#### Course structure of Bachelor of Science Program in Biomedical Science and Engineering in Jyoti and Bhupat Mehta School of Health Sciences and Technology

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Course No	Semester-I	L	Τ	Р	С	Course No	Semester-II	L	Τ	Р	С
	Course Name					117444	Course Name				
HT101	Multivariable Calculus and	3	1	0	8	HI111	Differential Equations	3	1	0	8
	Linear Algebra	_		-	-						
H1102	Physics	2	1	0	6	H1112	Digital system design	3	0	2	8
HT103	Chemistry	3	0	0	6	HT113	Biochemistry	3	0	0	6
HT104	Basic Electrical Sciences	3	1	0	8	HT114	Human Anatomy and Physiology	3	0	0	6
HT105	Introduction to Computing	3	0	0	6	HT115	Rigid body Mechanics	3	1	0	8
HT106	Organisation of Human Body	3	0	0	6	HT116	CAD Laboratory	1	0	3	5
HT107	Computing Laboratory	0	0	3	3						
		17	ω	3	43			16	2	5	41
XXX	\$English Communication	2	0	2	0	SA1xx	Students Activity Course-I	0	0	2	0
	Semester-III		-	_	_		Semester-IV		-	1	
Course No	Course Name			Ρ	C	Course No	Course Name		1	Ρ	С
HT201	Probability and Statistics	2	1	0	6	HT211	Biomedical Instrumentation	2	0	2	6
HT202	Thermodynamics	2	1	0	6	HT212	Medicinal Chemistry	.3	0	0	6
HT203	Molecular and Cell Biology	3	0	0	6	HT213	Signals and systems	2	1	0	6
111200	Molecular and Cell Biology	<u> </u>		0	0	111215	Diagnostics and Thorspoutio	2		0	0
HT204	Analog Integrated Circuits	3	0	0	6	HT214	Diagnostics and merapeutic	2	1	0	6
UT205	Defermeble Redy Mechanica	2	1	0	6	UT015	Option and Madical Imaging	2	0	0	6
<u>H1205</u>	Deformable Body Mechanics	2	1	0	0	пігіз		3	0	0	0
HT 206	Introduction to Data Science	2	0	2	6	HT216	Affeire	1	0	2	4
117.007	Diama dia al Lah 4			~		117.047	Allairs		_	•	0
HT 207	Biomedical Lab 1	0	0	3	3	HT 217	Biomedical Lab 2	0	0	3	3
HT 208	Prototyping lab	0	0	3	3	HS1XX	HSS Elective - I	3	0	0	6
								10	_	-	10
		14	3	8	42			16	2	1	43
SA2xx	Students Activity Course - II	0	0	2	0	SA3xx	Students Activity Course-III	0	0	2	0
Course No	Semester-V	· /	т	P	C	Course No	Semester-VI	,	τ	Р	C
000/30 110	Course Name	L	1	<u> </u>	<u> </u>	000/30 110	Course Name	<u> </u>	'	'	0
HT301	Numerical and Finite Element	2	0	2	6	HT311	Informatics and AL in Medicine	2	0	2	6
111301	Methods	2		2	0	111311	Informatics and Ar in Medicine	2	U	2	0
HT302	Sensors and Actuators	2	0	2	6	HT312	Pharmacology and Toxicology	3	0	0	6
HT303	Digital signal processing	2	0	2	6	HT313	Quantitative Human Physiology	3	0	0	6
117204	Eluid machanica	2	0	0	6	117244	Transport Phenomena in	2	4	0	0
H1304	Fluid mechanics	3	0	0	0	П1314	Physiological Systems	3	'	0	o
117205	Medical Microbiology and	2	0	0	6	117245	Diamatariala and Diamachaniaa	2	0	0	6
H1305	Immunology	3	0	0	0	пізіз	Biomaterials and Biomechanics	3	0	0	0
HT306	Biomedical Lab 3	0	0	3	3	HT316	Biomedical Lab 4	0	0	3	3
HT307	Clinical Immersion	0	0	3	3	HTXXX	Discipline Elective - I	3	0	0	6
HS1XX	HSS Elective - II	3	0	0	6			-	-		-
		-		-							
		15	0	12	42			17	1	5	41
SA4xx	Students Activity Course-IV	0	0	2	0	HT318	Summer Training (PP/NP)	0	0	0	0
	Technical Writing and			-	L V				U		,
HT308	Presentation	0	0	2	0						
Summer traini	ing in Engineering academic/ medi	cal Ac	adem	ia/Mor	lical Dev	vice industry is i	nreferred				
	Semester VII						Semester-V/III				
Course No		L	Т	Р	С	Course No	Course Name	L	Т	Р	С
	Drojant I	0	0	40	40	HT400	Dreiget II	-	0	10	10
H1498		0	0	12	12	H1499		0	0	12	12
HIXXX	Discipline Elective - II	3	0	0	6	HIXXX	Discipline Elective -III	3	U	U	6
XXX	Open Elective-I	3	0	0	6	HIXXX	Discipline Elective -IV	3	0	0	6
HS2xx	HSS Elective-III	3	0	0	6	XXX	Open Elective-II	3	0	0	6
						HS2xx	HSS Elective-IV	3	0	0	6
		9	0	12	30			12	0	12	36

<sup>\$</sup>As applicable to IITG UG (B Tech) curriculum.

Total Credits:

Sem	1	II	III	IV	V	VI	VII	VIII	Total
Credits	43	41	42	43	42	41	30	36	318

# List of Course Changes for the 4-Year BS Program at Jyoti and Bhupat Mehta School of Health Sciences and Technology

Sl. No	Initial course	Changes in the course	Brief description/justification
1	HT101: Linear	HT101: Multivariable	Name and credit are optimized.
	Algebra and Vector	Calculus and Linear	1. As per the suggestion from the subject
	Calculus	Algebra	expert from the mathematics department,
	L-T-P-C: 2-1-0-6	L-T-P-C: <b>3</b> -1-0- <b>8</b>	it is revised to have the appropriate name.
			Revised credit will be better for teaching
			and learning.
2	HT111: Differential	HT111: Differential	Credit is optimized.
	Equations	Equations	1. It might be helpful to have three
	L-T-P-C: 2-1-0-6	L-T-P-C: <b>3</b> -1-0- <b>8</b>	lectures instead of two lectures to cover
			the topics.
3	HT113: Biochemistry	HT113: Biochemistry	Credit is optimized.
	L-T-P-C: <b>2</b> -1-0-6	L-T-P-C: <b>3</b> -0-0-6	1. It might be better to have more
			theory/lecture classes initially to cover
			the entire syllabus.
4	HT115: Engineering	HT115: Rigid Body	The name is optimized.
	Mechanics	Mechanics	1. As per the suggestion from the subject
	L-T-P-C: 3-1-0-8	L-T-P-C: 3-1-0-8	expert from the mechanical engineering
			department, it is revised to have the
			appropriate name.
5	HT205: Solid	HT205: Deformable	The name is optimized.
	Mechanics	<b>Body Mechanics</b>	1. As per the suggestion from the subject
	L-T-P-C: 2-1-0-6	L-T-P-C: 2-1-0-6	expert from the mechanical engineering
			department, it is revised to have the
			appropriate name.
6	HT216: Regulatory	HT216:	The name is optimized.
	Affairs and	Entrepreneurship and	1. As per the discussion and suggestions
	Entrepreneurship	<b>Regulatory Affairs</b>	from various experts, it has been revised
	L-T-P-C: 3-0-0-6	L-T-P-C: 3-0-0-6	to have the appropriate name.
7	HT301: Finite	HT301: Numerical and	The name is optimized.
	Element and	Finite Element Methods	1. As per the suggestion from the subject
	Numerical Methods	L-T-P-C: 2-0-2-6	expert from the mathematics department,
	L-T-P-C: 2-0-2-6		it is revised to have the appropriate name.
8	HT315: Biomechanics	HT315: Biomaterials	The name is optimized.
	and Biomaterials	and Biomechanics	1. As per the discussion and suggestions
	L-T-P-C: 3-0-0-6	L-T-P-C: 3-0-0-6	from various experts, it has been revised
			to have the appropriate name.

