Integral University, Lucknow

Effective from Session: 2017 - 18							
Course Code	MT201	**Title of the Course**	**ENGINEERING MATHEMATICS – III**	**L**	**T**	**P**	**C**
Year	**II**	**Semester**	III	**3**	**1**	**0**	**4**
Pre-Requisite	Complex Variables, Calculus, Ordinary Differential Equations.	**Co-requisite**					
Course Objectives	• To identify the functions in engineering problems as analytic function and their study as a function of a complex variables. To learn the analysis of a system in time domain and predict the transient performance parameters of a system for different standard inputs. To understand the basic concepts of different types of controllers. • To specify some difficult integration that appear in applications can be solved by complex integration. • To understand the method of finding the series solution of Bessel's and Legendre's differential equations.						

Course Outcomes	
CO1	To solve Engineering problems using complex variable techniques
CO2	To evaluate the line integrals of a complex valued function
CO3	To apply the analytical technique to express periodic function as a Fourier sine and cosine series. Determine Z transform of DT signal and specify ROC, Using Z-transform properties to solve such problems efficiently
CO4	To apply the concept of probability to find the physical significance of various distribution phenomena.
CO5	To apply series solution of Bessel's differential equations for BVP.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	**Complex VariableI**	Analytic functions, C- R equations and harmonic functions, Lin e integral in the complex plane, Cauchy' s integral theorem, Cauchy' s integral formula for derivatives of analytic functions, Liouville' s theore.	8	1
2	**Complex VariableII**	Representation of a function by power series, Taylo r' s and Laurent' sseries, singularities, zeros and poles, Residue theorem, evaluation of real integrals of type $\int_0^{2} f(\cos\theta,\sin\theta)d\theta$ and bilinear transformations.	8	2
3	**Integral Transforms**	Fourier integral, Fourier complex transform, Fourier sine and cosine transforms and applications to simple heat transfer equations. Z-transformand its application to solve difference equations.	8	3
4	**Probability and Descriptive Statistics**	Probability, Correlation and Regression, Binomial distribution, Poissondistribution, Normal distribution.	8	4
5	**Series Solution**	Series solutions of ODE of 2nd order with variable co-efficient with special emphasis to differentialequations of Bessel, Bessel functions and their properties.	8	5

Reference Books:

1. Kreyszig E. (1993) : Advanced Engg. Mathematics John Willey & Sons inc.S. Hasan Saeed, Automatic Control System, Kataria and sons, New Delhi
2. Dennis G. Zill : Advanced Engineering Mathematics, CBS Pub.

e-Learning Source:

https://nptel.ac.in/courses/111103070

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	PSO4
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 Correlatio

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

Integral University, Lucknow
B.Tech Biotech , Food Tech

Effective from Session:							
Course Code	**ES202**	**Title of the Course**	Disasters, Management	**L**	**T**	**P**	**C**
Year	**II**	**Semester**	III	2	1	-	**3**
Pre-Requisite	10+2 having a minimum of 45% marks in the aggregate from a recognized Board/University	**Co-requisite**					
Course Objectives	• To Study the types of Disasters and its profile in India. • Knowledge of causes and impacts of Disasters, and Case studies of National and Global Disasters. • To learn about risk reduction approaches of Disasters with safety issues in mitigating Industrial disasters. • Basic concepts of Disaster Management Cycle and its Risk Reduction Measures. • To know the National Acts and policies for mitigating disasters. Role of Army, Police, Community, Corporate, Media etc. for post Disaster Management.						

Course Outcomes	
CO1	Students are able to learn types of disasters and its profile in India
CO2	Students are able to understand the causes and impacts of disasters on environment
CO3	Students are able to learn about risk reduction approaches of disasters with safety issues in mitigating industrial disasters.
CO4	To understand the concept of Disaster Management Cycle and its Risk Reduction
CO5	To understand the concept of Disaster Management Cycle and its Risk Reduction

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Introduction to disaster	Introduction to Disasters, Concepts, Definition and types (Natural and Man-made), Disaster profile of India.	8	CO1
2	Impact of Disaster	Causes and Impacts of Disasters, Global and National Perspective, Case studies from Disasters, Large Hydro projects and its risks for Disasters	8	CO2
3	Disaster Risk Reduction	Approaches to Disaster risk Reduction, Safety issues in mitigating Industrial disasters, Case studies, EHS etc.	8	CO4
4	Disaster Management	Disaster Management Cycle, Risk Reduction Measures (Preparedness, Mitigation, Response	8	CO3
5	Disaster Act. and Policies	National Acts and policies for mitigating Disasters (Disaster Management Act 2005, NDRF,	8	CO3

Reference Books:

(1) Gupta Harsh K., Disaster Management, Hyderabad University Press. Publications-Meerut.

(2) Sethi, V.K., Disaster Management, New Delhi Maxford Books

(3) Bhattacharya, Tushar, Disaster Science and Management, New Delhi Tata Mc Graw Hill.

(4) Nidhi Gauba, Dhawan/ Ambrina Sardar Khan, Disaster Management and Preparedness, CBS

e-Learning Source:

https://www.youtube.com/watch?v=9WIwlljva_s

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

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	PSO4	PSO5	PSO6
CO1	2	1	1	1	1	1	3	2	1	1	2	1	1	1	1	-	-	-
CO2	2	2	2	1	2	3	3	2	2	2	2	2	1	1	1	-	-	-
CO3	3	2	2	1	2	2	3	2	2	2	1	2	2	1	1	-	-	-
CO4	3	2	2	1	2	2	3	2	2	1	1	2	1	1	1	-	-	-
CO5	3	1	3	2	2	2	2	2	3	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:							
Course Code	EC249	**Title of the Course**	Circuit Theory Lab	**L**	**T**	**P**	**C**
Year	II	**Semester**	IV	**0**	**0**	**2**	**2**
Pre-Requisite	Mathematics, Basic Electrical Engineering	**Co-requisite**					
Course Objectives	1. The ability to conduct experimental procedures for verification of different theorems. 2. The ability to conduct testing and experimental procedures on Transient response of R-L circuits. 3. The ability to conduct testing and experimental procedures on Transient response of R-C circuits. 4. The ability to conduct testing and experimental procedures on Transient response of R-L-C circuits. 5. To give a chance to students to solve two port networks analysis. 6. To determine the two port parameter of a two port resistive network.						

Course Outcomes	
CO1	Given a circuit, students shall be able to **understand** and **analyze** the circuits by using the AC-DC different Theorems.
CO2	Given a circuit of passive elements with sources, **student** shall be able to conduct experiments to **analyze** and **evaluate** the circuits using
CO3	For a given circuit of R, L, C, student shall be able to generate experimentally and **investigates**, **examine**, **analyze** and **evaluate** the transient response characteristics.
CO4	For a given series RLC circuit student shall **examine** the variation in current and voltage and find the resonant frequency of the circuit.
CO5	Given a two port network, student shall be able to **understand** its parameters and **modify** its form as per requirement

Unit No.	**Experiment No.**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	**1**	To Verify Thevenin's Theorem.	2	1
2	2	To Verify Norton's Theorem.	2	1
3	3	To Verify the Maximum Transfer Theorem.	2	1
4	4	Obtain the transient response of RC circuit.	2	3
5	5	Obtain the frequency response of series RLC circuit.	2	4
6	6	To determine the z-parameters of two port resistive network.	2	5
7	7	Obtain the transient response of RL circuit.	2	2

Reference Books:

1. Networks and Systems, Ashfaq Husain, Khanna Books Publishing Co. (P) Ltd. New Delhi
2. Network Analysis & Synthesis, C.L.Wadhwa, New Age International Publishers
3. Networks And Systems, D. Roy Chowdhury, New Age International Publishers.
4. Introductory Circuit Analysis, Robert Boylestad, Pearson Education, Pearson Education, Precntice Hall.
5. Circuit Analysis Principles and Applications, Allan H. Robbins and Wilhelm C. Miller, Cenage Learning India Private Limited.
6. Circuit theory, Dr. Abhijit Chakrabarty, Dhanpat Rai & Co. Pvt. Ltd.

