4

Course Objective

1. The learner will be introduced to global corporate culture and professional communication.
2. It helps the students to focus on organizing professional event and documentation.
3. The student will be able to describe the events and process in an effective way.
4. It trains the student to analyze the problems and to find solution to it.
5. The learner will be familiar with business communication.

Unit	Description	Instructional Hours
I	Introduction- talking about teamwork- Making arrangements- Improving Communication in spoken language – Taking and leaving Voice mail messages (present Tense, Past Tense and Present Perfect) Talking about Business Hotel- (Speaking Activity) Talking about Corporate Hospitality- Formal and Informal Language – Making accepting and declining invitations (Auxiliary Verb, Countable or Uncountable Nouns) – Focus on Language – Definitions and Extended Definitions-**Reading comprehension.**	12
II	Talking about orders – Clarity Written Language – Phone and Letter Phrases – Talking about Company Finances – Conditional 1 and 2 – Managing Cash Flow (Intention and Arrangements Conditional 1 and 2) – Talking about Brands and Marketing – Ethical Banking- Talking about Public Relations – Organizing a PR Event – Describing Duties and Responsibilities – (Future Tense and Articles) – Reported Speech – Modal Verbs and Passive, Impersonal Passive Voice-**interpretation of posters or advertisements.**	12
III	Talking about relocation – Report Phrases – Talking about Similarity and difference- Giving Directions- Asking for Information and Making Suggestions – Talking about Location (Comparatives and Superlatives, Participles) – Talking about Company Performances- Describing Trends – Describing Cause and Effect – Talking about Environmental Impact – Discussing Green Issues – Language of Presentations (Adjectives and Adverbs, Determiners)- Homophones – Homonyms- Acronyms-Abbreviations- British and American words.	12
IV	Talking about Health and Safety – Expressing Obligation- Discussing Regulations- Talking about personnel Problems – Passives – Talking about Problem at Work (modal Verbs, Passives)- Talking about Expenses Claims- Talking about Air Travel (Relative Pronoun, Indirect Questions) – **E-mail Writing - Note completion-** Transcoding.	12
V	Talking about staff Benefits- Talking about Appraisal Systems (gerunds and Infinitives, Reported Speech) – Talking about Marketing Disasters – Expressing hypothetical Situations- Talking about entering Foreign Market (Conditional 3, Grammar review) – Letter for calling quotations, Replying for quotations – Placing an order and Complaint and **reply to a complaint**.	12
	Total Instructional Hours	**60**

Course Outcome

CO1: Introduced corporate culture and professional communication.
CO2: It focused on organizing a professional event and its documentation.
CO3: Improved the ability to describe the events and process in an effective way
CO4: Trained to analyze the problems and to find solution to it.
CO5: Practiced to make business communication.

TEXT BOOKS:

T1 - Norman Whitby, Cambridge English: Business BENCHMARK Pre-intermediate to Intermediate – 2nd Edition. 2014.
T2 - Ian Wood and Anne Willams. "Pass Cambridge BEC Preliminary", Cengage Learning press 2013.

REFERENCE BOOKS :

R1 - Communication Skills for Engineers, Sunitha Misra & C.Murali Krishna, Pearson Publishers
R2 - Technical Communication, Daniel G. Riordan, Cengage learning publishers.
R3 - Kamalesh Sadanan "A Foundation Course for the Speakers of Tamil-Part-I &II", Orient Blackswan,2010.

Chairman BoS
BME - HiCET

Chairman
ACADEMIC COUNCIL
HINDUSTHAN COLLEGE OF ENGINEERING

Dean (Academics)
HiCET

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16PH2102	PHYSICS OF MATERIALS	3	0	0	3

Course Objective

1. Gain knowledge about conducting materials.
2. Provide fundamental knowledge of semiconducting materials which is related to the engineering program.
3. Extend the properties of magnetic materials, applications and super conducting materials.
4. Defend the various types of dielectric materials and their uses.
5. Expose the students to smart materials and the basis of nano technology.

