Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

Course Contents (Syllabus) for

First Year B. Tech.
(All Programs)
Sem - I to II

AY 2020-21

Title of the Course: 5PH 101 Engineering Physics	L	T	P	Cr
	3	-	-	3

Pre-Requisite Courses: Students are expected to know the basic concept in Physics.

Textbooks: 1. M. N. Avadhanulu and P. G. Kshirsagar, "A Text book of Engineering Physics" S.Chand and Company, New Delhi. Revised edition 2014
2. R. K. Gaur and S. L. Gupta "Engineering Physics", Dhanpat Rai Publications, New Delhi. Edition: 2011

References:

1. Halliday, Resnic and Walker, "Fundamentals of Physics", John Wiley, 9th edition 2011.
2. A. Beiser, "Concepts of Modern Physics", McGraw Hill International, 5th edition, 2003.
3. Ajoy Ghatak, "Optics", Tata McGraw Hill 5th edition, 2012.
4. P. M. Mathews, K. Venkatesan, "Text Book of Quantum Mechanics", Tata McGraw Hill 2nd Edition, 2010
5. M.K Harbola, "Engineering Mechanics", Cengage 2nd edition, 2013.
6. D. Kleppner & R. Kolenkow, "An Introduction to Mechanics", McGraw Hill Education, 1st edition 2017

Course Objectives:

1. To provide basic concepts to solve many engineering and technical issues.
2. To give deep insights into the understanding of engineering courses.
3. To encourage them to understand engineering and technical development.

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive level	Bloom's Cognitive Descriptor
CO1	**Describe** optical phenomenon such as interference, diffraction polarization and in terms of wave model. **Explain** the methods of production and detection methods of ultrasonic waves and its applications.	**I**	**Understanding**
CO2	**Explain** Planck's quantum hypothesis, Compton effect, Heisenberg's uncertainty principle, Schrödinger's wave equations and their applications; **Show** motion of particle under central force field. **Discuss** two body problem, energy equation and diagram,	**II**	**Understanding**
CO3	**Apply** Kepler's law; **Use** the concepts of transducer and sensor, **Classify** transducers, and sensors and their applications. **Classify** solids on the basis of band theory; **Explain** fermi level and its behaviour in metal, semiconductor and insulator. **Solve** the problems on electrical conductivity and Hall effect.	**III**	**Applying**

CO-PO Mapping:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	**2**													
CO2	**2**													
CO3	**2**													

Assessments:

Teacher Assessment: Two components of In-Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50

ISE-1 and **ISE-2** are based on assignment/declared test/quiz/seminar etc.
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with 70-80% weightage for course content (Normally last three modules) covered after MSE.

Course Contents:

Module 1: Optics	**7Hrs.**
Introduction, types of optics, diffraction, types of diffraction, Fresnel's diffraction: Fresnel's half period zones, zone plate, diffraction at straight edge. Fraunhofer's diffraction: diffraction due to single slit, double slits, plane diffraction grating. Polarization: optical activity, specific rotation of optical active substances, Laurent's half shade polarimeter.	
Module 2: Quantum Physics	**7Hrs.**
Introduction, black body radiation, Planck's quantum theory, Wien's displacement law and Rayleigh – Jeans law, phase velocity, group velocity and particle velocity, de-Broglie's hypothesis, Compton effect: theory and experimental verification, Heisenberg's uncertainty principle and its applications, wave function and its physical significance, Schrödinger's wave equation: time independent and time dependent, applications of Schrödinger's wave equation.	
Module 3: Ultrasonics	**7Hrs.**
Introduction, classification of sound, ultrasonic waves, generation of ultrasonic waves (Magnetostriction and Piezoelectric method), detection of ultrasonic waves by Kundt's tube, thermal detection and sensitive flame method, velocity of ultrasonic waves in liquid, applications of ultrasonic waves in scientific and engineering field.	
Module 4: Solid State Physics	**6Hrs.**
Introduction, formation of energy bands in solid, classification of solid on the basis of band theory, number levels in band, density of states, Fermi-Dirac statistics, Fermi level, variation of Fermi level with change in temperature for semiconductor, electrical conductivity of metal and semiconductor, Hall effect, basic concept of p-n junction.	
Module 5: Gravitation and Central Force Motion	**8Hrs.**
Law of gravitation, Gravitational potential energy, Inertial and gravitational mass, Potential and field due to spherical shell and solid sphere, Motion of a particle under a central force field, Two body problem and its reduction to one-body problem and its solution, The energy equation and energy diagram, Kepler's Laws, Satellite in circular orbit and applications, Geosynchronous orbits.	
Module 6: Computer Instrumentation	**6Hrs.**
Introduction, instrumentations, measurement system, control system, Transducer and Sensor: transducers, sensors, classification of transducers, characteristics of transducers, selection criterion for transducers, temperature transducers, strain gauge, pressure transducers, force transducers, optical transducers, actuators.	

Module wise Measurable Students Learning Outcomes :

After the completion of the course the student should be able to:

Module-1: Describe Fresnel's and Fraunhofer type diffraction, polarization and applications in technological field.

Module-2: Use the concepts of quantum mechanics and apply for solving the problems.

Module-3: Acquire the knowledge of ultrasonic waves and implement in various fields.

Module-4: Explain the formation of bands in solid and acquire the knowledge of fermi level, electrical conductivity, Hall Effect and formation of p-n junction.

Module-5: Discuss two body problem, energy equation and diagram, Kepler's law.

Module-6: Distinguish between sensors and transducers, and use in the proper system for controlling the desired physical quantities.

Title of the Course: Engineering Mathematics –I **Course Code: 5MA101**	L	T	P	Cr
	3	**1**	**-**	**4**

Pre-Requisite Courses:

Textbooks:

1. "A Text Book of Applied Mathematics, Vol I and II", P. N. and J. N. Wartikar, Vidyarthi Griha Prakashan, Pune, 2006.
2. "Higher Engineering Maths", B .S. Grewal, Khanna Publication, 2005, 39th Edition.

References:

1. "Advanced Engineering Mathematics", Erwin Kreyszig, Wiley Eastern Limited Publication, 1978, 1st Edition
2. "*Advanced Engineering Mathematics",* Wylie C.R., Tata McGraw Hill Publication, 1999, 8th Edition.
3. *Advanced Engineering Mathematics",* H. K. Dass, S. Chand & Company Ltd., 1988, 1st Edition.

Course Objectives :

1. To develop mathematical skills and enhance thinking power of students.
2. To introduce fundamental concepts of mathematics and their applications in engineering fields.

Course Learning Outcomes:

CO	**After the completion of the course the student should be able to**	Bloom's Cognitive	
		level	Descriptor
CO1	Illustrating mathematical concepts in engineering field.	II	Understanding
CO2	Use mathematical and computational methods to solve problems in science and engineering field	III	Applying

CO-PO Mapping :

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
CO1	**2**										
CO2	**2**										

Assessments :

Teacher Assessment:

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar etc.
MSE: Assessment is based on 50% of course content (Normally first three modules)

ESE: Assessment is based on 100% course content with60-70% weightage for course content (normally last three modules) covered after MSE.

Course Contents:

Module 1 : Matrices: Rank of matrix, Homogeneous and non-homogeneous linear equations, symmetric and skew symmetric and orthogonal matrices, Eigen values, Eigen vectors, Cayley Hamilton theorem, Diagonalisation of matrices.	**6Hrs.**
Module 2: Calculus: Rolle's theorem, Mean value theorem, Taylor's and Maclaurin's theorem with remainders, L'hospital rule and indeterminate forms	**6Hrs.**
Module 3: Complex Number: Polar form of complex number, Argand's diagram, De Moiver's theorem, roots of complex number, Hyperbolic function, exponential form of complex number, relation between circular and hyperbolic function.	**7Hrs.**
Module 4: Partial Differentiation and its application : Partial derivative, chain rule for partial differentiation, Euler's theorem for homogeneous and non-homogeneous function, Jacobian, Error and approximation, maxima and minima of function of two variables.	**8Hrs.**
Module 5: First order ODE and its application: Exact, Linear, Bernoulli's equations, Euler's equations, Orthogonal trajectory, applications to simple electric circuit.	**8Hrs.**
Module 6: Curve tracing: Tracing of curves for Cartesian and polar coordianate.	**5Hrs.**

Title of the Course: Engineering Mechanics (5CV101)	L	T	P	Cr
	3	0	0	3

Pre-Requisite Courses: Physics

Textbooks:

1. Ramamrutham., S. *"Textbook of Applied Mechanics",* Dhanpat Rai Publishing Company Limited, 2008.
2. Bhavikatti., S. S. and Rajashekarappa., K. G. *"Engineering Mechanics",* New Age International Publishers, 2015, 5th Edition.
3. Khurmi. R. S., *"Textbook of Applied Mechanics",* Tata McGraw Hill Publishing Company, 2013, 20th Revised Edition.

References:

1. Beer, F. P. and Johnston, E. R. *"Vector Mechanics for Engineers Vol. I and II",* McGraw Hill Company Publication, 2011, 9th Edition.
2. Singer, F. L. *"Engineering Mechanics Statics & Dynamics",* B. S. Publications, 2011.
3. Timoshenko, S. and Young, D. H. *"Engineering Mechanics"*, McGraw Hill Companies, 2008, 4th Edition.
4. Meriam, L. and L.G. Kraige, "*Engineering Mechanics – Dynamics"*, John Wiley & Sons, 2002, 6th Edition.

Course Objectives :

1. To impart knowledge of mechanics concepts applicable to civil and mechanical engineering.
2. To illustrate behavior of static bodies using mechanics concepts.
3. To provide knowledge of motions, forces and work energy principles and its engineering applications.

Course Learning Outcomes:

CO	**After the completion of the course the student should be able to**	Bloom's Cognitive	
		Level	Descriptor
CO1	**Apply** laws and basic concepts of mechanics of rigid bodies.	II	Understanding
CO2	**Analyze** system of forces in Statics and Dynamics.	IV	Analyzing
CO3	**Apply** concept of mechanics to solve engineering problems.	III	Applying

CO-PO Mapping :

PO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	**2**	**2**										
CO2	**3**	**2**										
CO3	**3**	**2**										

Teacher Assessment:

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar etc.
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with 70-80% weightage for course content (normally last

three modules) covered after MSE.

