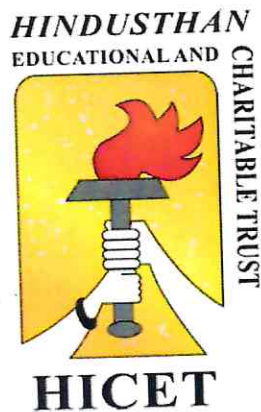# HINDUSTHAN COLLEGE OF ENGINEERING AND TECHNOLOGY

(An Autonomous Institution, Affiliated to Anna University, Chennai
Approved by AICTE, New Delhi & Accredited by NAAC with 'A' Grade)
Coimbatore – 641 032

B.E. MECHATRONICS ENGINEERING

HINDUSTHAN
EDUCATIONAL AND CHARITABLE TRUST

HICET

Curriculum & Syllabus

2017-2018

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

M1: To provide academic excellence in technical education through novel teaching methods.

M2: To empower students with creative skills and leadership qualities

M3: To produce dedicated professionals with social responsibility.

Chairman - BoS
MCT - HiCET

Chairman

Dean (Academics)
HiCET

VISION AND MISSION OF THE DEPARTMENT

VISION

To excel in Mechatronics engineering by imparting technical knowledge, innovation skills and ethics to fulfill the global needs with human values

MISSION

➢ To impart sound technical knowledge and produce highly proficient professionals in the mechatronics engineering domain.

➢ To empower students with strong competency skills to solve multi-disciplinary engineering problems using mechatronics approach.

➢ To inculcate human values and ethical responsibility to the students for social welfare.

B. Naamadh

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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 contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO 7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, 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 and design 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

PROGRAMME SPECIFIED OUTCOMES

PSO1- To provide ability to analyze, design and develop mechatronic systems by integrating knowledge in sensors, actuators and controllers to solve complex engineering problems.

PSO2- To provide smart automation solutions for real time industrial problems using multidisciplinary approach

PROGRAM EDUCATIONAL OBJECTIVES

To produce professional graduates

PEO1: With the ability to synergistically integrate multi-disciplinary domains to solve complex engineering problems with Mechatronics approach.

PEO2: With the acumen for interdisciplinary research, entrepreneurship and higher studies to meet the local and global needs.

PEO3: With ethical and moral values in rendering services to the society.

G. Narmadh

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Chairman
ACADEMIC COUNCIL
HINDUSTHAN COLLEGE OF ENGG & TECH

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CURRICULUM

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)
Valley Campus, Pollachi Highways, Coimbatore, Tamil Nadu.

DETAILS OF CHANGES CARRIED OUT IN CURRICULUM & SYLLABUS

CBCS PATTERN

UNDERGRADUATE PROGRAMMES

B.E. MECHATRONICS ENGINEERING (UG)

REGULATION-2016

For the students admitted during the academic year 2017-2018 and onwards

SEMESTER I

S.No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
THEORY									
1	16MA1101	Engineering Mathematics I	3	1	0	4	25	75	100
2	16PH1101	Engineering Physics	3	0	0	3	25	75	100
3	16CY1101	Engineering Chemistry	3	0	0	3	25	75	100
4	16HE1101R	Essential English for Engineers – I	3	1	0	4	25	75	100
5	16GE1101	Computer Programming	3	0	0	3	25	75	100
6	16GE1102	Engineering Graphics	3	1	0	4	25	75	100
PRACTICAL									
7	16PS1001	Physical Sciences Lab - I	0	0	2	1	50	50	100
8	16GE1001	Computer Programming Lab	0	0	4	2	50	50	100
9	16GE1002	Engineering Practices Lab	0	0	4	2	50	50	100
10	16GE1003	Value Added Course I: Language Competency Enhancement Course-I	0	0	2	1	0	100	100
		Total:	18	3	12	27	300	700	**1000**

SEMESTER II

S.No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
THEORY									
1	16MA2102	Engineering Mathematics - II	3	1	0	4	25	75	100
2	16PH2102	Physics of Materials	3	0	0	3	25	75	100
3	16CY2102	Environmental Sciences	3	0	0	3	25	75	100
4	16HE2102R	Essential English for Engineers - II	3	1	0	4	25	75	100
5	16GE2101	Engineering Mechanics	3	1	0	4	25	75	100
6	16EE2202	Basics of Electrical and Electronics Engineering	3	0	0	3	25	75	100
PRACTICAL									
7	16PS2001	Physical Sciences Lab – II	0	0	2	1	50	50	100
8	16ME2001	Computer Aided Drafting Lab	0	0	4	2	50	50	100
9	16GE2001	Value Added Course II: Language Competency Enhancement Course-II	0	0	2	1	0	100	100
		Total:	18	3	8	25	250	650	900

For the students admitted during the academic year 2016-2017 and onwards
SEMESTER III

S.No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
THEORY									
1	16MA3104	Fourier Analysis and Numerical Methods	3	0	0	3	25	75	100
2	16MT3201	Theory of Machines	3	1	0	4	25	75	100
3	16MT3202	Digital Applications in Mechatronics systems	3	0	0	3	25	75	100
4	16MT3203	Mechanics of Materials	3	0	0	3	25	75	100
5	16MT3204	Control of Electrical Machines	3	0	0	3	25	75	100
6	16MT3205	Production Technology	3	0	0	3	25	75	100
PRACTICAL									
7	16MT3001	Production Technology Laboratory	0	0	4	2	50	50	100
8	16MT3002	Control of Electrical Machines and Electronics Laboratory	0	0	4	2	50	50	100
		Total	18	1	8	23	250	550	800

SEMESTER IV

S.No.	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
THEORY									
1	16MT4201	Thermodynamics and Fluid Engineering	3	1	0	4	25	75	100
2	16MT4202	Control of Mechatronics Systems	3	1	0	4	25	75	100
3	16MT4203	Sensors and Signal Conditioning	3	0	0	3	25	75	100
4	16MT4204	Machine Design	3	1	0	4	25	75	100
5	16MT4205	Microcomputer Systems and Microcontroller	3	0	0	3	25	75	100
6	16MT4206	Engineering Metrology and Measurements	3	0	0	3	25	75	100
PRACTICAL									
7	16MT4001	Sensors and Signal Conditioning Laboratory	0	0	4	2	50	50	100
8	16MT4002	Assembly Language Programming Laboratory	0	0	4	2	50	50	100
9	16MT4003	Solid and Fluid Mechanics Laboratory	0	0	4	2	50	50	100
		Total	18	3	12	27	300	600	900

Credit Distribution

Semester	I	II	III	IV	V	VI	VII	VIII	Total
Credits	27	25	23	27	24	26	21	14	**187**

Chairman, Board of Studies

Dean – Academics

Principal

SYLLABUS

Programme B.E.	Course Code 16MA1101	Name of the Course ENGINEERING MATHEMATICS I (COMMON TO ALL BRANCHES)	L 3	T 1	P 0	C 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 real matrix – 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.	9+3
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.. .	9+3
III	**ORDINARY DIFFERENTIAL EQUATIONS** 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)	9+3
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.	9+3
V	**MULTIPLE INTEGRALS** Double integrals in Cartesian coordinates – Change of order of integration – Area enclosed by the plane curves (excluding surface area) – Triple integrals in Cartesian co-ordinates – Volume of solids using Cartesian co-ordinates.	9+3
	Total Instructional Hours	45+15=60

On completion of the course the students will be able to

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 model 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, "Engineering 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- Bali N.P & Manish Goyal, "A Text book of Engineering Mathematics", 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

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| Programme
B.E. | Course Code
16PH1101 | Name of the Course
ENGINEERING PHYSICS | L
3 | T
0 | P
0 | C
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, CO_2 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. Production – Magnetostrictive generator – Piezoelectric generator – Determination of velocity using acoustic grating – Non destructive testing – Ultrasonic pulse echo 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
On completion of the course the students will be able to CO1: Enhance the fundamental knowledge in Properties of Matter and Thermal Physics CO2: Understand 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 ultrasonic 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.

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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

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HiCET

Programme B.E.	Course Code 16CY1101	Name of the Course ENGINEERING CHEMISTRY	L 3	T 0	P 0	C 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	On completion of the course the students will be able to 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).

REFERENCE BOOKS:

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).

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5

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Programm B.E.	Course Code 16HE1101R	Name of the Course ESSENTIAL ENGLISH FOR ENGINEERS – I	L 3	T 1	P 0	C 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**	9+3
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.**	9+3
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.	9+3
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.	9+3
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.	9+3
	Total Instructional Hours	45+15=60

Course Outcome

On completion of the course the students will be able to

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 describe the basic properties and application of nanomaterials

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.

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Programme B.E.	Course Code 16GE1101	Name of the Course COMPUTER PROGRAMMING (COMMON TO ALL BRANCHES)	L 3	T 0	P 0	C 3

Course Objective

1. Learn the fundamentals of computers.
2. Learn the basics of C programming
3. Learn the basics of Arrays and String
4. Learn the uses of functions and pointers.
5. Learn the basics of structures and unions.