## Credit changes from:

Sem	Ι	II	III	IV	V	VI	VII	VIII	Total
Credits	41	39	42	43	42	41	30	36	314
to			<b>L</b>					•	
Sem	Ι	II	III	IV	V	VI	VII	VIII	Total
Credits	43	41	42	43	42	41	30	36	318

Course Number & Title: HT101 Multivariable Calculus and Linear Algebra					
L-T-P-C: 3-1-0-8					
Type of Letter Grading (Regular Letter Grades / PP or NP Letter Grades): Regular Letter					
Grades					
Kind of Proposal (New Course / Revision of Existing Course): New Course					
Offered as (Compulsory / Elective): Compulsory					
Offered to: Bachelor of Science Program in Biomedical Science and Engineering					

Offered in (Odd/ Even / Any): Odd

Offered by (Name of Department/ Center): Jyoti and Bhupat Mehta School of Health Sciences and Technology

Pre-Requisite: NIL

Preamble / Objectives (Optional):

### **Course Content / Syllabus:**

Multivariable calculus: Vector functions of one variable - continuity and differentiability; Scalar valued functions of several variables, continuity, partial derivatives, directional derivatives, gradient, differentiability, chain rule; Tangent planes and normals, maxima and minima, Lagrange multiplier method; Repeated and multiple integrals with applications to volume, surface area; Change of variables; Vector fields, line and surface integrals; Greens, Gauss and Stokes theorems and their applications.

Linear algebra: Systems of linear equations, matrices, Gaussian elimination, LU decomposition, echelon form, column space, null space, rank of a matrix, inverse and determinant; Vector spaces (over the field of real and complex numbers), subspaces, spanning set, linear independence, basis and dimension; Linear transformations, rank-nullity theorem, matrix of a linear transformation, change of basis and similarity; Eigenvalues and eigenvectors, algebraic and geometric multiplicity, diagonalization by similarity; Innerproduct spaces, Gram-Schmidt process, orthonormal basis; Orthogonal, Hermitian and symmetric matrices, spectral theorem for real symmetric matrices

Books (In case UG compulsory courses, please give it as "Text books" and "Reference books". Otherwise give it as "References".

Texts: (Format: Authors, Book Title in Italics font, Volume/Series, Edition Number, Publisher, Year.)

1.	Thomas	and	Finney,	Calculus	and	Analytic	Geometry,	Narosa	Publishing	House,
	2010.									

T. M. Apostol, Calculus, Volume-2, Wiley India, 2003 2.

Gilbert Strang, Linear Algebra, Cengage learning, 4th edition, 2006. 3.

References: (Format: Authors, Book Title in Italics font, Volume/Series, Edition Number, Publisher, Year.)

1.	Erwin Kreyszig, Advanced Engineering Mathematics, Wiley, 10th edition, 2011.
2.	J. E. Marsden, A. J. Tromba and A. Weinstein, Basic Multivariable Calculus, Springer
	India, 2002.

	Detailed Course Content (Optional)					
	It will not be included in the Courses of Study Booklet					
Sl. No.	Broad Title / Topics	Number				
		of				
		Lectures				
1	<b>Multivariable calculus:</b> Vector functions of one variable - continuity and differentiability; Scalar valued functions of several variables, continuity, partial derivatives, directional derivatives, gradient, differentiability, chain rule; Tangent planes and normals, maxima and minima Lagrange multipling method. Dependent of multiple integrals	21				
	with applications to volume, surface area; Change of variables; Vector fields, line and surface integrals; Greens, Gauss and Stokes theorems and their applications.					
2	Linear algebra: Systems of linear equations, matrices, Gaussian elimination, LU decomposition, echelon form, column space, null space, rank of a matrix, inverse and determinant; Vector spaces (over the field of real and complex numbers), subspaces, spanning set, linear independence, basis and dimension; Linear transformations, rank-nullity theorem, matrix of a linear transformation, change of basis and similarity; Eigenvalues and eigenvectors, algebraic and geometric multiplicity, diagonalization by similarity; Inner-product spaces, Gram-Schmidt process, orthonormal basis; Orthogonal, Hermitian and symmetric matrices, spectral theorem for real symmetric matrices	21				
	Total Number of Lectures =	42				

In case of revision of existing course, Please provide below the details of existing EXISTING COURSE	course.
Course Number Title L T D C.	
Course Number, The, L-T-F-C:	
Pre-Requisite (if any)	
Contents:	
References:	

Course Number & Title:	HT102 Physics					
L-T-P-C:	2-1-0-6					
Type of Letter Grading (Regular Letter Grades / PP or NP Letter Grades):						
Kind of Proposal (New Course / Revision of Existing Course):	New course					
Offered as (Compulsory / Elective):	Compulsory					
Offered to:	BS Biomedical Science					
	and Engineering					
Offered in (Odd/ Even / Any):	Odd					
Offered by (Name of Department/ Center):	JBMSHST					
Pre-Requisite:	Nil					

Preamble / Objectives (Optional): The objective of the course is to provide biomedical students with a strong foundation in core physics principles. The course emphasizes conceptual understanding, logical reasoning, and problem-solving skills, focusing on topics that are essential for the curriculum in biomedical sciences. Tutorials reinforce these skills by providing opportunities to apply concepts and strengthen analytical thinking. (Topics that are covered in other mandatory courses are not covered here e.g., Optics)

**Course Content / Syllabus:** 

**Mechanics:** Newtons Laws and Principle; Work, Energy, and Power; Linear & Angular Momentum: Conservation of momentum (collisions), Rotational dynamics (torque, moment of inertia); Rigid and Elastic bodies: Stress, Strain, Hooke's Law.

**Oscillations, Waves:** Simple Harmonic Oscillator: Over-, Under-, and Undamped oscillators, resonances; Coupled Systems; Wave Properties: Frequency, wavelength, speed, superposition, Standing waves and resonance; Sound Waves: Basic wave equation, Doppler effect, transversal and longitudinal waves.

**Electricity and Magnetism:** Electrostatics: Charge, Coulomb's Law, Electric potential and electric field; Magnetism: Magnetic fields, Lorentz force, Electromagnetic induction (Faraday's Law).

**Introduction to Modern Physics:** Special Relativity: relativistic kinetic energy and velocity; Aspects of Quantum theory: Photoelectric effect, energy levels, atomic structure; Nuclear Physics: Radioactivity, decay processes.

