Integral University, Lucknow

Effective from Session: 2020-2021									
Course Code	EC101	Title of the Course	Basic Electronics			L	T	P	C
Year	I	Semester	I			3	1	0	4
Pre-Requisite		Co-requisite							

Course Objectives	• To understand the concepts of mechanism of conduction in semiconductors: Mobility and Conductivity, Electrons and holes in intrinsic To learn the semiconductors, Donor and acceptor impurities, Fermi Level. To learn the working and it's characteristic of PN junction diode, Zenerand Avalanche Breakdown mechanism. To learn the working half wave rectifier, full wave rectifiers and LED. • To understand NPN Transistor, Common Emitter, Common Base and Common Collector configuration and their characteristics, transistorbiasing circuits. • To understand JFET: Construction, principle of working and its characteristics. To learn MOSFET: Working of Enhancement and depletiontype N-channel MOSFET, P-channel MOSFET and their characteristics..

	Course Outcomes
CO1	Understand the concepts of concepts of mechanism of conduction in semiconductors. Students shall be able to draw I-V characteristic of different diodes also know the working and the applications of different diodes
CO2	Understand the concepts of NPN Transistor, Common Emitter, Common Base and Common Collector configuration and their characteristics. Students can do circuit analysis with different methods of transistor biasing.
CO3	Understand the concepts of JFET: Construction, principle of working and its characteristics. Students shall be able to differentiate between JFEF & MOSFET,working of Enhancement and depletion type N-channel MOSFET, P-channel MOSFET and their characteristics.
CO4	For a given problem, **apply** the concept of Switching theory & Logic gates studentS shall be able to solve mathematical problems using 2's and 10's compliments ,minimize Boolean function using different laws and K map. Students shall be able to design combinational circuits for the given Boolean function.
CO5	Understand the concept of Operational Amplifier and develop Op-Amp as an Inverting, Non-inverting, integrator and differentiator. Students are able to use digital multimeter and draw different lissajous pattern on CRO using function generator.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Mechanism of Conduction in Semiconductors	Mobility and Conductivity, Electrons and holes in intrinsic semiconductors, Donor and acceptor impurities, Fermi Level.PN junction diode working and its characteristic, Zener and Avalanche Breakdown mechanism.Half wave and full wave rectifiers, LED.	8	CO1
2	BJT characteristics andcircuits	Working of NPN Transistor, Common Emitter, Common Base and Common Collector configuration and theircharacteristics, transistor biasing circuits	8	CO2
3	Field Effect Transistors	FieJFET: Construction, principle of working and its characteristics. MOSFET: Working of Enhancement and depletion type N-channel MOSFET, P-channel MOSFET and theircharacteristics.	8	CO3
4	Switching theory &Logic gates	Number system, Conversion, 2's and 10's Compliments, Addition and Subtraction, Boolean algebra, Logic gates, Minimization of logical function using Karnaugh map..	8	CO4
5	Operational Amplifier	Ideal characteristics of Op-Amp &it's application, Op-Amp as an Inverting, Non-inverting, integrator anddifferentiator. Block diagram and working of Digital Multimeter, Function Generator and CRO.	8	CO5

Reference Books:

1. Bolyested&Nashekey: Electronic Devices and Circuit Theory, PHI.

2. Milliman&Halkias: Integrated Electronics, McGraw- Hill.

e-Learning Source:

https://www.youtube.com/watch?v=4_nGFY7zgDM

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)															
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	
CO1	3	1	3	0	0	0	0	0	3	0	0	1	3	2		
CO2	3	2	3						3			1	3			
CO3	3	3	3	1	1				3				3	2		
CO4	3	3	2						3			1	3			
CO5	3	2	2	1	1				3			1	3	2		

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session: 2022-2023								
Course Code	**EE103**	**Title of the Course**	**Basic Electrical Engg.**	**L**	**T**	**P**	**C**	
Year	**1st**	**Semester**	**1st**	3	1	0	4	
Pre-Requisite	None	**Co-requisite**	None					
Course Objectives	● Knowledge and concept of D.C Circuit Analysis and Network Theorems Circuit. ● Use of Steady State Analysis of Single-Phase AC Circuits AC fundamentals. ● Knowledge and concept of Three Phase AC Circuits Three phase system and measuring devices. ● Basic concepts of Power System and Transformer ● Study of Electromechanical energy conversion devices: AC/ DC Machines.							

Course Outcomes	
CO1	Know about the concept of D.C Circuit Analysis and Network Theorems Circuit.
CO2	Steady State Analysis of Single Phase AC Circuits AC fundamentals.
CO3	Know about concept of Three Phase AC Circuits Three phase system and measuring devices
CO4	Layout of Power System and transformer
CO5	Know about Electromechanical energy conversion devices: AC/ DC Machines

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**D.C Circuit Analysis and Network Theorems**	Circuit concepts: Concept of network, Active and passive elements, linear network and non linear network, unilateral and bilateral elements, lumped and distributed network, sources, open circuit and short circuit, source transformation, Kirchhoff's Law. Loop analysis and nodal analysis, star delta transformation. Network theorems: Needs of theorem, Superposition theorem, Thevenin's theorem, Norton's theorem, maximum power transfer theorem.	8	CO1
2	**Steady State Analysis of Single Phase AC Circuits**	AC fundamentals: Average and effective value of Sinusoidal waveform , form factor and peak factor,concept of phasors, phasors representation of sinusoidally varying voltage and current, analysis of series RLC circuits. Apparent, active and reactive powers, power factor, causes and problems of low power factor, power factor improvement, resonance, bandwidth and quality factor in series circuit.	8	CO2
3	**Three Phase AC Circuits**	Three phase system: Its necessity and advantages, meaning of phase sequence, star and delta connections, balanced supply, line and phase voltage/current relationship. Measuring Instruments: Types of instruments: construction and working principle of PMMC,MI type instruments, induction type energy meter.	8	CO3
4	**Introduction of Power System**	General layout of electrical power system, standard generation, transmission and distribution voltage levels, concept of grid.Magnetic circuit: Concepts, analogy between electric and magnetic circuit. Single Phase Transformer: Principle of operation, construction, emf equation, equivalent circuit, losses, efficiency, Introduction to auto transformer.	8	CO4
5	**Electromechanical energy conversion devices**	DC Machines: Types, emf equation of generator and torque equation of motor, applications. Three Phase Induction Motor: Types, principle of operation, applications. Single Phase Induction Motor: Principle of operation and introduction to methods of starting, applications. Three Phase Synchronous Machines: Principle of operation of alternator, synchronous motor,applications.	8	CO5

Reference Books:

1. V.Deltoro, "Principle of Electrical Engg." PHI, 2009..

2. M.A Mallick, Dr. I. Ashraf, "Fundamental of Electrical Engg," CBS Publishers, 2010.

3. A. Hussain, "Basic Electrical Engg" Dhanpat Rai & sons, 2007

4. I J Nagrath,"Basic Electrical Engg" ,TMH, 2010.

e-Learning Source:

Course Articulation Matrix: (Mapping of COs with POs and PSOs)															
PO-PSO \ CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	1	1	3						3	3	3	2
CO2	3	3	3	2	1	1						2	3	2	2
CO3	3	2	1	1	2	2	3					3	2	2	2
CO4	3	2	2	2	3	3						2	3	2	2
CO5	3	1	1	1	1	2	1					2	3	2	2

4- **Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session: 2017-18									
Course Code	**EE104**	**Title of the Course**	Electrical Engineering Lab			**L**	**T**	**P**	**C**
Year	**I**	**Semester**	I			**0**	**0**	**2**	**1**
Pre-Requisite		**Co-requisite**							
Course Objectives		☐ To understand and experiment with the verification of DC Network Theorems ☐ To understand and experiment with the study of diode, rectifier, BJT characteristics andAmplifier ☐ To understand and experiment with the study of resonance and determination oftransformer losses ☐ To understand and experiment with the calibration of energy meter and operation of induction motor							

Course Outcomes	
CO1	Adopt, perform, analyze and implement the methods of verification of DC Network Theorems; contribute in relateddevelopment
CO2	Adopt, perform, analyze and implement the methods of study of diode, rectifier, BJT characteristics and Amplifier; contributein related development
CO3	Adopt, perform, analyze and implement the methods of study of resonance and determination of transformer losses; contribute in related development
CO4	Adopt, perform, analyze and implement the methods of calibration of energy meter and operation of induction motor;contribute in related development