e-Learning Source:

https://www.vlab.co.in/broad-area-electronics-and-communications

http://vlabs.iitb.ac.in/vlab/

https://vlab.amrita.edu/

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	1	1	2				1				3	3	2	
CO2	3	3	1	1	2				2				3	3	3	
CO3	**3**	**3**	**1**	**1**	**2**				**2**				**3**	**3**	**2**	
CO4	**3**	**3**	**1**	**1**	**2**				**2**				**3**	**3**	**3**	
CO5	**3**	**3**	**2**	**1**	**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:							
Course Code	EC232	**Title of the Course**	Fundamental of Circuits & Networks	**L**	**T**	**P**	**C**
Year	II	**Semester**	III	**3**	**1**	**0**	**4**
Pre-Requisite	Mathematics, Basic Electrical Engineering	**Co-requisite**					
Course Objectives	❖ To understand the concepts of signals and their applications in DC and AC circuits. ❖ To learn the analysis of electrical circuits by basic law's, AC theorems and Kirchhoff's law. ❖ To understand the analysis of circuit by implementation of Graph Theory						

Course Outcomes	
CO1	Given a circuit, students shall be able to **represent** signals in mathematical form, **identify** type of system**, apply** Kirchhoff's laws, and **formulate** source transformation.
CO2	Given a circuit of passive elements with sources, student shall be able to **analyze** and **evaluate** the circuits usingKirchhoff's laws and AC-DC theorems
CO3	For a given circuit student shall be able to draw the graph of the given circuits and **examine**, **analyze** and **evaluate** the circuit characteristics.
CO4	For a given transfer function, students shall be able to identify its pole zeros and for stable circuits, **select** suitable **design** of implementation, **develop** series / parallel combination by differential equations.
CO5	Given a two port network, student shall be able to **define** its parameters**, solve, analyze,** and **modify** its form.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Introduction and Basic laws	Introduction Review of D.C. & A.C. circuits, DC Circuits: Current & Voltage Source Transformation. Mesh & Node Analysis of D.C., concept of network, active and passive	8	1
2	Network Theorems	Network Theorem Superposition Theorem, Thevenin's Theorem, Norton'sTheorem, Maximum Power Transfer Theorem, Millman's Theorem,	8	2
3	Graph Theory	Circuit Analysis Introduction to Graph Theory. Tree, link currents, branch voltages, cut set & tie set, Mesh & Node Analysis	8	3
4	Time & Frequency Domain	Time and Frequency Response of Circuits: First & second order ifferentialequations, initial conditions. Evaluation & Analysis of Transient Steady state responses using Classical Technique as well as by Laplace Transform.	8	4
5	Two Port Network	Two-Port Networks: Concept of two-port network. Driving point and Transfer Functions, Open Circuit impedance (Z) parameters, Short Circuitadmittance (Y) parameters, Transmission (ABCD) parameters. Inverse Transmission (A'B'C'D') parameters. Hybrid (h) parameters. Inter Relationship of different parameters. Interconnections of two-port.	8	5

Reference Books:

1. Networks and Systems, Ashfaq Husain, Khanna Books Publishing Co. (P) Ltd. New Delhi
2. Network Analysis & Synthesis, C.L.Wadhwa, New Age International Publishers.

e-Learning Source:

https://www.vlab.co.in/broad-area-electronics-and-communications

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**	**1**	**1**	**2**							**2**	**3**	**3**	**3**
CO2	**3**	**3**	**1**	**1**	**2**								**3**	**3**	**3**
CO3	**3**	**3**	**1**	**1**	**2**				**2**				**3**	**3**	**3**
CO4	**3**	**3**	**1**	**1**	**2**				**2**				**3**	**3**	**3**
CO5	**3**	**3**	**2**	**1**	**2**				**2**				**3**	**3**	**3**

Integral University, Lucknow

Effective from Session: 2017-18							
Course Code	EC233	**Title of the Course**	Electronic circuit lab	**L**	**T**	**P**	**C**
Year	**II**	**Semester**	IV	**0**	**0**	**2**	**1**
Pre-Requisite		**Co-requisite**					
Course Objectives	1 To understand application of p-n junction Diode, Zener diode, Rectifier etc. 2. To analyze the performance of multistage amplifier and power amplifier 3. To study and analyze the performance of multi-vibrators 4. To understand application of OP AMP.						

Course Outcomes	
CO1	Design voltage regulator using Zener Diode.
CO2	Design a DC voltage supply circuit.
CO3	Design and analyze amplifier circuit using transistor.
CO4	Design different Wave Form generator circuit.
CO5	Design and analyze different circuits using OPAMP, Design different filter circuits and study their performance.

Experiment No.	**Title of the Experiment**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Clipper &Clamper	Study of Diode as clipper &clamper	2	CO1
2	Zener diode	Study of Zener diode as a voltage regulator To draw the performance	2	CO1
3	Full wave rectifier	Study of ripple and regulation characteristics of full wave rectifier without and with capacitor filter.	2	CO2
4	B.J.T	Study of characteristics curves of B.J.T .	2	CO3
5	R-C coupled amplifier	Construction of a two-stage R-C coupled amplifier & study of it's gain.	2	CO3
6	Power amplifiers	Study of class A & class B power amplifiers.	2	CO3
7	Timer circuit using NE555	Study of timer circuit using NE555 & configuration for Monostable & astablemulti-vibrator.	2	CO4
8	Phase shift oscillator	Construction & study of RC phase shift oscillator.	2	CO5
9	Switched Mode Power Supply	Study of Switched Mode Power Supply & construction of a linear voltage regulator using regulator ICchip.		CO1
10	Function generator using IC	Construction of a simple function generator using IC.		CO2

e-Learning Source:

https://www.vlab.co.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**	**PSO4**
CO1	3	3	1	1	2				2				3	3	2	1
CO2	3	3	1	1	2				2				3	3	2	1
CO3	3	3	1	1	2				2				3	3	2	1
CO4	3	3	1	1	2				2				3	3	2	1
CO5	3	3	2	1	2				2				3	3	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:							
Course Code	EC 231	**Title of the Course**	**FUNDAMENTAL OF BIOMEDICAL ELECTRONICS**	**L**	**T**	**P**	**C**
Year	**SECOND**	**Semester**	THIRD	**3**	**1**	**0**	**4**
Pre-Requisite		**Co-requisite**					
Course Objectives	• To understand the basic concepts of semiconductor physics and analyze the characteristics of PN Junction Diode and analyze the transport phenomena of various current components in a Semiconductor device and also understand the behavior and characteristic features of special diodes like LED, Schottky, Laser, etc • To understand and develop analytical capability to analyze feedback in amplifiers and apply it to check the stability of feedback amplifiers and analyze multistage and tuned amplifiers. • To understand the concept of Oscillators and analyze the working of different oscillators. To study the concept of regulated power supply and study various circuits for generating regulated power supply.						