Books (In case UG compulsory courses, please give it as "Text books" and "Reference books". Otherwise give it as "References".

Texts: (Format: Authors, *Book Title in Italics font,* Volume/Series, Edition Number, Publisher, Year.)

1. S.K. Chatterjee, *Fundamental Physics – An Introduction*, 1 ed., AlphaScience, 2013

2. Davidovits Paul, *Physics in Biology and Medicine*, 3 ed. Elsevier, 2008 References: (Format: Authors, *Book Title in Italics font*, Volume/Series, Edition Number, Publisher, Year.)

1 Ramamurti Shankar, *Fundamentals of Physics I*, Yale University Press, 2019

2	Ramamurti Shankar, Fundamentals of Physics II, Yale University Press, 2020
3	Deepto Chakrabarty et al., Classical Mechanics, MIT OpenCourseWare (Online Book),
	2016, https://ocw.mit.edu/courses/8-01sc-classical-mechanics-fall-2016/pages/online-
	textbook/

Detailed Course Content (Optional)								
	It will not be included in the Courses of Study Booklet							
Sl. No.	Broad Title / Topics	Number of						
		Lectures						
1	Classical Mechanics: Newtons Principle Work, Power etc.	3						
2	Classical Mechanics: Rotational dynamics	2						
3	Classical Mechanics: Elastic bodies	2						
4	Oscillations: Simple harmonic oscillator & Coupled systems	3						
5	Waves: Couple systems and wave properties	4						
6	Electricity	4						
7	Magnetism	4						
8	Modern Physics	6						
Total Number of Lectures =								

In case of revision of existing course, Please provide below the details of existing course. EXISTING COURSE Course Number, Title, L-T-P-C: Pre-Requisite (if any) Contents: References:

Course Number & Title: **HT103 Chemistry** 

L-T-P-C: 3-0-0-6
Type of Letter Grading (Regular Letter Grades / PP or NP Letter Grades): Regular Letter Grades
Kind of Proposal (New Course / Revision of Existing Course): New Course
Offered as (Compulsory / Elective): Compulsory
Offered to: Bachelor of Science Program in Biomedical Science and Engineering
Offered in (Odd/ Even / Any): Odd
Offered by (Name of Department/ Center): Jyoti and Bhupat Mehta School of Health Sciences
and Technology
Pre-Requisite: NIL
Preamble / Objectives (Optional):
Course Content / Syllabus:
Principles of Thermodynamics: First and Second Law of Thermodynamics, Concept of entropy,

Principles of Thermodynamics: First and Second Law of Thermodynamics, Concept of entropy, Helmholtz and Gibbs free energy, Equilibrium and spontaneity conditions for closed systems, Maxwell relations, The chemical potential; Definition and concept of open systems.

Bonding and coordination chemistry, Metal ions from laboratory to living systems, Organometallics and catalysis, Redox chemistry, bioactive inorganic molecules.

Understanding the 3D structure of organic compounds: Concept of chirality and molecular structure, representations in 2D and 3D forms, absolute configuration and CIP nomenclature, molecules devoid of point chirality, significance of chirality in living systems, conformational analysis, a few acyclic and monocyclic systems and their conformational aspects, nucleophilic and electrophilic reactions bioactive organic molecules.

Chromatography techniques, potentiometry, spectroscopy, FTIR, conductivity, NMR, mass spectrometry, polarography, X-Ray diffraction analysis, amperometry, fluorimetry, flame photometry, atomic absorption spectroscopy, radioimmunoassay

Books (In case UG compulsory courses, please give it as "Text books" and "Reference books". Otherwise give it as "References".

Texts: (Format: Authors, *Book Title in Italics font,* Volume/Series, Edition Number, Publisher, Year.)

1.	Catherine Housecroft, Alan Sharpe, Inorganic Chemistry, Fifth edition, Pearson, 2018	
2.	Clayden, J., Greeves, N. & Warren, S. Organic Chemistry, Second edition, Oxford	
	University	
	Press, 2012	
3.	Rakshit, P.C. (Revised by Rakshit, S.C.), Physical Chemistry Revised and Enlarged 7th	
	Edition,	
	Sarat Book House, 2014	
4.	G. D. Christian, P. K. Dasgupta, K. A. Schug, Analytical Chemistry, Seventh edition,	
	Wiley, 2013	
References: (Format: Authors, Book Title in Italics font, Volume/Series, Edition Number,		
Publisher, Year.)		
1.	Sarkar, R., General and Inorganic Chemistry, New Central Book Agency, 211	

Detailed Course Content (Optional)

It will not be included in the Courses of Study Booklet

Sl. No.	Broad Title / Topics	Number	of
		Lectures	
1	Principles of Thermodynamics: First and Second Law of	10	
	Thermodynamics, Concept of entropy, Helmholtz and Gibbs free		
	energy, Equilibrium and spontaneity conditions for closed systems,		
	Maxwell relations, The chemical potential; Definition and concept		
	of open systems.		
2	Bonding and coordination chemistry, Metal ions from laboratory to	10	
	living systems, Organometallics and catalysis, Redox chemistry,		
	bioactive inorganic molecules		
	Understanding the 3D structure of organic compounds: Concept of	12	
2	chirality and molecular structure, representations in 2D and 3D		
3	forms, absolute configuration and CIP nomenclature, molecules		
	devoid of point chirality, significance of chirality in living systems,		
	conformational analysis, a few acyclic and monocyclic systems and		
	their conformational aspects, nucleophilic and electrophilic		
	reactions bioactive organic molecules		
4	Chromatography techniques, potentiometry, spectroscopy, FTIR,	10	
	conductivity, NMR, mass spectrometry, polarography, X-Ray		
	diffraction analysis, amperometry, fluorimetry, flame photometry,		
	atomic absorption spectroscopy, radioimmunoassay		
Total Num	ber of Lectures =	42	

Course Number & Title: HT104 Basic Electrical Sciences
L-T-P-C: 3-1-0-8
Type of Letter Grading (Regular Letter Grades / PP or NP Letter Grades): Regular Letter
Grades

Kind of Proposal (New Course / Revision of Existing Course): New Course

Offered as (Compulsory / Elective): Compulsory

Offered to: Bachelor of Science Program in Biomedical Science and Engineering

Offered in (Odd/ Even / Any): Odd

Offered by (Name of Department/ Center): Jyoti and Bhupat Mehta School of Health Sciences and Technology

Pre-Requisite: NIL

Preamble / Objectives (Optional):

### **Course Content / Syllabus:**

DC Analysis: Dependent and independent Voltage and current sources, Nodes, Paths, Loops and Branches, Nodal and Mesh Analysis, Superposition, Source Transformations, Thevenin's and Norton's Theorems, Maximum Power Transfer. RL, RC and RLC Circuit. AC Circuit Analysis: Sinusoidal Forcing Function, Phasor Relationship for R, L and C, Impedance and Admittance, Phasor Diagrams. Instantaneous Power, Average Power, Complex Power, Apparent Power and Power Factor,

Polyphase Circuits: Balanced Three-phase Systems (Star (Y) & Delta ( $\Delta$ )), Three-phase Power Measurement, Magnetic Circuit: Ampere's circuital law, Application of Ampere's circuital law in magnetic circuit, Reluctance & permeance, Analysis of Series magnetic circuit, Analysis of Series-parallel magnetic circuit, Flux linkage, self and mutual inductance. Frequency Response: Low pass and High pass RC and RL circuits, Series and Parallel Resonance, Quality factor. Fundamentals of motors and transformers needed for medical applications. Introduction to transient analysis

Books (In case UG compulsory courses, please give it as "Text books" and "Reference books". Otherwise give it as "References".