Unit	Description	Instructional Hours
	BASICS OF COMPUTER	
I	Generation and Classification of Computers- Basic Organization of a Computer – Input and Output Devices–Hardware and Software definitions- Categories of Software- Number System Conversion and problems. Need for logical analysis and thinking – Algorithm -Pseudo code – Flow Chart.	9
	BASICS OF 'C' PROGRAMMING	
II	Fundamentals of ' C' programming – Structure of a 'C' program – compilation and linking processes – Constants, Variables – Data Types –Expressions using operators in 'C' – Managing Input and Output operations-Decision making-Branching and Looping-Case study	9
	ARRAYS AND STRINGS	
III	Arrays – Initialization – Declaration – One dimensional and Two dimensional arrays. String- String Library functions – String Arrays. Matrix operations-Addition-Subtraction-Multiplication-Transpose-Case study.	9
	FUNCTIONS AND POINTERS	
IV	Function – definition – Declaration – Types of Function definition – call by value-call by reference- Recursion – Pointers - Definition – Initialization – Pointers arithmetic – Pointers and arrays-Case study.	9
	STRUCTURES AND UNIONS	
V	Structure- data type – definition – declaration –Nesting of structure - Union – Storage classes, Pre-processor directives-Case study.	9
	Total Instructional Hours	45

Course Outcome

On completion of the course the students will be able to

CO1: Use computers at user level, including operating systems, programming environments and differentiate between basic concepts of computer hardware and software.

CO2: Analyze problems, design and implementing algorithmic solutions.

CO3: Use data representation for the fundamental data types, read, understand and trace the execution of programs written in C language.

CO4: Write the C code using a modular approach and recursive concepts.

CO5: Explain the use of pointers, Structures and union.

TEXT BOOKS:

T1-   Anita Goel and Ajay Mittal, "Computer Fundamentals and Programming in C", Dorling Kindersley (India) Pvt. Ltd., Pearson Education in South Asia, 2011.

T2-   Dr.N.Sengottaiyan and K.Ramya, "Fundamentals of Computer Programming",Cengage Learning (India) Pvt.Ltd.,2016.

REFERENCE BOOKS:

R1-   Yashavant P. Kanetkar. " Let Us C", BPB Publications, 2011.

R2-   Balagurusamy"Programming in ANSI C", Schaum's Outlines, Second Edition, Tata McGraw-Hill, 2006.

R3-   M.Rajaram and P.Uma maheswari, "Computer Programming with C" Dorling Kindersley (India) Pvt. Ltd., Pearson Education in South Asia, 2014

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Programme B.E.	Course Code 16GE1102	Name of the Course ENGINEERING GRAPHICS (COMMON TO ALL BRANCHES)	L 3	T 1	P 0	C 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	Instructional 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 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	On completion of the course the students will be able to 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- Basant Agrawal 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.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16PS1001	PHYSICAL SCIENCES LAB - I (COMMON TO ALL BRANCHES)	0	0	2	1

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

Unit	Description of the Experiments	Practical Hours
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

On completion of the course the students will be able to

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.

*** Student will prepare lab record during the course of the semester.

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Programme B.E.	Course Code 16GE1001	Name of the Course COMPUTER PROGRAMING LAB (COMMON TO ALL BRANCHES)	L 0	T 0	P 4	C 2

Course Objective	1. Be familiar with Microsoft office software. 2. Be exposed to role of constants, variables, identifiers, operators and other building blocks of C Language. 3. Be familiar with the use of conditional expressions and looping statements to solve problems associated with conditions and repetitions. 4. Be familiar with the concept of Array and pointers dealing with memory management. 5. Be exposed to Structures and unions.

Unit	Description of the Experiments	Practical Hours
1	**a. Word Processing:** 1. Document creation, Text manipulation with Scientific notations 2. Table creation, Table formatting and conversion 3. Mail merge and Letter preparation 4. Flow Chart	3
2	**b. Spread Sheet:** 1. Chart - Line, XY, Bar and Pie. 2. Formula - formula editor. 3. Spread sheet - inclusion of object, picture and graphics, protecting the document and sheet. 4. Sorting and Import / Export features	6
3	**c. Basic C programming:** C program using I/O Statements	3
4	C program using arithmetic operations	3
5	Decision making statement & Looping Concepts • Designing a simple arithmetic calculator. (Use switch statement) • Performing the following operations: (Use loop statement) • Generate Pascal's triangle. • Construct a Pyramid of numbers	6
6	**d. Arrays and Strings** C program using one dimensional arrays	3
7	C program using two dimensional arrays	3
8	C program using string functions	3
9	**e. Functions and pointers** 1. Perform the following operations: (Use recursive functions) i. Find the factorial of a given integer. ii. Find the GCD (Greatest Common Divisor) of two given integers iii. Solve Towers of Hanoi problem.	6
10	Program to swap two numbers using pointers - call by reference.	3
11	**f. Structures and Unions** C Program using Structures	3
12	C Program using Unions	3
	Total Practical Hours	45

Course Outcome	On completion of the course the students will be able to
	CO1: Use office packages for documentation and presentation.
	CO2: Implement program using control structures.
	CO3: Handle arrays and strings.
	CO4: Handle functions and pointers.
	CO5: Form heterogeneous data using structure and union.

Programme B.E.	Course Code 16GE1002	Name of the Course ENGINEERING PRACTICES LAB (COMMON TO ALL BRANCHES)	L 0	T 0	P 4	C 2

Course Objective	1. 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)

Unit	Description of the Experiments	Practical Hours
	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.	9
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.	
1	**II MECHANICAL ENGINEERING** **(A) Welding:** 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	
1	**(C) Sheet Metal Work:** Practice on Models– Trays, cone and cylinder.	10
	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.**	

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GROUP B (ELECTRICAL & ELECTRONICS)

Unit	Description of the Experiments	Practical Hours
	ELECTRICAL ENGINEERING PRACTICES	
1	Residential house wiring using switches, fuse, indicator, lamp and energy meter.	
2	Fluorescent lamp wiring	
3	Stair case wiring.	10
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 .	13
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	On completion of the course the students will be able to CO1: Fabricate wooden components and pipe connections including plumbing works. CO2: Fabricate simple weld joints. CO3: Fabricate electrical and electronics circuits.

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16GE1003	VALUE ADDED COURSE I: LANGUAGE COMPETENCY ENHANCEMENT COURSE- I (COMMON TO ALL BRANCHES)	0	0	2	1

Course Objective	✓ To enhance student language competency ✓ To identify individual students level of communication skills ✓ To develop English Vocabulary and spoken communication skills. ✓ To revive the fundamentals of English Grammar.

Unit	Description	Instructional Hours
I	**Listening** Language of Communication- English listening- Hearing Vs Listening- Verbal and Non-verbal communication – Listening strategies-Sounds of English.	3
III	**Reading** English Language Enhancement – Indianism in English – Role of Reading in effective communication – Techniques for good reading (skimming and scanning) Reading articles from newspaper, magazine. Reading and interpreting a passage.	3
III	**Speaking** Common errors in Pronunciation – Signposts in English (Role play) – Public Speaking skills – Social Phobia – Eliminating fear – Common etiquette of speaking - Debate and Discuss.	3
IV	**Writing** Writing genre – Enhancement of basic English Vocabulary; Parts of Speech, Noun, Verbs, and Tenses – combining sentences, sentence formation and completion.	3
V	**Art of Communication** Communication process – Word building and roleplay – Exercise on English Language for various situations through online and offline activities.	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.

REFERENCE BOOKS :

1. Verbal Ability and Reading Comprehension by Arun Sharma,9th edition,Tata Mc graw Hill
2. Word Power Made Easy by Norman Lewis,– Print, 1 June 2011.
3. High School English Grammar by Wren and Martin,S.CHAND Publications, 1 January 2017.
4. Practical course in Spoken English by J.K. Gangal,PHI Learning , Second edition, 1 January 2018.

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16MA2102	ENGINEERING MATHEMATICS –II (COMMON TO ALL BRANCHES)	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	**VECTOR CALCULUS** 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.	9+3
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.	9+3
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.	9+3
IV	**LAPLACE TRANSFORM** Laplace transform –Basic properties – Transforms of derivatives and integrals of functions - Transforms of unit step function and impulse function – Transform of periodic functions. Inverse Laplace transform - Convolution theorem (with out proof) – Solution of linear ODE of second order with constant coefficients using Laplace transformation techniques.	9+3
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.	9+3
	Total Instructional Hours	45+15=60

Course Outcome

On completion of the course the students will be able to

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, "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

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15

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REFERENCE BOOKS:

R1- Bali N.P & Manish Goyal, "A Text book of Engineering Mathematics", 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

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16

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Programme B.E.	Course Code 16PH2102	Name of the Course PHYSICS OF MATERIALS	L 3	T 0	P 0	C 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	**CONDUCTING MATERIALS** 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 – carrier concentration derivation – Fermi level – Variation of Fermi level with temperature – electrical conductivity – band gap determination – compound semiconductors –direct and indirect band gap of semiconductors- 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

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On completion of the course the students will be able to

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 everyday 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 Nano materials.

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

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

PULATION AND THE ENVIRONMENT

| HU MA N PO | 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   On completion of the course the students will be able to

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.

REFERENCE BOOKS:

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

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20

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

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.**	9+3
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.**	9+3
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.	9+3
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.	9+3
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.**	9+3
	Total Instructional Hours	45+15=60

Course Outcome

On completion of the course the students will be able to

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

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21

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Programme B.E.	Course Code 16GE2101	Name of the Course ENGINEERING MECHANICS (COMMON TO ALL BRANCHES)	L 3	T 1	P 0	C 4

Course Objective

1. Understand the vector and scalar representation of forces and moments
2. Understand the static equilibrium of particles and rigid bodies both in two dimensions.
3. Understand the principle of work and energy.
4. Comprehend the effect of friction on equilibrium.
5. Write the dynamic equilibrium equation.