Course Outcomes	
CO1	The learners shall **recall** the basic concepts of semiconductor physics and **analyze** the characteristics of PNJunction Diode and **analyze** the transport phenomena of various current components in a Semiconductor device and also **understand** the behavior and characteristic features of special diodes like LED, Schottky
CO2	The learners shall **understand** the concepts of Bipolar Junction Transistor and **analyze** the terminal behavior of the devices such as Junction Diode, BJT &MOSFET, also **infer** the region of operation with itsequivalent circuit model.
CO3	The learners shall **understand** the concept of MOSFET and **apply** the same to **understand** the MOS
CO4	The learners shall **understand** and **develop** analytical capability to **analyze** feedback in amplifiers and **apply** it to check the stability of feedback amplifiers and **analyze** multistage and tuned amplifiers.
CO5	The learners shall **understand** the concept of Oscillators and **analyze** the working of different oscillators. The learners shall **understand** the concept of regulated power supply and **analyze** various circuits for generating regulated power supply.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**Diodes**	Review of PN Junction Diode- characteristics and application Special purpose diodes: Tunnel diode, Varactor Diode, Schottkey Diode, Light Emitting Diode, Laser Diode and photo voltaic cell, with their working principle	8	1
2	**Bipolar Junction Transistor**	Review of Configuration and V I characteristics of BJT, Small signal and low frequency analysis of BJT amplifier, Darlington pair, cascode amplifierClassification of Amplifiers: Class A,B,C amplifiers, Audio Amplifiers, Power amplifier.	8	2
3	**MOSFET** :	Review of device structure, operation & V I characteristic. Ohmic and saturation region equations. Classification of MOS (NMOS, PMOS,CMOS) principle of working and comparison, MOSFET as an amplifier and switch, biasing of MOS amplifier circuit	8	3
4	**Feedback Amplifiers**:	Basic concept of feedback, General Characteristics of negative feedback amplifiers, Classification of feedback, Voltage/Current shunt and series feedback, stability of feedback amplifiers, Multistage Amplifiers.	8	4
5	**Oscillators & Voltage Regulator Oscillators**	Condition for oscillation, generalized form of oscillator circuit, The phase shift oscillator, Hartley &Colpitt"s oscillator. The Wein Bridge oscillator, Crystal oscillator, frequency stability. Regulated Power Supplies: SMPS,UPS (block diagram).	8	5

Reference Books:

1. Shilling & Belove, Electronic Circuit, McGraw-Hill Education India.
2. Streetman, B.G. Banerjee Sanjay, Solid State Electronic Devices, PHI.

e-Learning Source:

1.You tube link: https://www.youtube.com/watch?v=9FJJre

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	1	2				1		1	3	3	2
CO2	3	2	2	1	1	2				1		1	3	3	2
CO3	2	1	2			2				1		1	3	3	2
CO4	2	1	2			2				1		1	3	3	2
CO5	2	1	2			2				1		1	3	3	2

Integral University, Lucknow

Effective from Session: 2020-21							
Course Code	**CS-203**	**Title of the Course**	**Cyber Law & Information Security**	**L**	**T**	**P**	**C**
Year	**II**	**Semester**	III	**2**	**1**	**0**	**3**
Pre-Requisite	**None**	**Co-requisite**	**None**				
Course Objectives	• Knowledge about cyber law, intellectual property and cyber crimes(internet security threats), trademarks and domain theft • Knowledgeon the disciplines of technology, E-business and law to allow them to minimize the occurrence and severity of information security incidents.						

Course Outcomes	
CO1	Understand key terms and concepts in cyber law, intellectual property and cybercrimes(internet security threats), trademarks
CO2	Keep an appropriate level of awareness, knowledge and skill on the disciplines of technology, E-business and law to allow them.
CO3	Understand about Information System and principles of Information Security (as confidentiality, integrity, and availability)
CO4	Understand about cryptography and techniques used to detect and prevent network intrusions.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**Fundamentals of Cyber Law**	Jurisprudence of Cyber Law, Object and Scope of the IT Act 2000, Introduction to Indian Cyber Law, Unicitral Model Law, ISP Guideline. Intellectual property issues and cyber space, Indian perspective, Overview of Intellectual property related legislation in India, Patent, Copy Right, Trademark law, Law related to semiconductor layout &design.	8	1
2	**E - Commerce**	Security Threats to E - Commerce, Virtual Organization, Business Transactions on Web, E-Governance and EDI, Concepts in Electronics payment systems, E-Cash, Credit/Debit Cards, E- Agreement, Legal recognition of electronic and digital records, E- Commerce Issues of privacy, Wireless Computing- Security challenges in Mobile devices. Digital Signatures - Technical issues, legal issues, Electronic Records, Digital Contracts, and Requirements of Digital Signature System.	7	2
3	**Investigation and Ethics**	Cyber Crime, Cyber jurisdiction, Cyber crime and evidence act, Treatment of different countries of cyber crime, Ethical issues in data and software privacy, Plagiarism, Pornography, Tampering computer documents, Data privacy and protection, Domain Name System, Software piracy, Issues in ethical hacking. Internet security threats: Hacking, Cracking, Sneaking, Viruses, Trojan horse, Malicious Code & logic bombs.Introduction to biometric security and its challenges, Finger prints.Cyber crime forensic: CASE STUDY in Cyber Crime.	9	3
4	**Information security**	Information Systems and its Importance, Role of Security in Internet and Web Services, Principles of Information Security, Classification of Threats and attacks, Security Challenges, Security Implication for organizations, Security services - Authentication, Confidentiality, Integrity, Availability and other terms in Information Security, Information Classification and their Roles. Introduction to Cryptography, Issues in Documents Security, Keys: Public Key, Private Key, Firewalls, Basic Concepts of Network Security, Perimeters of Network protection & Network attack, Need of Intrusion Monitoring and Detection.	9	4

Reference Books:

1. Harish Chander "Cyber Law and IT Protection" , PHI Publication, New Delhi
2. Merkov, Breithaupt," Information Security", Pearson Education

e-Learning Source:

https://nptel.ac.in/courses/106106129

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	PSO5	PSO6	PSO7
CO1	**1**	**2**	**2**	**3**	**1**	**2**	**1**	**3**	**1**	**2**	**1**	**2**	**1**	**2**	**2**			
CO2	**3**	**2**	**1**	**1**	**1**	**2**	**3**	**2**	**2**	**2**	**3**	**1**	**3**	**2**	**2**			
CO3	**2**	**2**	**2**	**2**	**1**	**1**	**3**	**2**	**3**	**1**	**1**	**2**	**2**	**1**	**2**			
CO4	**3**	**2**	**1**	**2**	**3**	**1**	**1**	**3**	**2**	**2**	**3**	**3**	**2**	**3**	**1**			
CO5	**1**	**2**	**2**	**3**	**1**	**2**	**1**	**3**	**1**	**2**	**1**	**2**	**1**	**2**	**2**			

Integral University, Lucknow

Effective from Session:							
Course Code	BM-226	**Title of the Course**	Human Values & Professional Ethics,	**L**	**T**	**P**	**C**
Year	**2nd**	**Semester**	3rd				
Pre-Requisite	None	**Co-requisite**	none				
Course Objectives	➢ To understand the moral values that ought to guide the Management profession, Resolve the moral issues in the profession, ➢ To justify the moral judgment concerning the profession. ➢ To create an awareness on Management Ethics and Human Values. ➢ To inspire Moral and Social Values and Loyalty. Intended to develop a set of beliefs, attitudes, and habits that engineers should display concerning morality. ➢ To create awareness about the important global issues: . Multinational corporations - Environmental ethics - computer ethics - weapons development						

Course Outcomes	
CO1	Development of moral and ethical values, right understanding and relationships
CO2	Knowledge of Moral Rights and Moral rules, Moral character and responsibilities. Privacy, Confidentiality, Intellectual Property rights and its laws.
CO3	Awareness about the Professional Responsibility of engineers, Responsibility of engineers related to risks, hazards and safety.
CO4	Development of Engineers Ethics. Understanding of variety of moral issues, moral judgment concerning the profession.
CO5	Understanding of various of global issues; Environmental ethics - computer ethics - weapons development.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Human Value Education	Understanding the need, basic guidelines, content and process for Value Education, Self-Exploration. Its content and process; 'Natural Acceptance' and Experiential Validation- as the mechanism for self-exploration, Continuous Happiness and Prosperity- A look at basic Human Aspirations, Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority, Understanding Happiness and Prosperity correctly.	6	CO1
2	Introduction to Ethical Concept	Definition of industrial ethics and values, Ethical rules of industrial worker. Values and Value Judgments. Moral Rights and Moral rules, Moral character and responsibilities. Privacy, Confidentiality, Intellectual Property and the Law. Ethics as Law.	6	CO2
3	Professional Responsibility	The basis and scope of Professional Responsibility, Professions and Norms of Professional Conduct, Ethical Standards versus Profession, Culpable mistakes, the Autonomy of professions and codes of ethics. Employee status and Professionalism. Central Professional Responsibilities of Engineers: The emerging consensus on the Responsibility for safety among engineers, hazards and risks.	6	CO3
4	Engineers Ethics	Senses of 'Engineering Ethics' - variety of moral issues - types of inquiry - moral dilemmas – moral autonomy - Kohlberg's theory - Gilligan's theory - consensus and controversy – Models of Professional Roles theories about right action – Self-interest - customs and religion - uses of ethical theories. Valuing Time – Cooperation – Commitment.	6	CO4
5	A Glimpse of Life Stories, Global Issues	Life story of Prophet Mohammad, Mahatma Gandhi, Swami Vivekanand, Marie Curie and Steve Jobs. Multinational corporations - Environmental ethics - computer ethics - weapons development - engineers as managers consulting engineers-engineers as expert witnesses and advisors -moral leadership.	6	CO5

