RCOEM

Shri Ramdeobaba College of
Engineering and Management, Nagpur

SHRI RAMDEOBABA COLLEGE OF ENGINEERING AND MANAGEMENT, NAGPUR – 440013

An Autonomous College affiliated to
Rashtrasant Tukadoji Maharaj Nagpur University,
Nagpur, Maharashtra (INDIA)

PROGRAMME SCHEME & SYLLABI
2023 – 2024

B. Tech. (BIOMEDICAL ENGINEERING)

Published By

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About the Department

Biomedical Engineering is the blend of engineering principles and medical procedures in order to create solutions for the healthcare. The aim of Biomedical Engineering programme is to provide educate students so as to bridge engineering with life sciences and represent the biomedical profession with distinction tools that helps the doctors in diagnosis and treatment of different medical conditions. Being a transdisciplinary field, it is behind some of the most important medical breakthroughs today, and has significantly contributed to improvement in quality of life.

The nature of the programme goes beyond the subject barriers and instils the faculty to train the students from both Engineering as well as Science aspects application to Biomedical Engineering. Students will be given an opportunity to explore different dimensions of learning in the field of Biomedical engineering through the blended and experiential learning mode and elevate their education as part of our engineering Honors / Minor Programme with additional certification.

Program Educational Objectives

1. To inculcate the knowledge and skills in designing, manufacturing, testing and instrumentation in the field Biomedical Engineering.
2. Exercise the acquired knowledge to provide economically feasible and socially acceptable solutions for healthcare problems

Program Outcomes

Engineering Graduates will be able to:

1. **Engineering knowledge :** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis :** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design /development of solutions :** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems :** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool usage :** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. **The Engineer and Society :** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability :** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics :** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and Team Work :** Function effectively as an individual, and as a member or leader in diverse teams, and in multi-disciplinarysettings.
10. **Communication :** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project Management and Finance :** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multi-disciplinary environments.
12. **Life-long Learning :** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes

PSO1: To apply concepts of Biomedical Engineering and Computing Technology to analyze Biomedical systems and signals.

PSO2: To design and develop indigenous medical solutions for healthcare and life sciences

Teaching Scheme for Bachelor of Technology
B. Tech. (Biomedical Engineering)
(Semester - I)

Sr. No.	Course Type	Course Code	Course Name	Hours/Week			Credits	Maximum marks			ESE Exam Duration (Hrs.)
				L	T	P		Continuous Assessment	End Sem Exam	Total	
1.	BSC	PHT1002	Physics of Materials	2	1	0	3	50	50	100	3Hrs
2.	BSC	PHP1002	Physics of Materials Lab	0	0	2	1	50	-	50	
3.	BSC	MAT1001	Applied Mathematics-I	2	1	0	3	50	50	100	3Hrs
4.	ESC	BMT1001	Fundamentals of Electrical & Electronics Engineering	3	0	0	3	50	50	100	3Hrs
5.	ESC	BMP1001	Fundamentals of Electrical & Electronics Engineering Lab	0	0	2	1	50	-	50	-
6.	ESC	BMT1002	Programming for problem solving	3	0	0	3	50	50	100	3Hrs
7.	ESC	BMP1002	Programming for problem solving Lab	0	0	2	1	50	-	50	-
8.	VSEC	BMP1003	Instrumentation- Maintenance and Repair Lab	0	0	2	1	50	-	50	-
9.	AEC	HUT1002	English for Professional Communication	2	0	0	2	50	50	100	2Hrs
10.	AEC	HUP1002	English for Professional Communication Lab	0	0	2	1	50	-	50	
11.	CCA	HUP0001-1 to HUP0001-10	Liberal/Performing Art	0	0	2	1	50	-	50	-
12.	VEC	HUT1004	Foundational Course in Universal Human Value	1	0	0	1	50	-	50	-
			TOTAL	**13**	**2**	**12**	**21**				

Teaching Scheme for Bachelor of Technology
B. Tech. (Biomedical Engineering)
(Semester - II)

Sr. No.	Course Type	Course Code	Course Name	Hours/Week			Credits	Maximum marks			ESE Exam Duration (Hrs.)
				L	T	P		Continuous Assessment	End Sem Exam	Total	
1.	BSC	CHT2005	Biochemistry	2	0	0	2	50	50	100	2 Hrs
2.	BSC	CHP2005	Biochemistry Lab	0	0	2	1	50	-	50	
3.	BSC	MAT2001	Applied Mathematics-II	2	1	0	3	50	50	100	3Hrs
4.	BSC	MAP2002	Computational Mathematics Lab	0	0	2	1	50	-	50	
5.	ESC	BMT2001	Digital Circuit Design	3	0	0	3	50	50	100	3Hrs
6.	ESC	BMP2001	Digital Circuit Design Lab	0	0	2	1	50	-	50	
7.	BSC	CHP2007	Bioinformatics Lab	0	0	2	1	50	-	50	
8.	ESC	BMT2002	Introduction to Digital Fabrication & 3D Printing	2	0	0	2	50	50	100	2 Hrs
9.	ESC	BMP2002	Introduction to Digital Fabrication & 3D Printing Lab	0	0	2	1	50	-	50	.
10.	VSEC	BMT2003	Computer Workshop	1	0	0	1	50	-	50	
11.	VSEC	BMP 2003	Computer Workshop Lab	0	0	2	1	50	-	50	
12.	IKS	HUT2001	Foundational Literature of Indian Civilization	2	0	0	2	50	50	100	2 Hrs
13	CCA	PET2001	Sports- Yoga-Recreation	1	0	0	1	50		50	
14.	CCA	PEP2001	Sports- Yoga-Recreation	0	0	2	1				
			TOTAL	**13**	**1**	**14**	**21**				

Exit Course Option for I year UG Certificate in Engineering/Tech.		
1	Medical Instruments- With Project	**8**
	OR	
2	Minimum two online course of 4 credits each	**8**

Teaching Scheme for Bachelor of Technology
B. Tech. (Biomedical Engineering)
(Semester - III)

Sr. No.	Course Type	Course Code	Course Name	Hours/Week			Credits	Maximum marks			ESE Exam Duration (Hrs.)
				L	T	P		Continuous Assessment	End Sem Exam	Total	
1.	PCC	BMT3001	Human Anatomy and Physiology for Engineers-I	3	0	0	3	50	50	100	3Hrs
2.	MDM	BMT3002	Legal and Ethical Practices of Biomedical Engineering	2	0	0	2	50	50	100	2Hrs
3.	PCC	BMT3003	Analog Devices and Circuits	3	0	0	3	50	50	100	3Hrs
4.	PCC	BMP3003	Analog Devices and Circuits Lab	0	0	2	1	50	-	50	
5.	PCC	BMT3004	Biomedical Sensors & Measurement Devices	3	0	0	3	50	50	100	3Hrs
6.	PCC	BMP3004	Biomedical Sensors & Measurement Devices Lab	0	0	2	1	50	-	50	
7.	OE	BMT2980	OE-1/MOOC Courses	3	1	0	4	50	50	100	3Hrs
8.	AEC	HUT3001	Business Communication	2	0	0	2	50	50	100	2Hrs
9.	VEC	HUT3004	Universal Human Values	1	0	0	1	50	-	50	
10.	CEP	BMP3005	Field Project-1	0	0	4	2	50	-	50	
			TOTAL	**17**	**1**	**6**	**22**				

(Semester - IV)