Unit No.	Title of the Unit	Content of Experiment	Contact Hrs.	Mapped CO
1.		Verification of Thevenin's Theorem.	2	1
2.		Verification of Superposition Theorem.	2	1
3.		Verification of Maximum Power Transfer Theorem.	2	1
4.		To study V-I characteristics of diode.	2	2
5.		To study the input & output characteristics of BJT in CE configuration.	2	2
6.		To study the full wave rectifier circuit with & without filter and determine the ripplefactor.	2	2
7.		To study the phenomenon of resonance in series RLC circuit.	2	3
8.		Determination of losses in single phase transformer by OCT and SCT.	2	3
9.		To calibrate a single-phase induction type energy meter.	2	4
10.		To study the running and reversing of a three phase SCIM.	2	4
11.		Study of OP Amp based inverting and non-inverting amplifier	2	2

Reference Books:

1. V.Deltoro, "Principle of Electrical Engg." PHI, 2009.

2. M.A Mallick, Dr. I. Ashraf, "Fundamental of Electrical Engg," CBS Publishers, 2010.

3. A. Hussain, "Basic Electrical Engg" Dhanpat Rai & sons, 2007.

4. R. Boylestad, "Electronic Devices and Circuit Theory", Pearson, 2013.

e-Learning Source:

Course Articulation Matrix: (Mapping of COs with POs and PSOs)															
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	1	1	3						3	3	3	2
CO2	3	3	3	2	1	1						2	3	2	1
CO3	3	2	1	1	2	2	3					3	3	3	2
CO4	3	2	2	2	3	3						2	3	2	2

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session: 2015-16									
Course Code	ME103	**Title of the Course**	ENGINEERING GRAPHICS			**L**	**T**	**P**	**C**
Year	I	**Semester**	I			0	0	2	1
Pre-Requisite	None	**Co-requisite**	None						
Course Objectives	• Main objective is to teach the fundamentals of Engineering Graphics. • This course enhances visualization skill and imagination power. • To understand techniques of drawings for various fields of engineering • To improve their technical communication skill in the form of communicative drawings.								

Course Outcomes	
CO1	Describe the fundamentals of engineering drawing, use of geometrical instruments and drawing steps
CO2	To understand the concept of projection and acquire visualization skills, draw the projection of points, lines and planes.
CO3	Classify solids and projection of solids at different positions
CO4	To get the exact sectioned view of solids and development of their surfaces.
CO5	To draw isometric projection and perspective views of an object.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Lettering and geometrical constructions	Describe the fundamentals of engineering drawing, use of geometrical instruments and layout for initial drawing.	2	CO1
2	Orthographic projections of points	Describe the fundamentals orthographic projections and use of geometrical instruments and layout for initial drawing.	2	CO2
3	Projections of lines	Describe the fundamentals of projections of lines and use of geometrical instruments and procedure for the drawing.	2	CO2
4	Projections of solids	Describe the fundamentals of projections of solids and use of geometrical instruments and procedure for the drawing.	2	CO3
5	Sectioning of solids	Describe the fundamentals of sectioning of solids and use of geometrical instruments and procedure for the drawing.	2	CO4, CO3
6	Isometric Projections	Describe the fundamentals of Isometric projections and use of geometrical instruments and procedure for the drawing.	2	CO5
7	Production drawing	Describe the fundamentals of production drawing.	2	CO1, CO2

Reference Books:

Engineering graphics by Pradeep Jain

Engineering graphics by Krunal Patel

e-Learning Source:

https://www.youtube.com/watch?v=p62LPzFqGQw&list=PLp6ek2hDcoNCjoRLQ4rjpCozisCACBxKA

https://www.youtube.com/watch?v=VrU73IwRyc4&list=PLLy_2iUCG87Bw9XPfEF3r3EW5UlAOv8iz

Course Articulation Matrix: (Mapping of COs with POs and PSOs)															
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3								1	2		3	3		3
CO2	3	2	2						1	2		3	3		3
CO3	3	2	2						1	2		3	3		3
CO4	3	2	2						1	2		3	3		3
CO5	3	2	2						1	2		3	3		3

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session: 2015-16								
Course Code	ME104	Title of the Course	WORKSHOP PRACTICE		L	T	P	C
Year	I	Semester	I		0	0	2	1
Pre-Requisite	None	Co-requisite	None					
Course Objectives	- To impart practical knowledge and hands-on practice on the lathe machine. - To impart practical knowledge of basic tools and operations in the fitting shop and carpentry shop. - To impart basic knowledge of smithy tools and hands-on practice in smithy shop. - To impart basic knowledge of different welding tools and equipment and hands-on practice of making differentwelding joints. 5. To impart practical knowledge of different types of sheet metal tools and equipments and hands-on practice ofmaking sheet metal components.							

Course Outcomes	
CO1	Perform different operations on lathe machine.
CO2	Manufacture components using tools and equipments of fitting shop and carpentry shop.
CO3	Make components in smithy shop using different types of smithy tools and equipments.
CO4	Perform different joining operations using welding tools and equipments.
CO5	Make sheet metal components using different sheet metal tools and equipments.

Experiment No.	Title of the experiment	Content of Unit	Contact Hrs.	Mapped CO
1	Lathe machine	To study and sketch a lathe machine Practice of operations - facing, plain turning, step turning, Taper turning & chamfering	2	CO1
2	Fitting shop & carpentry shop	To study and sketch fitting tools and equipment Practice of step cutting, filing, drilling & tappingTo make a 90⁰ v-groove fitting on mild steel flat To study and sketch different types of carpentry tools & machines To make a mortise and tenon jointTo make a corner lap joint	2	CO2
3	Smithy shop	To study and sketch different smithy tools & equipmentsTo make a squire punch from mild steel round rod To make a pipe hook from a mild steel round rod	2	CO3
4	Welding shop	To study and sketch the welding equipments and tools To weld the two given plates & make a lap joint(by arc welding) To weld the two given plates & make a butt joint (by arc welding)	2	CO4
5	Sheet metal	To study and sketch different sheet metal tools & equipmentsTo make a rectangular tray To make a conical funnel	2	CO5

e-Learning Source:

https://www.vlab.co.in/

PO-PSO CO	Course Articulation Matrix: (Mapping of COs with POs and PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	3	3	2			2		2	3	3	2
CO2	3	2	2	2	2	2			2		2	3	3	2
CO3	2	2	2	2	2	2			2		2	3	3	2
CO4	2	2	2	2	3	2			2		2	3	3	2
CO5	2	2	2	2	2	2			2		2	3	3	2

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator   Sign & Seal of HoD

Integral University, Lucknow

Effective from Session: 2017 – 18								
Course Code	MT101	**Title of the Course**	Engineering Mathematics - I	**L**	**T**	**P**	**C**	
Year	I	**Semester**	I	3	1	0	4	
Pre-Requisite	10+2 Mathematics	**Co-requisite**						
Course Objectives	The course is aimed to develop the skills in mathematics which is necessary for grooming them into successfulengineering graduate. The topics introduced will serve as basic tools for specialized studies in science field.							