Reference Books:

1. R.S. Naagarazan 2006, "A Textbook on Professional Ethics and Human values" New Age International Publisher.
2. R R Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Value Education.
3. Mike Martin and Roland Schinzinger, "Ethics in Engineering", McGraw-Hill, New York 1996.

e-Learning Source:

1. Value Education website, http://www.uptu.ac.in . 2. Story of Stuff, http://www.storyofstuff.com

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	3	3			3		2		2	2	2	3
CO2	3	3	2	3	3			2					2	3	3
CO3	2	3	2	3	2			3		3			3	3	3
CO4	2	3	2	3	2			2				1	3	3	2
CO5	3	2	3	3	2			3		2		1	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: 2020-21							
Course Code	BE272	**Title of the Course**	Human Anatomy and Physiology for Engineers	**L**	**T**	**P**	**C**
Year	II	**Semester**	III	**3**	**1**	**0**	**4**
Pre-Requisite	None	**Co-requisite**	None				
Course Objectives	The course is designed to provide the students with in-depth understanding of anatomy and physiology of the cardiovascular system (heart and blood vessel), the pulmonary system (lung), the renal system, the digestive system, the nervous system, the muscular system and the skeletal systems						

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.
CO5	Students will be introduced to neuro-physiology and will be able to understand the details of the nervous system.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Blood Vascular system	Composition and functions of blood. Plasma proteins – normal values, origin and functions. Brief idea on Bone marrow. Formed elements of blood – origin, formation, functions and fate. Hemoglobin – functions, compounds and derivatives. Abnormal hemoglobin-overview. Erythrocyte sedimentation rate (ESR) and its significance. Hematocrit. PCV, MCV, MCH, MCHC. Blood coagulation –factors, process, anticoagulants, Prothrombin time. Clotting time. Bleeding time. Blood groups – ABO systems and Rh factors. Blood transfusion. Ultra structure & functions ofblood vessels (artery, vein, capillary). Differences between artery & vein.	8	CO1
2	Cardio Vascular System	Structure & function of Heart, Anatomical position, chambers of heart, Blood circulation through heart. Special junctional tissue of heart. Cardiac cycle. Heart Sound. Systemic & pulmonary circulation. Cardiac output. Blood Pressure-regulation & controlling factors.	8	CO2
3	Muscular & Skeletal System	Microscopic and electron microscopic structure of skeletal, smooth and cardiac muscles. Difference between skeletal, smooth and cardiac muscles. The sarcotubular system. Red and white striated muscle fibers. Properties of muscle: excitability and contractility, all or none law, summation of stimuli, summation of contractions, effects of repeated stimuli, genesis of tetanus, onset of fatigue, refractory period. Muscle contraction – E C Coupling, Muscle fatigue, Rigor mortis, Sliding filament theory, Slow & fast muscle fibers, Isotonic & Isometric contraction. Types of Bones, Structure and Composition of Bone, Classification of Joints, Structure of Synovial Joint, Cartilage, Tendon, Ligament.	8	CO3
4	Renal System Digestive System Respirator y System	Function of kidney, Anatomy & Histology of Nephron & collecting duet. Urine formation (Filtration, reabsorption and secretion) Counter – current system of urine concentration, Anomalies in urine concentration. Organization of GI system, Digestion and Absorption, Movement of GI tract, Liver, Intestine, Pancreas, Role of Enzymes in Digestion. Respiratory Pathways, Mechanism of Respiration, Respiratory membrane and gaseous exchange, Lungs, Role of Lungs in Respiration and Thermoregulation.	8	CO4
5	Neuro Physiology	Electron microscopic structure of nerve cell or neurons. Neuroglia. Myelinated and non-myelinated nerve fibers. The resting membrane potential. The action potential. Propagation of nerve impulse in different types of nerve fibers. Compound action potentials. Conduction velocity of nerve impulse in relation to myelination and diameter of nerve fibers. Synapses – types, structure, synaptic transmission of the impulse, synaptic potentials, neurotransmitters. Autonomic nervous system – Introduction. Structure of sympathetic and parasympathetic division. Neuromuscular Junction – structure, events in transmission, end-plate potential, post titanic potential. CNS- Brain and Spinalcord.	8	CO5

Reference Books:

1 Essential of Medical Physiology - Anil Baran Singha Mahapatra, Current Books International

2. Human Physiology - C.C.Chatterjee, Medical Allied Agency

3. Text book of Medical Physiology- Guyton

4. Concise Medical Physiology - Chauduri

5. Anatomy and Physiology – Ross & Wilson, Churchill Livigstone publications

6. Modern Physiology & Anatomy for Nurses - J Gibson, Black-well Scientific Publishers

e-Learning Source:

https://youtu.be/uBGl2BujkPQ

	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	PSO4	PSO5	PSO6
CO1	1	3	1	1	3	2		3				3	3	1	2	1		
CO2	1	3	1	1	3	2		3				3	3	1	2	1		
CO3	1	3	1	1	2	2		3				3	3	1	2	1		
CO4	1	3	1	1	2	2		3				3	3	1	2	1		
CO5	1	3	1	1	2	2		3				3	3	1	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: 2020-21							
Course Code	BE273	**Title of the Course**	Biochemical Analysis and Techniques	**L**	**T**	**P**	**C**
Year	II	**Semester**	III	**3**	**1**	**0**	**4**
Pre-Requisite	None	**Co-requisite**	None				
Course Objectives	This course is intended to impart the fundamental knowledge of versatile analytical & diagnostic equipments used in the healthcare system.						

Course Outcomes	
CO1	Identify, understand and explain the working principle of basic analytical & diagnostic equipments used in biomedical engineering domain
CO2	Understand and explain the working principle of Blood gas analyzers and Oximeters
CO3	Understand and explain the working principle of Blood cell counters and Bloodpressure apparatus
CO4	Understand and explain the working principle of Blood Flow meters and Pulmonary function analyzers,
CO5	Understand and explain the working principle of Endoscopy

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Clinical equipments	Principles of photometric measurement, Radiation sources, Optical filters, Colorimeter, Spectrometer , Design of Monochromators, Flame photometer, Atomic absorption spectrophotometer, Automated biochemical analyzer- Auto analyzer, Electromechanical analyzer – Chromatographs, Microscopes, Scanning Electron Microscope, Transmission Electron Microscope, Centrifuge-principles and applications.	8	CO1
2	Blood gas analyzers and Oximeters	Blood pH measurement, Blood pCO2 measurement, Blood pO2 measurement, a complete blood gas analyzer, Fiber optic based blood gas sensors, Oximetry, Principles of oximetric measurements, Ear oximeter, Pulse oximeter, Intravascular oximeter.	8	CO2
3	Blood cell counters and Blood pressure apparatus	Methods of cell counting, Flow cytometry, Coulter Counters, automatic recognition and differential counting of cells, Sphygmomanometer, Automated indirect and specific direct method of B.P. monitor.	8	CO3
4	Blood Flow meters Pulmonary function analyzers	Electromagnetic blood flow meter, Ultrasonic blood flow meter- Transit time and Doppler blood flow meter, Cardiac output measurement-Dye dilution method and Impedancetechnique. Respiratory volumes and capacities, Compliance and related pressure, Spirometer, Pneumo-tachometer, impedance pneumograph plethysmograph, apnea detector.	8	CO4
5	Endoscopy	Basic endoscopic equipments, Fibreoptic instruments and video- endoscopes, Accessories-illumination, instrument tips, instrument channels, tissue sampling devices, suction traps and fluid-flushing devices, Various endoscopic applications. Maintenance and Storage.	8	CO5