Unit	Description	Instructional Hours
I	**CONDUCTINGMATERIALS** Introduction – Conductors – Classical free electron theory of metals – Electrical and thermal conductivities – Wiedemann–Franz law – Lorentz number – Draw backs of classical theory – Quantum theory – Fermi distribution function – Effect of temperature on Fermi function – Density of energy states – Carrier concentration in metals.	9
II	**SEMICONDUCTING MATERIALS** Introduction – Intrinsic semiconductor – Compound and elemental semiconductor (direct and indirect band gap of semiconductors). carrier concentration derivation – Fermi level – Variation of Fermi level with temperature – electrical conductivity – band gap determination – Extrinsic semiconductor - derivation of carrier concentration in n-type and p-type semiconductor – variation of Fermi level with temperature and impurity concentration — Hall effect –Determination of Hall coefficient – Applications.	9
III	**MAGNETIC & SUPERCONDUCTING MATERIALS** **Magnetic Materials**: Origin of magnetic moment – Bohr magneton – comparison of Dia, Para and Ferro magnetism – Domain theory – Hysteresis – soft and hard magnetic materials – anti ferromagnetic materials – Ferrites and its applications. **Superconducting Materials :** Superconductivity : properties(Messiner effect, effect of magnetic field, effect of current and isotope effects) – Type I and Type II superconductors – BCS theory of superconductivity(Qualitative) - High Tc superconductors – Applications of superconductors – SQUID, cryotron, magnetic levitation.	9
IV	**DIELECTRIC & COMPOSITES MATERIALS** Introduction – Electrical susceptibility – dielectric constant – polarization - electronic, ionic, orientation and space charge polarization –internal field – Claussius – Mosotti relation (derivation) – dielectric loss and dielectric breakdown (qualitative) Introduction to composites materials – types of composites materials – polymer, metallic and ceramic matrix composites (qualitative). Application in surgery, sports equipment.	9
V	**SMART MATERIALS AND NANOTECHNOLOGY** **New Engineering Materials:** Metallic glasses – preparation, properties and applications – shape memory alloys (SMA) – characteristics, properties of NiTi alloy applications. **Nano Materials**: Synthesis - plasma arcing – Chemical vapour deposition – properties of nanoparicles and applications. – Carbon nano tubes – fabrication – pulsed laser deposition - Chemical vapour deposition - properties & applications.	9
	Total Instructional Hours	**45**

Course Outcome

CO1:Illustrate the electrical / thermal conductivity of conducting materials.
CO2:Understand the purpose of the acceptor or donor levels and the band gap of a semiconductor.
CO3:Interpret the basic idea behind the process of magnetism and applications of magnetic materials in every day life
CO4:Identify and compare the various types of dielectric polarization and dielectric breakdown.
CO5:Evaluate the properties and applications of various advanced engineering materials and develop the new ideas to synthesis Nanomaterials.

TEXT BOOKS:

T1 - S.O.Pillai "Solid State Physics" New Age International Publishers, New Delhi – 2011.
T2- Rajendran V "Materials Science" McGraw-Hill Education" New Delhi -2016.

REFERENCE BOOKS:

R1 – William D Callister, Jr "Material Science and Engineering" John wiley and Sons, New York, 2014.
R2 - Raghavan, V. "Materials Science and Engineering – A First Course" Prentice Hall of India, New Delhi 2016.
R3 -Dr. G. Senthilkumar "Engineering Physics – II" VRB publishers Pvt Ltd., 2013.

Chairman BoS
BME - HiCET

HINDUSTHAN ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean (Academics)
HiCET

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16MA2102	ENGINEERING MATHEMATICS–II	3	1	0	4

Course Objective

1. Learn the basics of vector calculus comprising gradient, divergence, Curl and line, surface, volume integrals.
2. Understand analytic functions of complex variables and conformal mappings.
3. Know the basics of residues, complex integration and contour integration.
4. Apply Laplace transform techniques to solve linear differential equations.
5. Know the effective mathematical tools for the solutions of partial differential equations that model several physical problems in mathematical physics

Unit	Description	Instructional Hours
I	**VECTORCALCULUS** Gradient, divergence and curl–Directional derivative–Irrotational and solenoidal vector fields– Vector integration –Green's theorem in a plane, Gauss divergence theorem and Stokes' theorem (excluding proofs)– Simple applications involving cubes and rectangular parallelopipeds.	12
II	**ANALYTIC FUNCTIONS** Analytic function -Cauchy-Riemann equations -sufficient conditions (excluding proof) – Harmonic - conjugate harmonic functions– Construction of analytic functions (Milne-Thompson method)–Conformal mapping : w= z+c,cz,1/z and bilinear transformation without problems related to the concept of conformal mapping.	12
III	**COMPLEX INTEGRATION** Complex integration–Statements of Cauchy's integral theorem – Taylor's and Laurent's series expansions - Singular points–Residues–Cauchy's residue theorem – Evaluation of real definite integrals as contour integrals around unit circle.	12
IV	**LAPLACETRANSFORM** Laplace transform–Basic properties –Transforms of derivatives and integrals offunctions-Transformsofunitstepfunctionandimpulsefunction–Transformofperiodic functions. Inverse Laplace transform-Convolution theorem (with out proof) – Solution of linear ODE of second order with constant coefficients using Laplace transformation techniques.	12
V	**PARTIAL DIFFERENTIAL EQUATIONS** Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions- Solution of standard types of first order partial differential equations of the form f(p,q) = 0, Clairaut's type: z = px + qy + f(p, q) – Lagrange's linear equation- Linear homogeneous partial differential equations of second and higher order with constant coefficient.	12
	Total Instructional Hours	**60**

Course Outcome

CO1: Know the gradient, divergence and curl of vectors useful for engineering application like fluid flow, electricity and magnetism.
CO2: Test the analyticity to construct the analytic function and transform complex functions from one plane to another plane graphically.
CO3: Evaluate real and complex integrals over suitable closed paths or contours.
CO4: Know the applications of Laplace transform and its properties and to solve certain linear differential equations using Laplace transform technique.
CO5: Solve the engineering problems using Partial Differential Equations.