Course Contents:

Module 1: Equilibrium of Forces	**Hrs.**
Fundamental concepts and axioms, Types of Force Systems, Composition and resolution of forces, Moment of a force, Couple, Resultant of planar force systems. Equilibrium of forces- Free body diagrams, Equations of equilibrium, Equilibrium of planar systems, Equilibriums of beams- Types of loads and supports. Friction-Laws of friction, equilibrium of bodies on inclined plane, applications- problem involving wedges, ladders etc.	**8**
Module 2: Virtual work and Moment of inertia	**Hrs.**
Principle of Virtual work- applications to statically determinate simple and compound beams. Centre of gravity and Centroid, Moment of inertia, Radius of gyration, Mass-Moment of inertia.	**6**
Module 3: Analysis of plane frames	**Hrs.**
Pin-jointed statically determinate plane trusses- Assumptions, imperfect, perfect and redundant trusses, Analysis of statically determinate trusses, method of joints, method of sections and graphical method.	**6**
Module 4: Kinematics of particles	**Hrs.**
Rectilinear motion of a particle under uniform and variable acceleration, Equations of motion, Motion under gravity, Relative motion, Motion of a projectile, Curvilinear motion of a particle, Relation between linear and angular motion.	**7**
Module 5: Kinetics of particles	**Hrs.**
Newton's laws of motion, D'Alemberts principle. Rectilinear motion- Motion on a rough inclined plane, motion of a lift, motion of connected bodies, Circular motion- Centripetal and centrifugal force, motion of a bicycle, Car along a curved track, super elevation of roads and railway curves, Kinetics of rotation-Torque, mass moment of inertia, problems on centroidal and non centroidal rotation.	**7**
Module 6: Kinetics	**Hrs.**
Work energy method- potential energy, kinetic energy, law of conservation of energy. Impulse momentum method. Collisions- impact, collision of bodies, coefficient of restitution, loss of kinetic energy due to impact.	**6**

Module wise Measurable Students Learning Outcomes :

After the completion of the course the student should be able to:

1. Apply fundamental knowledge of engineering mechanics for rigid bodies under system of forces.
2. Use virtual work principle for analysis of beams. Evaluate various sectional properties such as centre of gravity, moment of inertia etc.
3. Analyse various types of statically determinate pin jointed trusses with analytical as well as graphical methods.
4. Apply knowledge of kinematics of rigid body motion to solve engineering problems in dynamics.
5. Apply knowledge of kinetics of rigid body motion to solve engineering problems in dynamics and recognition of the importance of safety in phases of engineering design and practice.
6. Analyze the impact of work power and energy on engineering problems.

Title of the Course: English for Professional Communication **Course Code : 5HS101**	L	T	P	Cr
	2	1	0	3

Pre-Requisite Courses: Higher Secondary Level

Textbooks:

References:

1. K.R.Laxminarayanan, *English for Technical Communication,* Scitech, Sixth Edition, 2008
2. William Sanborn Pfeiffer ,T.V.S. Padmaja ,*Technical Communication: A Practical Approach,* Pearson, Sixth Edition 2012
3. A.K.Jain, Praveen Bhatia, A.M.Shaikh, *Professional Communication Skills,* S. Chand and Co: Fifth edition ,2009
4. Ashraf Rizvi ,*Effective Technical Communication,* Tata McGraw Hills publishing Company 2006
5. F.T.Wood,Remedial English Grammar, Macmillan, 2007
6. Andrea J.Rutherford,Phd. *Basic Communication Skills for Technology,* Pearson Education Asia,2001
7. Exercises in Spoken English, Parts 1 and II CIEFL, Hyderabad , Oxford University Press
8. Sanjay Kumar, Pushplata , *Communication Skills*, Oxford University Press, First edition ,2012

Course Objectives :

1. Inculcate the importance of Technical English Communication Skills
2. Enhance their communicative competence
3. Enable the students to communicate with clarity and precision
4. Prepare the students to acquire structure and written expression required for their profession and enable them to acquire proper behavioral skills.

Course Learning Outcomes:

After completing this course students will be able to:

1. Communicate clearly, precisely and competently in different scenario.
2. Demonstrate the information through oral, written and graphic messages.
3. Acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

CO	**After the completion of the course the student should be able to**	Bloom's Cognitive	
		level	Descriptor
CO1	Communicate clearly, precisely and competently in different scenario	III	Applying
CO2	Demonstrate the information through oral , written and graphic messages	II	Understanding
CO3	Acquire basic proficiency in English including reading and listening comprehension ,writing and speaking skills	III	Applying

CO-PO Mapping :

PO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PS 01**	**PS O2**
CO1										3				
CO2										3				
CO3										3				

Assessments :

Teacher Assessment:

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Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar etc.
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with 70-80% weightage for course content (normally last

three modules) covered after MSE.	
Course Contents:	
Module 1: Sentence Structure and Vocabulary Building 1. Subject Verb Agreement 2. Modal verbs 3. Question tags 4. Connectives 5. Synonyms, Antonyms, and Standard abbreviations 6. Redundancies 7. Misplaced Modifiers 8. Passives	**5 Hrs.**
Module 2 : Fundamentals of Communication 1. Features and Functions 2. Importance of Communication 3. The Communication Process 4. Barriers and Breakdown of Communication 5. Communication in an Organization i. Upward communication ii. Downward communication iii. Horizontal communication iv. Diagonal communication v. Informal communication / Grapevine communication	**3 Hrs.**
Module 3 : Nature and Style of Writing 1. Describing 2. Defining 3. Classifying 4. Providing examples or evidence 5. Writing Introduction and Conclusion	**3.Hrs.**
Module 4 : **A. Non Verbal Communication** 1. Kinesics or Body Language 2. Proxemics : Space Distance 3. Haptic 4. Vocalic : Paralinguistic features i. Pitch ii. Volume iii. Pauses iv. Rate of words/minute 5.Chronemics 6.Nonverbal Barriers **B. Listening Skills** 1. Process of Listening 2. Types of Listening 3. Barriers to effective Listening	**2Hrs.** **2Hrs.**
Module 5 : **A. Oral Communication**	**4 Hrs.**

1. Speeches for different Occasions (Welcome Speech , Introductory Speech, Vote of Thanks Speech) 2. Group Presentations 3. Group Discussions 4. Individual Presentations 5. Job Interviews **B. Basics of Phonetics** 1. Improper Pronunciation 2. Classification of Sounds in English 3. Word Stress 4. Sentence Stress or Intonation 5. Pronunciation and Articulation	**1 Hrs.**
Module 6 : Writing Communication **A. Basic Writing Skills :** 1. Paragraph Writing 2. Comprehension 3. Essay Writing 4. Sentence Structures 5. Use of phrases & clauses in sentences 6. Importance of proper punctuations 7. Creating coherence 8. Organising the principles of paragraphs in documents 9. Techniques for writing precisely **B. Business Correspondence** : 1. Job Applications 2. Complaint Letters and Adjustment Letters 3. Inquiry and Order **C**. **Official Correspondence :** **1**. Memorandums 2. Circulars 3. Notices **D** .**Report Writing** : 1. Individual Report 2. Lab Report 3. Inspection Reports	**2Hrs.** **2Hrs.** **2Hrs.** **2Hrs.**

Module wise Measurable Students Learning Outcomes :

Module 1: Construct different types of sentences

Module 2: Communicate effectively and avoid barriers

Module 3: Understand the different styles of writing.

Module 4: Demonstrate the advantages and limitations of non verbal Communication

Module 5: Acquire proficiency in technical English and communicate confidently in different Formal situations.

Module 6: Write effective paragraphs, reports, letters and practice written communication effectively.

After the completion of the course the student should be able to:

1. Enrich their Vocabulary.
2. Improve their sentence structure.
3. Communicate confidently in different formal situations

Tutorial: Computer Usage / Lab Tool :
Language lab activities are conducted on computers
Laboratory Experiences:
1. Listening and reading skills improved
2. Thinking and concentration are developed
Independent Learning Experiences:
Students prepare for Seminars, presentations, Group Discussions and also Written Tests confidently.

Title of the Course: Programming for problem solving **Course code: 5CS101**	L	T	P	Cr
	2	0	0	2

Desirable requirements: Basic course of software and hardware programming.

Textbooks:

1. Byron Gottfried, Schaum's, "Outline of Programming with C", McGraw-Hill, Third edition, 2017.
2. Yashavant Kanetkar, "Let Us C", BPB Publication, Fifteenth edition, 2016.
3. E. Balagurusamy, "Programming in ANSI C", Tata McGraw-Hill Education, Seventh edition, 2016.

References:

1. Brian W. Kernighan and Dennis M. Ritchie, "The C Programming Language", Prentice Hall of India, Second Edition, 2015.

Course Objectives :

- To imbibe an understanding of programming.
- To develop problem-solving skills to translate text described problems into programs written using the Programming language with the help of language constructs.
- To impart knowledge on general principles of computer languages such as: conditional branching, loops, block structures, functions, and input/output.

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive	
		level	Descriptor
CO1	**paraphrase** the basics of programming	2	Understanding
CO2	**convert** the algorithms to programs	2	Understanding
CO3	**apply** programming language principles and constructs to solve problems	3	Applying

CO-PO Mapping :

PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	2	1										
CO2	2	1										
CO3	3	2	1									

1: Low, 2: Medium, 3: High

Assessments :

Teacher Assessment:

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar etc.
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with 70-80% weightage for course content (normally last three modules) covered after MSE.

Course Contents:

Module 1: Introduction to Programming	**Hrs.**
Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.) Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudocode with examples. **From algorithms to programming Language**: source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code.	**4**
Module 2: Arithmetic expressions, Precedence constraints, Conditional Branching & Loops	**Hrs.**
Arithmetic expressions & Precedence : Arithmetic, relational and logical operators, increment and decrement operators, conditional operator, bit-wise operators, assignment operators, expressions, type conversions, conditional expressions, precedence and order of evaluation **Conditional Branching & Loops:** Statements and blocks, if and switch statements, Loops- while, do-while and for statements, break, continue, goto and labels.	**4**
Module 3: Arrays	**Hrs.**
Arrays- concepts, declaration, definition, accessing elements, storing elements, arrays and functions, two-dimensional arrays, Character arrays, Strings, and applications of arrays.	**5**
Module 4: Functions and Recursion	**Hrs.**
Designing structured programs, Functions basics, parameter passing, call by value, idea of call by reference, storage classes like extern, auto, register, static, scope rules, block structure, user defined functions, Recursion with examples.	**4**
Module 5: Pointers, Structures and Union	**Hrs.**
Pointers- concepts, initialization of pointer variables, pointers and function arguments, address arithmetic, Character pointers and functions, pointer to pointer. Derived types: structures- declaration, definition and initialization of structures, accessing structures, nested structures, arrays of structures, structures and functions, pointers to structures, self-referential structures, and unions.	**5**
Module 6: Introduction to File handling	**Hrs.**
Input and output - concept of a file, text files and binary files, streams, standard I/O, Formatted I/O, file I/O operations, error handling.	**4**

Module wise Measurable Students Learning Outcomes :

After the completion of the course the student should be able to:

Module 1

- grasp basics of representing problems into flowchart/pseudocode/algorithm.
- grasp the basics of programming languages.
- convert simple algorithms to programs.

Module 2:

- grasp and formulate simple algorithms by using arithmetic expression and logical operators.
- apply conditional branching, iterations to solve a problem using programming language.

Module 3:

- apply arrays to formulate algorithms and programs.
- apply programming to solve matrix addition, multiplication problems and searching/ sorting problems.

Module 4:

- apply functions to decompose problems.
- use recursive functions to solve problems.

Module 5:

- apply pointers, structures and union to formulate algorithms and programs.

Module 6:

- grasp fundamentals of file handling.

Title of the Course: Engineering Mechanics Lab (5CV151)	L	T	P	Cr
	--	--	2	1

Pre-Requisite Courses: Engineering Mechanics

References:

1. Bhavikatti., S. S. and Rajashekarappa., K. G. *"Engineering Mechanics",* New Age International Publishers, 2015, 5th Edition.
2. Khurmi. R. S., *"Textbook of Applied Mechanics",* Tata McGraw Hill Publishing Company, 2013, 20th Revised Edition.

Course Objectives :

1. To conduct the experiments to verify the principles of mechanics.
2. To execute the graphical methods to verify the analytical solutions.