Course Outcomes	
CO1	Able to calculate rank of matrix, characteristic equation & characteristic roots & use the applicability of Caylay Hamilton Theorem to findinverse of matrix which is very important in many engineering application.
CO2	To develop ability to solve higher derivative, expansion of functions in ascending power of variable & partial derivatives.
CO3	Develops ability to solve Jacobian, error and approximation and Extrema of the function.
CO4	Learn the evaluation policy of some special function like gamma & Beta function. & their relation which is helpful to evaluate some definiteintegral arising in various branch of Engineering.
CO5	Able to determine vector differentiation and integration.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**Unit I**	Introduction, Different types of matrices, Algebraic operations, Elementary row and column transformations, Rank of matrix, Linear dependence, Consistency of linear system of equations, Characteristic equation, Cayley-Hamilton theorem, Eigen values and eigen vectors.	8	1
2	**Unit II**	Leibnitz theorem, Partial differentiation, Homogeneous functions, Euler's theorem, Expansionof functions of one and two variables.	8	2
3	**Unit III**	Jacobian, Approximation of errors, Extrema of functions of several variables, Lagrange'smethod of multipliers (simple applications).	8	3
4	**Unit IV**	Double and triple integrals, Change of order of integration, Gamma and Beta functions,Applications to area and volume, Dirichlet's integral and its applications.	8	4
5	**Unit V**	Scalar and Vector point functions, Gradient of a scalar function, Directional derivative, Divergence and Curl of a vector, Line, Surface and Volume integrals, Green's, Stoke's andGauss divergence theorems (without proof).	8	5

Reference Books:

1. A Text Book of Matrices, S. Chand & Co. New Delhi

2. Calculus and Analytical Geometry, Narosa Publishing House, New Delhi

3. Higher Engineering Mathematics, Khanna, Publishers, Pvt. Ltd

4. Advanced Engineering Mathematics, Khanna Publication

e-Learning Source:

https://nptel.ac.in/courses/122104018/

https://nptel.ac.in/courses/111104092/

https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/111104092/lec21.pdf

https://nptel.ac.in/courses/111107108/

PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	2	2	1				1		2	1	1	
CO2	3	2	1	2	2	1						2	1	1	
CO3	3	2	1	1	1	1						2	1	1	
CO4	3	2	1	2	3	1				1		2	1	1	
CO5	3	1	1	1	2	1						2	1	1	

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Effective from Session:							
Course Code	PY101	Title of the Course	Physics	L	T	P	C
Year	1	Semester	1	3	1	0	
Pre-Requisite	10+2 with Physics and Mathematics	Co-requisite					
Course Objectives		The purpose of this undergraduate course is to impart basic knowledge of fundamental concept of physics which is necessary for a strong engineeringknowledge base.					

	Course Outcomes
CO1	To analyze the connection between daily life observations and science. To realize that apparently different ideas of Optics such as Interference and Diffraction have interrelationship between them.To realize the simplicity of ideas involved in explaining complex phenomenon.
CO2	To grow in ideas of different aspect of light and develop connection between daily life applications and science.To analyze the process of development of a new theory while dealing with Polarization. To correlate that the conceptualization of an idea is far ahead than its practical realization while dealing with LASER.To grow in realization of totally different manifestation of light. To find the most recent applications of light in terms of communication and storage of data.To realize that how the design of complex systems is based on the simple ideas. To realize that the conceptualization of an idea is far ahead than its practical realization while dealing with Optical Fibers.
CO3	To grow in developing connection between philosophy and science. To find that seemingly different ideas such as Optics and Mechanics have interrelationship between them.To understand the process of development of a new theory and its application in life. To realize the requirement of power of imagination.
CO4	To grow in developing the connection between philosophy and science. To find that seemingly different ideas such as Compton Effect and Quantum Theory have interrelationship between them. To understand and analyze the process of development of a new theory and how the development of one idea leads to the development of a apparently different idea.To realize and appreciate the efforts made by the individuals to give a new understanding of science that led to the modern day applications.
CO5	To grow in developing connection between daily life utility and material science. To realize that apparently different materials with respect to Electric and Magnetic properties have inter relationship between them.To evaluate that how totally different manifestation of Modern Science leads to new technology. To do the evaluation that how an idea is far ahead than its practical realization while dealing with Nano Technology and Super Conductivity.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Wave Optics	Methods of formation of coherent sources, Fresnel's Bi-prism, displacement of fringes, thin film interference, Newton's ring. Fraunhoffer diffraction at single slit, grating, Rayleigh's criterion of resolution, resolving power of grating.	8	CO1
2	Optical Activity andModern Optics	Production of plane polarized light by reflection and Double refraction, Nicol prism, Optical activity, polarimeter(Laurent's and Bi-quartz). Principle of fiber optics, numerical aperture, attenuation, dispersion in optical fibers, material dispersion, waveguide dispersion, intermodal and intra-modal dispersion, Pulse dispersion in step index fiber. Main components of laser, Einstein's coefficients, He-Ne laser, Nd-YAG laser and their applications.	8	CO2
3	Properties of Matter andRelativistic Mechanics	Viscosity, Poiseulli's equation, Michelson-Morley experiment and its implications, Galilean transformation equations, Lorentz transformation equations and their consequences, energy mass relation, relativistic kinetic energy.	8	CO3
4	Quantum Physics	Compton effect, basic postulates of quantum mechanics, Wave function and its physical admissibility, orthogonality of wave functions, normalization of wave functions, Heisenberg's uncertainty principle (no derivation) and its applications (non-existence of electron in nucleus, Bohr's radius), Schrodinger's equation and its application to free particle, particle in one dimensional box	8	CO4
5	Physics of Materials	Magnetic Properties: Magnetization, Origin of magnetic moment, dia, para and ferro magnetism, Langevin's theory for diamagnetic material, Phenomena of hysteresis and its applications. Superconductors: Temperature dependence of resistivity in superconducting materials, Effect of magnetic field (Meissner effect), Temperature dependence of critical field, Type I and Type II superconductors, BCS theory (Qualitative), High temperature superconductors and Applications of Super-conductors. Nano-Materials: Basic principle of nanoscience and technology, structure, properties and uses of Fullerene and Carbon nanotubes, Applications of nanotechnology.	8	CO5

Reference Books:
1. Fundamentals of Optics by Jenkins and White
2. Optical Fiber Communication by Gerd Keiser
3. Concepts of Modern Physics by Arthur Beiser
4. Introduction to Special Theory of Relativity by Robert Resnick
5. Quantum Physics by Eisberg
e-Learning Source:
1. https://nptel.ac.in/courses/115/101/115101011/
2. https://nptel.ac.in/courses/115/107/115107095/

Integral University, Lucknow

PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
	Course Articulation Matrix: (Mapping of COs with POs and PSOs)														
CO1	0	3	2	1	3	3	1	3	2	2	1	3	2	1	1
CO2	3	3	2	1	3	3	1	2	2	3	2	3	2	1	1
CO3	3	3	3	3	1	3	1	3	2	2	1	3	2	1	1
CO4	3	3	3	2	2	3	1	2	2	1	1	3	2	1	1
CO5	3	3	3	3	3	3	3	2	2	2	3	3	2	1	1

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session:								
Course Code	PY104	Title of the Course	Physics Lab	L	T	P	C
Year	1	Semester	1	0	0	6	
Pre-Requisite	10+2 with Physics and Mathematics	Co-requisite					
Course Objectives		The purpose of this undergraduate course is to impart practical knowledge of the concepts through different experimentsrelated to its theoretical course.						

Course Outcomes	
CO1	To demonstrate how interference takes place by division of amplitude and by division of wavefront.
CO2	To demonstrate the practical applications of polarization phenomenon in finding the specific rotation, refractive index and Brewster'sangle.
CO3	To demonstrate the practical application of Fraunhoffer diffraction in wavelength and focal length calculation.
CO4	To demonstrate the magnetic and heating effect of current in finding the magnetic field and Stefan's constant.
CO5	To demonstrate how to calculate the energy band gap of a semiconductor material and viscosity of a liquid.

List of experiments	Content of Unit
Exp.1	To determine the wave length of monochromatic light by Newton's ring.
Exp.2	To determine the wave length of monochromatic light with the help of Fresnel's Biprism.
Exp.3	To determine the focal length of two lenses by nodal slide and locate the position of cardinal points.
Exp.4	To determine the specific rotation of cane sugar solution using Half Shade polarimeter.
Exp.5	To determine the wavelength of spectral lines using plane transmission grating.
Exp.6	To determine the Brewster's angle and refractive index of material with the help of a laser source.
Exp.7	To determine the variation of magnetic field along the axis of a current carrying coil and then to estimate the radius of the coil.
Exp.8	To verify Stefan's law by electrical method.
Exp.9	To determine the energy band gap of a given semiconductor material.
Exp.10	To determine the coefficient of viscosity of a liquid.