TEXT BOOKS:

T1- Ravish R Singh, Mukul Bhatt, "Engineering Mathematics", McGraw Hill education (India) Private Ltd.,Chennai,2017.
T2- Veerarajan T, "Engineering Mathematics–II", McGraw Hill Education(India) Pvt Ltd, New Delhi, 2016.

REFERENCE BOOKS :

R1-BaliN.P &ManishGoyal,"ATextbookofEngineeringMathematics",8th Edition, Laxmi Pub. Pvt. Ltd. 2011.
R2- Grewal B.S, "Higher Engineering Mathematics", 42nd Edition, Khanna Publications, Delhi, 2012.
R3- Peter V. O'Neil, "Advanced Engineering Mathematics", 7th Edition, Cengage learning,2012.
R4-Sivarama Krishna Das P and Rukmangadachari E., "Engineering Mathematics" Vol II, Second Edition, Pearson publishing, 2011.
R5- Wylie & Barett, "Advanced Engineering Mathematics", McGraw Hill Education, 6th edition, 2003.

Chairman BoS
BME - HiCET

HINDUSTHAN ACADEMIC COUNCIL Chairman HINDUSTHAN COLLEGE OF ENGG & TECH

Dean (Academics)
HiCET

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16CY2102	ENVIRONMENTAL SCIENCES	3	0	0	3

Course Objective

1. To gain knowledge on the importance of environmental education, ecosystem and biodiversity.
2. To acquire knowledge about environmental pollution – sources, effects and control measures of environmental pollution.
3. To find and implement scientific, technological, economic and political solutions to environmental problems.
4. To study about the natural resources, exploitation and its conservation
5. To be aware of the national and international concern for environment and its protection.

Unit	Description	Instructional Hours
I	**ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY** Importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers- energy flow in the ecosystem – ecological succession processes – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.	9
II	**ENVIRONMENTAL POLLUTION** Definition – causes, effects and control measures of: Air pollution – Air pollution standards – control methods- Water pollution – Water quality parameters- Soil pollution - Marine pollution - Noise pollution- Thermal pollution - Nuclear hazards–role of an individual in prevention of pollution – pollution case studies.	9
III	**NATURAL RESOURCES** Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and overutilization of surface and ground water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and Desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles.	9
IV	**SOCIAL ISSUES AND THE ENVIRONMENT** From unsustainable to sustainable development – urban problems related to energy- energy conversion – electrical energy calculations- environmental ethics: Issues and possible solutions – 12 Principles of green chemistry- Current Environmental issues at Country level – management of municipal sewage, municipal solid waste, Hazardous waste and Bio-medical waste – Global issues –Climatic change, Acid rain, greenhouse effect and Ozone layer depletion. Disaster management: floods, earthquake, cyclone and landslides.	9
V	**HUMAN POPULATION AND THE ENVIRONMENT** Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare –Environmental impact analysis (EIA)- GIS-remote sensing-role of information technology in environment and human health – Case studies.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Understand the natural environment and its relationships with human activities.
CO2: Characterize and analyze human impacts on the environment
CO3: Apply systems concepts and methodologies to analyze and understand interactions between social and environmental processes
CO4: Reflect critically about their roles and identities as citizens, consumers and environmental actors in a complex, interconnected world.
CO5: Understand and implement scientific research strategies, including collection, management, evaluation, and interpretation of environmental data.

TEXT BOOKS:

T1- Anubha Kaushik and C. P. Kaushik, "Environmental Science and Engineering", Fourth edition, New Age International Publishers, New Delhi, 2014.
T2 – Deeksha Dave and S.S.Katewa, "Textbook of Environmental Studies", Second Edition, Cengage Learning, 2012.

REFERENCES:

R1 - Trivedi R.K. "Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards", Vol. I and II, Enviro Media.
R2 - G.Tyler Miller, Jr and Scott E. Spoolman"Environmental Science" Thirteenth Edition, Cengage Learning, 2010.
R3 - Gilbert M. Masters, "Introduction to Environmental Engineering and Science", 2nd edition, Pearson Education, 2004

Chairman BoS
BME - HiCET

Chairman

Dean (Ac- -nics)
HiCE-T

Programme	Course code	Name of the course	L	T	P	C
B.E.	16BM2201	ELECTRON DEVICES AND CIRCUITS	3	0	0	3

Course Objective

1. To be familiar with the theory, construction, and operation of Semiconductor diodes.
2. To impart knowledge on the configurations and operation of transistors.
3. To give an insight of the operation of amplifiers.
4. To be familiar with the concept of multistage amplifiers and differential amplifiers.
5. To impart knowledge on feedback amplifiers and oscillators.