Course Learning Outcomes:

CO	**After the completion of the course the student should be able to**	Bloom's Cognitive	
		level	Descriptor
CO1	**Demonstrate** verification of laws and basic principles of mechanics through experiments.	III	Applying
CO2	**Execute** the experiments to verify the laws of mechanics analytically and graphically.	III	Applying

CO-PO Mapping :

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	3	2			2							
CO2	3	2			2							

Assessments :

Teacher Assessment:

In Semester Evaluation (ISE), and End Semester Examination (ESE) having 50% weights each.

Assessment	Marks
ISE	100
ISE is based on experimental work/performance in laboratory/assignment/declared test/etc.	

Course Contents:

LIST OF EXPERIMENTS

1. To verify of law of triangle of forces.
2. To verify of law of polygon of forces.
3. Determine the support reactions for Simply Supported Beam.
4. To verify the principle of moments with the help of Bell crank lever apparatus.
5. Determine the coefficient of friction for motion on horizontal plane.
6. Determine the coefficient of friction for motion on inclined plane.
7. Determine efficiency of simple screw jack apparatus.
8. Determine efficiency of worm and worm wheel apparatus.
9. Graphical solution for concurrent and non-concurrent coplanar force system.
10. Graphical solution of statically determinate Beams.
11. Graphical solution of pin jointed perfect plane frames.

Lab Assessment:

There are four components of lab assessment, LA1, LA2, LA3 and Lab ESE.
IMP: Lab ESE is a separate head of passing.

Assessment	Based on	Conducted by	Conduction and Marks Submission	Marks
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 4 Submission at the end of Week 5	25
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 5 to Week 8 Submission at the end of Week 9	25
LA3	Lab activities, attendance, journal	Lab Course Faculty	During Week 10 to Week 14 Submission at the end of Week 14	25
Lab ESE	Lab Performance and related documentation	Lab Course faculty	During Week 15 to Week 18 Submission at the end of Week 18	25

Week 1 indicates starting week of Semester.
Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming and other suitable activities, as per the nature and requirement of the lab course.
The experimental lab shall have typically 8-10 experiments.

Title of the Course: Workshop Practices LAB **Course code: 5ME152**	L	T	P	Cr
	0	**0**	**02**	**01**

Pre-Requisite Courses:

Textbooks:

1. Raghuwanshi B. S.,"*A Course in Workshop Technology I*",DhanapatRai Publications,10th Ed.2009
2. S. K. Hajra Choudhury and A. K. HajraChoudhary,"*Workshop Technology" – Vol I [Manufacturing Processes]*", , Media Promoters and Publishers Pvt. Ltd., 10th edition, reprint 2001

References:

1. W.A.J. Chapman, *"Workshop Technology Volume I"*, CBS Publishing & Distributors, Delhi. [ISBN-13:9788123904016] 2001
2. Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata McGrawHill House,2017.
3. Gowri P. Hariharan and A. Suresh Babu,"Manufacturing Technology – I" Pearson Education, 2008

Course Objectives :

1. To train the students to use different tools and equipments involved in the manufacturing processes.
2. To develop the skills to handle the basic machine tools and equipments required for various manufacturing processes.
3. To prepare the students to carry out the various operations to make a finished product.
4. Train the students for making PCB for electronic applications.

Course Learning Outcomes:

CO	After the completion of the course the student should be able t	Bloom's Cognitive	
		Level	Descriptor
CO1	Describe the methods, operations and processes of manufacturing	II	Understanding
CO2	Summarize the simple mechanical systems, machines, equipment's, the basic working of cutting tools for manufacturing.	II	Understanding
CO3	Use of chemical etching technique for making the PCB for electronic applications.	III	Applying

CO-PO Mapping : For Mechanical

	1	2	3	4	5	6	7	8	9	10	11	12	PSO-1	PSO-2
CO1	~~L~~			L										
CO2	~~L~~			L										
CO3	~~L~~				L									

Lab Assessments :

There are four components of lab assessment, LA1, LA2, LA3 and Lab ESE.
IMP: Lab ESE is a separate head of passing.

Assessment	Based on	Conducted by	Conduction and Marks Submission	Marks
LA1	Lab activities, attendance, journal	Lab batch Faculty	During Week 1 to Week 4 Submission at the end of Week 5	25
LA2	Lab activities,	Lab batch Faculty	During Week 5 to Week 8	25

	attendance, journal		Submission at the end of Week 9	
LA3	Lab activities, attendance, journal	Lab batch Faculty	During Week 10 to Week 14 Submission at the end of Week 14	25
Lab ESE	Lab Performance and related documentation	Lab batch faculty	During Week 15 to Week 18 Submission at the end of Week 18	25

Week 1 indicates starting week of Semester after **admission procedure and induction period.**

Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments.

For workshop practice lab various lab activities are : Preparation of Job drawing, processing of the job in different sections of workshop, completing the process sheet and writing journal based on questions provided.

Course Contents:

1. Composite job based on carpentry, fitting, tin-smithy, welding etc. (16 Hrs.)
2. Composite job of PCB making based on negative film making, UV exposure, development and etching etc. (6 Hrs.)

Module wise Measurable Students Learning Outcomes :Laboratory Outcomes

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

CO-PO Mapping for other departments:

Electronics

	1	2	3	4	5	6	7	8	9	10	11	12	PSO-1	PSO-2
CO1				L		L								
CO2	L			L										
CO3				L					L					

Electrical

	1	2	3	4	5	6	7	8	9	10	11	12	PSO-1	PSO-2
CO1				L	L			L						
CO2				L					L	L				
CO3				L						L				

IT

	1	2	3	4	5	6	7	8	9	10	11	12	PSO-1	PSO-2
CO1				L				L						
CO2				L					L					
CO3				L										

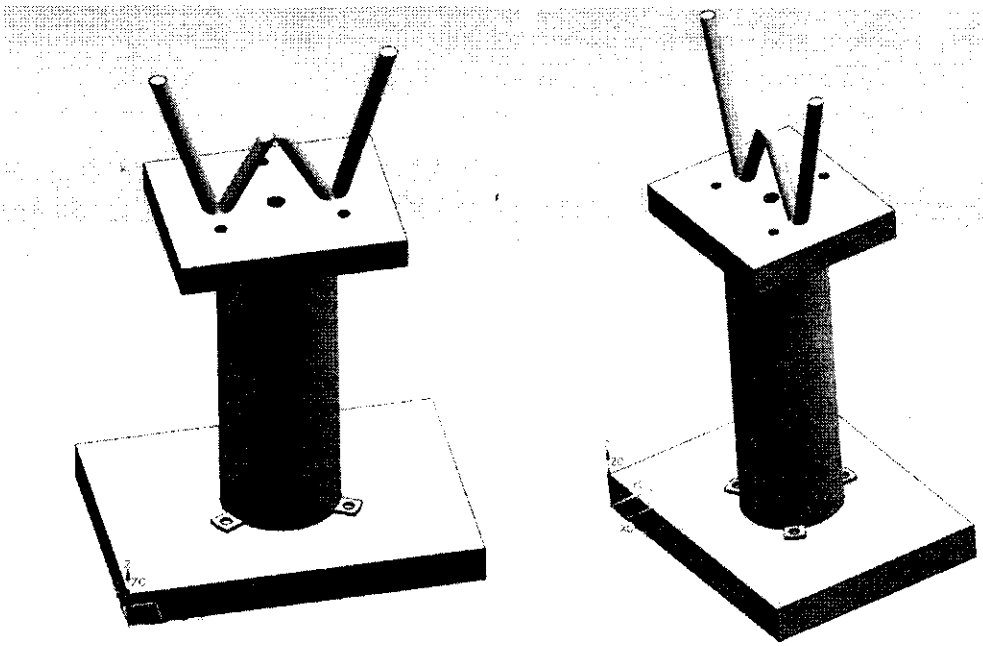
Civil

	1	2	3	4	5	6	7	8	9	10	11	12	PSO-1	PSO-2
CO1						L			L					
CO2						L			L					
CO3						L					L			

CSE

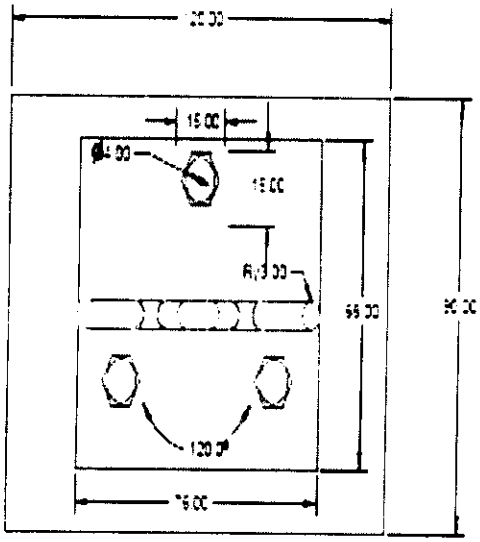
	1	2	3	4	5	6	7	8	9	10	11	12	PSO-1	PSO-2
CO1				L				L						
CO2				L										
CO3				L				L						

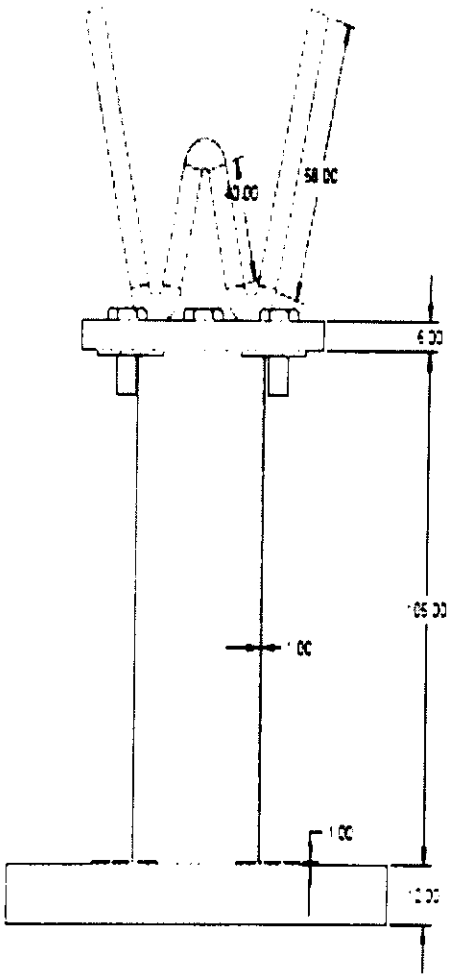
Job Drawings [The detailed drawing of each section will be finalized after finalizing the proper dimensions of individual jobs and availability of respective job raw material]

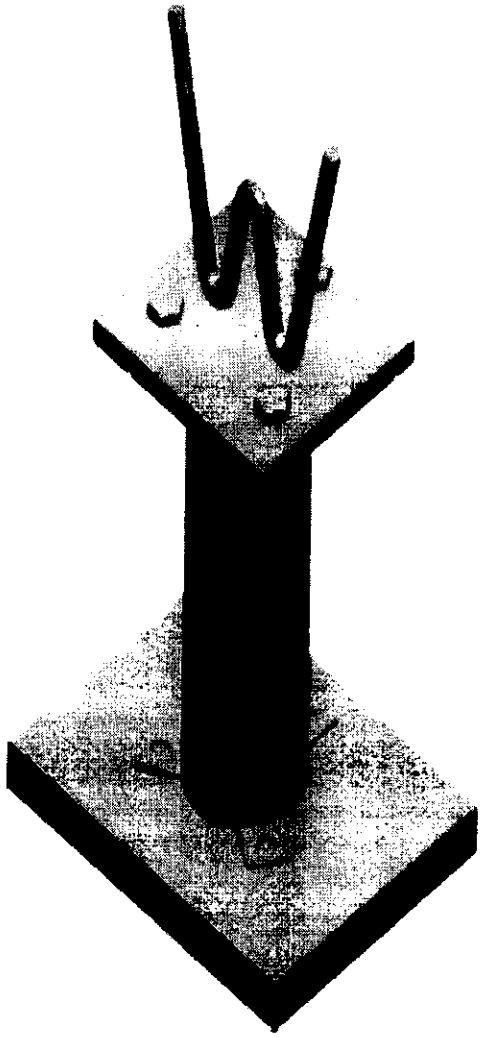


View 1 View 2

All dimensions are in mm







Title of the Course: Programming for problem solving lab **Course code: 5CS151**	L	T	P	Cr
	0	0	2	1

Desirable requirements: Basic course of software and hardware programming.