Unit	Description	Instructional Hours
I	**BASICS & STATICS OF PARTICLES** Introduction – Units and Dimensions – Laws of Mechanics – Lame's theorem, Parallelogram and triangular Law of forces – Vectors – Vector representation of forces and moments – Coplanar Forces – Resolution and Composition of forces – Equilibrium of a particle – Forces in space – Equilibrium of a particle in space – Equivalent systems of forces – Principle of transmissibility.	9+3
II	**EQUILIBRIUM OF RIGID BODIES** Free body diagram – Types of supports and their reactions – requirements of stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis– Scalar components of a moment – Varignon's theorem – Single equivalent force – Equilibrium of Rigid bodies in two dimensions.	9+3
III	**PROPERTIES OF SURFACES AND SOLIDS** Determination of Areas and Volumes – First moment of area and the Centroid of sections – Rectangle, circle, triangle from integration – T section, I section, - Angle section, Hollow section by using standard formula – Second and product moments of plane area – Rectangle, triangle, circle from integration – T section, I section, Angle section, Hollow section by using standard formula – Parallel axis theorem and perpendicular axis theorem – Polar moment of inertia – Principal moments of inertia of plane areas.	9+3
IV	**DYNAMICS OF PARTICLES** Displacements, Velocity and acceleration, their relationship – Relative motion – Curvilinear motion – Newton's law – Work Energy Equation of particles – Impulse and Momentum – Impact of elastic bodies. Co-efficient of restitution.	9+3
V	**FRICTION** Frictional force – Laws of Coloumb friction – Simple contact friction – Rolling resistance – Wedge friction - Belt friction, Applications of friction.	9+3
	Total Instructional Hours	45+15=60

Course Outcome

On completion of the course the students will be able to

CO1: To solve engineering problems dealing with force, displacement, velocity and acceleration.
CO2: To analyze the forces in any structure.
CO3: To solve rigid body subjected to dynamic forces.

TEXT BOOKS:

T1- F.P.Beer, and Jr. E.R.Johnston., "Vector Mechanics for Engineers (In SI Units): Statics and Dynamics", 8th Edition, Tata McGraw-Hill Publishing company, New Delhi (2004).

REFERENCE BOOKS:

R1- R.C.Hibbeller, and Ashok Gupta, "Engineering Mechanics: Statics and Dynamics", 11th Edition, Pearson Education 2010.

R2- S.Rajasekaran and G.Sankarasubramanian, "Engineering Mechanics Statics and Dynamics", 3rd Edition, Vikas Publishing House Pvt. Ltd., 2005.

R3- S.S.Bhavikatti, and K.G.Rajashekarappa, "Engineering Mechanics", New Age International (P) Limited Publishers, 1998.

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Programme B.E.	Course Code 16GE2202	Name of the Course BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING	L 3	T 0	P 0	C 3

Course Objective

1. To apply the basic laws used in Electrical circuits and the different components.
2. To impart knowledge on construction and working of DC and AC machines
3. To provide knowledge on the fundamentals of semiconductor devices and their applications.
4. To impart knowledge on digital electronics and its principles.
5. To develop block diagrams for satellite and optical fiber communications.

Unit	Description	Instructional Hours
I	**ELECTRICAL CIRCUITS AND MEASUREMENTS** Ohm's Law – Kirchoff's Laws – Steady State Solution of DC Circuits – Introduction to AC Circuits – Waveforms and RMS Value – Power and Power factor – Single Phase circuits - Three Phase Balanced Circuits. Operating Principles of Moving Coil and Moving Iron Instruments - Ammeters and Voltmeters, Dynamometer type Watt meters and Energy meters.	9
II	**ELECTRICAL MACHINES** Construction, Principle of Operation of DC Generators - EMF Equation - Construction, Principle of Operation of DC shunt and series Motors, Single Phase Transformer - EMF Equation, Single phase capacitor start - capacitor run – Construction, Principle of Operation of Three Phase Induction Motor – Applications - (Qualitative Approach only).	9
III	**SEMICONDUCTOR DEVICES AND APPLICATIONS** Characteristics of PN Junction Diode – Zener Diode and its Characteristics – Zener Effect – Half wave and Full wave Rectifiers – Voltage Regulation. Bipolar Junction Transistor (BJT) – CB, CE, CC Configurations and Characteristics – FET – Characteristics.	9
IV	**DIGITAL ELECTRONICS** Binary Number System – Logic Gates – Boolean Algebra – Half and Full Adders – Flip-Flops (RS, JK, T & D), A/D and D/A Conversion (Dual Slope, SAR, Binary-weighted and R-2R).	9
V	**FUNDAMENTALS OF COMMUNICATION ENGINEERING** Types of Signals: Analog and Digital Signals – Modulation and Demodulation: Principles of Amplitude and Frequency Modulations - Satellite and Optical Fibre communications (Block Diagram Approach only).	9
	Total Instructional Hours	45

Course Outcome

On completion of the course the students will be able to
CO1: Apply the KVL and KCL in Electrical circuits
CO2: Explain the constructional features of AC and DC machines.
CO3: Identify electronics components and use of them to design circuits.
CO4: Use appropriate logic gates in circuit design.
CO5: Construct block diagram and explain satellite and optical Fibre communication systems.

TEXT BOOKS:
T1- Mittle N., "Basic Electrical Engineering", Tata McGraw Hill Edition, New Delhi, 1990.
T2- Sedha R.S., "Applied Electronics", S. Chand & Co., 2006.
T3- Muthusubramanian R, Salivahanan S and Muraleedharan K A, "Basic Electrical, Electronics and Computer Engineering", Tata McGraw Hill, Second Edition, 2006.

REFERENCE BOOKS:
R1- Nagsarkar T K and Sukhija M S, "Basics of Electrical Engineering", Oxford press 2005.
R2- Mehta V K, "Principles of Electronics", S.Chand & Company Ltd, 1994.
R3- Premkumar N, "Basics of Electrical Engineering", Anuradha Publishers, 2003.
R4- T.Thyagarajan. "Fundamentals of Electrical and Electronics Engineering" Scitech Publications Pvt Ltd, 2011.

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23

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Programme B.E.	Course Code 16PS2001	Name of the Course PHYSICAL SCIENCES LAB– II Physics Lab II (COMMON TO ALL BRANCHES)	L 0	T 0	P 2	C 1

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.

Unit	Description of the Experiments	Practical Hours
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

On completion of the course the students will be able to

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.

*** Student will prepare lab record during the course of the semester.

Programme B.E.	Course Code 16PS2001	Name of the Course PHYSICAL SCIENCE LAB – II CHEMISTRY LAB – II (COMMON TO ALL BRANCHES)	L 0	T 0	P 2	C 1

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.

Unit	Description of the Experiments	Practical Hours
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	On completion of the course the students will be able to
	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.

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Programme B.E.	Course Code 16ME2001	Name of the Course COMPUTER AIDED DRAFTING LAB (COMMON TO ALL BRANCHES)	L 0	T 0	P 4	C 2

Course Objective	1. To develop skills on using software for preparing 2D Drawings.
	2. To provide the importance of computer aided drawing in engineering society.

Concepts and Conventions:

Understand the basic idea of software and its features like draw panel, modify panel, line types, creating dimensions, hatching techniques, layer Creations, text styles, and template drawings, use of Blocks, Design Center, Tool Palettes and Plotting.

Unit	Description of the Experiments	Practical Hours
1	Study of drafting software– Coordinate systems (absolute, relative, polar, etc.) – Creation of simple geometries like polygon and general multi-line figures.	
2	Drawing the conic and special curves.	
3	Draw the orthographic projections of simple solids like Prism, Pyramid, Cylinder, Cone and its dimensioning.	
4	Draw the symbols of fasteners, weld, rivets, bolts nuts and screws.	
5	Drawing Isometric projection of simple objects.	
6	Draw the orthographic projections of Bush bearing.	
7	Draw the orthographic projections of Oldham's coupling.	
8	Draw the orthographic projections of cotter joint.	
9	Draw the orthographic projections of simple gate valve.	
10	Draw the Plan and Elevation of simple Residential Building.	

	Total Practical Hours	45

Course Outcome	On completion of the course the students will be able to
	CO1: The students shall be able to use the software package for drafting
	CO2: The students shall be able to create 2D Drawing of Engineering Components
	CO3: The students shall be able to apply basic concepts to develop construction drawing techniques

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

Course Objective	✓ To improve communication skills and Professional Grooming. ✓ To impart deeper knowledge of English Language and its practical application in different facets of life. ✓ To equip the techniques of GD, Public Speaking, debate etc.

Unit	Description	Instructional Hours
I	**Listening** Listening for gist and respond – Listen for detail using key words to extract specific meaning – listen for phonological detail – Listen and identify the main points for short explanations and presentation.	3
II	**Reading** Strategies for effective reading – read and recognize different text types – Genre and Organization of Ideas – Quantifying reading – reading to comprehend – Interpreting sentences – contrasting, summarizing or approximating	3
III	**Speaking** Speak to communicate – Make requests and ask questions to obtain personal information – use stress and intonation – articulate the sounds of English to make the meaning understood – speaking to present & Interact – opening and closing of speech.	3
IV	**Writing** Plan before writing – develop a paragraph: topic sentences, supporting sentences – write a descriptive paragraph – elements of good essay – descriptive, narrative, argumentative – writing emails – drafting resumes – project writing – convincing proposals.	3
V	**Language Development** Demonstration at level understanding of application of grammar rules – revision of common errors : preposition, tenses, conditional sentences –reference words – pronouns and conjunctions.	3
	Total Instructional Hours	15

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

REFERENCE BOOKS :

1. Verbal Ability and Reading Comprehension by Arun Sharma,9th edition,Tata Mc graw Hill
2. Word Power Made Easy by Norman Lewis,– Print, 1 June 2011.
3. High School English Grammar by Wren and Martin,S.CHAND Publications, 1 January 2017.
4. Practical course in Spoken English by J.K. Gangal,PHI Learning , Second edition, 1 January 2018.