Unit	Description	Instructional Hours
I	**PN JUNCTION** PN junction diode –structure, operation and V-I characteristics, diffusion and transient capacitance – Rectifiers – Half Wave and Full Wave Rectifier,– Display devices- LED, Laser diodes- Zener diode-characteristics-Zener Reverse characteristics – Zener as regulator	9
II	**TRANSISTORS** BJT, JFET, MOSFET- structure, operation, characteristics and Biasing UJT, Thyristor and IGBT – Structure and characteristics	9
III	**AMPLIFIERS** BJT small signal model – Analysis of CE amplifiers- Gain and frequency response – MOSFET small signal model– Analysis of CS and Source follower – Gain and frequency response- High frequency Model	9
IV	**DIFFERENTIAL AMPLIFIER AND POWER AMPLIFIER** BIMOS cascade amplifier, Differential amplifier – Common mode and Difference mode analysis – FET input stages – Single tuned amplifiers – Gain and frequency response – Neutralization methods, power amplifiers –Types (Qualitative analysis).	9
V	**FEEDBACK AMPLIFIERS AND OSCILLATORS** Advantages of negative feedback – voltage / current, series , Shunt feedback –positive feedback – Condition for oscillations, phase shift – Wien bridge, Hartley, Colpitts and Crystal oscillators	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Ability to explain the theory, construction, and operation of PN junction diodes.
CO2: Ability to demonstrate the theory, construction, and operation of transistors.
CO3: To understand the working of amplifiers.
CO4: To understand the working multistage amplifiers and differential amplifiers.
CO5: To differentiate different types of feedback amplifiers and oscillators.

TEXT BOOKS:

1. David A. Bell ,"Electronic Devices and Circuits", Prentice Hall of India, 2004.
2. Sedra and smith, "Microelectronic Circuits " Oxford University Press, 2004.

REFERENCES:

1. Rashid, "Micro Electronic Circuits" Thomson publications, 1999.
2. Floyd, "Electron Devices" Pearson Asia 5th Edition, 2001.
3. Donald A Neamen, "Electronic Circuit Analysis and Design" Tata McGraw Hill, 3rd Edition, 2003.
4. Robert L.Boylestad, "Electronic Devices and Circuit theory", 2002.
5. Robert B. Northrop, "Analysis and Application of Analog Electronic Circuits to Biomedical Instrumentation", CRC Press, 2004.

Chairman BoS
BME - HiCET

HINDUSTHAN ACADEMIC COUNCIL * Chairman * HINDUSTHAN COLLEGE OF ENGG & TECH

Dean (Academics)
HiCET

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16BM2202	CIRCUITS AND NETWORKS	3	1	0	4

Course Objective

1. To introduce the concept of electric circuits and its analysis.
2. To impart knowledge on solving circuits using network theorems
3. To introduce the phenomenon of resonance in coupled circuits.
4. To educate on concepts of obtaining the transient response of circuits.
5. To give an insight of the basic concepts of Graph theory.

Unit	Description	Instructional Hours
I	**BASIC CIRCUITS ANALYSIS** Ohm's Law - Kirchoff's laws - DC and AC Circuits - Form Factor-Peak factor- Series and Parallel circuits – Voltage and Current division techniques– Phasor Diagram – Power and Power Factor- Mesh current and Node voltage method-Source transformation-Dependent and Independent sources .	12
II	**NETWORK REDUCTION AND NETWORK THEOREMS FOR DC AND AC CIRCUITS** Star delta conversion. -Thevenin's and Norton's Theorem – Superposition Theorem – Maximum power transfer theorem –Reciprocity Theorem-Compensation Theorem-Duality.	12
III	**RESONANCE AND COUPLED CIRCUITS** Series and Parallel resonance – Frequency response – Quality factor and Bandwidth - Self and Mutual inductance – Coefficient of coupling – Dot rule for coupled circuits - Tuned circuits – Single tuned and double tuned circuits.	12
IV	**CIRCUIT TRANSIENTS AND TWO PORT NETWORK** Transient response of RL, RC and RLC Circuits using Laplace transform for DC and sinusoidal inputs-Time constants - Free and forced responses-Two port networks-Z, Y parameters .	12
V	**GRAPH THEORY** Network terminology : Incidence Matrix,Graph of a network -Incidence and reduced incidence matrices – Trees –Cutsets -Fundamental cutsets -Cutset matrix –Tie sets -Link currents and Tie set schedules -Twig voltages and Cutset schedules, Duality and dual networks.	12
	Total Instructional Hours	**60**

Course Outcome

CO1: To analyze AC and DC Circuits
CO2: To apply network theorems for AC and DC Circuits .
CO3: To design resonance and single tuned circuits.
CO4: To analyze two port networks
CO5: To understand the basic concepts of Graph theory.