Reference Books:

1. R. S. Khandpur “Handbook of Bio-Medical Instrumentation”, 2nd Edition, Tata McGraw Hill.
2. J.J.Carr& J.M.Brown, “Introduction to Biomedical Equipment Technology” Pearson Education, Asia.
3. Cromwell, Weibell& Pfeiffer, “Biomedical Instrumentation & Measurement”, Prentice Hall, India.

e-Learning Source:

https://youtu.be/bVYOWuJlgEs

	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	PSO4	PSO5	PSO6
CO1	3	3	3	2	3	3	1	3	1			3	3	2	3	3		
CO2	2	3	3	2	3	3	1	3	1			3	3	2	3	3		
CO3	2	3	3	2	3	3	1	3	1			3	3	2	3	3		
CO4	2	3	3	2	3	3	1	3	1			3	3	2	3	3		
CO5	2	3	3	2	3	3	1	2	1			3	3	2	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	BE274	**Title of the Course**	Human Anatomy and Physiology Lab	**L**	**T**	**P**	**C**
Year	II	**Semester**	III	**0**	**0**	**2**	**1**
Pre-Requisite	None	**Co-requisite**	None				
Course Objectives	The lab is designed to equip the students with the knowledge of the practical aspects of the Human anatomy and physiology.						

Course Outcomes	
CO1	Understand the concept of microscopy.
CO2	Learn the preparation of histological slides.
CO3	Learn the procedure to determine blood groups, types of blood corpuscles and differential counts through slides.
CO4	Learn the procedure for diagnostic analysis through estimation of blood pressure hemoglobin, bleeding and clotting time, ECG wave identification.

Unit No.	Title of the Experiment	Content of Unit	Contact Hrs.	Mapped CO
1	Microscopy	Study on Compound Microscope.	2	CO1
2	Histological slides	Identification of fixed histological slides: Cerebellum, Cerebral cortex, Spinal cord, Renal tissues, Blood vessels (artery and vein); Skin, Tongue, Liver.	2	CO2
3	Hb estimation	Hemoglobin estimation.	2	CO4
4	Blood Pressure determination	Determination of blood pressure.	2	CO4
5	Blood cell slides	Blood film making & identification of different blood corpuscle.	2	CO3
6	ECG	ECG wave identification	2	CO4
7	Differential count	DC of WBC	2	CO3
8	Blood group determination	Determination of Blood Group (ABO; Rh)	2	CO3
9	BT and CT	Measurement of Bleeding Time (BT) Clotting Time (CT)	2	CO3

Reference Books:

e-Learning Source:

https://www.slideshare.net/mujtabaashraf/blood-group-61147794

http://nbtc.naco.gov.in/assets/resources/training/5.pdf

	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**	**PSO4**	**PSO5**	**PSO6**
CO1	3	2	1	2	3	2			1			3	3	1	1			
CO2	2	2	1	3	2	2		2	1			3	3	3	2	1		
CO3	3	3	3	3	2	3		3	1			3	3	3	2	2		
CO4	3	3	3	3	3	3		3	1			3	3	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: 2020-2021							
Course Code	**BE275**	**Title of the Course**	**BIOMECHANICS**	**L**	**T**	**P**	**C**
Year	**2**	**Semester**	4	**3**	**1**	**0**	**4**
Pre-Requisite	NONE	**Co-requisite**	NONE				
Course Objectives	1. To describe the fundamental of biomechanics. 2. To Study the deformability, strength, visco elasticity of bone and flexible tissues, modes of loading and failure. 3. To describe the types and mechanics of skeletal joints. 4. To describe movement precisely, using well defined terms (*kinematics*) and also to consider the role of force in movement (*kinetics*). 5. To teach students the unique features of biological flows, especially constitutive laws and boundaries.						

Course Outcomes	
CO1	To describe the fundamental of biomechanics.
CO2	To Study the deformability, strength, visco elasticity of bone and flexible tissues, modes of loading and failure.
CO3	To describe the types and mechanics of skeletal joints.
CO4	To describe movement precisely, using well defined terms (*kinematics*) and also to consider the role of force in movement (*kinetics*).
CO5	To teach students the unique features of biological flows, especially constitutive laws and boundaries.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	**Introduction to Biomechanics**	Review of the principles of mechanics, Vector mechanics- Resultant forces of Coplaner & Noncoplaner and Concurrent & non-concurrent forces, parallel force in space, Equilibrium of coplanar forces, Newton's laws of motion, Work and energy, Moment of inertia.	8	1
2	**Tissue Biomechanics**	**Hard Tissues:** Bone structure & composition mechanical properties of bone, cortical and cancellous bones, viscoelastic properties, Maxwell & Voight models – anisotropy. Electrical properties of bone, type of fractures, biomechanics of fracture healing. **Soft Tissues:** Structure and functions of Soft Tissues: Cartilage, Tendon, Ligament, and Muscle; Material Properties: Cartilage, Tendon, Ligament, and Muscle; Modeling: Cartilage, Tendon, Ligament, and Muscle.	8	2
3	**Joints Biomechanics**	Skeletal joints, forces and stresses in human joints, Analysis of rigid bodies in equilibrium, free body diagrams, types of joint, biomechanical analysis of elbow, shoulder, hip, knee and ankle. **Movement Biomechanics** Gait analysis, body & limbs: mass & motion characteristics actions, forces transmitted by joints. Joints forces results in the normal & disable human body, normal & fast gait on the level. Patterns: Push/Throw Continuum Biomechanics of push - like motions, Biomechanics of throw - like motions.	8	3
4	**Cardiac & Respiratory Mechanics**	Cardiovascular system, Mechanical properties of blood vessels: arteries, arterioles, capillaries, and veins. artificial heart valves, biological and mechanical valves development, testing of valves. Alveoli mechanics, Interaction of blood and lung, P-V curve of lung, Breathing mechanism, Airway resistance, Physics of lung diseases. **Biofluid Mechanics** Newton's law, stress, strain, elasticity, Hooke's law, viscosity, Newtonian fluid, Non- Newtonian fluid, viscoelastic fluids, Vascular tree. Relationship between diameters, Velocity and pressure of blood flow, Resistance against flow.	8	4
5	**Implant Mechanics**	General concepts of Implants, classification of implants, Soft tissues replacements and Hard tissue replacements, basic consideration and limitation of tissue replacement, Design of orthopedic implant, specifications for a prosthetic joint, biocompatibility, requirement of a biomaterial, characteristics of different types of biomaterials, manufacturing process of implants, fixation of implants.	8	5

Reference Books:

1. R. M. Kennedy, A textbook of Biomedical Engineering, GTU, 2010
2. Richard Shalak & Shu Chien, Handbook of Bioengineering,