Texts: (Format: Authors, *Book Title in Italics font,* Volume/Series, Edition Number, Publisher, Year.)

1. L. Bobrow, Fundamentals of Electrical Engineering, 12th edition, Oxford university Press, 2003

2. W. H. Hayt, J. E. Kemmerly, and S. M. Durbin, Engineering Circuit Analysis, 8th edition. McGraw-Hill, 2013.

3. V. D. Toro, Electrical Engineering Fundamentals, 2nd edition. PHI, 2014.

References: (Format: Authors, *Book Title in Italics font*, Volume/Series, Edition Number, Publisher, Year.)

1.	R. L. Boylestad and L. Nashelsky, Electronic Devices and Circuit Theory, 11th
	edition. Pearson, 2012.

Detailed Course Content (Optional)		
It will not be included in the Courses of Study Booklet		
Sl. No.	Broad Title / Topics	Number of
		Lectures
1	DC Analysis: Dependent and independent Voltage and current	9
	sources, Nodes, Paths, Loops and Branches, Nodal and Mesh	
	Analysis, Superposition, Source Transformations, Thevenin's and	
	Norton's Theorems, Maximum Power Transfer	
2	RL, RC and RLC Circuit	3
3	AC Circuit Analysis: Sinusoidal Forcing Function, Phasor Relationship for R, L and C, Impedance and Admittance, Phasor Diagrams. Instantaneous Power, Average Power, Complex Power, Apparent Power and Power Factor	9
4	Polyphase Circuits: Balanced Three-phase Systems (Star (Y) & Delta ( $\Delta$ )), Three-phase Power Measurement	6
5	Magnetic Circuit: Ampere's circuital law, Application of Ampere's circuital law in magnetic circuit, Reluctance & permeance, Analysis of Series magnetic circuit, Analysis of Series-parallel magnetic circuit, Flux linkage, self and mutual inductance	6
6	Frequency Response: Low pass and High pass RC and RL circuits, Series and Parallel Resonance, Quality factor.	6
7	Fundamentals of motors and transformers needed for medical applications. Introduction to transient analysis	3
Total Num	ber of Lectures (Excluding tutorials)	42

In case of revision of existing course, Please provide below the details of existing course.
EXISTING COURSE
Course Number, Title, L-T-P-C:
Pre-Requisite (if any)
Contents:
References:

Course Number & Title: HT105 Introduction to Computing

L-T-P-C: 3-0-0-6

Type of Letter Grading (Regular Letter Grades / PP or NP Letter Grades): Regular Letter Grades

Kind of Proposal (New Course / Revision of Existing Course): New Course

Offered as (Compulsory / Elective): Compulsory

Offered to: Bachelor of Science Program in Biomedical Science and Engineering

Offered in (Odd/ Even / Any): Odd

Offered by (Name of Department/ Center): Jyoti and Bhupat Mehta School of Health Sciences and Technology

Pre-Requisite: NIL

Preamble / Objectives (Optional):

## **Course Content / Syllabus:**

Introduction to Computers: the von Neumann architecture, low/high-level language, compiler, interpreter, loader, linker, operating system, flowchart, and programming environment.

Concepts of programming (using Python): Variables and identifiers, data types, literals, operators, expressions; Conditional statements; Loops; Lists, tuples, dictionaries, and sets; Functions: Procedural and Recursive; Classes; Exception handling; File handling.

Program development lifecycle. Algorithms, efficiency, correctness, implementation, verification, assertions, pre/post conditions, invariants, testing.

Introduction to object-oriented programming.

Books (In case UG compulsory courses, please give it as "Text books" and "Reference books". Otherwise give it as "References".

Texts: (Format: Authors, *Book Title in Italics font*, Volume/Series, Edition Number, Publisher, Year.)

1. Charles Dierbach, Introduction to Computer Science using Python: A Computational Problem-Solving Focus, 1st Edition, Wiley, 2015

References: (Format: Authors, *Book Title in Italics font,* Volume/Series, Edition Number, Publisher, Year.)

1.	J. Glenn Brookshear and Dennis Brylow, Computer Science: An Overview, 12th Ed.,
	Pearson Education, 2017.

2.	Peter Wentworth, Jeffrey Elkner, Allen B. Downey, and Chris Meyers, How to Think
	Like a Computer Scientist: Learning with Python 3, 3rd Edition, 2012.

3. R. G. Dromey, How to Solve it by Computer, 1st Ed., Pearson Education, 2008.

Detailed Course Content (Optional)		
It will not be included in the Courses of Study Booklet		
Sl. No.	Broad Title / Topics	Number
		of
		Lectures
1	Introduction to Computers: the von Neumann architecture,	7
	low/high-level language, compiler, interpreter, loader, linker,	
	operating system, flowchart, and programming environment.	
2	Concepts of programming (using Python): Variables and identifiers,	12
	data types, literals, operators, expressions; Conditional statements;	
	Loops; Lists, tuples, dictionaries, and sets; Functions: Procedural	
	and Recursive; Classes; Exception handling; File handling.	
3	Program development lifecycle	8
		-
4	Algorithms, efficiency, correctness, implementation, verification,	9
	assertions, pre/post conditions, invariants, testing.	
5	Introduction to object-oriented programming	6
Total Number of Lectures =		42

Cours	se Numbe	er & Title	: HT	106 (	Organis	ation	of Hu	ıman Body	/			
L-T-P	P-C: 3 – (	0 - 0 - 6										
										 _	_	

Type of Letter Grading (Regular Letter Grades / PP or NP Letter Grades): Regular Letter Grades

Kind of Proposal (New Course / Revision of Existing Course): New Course

Offered as (Compulsory / Elective): Compulsory

Offered to: Bachelor of Science Program in Biomedical Science and Engineering

Offered in (Odd/ Even / Any): Even

Offered by (Name of Department/ Center): Jyoti and Bhupat Mehta School of Health Sciences and Technology

Pre-Requisite: NA

Preamble / Objectives (Optional):

#### **Course Content / Syllabus:**

Importance of chemistry in life. Biomolecules: General structure and overview of – carbohydrates; lipids; proteins; Enzymes; DNA, RNA, amino acids. Cells: basics of cell types; structural organization and function of intracellular organelles; Cellular systems: Cellular level organization – cell structure and functions – structure of plasma membrane, membrane proteins, cytoplasm and organelles (nucleus, mitochondria, Golgi bodies, lysosomes, endoplasmic reticulum, peroxisomes, vacuoles, structure & function of cytoskeleton and its role in motility), cell growth, cell death, cellular differentiation, example of cellular structure in human body – nerve cell, blood cells, cardiac cells. Molecules. Tissues: tissue level organization; structure, types and functions of different tissues–epithelial, connective, muscle, brain tissue, bone. Organs; organs formation and organ level organization, structure and function of different organs, e.g., skin, brain, heart, lungs, liver, kidneys, digestive system, excretory system, reproductive system, endocrine system.