TEXT BOOKS:

T1 - Sudhakar A and Shyam Mohan SP, "Circuits and Network Analysis and Synthesis",Tata McGraw Hill, (2007).
T2- William H. Hayt Jr, Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuits Analysis", Tata McGraw Hill publishers, 6th edition, New Delhi, 2003.

REFERENCE BOOKS :

R1 - Nagoor Kani,"Electric circuits",RBA publications,First Edition.
R2 - Paranjothi SR, "Electric Circuits Analysis," New Age International Ltd., New Delhi, (1996).
R3 - Joseph A. Edminister, Mahmood Nahri, "Electric circuits", Schaum's series,TMHI, NewDelhi, 2001.
R4 - Chakrabati A, "Circuits Theory (Analysis and synthesis), Dhanpath Rai & Sons, New Delhi, (1999).
R5 - Charles K. Alexander, Mathew N.O. Sadiku, "Fundamentals of Electric Circuits", II Edition, TMH (2003).

Chairman BoS
BME - HiCET

ACADEMIC COUNCIL Chairman HINDUSTHAN COLLEGE OF ENGG & TECH

Dean (Academics)
HiCET

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16PS2001	PHYSICAL SCIENCES LAB – II	0	0	2	1

PHYSICS LAB-II

Course Objective

1. Evaluate the band gap of a semiconductor.
2. Apply the concept of interference and calculate the thickness of thin wire.
3. Acquire the practical skills in Young's modulus by uniform bending method.

Expt. No.	Description of the Experiments
1.	Determination of Young's modulus by uniform bending method
2.	Determination of band gap of a semiconductor
3.	Determination of Coefficient of viscosity of a liquid –Poiseuille's method
4.	Determination of Dispersive power of a prism – Spectrometer
5.	Determination of thickness of a thin wire – Air wedge method
6.	Determination of Rigidity modulus – Torsion pendulum
7.	Magnetic hysteresis experiment
8.	Calibration of ammeter using potentiometer

TOTAL PRACTICAL HOURS **30**

Course Outcome

CO1: Experiment involving the physical phenomena of the Rigidity modulus of wire.
CO2: Determine the band gap of a semiconductor and variation of Energy Gap (E_g) with temperature.
CO3: Assess the Young's modulus of a beam using non uniform bending method.
CO4: Explain the concept of interference and calculate the thickness of thin wire and other fine objects.
CO5: Experiment provides a unique opportunity to validate Dispersive power of a prism using Spectrometer.

CHEMISTRY LAB – II

Course Objective

1. Acquire practical skills in the quantitative analysis of water quality parameters.
2. Acquire practical skills in the instrumental methods for quantitative estimation of metal ion content.
3. Gain knowledge in determination of rate of corrosion.

Expt. No.	Description of the Experiments
1.	Determination of Dissolved Oxygen in water by Winkler's method.
2.	Estimation of alkalinity of water sample by indicator method.
3.	Estimation of hydrochloric acid by pH metry.
4.	Estimation of ferrous iron by Potentiometry.
5.	Estimation of Copper by EDTA
6.	Determination of sodium by flame photometry
7.	Determination of corrosion rate of mild steel by weight loss method.

Total Practical Hours **30**

Course Outcome

CO1: Determine the level of DO in a water sample.
CO2: Identify and estimate the different types of alkalinity in water sample.
CO3: Estimate the acidity of water sample using pH metry.
CO4: Estimate the amount of copper in a brass sample.
CO5: Determine the metal ion content using instrumental methods.

Chairman BoS
BME - HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean (Academics)
HiCET

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16BM2001	ELECTRON DEVICES AND CIRCUITS LAB	0	0	4	2

Course Objective

1. To learn the characteristics of PN junction diode.
2. To understand the characteristics of Zener diode.
3. To learn the characteristics of Transistors and frequency response of amplifiers.
4. To learn the basic laws and network reduction theorems.
5. To learn the working of oscillators.

S.No	Description of the Experiments
1	PN Junction Diode Characteristics
2	Zener Diode Characteristics
3	Common Emitter transistor, Input-Output Characteristics
4	JFET Characteristics
5	Frequency Response analysis of CE amplifier
6	RC Phase shift oscillator
7	Verification Of Thevenin's and Norton's Theorem
8	Verification of KVL & KCL
9	Verification of Super Position Theorem
10	Verification of Maximum Power Transfer

Total Instructional Hours **45**

Course Outcome

- To understand the characteristics of PN junction diode, Zener diode and transistors.
- To understand the concept of amplifiers and Oscillators.
- Apply the concept of basic laws and network reduction theorems.