Sr. No.	Course Type	Course Code	Course Name	Hours/Week			Credits	Maximum marks			ESE Exam Duration (Hrs.)
				L	T	P		Continuous Assessment	End Sem Exam	Total	
1.	PCC	BMT4001	Human Anatomy Physiology for Engineers-II	3	0	0	3	50	50	100	3Hrs
2.	PCC	BMT4002	Microcontrollers and its application in Healthcare	3	0	0	3	50	50	100	3Hrs
3.	PCC	BMP400 2	Microcontrollers and its application in Healthcare Lab	0	0	2	1	50	-	50	
4.	PCC	BMT4003	Biomedical Signals and System	3	1	0	4	50	50	100	3Hrs
5.	VSEC	BMT4004	Medical Imaging	2	0	0	2	50	50	100	
6.	OE	BMT2990	OE-2/MOOC Courses	2	0	0	2	50	50	100	3Hrs
7.	MDM	BMT4005	Data Structure and Algorithms	1	0	0	1	50		50	
8.	MDM	BMP4005	Data Structure and Algorithms Lab	0	0	2	1	50	-	50	
9.	HSSM	BMT4006	Business Management & Entrepreneurship	2	0	0	2	50	50	100	2Hrs.
10.	VEC	CHT4001	Environmental Science	2	0	0	2	50	-	50	
11.	CEP	BMP4007	Field Project-2	0	0	4	2	50	-	50	
			TOTAL	**18**	**1**	**8**	**23**				

Exit Course Option for II year UG Diploma in Engineering/Tech.		
1	Design and Manufacturing of PCB- With Project	**8**
	OR	
2	Radiology Equipment (In Collaboration with Hospitals)/Online Courses	**8**

Teaching Scheme for Bachelor of Technology
B. Tech. (Biomedical Engineering)
(Semester - V)

Sr. No.	Course Type	Course Code	Course Name	Hours/Week			Credits	Maximum marks			ESE Exam Duration (Hrs.)
				L	T	P		Continuous Assessment	End Sem Exam	Total	
1.	PCC	BMT5001	Biomechanics	3	0	0	3	50	50	100	3 Hrs
2.	PCC	BMT5002	Biomaterials	3	0	0	3	50	50	100	3 Hrs
3.	MDM	BMT5003	Healthcare application design using FPGA	3	0	0	3	50	50	100	3 Hrs
4.	MDM	BMP5003	Healthcare application design using FPGA lab	0	0	2	1	50	-	50	
5.	PCC	BMT5004	Analytical & Diagnostic Equipment	3	0	0	3	50	50	100	3 Hrs
6.	PCC	BMP5004	Analytical & Diagnostic Equipment Lab	0	0	2	1	50	-	50	
7.	PEC	BMT5005	Program Elective-I	3	0	0	3	50	50	100	3 Hrs
8.	PEC	BMP5005	Program Elective-I Lab	0	0	2	1	50	-	50	
9.	OE	BMT3980	OE-3/MOOC Course	2	0	0	2	50	50	100	2 Hrs
10.	CEP	BMP5006	Project-I	0	0	4	2	50	50	100	
			TOTAL	**17**	**0**	**8**	**22**				

Program Elective – I with Lab

Course Code	Course Name	Course Code	Course Name
BMT5005-1	Biostatistics	BMP5005-1	Biostatistics Lab
BMT5005-2	Fundamentals of Bio-Sensors	BMP5005-2	Fundamentals of Bio-Sensors Lab
BMT5005-3	Control Systems	BMP5005-3	Control Systems Lab
BMT5005-4	Embedded Systems & IoT	BMP5005-4	Embedded System & IoT Lab

Teaching Scheme for Bachelor of Technology
B. Tech. (Biomedical Engineering)
(Semester - VI)

Sr. No.	Course Type	Course Code	Course Name	Hours/Week			Credits	Maximum marks			ESE Exam Duration (Hrs.)
				L	T	P		Continuous Assessment	End Sem Exam	Total	
1.	PCC	BMT6001	Biomedical Microsystems	3	0	0	3	50	50	100	3Hrs
2.	MDM	BMT6002	Biomedical Product and Prototype Design	2	0	0	2	50		50	
3.	PCC	BMT6003	Machine Learning for Healthcare	3	0	0	3	50	50	100	3Hrs
4.	PCC	BMP6003	Machine Learning for Healthcare Lab	0	0	2	1	50		50	
5.	PCC	BMT6004	Biomedical Image Processing	3	0	0	3	50	50	100	3Hrs
6.	PCC	BMP6004	Biomedical Image Processing Lab	0	0	2	1	50		50	
7.	PEC	BMT6005	Program Elective-II	3	0	0	3	50	50	100	3Hrs
8.	PEC	BMT6006	Program Elective-III	3	0	0	3	50	50	100	3Hrs
9.	VSEC	BMT6007	Soft skill Development	2	0	0	2	50		50	
10.	CEP	BMP6008	Project -II	0	0	4	2	50	50	100	
			TOTAL	19	**0**	**8**	**23**				

Exit Course Option for III year Bachelor Degree in B.Sc. (Eng./Tech)		
1	Internship in Centre for Microsystems	8
	OR	
2	Internship at Biomedical Dept. of Hospitals	8

Program Elective – II

Course Code	Course Name	Course Code	Course Name
BMT6005-1	Molecular Biology	BMT6005-3	Fundamentals of Robotics
BMT6005-2	Bionanotechnology	BMT6005-4	Object Oriented Programming

Program Elective – III

Course Code	Course Name	Course Code	Course Name
BMT6006-1	Advanced Bioinformatics	BMT6006-3	RTOS for Embedded System
BMT6006-2	Reliability of Medical Equipments	BMT6006-4	Telemedicine

Teaching Scheme for Bachelor of Technology
B. Tech. (Biomedical Engineering)
(Semester - VII)

Sr. No.	Course Type	Course Code	Course Name	Hours/Week			Credits	Maximum marks			ESE Exam Duration (Hrs.)
				L	T	P		Continuous Assessment	End Sem Exam	Total	
1.	PCC	BMT7001	Implants and Prostheses Design	3	0	0	3	50	50	100	3Hrs
2.	PCC	BMP7001	Implants and Prostheses Design Lab	0	0	2	1	50		50	
3.	PEC	BMT7002	Program Elective-IV	3	1	0	4	50	50	100	3Hrs
4.	PEC	BMT7003	Program Elective-V	3	1	0	4	50	50	100	3Hrs
5.	CEP	BMT7004	Research Methodology	3	1	0	4	50	50	100	3Hrs
6.	MDM	BMT7005	Hospital Engineering and Management	2	0	0	2	50	-	50	
7.	CEP	BMP7006	Project-III	0	0	4	2	50	50	100	
			TOTAL	**14**	**3**	**6**	**20**				

Program Specific Elective – IV		Program Specific Elective – V	
Course Code	**Course Name**	**Course Code**	**Course Name**
BMT7002-1	Programming in Bioinformatics	BMT7003-1	Tissue Engineering
BMT7002-2	Lab on chip Technologies	BMT7003-2	Biomedical Hazards and safety
BMT7002-3	Medical Robotics and Automation	BMT7003-3	Wearable Systems and Mobile Healthcare

(Semester - VIII)

Sr. No.	Course Type	Course Code	Course Name	Hours/Week			Credits	Maximum marks			ESE Exam Duration (Hrs.)
				L	T	P		Continuous Assessment	End Sem Exam	Total	
1.	PEC	BMT8001	Program Elective-VI	3	0	0	3	50	50	100	3 Hrs
2.	PEC	BMT8002	Program Elective-VII	3	0	0	3	50	50	100	3 Hrs
3.	MDM	BMT8003	Data Visualization in Healthcare	2	0	0	2	50	50	100	2 Hrs
4.	CEP	BMP8004	Major Project	0	0	8	4	50	50	100	
			OR								
5.	CEP	BMP8005	Internship/On-job Training/Research Internship	0	0	0	12	100		100	3Hrs
			TOTAL	**8**	**0**	**8**	**12**				

Program Elective – VI		Program Elective – VII	
Course Code	**Course Name**	**Course Code**	**Course Name**
BMT8001-1	Healthcare Data Analytics	BMT8002-1	AI for Healthcare
BMT8001-2	Rehabilitation Engineering	BMT8002-2	Computer Analysis of Biomedical Images
BMT8001-3	Bioinspired Robotics	BMT8002-3	Reliability of Medical Equipments