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27

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SYLLABUS
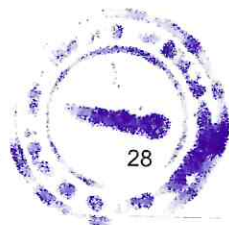
Programme B.E.	Course Code 16MA3104	Name of the Course FOURIER ANALYSIS AND NUMERICAL METHODS (COMMON TO CIVIL & MECHATRONICS)	L 3	T 0	P 0	C 3

Course Objective	1. Introduce fourier series analysis which is central to many applications in engineering 2. Solve boundary value problems by applying fourier series 3. Acquaint with fourier transforms techniques used in wide variety of situations 4. Familiar with the concepts of numerical differentiation and numerical integration 5. Find the numerical solution of ordinary differential equations as most of the engineering problems are expressed in the form of differential equations

Unit	Description	Instructional Hours
I	**FOURIER SERIES** Introduction - Dirichlet's Conditions - General Fourier Series - Odd and Even Functions - Half Range Sine and Cosine Series - Change of Interval - Parseval's Identity - Harmonic Analysis.	9
II	**BOUNDARY VALUE PROBLEMS** Classification - Solution of One Dimensional Wave Equation - One Dimensional Heat Equation - Fourier Series Solution in Cartesian Coordinates.	9
III	**FOURIER TRANSFORMS** Fourier Transform Pairs - Fourier Sine and Cosine Transforms - Properties - Transforms of Simple Functions - Convolution Theorem - Parseval's Identity.	9
IV	**NUMERICAL DIFFEREN TIATION AND INTEGRATION** Differentiation using Interpolation Formulae - Numerical Integration by Trapezoidal and Simpson's 1/3 and 3/8 Rules - Romberg's Method - Double Integrals using Trapezoidal and Simpson's Rules.	9
V	**INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS** Single Step Methods: Taylor Series Method - Euler and Modified Euler Method for First Order Equation - Fourth Order Runge - Kutta Method for Solving First Order Equations - Multi Step Method: Milne's Predictor and Corrector Methods.	9
	Total Instructional Hours	45

Course Outcome	On completion of the course the students will be able to CO1: Understand the mathematical principles of fourier series which would provide them the ability to formulate and solve some of the physical problems of engineering CO2: Acquire the knowledge of application of fourier series in solving the heat and wave equations CO3: Express the information from discrete data set through numerical differentiation CO4: Evaluate many numerical integration problems and appreciate their applications for engineering problem solving CO5: Obtain the knowledge of solving ordinary differential equations using single and multi step methods

TEXT BOOKS:

T1- Veerarajan. T., *"Transforms and Partial Differential Equations"*, 2nd Edition Reprint, Tata McGraw Hill Publishing Company Limited, New Delhi, 2012.

T2- Grewal. B.S, *"Higher Engineering Mathematics"*, 40th Edition, Khanna Publishers, New Delhi, 2007.

REFERENCE BOOKS:

R1- Kreyszig. E, *"Advanced Engineering Mathematics"*, 8th Edition, John Wiley and Sons Ltd., Singapore 2001.

R2- Kandasamy P., Thilagavathy K. and Gunavathy K, *"Engineering Mathematics Volume III"*, S. Chand & Company Ltd., New Delhi, 1996.

R3- Kandasamy P., Thilagavathy K. and Gunavathy K, *"Numerical Methods"*, S. Chand & Company Ltd., New Delhi, 1996.

R4- S.K. Gupta, *"Numerical Methods for Engineers"*, New Age International (P) Ltd., New Delhi, 2015.

Chairman 29

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Programme B.E.	Course Code 16MT3201	Name of the Course THEORY OF MACHINES	L 3	T 1	P 0	C 4

Unit	Description	Instructional Hours
	MECHANISMS	
I	Introduction - Kinematic Links, Joints, Pairs and Chains - Degree of Freedom - Mobility - Kutzbach Criterion - Grashoff's Law - Kinematic Inversions of Mechanism - Steering Gear Mechanism - Ackermann Steering Gear.	9+3
	CAMS	
II	Classification of Cams and Followers - Terminology - Displacement Diagram - Uniform Velocity, Parabolic, Simple Harmonic and Cycloidal Motions on Radial Cams. Velocity and Acceleration Analysis of Slider Crank mechanisms.	9+3
	GEARS AND BELT DRIVES	
III	Gears classification - Law of Toothed Gearing - Terminology - Gear Tooth Action - Interference - Simple and Compound Gear Trains - Belt drives - Types - Angle of Contact - Maximum Tension in the Belt - Advantages and Disadvantages.	9+3
	VIBRATION	
IV	Introduction - Terms - Types - Free Longitudinal Vibrations - Free Transverse Vibrations - Whirling Speed of the Shaft - Damped Vibration(Free and Forced) - Damping Factor - Logarithmic Decrement - Vibration Isolation and Transmissibility.	9+3
	BALANCING	
V	Static and Dynamic Balancing - Balancing of Rotating Masses - Balancing of Reciprocating Masses - Balancing of Radial Engine and V Engines - Hammer Blow - Swaying Couple. Case Studies: Effect of Gyroscopic Couple on Navel Ship and Centrifugal Governors in Automobiles.	9+3
	Total Instructional Hours	45+15=60

Course Outcome

On completion of the course the students will be able to
CO1: Design and analyze all types of mechanism
CO2: Sketch and analyze the profile of various cam mechanisms
CO3: Solve and evaluate the kinematics aspects of gears and gear trains
CO4: Interpret the principles of vibration and mechanism for its control
CO5: Analyze the concept of balancing of masses

TEXT BOOKS:

T1- S.S.Rattan, *"Theory of Machines"*, 4th Edition, Tata McGraw Hill Publishing Company Limited, New Delhi, 2016.
T2- R.S.Khurmi and J.K.Gupta , *"Theory of Machines"*, 5th Edition, S. Chand and Company Ltd., New Delhi, 2010.

REFERENCE BOOKS:

R1- H.David Myszka, *"Machines and Mechanism - Applied Kinematic Analysis"*, 4th Edition, Pearson Education, New Jersey, 2010.
R2- L.Robert Norton, *"Design of Machinery"*, 7th Edition, Tata McGraw Hill Publishing Company Limited, New Delhi, 2013.
R3- J.E.Shigley and J.J.Uicker, *"Theory of Machines and Mechanisms"*, 3rd Edition, Oxford University Press India, 2014.

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1. http://www.mechanicalbooster.com/2013/11/what-is-governor-in-automobile-how-does-it-works.html

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Programme B.E.	Course Code 16MT3202	Name of the Course DIGITAL APPLICATIONS IN MECHATRONIC SYSTEMS	L 3	T 0	P 0	C 3

Course Objective	1. To impart knowledge about the fundamentals of logic gates and boolean algebra
	2. To learn various combinational and sequential circuits
	3. To describe various flip-flops used in sequential circuits
	4. To familiarize the basics of synchronous and asynchronous circuits
	5. To introduce digital concepts in mechatronics applications

Unit	Description	Instructional Hours
I	**LOGIC GATES AND MINIMIZATION TECHNIQUES** Logic Gates: Logic Functions using Gates - NAND - NOR Implementations - Multi Level Gate Implementations - Multi Output Gate Implementations. Minimization Techniques: Boolean Algebra - Simplification of Boolean Functions - Minterm - Maxterm - Simplification of Logic Functions using Karnaugh Map - Quine McClusky Method.	9
II	**COMBINATIONAL CIRCUITS** Half and Full Adders - Half and Full Subtractors - Code Converters - Encoder - Decoder - Multiplexer - Demultiplexer - Carry Look Ahead Adder - Parity Checker - Parity Generators - Magnitude Comparator.	9
III	**SEQUENTIAL CIRCUITS** Latches - Flip-Flops SR, JK, D, T, and Master - Slave. Asynchronous & Synchronous Up/Down Counters. Design of Synchronous Counters: State Diagram - State Table - State Minimization - State Assignment - Excitation Table and Maps - Modulo-n Counter.	9
IV	**MEMORY DEVICES** Classification of Memories - ROM Organization - RAM Organization. Programmable Logic Devices - Programmable Logic Array (PLA) - Programmable Array Logic (PAL) - Field Programmable Gate Arrays (FPGA).	9
V	**APPLICATIONS** Digital Electronics on Engine Management - FADEC. Industrial Automation - Process Monitoring and Control - Distributed Control Systems in Robotics - 3C - Communications, Command and Control - Automotive Industry - Electronic Control Unit.	9
	Total Instructional Hours	45

Course Outcome	On completion of the course the students will be able to
	CO1: Design logic circuits and to evaluate its function realizations using gates
	CO2: Develop combinational and sequential circuit systems using flip flops
	CO3: Apply the minimization techniques in sequential circuits
	CO4: Compare various programmable logic devices and its functions
	CO5: Enumerate the applications of digital electronics in various fields

TEXT BOOKS:
T1- M. Morris Mano, Michel D. Ciletti, "Digital Design", 5th Edition, Pearson Education, New Delhi, 2012.
T2- John.M Yarbrough, "Digital Logic Applications and Design", 1st Edition, Thomson Learning, 2002.

REFERENCE BOOKS:
R1- John F.Wakerly, "Digital Design", 4th Edition, PHI Learning Private Limited, New Delhi, 2006.
R2- Thomas L. Floyd, "Digital Fundamentals", 8th Edition, PHI Learning Private Limited, New Delhi, 2003.
R3- Charles H.Roth, "Fundamentals of Logic Design", 7th Edition, Thomson Learning, 2003.