Chairman BoS
BME - HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean (Academics)
HiCET

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16GE2001	LANGUAGE COMPETENCY ENHANCEMENT COURSE- II (COMMON TO ALL BRANCHES)	0	0	2	1

Course Objective

1. To introduce to business communication.
2. To train the students to react to different professional situations.
3. To make the learner familiar with the managerial skills
4. To empower the trainee in business writing skills.
5. To learn to interpret and expertise different content.

Unit	Description	Instructional Hours
I	**Listening and Speaking** – listening and discussing about programme and conference arrangement **Reading** –reading auto biographies of successful personalities **Writing** Formal & informal email writing, Recommendations **Grammar and Vocabulary-** Business vocabulary, Adjectives & adverbs.	3
II	**Listening and Speaking**- listening to TED talks **Reading-**Making and interpretation of posters **Writing-** Business letters: letters giving good and bad news, Thank you letter, Congratulating someone on a success" **Grammar and Vocabulary**- Active & passive voice, Spotting errors (Tenses, Preposition, Articles).	3
III	**Listening and Speaking-**travel arrangements and experience **Reading-** travel reviews **Writing-** Business letters (Placing an order, making clarification & complaint letters). **Grammar and Vocabulary**- Direct and Indirect speech.	3
IV	**Listening and Speaking-**Role play- **Reading-** Sequencing of sentence **Writing-** Business report writing (marketing, investigating) **Grammar and Vocabulary-** Connectors, Gerund & infinitive.	3
V	**Listening and Speaking-** Listen to Interviews & mock interview **Reading-** Reading short stories, reading profile of a company **- Writing-** Descriptive writing (describing one's own experience) **Grammar and Vocabulary**- Editing a passage(punctuation, spelling & number rules).	3
	Total Instructional Hours	**15**

Course Outcome

CO1- Introduced to different modes and types of business communication.
CO2- Practiced to face and react to various professional situations efficiently.
CO3- learnt to practice managerial skills.
CO4- Familiarized with proper guidance to business writing.
CO5- Trained to analyze and respond to different types of communication.

TEXT BOOKS:

T1 - Norman Whitby, "Business Benchmark-Pre-intermediate to Intermediate",Cambridge University Press, 2016.

T2- Ian Wood and Anne Willams. "Pass Cambridge BEC Preliminary", Cengage Learning press 2015.

REFERENCE BOOKS :

R1 - Michael Mc Carthy, "Grammar for Business", Cambridge University Press, 2009.

R2- Bill Mascull, "Business Vocabulary in use: Advanced 2nd Edition", Cambridge University Press, 2009.

R3-Frederick T. Wood, "Remedial English Grammar For Foreign Students", Macmillan publishers, 2001.

Chairman BoS
BME - HiCET

ACADEMIC COUNCIL HINDUSTHAN COLLEGE Chairman

Dean (Academics)
HiCET

Department Of Biomedical Engineering
Academic year 2018-2019
Regulation 2016

CO'S, PO'S & PSO'S MAPPING
Semester – I

Course Code & Name: 16HE1101 Essential English for Engineers-I

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	1	-	-	-	-	1	1	-	-	3	-	1	-	-	1
CO2	1	1	-	2	-	2	1	-	2	3	-	2	-	1	1
CO3	1	-	1	-	-	3	-	-	2	3	-	1	-	1	2
CO4	1	1	1	1	-	1	1	-	2	3	-	2	-	-	1
CO5	1		1	1	-	2	1	-	-	3	-	2	1	1	1
Avg	1	1	1	1	-	2	1	-	2	3	-	2	1	1	2

Course Code & Name: 16MA1101 Engineering Mathematics-I
(Matrices & Calculus)

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	3	3	2	2	-	-	-	-	-	-	2	2	2	1
CO2	3	3	3	2	2	-	-	-	-	-	-	2	2	2	1
CO3	3	3	3	2	2	-	-	-	-	-	-	2	2	2	1
CO4	3	3	3	2	2	-	-	-	-	-	-	2	2	2	2
CO5	3	3	3	2	2	-	-	-	-	-	-	2	2	2	1
Avg	3	3	3	2	2	-	-	-	-	-	-	2	2	2	1

Course Code & Name: 16PH1101 Engineering Physics

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	2	3	2	3	3	-	-	-	-	-	-	1	1	1
CO2	3	2	3	3	3	-	-	-	-	-	-	-	1	1	1
CO3	3	2	3	3	3	3	-	-	-	-	-	-	1	2	1
CO4	3	2	3	1	2	-	2	-	-	-	-	-	1	1	2
CO5	3	2	-	1	2	-		-	-	-	-	-	2	1	1
Avg	3	2	3	2	3	-	2	-	-	-	-	-	1	1	1