Textbooks:

1. Byron Gottfried, Schaum's, "Outline of Programming with C", McGraw-Hill, Third edition, 2017.
2. Yashavant Kanetkar, "Let Us C", BPB Publication, Fifteenth edition, 2016.
3. E. Balagurusamy, "Programming in ANSI C", Tata McGraw-Hill Education, Seventh edition, 2016.

References:

1. Brian W. Kernighan and Dennis M. Ritchie, "The C Programming Language", Prentice Hall of India, Second Edition, 2015.

Course Objectives :

- To impart problem-solving and programming skills to translate text described problems into programs, written using the Programming language with the help of language constructs.
- To demonstrate use of computer language constructs and principles such as: conditional branching loops, block structures, functions, and input/output for implementing programs to solve problems.

Course Learning Outcomes:

CO	**After the completion of the course the student should be able to**	Bloom's Cognitive	
		level	Descriptor
CO1	**illustrate** the use of different Language constructs and principles of programming language using a programming environment/tool	3	Applying
CO2	**implement** programs using programming language in a programming environment/using programming tool to solve problems	3	Applying
CO3	**examine** a given program to identify its output	3	Applying

CO-PO Mapping :

PO	**PO1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO1				3	2							
CO2				3	2							
CO3				3	2							

1: Low, 2: Medium, 3: High

Assessments :

Lab Assessment:

There are four components of lab assessment, LA1, LA2, LA3 and Lab ESE.

IMP: Lab ESE is a separate head of passing.

Assessment	Based on	Conducted by	Conduction and Marks Submission	Marks
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 4 Submission at the end of Week 5	25
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 5 to Week 8 Submission at the end of Week 9	25
LA3	Lab activities, attendance, journal	Lab Course Faculty	During Week 10 to Week 14 Submission at the end of Week 14	25
Lab ESE	Lab Performance and related documentation	Lab Course faculty	During Week 15 to Week 18 Submission at the end of Week 18	25

Week 1 indicates starting week of Semester.

Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments.

List of Experiments:

Assignments based on the following topics in line with topics covered in theory course:

1. Familiarization with programming environment IDE (Integrated development environment).
2. Writing algorithms to solve problems.
3. Variable types and type conversions
4. Programs to demonstrate different operators and their order precedence.
5. Programs to solve simple computational problems using arithmetic expressions e.g. simple and compound interest.
6. Programs to demonstrate problems on conditional branching e.g. roots of quadratic equation, finding a maximum/minimum value.
7. Programs to show statement block, conditional statement.
8. Programs to show different types of iteration / loop.
9. Implementation of iterative problems e.g., sum of series.
10. Programs to demonstrate matrix problems, string operations, sorting problems.
11. Programs to implement numerical methods problems (Root finding, numerical differentiation, and numerical integration): using array, function and recursion.
12. Programs to illustrate use of pointer with simple data type (create pointer variable, assign value, access value and show address using (* and &).
13. Programs to solve the problems using pointers and structures e.g. swap two numbers.
14. File handling: Study and implementation file operations.
15. Programs to demonstrate simple read and write operation on the external text file.
16. Case study to demonstrate basic programming constructs.

Title of the Course: Engineering Physics Lab. 5PH151 **Branch:** All Branches	L	T	P	Cr
	0	0	2	1

Pre-Requisite Courses: Students are expected to know the basic practical knowledge in HSC Level.

Textbooks: 1. C. L. Arora "Practical Physics" S. Chand & Co Edition 2009.
2. P.R. Sasi Kumar "Practical Physics", PHI Learning Pvt.Ltd 1st edition 2011.

References:

1. Halliday, Resnic and Walker, "Fundamentals of Physics", John Wiley, 9th edition 2011.
2. A. Beiser, "Concepts of Modern Physics", McGraw Hill International, 5th edition, 2003.
3. Ajoy Ghatak, "Optics", Tata McGraw Hill 5th edition, 2012.

Course Objectives:

1. To gain practical knowledge by applying the experimental methods to correlate with the Physics theory.
2. To learn the usage of electrical and optical systems for various measurements.
3. To Apply the analytical techniques and graphical analysis to the experimental data.

Course Learning Outcomes:

CO	**After the completion of the course the student should be able to**	**Bloom's Cognitive**	
		level	**Descriptor**
CO1	**Calculate** the diameter of the thin wire, wavelength of light, Planck's constant, values of e/m of an electron, Specific rotation of optical active substances. **Demonstrate** Hartley and Colpitt's oscillator with their simulations, Newton's ring, and I-V characteristics of semiconductor diode. Kundt's tube.	**III**	**Applying**

CO-PO Mapping : 3: High, 2: Moderate, 1: Low

PO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**
CO1	**1**	**1**												

Assessments: : In Semester Evaluation (ISE)

Assessment	Marks
ISE-1	25
ISE-2	25
ISE-3	25
ISE-4	25
On the basis of each experiment performed during regular laboratory session, performance of experiment, quiz or oral, and final internal practical examination.	

Course Contents:

List of Experiments (Minimum 8 experiments from the following list) 1. Find the diameter of the thin wire by diffraction of the light 2. Determination of wavelength of light by plane diffraction grating. 3. Determine the Specific rotation of sugar solution 4. Find the wavelength of He-Ne Laser using Plane diffraction grating. 5. Find the e/m for the cathode rays 6. Verify the expression for the resolving power of a telescope. 7. Measure the wavelength of ultrasonic waves by Kundt's tube method. 8. Design and simulate Colpitt's & Hartley Oscillator. 9. Determine the Planck's constant. 10. Find the wavelength and velocity of ultrasonic waves in liquid. 11. Study the I-V characteristic of semiconductor diode. 12. Newton's ring: Determination of wavelength of light and refractive index of liquid.	**2 Hrs. each Expt.**

Title of the Course: Environmental Science (5IC101)	L	T	P	Cr
	2	0	0	0

Textbooks:

1. Mrinalini Pande, "Disaster Management", Wiley Publications New Delhi, First edition, 2014
2. N.K Uberoi, "Environmental Studies", Excel Books Publications New Delhi, first edition, 2005.
3. R.Rajagopalan, "Environmental Studies from crisis to cure" Oxford university press, second edition, 2011

References:

1. William. Cunningham and Barbara Woodworth Saigo, "Environmental Science: A Global Concern", WCB/McGraw Hill publication, 5th Edition, 1999.
2. Peter. H. Raven, Linda. R. Berg, George. B. Johnson, "Environment", McGraw Hill publication, 2nd -Edition, 1998.
3. Catherine Allan & George H. Stanley (Editors), "Adaptive Environmental Management", Springer Publications. 2009.

Course Objectives :

1. Infuse an understanding of the various environmental concepts on scientific basis in the functional area of Engineering and technology.
2. Provide a foundation to critically assess the approaches to pollution control, environmental and resource management, sustainable development, cleaner technologies, Environmental Legislation based on an understanding of the fundamental, environmental dimensions.
3. Inculcate the modern concept of green industry and the impact of excess human population, globalization, and climate change on the environment.

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	**Bloom's Cognitive**	
		Level	**Descriptor**
CO1	Describe key concepts of Environmental science and their relationship to engineering.	II	Understanding
CO2	Explain ethical and legal responsibility of an engineer and his role in effective implementation of sustainable activities through EIA and EMS in the corporate sector.	II	Understanding
CO3	Predict impact of contemporary issues (Population Explosion, Climate change, Environmental pollution) on the environment.	II	Understanding

CO-PO Mapping : (Use 1, 2, 3 as Correlation Strengths)

PO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**
CO1						**2**	**2**							
CO2							**3**	**2**						
CO3							**2**							

Assessments :

Teacher Assessment:

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar etc.

MSE: Assessment is based on 50% of course content (Normally first three modules)

ESE: Assessment is based on 100% course content with 60-70% weightage for course content (normally last three modules) covered after MSE.

Course Contents:

Module 1: Environment, Ecology and Biodiversity	**Hrs.**
Introduction: Natural and Built Environment, Environmental education: definition, scope, objectives and importance, Components of the Environment: Atmosphere, Hydrosphere, Lithosphere and Biosphere. Ecology : Introduction, Types (terrestrial and aquatic ecosystems) , Structure and function, Trophic levels, Food chains, food webs, Ecological pyramids, Ecological succession, Biogeochemical cycles. Biological Diversity: Introduction, Value of biodiversity: consumptive use, Threats to biodiversity, Conservation of biodiversity.	**07**
Module 2: Human Population, Energy and Natural Resources	**Hrs.**
Human Population Growth and Environment: Population Dynamics, Age structures, Energy Scenario: Future projections of Energy Demand, Utilization of various Energy Sources, Conventional Energy Sources and Non- Conventional Energy Sources, Urban problems related to energy. Natural Resources: Food, Water, Forest, Geological, Equitable Use of Resources for Sustainable life style. Case studies.	**05**
Module 3: Climate Change, Environmental Quality and Pollution Control	**Hrs.**
Climate change: Global warming, Ozone depletion, Acid Rain. Environmental Impact: Impact of Modern agriculture on the Environment, Impact of Mining on the Environment, Impact of Large dams on the Environment, Environmental pollution: Air, Water, Soil, Noise, Marine, classification of pollutants, their causes, effects and control measures. Case studies.	**05**
Module 4: Solid, Hazardous Waste and Disaster Management	**Hrs.**
Solid and Hazardous waste management: Introduction, categories, causes, effects and management of municipal solid waste, Hazardous waste Disaster Management: Introduction, types of disasters, Disaster mitigation. Case studies.	**04**

Module 5: Social Issues, Environmental Management and Legislation	**Hrs.**
Environmental ethics: Introduction, Ethical responsibility, issues and possible solutions. Environmental Management**:** Introduction to Environmental Impact Assessment, Environmental Management System: ISO 14001Standard, Environmental Auditing, National and International Environmental protection Agencies pertaining to Environmental Protection. Environmental Legislation: Environmental protection act 1986, Water (prevention and control of pollution) Act 1974, Air (prevention and control of pollution) Act 1981, Wild life Protection Act 1972, and Forest Conservation Act 1980. Municipal Solid Wastes (Management and Handling) Rules, 2000.	**04**
Module 6: Cleaner technology	**Hrs.**
Restoration Ecology, Role of Information Technology in Environment science, Green buildings, Green products, Consumerism and Waste Products, Minimization of Hazardous Products, Reuse of Waste, By-products, Rainwater Harvesting, Translocation of trees. Some Success Stories. Case studies	**03**
<u>Module wise Outcomes</u> At end of each module students will be able to **Module 1:** Determine an in-depth understanding of the interdisciplinary relationship of cultural, ethical, and social aspects of local/global environmental issues. Understand how interactions between organisms and their environments drive the dynamics of individuals, populations, communities, and ecosystems. **Module 2:** Describe the impact of human population on the environment, and the utilization of natural resources for sustainable life style. **Module 3:** Explain the issues like Climate change, Global warming, Global Warming Potential, Ozone depletion, Ozone depletion Potential, Impact of Modern agriculture on the Environment, Impact of Mining on the Environment, Impact of Large dams on the Environment, Bio magnification, Eutrophication and apply learned information to postulated environmental scenarios to predict potential outcomes. **Module 4:** Identify and define different disasters and their mitigation in addition to solid and hazardous waste management. **Module 5:** Sense the legislation governing environmental research and the environment. Integrate facts, concepts, and methods from multiple disciplines and apply to environmental problems. **Module 6:** Describe strategies, technologies, and methods for assessment and sustainable management of environmental systems and for the remediation or restoration of degraded environments.	
Tutorial: The tutorials consist of Quiz, Tests, Assignments in addition to a mini project work based on diverse environmental issues and topics.	