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1. http://www.experimentalaircraft.info/articles/aircraft-engines-fadec.php
2. http://www.mouser.com/applications/distributed-control-systems-robotics/
3. http://embedded-computing.com/articles/automotive-industry-innovation-driven-electronics

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31

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Programme B.E.	Course Code 16MT3203	Name of the Course MECHANICS OF MATERIALS	L 3	T 0	P 0	C 3

Unit	Description	Instructional Hours
I	**STRESS STRAIN AND DEFORMATION OF SOLIDS** Introduction to Materials - Classification - Properties of Engineering Materials - Hooke's Law - Types of Stresses - Deformation of Simple and Composite Bars - Thermal Stresses - Elastic Constants and their Relations - Factor of Safety.	9+3
II	**SHEAR FORCE AND BENDING MOMENT** Beams and its Types -Types of Loading on Beams - Shear Force and Bending Moment in Beams - Cantilevers, Simply Supported Beams and Over Hanging Beams - Theory of Simple Bending - Bending Formula - Bending Stress Distribution - Shear Stress Distribution.	9+3
III	**TORSION OF SHAFT AND SPRINGS** Introduction to Torsion Stresses and Deformation in Circular and Hollows Shafts - Composite Shafts - Stresses in Helical Springs - Deflection of Helical Springs and Leaf Springs.	9+3
IV	**DEFLECTION OF BEAMS AND COLUMNS** Slope and Deflection of Cantilever and Simply Supported Beams by Double Integration and Macaulay's Methods - Column - Buckling of column - Euler's and Rankine's Formula for Different End Condition.	9+3
V	**THIN ANDTHICK CYLINDERS** Stresses in Thin Cylindrical Shell due to Internal Pressure Circumferential and Longitudinal Stresses and Deformation in Thin and Thick cylinders - Applications - Design of Mechatronics System Components - Spring - Shaft - Rope - Case Study of Stress Distribution in Automobile Tyres - Case Study of Automation Systems used in Investigating Strength of the Engineering Materials.	9+3
	Total Instructional Hours	45+15=60

Course Outcome

On completion of the course the students will be able to
CO1: Compute stresses and strain under different load conditions
CO2: Sketch the shear force and bending moment diagrams of different beams
CO3: Analyse the stresses and strains in shafts subjected torsion
CO4: Design standard beams for safe working conditions
CO5: Investigate the mode of failure in pressure vessels

TEXT BOOKS:
T1- Bansal, R.K., *"Strength of Materials"*, 6th Edition, Laxmi Publications (P) Ltd., New Delhi, 2017.
T2- Ferdinand P. Beer *"Mechanics of solids"*, 7th Edition, McGraw Hill Education, New Delhi, 2014.

REFERENCE BOOKS:
R1- Khurumi R S *"Strength of Materials"*, 3rd Edition, Asian Books Pvt. Ltd., New Delhi, 2007.
R2- Subramanian R., *"Strength of Materials"*, 2nd Edition, Oxford University Press, Oxford Higher Education Series, 2007.
R3- Rajput, R. K, *"A Textbook of Strength of Materials"*, 5th Edition, S. Chand and company Ltd., New Delhi, 2007.
R4- Hibbeler, R.C., *"Mechanics of Materials"*, 8th Edition, Pearson Education, New Delhi, 2011.

WEB REFERENCES:
1. http://www.timeattack.co.uk/chassis-stiffening-basics/#sthash.kzqhpA2W.dpbs
2. http://www.totalconstructionhelp.com/columns.html

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32

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Programme B.E.	Course Code 16MT3204	Name of the Course CONTROL OF ELECTRICAL MACHINES	L 3	T 0	P 0	C 3

Course Objective	1. To discuss Constructional details, principle of operation, starters, and speed control of Electrical Machines
	2. To identify the control circuit components used in electrical circuit
	3. To illustrate DC electric machines control circuits
	4. To select the suitable parts to construct the AC electrical machines
	5. To learn to use Different control circuits for industrial applications

Unit	Description	Instructional Hours
I	**ELECTRICAL MACHINES** Review of Constructional Details - Working Principle of DC Machines & AC Motor - Characteristics of Shunt, Series & Compound Motors - Necessity of Starters - Speed Control - Construction and Principle of Operation of Single Phase Induction Motors.	9
II	**INTRODUCTION TO CONTROL CIRCUIT COMPONENTS** Control Circuit Components Switches - Push Button, Selector, Limit, Pressure, Temperature (Thermostat). Relays - Voltage Relay, DC Series Current Relay - Over Current Relay - Bimetallic Thermal Over Load Relay and Magnetic Dash Pot Oil Filled Relay - Timer - Thermal, Pneumatic and Electronic Timer - Solenoid Valve, Solid State Relay, Simple ON - OFF Motor Control Circuit.	9
III	**DC MOTOR CONTROL CIRCUITS** Need of Starter - Manual Starters for DC Motors - Speed Controlling Methods - Current Limit Acceleration Starters - Series Relay and Counter EMF Starters - Definite Time Acceleration Starters - Jogging Control, Dynamic Braking Control, Reversing Control and Plugging Control Circuits.	9
IV	**AC MOTOR CONTROL CIRCUITS** Types of AC Motors - Construction and Working of Three Phase AC Motors - DOL Starter - Automatic Auto Transformer Starter, Star/Delta Starter (Semi Automatic and Automatic) Starter for Two Speed, Two Winding Motor - Reversing the Direction of Rotation of Induction Motor - Plug Stopping of the Motor - Dynamic Braking - Three Step Rotor Resistance Starter for Wound Induction Motor.	9
V	**INDUSTRIAL CONTROL CIRCUITS** Planner Machine - Battery Trolley - Battery Operated Truck - Skip Hoist Control - Automatic Control of a Water Pump - Control of Electric Oven - Control of Air Compressor - Control of Over Head Crane - Control of Conveyor System - Control of Elevator.	9
	Total Instructional Hours	45

Course Outcome	On completion of the course the students will be able to
	CO1: Analyze the principle, construction and operation of electrical machine
	CO2: Recognize the control circuit components used in electrical wiring
	CO3: Illustrate the control circuits for DC Machines
	CO4: Sketch and describe the control circuits for AC Machines
	CO5: Apply the control circuit concepts into various industrial applications

TEXT BOOKS:

T1- Bhattacharya.S.K & Brijinder Singh, *"Control of Electrical Machines"*, 2nd Edition, New Age International (P) Ltd., New Delhi, 2010.

T2- D. P. Kothari & I. J. Nagrath, *"Electric Machines"*, 4th Edition, Tata McGraw Hill Publishing Company Limited, New Delhi, 2016.

REFERENCE BOOKS:

R1- Clarence A. Phipps, *"Fundamentals of Electrical Control"*, 2nd Edition, Fairmont Press, 2011.

R2- Steve Senty, *"Motor Control Fundamentals"*, 2nd Edition, Delmar Cengage Publication, 2013.

R3- Metha.V.K. & Rohit Metha, *"Principle of Electrical Engineering"*, 2nd Edition, S.Chand & Company Ltd., New Delhi, 2010.

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33

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Programme B.E.	Course Code 16MT3205	Name of the Course PRODUCTION TECHNOLOGY	L 3	T 0	P 0	C 3

Course Objective

1. To list the fundamentals and various methods of manufacturing process
2. To choose the suitable welding process for manufacturability
3. To identify the different forming operations
4. To develop the knowledge about the casting and molding process
5. To identify the finishing operations

Unit	Description	Instructional Hours
	MACHINING	
I	Lathe and Lathe Operations - Drilling Machines - Reaming and Tapping Operations - Shaper - Planer - Slotter - Milling Machine.	9
	WELDING	
II	Welding Equipments - Electrode Types - Specification - Arc Welding - Gas Welding - Thermit Welding - Laser Beam Welding - Electron Beam Welding - Plasma Arc - Ultrasonic Welding - Friction Welding - Welding Defects.	9
	FORMING	
III	Hot and Cold Working, Rolling - Rolling Mills and Rolling Operations - Forging Operations and Drop Forging - Extrusion and Types - Sheet Metal Operations: Blanking - Piercing - Punching - Trimming.	9
	CASTING	
IV	Introduction to Casting and Patterns - Moulding and Moulding Sand - Cores & Core Making - Special Casting Process, Shell Mould Casting - Die Casting, Investment Casting and Centrifugal Casting - Casting Defects.	9
	FINISHING OPERATIONS AND APPLICATIONS OF PRODUCTION TECHNOLOGY	
V	Finishing Operations - Grinding - Lapping - Honing and Broaching. Applications: Manufacturing of Air Bag System in Automobiles - Marine Propeller Manufacturing - PCB Board Manufacturing - Aircraft Fuselage Manufacturing.	9
	Total Instructional Hours	45

Course Outcome

On completion of the course the students will be able to

CO1: Justify the most appropriate manufacturing process and material for a given product
CO2: Interpret the different welding processes used in manufacturing
CO3: Design the process parameters for rolling and sheet metal operations
CO4: Choose the suitable casting process based on the product requirements
CO5: Perform a variety of finishing operations on manufacturing products

TEXT BOOKS:

T1- Kalpakjian, *"Manufacturing Engineering and Technology"*, 4th Edition, Addison Wesley Congmen Pvt. Ltd., Singapore, 2013.
T2- Hajra Choudhury, *"Elements of Workshop Technology"*, Vol - I and II, 3rd Edition, Media Promoters and Publishers Pvt. Ltd., Mumbai, 2012.