Course Code & Name: 16CY1101 Engineering Chemistry

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	2	2	-	2	1	1	-	-	-	-	1	1	1	1
CO2	3	2	2	-	2	1	-	-	-	-	-	1	1	-	1
CO3	3	2	2	-	2	1	1	-	-	-	-	1	1	-	1
CO4	3	2	2	2	2	1	-	-	-	-	-	1	1	1	2
CO5	3	2	2	-	2	1	-	-	-	-	-	1	1	1	1
Avg	3	2	2	2	2	1	-	-	-	-	-	1	1	1	1

Course Code & Name: 16GE1103 Problem Solving & Python Programming

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	3	3	-	2	-	-	-	-	-	-	2	2	2	1
CO2	2	3	3	-	2	-	-	-	2	-	-	2	2	2	1
CO3	2	3	3	-	2	-	-	-	2	-	-	2	2	2	1
CO4	2	3	3	-	2	-	-	-	2	-	-	2	2	2	2
CO5	2	3	3	-	2	-	-	-	2	-	-	2	2	2	1
Avg	2	3	3	-	2	-	-	-	2	-	-	2	2	2	1

Course Code & Name: 16GE1102 Engineering Graphics

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	3	3	2	2	-	-	-	-	-	-	2	1	1	1
CO2	3	3	3	2	2	-	-	-	-	-	-	3	2	2	2
CO3	3	3	3	2	2	-	-	-		-	-	3	3	3	1
CO4	3	3	3	2	2	-	-	-	-	-	-	3	1	1	1
CO5	3	3	3	2	2	-	-	-	-	-	-	3	2	2	2
Avg	3	3	3	2	2	-	-	-	-	-	-	3	2	2	1

Course Code & Name: 16PS1001 Physical Sciences Lab-I

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	2	3	2	3	3	-	-	-	-	-	-	1	1	-
CO2	3	2	3	3	3	-	-	-	-	-	-	-	1	1	-
CO3	3	2	3	3	3	3	-	-	-	-	-	-	1	2	-
CO4	3	2	3	1	2	-	2	-	-	-	-	-	1	1	-
CO5	3	2	-	1	2	-		-	-	-	-	-	2	1	-
Avg	3	2	3	2	3	-	2	-	-	-	-	-	1	1	-

Course Code & Name: 16GE1004 Problem Solving & Python Programming Lab

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	3	3	-	2	-	-	-	-	-	-	2	2	2	1
CO2	2	3	3	-	2	-	-	-	2	-	-	2	2	2	1
CO3	2	3	3	-	2	-	-	-	2	-	-	2	2	2	1
CO4	2	3	3	-	2	-	-	-	2	-	-	2	2	2	2
CO5	2	3	3	-	2	-	-	-	2	-	-	2	2	2	1
Avg	2	3	3	-	2	-	-	-	2	-	-	2	2	2	1

Course Code & Name: 16GE1002 Engineering Practices Lab

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	-	3	-	3	-	1	-	1	-	-	-	1	2	1
CO2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
CO3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
CO4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
CO5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Avg	3	-	3	-	3	-	-	-	1	-	-	-	1	2	1

SEMESTER II

Course Code & Name: 16HE2102 Essential English for Engineers-II

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	-	-	-	-	-	-	-	-	1	3	-	-	1	-	-
CO2	2	2	-	-	-	2	-	-	3	3	-	2	-	1	-
CO3	2	-	2	-	-	-	-	-	2	3	-	-	1	-	-
CO4	-	1	-	1	-	-	-	-	1	2	-	2	1	1	-
CO5	2	1	2	-	1	-	-	-	1	3	-	-	2	1	-
Avg	2	1	2	1	1	2	-	-	2	3	-	2	1	1	-

Course Code & Name: 16M A2102 Engineering Mathematics-II
(Vector Calculus, Complex Variables & Laplace Transforms)

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	3	3	2	2	-	-	-	-	-	-	2	1	2	1
CO2	3	3	3	2	2	-	-	-	-	-	-	2	1	2	2
CO3	3	3	3	2	2	-	-	-	-	-	-	2	1	2	1
CO4	3	3	3	2	2	-	-	-	-	-	-	2	1	2	2
CO5	3	3	3	2	2	-	-	-	-	-	-	2	1	2	1
Avg	3	3	3	2	2	-	-	-	-	-	-	2	1	2	1

Course Code & Name: 16PH2102 Physics of Materials

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	2	1	1	1	1	-	-	-	-	-	-	1	1	1
CO2	3	3	1	1	2	-	-	-	-	-	-	-	2	1	1
CO3	3	2	1	2	2	-	-	-	-	-	-	-	3	2	2
CO4	3	3	1	2	2	1	-	-	-	-	-	-	1	1	1
CO5	3	2	2	3	2	1	2	-	-	-	-	-	2	2	2
Avg	3	2	1	2	2	1	2	-	-	-	-	-	2	1	1