Teaching Scheme for Bachelor of Technology
B. Tech. (Biomedical Engineering)
(Honors Specialization)

Sr. No.	Sem.	Course Code	Course Name	Hours/Week			Credits	Maximum marks			ESE Exam Duration (Hrs.)
				L	T	P		Continuous Assessment	End Sem Exam	Total	
1.	III	BMTH3100	Biological Data and Databases	3	0	0	3	50	50	100	3Hrs
2.	IV	BMTH4100	Computational Biology and Bioinformatics	3	0	0	3	50	50	100	3Hrs
3.	V	BMTH5100	Programming in Bioinformatics	3	0	0	3	50	50	100	3Hrs
4.	VI	BMTH6100	Computer Aided Drug design and Chemoinformatics	3	0	0	3	50	50	100	3Hrs
5.	VII	BMPH7100	Minor Project (Honors and Multidisciplinary Minor)	6	0	0	6	50		50	
				18	**0**	**0**	**18**				
6.	VIII	BMPH 8100	Major Research Project for Honor with Research and Multidisciplinary Minor	12	0	0	12	100		100	
			TOTAL	**12**	**0**	**0**	**12**				

Teaching Scheme for Bachelor of Technology
B. Tech. (Biomedical Engineering)
(Minors Specialization)

Sr. No.	Sem.	Course Code	Course Name	Hours/Week			Credits	Maximum marks			ESE Exam Duration (Hrs.)
				L	T	P		Continuous Assessment	End Sem Exam	Total	
1.	III	BMTM3100	Cell Biology	3	0	0	3	50	50	100	3Hrs
2.	IV	BMTM4100	Structural Biology	3	0	0	3	50	50	100	3Hrs
3.	V	BMTM5100	Bioinformatics	3	0	0	3	50	50	100	3Hrs
4.	VI	BMTM6100	Computational Biology	3	0	0	3	50	50	100	3Hrs
5.	VII	BMPM7100	Minor Project	6	0	0	6	50	50	50	
			TOTAL	**18**	**0**	**0**	**18**				

Open Electives for Other Department Students

OE-I-BMT2980	OE-II BMT2990	OE-III BMT3980
Biomedical Systems (4 credit)	Bioinformatics (2 credit)	Computational Biology (2credit)

Syllabus for Semester I
B. Tech. (Biomedical Engineering)

Course Code : PHT1002 **Course : Physics of Materials**

L: 2 Hrs, T: 1 Hr., P: 0 Hrs Per Week **Total Credits : 3**

Course Outcomes

After successful completion of the course, the students will be able to:

1. Describe the electrical, thermal and optical properties of materials.

Syllabus

Module - 1

Electrical and thermal conduction in Solids Classical Theory of electrical conduction in Metals, Resistivity of Materials, Thermal conduction, Electrical conductivity in non-metals.

Module - 2 : Quantum Physics

Electron in Quantum Mechanics, Wave-particle duality, wave packets, Heisenberg uncertainty relations; Wave function, probability, phenomenon of tunnelling, application to tunnel diode.

Module - 3 : Laser and Optical Fibre

Interaction of matter and radiation, LASER, spontaneous and stimulated emission, population inversion; Common types of lasers and their applications; Optical fibre, structure, types, propagation in a fibre, modes of propagation, signal attenuation, signal distortion Applications of lasers and fibre in biomedical instrumentation.

Module - 4 : Semiconductors

Intrinsic and Extrinsic Semiconductors, Carrier concentrations, Drift and diffusion current density, mobility, Junction physics, Semiconductor diode, Zener diode, LED and bipolar junction transistor, Applications of these devices in bioelectric sensors

Module - 5 : Dielectric Materials and Insulation

Polarization and relative permittivity, Type of polarization, Dielectric loss, Dielectric strength and Insulation breakdown, Capacitor dielectric materials, Piezo-ferro and Pyroelectricity, Applications in Transducers.

Module - 6 : Magnetic Materials and Superconductivity

Magnetization vector, Permeability and Susceptibility, Magnetic materials, Ferromagnetism, Soft and hard magnetic materials,Ferro fluids for drug delivery, Superconductivity, Phenomenological theory of superconductivity, Superconducting magnets in Biomedical imaging.

Text Book

1. Principles of Electronic Materials and Devices, S. O. Kasap,3rd Edition McGraw Hill.

Reference Books

1. Electrical Engineering Materials, A. J. Dekker, Prentice Hall.
2. Introduction to Solid State Physics, Charles Kittle, John Wiley & Sons,Inc.
3. Semiconductor Nanocrystals and Metal Nanocrystals, Physical Properties and Device Applications, Eds. Tupei Chen, Yang Liu, CRC Press2017.
4. Clinical Applications of Magnetic Nanoparticles, Eds. Nguyên T. K. Thanh, CRC Press 2018.
5. How Does MRI work, Eds. D. Weishaupt, V. D. Kochli, B. Marincek, 2nd Edition, Springer 2006.

Syllabus for Semester I
B. Tech. (Biomedical Engineering)

Course Code : MAT1001 **Course : Applied Mathematics-I**

L: 3 Hrs, T: 0 Hr., P: 0 Hrs Per Week **Total Credits : 3**

Course Objective

The objective of this course is to familiarize the prospective engineers with techniques in Ordinary differential equation, statistics, probability and differential calculus.

It aims to equip the students to deal with advanced level of mathematics and applications that would be essential for their disciplines.

Course Outcomes

On successful completion of the course, the students will able to:

1. Recognize first order ordinary differential equations that can be solved by each of the four methods-Linear DE, exact DE, reducible to linear DE and reducible to exact differential equations and use the appropriate method to solve them.
2. Solve higher order ordinary differential equations with constant and variable coefficients.
3. Find best fit curve by method of least square method and calculate correlation, regressions.
4. Recognize and understand discrete, continuous probability distributions and apply Binomial distribution, Poisson distribution and Normal distribution to appropriate problems.
5. Internalize multivariable calculus and apply it find Jacobians, maxima and minima of function.
6. Solve numerical integrations by Newton coat formulas and Gauss-Legendre Quadrature.

Syllabus

Module - 1 : First order ordinary differential equations (7 hours)

Exact, linear and Bernoulli's equations, Euler's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type, Applications of First order Differential Equations.

Module - 2 : Ordinary differential equations of higher orders (8 hours)

Second order linear differential equations with constant and variable coefficients, method of variation of parameters, Cauchy-Euler equation. Applications of Higher order Differential Equations.

Module - 3 : Statistics (7 hours)

Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves, correlation and regression - Rank correlation, Multiple regression and correlation and its application in Engineering.

Module - 4 : Differential Calculus (10 hours)

Taylor's and Maclaurin's series expansions, radius of curvature (Cartesian form), evolutes and involutes, Limit and continuity of functions of several variables and their partial derivatives, Eulers Theorem, chain rule, total derivative, Jacobians, Maxima, minima and saddle points; Method of Lagrange multipliers.

Module - 5 : Probability (8 hours)

Probability spaces, conditional probability, independence, Bay's Theorem, Discrete random variables, Binomial distribution, Poisson distribution, Normal distribution. Relation between binomial, Poisson and Normal distributions.

Text Books / References

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, 9th Edition, Wiley India, 2009.
3. S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984.
4. E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India, 1995.
5. E. L. Ince, Ordinary Differential Equations, Dover Publications, 1958.

6.B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.

7. Theory and Problems of probability and statistics : 2nded :J. R. Spiegal ,Schaum series
8. A text book of Applied Mathematics Volume I & II, by P. N. Wartikar and J. N. Wartikar, Pune VidhyarthiGrihaPrakashan, Pune-411030 (India).
9. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.