Title of the Course: 5 CH 101: Engineering Chemistry	L	T	P	Cr
	03	0	0	03

Pre-Requisite Courses: **Chemistry course at secondary and higher secondary level**

Textbooks:

1. S.K. Singh, "Engineering Chemistry", New Age Publication, 3rd Edition , 2005.
2. Shasi Chawla, "Engineering Chemistry", Dhanpat Rai Publication, 3rd Edition , 2003.
3. Jain P.C. and Jain Monika, "Engineering Chemistry", Dhanpat Rai Publication, 16th Edition, 2013

References:

1. O G Palanna, "Engineering Chemistry" Tata McGraw Hill 2009.
2. J Mendham, R.C. Denney, J.D. Barnes, M.J.K Thomas, "Quantitative Chemical analysis", Vogel's Pearson Education, 6th Edition , 2008.
3. S.S Dara, "Engineering Chemistry" S. Chand and Company 2008.
4. Askeland and Phule , "The Science and Engineering of Materials" Thomson Publication 4th Edition ,2003

Course Objectives :

1. To make student familiar with engineering properties associated with different materials to use them successfully in practice.
2. To provide knowledge on methods of characterization and chemical analysis.

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive level	Descriptor
CO1	**Explain** chemical analysis, thermal analysis, water chemistry, phase rule. Types of polymers and its application and water's industrial applications. **Draw** schematic of water softeners, phase diagrams, Thermo grams, calorimeter and fuel cells set ups.	II	Understanding
CO2	**Classify** types of chemical analysis, hard water, polymers, fuel, fuel cells and thermal analysis.	II	Understanding
CO3	**Calculate** concentration of solutions, % or GF of analyte gravimetrically, hardness of water, Calorific values	III	Applying

CO-PO Mapping : CO-PO Mapping : 3: High, 2: Moderate, 1: Low

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	2													
CO2	2													
CO3	2													

Assessments :

Teacher Assessment:

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar etc.

MSE: Assessment is based on 50% of course content (Normally first three modules)

ESE: Assessment is based on 100% course content with 70-80% weightage for course content (normally last three modules) covered after MSE.

Course Contents:

Module 1. General principles of chemical Analysis - Chemical analysis, Its types, Advantages and Disadvantages of instrumental and non-instrumental methods, Different ways to express concentration of solution. Numerical problems. Standards and its types. Titrimetric analysis, Definition of terms associated with titrimetry. Classification of titrimetry, Gravimetry and its requirements, applications.	**08Hrs**
Module 2 Water Chemistry - Natural sources of water, Impurities in natural water. Water quality parameters Hardness- Definition, Causes, Types, Expressing hardness, units to measure hardness, Numerical problems on hardness calculation, ill effects of hard water in steam generation, Ion exchange method of water softening, Dissolved oxygen(DO), Biological Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) its significance.	**5Hrs.**
Module 3- Phase Rule: Gibbs phase rule, Explanation of the terms Phase, Component, Degree of freedom, Phase reactions, types of equilibrium, equilibrium conditions. One component system- Water system, Sulphur system, Two component system- Lead Silver system, Application of Eutectic system, Merit and Demerits of Phase rule.	**6Hrs.**
Module 4 Polymers- Polymer, Polymerization reactions – Addition, Condensation and Co polymerization. Comparison of addition and condensation polymerization and polymers, Plastics and its types- Thermoplastic and thermosetting plastics, comparison Thermoplastic and thermosetting plastics, Properties and Uses of Poly Vinyl Chloride (PVC), Bakelite, Epoxy resin, Fiber Reinforced Plastic (FRP), Rubber and properties of Rubber, vulcanization of natural rubber.	**7Hrs.**
Module 5 Thermal Analysis – Thermal analysis and its types, Thermal events, Thermal analysis methods Thermo gravimetric Analysis (TGA), Differential Thermal Analysis (DTA)and Differential Scanning Calorimetry (DSC) w.r.t. Principle, instrumentation, and applications, Interpretation of Thermogram	**6Hrs.**
Module 6.Energy Science: Fuel and its classification, Characteristics of good fuel, Properties of solid, liquid and gaseous fuels. Calorific value, Gross and net calorific value, its units, and determination by bomb and Boys calorimeter, Numerical problems on calorific value. Fuel cell, its types and applications.	**6Hrs.**

Module wise Measurable Students Learning Outcomes :

After the completion of the course the student should be able to:

1: Explain and select chemical method of analysis.

2: Decide suitability of available water towards various industrial applications.

3: Describe one and two component systems and terms associated with respect to heterogeneous systems.

4: Describe properties and uses of different organic materials plastics i.e. PVC, Bakelite, Epoxy, FRP

5: Select proper thermal method to analyse properties of material.

6: Describe and determine calorific value by different methods. Solve calorific value calculation problems.

Tutorial: Nil

Title of the Course: Engineering Mathematics –II **Course Code: 5 MA-102**	L **3**	T **1**	P **-**	Cr **4**

Pre-Requisite Courses:

Textbooks:

1. "A Text Book of Applied Mathematics, Vol I and II", P. N. and J. N. Wartikar, Vidyarthi Griha Prakashan, Pune, 2006.
2. "Higher Engineering Maths", B .S. Grewal, Khanna Publication, 2005, 39th Edition.
3. Fundamentals of Mathematical Statistics and probability S.C. Gupta 2014 ,Sultan chand &Sons

References:

1. "Advanced Engineering Mathematics", Erwin Kreyszig, Wiley Eastern Limited Publication, 1978, 1st Edition.

2. "*Advanced Engineering Mathematics",* Wylie C.R., Tata McGraw Hill Publication, 1999, 8th Edition.
3. *Advanced Engineering Mathematics",* H. K. Dass, S. Chand & Company Ltd., 1988, 1st Edition.

4"Engineering Mathematics (Volume-I)", S. S. Sastry, Prentice Hall Publication, 2006, 3rd Edition.

Course Objectives :

1. To develop mathematical skills and enhance thinking power of students.
2. To introduce fundamental concepts of mathematics and their applications in engineering fields.

Course Learning Outcomes:

CO	**After the completion of the course the student should be able to**	Bloom's Cognitive	
		level	Descriptor
CO1	Illustrating mathematical concepts in engineering field.	II	Understanding
CO2	Use mathematical and computational methods to solve the problems in science and engineering field.	III	Applying

CO-PO Mapping :

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
CO1	**2**										
CO2	**2**										

Assessments :

Teacher Assessment:

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar etc.
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with60-70% weightage for course content (normally last three

modules) covered after MSE.

Course Contents:

Module 1: Beta-Gamma Functions: Definition of Beta, Gamma functions and properties of Beta Gamma functions.	**5Hrs.**
Module 2: Multivariable Calculus: Multiple Integrals: Double integrals, change of order of integration, change of variables (Cartesian to polar) Evaluation of triple integrals, Application of Multiple integrals such as Area enclosed by plane curves, Mass of lamina, Volume of solid.	**10Hrs.**
Module 3: Numerical Solution of Ordinary Differential Equations of first order and first degree: Numerical Solution by (i) Picard's Method (ii) Taylor's series method (iii) Euler's method (iv) Modified Euler's method (v) Runge- Kutta fourth order method.	**6Hrs.**
Module 4: Probability theory: Introduction, Sample Space, Events, Axioms of probability, Conditional probability Baye's Theorem	**6 Hrs.**
Module 5: Statistics: Correlation, Regression, Curve-fitting.	**6 Hrs.**
Module 6: Probability Distribution: Random Variable, Binomial distribution, Poisson distribution, Normal distribution.	**7Hrs.**

Title of the Course: Engineering Graphics and AutoCAD Course Code: 5ME101	L	T	P	Cr
	2	0	0	2

Textbooks:

1. Bhatt N.D., Panchal V.M. and Ingle P.R., Engineering Drawing, Charotar Publishing House, 2014.
2. Shah, M.B. and Rana B.C., Engineering Drawing and Computer Graphics, Pearson Education, 2008.
3. Agrawal B. and Agrawal C. M., Engineering Graphics, TMH Publication, 2012.

References:

1. Narayana, K.L. and P Kannaiah, Text book on Engineering Drawing, Scitech Publishers, 2008.
2. Warren J. Luzzader, Fundamentals of Engineering Drawing, Prentice Hall of India, New Delhi, 2010
3. Fredderock E. Giesecke, Alva Mitchell others, Principles of Engineering Graphics, Maxwell McMillan Publishing, 2010.

Course Objectives :

1. Introduce students to the conventions, concepts and basic principles of Engineering Drawing.
2. Draw projections of geometrical objects and real life components.
3. Demonstrate graphics skill for communication of concepts, ideas and design of engineering products

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive level	Descriptor
CO1	**Understanding** Principles of Engineering and Computer Graphics	II	Understanding
CO2	**Outline** projection of engineering objects	II	Understanding
CO3	**Demonstrating** Principles of Engineering, Computer Graphics through drafting software	III	Demonstrating

CO-PO Mapping :

Mechanical Engineering Department

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO-1	PSO-2
CO1	H				M					L		L	M	
CO2			M											
CO3					H					L				

Civil Engineering Department

PO	1	2	3	4	5	6	7	8	9	10	11	12
CO1	H		H		M					L		L
CO2			M									
CO3					H					L		

Electrical Engineering Department

PO	1	2	3	4	5	6	7	8	9	10	11	12
CO1	M				L					L		L
CO2			L									
CO3					M					L		

Electronics Engineering Department

PO	1	2	3	4	5	6	7	8	9	10	11	12
CO1	L				L					M		L
CO2			L									
CO3					M					L		

Computer Science and Engineering Department

PO	1	2	3	4	5	6	7	8	9	10	11	12
CO1					H					L		L
CO2			L									
CO3					H					L		

Information Technology Department

PO	1	2	3	4	5	6	7	8	9	10	11	12
CO1					H					L		L
CO2			L									
CO3					H					L		

Assessments :

Teacher Assessment:

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar etc.
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with 60-70% weightage for course content (normally last three modules) covered after MSE.