Course Code & Name: 16CY2102 Environmental Science

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	-	-	-	-	2	3	3	2	-	2	2	2	1	1
CO2	2	1	1	-	-	2	3	3	2	-	2	2	2	1	1
CO3	2	-	-	-	-	2	3	3	2	-	2	2	2	1	2
CO4	2	1	2	-	-	2	3	3	2	-	2	2	2	2	1
CO5	2	1	2	-	-	2	3	3	2	-	2	2	2	2	2
Avg	2	-	-	-	-	2	3	3	2	-	2	2	2	1	1

Course Code & Name: 16BM2201 Electron Devices and Circuits

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	2	3	2	-	-	-	-	-	-	-	-	1	2	1
CO2	2	2	2	-	-	-	-	-	-	-	-	-	1	2	1
CO3	3	2	3	-	-	-	-	-	-	-	-	-	-	2	2
CO4	2	-	2	3	-	-	-	-	-	-	-	-	-	3	1
CO5	2	-			-	-	-	-	-	-	-	-	-	3	1
Avg	2	1	2	1	-	-	-	-	-	-	-	-	-	2	1

Course Code & Name: 16BM2202 Circuits and Networks

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	2	3	2	-	-	-	-	-	-	-	-	1	2	1
CO2	2	2	2	-	-	-	-	-	-	-	-	-	1	2	1
CO3	3	2	3	-	-	-	-	-	-	-	-	-	-	2	2
CO4	2	-	2	3	-	-	-	-	-	-	-	-	-	3	1
CO5	2	-	-	-	-	-	-	-	-	-	-	-	-	3	1
Avg	2	1	2	1	-	-	-	-	-	-	-	-	0	2	1

Course Code & Name: 16PS2001 Physical Sciences Lab-II

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	-	3	-	3	-	1	-	1	-	-	-	1	2	1
CO2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
CO3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
CO4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
CO5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Avg	3	-	3	-	3	-	-	-	1	-	-	-	1	2	1

Course Code & Name: 16BM2001 Electron Devices and Circuits Lab

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	-	2	-	-	-	-	-	3	-	-	-	-	2	2
CO2	2	2	3	-	-	-	-	-	3	-	-	-	-	2	1
CO3	3	-	-	-	-	-	-	-	3	-	-	-	-	2	1
CO4	3	-	-	-	-	-	-	-	3	-	-	-	-	3	1
CO5	3	-	-	-	-	-	-	-	3	-	-	-	1		1
Avg	3	0	1	-	-	-	-	-	3	-	-	-	1	2	1

Mapping of Course Outcome and Programme Outcome:

Year	Sem	Course code & Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO2
I	I	16HE1101 Essential English for Engineers-I	1	1	1	1		2	1		2	3		2	1	1	2
		16MA1101 Engineering Mathematics-I (Matrices & Calculus)	3	3	3	2	2	-	-	-	-	-	-	2	2	2	1
		16PH1101 Engineering Physics	3	2	3	2	3	-	2	-	-	-	-	-	1	1	1
		16CY1101 Engineering Chemistry	3	2	2	2	2	1	-	-	-	-	-	1	1	1	1
		16GE1103 Problem Solving & Python Programming	2	3	3	-	2	-	-	-	2	-	-	2	2	2	1
		16GE1102 Engineering Graphics	3	3	3	2	2	-	-	-	-	-	-	3	2	2	1
		16PS1001 Physical Sciences Lab-I	3	2	3	2	3	-	2	-	-	-	-	-	1	1	-
		16GE1004 Problem Solving & Python Programming Lab	2	3	3	-	2	-	-	-	2	-	-	2	2	2	1
	II	16M A2102 Engineering Mathematics-II (Vector Calculus, Complex Variables & Laplace Transforms)	2	1	2	1	1	2	-	-	2	3	-	2	1	1	-
		16PH2102 Physics of Materials	3	2	1	2	2	1	2	-	-	-	-	-	2	1	1

		16CY2102 Environmental Science	2	-	-	-	-	2	3	3	2	-	2	2	2	1	1
		16BM2201 Electron Devices and Circuits	2	1	2	1	-	-	-	-	-	-	-	-	0	2	1
		16BM2202 Circuits and Networks	2	1	2	1	-	-	-	-	-	-	-	-	0	2	1
		16PS2001 Physical Sciences Lab-II	3	-	3	-	3	-	-	-	1	-	-	-	1	2	1
		16BM2001 Electron Devices and Circuits Lab	3	0	1	-	-	-	-	-	3	-	-	-	1	2	1

CHAIRMAN-BOS **DEAN ACADEMICS**