Syllabus for Semester I
B. Tech. (Biomedical Engineering)

Course Code : BMT1001 **Course : Fundamentals of Electrical and Electronics Engineering**

L: 3 Hrs, T: 0 Hr., P: 0 Hrs Per Week **Total Credits : 3**

Course Outcomes

Upon the completion of this course, students will demonstrate the ability to:

1. Understand DC and AC operations.
2. Design different Electric and Magnetic circuits.
3. Develop applications employing appropriate electrical machines.
4. Apply knowledge of two terminal semiconductor devices like diodes to develop applications.

Syllabus

Unit - I

Introduction to DC and AC circuits, Active and passive two terminal elements, Ohms law, Voltage-Current relations for resistor, inductor, capacitor, Kirchhoff's laws, Mesh analysis, Nodal analysis, Voltage and current sources, equivalent resistor, current division, voltage division, Superposition theorem, Thevenin's and Norton's theorems, Star- delta and Delta- star conversions, Maximum Power Transfer Theorem.

Unit - II

Sinusoids, Generation of AC, Average and RMS values, Form and peak factors, concept of phasor representation, J operator, Analysis of R-L, R-C, R-L-C circuits, Introduction to three phase systems - types of connections, relationship between line and phase values.

Unit - III : Single Phase Transformer

Analogy Between electrical and magnetic circuits, solutions of magnetic circuits, Constructional details and Principle of transformer, EMF equation, Phasor diagram on no load and full load, Equivalent circuits, Open circuit and short circuit tests, regulation and efficiency, Hysteresis and eddycurrent losses.

Unit - IV : DC and AC Rotating Machines

Types, Construction, Principle, EMF and torque equation, Application Speed Control, Basics of Stepper Motor, Brushless DC motors, Servo Motors, Solenoid pump.

UNIT - V

PN diode operation- forward bias and reverse bias , Volt-Ampere characteristics of p-n diode, Temperature dependence of VI characteristics, Current components in p-n diode, Diode equation, Transition and Diffusion capacitances, Breakdown Mechanisms in Semiconductor diodes, Rectifiers: half wave and full wave, Wave shaping circuits

UNIT - VI

Zener diode characteristics and application, Tunnel Diode, LED, LDR, Varactor, Photo diode, PIN diode, Schottky diode, LASER, Applications.

Text Books

1. Basic Electrical and Electronics Engineering by S. K. Bhattacharya, Pearson Publications
2. Basic Electrical and Electronics Engineering by D. P. Kothari and I J Nagrath, TMH.

Reference Books

1. Basic Electrical Engineering by Fitzerald and Higginbotham, TMH.
2. Basic Electrical Engineering by I. J. Nagrath, TMH.
3. Millman's Integrated Electronics: Jacob Millman, Christos Halkias, Chetan Parikh, McGraw Hill.

Syllabus for Semester I
B. Tech. (Biomedical Engineering)

Course Code : BMP1001 **Course : Fundamentals of Electrical and Electronics Engineering Lab**

L: 0 Hrs, T: 0 Hr., P: 2 Hrs Per Week **Total Credits : 1**

Course Outcomes

Upon the completion of this course, students will demonstrate the ability to:

1. Understand DC and AC operations.
2. Design different Electric and Magnetic circuits.
3. Develop applications employing appropriate electrical machines.
4. Apply knowledge of two terminal semiconductor devices like diodes to develop applications.

List of Experiments

Practical are based on BMT1001 Syllabus

Syllabus for Semester I
B. Tech. (Biomedical Engineering)

Course Code : BMT1002 **Course : Programming for Problem Solving**

L: 3 Hrs, T: 0 Hr., P: 0 Hrs Per Week **Total Credits : 3**

Course Outcomes

On successful completion of course student will learn:

1. Formulate simple algorithms for arithmetic and logical problems, translate the algorithms to programs, test and execute the programs and correct syntax and logical errors.
2. Develop the fundamentals of C programming and choose the decision making and loops statements to solve and execute the given problem.
3. Implement different Operations on arrays also design functions to solve the given problem using C programming.
4. Use of pointers, structures and I/O operations for the formulation of algorithms and programs.

Unit - I : Introduction to Programming

Introduction to components of a computer system. Idea of algorithm: Steps to solve logical and numerical problems. Representation of algorithm: Flowchart / Pseudocode with examples. Arithmetic expressions and precedence

Unit - II : C Programming Language

Introduction to C language: Keywords, Constant, Variable, Data types, Operators, Types of Statements: Decision Control Statement-if, if-else, Nested if-else statement, Switch case, Loops statements, etc. Preprocessor Directives.

UNIT - III : Arrays and Functions

Arrays: 1-D, 2-D, Character arrays and Strings. Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection).

User defined and Library Functions, Parameter passing in functions, call by value, passing arrays to functions: idea of call by reference. Recursion.

Unit - IV : Pointers, Structures and File handling

Structures, Defining structures, Array of Structures, Introduction to pointers, Defining pointers, Pointer arithmetic, pointer operators, Use of Pointers.

Streams in C, Types of Files, File Input/ Output Operations: Modes of file opening, Reading and writing the file, closing the files.

Text Books

1. Programming in ANSI C: E. Balguruswami McGraw Hill
2. Mastering C: K. R. Venugopal and S. R. Prasad, Tata McGraw Hill

Reference Books

1. Programming with C: Byron Gottfried, Schaums Outline Series.
2. Let Us C: Yashwant Kanetkar, BPB Publication

Syllabus for Semester I
B. Tech. (Biomedical Engineering)

Course Code : BMP1002 **Course : Programming for Problem Solving Lab**

L: 0 Hrs, T: 0 Hr., P: 2 Hrs Per Week **Total Credits : 1**

Course Outcomes

Upon the completion of this course, students will demonstrate the ability to:

1. Identify and test different electronic components and Integrated Circuits.
2. read and interpret the data sheets
3. implement a circuit and its debugging
4. create an application-based circuit

Practicals Based on

1. Passive Components and their Testing
2. Testing of Semiconductor Devices
3. Introduction to electronic test and measurement equipment's (Multimeters, CRO, DSO, Function generator, power supply, etc.)
4. Understanding the data sheets of various components and Integrated circuits like 741, 555,74XX
5. Circuit implementation and testing on breadboard
6. Component mounting and soldering on PCB
7. Circuit design and debugging on bread board
8. Circuit simulation tools like multisim etc.
9. Case study on LED strips, Drivers, Chargers, fan regulators, power supplies, and interfacing with controller etc.
10. Mini project

Text Book

1. Troubleshooting Electronic Equipment : Includes Repair and Maintenance, Second Edition, Dr R. S. Khandpur

Syllabus for Semester I
B. Tech. (Biomedical Engineering)

Course Code : HUT1002 **Course : English for Professional Communication**

L: 2 Hrs, T: 0 Hr., P: 0 Hrs Per Week **Total Credits : 2**

Course Outcomes

On successful completion of the course the students will be able to achieve the following:

1. Demonstrate effective use of word power in written as well as oral communication.
2. Understand the techniques of listening and apply the techniques of reading comprehension used in professional communication.
3. Apply the principles of functional grammar in everyday as well as professional communication.
4. Effectively implement the comprehensive principles of written communication by applying various writing styles.
5. Create precise and accurate written communication products.