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	1	2	1	1	1		1	1	1	1	1	1	1
CO2	1	1	2	1	1	1	1		1	1	1	1	1	1	1
CO3	2	1	2	1	1	1	1		1	1	1	1	1	1	1
CO4	2	2	3	3	1	1	1		1	1	2	3	2	1	3
CO5	2	3	3	3	2	2	1	2	1	1	3	3	3	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: 2016-17							
Course Code	**BE276**	**Title of the Course**	**BIOMEDICAL SIGNALS AND SYSTEMS**	**L**	**T**	**P**	**C**
Year	**2**	**Semester**	4	3	1	0	4
Pre-Requisite	NONE	**Co-requisite**	NONE				
Course Objectives	• State the basics of signal analysis and processing for communication engineering • Apply the basic tools of continuous time signals analysis such as Fourier series and Fourier transform • Apply the basic tools of discrete time signals analysis such as discrete time Fourier series (DTFS), discrete time Fourier transform (DTFT) and Z transform						

Course Outcomes	
CO1	Students will be able to identify the different types of signals and able to apply the different operations on signals.
CO2	Students will be able to identify the different types of systems and able analyze the LTI system and its characteristic
CO3	Students will be able to determine the Fourier series and Fourier transform of continuous and discrete signals.
CO4	Students will be able to determine the Z-transform, inverse Z-transform and able to get the analysis and characterization of discrete LTI systems.
CO5	Students will be able to explain and analyze different types of Bio -Signals analysis like EEG, ECG, Phonocardiogram,

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Signal Classification	Signal Classification; continuous time versus discrete time, periodic versus not periodic, analog versus digital, deterministic versus random, Basic signals; Sinusoidal, exponential, unit impulse, unit step, unit Ramp, Mathematical operations on signals; scaling, folding, time shifting, addition, multiplication, convolution, correlation	8	1
2	Basics of systems	Classification of systems: static and dynamic systems, time invariant and time variant, linear and nonlinear systems, causal and non-causal systems, stable and unstable systems, Linear Time invariant systems (LTI) representation; impulse response, transfer function, constant coefficient differential equation.	8	2
3	Analysis of Continuous Time Signals and System	Fourier series analysis; complex form Fourier transform; properties Relation between Laplace transform and Fourier transform, Fourier transform application to LTI systems	8	3
4	Analysis of discrete Time Signals and System	Sampling Theorem; ideal sampling and reconstruction Z transform; properties, region of convergence (ROC)- representation of poles and zeros in z transform Relation between Z transform and DTFT Z transform application to LTI systems	8	4
5	Application to Bio Signals	Introduction, Characteristics of Bio–Signals, Types of Signals, Measurement, Transformation and reduction, Application areas of Bio -Signals analysis – EEG, ECG, Phonocardiogram,	8	5

Reference Books:

1. M.J. Roberts, “Signals and Systems: Analysis using transform methods & MATLAB” Tata McGraw Hill,2ndedition, 2007.
2. Suresh R, Devashayam, “Signals and Systems in Biomedical Engineering”, Springer US, 2nd edition,
3. Allan V. Oppenheim, Alan S. Willsky and S. Hamid, “Signals and systems”, Prentice Hall of India Pvt.Ltd, 2nd edition, 1997.

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	3		1	1		2	1		2	3	3	2
CO2	3	3	3	3		1			1	1		2	3	3	2
CO3	3	3	2	3		1			1			2	3	3	2
CO4	3	3	2	2			1		2	1		2	3	3	2
CO5	3	3	3	3					1			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: 2019-2020							
Course Code	EC235	**Title of the Course**	Digital Logic circuits for Clinical Engineers	**L**	**T**	**P**	**C**
Year	**II**	**Semester**	IV	**2**	**1**	**0**	**3**
Pre-Requisite	EC101	**Co-requisite**					
Course Objectives	To understand the concepts of digital electronics and their applications. To provide a conversion in mathematical form. Can identify type of complements, can apply 1's and 2's complements. To learn the Boolean Expression, K- Map method. To understand the basic concepts of various combinational circuit including gates, adders, Subtractor, multiplexer and encoders. To learn the analysis of various sequential circuits flip flops, counters and various shift register.						

Course Outcomes	
CO1	Given a number, students shall be able to represent various conversion in mathematical form, identify type of complements, apply 1's and 2's complements and formulate conversion of any radix to decimal and decimal to any radix and solve 1's, 2's, 9's and 10's complements.
CO2	Given a Boolean Expression, student shall be able to analyze and evaluate various axioms and theorems also K- Map method. For a given Combinational circuit, student shall be able to understand its various building blocks and examine, analyze and evaluate various gates, adders, subtractor, multiplexer and encoders.
CO3	Given concept of sequential logic would be able to select suitable design of various flip flops, shift registers and counters.
CO4	Given concept of asynchronous sequential logic would be able to understand and analyze transition table, flow table, reduction of states and circuit with latches.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Boolean Algebra and Logic gates	Review of Number system: Binary, Octal, Hexadecimal number system, Complements Logic gates, Boolean algebra postulates and theorems, Boolean function minimization:, Karnaugh map, QuineMcCluskey method	8	CO-1
2	Combinational Circuit	Analysis and design of combinational circuit, Half adder and full adder circuits, parallel adder /Subtractor, magnitude comparator Encoder and decoder, Multiplexer and de-multiplexer	8	CO-2
3	Sequential Circuit	Latches, Flip Flops; JK, D,T, Characteristics table and equation Analysis and design of clocked sequential circuits 4 bit shift register Counters: Modulo N counter, ring counter, ripple counter	8	CO-3
4	Logic families and Memory	Logic family characteristics and their comparison, Types of Memory: RAM, ROM, PLD's Medical Applications Digital Blood pressure Monitor, Digital Blood Glucose monitor, Digital thermometer, Heart rate Monitor Digital stethoscope, Hearing Aid	8	CO-4

Reference Books:

M.Morris Mano and Michael D.Ciletti, "Digital design", Pearson, 5th edition 2013.William H. Hayt, Jack e. Kemmerly & Steven M. Durbin, Engineering Circuit Analysis, McGraw Hill International, sixth edition, 2202.

Thomas L. Floyd, "Digital fundamentals", Pearson, 11th edition 2015.

e-Learning Source:

https://nptel.ac.in/courses/108105132

https://nptel.ac.in/courses/108105113

	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	3	1		1			1				1	2	
CO2	3	3	3	2		3			1				1	1	2
CO3	3	2	3	2	1	1			2				1	1	1
CO4	3	3	2	2	1				1				1	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: 2015-16							
Course Code	**EC239**	**Title of the Course**	**Biomedical Sensors and Measurement**	**L**	**T**	**P**	**C**
Year	**II**	**Semester**	IV				
Pre-Requisite	Basics of instrumentations	**Co-requisite**	Electronics Measurement and instrumentation				
Course Objectives	1. To explain the basic concepts and definitions in biomedical measurement. 2. To describe the bridge configurations and their applications. 3. To explain the measurement of non-electrical quantity, their working principle and construction. 4. To elaborate the discussion about the importance of signal generators and analyzers in Measurement.						

Course Outcomes	
CO1	To understand the different measurement standards, systems and Errors in an electronic measurement system, transducers and their classification.
CO2	To analyze the different types of DC and AC bridges and high frequency measurement.
CO3	To understand the measurement of non-electrical quantities along with their basic construction and working principle.
CO4	To understand the measurement of Amplifier and Receiver Characteristics, principle and working of telemetry tracking and command.
CO5	To understand the different types of signal generations, their applications in the instruments and to understand the different analyzers in biomedical application.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Standards and Measuring errors	Scientific notations and metric prefixes. SI electrical units, SI temperature scales, other unit systems, dimensions and standards. Measurement Errors: Gross error, systematic error, absolute error and relative error, accuracy, precision, resolution and significant figures, Measurement error combination, PMMC instrument, Galvanometer, Conversion to ammeter and voltmeter	**8**	**CO.1**
2	Transducer	Classification of transducers and characteristics for selection of transducers, Resistive transducers, Inductive transducers, Capacitive transducers, Piezoelectric effect transducer, Thermoelectric Transducers	**8**	**CO.2**
3	Multimeter and CRO	Digital voltmeter systems, Digital multimeter CRT, Wave Form Display,	**8**	**CO.3**
4	Measuring Instruments	Time Base, Dual Trace Oscilloscope, measurement of voltage, frequency and phase by CRO, DSO, DSO applications.	**8**	**CO.4**
5	Medical Applications of Sensors:	Biosensors: Principles and, classification, Optical biosensors for measurement of blood glucose level, Smart sensor, electronic nose.	**8**	**CO.5**

Reference Books:

1.Patranabis D, "Sensors and transducers", PHI, 2nd edition,2004.