Course Articulation Matrix: (Mapping of COs with POs and PSOs)															
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	1	3	1	3	-	-	-	-	-	2	1	1
CO2	2	2	2	2	2	3	2	-	-	-	-	-	2	1	1
CO3	3	3	1	3	3	1	3	-	-	-	-	-	2	1	1
CO4	2	2	2	3	1	2	2	-	-	-	-	-	2	1	1
CO5	2	1	1	1	2	2	2	-	-	-	-	-	2	1	1

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	Sign & Seal of HoD

Integral University, Lucknow

Effective from Session: 2020-2021								
Course Code	BE103	Title of the Course	REMEDIAL BIOLOGY		L	T	P	C
Year	1	Semester	1		2	1	0	0
Pre-Requisite	None	Co-requisite	None					
Course Objectives	To learn and understand the components of living world, structure and functional system of plantand animal kingdom. Upon completion of the course, the student shall be able to 1. Know the classification and salient features of five kingdoms of life 2. Understand the basiccomponents of anatomy & physiology of plant 3. Know understand the basic components of anatomy & physiology animal with special reference to human							

Course Outcomes	
CO1	Students will be able to get an in-depth understanding of blood vascular system
CO2	Students will learn about the cardio-vascular system and its structure-function relationship in detail
CO3	Students will be able to understand the musculo-skeletal system and its functioning
CO4	Students will gain knowledge about the structure and function of the renal, digestive, and respiratory system

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Living world	Definition and characters of living organisms Diversity in the living world Binomial nomenclature Five kingdoms of life and basis of classification. Salient features of Monera, Potista, Fungi, Animalia and Plantae, Virus. Cell - The unit of life Structure and functions of cell and cell organelles. Cell division Tissues Definition, types of tissues, location and functions.	8	Co1
2	Body fluids and circulation	Composition of blood, blood groups, coagulation of blood Composition andfunctions of lymph Human circulatory system Structure of human heart and blood vessels Digestion and Absorption Human alimentary canal anddigestive glands Role of digestive enzymes	8	Co2
3	Breathing and respiration	Human respiratory system Mechanism of breathing and its regulationExcretory products and their elimination Modes of excretion Human excretory system- structure and function	8	Co3
4	Neural control and coordination	Definition and classification of nervous system Structure of a neuron Chemical coordination and regulation Endocrine glands and their secretionsFunctions of hormones secreted by endocrine glands	8	Co4

Reference Books:
1. Text book of Biology by B.V. Sreenivasa Naidu
2. A Text book of Biology by Naidu and Murthy.
e-Learning Source:

Course Articulation Matrix: (Mapping of COs with POs and PSOs)															
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	3	1	1	3	2		3				3	3	1	2
CO2	1	3	1	1	3	2		3				3	3	1	2
CO3	1	3	1	1	2	2		3				3	3	1	2
CO4	1	3	1	1	2	2		3				3	3	1	2

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator

Sign & Seal of HoD

Integral University, Lucknow

Effective from Session: 2020-2021									
Course Code	BE102	Title of the Course	REMEDIAL MATHEMATICS			L	T	P	C
Year	1	Semester	1			2	1	0	0
Pre-Requisite	None	Co-requisite	None						
Course Objectives	This is an introductory course in mathematics. This subject deals with the introduction to Partial fraction, Logarithm, matrices and Determinant, Analytical geometry, Calculus, differential equation and Laplace transform. Upon completion of the course the student shall be able to								

Course Outcomes	
CO1	Able to calculate rank of matrix, characteristic equation & characteristic roots & use the applicability of Caylay Hamilton Theorem to find inverse of matrix which is very important in many engineering application.
CO2	To develop ability to solve higher derivative, expansion of functions in ascending power of variable & partial derivatives.
CO3	Develops ability to solve Jacobian, error and approximation and Extrema of the function.
CO4	Learn the evaluation policy of some special function like gamma & Beta function. & their relation which is helpful to evaluate some definite integral arising in various branch of Engineering.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Algebra	Determinants, Properties of determinants, solution of simultaneous equations by Cramer's rule, matrices, properties of matrices, solution of simultaneous equations by matrices, applications of determinants and matrices. Measures of Central value: Objectives and pre-requisites of an ideal measure, mean, mode and median.	8	Co1
2	Trigonometry	Measurement of angle, T-ratio, addition, subtraction and transformation formulae, T-ratio of multiple, submultiple, allied and certain angles, application of logarithms.	8	Co2
3	Analytical Plane Geometry	Certain co-ordinates, distance between two points, area of triangle, locus of a point, straight line, slope and intercept form, double intercept form normal (perpendicular form), slope-point and two-point form, general equation of first degree.	8	Co3
4	Calculus	Differential: Limits and functions, definition of differential coefficient, differentiation of standard functions, including function of a function(chain rule).	8	Co4

Reference Books:

1. A textbook of Mathematics for XI-XII Students, NCERT Publication Vol. I-IV.

2. Loney, S.L "Plane Trigonometry" AITBS Publishers.

e-Learning Source:

Course Articulation Matrix: (Mapping of COs with POs and PSOs)															
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	2	2	1				1		2	1	1	
CO2	3	2	1	2	2	1						2	1	1	
CO3	3	2	1	1	1	1						2	1	1	
CO4	3	2	1	2	3	1				1		2	1	1	
	3	1	1	1	2	1						2	1	1	

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator   Sign & Seal of HoD

Integral University, Lucknow

Effective from Session: 2020-21

Course Code	LN 101	Title of the Course	Basic Professional Communication	L	T	P	C
Year	1	Semester	I	3	1	0	4
Pre-Requisite	10+2	Co-requisite					
Course Objectives			Developing the art of communication and learning language though literature. Knowledge of Professional, cultural and cross-cultural communication. Basic concept of structural and functional grammar; meaning and process of communication, verbal and nonverbal communication. Knowledge of reading and comprehension of general and technical articles, precise writing, summarizing, abstracting. Basic concepts of group discussion, organizing seminars and conferences. Development of Reading and Writing skills				

Course Outcomes	
CO1	Basic Understanding of communication and Professional Communication
CO2	Basic knowledge of structural and functional grammar. Learning Language through literature
CO3	Basic tools of communication and improvement in communicative competence
CO4	Understanding the basic grammar and basic structure of language
CO5	Enhancement of writing skills in English i. e. writing application, report and various types of letters

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Professional Communication	Professional Communication: Its meaning & importance, Essentials of Effective Communication, Barriers to Effective Communication	06	CO1
2	Language through Literature	A. Essays: "The Effect of the Scientific Temper on Man" by Bertrand Russell. "The Aims of Science and Humanities" by Moody E. Prior B. Short Stories: "The Meeting Pool" by Ruskin Bond "The Portrait of a Lady" by Khushwant Singh	07	CO2
3	Basic Vocabulary	Euphemism , One-word Substitution, Synonyms, Antonyms, Homophones, Idioms and Phrases, Common mistakes, Confusable words and expressions	07	CO3
4	Basic Grammar	Articles, Prepositions, Tenses, Concord (Subject-Verb agreement, Verbs: its Kind & Uses, Degrees of Comparison	06	CO4
5	Basic Composition	Report writing: What is a report? Kinds and objectives of reports, writing reports. Business Letter writing: Introduction to business letters, types of business letters, Layout of business letters, Letter of Enquiry / Complaint	08	CO5

Reference Books:

1. Lata , Pushp & Kumar, Sanjay .Communication Skills , Oxford University Press-2012
2. Quintanilla ,Kelly M. & Wahl ,Shawn T.Business and Professional Communication , Sage Publications India Pvt. Ltd-2011
3. Juneja, Om P & Mujumdar, Aarati .Business Communication :Techniques and Methods, Orient Black Swan-2010
4. Arora, V. N. & Chandra, Lakshmi . Improve Your Writing: From Comprehensive to Effective Writing, Oxford University Press-2010 (For the prescribed essays- "The Effect of the Scientific Temper on Man" by Bertrand Russell &"The Aims of Science and Humanities" by Moody E. Prior)
5. Mukherjee, Meenakshi .Let's Go Home and Other Stories, Orient Black Swan-2009 (For the prescribed short stories-"The Meeting Pool" by Ruskin Bond, "The Portrait of a Lady" by Khushwant Singh)
6. Quirk , Randolph & Greenbaum ,Sidney .A University Grammar of English,Pearson-2013

e-Learning Source:

Course Articulation Matrix: (Mapping of COs with POs and PSOs)															
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	1	1	3	1	1	3	3	3	3	3	2	3	3
CO2	1	2	1	1	3	1	1	3	3	3	3	3	1	1	2
CO3	1	2	1	1	1	1	1	3	3	3	3	3	3	2	3
CO4	1	2	1	1	1	1	1	3	2	3	3	3	1	2	3
CO5	1	2	1	1	3	1	1	2	3	3		3	2	2	1

1-Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator

Sign & Seal of HoD

Integral University, Lucknow

Effective from Session: 2019-20							
Course Code	CH101	Title of the Course	Chemistry	L	T	P	C
Year	1st	Semester	2nd	3	1	0	4
Pre-Requisite	10 + 2 (PCM/PCB)	Co-requisite	None				
Course Objectives	1. Develop curiosity and interest in chemistry 2. Acquire an appropriate knowledge and understanding in Chemistry 3. Develop an appreciation of chemistry and its applications in daily life.						