Syllabus

Module - 1 : Vocabulary Building

1.1 Importance of using appropriate vocabulary

1.2 Techniques of vocabulary development

1.3 Commonly used power verbs, power adjectives and power adverbs.

1.4 Synonyms, antonyms, phrases & idioms, one-word substitutions and standard abbreviations

Module - 2 : Listening and Reading Comprehension

2.1 Listening Comprehension: active listening, reasons for poor listening, traits of a good listener, and barriers to effective listening

2.2 Reading Comprehension: types and strategies.

Module - 3 : Functional Grammar and Usage

3.1 Identifying Common Errors in use of: articles, prepositions, modifiers, modal auxiliaries, redundancies, and clichés

3.2 Tenses

3.3 Subject-verb agreement, noun-pronoun agreement

3.4 Voice

Module - 4 : Writing Skills

4.1 Sentence Structures

4.2 Sentence Types

4.3 Paragraph Writing: Principles, Techniques, and Styles

Module - 5 : Writing Practices

5.1 Art of Condensation: Précis, Summary, and Note Making

5.2 Correspondence writing techniques and etiquettes – academic writing

5.3 Essay Writing

Reference Books

1. Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.
2. Practical English Usage. Michael Swan. OUP. 1995.
3. Remedial English Grammar. F.T. Wood. Macmillan.2007
4. On Writing Well. William Zinsser. Harper Resource Book. 2001
5. Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.
6. Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press

Syllabus for Semester I
B. Tech. (Biomedical Engineering)

Course Code : HUP1002 **Course : English for Professional Communication Lab**

L: 0 Hrs, T: 0 Hr., P: 2 Hrs Per Week **Total Credits : 1**

Course Outcomes

On completion of English Lab course, students will be able to achieve the following:

1. Apply effective listening and speaking skills in professional and everyday conversations.
2. Demonstrate the techniques of effective Presentation Skills
3. Evaluate and apply the effective strategies for Group Discussions
4. Analyse and apply the effective strategies for Personal Interviews
5. Implement essential language skills- listening, speaking, reading, and writing

Syllabus

List of practical

Computer Assisted + Activity Based Language Learning

Practical - 1 : Everyday Situations: Conversations and Dialogues - Speaking Skills

Practical - 2 : Pronunciation, Intonation, Stress, and Rhythm

Practical - 3 : Everyday Situations: Conversations and Dialogues - Listening Skills Activity Based Language Learning

Practical - 4 : Presentation Skills: Orientation & Mock Session Practical 5: Presentation Skills: Practice

Practical - 6 : Group Discussions: Orientation & Mock Session

Practical - 7 : Group Discussions: Practice

Practical - 8 : Personal Interviews: Orientation & Mock Session

Practical - 9 : Personal Interviews: Practice

Syllabus for Semester I
B. Tech. (Biomedical Engineering)

Course Code : CCA-02-HUP0001 to 10 **Course : Liberal / Performing Arts**

L: 0 Hrs, T: 0 Hr., P: 2 Hrs Per Week **Total Credits : 1**

Course Code	Course Name	Sem.	Hours/ week	Credits	Maximum marks
					Continuous Evaluation
CCA-02-HUP0001- 1	Fundamentals of Indian Classical Dance: Bharatnatayam	I/II	2	1	50
CCA-02-HUP0001- 2	Fundamentals of Indian Classical Dance: Kathak	I/II	2	1	50
CCA-02-HUP0001- 3	Introduction to Digital Photography	I/II	2	1	50
CCA-02-HUP0001- 4	Introduction to Japanese Language and Culture	I/II	2	1	50
CCA-02-HUP0001- 5	Art of Theatre	I/II	2	1	50
CCA-02-HUP0001- 6	Introduction to French Language	I/II	2	1	50
CCA-02-HUP0001- 7	Introduction to Spanish Language	I/II	2	1	50
CCA-02-HUP0001- 8	Art of Painting	I/II	2	1	50
CCA-02-HUP0001- 9	Art of Drawing	I/II	2	1	50
CCA-02-HUP0001- 10	Nature Camp	I/II	2	1	50

Syllabus for Semester I
B. Tech. (Biomedical Engineering)

Course Code : CCA-02-HUP0001-1 **Course : Fundamentals of Indian Classical Dance: Bharatnatayam**

L: 0 Hrs, T: 0 Hr., P: 2 Hrs Per Week **Total Credits : 1**

Course Outcomes

On completion of English Lab course, students will be able to achieve the following:

1. Understand the importance of dance and Bharatnataym as an Indian dance form.
2. Develop skills to perform the dance form at its basic level.
3. Evaluate their strengths and interest to take bridge course to give Pratham (1st level formal exam of Bharatnatayam)

Syllabus

Practical - 1 : Orientation in Bharatnatayam

Practical - 2 : Tattu Adavu till 8, NaattaAdavu 4 Steps, PakkaAdavu 1 step, Metta Adavu 1 Step, Kuditta Metta Adavu 4 Steps

Practical - 3 : Practice sessions

Practical - 4 : Tatta Kuditta Adavu (Metta), TattaKudittaAdavu (Metta) 2 Steps, TirmanamAdavu 3 Steps, KattuAdav - 3 Steps, KattuAdav - 3 Steps

Practical - 5 : Practice sessions

Practical - 6 : Tiramanam (front) 3 Steps, Repeat of Tiramanam (Overhead) 3 Steps.

Practical - 7 : Practice sessions

Practical - 8 : Final practice sessions and performances.

Recommended Reading

1. Introduction to Bharata's Natyasastra, Adya Rangacharya, 2011
2. The Natyasastra and the Body in Performance: Essays on the Ancient Text, edited by Sreenath Nair, 2015.
3. Bharatanatyam How to ... : A Step-by-step Approach to Learn the Classical Form, Eshwar Jayalakshmi, 2011.

Syllabus for Semester I
B. Tech. (Biomedical Engineering)

Course Code : CCA-02-HUP0001-2 **Course : Fundamentals of Indian Classical Dance: Kathak**

L: 0 Hrs, T: 0 Hr., P: 2 Hrs Per Week **Total Credits : 1**

Course Outcomes

On completion of the course, students will be able to achieve the following:

1. Understand the importance of dance and Kathak as an Indian dance form
2. Develop skills to perform the dance form at its basic level.
3. Evaluate their strengths and interest to take bridge course to give Prarambhik (1st level formal exam of Kathak).

Syllabus

Practical-1 : Orientation in Kathak. Correct posture of kathak, Basic Movements and exercise Stepping, Chakkar of 5 count(Bhramari),

Practical-2 : practice sessions of practical 1

Practical-3 : Hastaks, Hastaks and Steppings, Reciting asamyukta Mudra shloka, Hastak and steppings

Practical-4 : Practice sessions of practical 3

Practical-5 : Todas and Asamyukta hasta mudra shlok, Vandana of Shlok, 2 Todas and Vandana, Ghante Ki Tihai,

Practical-6 : practice sessions of practical 5

Practical-7 : Chakkardar Toda and Ginnti Ki Tihai, 2 Todas and 1 Chakkardar Toda, practice sessions

Practical-8 : Final performances.

Recommended Reading

1. Kathak Volume1 A "Theoretical & Practical Guide" (Kathak Dance Book), Marami Medhi & Debasish Talukdar, 2022, Anshika Publication (13 September 2022)

Syllabus for Semester I
B. Tech. (Biomedical Engineering)

Course Code : CCA-02-HUP0001-3 **Course : Introduction to Digital Photography**

L: 0 Hrs, T: 0 Hr., P: 2 Hrs Per Week **Total Credits : 1**

Course Outcome

At the end of the course the students will be able to achieve the following:

1. Develop an understanding of the technical aspects and aesthetics of Photography.
2. Apply the rules of digital photography for creating photographs.
3. Develop skills to enhance photographs through post processing.
4. Create a portfolio of their photographs in selected genre.

Syllabus

Practical - 1 : Orientation in digital photography: Genres, camera handling and settings.

Practical - 2 : Rules of Composition.

Practical - 3 : Rules of Composition: practice sessions.

Practical - 4 : Understanding Exposure and Art of Pre-Visualization.

Practical - 5 : Rules of Composition andArt of Pre-Visualization: practice sessions.

Practical - 6 : Post Processing Photographs and Portfolio creation.

Practical - 7 : Post Processing Photographs: practice sessions.

Practical - 8 : Portfolio finalization and presentation in selected genre.