Books (In case UG compulsory courses, please give it as "Text books" and "Reference books". Otherwise give it as "References".

	U
Texts	:: (Format: Authors, Book Title in Italics font, Volume/Series, Edition Number,
Publi	sher, Year.)
1.	Lisa Urry, Michael Cain, Steven Wasserman, Peter Minorsky and Jane Reece.
	Campbell Biology, Publisher: Pearson, 12th Edition, 2017
2.	John E. Hall. Guyton and Hall Textbook of Medical Physiology-14E, Elsevier, 2020
	by PhD (Author)
Refer	rences: (Format: Authors, Book Title in Italics font, Volume/Series, Edition Number,
Publi	sher, Year.)
1.	David L. N., Michael C., Lehninger Principles of Biochemistry, 8th Edition, WH
	Freeman, 2017
2.	Cooper, G. M. and Hausman, R. E., The Cell: A Molecular Approach, 6 <sup>th</sup> Edition,
	Sinauer Associates Inc, 2013
3	Alberts, B., Bray, D., Hopkin, K., Johnson, A.D., Lewis, J., Raff, M., Roberts, K. and

Detailed	Detailed Course Content (Optional)			
It will no	t be included in the Courses of Study Booklet			
Sl. No.	Broad Title / Topics	Number of		
		Lectures		
1	Importance of chemistry in life, biomolecules: General structure and	8		
	overview of - carbohydrates; lipids; proteins; Enzymes; DNA,			
	RNA, amino acids.			
2	Cells: basics of cell types; structural organization and function of	8		
	intracellular organelles; cell structure and functions – structure of			
	plasma membrane, membrane proteins, cytoplasm and organelles			
	(nucleus, mitochondria, Golgi bodies, lysosomes, endoplasmic			
	reticulum, peroxisomes, vacuoles, structure and function of			
	cytoskeleton and its role in motility)			
3	Cell growth, cell death, cellular differentiation, example of cellular	8		
	structure in human body – nerve cell, blood cells, cardiac cells			
4	Tissues: tissue level organization; structure, types and functions of	8		
	different tissues- epithelial, connective, muscle, brain tissue, bone.			
5	Organs; organs formation and organ level organization, structure	10		
	and function of different organs, e.g., skin, brain, heart, lungs, liver,			
	kidneys, digestive system, excretory system, reproductive system,			
	endocrine system.			
Total Nu	mber of Lectures =	42		

In case of revision of existing course, Please provide below the details of existing course. EXISTING COURSE
Course Number, Title, L-T-P-C:
Pre-Requisite (if any)
Contents:
References:

Course Number & Title: HT107 Computing Laboratory

L-T-P-C: 0-0-3-3

Type of Letter Grading (Regular Letter Grades / PP or NP Letter Grades): Regular Letter Grades

Kind of Proposal (New Course / Revision of Existing Course): New Course

Offered as (Compulsory / Elective): Compulsory

Offered to: Bachelor of Science Program in Biomedical Sciences and Engineering

Offered in (Odd/ Even / Any): Odd

Offered by (Name of Department/ Center): Jyoti and Bhupat Mehta School of Health Sciences and Technology

Pre-Requisite: NIL

Preamble / Objectives (Optional):

**Course Content / Syllabus:** 

Programming Laboratory will be set in consonance with the material covered in HT 105. This will include assignments in a programming language like Python

Books (In case UG compulsory courses, please give it as "Text books" and "Reference books". Otherwise give it as "References".

Texts: (Format: Authors, *Book Title in Italics font,* Volume/Series, Edition Number, Publisher, Year.)

 Charles Dierbach, Introduction to Computer Science using Python: A Computational Problem-Solving Focus, 1st Edition, Wiley, 2015.

References: (Format: Authors, *Book Title in Italics font*, Volume/Series, Edition Number, Publisher, Year.)

1. Peter Wentworth, Jeffrey Elkner, Allen B. Downey, and Chris Meyers, How to Think Like a Computer Scientist: Learning with Python 3, 3rd Edition, 2012

Detailed Co	ourse Content (Optional)						
It will not be included in the Courses of Study Booklet							
Sl. No. Broad Title / Topics Number of Lectures							
1							
Total Number of Lectures =							

In case of revision of existing course, Please provide below the details of existing course. **EXISTING COURSE** 

Course Number, Title, L-T-P-C:

Pre-Requisite (if any)

Contents:

References:

Course Number & Title: HT 111 Differential Equations

L-T-P-C: 3-1-0-8

Type of Letter Grading (Regular Letter Grades / PP or NP Letter Grades): Regular Letter Grades

Kind of Proposal (New Course / Revision of Existing Course): New Course

Offered as (Compulsory / Elective): Compulsory

Offered to: Bachelor of Science Program in Biomedical Science and Engineering.

Offered in (Odd/ Even / Any): Even

Offered by (Name of Department/ Center): Jyoti and Bhupat Mehta School of Health Sciences and Technology

Pre-Requisite: NIL

Preamble / Objectives (Optional):

#### **Course Content / Syllabus:**

**Ordinary differential equations:** First order differential equations: exact differential equations, integrating factors, Bernoulli equations, existence and uniqueness theorem for IVP, applications; Higher-order linear differential equations: solutions of homogeneous and nonhomogeneous equations, method of variation of parameters, operator method; Cauchy-Euler equation; Series solutions of linear differential equations, Legendre equation and Legendre polynomials, Bessel equation and Bessel functions of first and second kinds; Systems of first-order equations, phase plane, critical points, stability.

**Transform Calculus:** Fourier series, half-range Fourier series, Fourier transforms, finite sine and cosine transforms; Laplace and inverse Laplace transforms, properties, convolutions; Solutions of ODEs by Laplace transform.

**Partial differential equations:** Classification of second-order PDEs, canonical form; Initial and boundary value problems involving wave equation and heat conduction equation, boundary value problems involving Laplace equation and solutions by method of separation of variables; Initial-boundary value problems in non-rectangular coordinates. Solution of PDEs by Fourier transform.

Books (In case UG compulsory courses, please give it as "Text books" and "Reference books". Otherwise give it as "References".

Texts: (Format: Authors, *Book Title in Italics font,* Volume/Series, Edition Number, Publisher, Year.)

- 1. S. L. Ross, Differential Equations, Wiley India, 3rd Edition, 2004.
- 2. K. Sankara Rao, Introduction to Partial Differential Equations, 3rd Ed., Prentice Hall of India, 2011.

References: (Format: Authors, *Book Title in Italics font,* Volume/Series, Edition Number, Publisher, Year.)

1.	E. Kreyszig, Advanced Engineering Mathematics, 10th Ed., Wiley, 2015.
2.	Glyn James et al., Modern Engineering Mathematics, Pearson, 5 <sup>th</sup> edition, 2015.
3.	I. N. Sneddon, Elements of Partial Differential Equations, McGraw Hill, 1957.
4.	E. A. Coddington, An Introduction to Ordinary Differential Equations, Dove
	Publications, 1989.