Course Outcomes	
CO1	Analyze and compare magnetic behavior and stability of heteronuclear diatomic molecules, Significance of hydrogen bonding ,band theory, radius ratio, density of unit cell, fullerenes and graphite
CO2	Comprehension of types of polymers to make an appropriate choice of use of polymers (Natural, synthetic and biodegradable).
CO3	Compare reaction intermediates and mechanism of chemical reactions and isomerism.
CO4	Interpret phase rule, phase diagram, corrosion and its prevention, calculation of activation energy, rate constant, half-life period, emf of electrochemical cells, construction and operation of galvanic cell and concentration cells,
CO5	Determination of calorific value , analyzing water softening methods, principles, instrumentations of UV, IR and NMR spectroscopy and their applications.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Chemical bonding and state of matter	Molecular theory of hetero diatomic molecules, Band theory of bonding in metals, Hydrogen bonding. Solid state chemistry: Radius ratio rule, Space lattice (only cubes), Types of Unit cells, Bragg's law, calculation of density of unit cell. One and Two Dimensional solids, Graphite as two dimensional solid and its conducting and lubricating properties. Fullerene & its applications	08	CO-1
2	Polymers	Polymerization and its classification, Thermoplastic and thermosetting resins. Elastomers (Buna-S, Buna-N, thiokols, polyurethanes, silicons), Polyamides (Nylon-6, Nylon-6,6, Nylon-6,10, Nylon-11, Kevlar), Polyesters (Terelene), Polyacrylates (PMMA, PAN, PVC). Organic conducting and biodegradable polymers.	08	CO-2
3	Structural and mechanistic concepts in organics	Stability of reaction intermediates, e.g. Carbanions, Carbocations and free radicals. Types of organic reactions, mechanism of nucleophilic substitutionreactions. Mechanism of the following name reactions. i. Aldolcondensation ii. Cannizzaro reaction iii. Beckmannrearrangement iv. Hofmann rearrangement and v. Diels-Alderreaction E-Z Nomenclature. R.S configuration, Optical isomerism of organic compounds containing one chiral center. Examples of optically active compounds without chirality. Conformations of n-butane.	08	CO-3
4	Reaction kinetics, Phase rule, Electrochemistry and Corrosion	Order and molecularity of reactions. First and second order reactions. Energy of activation. Phase Rule, its application to one component system (water). Equilibrium potential, electrochemical cells (galvanic and concentration cells) Electrochemical theory of corrosion and protection of corrosion.	08	CO-4
5	Analytical methods, Fuel and Water treatment	Basic principles of spectroscopic methods. The use of UV, Visible, IR, 1HNMR, for the determination of structure of simple organic compounds. Classification of fuels, determination of gross and net calorific values using Bomb Calorimeter. Hardness of water, softening of water by Lime-Soda process, Zeolites and ion exchange resins process and Reverse Osmosis. Treatment of boiler feed water by Calgon process	08	CO-5

Reference Books:

Jain P. C. and Jain M. 1994. Engineering Chemistry. Danpat Rai publishing company Pvt. Ltd., Delhi.

Bahl B.S, Arun Bahl and Tuli B.D. 2007. Essentials of Physical Chemistry. S. Chand and Co. Ltd., Delhi.

Industrial Chemistry B.K.Sharma, Goel publishing house.

e-Learning Source:

https://www.bing.com/videos/search?q=MO+diagram&&view=detail&mid=205AE2DEEABF42ACF824205AE2DEEABF42ACF824&&FORM=VRDGAR&ru=%2Fvideos%2Fsearch%3Fq%3DMO%2520diagram%26qs%3Dn%26form%3DQBVR%26%3D%2525eManage%2

https://www.bing.com/videos/search?q=phase+diagram+video&&view=detail&mid=D49B5109D6339097E40BD49B5109D6339097E40B&&FORM=VRDGAR&ru=%2Fvideos%2Fsearch%3Fq%3Dphase%2Bdiagram%2Bvideo%26FORM%3DHDRSC3

https://www.bing.com/videos/search?q=organic+reaction+mechanism&qpvt=organic+reaction+mechanism&FORM=VDRE

Course Articulation Matrix: (Mapping of COs with POs and PSOs)															
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2								1		2	3		
CO2	3	2	2			1				1		2	3		
CO3	3	2								1		2	3		
CO4	3	2		1						1		2	3		
CO5	3	2	2	1	1	1	2			1		2	3	1	

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Effective from Session: 2020-2021								
Course Code	ES 101	Title of the Course	Environmental Studies			L	T	P	C
Year	1st	Semester	2nd			2	1	0	3
Pre-Requisite	10+2 with Physics, Chemistry & Biology	Co-requisite						
Course Objectives		The purpose of this undergraduate course is to impart basic and key knowledge of environment and Ecosystem. This will help students in enhancing their knowledge of biodiversity and its conservation. After successful completion of course, the student will able to explore concept of the subject into their respective dimensions.						

Course Outcomes	
CO1	Gain knowledge about environment and Ecosystem
CO2	Students will learn about natural resource, its importance and environmental impacts of human activities on natural resource.
CO3	Gain knowledge about the conservation of biodiversity and its importance.
CO4	Aware students about problems of environmental pollution, its impact on human and ecosystem and control measures.
CO5	Students will learn about increase in population growth and its impact on environment.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Introduction to Environment and Ecosystems	Environment, its components and segments, Multidisciplinary nature of Environmental studies, Concept of Sustainability and sustainable development, Environmental movements, Ecosystem, Structure & Function, Energy flow in the Ecosystem, Ecological Pyramids and Ecological Succession.	8	CO1
2	Natural Resources	Renewable and non-renewable, Soil erosion and desertification, Deforestation, Water: Use and over exploitation, Impacts of large Dams, Case studies	8	CO2
3	Biodiversity and Conservation	Levels of biological diversity, Hot spots of biodiversity, India as a Mega Diversity Nation, Endangered and endemic species of India, Threats to Biodiversity, Conservation of Biodiversity, Ecosystem and biodiversity services.	8	CO3
4	Environmental Pollution, Policies and Practices	Environmental pollution, Solid waste management, Ill effects of fireworks, Climate change, Ozone layer depletion, acid rain and impacts on human communities and Environment, Environmental Laws: Environment Protection Act, Wildlife protection Act, Forest conservation Act, Convention on Biological Diversity (CBD), Tribal rights, Human wildlife conflicts.	8	CO4
5	Human Population and the Environment	Human population growth: Impacts on environment, human health and welfare, Resettlement and rehabilitation of project affected persons, Environmental ethics, Environmental communication and public awareness, case studies.	8	CO5

Reference Books:

1) Agarwal, K.C. 2001 Environmental; Biology, Nidi Pub. Ltd. Bikaner.

2) Bharucha Erach, The Biodiversity of India, Mapin Pub. Pvt. Ltd., Ahemdabad-380, India.

3) Brunner R.C. 1989. Hazardous waste incineration, Mc Graw Hill

4) Clark R.S. Marine Pollution, Clanderon Press Oxford (TB)

5) Cunningham W.P.2001.Cooper, T.H. Gorhani, E & Hepworth, Environmental encyclopedia, Jaicob Publication House, Mumbai.

6) De. A.K. Environmental chemistry Willey Eastern Limited.

7) Glick, H.P.1993 water in crisis, Pacific Institute for studies in dev, Environment & security, Stockholm Env, Institute, Oxford Univ, Press 473 p.