Reference Material

1. Scott Kelby (2020) The Digital Photography Book: The Step-by-Step Secrets for how to Make Your Photos Look Like the Pros, Rocky Nook, USA
2. Larry Hall (2014) Digital Photography Guide: From Beginner to Intermediate: A Compilation of Important Information in Digital Photography, Speedy Publishing LLC, Newark
3. J Miotke (2010) Better Photo Basics: The Absolute Beginner's Guide to Taking Photos Like a Pro, AM PHOTO Books, Crown Publishing Group, USA

Syllabus for Semester I
B. Tech. (Biomedical Engineering)

Course Code : CCA-02-HUP0001-4 **Course : Introduction to Japanese Language and Culture**

L: 0 Hrs, T: 0 Hr., P: 2 Hrs Per Week **Total Credits : 1**

Course Outcome

1. Gain a brief understanding about Japan as a country and Japanese culture.
2. Develop ability to use vocabulary required for basic level communication in Japanese language.
3. Able to write and read the first script in Japanese language.
4. Able to frame simple sentences in Japanese in order to handle everyday conversations.
5. Able to write in basic Japanese about the topics closely related to the learner.

Syllabus

Practical - 1 : Orientation about Japan, its language, and its culture

Practical - 2 : Communication Skills 1: Vocabulary for basic Japanese language

Practical - 3 : Practice sessions

Practical - 4 : Writing Skills 1: Reading and writing first script in Japanese

Practical - 5 : Practice sessions

Practical - 6 : Communication Skills 2: framing sentences

Practical - 7 : Practice sessions

Practical - 8 : Writing Skills 2: Write basic Japanese and practice

Recommended Reading

1. Marugoto Starter (A1) Rikai - Course Book for Communicative Language Competences, by The Japan Foundation, Goyal Publishers & Distributors Pvt. Ltd (ISBN: 9788183078047)
2. Japanese Kana Script Practice Book - Vol. 1 Hiragana, by Ameya Patki, Daiichi Japanese Language Solutions (ISBN:9788194562900)

Syllabus for Semester I
B. Tech. (Biomedical Engineering)

Course Code : CCA-02-HUP0001-5 **Course : Art of Theatre**

L: 0 Hrs, T: 0 Hr., P: 2 Hrs Per Week **Total Credits : 1**

Course Outcome

On completion of the course, students will be able to achieve the following:

1. Understand and synthesize the working of the prominent genres of theatre across the world.
2. Apply the skill of voice and speech in theatre and public speaking
3. Apply the art of acting and also develop generic skills such as confidence, communication skills, self- responsibility, motivation, commitment, interpersonal skills, problem solving, and self-discipline.
4. Apply skills acquired related to technical/production aspects of theatre and also develop problem solving and interpersonal skills.

Syllabus

Practical - 1 : Orientation in theatre

Practical - 2 : Voice and Speech training

Practical - 3 : Voice and Speech training: practice sessions

Practical - 4 : Art of acting

Practical - 5 : Art of acting: practice sessions

Practical - 6 : Art of script writing

Practical - 7 : Art of script writing: practice sessions

Practical - 8 : Final performances

References

1. Boleslavsky, R. (2022). Acting: The First Six Lessons (1st ed., pp. 1-92). Delhi Open Books.
2. Shakthi, C. (2017). No Drama Just Theatre (1st ed., pp. 1-171). Partridge.
3. Bruder, M., Cohn, L. M., Olnek, M., Pollack, N., Previto, R., &Zigler, S. (1986). A Practical Handbook for the Actor (1st ed.).Vinatge Books New York.

Syllabus for Semester I
B. Tech. (Biomedical Engineering)

Course Code : CCA-02-HUP0001-6 **Course : Introduction to French Language**

L: 0 Hrs, T: 0 Hr., P: 2 Hrs Per Week **Total Credits : 1**

Course Outcomes

On successful completion of the course the students will be able to achieve the following:

1. Demonstrate basic knowledge about France, the culture and similarities/differences between India and France
2. Learn to use simple language structures in everyday communication.
3. Develop ability to write in basic French about themselves and others.
4. Develop ability to understand beginner level texts in French

Syllabus

List of Practicals

Practical - 1 : Orientation about France, the language, and culture

Practical - 2 : Communication Skills 1: Vocabulary building for everyday conversations

Practical - 3 : Practice sessions

Practical - 4 : Reading and writing Skills : Reading and writing simple text in French

Practical - 5 : Practice sessions

Practical - 6 : Communication Skills 2: listening comprehension

Practical - 7 : Practice sessions

Practical - 8 : Writing Skills: Write basic French and practice

Recommended Reading

1. 15-minute French by Caroline Lemoine
2. Cours de Langue et de Civilisation Françaises by G. Mauger Vol. 1.1
3. Cosmopolite I by Natalie Hirschsprung, Tony Tricot

Syllabus for Semester I
B. Tech. (Biomedical Engineering)

Course Code : CCA-02-HUP0001-7 **Course : Introduction to Spanish Language**

L: 0 Hrs, T: 0 Hr., P: 2 Hrs Per Week **Total Credits : 1**

Course Outcomes

On successful completion of the course the students will be able to achieve the following:

1. Demonstrate basic knowledge about Spain, the culture and similarities/differences between India and France
2. Learn to use simple language structures in everyday communication.
3. Develop ability to write in basic Spanish about themselves and others.
4. Develop ability to read and understand beginner level texts in Spanish

Syllabus

List of Practicals

Practical - 1 : Orientation about Spain, the language, and culture

Practical - 2 : Communication Skills 1: Vocabulary building for everyday conversations.

Practical - 3 : Practice sessions

Practical - 4 : Reading and writing Skills : Reading and writing simple text in Spanish.

Practical - 5 : Practice sessions

Practical - 6 : Communication Skills 2: listening comprehension.

Practical - 7 : Practice sessions

Practical - 8 : Writing Skills: Write basic Spanish and practice

Recommended Reading

1. 15-Minute Spanish by Ana Bremon
2. Aula Internacional 1 by Jaime Corpas ,Eva Garcia, Agustin Garmendia.
3. Chicos Chicas Libro del Alumno by María Ángeles Palomino

Syllabus for Semester I
B. Tech. (Biomedical Engineering)

Course Code : CCA-02-HUP0001-8 **Course : Art of Painting**

L: 0 Hrs, T: 0 Hr., P: 2 Hrs Per Week **Total Credits : 1**

Course Outcome

At the end of the course the students will be able to achieve the following:

1. Become familiar with the basic methods, techniques & tools of painting.
2. Train the eye and hand to develop sense of balance, proportion and rhythm.
3. Develop the ability to observe and render simple natural forms.
4. Enjoy the challenging and nuanced process of painting.

Syllabus

Practical - 1 : Orientation in Painting tools & basics of lines, shapes, light, shadows and textures.

Practical - 2 : The art of observation how to see shapes in drawing.

Practical - 3 : Introduction Water colorhow to handle water paints.

Practical - 4 : Introduction to acrylic colorshow to handle acrylic paints

Practical - 5 : Explore layering paint and capturing the quality of light with paint.

Practical - 6 : Create landscape painting

Practical - 7 : Create Abstract painting

Practical - 8 : Paint on Canvas (try to recreate any famous painting)

Reference Material

1. Drawing made easy by Navneet Gala; 2015th edition
2. Alla Prima II Everything I Know about Painting--And More by Richard Schmid with Katie Swatland.
3. Daily Painting: Paint Small and Often To Become a More Creative, Productive, and Successful Artist by Carol Marine.

Syllabus for Semester I
B. Tech. (Biomedical Engineering)

Course Code : CCA-02-HUP0001-9 **Course : Art of Drawing**

L: 0 Hrs, T: 0 Hr., P: 2 Hrs Per Week **Total Credits : 1**

Course Outcome

At the end of the course the students will be able to achieve the following:

1. Become familiar with the basic methods, techniques & tools of drawing.
2. Train the eye and hand to develop sense of balance, proportion and rhythm.
3. Develop the ability to observe and render simple natural forms.
4. Enjoy the challenging and nuanced process of drawing.