# Detailed Course Content (Optional) It will not be included in the Courses of Study Booklet

Sl. No.	Broad Title / Topics	Number
		of
		Lectures
1	<b>Ordinary differential equations:</b> First order differential equations: exact differential equations, integrating factors, Bernoulli equations, existence and uniqueness theorem for IVP, applications; Higher-order linear differential equations: solutions of homogeneous and nonhomogeneous equations, method of variation of parameters, operator method; Cauchy-Euler equation; Series solutions of linear differential equations, Legendre equation and Legendre polynomials, Bessel equation and Bessel functions of first and second kinds; Systems of first-order equations, phase plane, critical points, stability.	21
2	<b>Transform Calculus:</b> Fourier series, half-range Fourier series, Fourier transforms, finite sine and cosine transforms; Laplace and inverse Laplace transforms, properties, convolutions; Solutions of ODEs by Laplace transform.	6
3	<b>Partial differential equations:</b> Classification of second-order PDEs, canonical form; Initial and boundary value problems involving wave equation and heat conduction equation, boundary value problems involving Laplace equation and solutions by method of separation of variables; Initial-boundary value problems in non-rectangular coordinates. Solution of PDEs by Fourier transform.	15
	Total Number of Lectures =	42

In case of revision of existing course, Please provide below the details of existing course.
EXISTING COURSE
Course Number, Title, L-T-P-C:
Pre-Requisite (if any)
Contents:
References:

Course Number & Title: HT112 Digital System Design

L-T-P-C: 3 - 0 - 2 - 8

Type of Letter Grading (Regular Letter Grades / PP or NP Letter Grades): Regular Letter Grades

Kind of Proposal (New Course / Revision of Existing Course): New Course

Offered as (Compulsory / Elective): Compulsory

Offered to: Bachelor of Science Program in Biomedical Science and Engineering

Offered in (Odd/ Even / Any): Even

Offered by (Name of Department/ Center): Jyoti and Bhupat Mehta School of Health Sciences and Technology

Pre-Requisite: NA

Preamble / Objectives (Optional):

#### **Course Content / Syllabus:**

Digital Electronics: Number Systems and Binary Codes, Boolean Algebra and Logic Gates, De Morgan's Theorems, Sum-of-Product and Product-of-Sum Forms, Algebraic Simplification, Karnaugh-Map Method. Gate level combinational circuits: multiplexer/ demultiplexer, encoder/ decoder, adder/ subtractor, comparator and parity generators; Gate level sequential circuits: latches and flip-flops (RS, JK, D, T, and Master Slave); Registers; Counters: ripple, ring, and shift register counters; Design and analysis of synchronous sequential finite state machine; Memory and Programmable logic devices PLA, PAL, FPGA, ROM, memory.

Embedded Systems: Fundamentals of Embedded systems, Arduino programming basics in Embedded C, and examples of programming digital and analog inputs/outputs, LCD interfacing, serial communication.

Books (In case UG compulsory courses, please give it as "Text books" and "Reference books". Otherwise give it as "References".

Texts: (Format: Authors, *Book Title in Italics font,* Volume/Series, Edition Number, Publisher, Year.)

	1.	M. M. Mano and M. D. Ciletti, Digital Design, 6th edition. Pearson, 2	2018.
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2. N. S. Widmer, G. L. Moss, and R. J. Tocci, Digital Systems, 12th edition. Pearson, 2017.

3. Russell, Introduction to Embedded Systems Using ANSI C and the Arduino Development Environment. Morgan & Claypool, 2010.

References: (Format: Authors, *Book Title in Italics font,* Volume/Series, Edition Number, Publisher, Year.)

McGraw-Hill, 2017.	1.	Kamal, Embedded Systems: Architecture, Programming and Design, 3rd Edition	۱.
		McGraw-Hill, 2017.	

2. Noergaard T, Embedded Systems Architecture, 1st Edition. Elsevier, 2005.

Detailed Course Content (Optional) It will not be included in the Courses of Study Booklet

Sl. No.	Broad Title / Topics	Number of
		Lectures
1	Digital Electronics: Number Systems and Binary Codes, Boolean	10
	Algebra and Logic Gates, De Morgan's Theorems, Sum-of-Product	
	and Product-of-Sum Forms, Algebraic Simplification, Karnaugh-	
	Map Method	
2	Gate level combinational circuits: multiplexer/ demultiplexer,	8
	encoder/ decoder, adder/ subtractor, comparator and parity	
	generators	
3	Gate level sequential circuits: latches and flip-flops (RS, JK, D, T,	6
	and Master Slave); Registers	
4	Counters: ripple, ring, and shift register counters	2
5	Design and analysis of synchronous sequential finite state machine	2
6	Memory and Programmable logic devices PLA, PAL, FPGA, ROM,	2
	memory	
7	Embedded Systems: Fundamentals of Embedded systems, Arduino	10
	programming basics in Embedded C, and examples of programming	
	digital and analog inputs/outputs, LCD interfacing, serial	
	communication.	
Total Nu	umber of Lectures =	42

In case of revision of existing course, Please provide below the details of existing course. **EXISTING COURSE** Course Number, Title, L-T-P-C: Pre-Requisite (if any) Contents:

References:

Course Number & Title: HT113 Biochemistry

L-T-P-C: 3 - 0 - 0 - 6

Type of Letter Grading (Regular Letter Grades / PP or NP Letter Grades): Regular Letter Grades Kind of Proposal (New Course / Revision of Existing Course): New Course

Offered as (Compulsory / Elective): Compulsory

Offered to: Bachelor of Science Program in Biomedical Science and Engineering.

Offered in (Odd/ Even / Any): Even

Offered by (Name of Department/ Center): Jyoti and Bhupat Mehta School of Health Sciences and Technology

Pre-Requisite: NA

Preamble / Objectives (Optional):

## **Course Content / Syllabus:**

Introduction to biochemistry, biomolecules, enzymology, and biochemistry of body fluids.

Analytical biochemistry: detection of biomolecules such as protein, carbohydrate, and fat.

Principles of bioenergetics; metabolic pathways such as glycolysis, TCA cycle, fatty acid, and nucleic acids.

Genes, chromosomes, genetic code, protein synthesis, protein targeting and degradation, regulation of gene expression, cell signaling.

Disorders of biomolecule metabolism - carbohydrate metabolism disorders such as diabetes mellitus and galactosemia; protein metabolism disorders such as phenylketonuria, maple syrup urine disease; nucleic acid metabolism disorders such as Lesch-Nyhan syndrome, adenosine deaminase deficiency, gout, and Orotic aciduria.

Books (In case UG compulsory courses, please give it as "Text books" and "Reference books". Otherwise give it as "References".

Texts: (Format: Authors, *Book Title in Italics font,* Volume/Series, Edition Number, Publisher, Year.)

- 1. David L. N., Michael C., Lehninger Principles of Biochemistry, WH Freeman, 2017
- 2. Jeremy Berg, Gatto Jr. Gregory, Hines Justin, Tymoczko John, Stryer Lubert, Biochemistry, W H Freeman & Co
- 3. Peter J. Kennelly, Kathleen M. Botham, Owen McGuinness, Victor W. Rodwell, P. Anthony Weil, Harper's Illustrated Biochemistry, McGraw Hill / Medical, 2022

References: (Format: Authors, *Book Title in Italics font,* Volume/Series, Edition Number, Publisher, Year.)