Course Contents:

Module 1: ***Introduction to Engineering Drawing***	**4 Hrs.**
Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid and Involute; Scales – Plain, Diagonal and Vernier Scales; Problems from the above units should also be practiced on computer aided drafting software.	
Module 2: ***Orthographic Projections***	**5 Hrs.**
Principles of Orthographic Projections-Conventions - Projections of Points and lines inclined to both planes; Projections of planes inclined Planes - Auxiliary Planes; Problems from the above units should also be practiced on computer aided drafting software.	
Module 3: ***Projections of Regular Solids Sections and Sectional Views of Right Angular Solids***	**4 Hrs.**
Inclined to both the Planes- Auxiliary Views; Draw simple annotation, dimensioning and scale. Floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc. Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids, objects from industry and dwellings (foundation to slab only) Problems from the above units should also be practiced on computer aided drafting software.	
Module 4: ***Isometric Projections***	**4 Hrs.**
Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions; Problems from the above units should also be practiced on computer aided drafting software.	
Module 5: ***Introduction to Computer Aided Sketching***	**5 Hrs.**
Introduction, Drawing Instruments and their uses, BIS conventions, Lettering, Dimensioning and free hand practicing. Computer screen, layout of the software, standard tool bar/menus and	

description of most commonly used tool bars, navigational tools. Co-ordinate system and reference planes. of HP, VP, RPP & LPP. of 2D/3D environment. Selection of drawing size and scale. Commands and creation of Lines, Co-ordinate points, axes, poly-lines, square, rectangle, polygons, splines, circles, ellipse, text, move, copy, off-set, mirror, rotate, trim, extend, break, chamfer, fillet, curves, constraints viz. tangency, parallelism, inclination and perpendicularity. Dimensioning, line conventions, material conventions and lettering.	
Module 6: Annotations, layering & other functions	**4 Hrs.**
Applying dimensions to objects, applying annotations to drawings; Setting up and use of Layers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print command; orthographic projection techniques; Drawing sectional views of composite right regular geometric solids and project the true shape of the sectioned surface; Drawing annotation, Computer-aided design (CAD) software modeling of parts and assemblies. Parametric and non-parametric solid, surface, and wireframe models. Part editing and two dimensional documentation of models. Planar projection theory, including sketching of perspective, isometric, multiview, auxiliary, and section views. Spatial visualization exercises. Dimensioning guidelines, tolerancing techniques; dimensioning and scale multi views of dwelling;	
Module wise Measurable Students Learning Outcomes : **After the completion of the course the student should be able to:** The student will learn : ▪ Introduction to engineering drawing and its place in society ▪ Exposure to the visual aspects of engineering design ▪ Exposure to engineering graphics projection of standard solid primitives ▪ Exposure to visualization of 3-D solid modeling ▪ Exposure to computer-aided geometric drafting ▪ Exposure to creating working drawings	

Title of the Course: Basic Electrical Engineering 5EL 101	L	T	P	Cr
	3	0	0	3

Pre-Requisite Courses:

Textbooks:

1. D.C. Kulshreshtha, "Basic Electrical Engineering", 1st revised editionMcGraw Hill, 2012.
2. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
3. B.L Theraja "A Textbook of Electrical Technology", S Chand Publication, 2013.

References:

1. V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.
2. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
3. V. N. Mittle and Arvind Mittal, "*Basic Electrical Engineering*", 2nd edition TMH, 2006.

Course Objectives :

1. This course intends to summarize and solve electrical and magnetic circuits.
2. It imparts skill to identifying principles, construction and working of electrical machines.
3. It develops skill to describe the wiring system, lamps and low voltage installation components.

Course Learning Outcomes:

CO	After the completion of the course the student will be able to	Bloom's Cognitive	
		level	Descriptor
CO1	**Explain** principles, construction and working of electrical machines.	2	Understanding
CO2	**Solve** electrical and magnetic circuits.	3	Applying

CO-PO Mapping :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3													
CO2		3												

Assessment:

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weightage respectively.

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50

ISE 1 and ISE 2 are based on assignment, oral, seminar, test (surprise/declared/quiz), and group discussion.[One assessment tool per ISE. The assessment tool used for ISE 1 shall not be used for ISE 2]
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with70-80% weightage for course content (normally last three modules) covered after MSE.

Course Contents:

Module 1: DC Circuits	Hrs.
Review of R-L-C- Electrical circuit elements, KCL and KVL. Star- delta conversion, voltage and current sources. Thevenin, Norton and Superposition, Maximum power transfer Theorems.	7

Module 2: AC Circuits	
Representation of sinusoidal waveforms, peak, RMS values, phasor representation real, reactive and apparent power. Analysis of single-phase, ac circuits consisting of R, L, C, RL, RC, RLC (series and parallel) circuits and three-phase balanced circuits. Voltage and current relations in star and delta.	**7**
Module 3: DC Machines	**Hrs.**
Construction, working principle and types of DC generator and Motor. Voltage and speed control methods, Speed-Torque characteristics. Principle, construction, working and application of stepper, servo and universal motors.	**6**
Module 4: Transformers	**Hrs.**
Magnetic circuits, Construction, working principle and types of single-phase transformer, open circuit and short circuit tests: Losses, efficiency, all-day efficiency and regulation. Autotransformer.	**6**
Module 5: AC Machines	**Hrs.**
Construction and working principle of single and three- phase induction motor. Types, torque- speed characteristics and applications of induction motor, Types of starters, AC generator.	**6**
Module 6: Wiring, Electrical Installations and Components of LT Switchgear	**Hrs.**
Switch fuse unit, MCB, ELCB, MCCB. Types of wire and cables. Staircase, Go-down and Domestic wiring, CFL, LED, Fluorescent tube. Lighting schemes, Earthing, types of batteries, characteristics of batteries.	**4**

Module wise Measurable Students Learning Outcomes:

After completion of the course students will be able to:

1. Explain the KVL and KCL to solve electric and magnetic circuit.
2. Explain fundamentals of AC circuit.
3. Describe construction and working of DC machine.
4. Summarize construction and working of single- phase transformer .
5. Describe three- phase and single- phase Induction Motor with application.
6. Recognize wiring, illumination, supply system and installation components.

Title of the Course: Arduino Based Systems 5EN101	L	T	P	Cr
	2	0	0	2

Pre-Requisite Courses: : No pre-requisite course.

Textbooks:

1. "Arduino Cookbook", Michael Margolis, O'Reilly Publications, 2020

References:

1. "Beginning Arduino", Michal Mc Roberts, Second Edition, Apress Publishing, 2013
2. "Getting started with Arduino", Massimo Banzi, 2nd Edition, O'Reilly, 2011

Course Objectives :

The objectives of the course are:

- To explain and illustrate the fundamentals of digital systems and op-amps which are necessary for Arduino based simple systems.
- To explain, demonstrate the Arduino programming language and IDE
- To illustrate and demonstrate programing for basic Arduino systems.
- To illustrate how to build the prototype circuits and connect them to the Arduino for building useful systems.

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive	
		Level	Descriptor
CO1	Explain fundamentals of digital systems and operational amplifiers	II	Explain
CO2	Illustrate the fundamentals of Arduino, installation of Arduino IDE, Running the arduino executable file, Using IDE to prepare Arduino sketch	II	Describe
CO3	Writing programs for interfacing various sensors and output devices with Arduino	III	Demonstrate
CO4	Illustrate use of Arduino for an application or a system	III	Use

.

CO-PO Mapping :

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3													
CO2		3												
CO3			2											
CO4		2												

Assessments :

Teacher Assessment:

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar/orals etc.
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with 70-80% weightage for course content (normally last three modules) covered after MSE.

Course Contents:	
Module 1 : Overview of Digital Systems	**Hrs.**
Combinational Circuits- Adder, Subtractor, Multiplexer, Demultiplexer / Decoder, Sequential Circuits- Flip flops: S-R, D, Clocked flipflop, J-K Flip flop, Counters: Synchronous and Asynchronous, MOD –N Counters, Shift Registers, Memory Block	**5**
Module 2 : Operational amplifiers	**Hrs.**
Block Diagram, Basic Operations, Op-Amps as comparator, Op amp in feedback mode, Inverting/ Non-inverting Amplifier, Adder/ Subtractor	**5**
Module 3 :Introduction to Arduino	**Hrs.**
Arduino device, Types of arduino, Features of Arduino, Components of Arduino board, Description of Microcontrollers, Installation of Arduino, Run the arduino executable file, Using IDE to prepare Arduino sketch, Uploading and running the sketch, Program notation: variables, functions, control flow, Arduino conventions. The concept of a program variable. Numerical values and basic numerical operators. if/then/else iteration using for loops. Real world timing and the delay() function	**5**
Module 4 : Input/Output Programming	**Hrs.**
Sensor Inputs:- Definition, Types. Interfacing arduino to different sensors- light sensor, temperature sensor, sound sensor, distance ranging sensor, water/detector sensor, smoke, gas, alcohol sensor, ultrasonic sensor Displays: Basics of LED's and LCD's. Interfacing arduino to LED's- blinking single LED, blinking multiple LED's, 7 segment display, LED dot matrix. Interfacing to LCD's- 16x2 LCD display	**4**
Module 5 : Input/Ouput Programming	**Hrs.**
Motor control: DC motors- Speed control, spin direction control. Servo motor control, Steppers and Robots, Communication over Ethernet: Ethernet shield, internet weather, display, e-mail alert system, Arduino Libraries Using ESP 8266 – Logging data on online server using ThingSpeak	**4**
Module 6 : Arduino Applications	**Hrs.**
Case studies : Arduino based robot car, Arduino based PLC industrial application	**3**

Module wise Measurable Students Learning Outcomes :
Students will be able to

1. Explain the basic concepts of digital systems.
2. Explain the basic concepts of operational amplifier
3. Illustrate the basics of Arduino and
4. Illustrate the programming of Arduino for various sensors
5. Illustrate the programming of Arduino for motor/display control
6. Explain and illustrate case studies of systems using Arduino.

Title of the Course: Engineering Graphics and AutoCAD Lab Course Code: 5ME151	L	T	P	Cr
	0	0	2	1

Pre-Requisite Courses: Basic Knowledge of Computer

Textbooks:

1. Bhatt N.D., Panchal V.M. and Ingle P.R., Engineering Drawing, Charotar Publishing House, 2014.
2. Shah, M.B. and Rana B.C., Engineering Drawing and Computer Graphics, Pearson Education, 2008.
3. Agrawal B. and Agrawal C. M., Engineering Graphics, TMH Publication, 2012.

References:

1. Narayana, K.L. and P Kannaiah, Text book on Engineering Drawing, Scitech Publishers, 2008.
2. Warren J. Luzzader, Fundamentals of Engineering Drawing, Prentice Hall of India, New Delhi, 2010
3. Fredderock E. Giesecke, Alva Mitchell others, Principles of Engineering Graphics, Maxwell McMillan Publishing, 2010.