Syllabus

Practical - 1 : Orientation in Drawing tools & basics of lines, shapes, light, shadows and textures.

Practical - 2 : The art of observation how to see shapes in drawing.

Practical - 3 : One/two-point basic linear perspective.

Practical - 4 : Nature drawing and landscapes.

Practical - 5 : Gestalt principles of visual composition

Practical - 6 : Figure drawing: structure and proportions of human body.

Practical - 7 : Gesture drawing: expression and compositions of human figures.

Practical - 8 : Memory drawing: an exercise to combine the techniques learnt

Reference Material

1. Drawing made easy by Navneet Gala; 2015th edition.
2. Perspective Made Easy (Dover Art Instruction) by Ernest R. Norling.

Syllabus for Semester I
B. Tech. (Biomedical Engineering)

Course Code : CCA-02-HUP0001-10 **Course : Nature Camp**

L: 0 Hrs, T: 0 Hr., P: 2 Hrs Per Week **Total Credits : 1**

Course Objective

To create an opportunity for the students to develop affinity with nature and thus subsequently impact their ability to contribute towards sustainability of nature.

Course Outcome

After the completion of the course the students will be able to do the following:

CO1: Develop an affinity with nature by observing and understanding it marvels with guidance from experts

CO2: Develop an understanding of the challenges and solutions associated with nature and its conservation.

Course Content

In collaboration with the Forest Department and/or a local NGO working in the field of environment conservation, this course would be conducted in 24 hours. Students will be taken to a tiger reserve in Central Indian region or Forest fringe villages or work with an NGO from Central Indian region working on natural resource management. The camps (for 2 days) will cover any one of the following topics as decided by the course coordinator:

1. Awareness about each element of biodiversity (camps on moths, butterflies, birds, other wildlife etc).
2. Environment management (water, forest, wildlife) – practices of Forest Department in managing a tiger reserve, and other aspects of water and forest conservation.
3. Sustainable natural resource management - initiatives by rural communities and local NGOs.
4. Man-animal conflict and solutions (socio-economic and technical) – role of local communities and Forest Department.
5. Traditional practices in environment conservation – role of local communities and local NGOs.

Syllabus for Semester I
B. Tech. (Biomedical Engineering)

Course Code : HUT1004 / HUT2004 **Course : Foundation course in Universal Human Values**

L: 0 Hrs, T: 0 Hr., P: 2 Hrs Per Week **Total Credits : 1**

Course Objectives

- To help the student see the need for developing a holistic perspective of life
- To sensitize the student about the scope of life – individual, family (inter-personal relationship), society and nature/existence
- To strengthen self-reflection
- To develop more confidence and commitment to understand, learn and act accordingly

Course Outcome

On completion of course, students will be able to achieve the following:

CO1: Develop a holistic perspective of life.

CO2: Better understanding of inter-personal relationships and relationship with society and nature.

CO3: An ability to strengthen self-reflection.

Syllabus

Unit - 1 : Aspirations and concerns

Need for Value Education: Guidelines and content of value education.

Exploring our aspirations and concerns: Knowing yourself, Basic human aspirations Need for a holistic perspective, Role of UHV; Self-Management: harmony in human being

Unit - 2 : Health

Harmony of the Self and Body, Mental and physical health; Health for family, friends and society.

Unit - 3 : Relationships and Society

Harmony in relationships, Foundational values: Trust, Respect, Reverence for excellence, Gratitude and love; harmony in society; harmony with nature.

Reference Material

The primary resource material for teaching this course consists of

Text Book

1. R. R Gaur, R Sangal, G P Bagaria, A foundation course in Human Values and professional Ethics, Excel books, New Delhi, 2010, ISBN 978-8-174-46781-2

Reference Books

1. B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.
2. PL Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.
3. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991
4. Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and Harper Collins, USA
5. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, limits to Growth, Club of Rome's Report, Universe Books.
6. Subhas Palekar, 2000, How to practice Natural Farming, Pracheen (Vaidik) Krishi Tantra Shodh, Amravati.
7. A Nagraj, 1998, Jeevan Vidya ek Parichay, Divya Path Sansthan, Amarkantak.
8. E. F. Schumacher, 1973, Small is Beautiful: a study of economics as if people mattered, Blond & Briggs, Britain.
9. A. N. Tripathy, 2003, Human Values, New Age International Publishers.

Syllabus for Semester II
B. Tech. (Biomedical Engineering)

Course Code : CHT2005 **Course : Biochemistry**

L: 2 Hrs, T: 0 Hr., P: 0 Hrs Per Week **Total Credits : 2**

Course Outcomes

After the successful completion of the course, students will be able;

1. To comprehend the basic concepts of the quantitative analysis.
2. To apply the knowledge to understand the structure and function of biological molecules
3. Demonstrate and comprehend the principles of a wide range of biophysical and biochemical techniques.
4. To understand spectroscopic methods used for qualitative and quantitative analyses.

Syllabus

Module - 1 : Introduction to Biochemistry [8 Hours]

Introduction to Biochemistry, weak acid and bases, pH, buffers, physiological buffers in living systems, Hydrogen Bonding, Hydrophilic and Hydrophobic Interactions, van der Waals Interactions, Impurities in natural water, hardness and alkalinity,

Module - 2 : Introduction to Biomolecules [7 Hours]

Carbohydrates: Chemistry of few carbohydrates , Glycolysis and glycogenolysis, glycogensis, Amino Acid: Chemistry properties and metabolism.

Proteins: primary, Secondary, tertiary and quaternary structure, Isoenzymes.

Lipids: Chemistry, Metabolism of fatty acids, Phospholipids, Cholesterol regulation of metabolism. Nucleic Acid: Chemistry of DNA and RNA,

Enzymes: Classification and role in biological system, Michaelis- Menten equation. Vitamins: Structure and functions of some vitamins

Module - 3 : Fundamental Biochemical Concepts [7 Hours]

Basic concept in Techniques - Different methods of concentration calculations,

Purification techniques: Centrifugation, Filtration, Adsorption, Absorption, Sedimentation, Paper chromatography

Module - 4 : Material Characterization using different Spectroscopic Techniques [8 Hours]

Fundamentals of spectroscopy, concept of photochemical reaction, absorption, Beers Lamberts law, Infrared Spectroscopy, Electronic Spectroscopy, Nuclear Magnetic Resonance Spectroscopy, MRI.

Fundamentals of X-Ray Diffractions (XRD), X-Ray Fluorescence (XRF) spectroscopy.

Suggested Books

1. J. Michael Hollas, Modern Spectroscopy, Fourth Edition, John Wiley and Sons, 2004.
2. William Kemp, Organic Spectroscopy, Third Edition, Palgrave Publication, 1991.
3. S. S. Dara, A Textbook of Engineering Chemistry, S. Chand Publications.
4. P. C. Jain and Monica Jain, Engineering Chemistry, Dhanpat Rai Publication.
5. Y. Keith Wilson and J. Walkar, Principles and Techniques of Biochemistry and Molecular Biology, Seventh edition, Cambrige University Press, 2007.
6. Satyajit D. Sarker and Lutfun Nahar, Chemistry for Pharmacy Students General, Organic and Natural Product Chemistry, Wiley-Interscience and Sons Limited, 2007.
7. Thomas M. Devlin, Textbook of Biochemistry with Clinical Correlations, Fourth Edition, Wiley-LISS, 1977.
8. A. Upadhayay, K. Upadhayay, N. Nath, Biophysical Chemistry (Principles and Techniques), Himalaya Publishing House, 2009.
9. David L. Nelson and Michael M. Cox, Lehninger Principles of Biochemistry, Fifth Edition, W. H. Freeman and Company, New York, 2008.
10. Elsa Lundanes, Léon Reubsaet and Tyge Greibrokk, Chromatography Basic Principles, Sample Preparations and Related Methods, Wiley-VCH.
11. Natural Products -O.P. Agrawal Volume -1 & 2
12. Engineering Chemistry – B. K. Sharma

Syllabus for Semester II
B. Tech. (Biomedical Engineering)

Course Code : CHP2005 **Course : Biochemistry Lab**

L: 0 Hrs, T: 0 Hr., P: 2 Hrs Per Week **Total Credits : 1**

Course Outcomes

The chemistry laboratory course will consist of experiments illustrating the principles of chemistry relevant to the study of science and engineering.