1. Denise Ferrier, Lippincott's Illustrated Reviews – Biochemistry, Seventh edition, Lippincott Williams and Wilkins, 2017

Detailed	Course Content (Optional)		
It will not be included in the Courses of Study Booklet			
Sl. No.	Broad Title / Topics	Number of	
		Lectures	

1	Introduction to biochemistry; biomolecules; enzymology; biochemistry	12
	of body fluids; introduction to biomolecules analysis.	
2	Principles of bioenergetics; metabolic pathways such as glycolysis,	
	glycolysis, TCA cycle, fatty acid, and nucleic acids.	
3	Genes, chromosomes, genetic code, protein synthesis, protein targeting	10
	and degradation, regulation of gene expression, and cell signaling	
4	Disorders of biomolecule metabolism - carbohydrate metabolism disorders: diabetes mellitus, galactosemia; protein metabolism disorders: phenylketonuria, maple syrup urine disease; nucleic acid metabolism disorders such as Lesch- Nyhan syndrome, adenosine deaminase deficiency, gout, and Orotic aciduria.	10
Total Nur	mber of Lectures	42

In case of revision of existing course, Please provide below the details of existing course. **EXISTING COURSE** 

Course Number, Title, L-T-P-C:

Pre-Requisite (if any)

Contents:

References:

Course Number & Title: HT 114 Human Anatomy and PhysiologyL-T-P-C: $2 - 1 - 0 - 6$ Type of Letter Grading (Regular Letter Grades / PP or NP Letter Grades): Regular Letter GradesKind of Proposal (New Course / Revision of Existing Course): New CourseOffered as (Compulsory / Elective): CompulsoryOffered to: Bachelor of Science Program in Biomedical Science and Engineering.
Type of Letter Grading (Regular Letter Grades / PP or NP Letter Grades): Regular Letter Grades Kind of Proposal (New Course / Revision of Existing Course): New Course Offered as (Compulsory / Elective): Compulsory Offered to: Bachelor of Science Program in Biomedical Science and Engineering.
Kind of Proposal (New Course / Revision of Existing Course): New Course     Offered as (Compulsory / Elective): Compulsory     Offered to: Bachelor of Science Program in Biomedical Science and Engineering.
Offered as (Compulsory / Elective): Compulsory Offered to: Bachelor of Science Program in Biomedical Science and Engineering.
Offered to: Bachelor of Science Program in Biomedical Science and Engineering.
Offered to: Bachelor of Science Program in Biomedical Science and Engineering.
Offered in (Odd/ Even / Any): Even
and Technology
Pre Dequicite: NA
Preemble / Objectives (Optional):
Course Content / Syllobus:
Course Content / Synadus:
Gross anatomy: Osteology, Muscular System, Arthrology, Cardio Vascular System, Respiratory
System, Digestive System, Gento-Ormary System, Endocrine System, Nervous System and its
Anotomy, Microanotomy, Embryology and Consting, Neurosenstemy, Constal Histology
Anatomy. Microanatomy, Emoryology and Genetics, Neuroanatomy, General Histology.
Physiology: General Physiology Hematology Cardiovascular Physiology Gastro-Intestinal
Physiology, Deneral Thysiology, Hematology, Caldiovascular Thysiology, Gasto-Intestinal
Mussial Dhysiology, Respiratory Thysiology, Renar Thysiology, Endocrine Thysiology, Neive and
Division of the second se
Physiology.
Books (In case UG compulsory courses, please give it as "Text books" and "Reference books"
Otherwise give it as "References"
Texts: (Format: Authors <i>Rook Title in Italics font</i> Volume/Series Edition Number Publisher
Vear )
1 BD Chaurasia Human Anatomy Volume 1-4: CBS Publishers & Distributors 8 <sup>th</sup> edition
$\frac{1}{2019}$
2 AK Jain Textbook of Physiology 9 <sup>th</sup> Edition Arva publishing 2022
2. Int sun, reason of raystology, y Euclion, raya publishing, 2022
References: (Format: Authors, <i>Book Title in Italics font</i> , Volume/Series, Edition Number,
Publisher Vear)
ruonsher, rear.
1. Mario Vaz, Tony Raj, Guvton & Hall Textbook of Medical Physiology - E-Book A South
Asian Edition. Elsevier India, 3rd Edition. 2020
,,, - <b></b> -
2. R.S. Snell. <i>Clinical Anatomy for Medical Student</i> , 6th Edition Little, Brown & Co., 2000
3 Inderbir Singh, <i>Textbook of Human Histology</i> (4th Edition) Jaypee Brother, 2002
4 AR Crossman and David Neary. <i>Neuroanatomy: An Illustrated Color Text</i> , 2nd Edition,
Elsevier, 2000

	Detailed Course Content (Optional) It will not be included in the Courses of Study Booklet			
SI. No. Broad Little / Topics	Number of			

1	General Physiology, Hematology, Nerve and Muscle Physiology, Gastro-intestinal Physiology, Cardiovascular Physiology (CVS), Respiratory Physiology, Renal Physiology, Endocrine Physiology, Reproductive Physiology, Neurophysiology, Integrated Physiology	20
2	Anatomy: Anatomical terminology; General features of bones and Joints, Muscle, Skin and fascia; General features of the cardiovascular system, and lymphatic system and Introduction to the nervous system	2
3	Features of individual bones (Upper Limb), Pectoral region, Axilla, Shoulder and Scapular region Arm & Cubital fossa, Forearm & hand, General Features, Joints, radiographs & surface marking, Features of individual bones (Lower Limb), Front & Medial side of thigh, Gluteal region and back of thigh, Hip Joint, Knee joint, Anterolateral compartment of leg & dorsum of foot, Back of Leg and Sole	4
4	Thoracic cage, Heart and Pericardium, Mediastinum, Lungs & Trachea, Thorax	2
5	Skull osteology, Scalp, Orbit, Face and parotid region Anterior Triangle, Temporal and Infratemporal regions, Submandibular region, Deep structures in the neck, Deep structures in the neck, Mouth, Pharynx and Palate, Cavity of Nose, Larynx, Tongue, Organs of hearing and equilibrium, Eyeball, Back Region, Head and neck Joints, Histology, Development, Radiography & Surface marking	4
6	Anterior abdominal wall, Posterior abdominal wall, Male external genitalia, Abdominal cavity, Pelvic wall, and viscera, Perineum, Vertebral column, Sectional Anatomy	3
7	Genetics, Embryology, Neuroanatomy, Histology	6
	Total Number of Lectures =	42

In case of revision of existing course, please provide below the details of existing course.		
EXISTING COURSE		
Course Number, Title, L-T-P-C:		
Pre-Requisite (if any)		
Contents:		
References:		

Course Number & Title: HT115 Rigid body Mechanics

L-T-P-C: 3-1-0-8

Type of Letter Grading (Regular Letter Grades / PP or NP Letter Grades): Regular Letter Grades

Kind of Proposal (New Course / Revision of Existing Course): New Course

Offered as (Compulsory / Elective): Compulsory

Offered to: Bachelor of Science Program in Biomedical Science and Engineering.

Offered in (Odd/ Even / Any): Even

Offered by (Name of Department/ Center): Jyoti and Bhupat Mehta School of Health Sciences and Technology

Pre-Requisite: NA

Preamble / Objectives (Optional):

**Course Content / Syllabus:** 

**Introduction to Biomechanics and Rigid Body Mechanics**: Principles; understanding scalar and vector quantities; basic concepts of force, moment, equilibrium, and stability; Overview of biomechanics

**Force Systems and Equilibrium**: Types of forces— static equilibrium; free body diagrams, friction. Forces in biomechanics and free body diagrams for human body segments.