2.R.S. Khanpur, "Handbook of Biomedical Instrumentation" Tata McGraw Hill

3.H.E. Thomas, "Handbook of Biomedical Instrumentation and Measurement" Restone Publishing Company

4.Sawhney A.K, "A Course in electrical and electronic measurements and instrumentation", DhanpatRai & Co (P) Ltd, Educational and Technical Publishers, 19th Revised edition 2011

e-Learning Source:

https://nptel.ac.in/courses/115102014

https://archive.nptel.ac.in/courses/115/102/115102014/

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		2		2	2				1	3	1	1
CO2	3	2	3	2		2		1		1			3	2	1
CO3	3	2	2		2		2		1	1		1	3	2	2
CO4	3	2	2	2		1		1			1		3	1	2
CO5	3	3		2	2	1		1	2			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: 2020-2021							
Course Code	**BE277**	**Title of the Course**	**BIOMATERIALS AND ARTIFICALS ORAGANS**	**L**	**T**	**P**	**C**
Year	**2**	**Semester**	4	**3**	**1**	**0**	**4**
Pre-Requisite	NONE	**Co-requisite**	NONE				
Course Objectives	• The student would be able to learn characteristics and classification of Biomaterials. • Understand the characteristics of different metals and ceramics used as biomaterials. • Understand polymeric materials, composites and combinations that could be used as a tissue replacement implants.						

Course Outcomes	
CO1	The student would be able to learn characteristics and classification of Biomaterials.
CO2	Understand the characteristics of different metals and ceramics used as biomaterials.
CO3	Understand polymeric materials, composites and combinations that could be used as a tissue replacement implants.
CO4	Students should be able to understand how to develop artificial organ using these materials.
CO5	Instill a fundamental understanding of the properties and applications of biomaterials, both natural and synthetic that are used in contact with biological systems in the area of various tissues and organ replacement.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Introduction	Definition of biomaterials, requirements of biomaterials, classification of biomaterials, Comparison of properties of some common biomaterials. Effects of physiological fluid on the properties of biomaterials. Biological responses (extra and intra-vascular system). Surface properties of materials, physical properties of materials, mechanical properties. Metallic implant materials: Stainless steel, Co-based alloys, Ti and Ti-based alloys. Importance of stress-corrosion cracking. Host tissue reaction with biometal, corrosion behavior and the importance of passive films for tissue adhesion. Hard tissue replacement implant: Orthopedic implants, Dental implants. Soft tissue	8	1
2	Polymeric implant materials	Polyolefins, polyamides, acrylic polymers, fluorocarbon polymers, silicon rubbers, acetals. (Classification according to thermosets, thermoplastics and elastomers). Viscoelastic behavior: creep-recovery, stress relaxation, strain rate sensitivity. Importance of molecular structure, hydrophilic and hydrophobic surface properties, migration of additives (processing aids), aging and environmental stress cracking. Physiochemical characteristics of biopolymers. Biodegradable polymers for medical purposes, Biopolymers in controlled release systems. Synthetic polymeric membranes and their biological applications.	8	2
3	Ceramic implant materials	Definition of bioceramics. Common types of bioceramics: Aluminium oxides, Glass ceramics, Carbons. Bioresorbable and bioactive ceramics. Importance of wear resistance and low fracture toughness. Host tissue reactions: importance of interfacial tissue reaction (e.g. ceramic/bone tissue reaction). Composite implant materials: Mechanics of improvement of properties by incorporating different elements. Composite theory of fiber reinforcement (short and long fibers, fibers pull out). Polymers filled with osteogenic fillers (e.g. hydroxyapatite). Host tissue reactions.	8	3
4	Biocompatibility & toxicological screening of biomaterials	Definition of biocompatibility, blood compatibility and tissue compatibility. Toxicity tests: acute and chronic toxicity studies (in situ implantation, tissue culture, haemolysis, thrombogenic potential test, systemic toxicity, intra-cutaneous irritation test), sensitization, carcinogenicity, mutagenicity and special tests. Sterilization techniques: ETO, gamma radiation, autoclaving. Effects of sterilization on material properties.	8	4
5	Testing of biomaterials/Implants	In vitro testing (Mechanical testing): tensile, compression, wears, fatigue, corrosion studies and fracture toughness. In-vivo testing (animals): biological performance of implants. Ex- vivo testing: in vitro testing simulating the in vivo conditions. Standards of implant materials.	8	5

Reference Books:

1. J B Park, Biomaterials - Science and Engineering, Plenum Press , 1984.
2. Sujata V. Bhat, Biomaterials, Narosa Publishing House, 2002.

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	3	3	2	3	2	3	1	2	2	3	3	3	3
CO2	3	3	3	2	3	3	1	3	1	2	2	3	3	2	3
CO3	3	3	3	3	3	3	3	3	2	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	2	3	3	3	3	3	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: 2020-21							
Course Code	BM227	**Title of the Course**	MANAGEMENT CONCEPTS IN ENGINEERING	**L**	**T**	**P**	**C**
Year	**2nd**	**Semester**	4th	**3**	**1**	**0**	**4**
Pre-Requisite	NONE	**Co-requisite**	NONE				
Course Objectives	The objective of this course is to provide fundamental knowledge about management strategies and leadership qualities required in managing technical manufacturing organizations						

Course Outcomes	
CO1	The student will understand how essential various functions of management are for every business manager.
CO2	The student will develop knowledge about various managerial processes and become competent when involved in them to achieve success.
CO3	The student will gain acquaintance with the essence of superior-subordinate relationship which is an important aspect in accomplishing organizational objectives as a team.
CO4	The student will realize the importance of controlling and giving feedback for ensuring effective and efficient performance of the personnel.
CO5	Analyze decisions relating to demand, production and cost.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	**CONCEPTS OF MANAGEMENT**	Definition, Nature, Scope and significance of Management, the evolution of Management thought, contributions of F.W. Taylor, Henri Fayol and Chester Bernard to Management Science. Functions of Management, Values and Ethics in Management.	8	CO1
2	**PLANNING**	Definition, Objectives, Steps of Planning, The process and techniques of Decision Making, Strategies and policies. Management by objectives.	8	CO2
3	**ORGANISATION & DIRECTING:**	Definition, Line and Staff relationship. Delegation and Decentralization, Committee system, Issues in managing Human factors, Motivation: theories of Motivation. Leadership: Concept, Nature, Styles. Decision making: Concept, Nature, Process, Tools & techniques	8	CO3
4	**CONTROLLING**	Definition and Elements Control Techniques, Coordination, Determinants of an Effective Control System, Managerial Effectiveness. ECONOMIC & FINANCIAL ANALYSIS National Income, Inflation, GDP & Interest rates. Financial Function & Goals, Financial Statement & Ratio Analysis.	8	CO4

Reference Books:

1. Stoner Freeman & Gilbert Jr , Management, Prentice Hall of India, 6th Edition.
2. Koontz, Principles of Management, Tata Mc Graw Hill, Ist Edition 2008.
3. Robbins & Coulter, Management, Prentice Hall of India, 8th Edition.
4. Robbins S.P. & Decenzo David A., Fundamentals of Management: Essential Concepts and Applications, Pearson Education.
5. Hillier Frederick S. & Hillier Mark S., Introduction to Management Science: A Modeling and Case Studies Approach with Spreadsheets, Tata McGraw Hill, 2008

e-Learning Source:

https://www.youtube.com/watch?v=kTWyt6KC9Jw&list=PLaAhQ2ofZZRBjpgXHPpWF0sYwiLD5Gh1k

	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	2		3						2	2	2	3
CO2	2	3	3	2	2	3						3	2	3	2
CO3	3	3	3	3	2	3						1	3	2	3
CO4	3	3	3	2		3						2	3	3	2
CO5	1	1	1	1		2						2	1	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:2019-2020							
Course Code	EC237	**Title of the Course**	Digital Logic Lab	**L**	**T**	**P**	**C**
Year	**II**	**Semester**	IV	**0**	**0**	**2**	**1**
Pre-Requisite	EC235	**Co-requisite**					
Course Objectives	To acquire the basic knowledge of digital logic levels and application of knowledge to understand digital electronics circuits.						