8) Hawkins R .E. Encyclopedia of Indian Natural History, Bombay Natural History Society, Bombay.

9) Heywood, V.H. & Watson, R. T.1995.Global biodiversity Assessment, Cambridge Univ. Press 1140 p.

10) Jadhave, H. and Bhosale, V. M. 1995 Environmental protection and laws, Himalaya pub, house, Delhi.284 p.

11) Mckinnery, M.L. and School, R. M.1996 Environmental science systems and solutions, web enhanced edition 639 p.

12) Mhaskar A.K. Matter Hazardous, Techno Science Pub (TM)

13) Miller T.G. Jr, Environmental Ecology, W. B. Saunders Co.USA,574 p. 16

14) Odum, E.P.1997.Fundamental chemistry, Goel Pub House Meerut.

15) Survey of the Environment, The Hindu (M).

16) Sharma B.K.2001.Environmental Chemistry, Goel Pub House Meerut

e-Learning Source:

https://byjus.com/biology/difference-between-environment-and-eCOsystem.

https://www.youtube.com/watch?v=dRPl4TB8w7k

https://www.youtube.com/watch?v=3fbEVytyJCk

https://www.vedantu.com/biology/conservation-of-biodiversity

https://youmatter.world/en/definition/soil-erosion-degradation-definition/

https://byjus.com/biology/difference-between-environment-and-eCOsystem.

Course Articulation Matrix: (Mapping of COs with POs and PSOs)															
PO-PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	2	1	1	1	3	1	1	1	1	2	1	1	1
CO2	1	1	1	1	1	1	3	1	1	1	1	1	1	1	1
CO3	1	1	2	1	1	1	2	1	1	1	1	2	1	1	1
CO4	1	1	1	1	1	1	2	1	1	1	1	2	1	1	1
CO5	1	1	2	1	1	2	3	2	1	2	1	2	1	1	1

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session: 2017 - 18								
Course Code	MT112	**Title of the Course**	Engineering Mathematics - II	**L**	**T**	**P**	**C**
Year	I	**Semester**	II	3	1	0	4
Pre-Requisite	10+2 Mathematics	**Co-requisite**					
Course Objectives		The course is aimed to develop the skills in mathematics which is necessary for grooming them into successful engineering graduate. The topics introduced will serve as basic tools for specialized studies in science field.					

Course Outcomes	
CO1	Solve first order linear equations and higher order differential equation of certain types and interpret the solutions.
CO2	To use shift theorems to compute the Laplace transform, inverse Laplace transform and the solutions of second order, linear equations with constant coefficients.
CO3	Able to determine given function in terms of sine and cosine terms in Fourier series.
CO4	Apply problem-solving using concepts and techniques from PDE's and Fourier analysis applied to diverse situations in physics, engineering, financial mathematics and in other mathematical contexts.
CO5	Apply method of least squares to find the curve of best fit for the given data

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**Unit I**	Linear differential equations of first order, Linear differential equations of higher order with constant coefficients, Complementary functions and particular integrals, Solution of second order differential equations by changing dependent and independent variables, Method of variation of parameters, Applications to engineering problems (without derivation) .	8	1
2	**Unit II**	Laplace transform of different types of functions, Laplace transform of derivatives and integrals, Unit step function, Laplace transform of periodic functions, Inverse Laplace transform, Convolution theorem, Applications to solve simple linear differential equations.	8	2
3	**Unit III**	Periodic functions, Trigonometric series , Fourier series of period 2π, Euler's formulae, Even and odd functions, Functions having arbitrary period, Change of interval, Half range sine and cosine series Introduction of partial differential equations, Solution of second order linear homogeneous partial differential equations with constant coefficients and their classifications to parabolic, elliptic and hyperbolic forms with illustrative examples.	8	3
4	**Unit IV**	Method of separation of variables for solving partial differential equations, Wave equation up to two-dimensions, Heat conduction equations up to two dimensions, Laplace equation.	8	4
5	**Unit V**	Mean, Median, Mode, Standard deviation and Variance, Method of least squares, Curve fitting of straight line and parabola.	8	5

Reference Books:
1. Advanced Engineering Mathematics, Wiley Eastern Ltd.
2. Advanced Engineering Mathematics, Khanna Publication.
3. Higher Engineering Mathematics, Khanna Publication.
4. Advanced Engineering Mathematics, CBS Publication.

e-Learning Source:
https://nptel.ac.in/courses/111106100/
https://nptel.ac.in/courses/111105123/
https://courses.maths.ox.ac.uk/node/view_material/1720
https://nptel.ac.in/courses/111103021/

Course Articulation Matrix: (Mapping of COs with POs and PSOs)															
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	2	2	1				1		2	1	1	
CO2	3	2	1	2	2	1						2	1	1	
CO3	3	2	1	1	1	1						2	1	1	
CO4	3	2	1	2	3	1				1		2	1	1	
CO5	3	1	1	1	2	1						2	1	1	

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session:	2017-18							
Course Code	ME101	**Title of the Course**	Basic Mechanical Engineering		**L**	**T**	**P**	**C**
Year	**1st**	**Semester**	2nd		3	1	0	4
Pre-Requisite	NONE	**Co-requisite**	NONE					
Course Objectives	1. Be able to have the basic concepts of thermal sciences and temperature measurement on the basis of Zeroth law of thermodynamics. 2. To understand and apply first and second law of thermodynamics to various processes and real systems. 3. Be able to model the problem using free-body diagrams and reach to solution by using equilibrium equations. 4. Be able to draw Shear Force Diagram (SFD) and Bending Moment Diagrams (BMD) for statistically determinate beams. 5. Be able to design simple components on the basis of knowledge of stress, strain and strength of material.							

Course Outcomes	
CO1	Explain basic concepts of thermal sciences and temperature measurement on the basis of zeroth law of thermodynamics.
CO2	Understand and apply first and second law of thermodynamics to various processes and real systems.
CO3	Model the problem using free-body diagrams and reach to solution by using equilibrium equations.
CO4	Draw Shear Force Diagram (SFD) and Bending Moment Diagrams (BMD) for statistically determinate beams.
CO5	Design simple components on the basis of knowledge of stress, strain and strength of material.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Fundamental Concepts and Definitions	Definition of Thermodynamics, System, surrounding and universe, Phase, Concept of continuum, Macroscopic & microscopic point of view. Density, Specific volume, Pressure, temperature. Thermodynamic equilibrium, Property, State, Path, process, Cyclic process, Energy and its form, Work and heat, Enthalpy. Zeroth law: Concepts of Temperature, Zeroth law	8	CO1
2	First law Second law	First law of thermodynamics, Concept of processes, Flow processes and control volume, Flow work, Steady flow energy equation, Mechanical work in a steady flow of process. Essence of second law, Thermal reservoir, Heat engines, COP of heat pump and refrigerator. Statements of second law, Carnot cycle, Clausius inequality.	8	CO2
3	Basic Concept Friction	Laws of motion, Transfer of force to parallel position, Resultant of planer force system. Free Body diagrams, equilibrium and its equation. Introduction, Laws of Coulomb friction, Equilibrium of bodies involving dry friction, belt friction.	8	CO3
4	Structure analysis	Beams: Introduction, Shear force and bending moment, Shear and bending moment diagram for statically determinate beams.	8	CO4
5	Stress and strain analysis	Simple Stress and strain: Introduction, Normal, shear stresses, Stress-strain diagrams for ductile and brittle materials. Pure Bending of Beams: Introduction, Simple bending theory.	8	CO5

Reference Books:

Van Wylen G.J. & Sonnlog R.E. Fundamentals of Classical Thermodynamics, John Wiley & Sons, Inc. NY.

Wark Wenneth: Thermodynamics (2nd edition) Mc Graw Hill Book Co. NY.