**Center of Mass and Center of Gravity**: Concepts of center of mass and center of gravity, stability. First and second moments of inertia, parallel axis theorem. Importance of concepts of center of mass and center of gravity, stability and balance in biomechanics: applications to posture and gait.

**Kinematics of Rigid Bodies**: Linear and angular kinematics: position, velocity, and acceleration; Cartesian, polar, cylindrical and spherical coordinates. Kinematic analysis of joint motion in human body; introduction to human gait analysis.

**Kinetics of rigid bodies**: Force, mass, velocity, acceleration, torque, inertia, angular velocity, angular acceleration, translation, rotation. Joint Mechanics and Torques in Biomechanics: Mechanical advantage in muscles and joints; moment arms and joint torque; applications in limb movement and rehabilitation devices.

Work, Energy, and Power in Human Movement: Concepts of work, energy power, momentum, potential energy. Applications in biomechanics; power generation and absorption in human activities (e.g., running, jumping).

**Applications of Rigid Body Mechanics in Biomechanics**— Case Studies: Case studies on human movement, sports biomechanics, and assistive devices; introduction to inverse dynamics; some applications in medical devices, physical therapy, and sports science.

Books (In case UG compulsory courses, please give it as "Text books" and "Reference books". Otherwise give it as "References".

Texts: (Format: Authors, *Book Title in Italics font*, Volume/Series, Edition Number, Publisher, Year.)

1. Okuno, E., and Fratin, L. (2014). Biomechanics of the Human Body (Vol. 1461485754). New York (NY): Springer

 Beer, F.P., Johnston Jr., E.R., Mazurek, D.F., Cornwell, P.J., and Sanghi, S. (2013) Vector Mechanics for Engineers Statics and Dynamics, 10th Edition, McGraw Hill.
References: (Format: Authors, *Book Title in Italics font,* Volume/Series, Edition Number, Publisher, Year.)

1.	Hall, S. J. (2019). Basic Biomechanics, 8th edition, McGraw-Hill
2.	Beer, F.P., Johnston Jr., E.R., Mazurek, D.F., Cornwell, P.J., and Sanghi, S. (2013)
	Vector Mechanics for Engineers Statics and Dynamics, 10th Edition, McGraw Hill.
3.	Schneck, D. J., and Bronzino, J. D. (2002). Biomechanics: Principles and
	Applications. Boca Raton: CRC Press.

Detailed Course Content (Optional)			
It will not be included in the Courses of Study Booklet			
Sl. No.	Broad Title / Topics	Number of Lectures	
1	Introduction to Biomechanics and Rigid Body	6	
	Mechanics: Principles; understanding scalar and vector		
	quantities; basic concepts of force, moment, equilibrium,		
	and stability; Overview of biomechanics		
2	Force Systems and Equilibrium: Types of forces—	6	
	static equilibrium; free body diagrams, friction. Forces in		
	biomechanics and free body diagrams for human body		
	segments.		
3	Center of Mass and Center of Gravity: Concepts of	6	
	center of mass and center of gravity, stability. First and		
	second moments of inertia, parallel axis theorem.		
	Importance of concepts of center of mass and center of		
	gravity, stability and balance in biomechanics:		
4	applications to posture and gait.	(	
4	Kinematics of Kigid Bodies: Linear and angular	0	
	Cortesion polar cylindrical and spherical coordinates		
	Kinematic analysis of joint motion in human body:		
	introduction to human gait analysis		
5	Kinetics of rigid bodies: Force mass velocity	6	
	acceleration torque inertia angular velocity angular	0	
	acceleration translation rotation Joint Mechanics and		
	Torques in Biomechanics: Mechanical advantage in		
	muscles and joints: moment arms and joint torque:		
	applications in limb movement and rehabilitation devices.		
6	Work, Energy, and Power in Human Movement:	6	
	Concepts of work, energy power, momentum, potential		
	energy. Applications in biomechanics; power generation		
	and absorption in human activities (e.g., running,		
	jumping).		
7	Applications of Rigid Body Mechanics in	6	
	Biomechanics— Case Studies: Case studies on human		
	movement, sports biomechanics, and assistive devices;		
	introduction to inverse dynamics; some applications in		
	medical devices, physical therapy, and sports science.		
Total Number of Lectures (Excluding tutorial)		42	

In case of revision of existing course, Please provide below the details of existing course. **EXISTING COURSE** Course Number, Title, L-T-P-C: Pre-Requisite (if any) Contents: References:

Course Number & Title: HT116 CAD Laboratory

L-T-P-C: 1-0-3-5

Type of Letter Grading (Regular Letter Grades / PP or NP Letter Grades): Regular Letter Grades Kind of Proposal (New Course / Revision of Existing Course): New Course

Offered as (Compulsory / Elective): Compulsory

Offered to: Bachelor of Science Program in Biomedical Science and Engineering

Offered in (Odd/ Even / Any): Odd

Offered by (Name of Department/ Center): Jyoti and Bhupat Mehta School of Health Sciences and Technology

Pre-Requisite: NIL

Preamble / Objectives (Optional):

#### **Course Content / Syllabus:**

Computer Aided Drafting: Drafting Setting- Software Commands, Function keys, Drafting Aids, Editing and Modification- Two-dimensional drawings- Isometric drawings- 3D Geometrical Modelling (Wireframe, surface and solid)- Commands to generate profile-based 3D solids-Three dimensional drawings.

Books (In case UG compulsory courses, please give it as "Text books" and "Reference books". Otherwise give it as "References".

Texts: (Format: Authors, Book Title in Italics font, Volume/Series, Edition Number, Publisher, Year.)

1. K Venugopal and V Prabhu Raja, Engineering Drawing + Auto CAD, 6th Edition, New Age International Publishers, 2022

References: (Format: Authors, *Book Title in Italics font*, Volume/Series, Edition Number, Publisher, Year.)

1.	N D Bhatt, Engineering Drawing-Plane and Solid Geometry, 54th Edition, Charotar Publishing House Lvt Ltd, 2023
0	

2. Douglas Smith, Antonio Ramirez and Ashleigh Congdon-Fuller, Technical Drawing 101 with AutoCAD 2025, SDG Publications, 1<sup>st</sup> Edition 2024

Detailed Course Content (Optional) It will not be included in the Courses of Study Booklet			
Sl. No.		Broad Title / Topics	Number of Lectures
1	Fundamentals of engineering drawing and overview of CAD Software	Invoke commands from menu and tool bar, Draw lines, circles, Coordinate system. Selection, erase, undo and move commands, Plot and save options, Open existing file and start a new drawing file	1
2	Lines, lettering and dimensioning	Draw arcs, rectangles, ellipses, and elliptical arcs, polygons. Draw traces, polylines, and doughnuts. Points and change point style and point size.	1
3	Theory of projection, classification	Set up units and limits. Set up layers and assign colors and linotypes. Grid, snap, ortho, and object snap modes. Auto tracking, current, and global line type scaling for plotting.	1
4	Orthographic projection, Quadrant concepts	Make copies of existing objects. Fillet and chamfer objects. Cut and extend objects, Stretch objects, Create	1