REFERENCE BOOKS:

R1- Jain.R.K, *"Production Technology: Manufacturing Processes, Technology and Automation"*, 17th Edition, Khanna Publishers, New Delhi, 2011.
R2- Sharma.P.C, *"Production Technology: Manufacturing Processes"*, 7th Edition, S. Chand and Company Ltd., New Delhi, 2008.
R3- Chapman.W.A.J, *"Workshop Technology Vol. I and II"*, 5th Edition, Arnold Publisher, New Delhi, 2001.

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1. http://www.madehow.com/Volume-1/Air-Bag.html

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34

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Programme B.E.	Course Code 16MT3001	Name of the Course PRODUCTION TECHNOLOGY LABORATORY	L 0	T 0	P 4	C 2

Course Objective

1. To familiarize the basic concepts of manufacturing processes
2. To provide hands on training to the students on various machining operations
3. To interpret specifications and characteristics of all unconventional machines
4. To familiarize the basic concepts of finishing operations
5. To create a various gear profile from gear blanks

Unit	Description of the Experiments	Practical Hours
1	Lathe - Facing and Plain Turning.	3
2	Lathe - Step and Taper Turning.	6
3	Lathe - Grooving and External Threading.	6
4	Lathe - Drilling and Knurling.	3
5	Lathe - Boring and Internal Threading.	6
6	Drilling, Tapping and Reaming.	3
7	Milling - Face Mill.	3
8	Milling - Pocket Mill.	3
9	Milling - Gear.	3
10	Shaping - Slot Cutting.	3
11	Shaping - Dovetail Cutting.	3
12	Grinding - Surface Grinding.	3
	Total Practical Hours	45

Course Outcome

On completion of the course the students will be able to

CO1: Perform various operations on a given component using lathe
CO2: Operate milling, shaper and slotting machines on the given component to produce flat surface
CO3: Produce surface finishing for a given component.
CO4: Perform drilling, tapping and reaming operations
CO5: Produce required gear profile on the given component

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35

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Programme B.E.	Course Code 16MT3002	Name of the Course CONTROL OF ELECTRICAL MACHINES AND ELECTRONICS LABORATORY	L 0	T 0	P 4	C 2

Course Objective

1. To designing the electronic circuits using basic logic gates
2. To provide hands-on training for automatic starters of electrical motors
3. To impart knowledge on control circuits for braking, jogging and reversing operations
4. To test the characteristics of diode and transistor
5. To construct rectifier circuits using diode

Unit	Description of the Experiments	Practical Hours
1	Wire and Test the Control Circuit for Jogging in Cage Motor and Single Phase Preventer.	6
2	Wire and Test the DOL Starter and Control Circuit for Forward and Reverse Operations.	6
3	Performance Characteristics of Single Phase Transformer.	3
4	Load Test on Three Phase Induction Motor.	3
5	Wire and Test the Control Circuit for Automatic Star-Delta Starter and Semi-Automatic Star-Delta Starter.	6
6	Swinburne's Test.	3
7	Design and Implementation of Adders and Subtractors using Logic Gates.	3
8	Design and Implementation of Code Converters using Logic Gates.	3
9	Design and Implementation of 2-Bit Magnitude Comparator using Logic Gates.	3
10	Design and Implementation of Full Wave and Half Wave Rectifier using Diode.	3
11	Characteristics of Semiconductor Diode and Zener Diode.	3
12	Input and Output Characteristics of Transistor under CE Configuration.	3
	Total Practical Hours	45

Course Outcome

On completion of the course the students will be able to
CO1: To design the electronic circuits using logic gates
CO2: To create various types of starters using contactors and relays
CO3: To develop the control circuits for braking, jogging, reversing operations
CO4: To perform the load test on 3 phase Induction Motor
CO5: To analyze the performance of machines without load

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Programme	Course Code	Name of the Course	L	T	P	C
B.E.	16MT4201	THERMODYNAMICS AND FLUID ENGINEERING	3	1	0	4

Course Objective

1. To interpret the basic concepts of thermodynamics
2. To derive how to apply the steady flow energy equation to a system of thermodynamic components to estimate required balances of heat, work and energy flow
3. To explain the refrigeration systems and air conditioning
4. To identify the properties of fluids and dynamics of fluids
5. To solve the problems in fluid dimensions and incompressible fluid dynamics

Unit	Description	Instructional Hours
I	**BASIC CONCEPTS AND FIRST LAW OF THERMODYNAMICS** Working Substance - System - Ideal Gas Laws - Perfect Gas - Property - State, Process, Path and Cycle - Equilibrium - Zero law of Thermodynamics - Point and Path Functions - Quasi Static Process, Reversible and Irreversible Processes - First law of Thermodynamics - Energy - Specific Heat - Internal Energy and Enthalpy - Energy Changes in Non-flow Processes - Flow Equation.	9+3
II	**SECOND LAW OF THERMODYNAMICS** Kelvin - Plank and Clausius Statements - Basic Concepts of Heat Engines and Heat pumps (Efficiency and COP) - Corollaries of II Law - Absolute Temperature Scale, Entropy, Entropy Change for a Perfect Gas, Principle of Entropy Increase, Clausius Inequality.	9+3
III	**AIR STANDARD CYCLES, REFRIGERATION AND AIR-CONDITIONING** Otto - Diesel - Dual combustion and Brayton cycles - Principles of Refrigeration - Refrigerator & Heat Pump Cycle Refrigerants - Refrigerant Properties - Refrigerant Selection and Vapor Compression Refrigeration Cycle. Vapor Absorption Cycle - Dry Bulb Temperature, Wet Bulb Temperature, Comfort Air Conditioning, Psychometric Chart, Humidification, De Humidification, Air Coolers and Cooling Towers.	9+3
IV	**FLUID PROPERTIES AND DYNAMICS OF FLUIDS** Definition of Fluid - Properties of Fluids - Mass Density, Specific Weight, Specific Volume, Specific Gravity, Viscosity, Compressibility, Vapour Pressure, Surface Tension and Capillarity, Continuity Equation - Application of Control Volume to Continuity - Energy Equation - Euler's Equation - Bernoulli Equation - Applications of Bernoulli's Equation and Momentum Equation	9+3
V	**INCOMPRESSIBLE FLUID FLOW AND DIMENSIONAL ANALYSIS** Boundary Layer Concepts - Darcy Weisbach Equation - Laminar Flow and Turbulent Flow - Minor Losses - Flow through Pipes in Series and in Parallel. Need for Dimensional Analysis - Buckingham's π Theorem.	9+3
	Total Instructional Hours	45+15=60

Course Outcome

On completion of the course the students will be able to

CO1: Identify the different concepts in thermodynamics
CO2: Analyze the processes on TV diagrams to solve engineering problems
CO3: Describe the principles of air conditioning, refrigeration and psychometric relations
CO4: Analyze the properties of fluids
CO5: Interpret the flow of fluid through pipes in series and parallel

TEXT BOOKS:

T1- Nag.P.K, *"Engineering Thermodynamics"*, 4th Edition, Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.

T2- Yunus A. Cengel, John M. Cimbala, *"Fluid Mechanics"*, 2nd Edition, Tata McGraw Hill Publishing Company Limited, New Delhi, 2011.

REFERENCE BOOKS:

R1- Rajput.R.K, *"Engineering Thermodynamics,"* 4th Edition, Laxmi Publications (P) Ltd., New Delhi, 2010.

R2- Kumar.D.S, *"Engineering Thermodynamics"*, 2nd Edition, S.K. Kataria & Sons, 2012.

R3- Bansal.R.K, *"Fluid Mechanics and Hydraulic Machines"*, Laxmi Publications (P) Ltd., New Delhi, 1995.

R4- Streeter, V. L. and Wylie E. B., *"Fluid Mechanics"*, Tata McGraw Hill Publishing Company Limited, New Delhi, 2010.

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Programme B.E.	Course Code 16MT4202	Name of the Course CONTROL OF MECHATRONICS SYSTEMS	L 3	T 1	P 0	C 4

Course Objective	1. To solve the fundamental concepts of control systems and mathematical modeling of the system 2. To discuss the concept of time response of the system 3. To Sketch the frequency response of system 4. To develop and analysis State variable model 5. To select the controller for mechatronics applications

Unit	Description	Instructional Hours
I	**SYSTEM REPRESENTATION AND MODELLING** Introduction and Need for Control Systems with Examples - Open Loop and Closed Loop Systems - Transfer Function Model - Mathematical Modeling of Mechanical, Electrical Systems - Block Diagram Reduction - Signal Flow Graph.	9+3
II	**TRANSIENT RESPONSE ANALYSIS** Standard Test Signals - Time Response of Second Order System - Time Domain Response Performance Criteria - Routh Hurwitz Criterion - Root Locus.	9+3
III	**FREQUENCY DOMAIN ANALYSIS** Bode Plot - Polar Plot - Nyquist Stability Criterion - Stability Analysis - Lead Lag and Lag Lead Compensation - M &N Circle-Nichols Charts.	9+3
IV	**STATE SPACE ANALYSIS** Concepts of State - State Variables and State Models - State Space Equations - Transfer Function - Transfer Model, State Space Representation of Dynamic Systems, State Transition Matrix - Decomposition of Transfer Function - Controllability and Observability.	9+3
V	**BASIC CONTROLLERS** P, PI, PD and PID Controller - Tuning of Controller - Process Reaction Curve Method - Ziegler Nicol Tuning Method - Mathematical Modeling of Pneumatic, Hydraulics and Thermal System - Distributed Control System.	9+3
	Total Instructional Hours	45+15=60

Course Outcome	On completion of the course the students will be able to CO1: Derive the mathematical model of a system CO2: Describe the response of different order systems for various step inputs CO3: Analyze the stability of the system CO4: Solve system equations in state-variable form CO5: Identify controller concepts in industry

TEXT BOOKS:

T1- B.C. Kuo and F.Golnaraghi, *"Automatic Control Systems"*, 9th Edition. Wiley India Pvt. Limited., New Delhi, 2014.
T2- Curtis D. Johnson, *"Process Control Instrumentation Technology"*, 2nd Edition, PHI Learning Private Limited, New Delhi, 2006.