Holman, J.P.: Thermodynamics, Mc Graw Hill Book Co.NY.

e-Learning Source:

https://www.youtube.com/watch?v=Dy2UeVCSRYs&list=PL2_EyjPqHc10CTN7cHiM5xB2qD7BHUry7

https://www.youtube.com/watch?v=DzyIEz3dKXQ&t=1s

Course Articulation Matrix: (Mapping of COs with POs and PSOs)															
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1		2						3	3	2	2
CO2	3	3	3	2		3						3	3	3	2
CO3	3	3	3	2		3						3	3	2	1
CO4	3	2	2	2		3						3	3	2	1
CO5	3	3	2	1		3						3	3	2	2

1-   **Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session: 2020-21									
Course Code	CS101	**Title of the Course**	Computer Programming		**L**	**T**	**P**	**C**	
Year	I	**Semester**	II		3	1	0	4	
Pre-Requisite	None	**Co-requisite**	None						
Course Objectives	- To give knowledge of computers, networks, algorithms & flowcharts. - To provide fundamental concepts of programming language 'C'. - To show the use of functions and pointers to different problems. - To study the implementation of arrays, matrices and strings. - To give concepts of user defined data types structure & union.								

Course Outcomes	
CO1	Understand basic concepts of computer, networks and formulation of algorithmic solutions to problems.
CO2	Understanding of programming concepts of C language and their implementation.
CO3	Analyze and develop programs on pointers and functions.
CO4	Develop programs on different operations on arrays, matrices & strings.
CO5	Implement programs on structure, union & Dynamic memory allocation.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**Introduction to Computers**	Generation of computers, Characteristic and classifications of computers. Components of Computer: CPU, Various I/O Devices, Memory & its types, (Memory Hierarchy, Storage Media), Computer Software and their types, Operating System. Computer Networks & Communication: LAN, MAN, WAN, Network Topologies, Modes of Data Communication. Introduction to Internet and its Safeguard: Internet Addresses, Domain Name System, URL, Web Browsers Search Engines, Firewalls, Anti-Virus, Translators. Algorithm and flowchart: Algorithm and flow chart characteristics, Sketching Flowcharts of various problems.	8	1
2	**Starting C**	Standard I/O in 'C', 'C' Fundamental, C Character set, Constants, Variables, Keywords and Identifiers, Data types, Declaration. Operators and Expressions, Conditional statements (If, If-else), Nesting of if- else statement, switch statement, The? operator, goto statement. Decision making and Looping (While, Do-While, for), Break and Continue statements, Case Control Structures (Switch), C programs based on above concepts.	8	2
3	**Introduction to pointers**	Declaration and initialization of pointers, accessing the address of the variable, accessing the variable through the pointer, chain of pointers, pointers operators, pointer arithmetic Introduction to Functions: Need of "C" function, User Defined and Library Functions, Prototype of Function, Call by Value; Call by Reference; Nesting of Functions, Recursion. Pointers with function, C program based on above concept.	8	3
4	**Array**	Concept of One Dimensional and Multi-Dimensional arrays, Declaration, Operations: insert, delete, search, traverse, and merge, matrix operations, Sorting: Bubble sort, merge sort, insertion sort. Character array and strings: declaring and initializing strings variable, reading and writing a character, reading and writing strings from terminal, Arithmetic operations on characters, string handling functions. Application of pointers, and function on array, C program based on above concept.	8	4
5	**Structures**	Defining Structure, Declaration of Structure Variable, Accessing Structure members, copying and comparing structure variable, operation on individual member, nesting of structures, Array of structures. Application of pointers and function on Structures. Union Defining Union Declaration of Union, difference between structure and Union, Introduction of Static and Dynamic memory allocation- The process of Dynamic memory allocation, C program based on above concept.	8	5

Reference Books:
1. Foundation of Information Technology by 'D.S. Yadav'- New age International
2. Programming in 'C' by 'E Balagurusamy'. -TMH Publication.

e-Learning Source:
1.   https://onlinecourses.nptel.ac.in/noc22_cs40/preview

PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2				3		3	2			2	3	2	
CO2	3	3	1			1		2				2	1	3	
CO3	3	2				2	3	2				3			3
CO4	3	2		2		3	2	2				1			3
CO5			1			1							1		3

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session: 2019-20								
Course Code	CH102	**Title of the Course**	Engineering Chemistry Lab	**L**	**T**	**P**	**C**	
Year	1st	**Semester**	2nd	**0**	**0**	**1**	**2**	
Pre-Requisite	10 + 2 (PCM/PCB)	**Co-requisite**						
Course Objectives	• To understand qualitative and quantitative problems • Improvement of practical/technical skills. • Ability to work effectively and safely in a laboratory environment. • Enhancing communication skill.							

Course Outcomes	
CO1	Analysis of iron ore.
CO2	Study of water quality parameters.
CO3	Study of Iodometric titration.
CO4	Comprehension of principle, instrumentation and use of UV-VIS spectrophotometer and pH meter.
CO5	Detection of functional groups and elements in organic compounds.

Unit No.	Title of the Experiment	Content of Unit	Contact Hrs.	Mapped CO
1	Iron content	To determine the Iron content in the given iron ore by using external indicator.	2	CO-1
2	Alkalinity	To determine the Alkalinity in the given water sample.	2	CO-2
3	Chloride content	To determine the Chloride content in the given water sample by Mohr's method. (Argentometric method).	2	CO-2
4	Available chlorine	To determine the Percentage of Available Chlorine in the given sample of Bleaching powder iodometrically.	2	CO-3
5	Hardness	To determine the temporary and permanent hardness in water sample by Complexometric titration using EDTA as standard solution.	2	CO-2
6	Chemical displacement	To determine the Equivalent weight of Iron by Chemical Displacement method. (The Equivalent weight of copper is 63.5)	2	CO-3
7	pH metric determination	To determine the strength of given HCl solution by titrating it against NaOH solution using pH meter.	2	CO-4
8	Spectrophotometric measurement	To determine the iron concentration in the given water sample by Spectrophotometer using potassium thiocyanate as color developing agent.	2	CO-4
9	Functional group detection	To detect the presence of functional groups in the given organic compound.	2	CO-5
10	Elements detection	To detect the presence of Elements in the given organic compound.	2	CO-5

e-Learning Source:
https://www.bing.com/videos/search?q=alkalinility+of+water+sample&qpvt=alkalinility+of+water+sample&view=detail&mid=7AF6506DB69D2C2F3EA37AF6506DB69D2C2F3EA3&&FORM=VRDGAR&ru=%2Fvideos%2Fsearch%3Fq%
https://www.bing.com/videos/search?q=functinal+group+detection&&view=detail&mid=F232CD67537BBA0CC3EBF232CD67537BBA0CC3EB&&FORM=VRDGAR&ru=%2Fvideos%2Fsearch%3Fq%3Dfunctinal%2520group%2520detection%26qs%3Dn%26form%3DQBVR%26%3D%2525eManage
https://www.bing.com/videos/search?q=iodometric+titration&qpvt=Iodometric+titration&FORM=VDRE

Course Articulation Matrix: (Mapping of COs with POs and PSOs)															
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2					2	1	2	2		2	3		
CO2	3	2	2				2	1	2	2		2	3	2	
CO3	3	2					2	1	2	2		2	3		
CO4	3	2		2	1		2	1	2	2		2	3	2	
CO5	3	2					2	1	2	2		2	3		

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session: 2015-16

Course Code	ME102	Title of the Course	MECHANICAL ENGINEERING LAB	L	T	P	C
Year	I	Semester	II	0	0	2	1
Pre-Requisite	NONE	Co-requisite	NONE				
Course Objectives		• To understand the working and basic components of 4 stroke petrol engine and 4 stroke Diesel engine through study their models. • To understand the working and basic components of 2 stroke petrol and vapor compression refrigeration system through model study. • To understand basic components and working of water tube boiler through model study. • To learn the technique for determine of hardness and impact strength of a material. • To learn the technique for determine of compressive strength of a brick through UTM.					

Course Outcomes	
CO1	To understand the working and basic components of 4 stroke petrol engine and 4 stroke Diesel engine through study their models.
CO2	To understand the working and basic components of 2 stroke petrol and vapor compression refrigeration system through model study
CO3	To understand basic components and working of water tube boiler through model study.
CO4	To learn the technique for determine of hardness and impact strength of a material.
CO5	To learn the technique for determine of compressive strength of a brick through UTM.