Course Objectives :

1. To impart the techniques of engineering graphics using the CAD software.
2. To prepare the students for applying knowledge of engineering graphics in real life drawings using CAD software..
3. To develop the skills of students for evaluating CAD software for its applications.

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive	
		Level	Descriptor
CO1	Understand the basic principle of Engineering graphics and working of CAD software.	II	Undersatnding
CO2	Draw different views of component using the CAD software.	III	Applying
CO3	Apply the knowledge of engineering graphics in real life applications.	III	Applying

CO-PO Mapping :

Mechanical Engineering Department

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO-1	PSO-2
CO1	H				M					L		L	M	
CO2			M											
CO3					H					L				

Civil Engineering Department

PO	1	2	3	4	5	6	7	8	9	10	11	12
CO1	H		H		M					L		L
CO2			M									
CO3					H					L		

Electrical Engineering Department

PO	1	2	3	4	5	6	7	8	9	10	11	12
CO1	M				L					L		L
CO2			L									
CO3					M					L		

Electronics Engineering Department

PO	1	2	3	4	5	6	7	8	9	10	11	12
CO1	L				L					M		L
CO2			L									
CO3					M					L		

Computer Science and Engineering Department

PO	1	2	3	4	5	6	7	8	9	10	11	12
CO1					H					L		L
CO2			L									
CO3					H					L		

Information Technology Department

PO	1	2	3	4	5	6	7	8	9	10	11	12
CO1					H					L		L
CO2			L									
CO3					H					L		

Lab Assessment:

There are four components of lab assessment, LA1, LA2, LA3 and Lab ESE.

IMP: Lab ESE is a separate head of passing.

Assessment	Based on	Conducted by	Conduction and Marks Submission	Marks
LA1	CAD Sheet Submission and Attendance	Lab Course Faculty	During Week 1 to Week 4 Submission at the end of Week 5	25
LA2	CAD Sheet Submission and Attendance	Lab Course Faculty	During Week 5 to Week 8 Submission at the end of Week 9	25
LA3	CAD Sheet Submission and Attendance	Lab Course Faculty	During Week 10 to Week 14 Submission at the end of Week 14	25
Lab ESE	Lab Test Performance and Oral Presentation	Lab Course faculty	During Week 15 to Week 18 Submission at the end of Week 18	25

Week 1 indicates starting week of Semester.

Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming and other suitable activities, as per the nature and requirement of the lab course.

The experimental lab shall have typically 8-10 experiments.

Course Contents:	4 Hours for Each sheet
Submission of A3 size print of CAD drawing on following topics	
1: Plane Curves and Conic Sections (Min. 5 Problems)	
2: Projections of Points and Lines (Min. 5 Problems)	
3: Projections of Planes and Solids (Min. 6 Problems)	
4: Development of Lateral Surfaces (Min. 3 Problems)	
5: Orthographic Projections (Min. 2 Problems)	
6: Isometric Projections (Min. 2 Problems)	

Title of the Course: Basic Electrical Engineering Lab 5EL 151	L	T	P	Cr
	0	0	2	1

Pre-Requisite Courses:

Textbooks:

1. D.C. Kulshreshtha, "Basic Electrical Engineering", 1st revised editionMcGraw Hill, 2012.
2. D.P Kothari and I.J Nagrath, "*Basic Electrical Engineering",*Tata McGraw Hill, 2010.

References:

1. V. N. Mittle and Arvind Mittal, "*Basic Electrical Engineering*", 2nd edition, Tata McGraw Hill.

Course Objectives :

1. This course intends to demonstrate basic knowledge of Electrical engineering.
2. It intends to develop skills to recognize working principle, construction and types of electrical machines.

Course Learning Outcomes:

CO	After the completion of the course the student will be able to	Bloom's Cognitive level	Bloom's Cognitive Descriptor
CO1	**Describe** basic concepts of electrical circuits and various theorems.	2	Understanding
CO2	**Demonstrate** the use of transformers and AC/DC machines.	3	Applying

CO-PO Mapping :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3													
CO2	3								2					

Assessment:

Assessment	Marks
ISE 1	25
MSE	25
ISE 2	25
ESE	25

ISE 1 and ISE 2 are based on assignment, oral, seminar, test (surprise/declared/quiz), and group discussion.[One assessment tool per ISE. The assessment tool used for ISE 1 shall not be used for ISE 2]
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with70-80% weightage for course content (normally last three modules) covered after MSE.

Course Contents:

1. To study AC and DC machines parts and their functions.
2. To study series-parallel RL, RC and RLC circuits
3. To verify KVL and KCL theorems.
4. Study of AC/DC motor starters.
5. To study speed control techniques of ac and dc machines.
6. To perform load test on transformer.
7. To study servo motor/ steeper motor with application.
8. Study of installation techniques using fuse, MCB and MCCB.

Title of the Course: Engineering Chemistry Lab 5CH151	L	T	P	Cr
	0	0	2	1

Pre-Requisite Courses: Chemistry course at secondary and higher secondary level

References:

1. Engineering Chemistry Laboratory Manual, Department of Chemistry WCE, Sangli.
2. J Mendham, R.C. Denney, J.D. Barnes, M.J.K Thomas, "Quantitative Chemical analysis", Vogels, Pearson Education, 2008, 6th Edition.

Course Objectives :

1. To make the student familiar with analytical techniques.
2. To provide hands on practice of titrimetric analysis.

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive level	Bloom's Cognitive Descriptor
CO1	**Apply** principles of Volumetry to quantitative analysis of water quality parameter, metal and alloys. **Demonstrate** use of instrument for quantitative analysis. **Experiment** physical/Chemical characteristics of material.	III	Applying

CO-PO Mapping : 3: High, 2: Moderate, 1: Low

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	1	1												

Assessments : In Semester Evaluation (ISE)

Assessment	Marks
ISE-1	25
ISE-2	25
ISE-3	25
ISE-4	25

On the basis of each experiment performed during regular laboratory session, quiz, Oral and Final performance of experiment.

Course Contents:

List of experiments (any 9) 1. Estimation of hardness of water by EDTA method (Complexometric Titration). 2. Estimation of alkalinity of water (Neutralization Titration). 3. Estimation of Dissolved Oxygen in water (Iodometric Titration). 4. Estimation of Chloride content in water (Argentometry). 5. Demonstration of pH meter & pH metric titration. 6. Determination of strength of acid/base conductometrically. 7. Colorimetric estimation of Copper. 8. Estimation of copper from Bronze. (Iodometric Titration). 9. Estimation of Zn from Brass (Displacement Titration). 10. Determination of purity of Iron (Redox Titration). 11. Determination of viscosity of given liquid. By Ostwald viscometer. 12. Determination of corrosion rate by weight loss method 13. Gravimetric estimation of Ba from $BaSO_4$ as BaO.	**2 Hrs each**

Title of the Course: Arduino Based Systems Lab **5EN151**	L	T	P	Cr
	0	0	2	1

Pre-Requisite Courses:
No pre-requisite course.

Textbooks:
1. "Arduino Cookbook", Michael Margolis, O'Reilly Publications, 2020

References:
1. "Beginning Arduino", Michal Mc Roberts, Second Edition, Apress Publishing, 2013
2. "Getting started with Arduino", Massimo Banzi, 2nd Edition, O'Reilly, 2011

Course Objectives :
- To demonstrate and facilitate students to learn the fundamentals of digital systems and op-amps which are necessary for Arduino based simple systems.
- To explain, demonstrate the Arduino programming language and IDE
- To illustrate and demonstrate programing for basic Arduino systems.
- To illustrate and facilitate to build the prototype circuits and connect them to the Arduino for building useful systems.

Course Learning Outcomes:

CO	**After the completion of the course the student should be able to**	Bloom's Cognitive	
		Level	Descriptor
CO1	Install Arduino IDE, Run the arduino executable file, Using IDE to prepare Arduino sketch.	II	Describe
CO2	Interface various sensors with Arduino	III	Demonstrate
CO3	Use Arduino to build specific application/system.	III	Use

CO-PO Mapping :

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**
CO1	3													
CO2		3												
CO3				2										

Assessments :

Teacher Assessment: Lab Assessment:

There are four components of lab assessment, LA1, LA2, LA3 and Lab ESE.
IMP: Lab ESE is a separate head of passing

Assessment	Based on	Conducted by	Conduction and Marks Submission	Marks
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 4 Submission at the end of Week 5	25
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 5 to Week 8 Submission at the end of Week 9	25
LA3	Lab activities, attendance, journal	Lab Course Faculty	During Week 10 to Week 14 Submission at the end of Week 14	25

Lab ESE	Lab Performance and related documentation	Lab Course faculty	During Week 15 to Week 18 Submission at the end of Week 18	25

Course Contents:

The course includes experiments based on:

1. Writing a program to blink the onboard LED
2. Arduino interfacing with Tricolor LED and Push button
3. Sensing analog voltage using onboard ADC and printing it on serial monitor
4. Using Arduino to generate Pulse width modulation output
5. Arduino-based servo motor control
6. Interfacing of ultrasonic distance sensor(HC-SR04) with Ardiuno
7. Ethernet and WiFi Connectivity with Arduino
8. Arduino interfacing with Tricolor LCD

Module wise Measurable Students Learning Outcomes :

From all experiments students will be able to write and execute input / output programming of Arduino for sensors interface and motor control.

Title of the Course: **Biology For Engineers (5BS101)**	L	T	P	Cr
	2	0	0	2

Pre Requisite: Nil

Textbooks:

1. P. S. Verma and V. K. Agarwal, Concept of Cell Biology, S. Chand and Company Ltd, 2002.
2. R. D. Vidyarthi and P. N. Pandey, A Text book of Zoology, S. Chand and Company Ltd, 2004.
3. T. S. Ranganathan, Text book of Human Anatomy, S. Chand and Company Ltd, 2002.

References:

1. Peter H. Raven, George B. Johnson, Biology, McGraw hill, 11th edition, 2017.
2. Engelbert Buxbaum, Fundamentals of Protein Structure and Function, Springer, 2007.
3. Surinder Kumar, Essentials of Microbiology, Jaypee Brothers Medical Publishers (P) Ltd, 2016.
4. Laurence A. Cole, Biology of Life - Biochemistry, Physiology and Philosophy, Elsevier, 2016.
5. V. Sreekrishna, Comprehensive Biotechnology I - Cell Biology and Genetics, New Age, 2005.

Course Objectives:

1. Provide a foundation in basic biological principles.
2. Develop an understanding of the modern biological concepts and their applications to engineering and life.
3. Describe the stages of biological evolution on Earth and the interrelation ships among the living organims.

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive level	Bloom's Cognitive Descriptor
CO1	Identify the characteristics and basic needs of living organisms and explain the mechanisms of evolution in living organisms.	II	Understanding
CO2	Outline the structure of the biomolecules and describe the structure and function of cells including the metabolic reactions that occur in cells.	II	Understanding
CO3	Describe the chromosome theory, molecular genetics as well as identify microorganisms and their role in various environments.	II	Understanding

CO-PO Mapping : (Use 1, 2, 3 as Correlation Strengths)

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1						1	1							
CO2							1	1						
CO3							1							

Assessments:

Teacher Assessment:

Two components of In-Semester Evaluation (ISE), One Mid-Semester Examination (MSE) and one End-Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50

ISE 1 and **ISE 2** are based on assignment/declared test/quiz/seminar etc.
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with60-70% weightage for course content (normally last three modules) covered after MSE.