REFERENCE BOOKS:

R1- Katsuhiko Ogata, *"Modern Control Engineering"*, 5th Edition, PHI Learning Private Limited, New Delhi, 2010.
R2- M Gopal, *"Control Systems - Principles and Design"*, 4th Edition, McGraw Hill Education, New Delhi, 2012.
R3- Norman S. Nise, *"Control Systems Engineering"*, 6th Edition, John Wiley & Sons Inc., New York, 2010.

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Programme B.E.	Course Code 16MT4204	Name of the Course MACHINE DESIGN (APPROVED DESIGN DATA BOOK IS PERMITTED)	L	T	P	C
			3	1	0	4

Course Objective	
	1. To familiarize the fundamentals involved in design process
	2. To learn fundamental approaches to failure prevention for static and repeated loading
	3. To interpret the types of gears and principles of gear tooth action
	4. To learn the fundamentals of brakes and chain drives
	5. To impart the knowledge in selection of bearings and springs for different applications

Unit	Description	Instructional Hours
I	**DESIGN FUNDAMENTALS** Design Process - Computer Aided Design - Optimum Design - Mechanical Properties of Materials - Types of Loads - Stresses - Static, Varying, Thermal, Impact and Residual - Factors of Safety - Theories of Failure - Stress Concentration Factors.	9+3
II	**DESIGN OF SHAFTS, KEYS AND COUPLINGS** Design of Solid and Hollow Shafts - Based on Strength, Rigidity and Deflection- Torsional Rigidity - Lateral Rigidity - Material Constants - Design of Keys - Types - Keyways - Design of Rigid and Flexible Couplings.	9+3
III	**GEARS** Principles of Gear Tooth Action - Gear Correction - Gear Tooth Failure Modes - Stresses and Loads - Component Design of Spur, Helical and Bevel gears.	9+3
IV	**BRAKES AND CHAIN DRIVES** Dynamic and Thermal Aspects of Braking - Design of Brakes - Chain Drives - Selection of Transmission Chains and Sprockets - Design of Sprockets - Failure of Chain Drives.	9+3
V	**BEARINGS AND SPRINGS** Design of Bearings - Sliding Contact - Rolling Contact - Design of Journal Bearings - Calculation of Bearing Dimensions - Design of Helical and Leaf Springs.	9+3
	Total Instructional Hours	45+15=60

Course Outcome	
	On completion of the course the students will be able to
CO1:	Analyse the stress, strain and deflection simple machine elements
CO2:	Calculate safety factors of simple structures exposed to static and repeated loads
CO3:	Determine the performance requirements in the selection of commercially available machine elements such as shaft, coupling, gears, bearings and springs etc.
CO4:	Design and optimize the selection of brakes and clutches for automotive components and machine elements
CO5:	Decide an appropriate failure model

TEXT BOOKS:

T1- Joseph Edward Shigley and Charles R.Mischke, *"Mechanical Engineering Design"*, Special Indian Edition, McGraw Hill Education, New Delhi, 2011.

T2- V.B.Bhandari, *"Design of machine elements"*, 3rd Edition, Tata McGraw Hill Publishing Company Limited, New Delhi, 2010.

REFERENCE BOOKS:

R1- William Orthwein, *"Machine Component Design (Vol. I & II)"*, M/s. Jaico Publishing House, Mumbai, 2003.

R2- Maitra.G.M., and Prasad.LN., *"Hand Book of Mechanical Design"*, 2nd Edition, Tata McGraw Hill Publishing Company Limited, New Delhi, 2005.

Programme B.E.	Course Code 16MT4203	Name of the Course SENSORS AND SIGNAL CONDITIONING	L 3	T 0	P 0	C 3

Course Objective

1. To learn the fundamentals of measurements and classify the transducers and instruments
2. To impart knowledge in selection of suitable sensor for temperature, pressure, vacuum and flow measurement
3. To describe the resistance, inductance and capacitance measuring methods
4. To acquire knowledge on modern sensors and optoelectronic sensors
5. To observe information about data acquisition, data logging and application of sensors in industries

Unit	Description	Instructional Hours
I	**SCIENCE OF MEASUREMENT** Units and Standards - Calibration Techniques - Errors in Measurement - Generalized Measurement System - Static and Dynamic Characteristics of Transducers - Generalized Performance of Zero Order and First Order Systems - Response of Transducers to Different Time Varying Inputs - Classification of Transducers.	9
II	**MECHANICAL MEASUREMENTS** Temperature Measurement: Filled Thermometer - Bimetallic Thermometer - Pressure Measurement - Manometers - Elastic Transducers. Vacuum Measurement - McLeod Gauge - Thermal Conductivity Gauge - Ionization Gauge - Flow Measurement - Orifice, Venturi, Turbine Flow Meter, Hot Wire Anemometer.	9
III	**ELECTRICAL MEASUREMENTS** Resistive Transducer: Potentiometer - RTD - Thermistor - Thermocouple - Strain Gauge. Inductive Transducer: LVDT - RVDT - Capacitive Transducer - Piezoelectric Transducer - Hall Effect Sensor.	9
IV	**OPTO ELECTRONIC AND MODERN SENSORS** Photo Conductive - Photo Voltaic Cells - Semiconductor Photodiode - Photo Transistors - Digital Encoding Transducers - Optical Displacement Transducers. Smart Sensors - Film Sensors - MEMS and Nano Sensors.	9
V	**DATA ACQUISITION AND SENSOR APPLICATIONS** Introduction - Signals - Amplification - Inverting and Non Inverting Amplifier - Filtering - Low Pass and High Pass Filter - Sample and Hold Circuits - Data Acquisition - Single Channel and Multi Channel Data Acquisition - Data Logging - Tactile Sensors for Pneumatic Switch - Robotic Arc Welding Sensors for Simple Active Optical Seam Tracker - Slip Sensing Fingers.	9
	Total Instructional Hours	45

Course Outcome

On completion of the course the students will be able to

CO1:	Generalize the performance of zero and first order system
CO2:	Classify the various mechanical measurements in different applications
CO3:	Apply various electrical and electronic sensors in real time applications
CO4:	Compare modern sensors from conventional sensors by their operation and construction
CO5:	Analyze the operations of various data acquisition systems

TEXT BOOKS:

T1- Beckwith, Marangoni and Lienhard, *"Mechanical Measurements"*, 1st Edition, Pearson Education, New Jersey, 2007.
T2- AK Sawney, Puneet Sawney, *"A Course in Electrical and Electronic Measurements and Instrumentation"*, 2nd Edition, Dhanpat Rai & Company, 2010.

REFERENCE BOOKS:

R1- Patranabis.D, *"Sensors and Transducers"*, 2nd Edition, PHI Learning Private Limited, New Delhi, 2003.
R2- Doeblin E.O, *"Measurements Systems - Applications and Design"*, 2nd Edition, Tata McGraw Hill Publishing Company Limited, New Delhi, 2011.
R3- D.V.S Murthy, *"Transducer & Instrumentation"*, PHI Learning Private Limited, New Delhi, 2011.
R4- Richard D Klafter, Thomas A Chmielewski, Michael Negin, *"Robotics Engineering: An Integrated Approach"*, PHILearning Private Limited, New Delhi, 2009.

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39

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Programme B.E.	Course Code 16MT4002	Name of the Course ASSEMBLY LANGUAGE PROGRAMMING LABORATORY	L 0	T 0	P 4	C 2

Course Objective

1. To impart knowledge about microprocessor and microcontroller programs
2. To learn about different interfacing I/O devices with microprocessor and microcontroller
3. To describe stepper motor control using microprocessor
4. To study DC motor control interface using microcontroller
5. To familiarize the ARM processor and PIC controller

Unit	Description of the Experiments	Practical Hours
1	Addition and Subtraction of Two 8 - Bit Numbers using 8085 Microprocessor.	6
2	Addition of Two 16 - Bit Numbers using 8085 Microprocessor.	3
3	Subtraction of Two 16 - Bit Numbers using 8085 Microprocessor.	3
4	ADC and DAC Conversion using 8085 Microprocessor.	6
5	To Arrange a Series of Numbers in Ascending Order using 8085 Microprocessor.	3
6	Stepper Motor Control using 8085 Microprocessor.	3
7	Addition of Two 8 - Bit Numbers using 8051 Microcontroller.	3
8	Subtraction of Two 8 - Bit Numbers using 8051 Microcontroller.	3
9	Multiplication of 8 - Bit Numbers using 8051 Microcontroller.	3
10	Division of 8 - Bit Numbers using 8051 Microcontroller.	3
11	Largest and Smallest Element in an Array using 8051 Microcontroller.	6
12	DC Motor Control Interface using 8051 Microcontroller.	3
	Total Practical Hours	45

Course Outcome

On completion of the course the students will be able to

CO1: Compile program for 8085 microprocessor and 8051 microcontroller
CO2: Design interfacing circuits with 8085 microprocessor & 8051 microcontroller
CO3: Implement stepper motor interfacing with microprocessor
CO4: Demonstrate DC motor control using microcontroller
CO5: Develop a microprocessor and microcontroller based system for mechatronics applications

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Programme B.E.	Course Code 16MT4001	Name of the Course SENSORS AND SIGNAL CONDITIONING	L 0	T 0	P 4	C 2