CourseOutcomes	
CO1	Define different types of logic gates, identify their ICs and verify truth table.
CO2	Analyze design and implement combinational logic circuit.
CO3	Analyze design and implement sequential logic circuit.
CO4	Derive basic gats, Adder and Sub tractor using universal gates.
CO5	Illustrate realization of Boolean expression in SOP and design it using logic gates.

Exp No.	**Title of the Experiment**	**Contentof Unit**	**Contact Hrs.**	**Mapped CO**
1	Realize logic gates	Realize OR, NOR,XOR,XNOR gates using NAND gate and verify its truth table.	2	CO1
2	1-bit magnitude comparator	Design and study of 1-bit magnitude comparator.	2	CO1
3	Shift Registers	Design of shift registers.	2	CO2
4	CODE CONVERTER	(a) Design and test a Code Converter from decimal number to binary number. Use diode and LED′s. (b) Measure voltage drops across the diodes, LED′s and resistor R. Find the current flowing through LED.	2	CO2
5	Half Adder and Full Adder	(a) Assemble the Half Adder circuit using X-OR and AND gates. Verify the truth table for Half Adder. (b) Using two Half Adder and an OR gate, assemble Full Adder circuit. Verify truth table.	2	CO3
6	7 Segment LED display	Display of decimal digits using 7 segments LED display and a suitable decoder. (a) Use a BCD to 7 segment decoder 0-9 digits. (b) Study the 7 segment LED display. Is it common anode or common cathode type? What is a suitable value of R for bright display of digit?	2	CO3
7	STUDY OF FLIP -FLOPS	STUDY OF FLIP -FLOPS (a) Design and test J-K F/F using NAND gates. (b) Study J-K Master -Slave F/F IC 74LS76. Make special observation of edge triggering, Preset and clear.	2	CO4
8	STUDY OF COUNTER	STUDY OF COUNTER Design Mod-10 counter using Master -Slave F/F (7476)and logic gates, (7400&7408) .Verify it′s truth table.	2	CO4
9	4-Bit Adder /Sub tractor	Study and verify 4-bit adder /Sub tractor circuit using IC7483 and IC7486.	2	CO_5
10	X-OR gate Module (7486)	STUDY THE X-OR GATE IV MODULE (7486) (a) Verify the truth table and record the voltage levels. (b) Design a 3-input X-OR gate using 2-input X-OR gate. Obtain its truth table F1 =A +B +C.	2	CO_5

e-LearningSource:

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

	CourseArticulationMatrix: (Mappingof COs withPOs and PSOs)														
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	3	2	3			3	2		3	3	2	2
CO2	3	3	2	3	2	3			3	2		3	3	2	2
CO3	3	3	2	3	2	3			3	2		3	3	2	2
CO4	3	3	2	3	2	3			3	2		3	3	2	2
CO5	3	2	2	2	2	3			2	2		3	3	2	2

1-LowCorrelation;2- moderateCorrelation;3-SubstantialCorrelation

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

Integral University, Lucknow

Effective from Session: 2019-2020							
Course Code	EC238	**Title of the Course**	Bio Instrumentation Lab	**L**	**T**	**P**	**C**
Year	**II**	**Semester**	IV	**0**	**0**	**2**	**1**
Pre-Requisite	EC239	**Co-requisite**					
Course Objectives	• To understand the working of a LVDT and strain Gauge. • To understand how to obtain the value of unknown inductance using maxwell's inductance bridge, Hay's Bridge and capacitance using Schering's Bridge. • To measure accuracy and precision of analog and digital instrument. • To measure phase difference and frequency using CRO and understand the working of a Crompton's Potentiometer. • To understand and study the Square Wave generator.						

Course Outcomes	
CO1	After study, student shall be able to realize the working of a LVDT and strain Gauge.
CO2	With the help of various bridges student shall understand and obtain the value of unknown inductance.
CO3	Student shall be able to understand how to measure accuracy and precision of analog and digital instrument.
CO4	Student shall be able to understand how to measure phase difference and frequency using CRO and able to understand the working of a Crompton's Potentiometer.
CO5	Student shall be able to understand and study the Square Wave generator.

Experiment No.	**Title of the Experiment**	**Content of Unit**	**ContactHrs.**	**Mapped CO**
1	Square Wave generator	To study the Square Wave generator.	2	CO1
2	strain Gauge	To study the working of strain Gauge.	2	CO1
3	Maxwell's inductance bridge	To obtain value of unknown inductance using Maxwell's inductance bridge.	2	CO2
4	Hay's Bridge	To obtain value of unknown inductance using Hay's Bridge.	2	CO2
5	Schering's Bridge	To obtain value of unknown capacitance using Schering's Bridge.	2	CO3
6	CRO.	Measurement of phase difference and frequency using CRO.	2	CO4
7	LVDT	To study the working of a LVDT.	2	CO5
8	Analog & digital instrument	Measurement of accuracy and precision of analog and digital instrument.	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
CO1	3	2	3	2	1		1		1	1			3	2	1
CO2	3	2	2	2		1		1			1	1	3		
CO3	3	2	2	1	1		1		1	1			3	1	1
CO4	3	2	2	2		1		1				1	3	1	
CO5	3	2	1	2	1	1	1	1	1	1		1	3	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	**BE278**	**Title of the Course**	**BIOMATERIALS AND BIOMECHANICS LAB**	**L**	**T**	**P**	**C**
Year	**2**	**Semester**	4	**0**	**0**	**2**	**1**
Pre-Requisite	NONE	**Co-requisite**	NONE				
Course Objectives	This course will provide basic hands on laboratory experiments in Biomaterials & Biomechanics						

Course Outcomes	
CO1	Perform Mechanical characterization & Hardness testing of biomaterials
CO2	Measure Surface roughness & haemo-compatibility of biomaterials
CO3	Stress Strain analysis of hip prosthesis
CO4	Determine moment of inertia of human limb & human bone
CO5	Perform Ultrasonic characterization of biomaterials-NDE

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	characterization	. Mechanical characterization of biomaterials	2	CO1
2	. Hardness testing of biomaterials	. Hardness testing of biomaterials	2	CO2
3	Surface roughness measurement	. Surface roughness measurement of biomaterials	2	CO2
4	haemolysis studies	. Estimation of haemo-compatibility of biomaterials by haemolysis studies	2	CO1
5	Measurement of torque	Measurement of torque required to tap and screwing in jawbone	2	CO1
6	human limb using dynamometer	Determination of moment of inertia of human limb using dynamometer	2	CO3
7	Determination of moment	. Determination of moment of inertia of human bone using compound pendulum method.	2	CO3
8	. Stress-strain analysis of hip prosthesis	. Stress-strain analysis of hip prosthesis	2	CO3
9	characterization	Ultrasonic characterization of biomaterials-NDE	2	CO4
10	Conductivity measurement of body fluid.	. Conductivity measurement of body fluid.	2	CO5

Reference Books:

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	3	2	3	1	3	3	3	3	3	2	1	3
CO2	3	3	2	3	2	3	1	3	3	3	3	3	2	1	3
CO3	3	3	3	3	1	3		3	3	3	3	3	3	3	3
CO4	3	3	3	3	1	3		3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	1	3	3	3	3	3	3	2	3

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

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