Experiment No.	Title of the Experiment	Content of Unit	Contact Hrs.	Mapped CO
1	Four Stroke Petrol Engine	To Study & Sketch the model of S.I. Engine (4 Stroke)	2	CO1
2	Four Stroke Diesel Engine	To Study & Sketch the model of C.I. Engine (4 Stroke).	2	CO1
3	Two Stroke Petrol Engine	To Study & Sketch the model of S.I. Engine (2 Stroke)	2	CO2
4	Vapor Compression	To Study & Sketch the model of Vapor Compression Refrigerators	2	CO2
5	Water Tube Boiler	To Study & Sketch the model of water tube boiler (Babcock & Wilcox)	2	CO3
6	Impact Testing	To determine the Impact Strength of Mild Steel using Izod Method	2	CO4
7	Hardness Testing	To determine the harness of a mild steel specimen by using hardness tester (Rockwell Hardness test)	2	CO4
8	UTM Testing	To learn the technique for determine of compressive strength of a brick through UTM.	2	CO5

e-Learning Source:

https://www.vlab.co.in/

PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Course Articulation Matrix: (Mapping of COs with POs and PSOs)															
CO1	3	2	2	1		3			3	2		3	3	2	2
CO2	3	2	2	2		3			3	2		3	3	2	2
CO3	3	2	3	2		3			3	2		3	3	2	2
CO4	3	3	3	2		3			3	2		3	3	2	2
CO5	3	3	2	1		3			2	2		3	3	2	2

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session: 2020-21

Course Code	LN151	Title of the Course	Basic Professional Communication Lab	L	T	P	C
Year	1st	Semester	2nd	0	0	2	1
Pre-Requisite	10+2	Co-requisite	None				
Course Objectives			1.The course aims to educate the students in both the artistry and utility of the English language for professional purposes through the study of language and literature. 2. The key component of the various types of professional communication is basically communication in the English language which is now a global language. 3. The Department of Languages caters to the needs of the students aspiring for training, expertise and excellence in professional communication with a marked emphasis on English for Specific/Special Purposes (ESP). 4. Students will be given new insights into the concepts of soft skills & professional communication to boost their confidence which will help them choose and build a better career which depends not only on the hard skills, but on one's soft skills & professional ethics also. 5. The course will help them overcome their fear & anxiety of public speaking & guide them to be a good & effective communicator whom people love to hear.				

	Course Outcomes
CO1	Students will be introduced to the basic understanding of communication and Professional Communication. Knowledge of Professional, cultural and cross-cultural communication will be imparted. Meaning and process of communication, verbal and nonverbal communication will be focused. Basic Understanding of communication and Professional/Business Communication will be provided. They will also learn & practice how to introduce oneself in professional setting & how to manage speaking anxiety. .
CO2	Corrections in basic English sounds and correct pronunciations will be practiced by various listening exercises & word games to help them become better conversationalist.
CO3	Basic tools of communication and improvement in communicative competence. Improvement in communicative competence will be done by using various software applications, showing them cultural movies & involving them in exercises like small & situational talk.
CO4	Phonetic Alphabet and Phonetic Transcriptions will be taught & practiced to improve vocal clarity & pronunciation. Understanding the structural and functional grammar and basic structure of language.
CO5	Intonation & Stress will be practiced to make them learn how paralinguistic features dramatically affect meaning & how it can help one in becoming a persuasive & engaging speaker.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Introduction	Difference between Introduction and Description, SWOT Analysis	6	CO 1
2	Software -I	Listening exercises, Pronunciation improvement through self- testing, Vocabulary improvement through word games	6	CO 2
3	Software – II	Conversational skills, Exercises based on Language Skills/ Small talk, Cultural movies	6	CO 3
4	Phonetics	Phonetic Alphabet and Phonetic Transcriptions	6	CO 4
5	Non-verbal communication	Intonation and Stress	6	CO 5

Reference Books:

1. Gerson, Sharon J. *Technical Writing: Process and Product* (5th edition). Prentice Hall, 2005.

2. K. Floyd, *Interpersonal Communication: The Whole Story*. McGraw Hill, 2009.

3. Greenbaum, Sidney and Nelson Gerald, *An Introduction to English Grammar*. Routledge, 2009.

4. Swan, Michael, *Practical English Usage*. OUP, 2005.

5. Murphy, Raymond. *English Grammar in Use*. Cambridge University Press, 2019.

6. Kumar, Sanjay and Pushp Lata., Communication Skills. Oxford University Press, Oxford 2011.

7. Raman, Meenakshi, and Sangeeta Sharma. Technical Communication: Principals and Practice. Second Edition, Oxford University Press, 2012.

8. Gerson, Sharon J. *Technical Communication: Process and Product* (9th edition). Longman Pub., 2016.

e-Learning Source:

1. https://ndl.iitkgp.ac.in./
2. https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=9RA537jM1m7VD3VCoav4lQ==
3. https://library.iul.ac.in/

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)													
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		2	1	3		2			2	3	1	3			
CO2		1	1	1	2	2			3	3	1	3			
CO3					1	2			1	3	1	3			
CO4					1	2			1	3		3			
CO5						2			1	3		3			

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session: 2020-21							
Course Code	CS102	Title of the Course	COMPUTER PROGRAMMING LAB	L	T	P	C
Year	I	Semester	II	0	0	2	1
Pre-Requisite	None	Co-requisite	None				
Course Objectives		• To learn the basic concepts and syntax of C programming. • To be able to develop logics which help them to create programs and applications using C language. • To learn the use of C libraries functions in C language. • To learn the file handling and basic memory allocation concepts in C language. • After learning the C programming, they can easily switch over to any other language.					

Course Outcomes	
CO1	Able to understand the basic concepts of C programming language and their implementation.
CO2	Able to design and develop various programming problems using C programming concepts.
CO3	Able to analyze and develop programs on pointers and functions.
CO4	Able to develop programs on different operations on arrays, matrices & strings.
CO5	Able to implement programs on structure, union & Dynamic memory allocation.

S. No.	List of Experiments	Contact Hrs.	Mapped CO
1	Write a Program to print any message.	1	1
2	Write a Program to print sum and multiply of two numbers.	1	1
3	Write a Program to enter the temperature in Celsius(c) then count it into Fahrenheit.	1	1
4	Write a Program to swap the number taking the help of third variable.	1	1
5	Write a Program to calculate the volume of box.	1	1
6	Write a Program to swap the number without taking the help of third variable.	2	2
7	Write a Program to check a year is leap year not.	2	2
8	Write a Program to print number is even or odd.	2	2
9	Write a Program to Print month of name using switch case.	2	2
10	Write a Program to print the no is positive or negative.	2	2
11	Write a Program to find the greater number enter by user.	2	3
12	Write a Program to find the greater number Input 3 No.	2	3
13	Write a Program to enter any no and check whether the given no is palindrome or not.	2	3
14	Write a Program to enter any no. and check whether the given no. is Armstrong or not.	2	3
15	Write a Program to Print Pattern * * * * * * * * * *	1	3
16	Write a Program to Print Pattern 1 2 3 4 1 2 3 1 2 1	1	4
17	Write a Program to Print Pattern 1 1 2 1 2 3 1 2 3 4	1	4
18	Write a program to find in C to design the report card of 5 subject according to the following condition if the total percentage are. >=35 and <45 IIIrdDiv >=45 and <60 IIndDiv >=60 IstDiv If any students score <35 in any of the subject display fail	1	4
19	Write a Program to create 2-D array or order M*N and insert the element and display it.	2	4

20	Write a Program to find the addition of two matrix of order M*N.	2	4
21	Write a Program to find the Transpose of the matrix.	2	5
22	Write a Program to swap two numbers Call by Value.	2	5
23	Write a Program to swap two number using function pointers.	2	5
24	Write a Program for structure of player Name, batting average and then name.	2	5

| **Reference Books:** |
| 1. Foundation of Information Technology by 'D.S. Yadav' |
| 2. Programming in 'C' by 'E Balagurusamy'. |
| 3. Let us 'C' by 'YashwantKanitkar' |
| 4. The C Programming Essentials by Dey |

| **e-Learning Source:** |
| 1. https://onlinecourses.nptel.ac.in/noc22_cs40/preview |

PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	2		3		3						2	1	1
CO2	1	1	1	2	1		3						2	1	1
CO3	1	2	2	2			3						2	1	1
CO4	1	2	2	2			3						2	1	1
CO5	1	2	1				3						2	1	1

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**