Course Objective

1. To acquire knowledge on sensors and transducers
2. To provide hands on experience in measurement of different signals using sensor and processing them in required form
3. To experiment the measurement of displacement using LVDT and capacitive transducers
4. To design a circuit to convert voltage to frequency and frequency to voltage signal
5. To design and test the amplifier, differentiator and intergrator

Unit	Description of the Experiments	Practical Hours
1	Measurement of Temperature using Thermistor and Thermocouple.	6
2	Measurement of Displacement using LVDT and Capacitive Transducer.	6
3	Strain Measurement using Strain Gauge.	3
4	Servomotor Position Control using Photo Electric Pickup.	3
5	Position and Velocity Measurement using Encoders.	3
6	Wave Shaping Circuit.	3
7	Voltage to Frequency Converter.	3
8	Frequency to Voltage Converter.	3
9	Measurement of Resistance using Wheatstone's Bridge and Kelvin's Double Bridge.	3
10	Design and Testing of Inverting, Non-inverting and Differential Amplifiers.	6
11	Design and Testing of Differentiator and Integrator.	3
12	Design and Testing of Sample and Hold Circuit.	3
	Total Practical Hours	45

Course Outcome

On completion of the course the students will be able to

CO1: Apply the sensors for the measurement of different signals and use of signal processing techniques to convert them to useful signal

CO2: Choose and apply suitable transducers for various measurement purposes

CO3: Select sensors for practical problems

CO4: Design different amplifier circuits

CO5: Interpret the operation of sample and hold circuit

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43

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Programme B.E.	Course Code 16MT4206	Name of the Course ENGINEERING METROLOGY AND MEASUREMENTS	L 3	T 0	P 0	C 3

Course Objective

1. To describe the principle of dimensional metrology
2. To discuss various linear and angular measurements
3. To identify the various types of errors using different instruments
4. To familiarize the principles, techniques and devices used for quality control in modern Industrial environment
5. To acquire the knowledge on various metrological equipments

Unit	Description	Instructional Hours
I	**BASIC OF MEASUREMENTS** Basic Concept of Measurement: Sensitivity, Stability, Range, Accuracy and Precision - Errors - Types of Errors - Standards of Measurement - Geometric Dimensioning, Tolerance - Types, Fits - Types.	9
II	**LINEAR AND ANGULAR METROLOGY** Linear Metrology: Vernier, Micrometer Measurement, Dial Indicator, Slip Gauges and Classification, Optical Flats - Limit Gauges, Comparators - Mechanical, Pneumatic and Electric Types, Applications. Angular Metrology: Sine Bar, Optical Bevel Protractor, Auto Collimator, Angle Decker - Taper Measurements.	9
III	**SURFACE MEASUREMENTS** Surface Finish Measurement - Terminology - Roughness - Waviness - Analysis of Surface Finish - Stylus Probe Instrument - Talysurf Screw Thread Metrology: Errors in Thread - Pitch Error - Drunkenness - Measurement of Various Elements of Thread - Two and Three Wire Method, Measurement of Gears - Measurement of Various Elements of Gear - Tooth Thickness - Constant Chord and Base Tangent Method - Parkinson Gear Tester.	9
IV	**ADVANCED TECHNIQUES IN METROLOGY** Coordinate Measuring Machine - Constructional Features - Types and Application, Machine Vision Systems, Profile Projector, Universal Measuring Machine, Laser principles - Laser Interferometer - Types - DC and AC Lasers Interferometer.	9
V	**APPLICATIONS OF MEASUREMENTS** Applications - Flow Measurements in Chemical Pipelines - Vehicle Tire Pressure Measurement, Temperature Measurement in Furnace - Force Measurements in Brake Pedal and Torque Measurements in Motors.	9
	Total Instructional Hours	45

Course Outcome

On completion of the course the students will be able to

CO1: Analyze the uncertainties in dimensional metrology and use the measurement standards
CO2: Apply geometric tolerance in design of engineering components
CO3: Choose the proper method to find the errors in surface and screw threads
CO4: Measure the complex profile using advanced techniques
CO5: Select the right measuring tool with decided accuracy for a given application

TEXT BOOKS:

T1- Ernest O Doebelin, *"Measurement Systems - Applications and Design"*, 4th Edition, Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.
T2- R. K. Jain, *"Engineering Metrology"*, 20th Edition, Khanna Publishers, New Delhi, 2013.

REFERENCE BOOKS:

R1- Thomas G Beckwith, Lienhard, Roy D. Marangoni, John H. Lienhard V *"Mechanical Measurements"*, 6th Edition Addison Wesley, 2009.
R2- Anand K Bewoor, Vinay A Kulkarni, *"Metrology and Measurement"*, 1st Edition, Tata McGraw Hill Publishing Company Limited, New Delhi, 2009.

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42

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Programme B.E.	Course Code 16MT4205	Name of the Course MICROCOMPUTER SYSTEMS AND MICROCONTROLLER	L 3	T 0	P 0	C 3

Course Objective	1. To impart knowledge on the basics of microcomputer systems 2. To introduce commonly used peripheral / interfacing ICs and simple applications to the students 3. To familiarize about the basic of 8051 microcontroller 4. To learn the programming language of 8051 microcontroller 5. To list out the applications of microprocessor and microcontroller in various field

Unit	Description	Instructional Hours
I	**MICROCOMPUTER SYSTEMS** Microcomputer - Components - Microprocessor 8085: Architecture, Internal Register Organization and Pin Configuration - Instruction Set of 8085 - Addressing Modes - Methods of 8085 Programs - Interrupts.	9
II	**INTERFACING DEVICES** Need for Interfacing - Programmable Peripheral Device (8255) - Programmable Communication Interface (8251) (USART) - Programmable Interrupt Controller - Programmable DMA Controller (8257).	9
III	**8051 MICROCONTROLLER** Selection of Microcontrollers - 8051 Microcontroller Architecture - Pin Configuration - Memory Organization - Special Function Registers - Program Counter - PSW Register - Stack and Stack Pointer - Timers - Counters.	9
IV	**ASSEMBLY LANGUAGE PROGRAMMING** I/O Port Programming - Timer Programming - Counter Programming - Serial Communication Programming - Interrupt Programming - A/D and D/A Converters.	9
V	**MICROPROCESSOR AND MICROCONTROLLER APPLICATIONS** Interfacing of Sensors - Temperature - Pressure - Level - Proximity Switches - Stepper Motor Control - DC Motor Speed Control - Case Studies: Automotive Applications, Robotic Applications & Aerospace Applications.	9
	Total Instructional Hours	45

Course Outcome	On completion of the course the students will be able to CO1: Interpret the configuration and constructional details of 8085 microprocessor CO2: Implement different microprocessor interfacing techniques CO3: Apply basic skills for interfacing common devices to microcontroller CO4: Develop skill in programming for 8051 Microcontroller CO5: Enumerate various applications interfacing with microcontroller

TEXT BOOKS:

T1- A. Nagoor Kani, *"Microprocessors & Microcontrollers"*, 2nd Edition, Tata McGraw Hill Publishing Company Limited, New Delhi, 2002.

T2- David G. Alciatore and Michael B. Histand, *"Introduction to Mechatronics and Measurement Systems"*, 4th Edition, Tata McGraw Hill Publishing Company Limited, New Delhi, 2011.

REFERENCE BOOKS:

R1- V. Douglas Hall, *"Microprocessors and Interfacing Programming and Hardware"*, 2nd Edition, Tata McGraw Hill Publishing Company Limited, New Delhi, 2002.

R2- Ramesh Goankar, *"Microprocessor Architecture, Programming and Applications with 8085"*, 2nd Edition, Penram International, Mumbai, 2009.

R3- Mazidi Muhammad Ali, Mazidi Janice Gillispie and McKinlay Rolin, *"The 8051 Microcontroller and Embedded Systems"*, 2nd Edition, PHI Learning Private Limited, New Delhi, 2013.

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2. http://home.roboticlab.eu/en/microcontrollers.

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41

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Programme B.E.	Course Code 16MT4003	Name of the Course SOLID AND FLUID MECHANICS LABORATORY	L 0	T 0	P 4	C 2

Course Objective

1. To demonstrate various performance tests on engineering materials
2. To provide knowledge on deflection test and compression test on materials
3. To impart knowledge of various flow meters and the concept of fluid mechanics
4. To obtain knowledge on the performance characteristics of various pumps
5. To impart knowledge on strengthening of engineering materials

Unit	Description of the Experiments	Practical Hours
		6
1	Tension and Torsion Test on a Mild Steel Rod.	3
2	Deflection Test on Beams.	3
3	Compression Test on Helical Springs.	3
4	Impact Test on Mild Steel Rod (Izod & chropy).	3
5	Hardness Test on Metals by Brinell and by Rockwell Hardness.	3
6	Double Shear Test on Mild Steel Rod.	6
7	Determination of Coefficient of Discharge by Venturimeter and Pitot Tube.	3
8	Experimental and Verification of Bernoulli's Equation.	6
9	Conducting Experiments and Drawing the Characteristic Curves of Centrifugal Pump and Gear Pump.	
10	Conducting Experiments and Drawing the Characteristic Curves of Pelton Wheel Turbine.	3
11	Conducting Experiments and Drawing the Characteristic Curves of Kaplan Turbine.	3
12	Study of Strengthening Mechanism of Engineering Materials.	3
	Total Practical Hours	**45**

Course Outcome

On completion of the course the students will be able to

CO1: Evaluate the different types of mechanical properties of engineering materials
CO2: Calculate the different stresses and strain of engineering materials
CO3: Apply the concepts of fluid energy in fluid flow applications
CO4: Calculate the performance characteristics of various pumps
CO5: Apply the measurement equipment for flow measurement

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45

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