Course Contents:

Module 1 : Introduction and Classification	**Hrs.**
Introduction: History and Significance of Biology. **Evolution**: Origin of life; Biological evolution. **Five kingdom classification**; Need for classification, Salient features and classification of Monera, Protista, Fungi, Plantae and Animalia, Lichens, Viruses and Viroids.	**03**
Module 2 : Molecular Biology	**Hrs.**
Cell theory and cell as the basic unit of life: Structure of Prokaryotic (Typical Bacterial Cell) and Eukaryotic cell (Plant cell and animal cell) **Cell organelles**: Structure and function of endoplasmic reticulum, Golgi bodies, lysosomes, vacuoles; mitochondria, ribosomes, plastids, micro bodies; Cytoskeleton, cilia, flagella, centrioles (ultra structure and function). Nucleus: nuclear membrane, chromatin, nucleolus. **Cell division**: Cell cycle, mitosis, meiosis and their significance.	**05**
Module 3 : Genetics	**Hrs.**
Introduction: Chromosomes, DNA, RNA, Genes, Genetics, Transcription and Translation in prokaryotic and eukaryotic cell **Inheritance**: Mechanisms of inheritance, Unifactorial Inheritance, Multifactorial inheritance, Sex-linked Inheritance.	**04**
Module 4 : Macromolecular Analysis and Protein Structure	**Hrs.**
Biomolecules: Structure and function of proteins (primary secondary, tertiary and quaternary structure), carbohydrates, lipid, nucleic acids; **Enzymes**: Types, properties, enzyme action: - Lock and Key hypothesis, Induced fit hypothesis.	**04**
Module 5 :Bioenergetics and Metabolism	**Hrs.**
Bioenergetics: Thermodynamics –First law of thermodynamics, second law of thermodynamics, Gibbs free energy, endergonic & exergonic reactions, **ATP:** Structure, properties and energy currency of the cell. **Introduction to Metabolism** - Catabolism, anabolism, catabolic, anabolic and amphibolic pathways **Carbohydrate Metabolism:** Introduction, Aerobic and anaerobic pathways: Glycolysis and its regulation, Gluconeogenesis and its regulation. TCA cycle, amphibolic & anaplerotic reactions, production of ATP, Photosynthesis – 'light' and 'dark' reactions: C4-pathway. **Lipid Metabolism:** Beta – oxidations of saturated & unsaturated fatty acids. Ketone bodies, Biosynthesis of fatty acids – Acetyl-CoA carboxylase reaction, Fatty acid synthase complex, Regulation of fatty acid biosynthesis. Biosynthesis of cholesterol. **Amino Acid Metabolism:** Biodegradation of amino acids – deamination, transamination, decarboxylation, urea cycle including its regulation. Biosynthesis of amino acids, Disorders of amino acid metabolism.	**07**
Module 6 : Microbiology	**Hrs.**
Introduction , Concept of single celled organisms, Concept of species and strains, Identification and Classification of microorganisms, Microscopy, Ecological aspects of single celled organisms, Sterilization and media compositions.	**05**

Module Wise Measurable Students Learning Outcomes:
Module 1 : Introduction and Classification
Identify and describe levels of organization and related functions in plants and animals, their characteristics and basic needs. Explain the classification and the stages of biological evolution on Earth and the interrelation ships among the living organims and development process in individuals and populations.
Module 2 : Molecular Biology
Describe the structure and function of eukaryotic and prokaryotic cells and explain the structure and function of endoplasmic reticulum, Golgi bodies, lysosomes, vacuoles; mitochondria, ribosomes, plastids, micro bodies; Cytoskeleton, cilia, flagella, centrioles (ultrastructure and function). Nucleus: nuclear membrane, chromatin, nucleolus. including the metabolic reactions that occur in cells. And discuss the process of cell division in both somatic and germ cells.
Module 3 : Genetics
Outline and explain the chromosome theory, molecular genetics and quantitative and evolutionary genetics. Discuss the function, replication and evolution of genomes. Describe Transcription and Translation in prokaryotic and eukaryotic cell Explain the process of inheritance.
Module 4 : Macromolecular Analysis and Protein Structure
Identify the structure of the biomolecules found in all living organisms. Describe how RNA, DNA and proteins are synthesized and describe the types and properties of enzymes and enzyme action.
Module 5 :Bioenergetics and Metabolism
Explain the fundamental energetics of biochemical processes and the chemical logic of metabolic pathways. Recognize the basic mechanisms of pathway regulation. Discuss the processes of metabolic transformation at the molecular level.
Module 6 : Microbiology
Describe cellular, biochemical, and physiological aspects of microorganisms Explain cellular and biochemical processes involved in pathogenesis (human-pathogen interactions).Identify microorganisms and their role in various environments. Describe the cultural use of microorganisms in food production, medicine, fuel production, and waste treatment.

Title of the Course: **LIFE SCIENCE (5BS104)**	L	T	P	Cr
	2	0	0	2

Pre requisite: NIL

Textbooks:

1. T. S. Ranganathan, Text book of Human Anatomy, S. Chand and Company Ltd, 2002.
2. P. S. Verma and V. K. Agarwal, Concept of Cell Biology, S. Chand and Company Ltd, 2002.
3. R. D. Vidyarthi and P. N. Pandey, A Text book of Zoology, S. Chand and Company Ltd, 2004.

Reference Books:

1. Bruce Alberts and Alexander Johnson, Molecular Biology of the Cell Garland Science, Taylor & Francis Group, 6th Edition, 2015.
2. Peter H. Raven, George B. Johnson, Biology, McGraw hill, 11th edition, 2017.
3. Laurence A. Cole, Biology of Life - Biochemistry, Physiology and Philosophy, Elsevier, 2016.
4. V. Sreekrishna, Comprehensive Biotechnology I - Cell Biology and Genetics, New Age, 2005.

Course Objectives:

1. Introduce students to modern aspect of life science.
2. Develop an understanding if scientific methods with a broad background in the life sciences at all levels of biological organization (from molecular, cellular, and organismal biology, to populations, communities and ecosystems)
3. Provide a foundation of basic biological principles aned education in life science technologies.

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive	
		level	Descriptor
CO1	Outline and describe cytological, biochemical, physiological and genetic aspects of the cell,	II	Understanding
CO2	Explain the structure and function of organ systems in the human body and describe the concept, practice and significance of immunity.	II	Understanding
CO3	Relate knowledge of Bio chemistry, Biotechnology and Bioinformatics with application areas in Engineering.	II	Understanding

CO-PO Mapping : (Use 1, 2, 3 as Correlation Strengths)

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1						1	1							
CO2							1	1						
CO3							1							

Assessments:

Teacher Assessment:

Two components of In-Semester Evaluation (ISE), One Mid-Semester Examination (MSE) and one End-Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50

ISE 1 and **ISE 2** are based on assignment/declared test/quiz/seminar etc.
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with60-70% weightage for course content (normally last three modules) covered after MSE.

Course Contents:

Module 1 : Cell Biology	**Hrs.**
Structure and function of prokaryotic (Typical Bacterial Cell) and eukaryotic cell (Plant cell and animal cell) and intracellular organelles, Mechanism of cell division including (mitosis and meiosis) and cell differentiation; Cell-cell interaction.	**03**
Module 2 : Bio Chemistry	**Hrs.**
Structure of atoms, molecules and chemical bonds, Principles of physical chemistry, Thermodynamics, kinetics, dissociation and association constants, Nucleic acid structure, genetic code, replication, transcription and translation in prokaryotic and eukaryotic cell, Structure, function and metabolism of carbohydrates, lipids and proteins, Enzymes and coenzyme.	**04**
Module 3 : Human Physiology	**Hrs.**
a. Digestive system - Digestion, absorption, energy balance b. Respiratory system: Comparison of respiration in different species, anatomical considerations, transport of gases, exchange of gases, waste elimination, neural and chemical regulation of respiration. c. Neural system: Neurons, action potential, gross neuroanatomy of the brain and spinal cord, central and peripheral nervous system, neural control of muscle tone and posture. d. Excretory system: Comparative physiology of excretion, kidney, urine formation, urine concentration, waste elimination, micturition, regulation of water balance, blood volume, blood pressure, electrolyte balance, acid-base balance. e. Cardiovascular System: Comparative anatomy of heart structure, myogenic heart, specialized tissue, ECG – its principle and significance, cardiac cycle, heart as a pump, blood pressure, f. Endocrinology and reproduction - Endocrine glands, basic mechanism of hormone action, hormones and diseases; reproductive processes, gametogenesis, ovulation, neuroendocrine regulation	**09**
Module 4 : Immunity	**Hrs.**
Antigen and Antibody: Introduction, definition and types of Antigens, Structure and functions of different classes of immunoglobulins, Primary and secondary immune response, Lymphocytes and accessory cells, Humoral and cell mediated immunity, Mechanism of immune response and generation of immunological diversity; Application of immunological techniques.	**04**
Module 5 : Biotechnology And Its Applications	**Hrs.**
Principles and process of Biotechnology: Genetic engineering (Recombinant DNA technology). Application of Biotechnology in health and agriculture: Production of secondary metabolites/products: Insulin, growth hormones: Indol acetic acid, interferons. Methods of gene transfer in plants, improvement. Introduction to trangenics**:** gene therapy, Genetically modified organisms Biosafety issues– Bio piracy.	**04**
Module 6 : Bioinformatics and its Applications	**Hrs.**
Introduction and Definition of Bioinformatics, Molecular Bio informatics: Genomics, Proteomics and Drug Design. Organic and Community Bioinformatics: Bioinformatics of species diversity. Applications of Bioinformatics: Human health, Microbial genome application, Biotechnology, Agriculture, Comparative studies**.**	**04**

Module wise measurable students learning outcomes

Module 1 : Cell Biology

Describe the intricate relationship between various cellular structures and their corresponding functions. Explain the cytological, biochemical, physiological and genetic aspects of the cell, including cellular processes common to all cells, to all eukaryotic, prokaryotic cells as well as processes in certain specialized cells. Relate normal cellular structures to their functions.

Module 2 : Bio Chemistry

Outline structure of atoms, molecules and chemical bonds. Describe principles of physical chemistry, thermodynamics and kinetics. Explain the structure, function and metabolism of carbohydrates, lipids and proteins, Enzymes and coenzyme.

Module 3 : Human Physiology
Outline and describe structure and function of major organ systems in the human body, the neural system and explain the transmission of signals in excitable cells.
Module 4 : Immunity
Identify major components of the immune system at organ, cellular and molecular levels and discuss normal functions of these components during immune responses. Elucidate the relationship between major cellular and molecular components of the immune system. Explain adverse functions of these cellular and molecular components during abnormal circumstances. Describe mechanisms of diseases associated with adverse functions of the immune system.
Module 5 : Biotechnology And Its Applications
Explain the theory and practice of recombinant DNA technology. Describe biocatalysis, pathway engineering, bioprocess control and downstream processing and Identify the applications of Biotechnology.
Module 6 : Bioinformatics and its Applications
Outline the flow and regulation of biological information. Explain the techniques used to collect sequence and expression data. Identify appropriate biological data bases for specific analyses and describe the applications of Bioinformatics