The students will learn to:

1. Estimate the amount of different impurities in water/waste water/food samples.
2. Measure molecular/system properties such as surface tension, viscosity of aqueous or other industrially important liquids/mixtures etc.
3. Synthesize a polymer or drug molecule or nano-material.
4. Use principle of spectroscopic and chromatographic techniques.

List of Experiments: [Any Eight from the List]

1. Preparation of different Solutions: Molar solution, Normal solution and percent solution and Determination of concentration.
2. To find out types of alkalinity and estimation of their extent in the water sample.
3. Estimation of hardness present in the water sample by complexometric titration method using EDTA.
4. Determination of COD in waste water sample.
5. Determination of BOD/ dissolved oxygen in waste water sample.
6. To study effect of bondings of water molecules with electrolyte (NaCl/KCl) and non-electrolytesolute (Soap) in the solution through Surface Tension Determination.
7. Synthesis of Drug/Polymer and its study.
8. Separation of different organic compounds by paper chromatography.
9. Determination of Fe content in food sample.
10. Demonstrations of laminar flow equipment
11. Spectroscopic/Colorimetric determine of wavelength of maximum absorption of chemical/biological compound in solution and determination of concentration using Lambert-Beer's Law.
12. Demonstration of chromatographic techniques: Gas chromatography, HPLC
13. Demonstrations of organic spectral techniques: IR, NMR.

Suggested Books / Reference Books

1. S. S. Dara, A Textbook on Experiments and Calculations in Engineering Chemistry, S. Chand Publications.
2. J. B. Yadav, Advanced Practical Physical Chemistry, Krishna's Prakashan Media (P) Limited.
3. A. J. Elias, Collection of Interesting General Chemistry Experiments, Universities Press Publications.
4. V. K. Ahluwalia, S. Dhingra and A. Gulati, College Practical Chemistry, Universities Press Publications.
5. Ashutosh Kar, Advanced Practical Medicinal Chemistry, New Age International Publisher.

Syllabus for Semester II
B. Tech. (Biomedical Engineering)

Course Code : MAT2001 **Course : Applied Mathematics-II**

L: 2 Hrs, T: 1 Hr., P: 0 Hrs Per Week **Total Credits : 3**

Course Objective

The objective of this course is to familiarize the prospective engineers with techniques in Calculus and multivariate analysis. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

Course Outcomes

On successful completion of the course, the students will able to:

1. Interpret the solutions of system of linear equations and use the concepts of Eigen values, Eigen vectors to find diagonalization of matrices, reduction of quadratic form to canonical form.
2. Evaluate definite and improper integrals using Beta, Gamma functions. Also trace Cartesian curves.
3. Solve multiple integration by change of order, change of variable methods and apply it to find area, volume, mass and center of gravity.
4. Understand geometric meaning of gradient, curl, divergence
5. Perform line, surface and volume integrals of vector-valued functions.
6. Analyze and compare different sets of data and classify the data by means of diagrams and graph.

Syllabus

Module - 1: Matrices (8 hours)

Algebra of matrices, Inverse and rank of a matrix, rank-nullity theorem; System of linear equations; Symmetric, skew-symmetric and orthogonal matrices; Eigen values and eigenvectors; Diagonalization of matrices; Cayley- Hamilton Theorem, Orthogonal transformation and quadratic to canonical forms, Introduction to n-dimensional space.

Module - 2 : Integral Calculus (8hours)

Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Tracing of curves(Cartesian form)

Module - 3 : Multiple Integrals (10 hours)

Multiple Integration: Double and triple integrals (Cartesian and polar), change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: area, mass and volume by double integration, Center of mass and Gravity (basic concepts).

Module - 4: Vector Calculus (Differentiation)(7hours)

Scalar point function, Vector point function, vector differentiation, gradient, divergence and curl, directional derivatives with their physical interpretations, solenoidal and irrotational motions, Scalar potential function.

Module - 5 : Descriptive Statistics (7- Lectures)(Only for Bio-Medical Engineering)

Types of statistical data: categorical, ranked, discrete, and continuous. Distinction between univariate, bi-variate, and multivariate statistics, Visualization techniques such as joint contingency tables, scatter plots, 2D histograms and line graphs, Measures of central tendency and Dispersion.

Topics for self learning

Rolle's theorem, Mean value theorems, Indeterminate forms, Applications of definite integrals to evaluate perimeter, area, surface areas and volumes of revolutions.

Text Books / References

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
3. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
4. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
5. P. N. Wartikar and J. N. Wartikar, A text book of Applied Mathematics Volume I & II, Pune Vidhyarthi Griha Prakashan, Pune - 411030 (India).
6. Biomedical Statistics -Shantikumar Yadav , Sompal Singh, Ruchika Gupta.
7. Theory and Problems of Probability and Statistics - M. R. Spiegal (Mc Graw Hill) Schaum Series.

Syllabus for Semester II
B. Tech. (Biomedical Engineering)

Course Code : BMT2001 **Course : Digital Circuit Design**

L: 3 Hrs, T: 0 Hr., P: 0 Hrs Per Week **Total Credits : 3**

Course Outcomes

1. Understand fundamental of minimization and implementation of digital logic circuits using logic gates.
2. Design and analysis of combinational digital circuit.
3. Design and analysis of sequential digital circuit.
4. Understand fundamental of logic families, memory elements & programmable logic devices (FPGA) and implementation with programmable logic devices.
5. Model, Verify and Implement digital circuits with the aid of HDL & EDA tools.

Syllabus

Module -1 : Logic Simplification : Binary Arithmetic, Boolean Algebra and De Morgan's Theorem, SOP & POS forms, Logic Gates, combinational Logic Optimization Techniques.

Module - 2 : Combinational logic Design : Comparators, Multiplexers, Demultiplexer, Encoder, Decoder, Arithmetic Circuit Design, Barrel Shifter, ALU.

Module - 3 : Sequential Logic Design : Latches, Flip flop – S-R, JK, D, T and Master-Slave JK FF, counters, Shift registers, Finite state machines & their implementation with respect to biomedical application.

Module - 4 : Logic Families and Programmable Devices : Introduction to logic families, comparison and interfacing, Concept of PLDs like ROM, PAL, PLA, CPLDs, FPGA etc. Logic implementation using Programmable devices, Memories & their architecture.

Module - 5 : Overview of Digital Design with HDL : Different methodologies and its implementation process. Introduction to Verilog HDL for Digital Circuit implementation, language constructs

Module - 6 : Modeling Styles : Structural, sequential, behavioural constructs, test bench, synthesis of HDL.

Text Book

1. Fundamentals of Digital Logic with Verilog: Stephen Brown and Zvonko Vranesic, Mc Graw Hill,2nd Edition.

Reference Books

1. Fundamentals of digital circuits: A. Anand Kumar, Prentice-Hall of India, 4th Edition.
2. Modern digital Electronics: R.P. Jain, Tata McGraw Hill, 4 th Edition
3. Digital Electronic Principles: Malvino, PHI, 3rd Edition.
4. Verilog HDL: A Guide to Digital Design and Synthesis: Samir Palnitkar, Prentice Hall PTR, 2ndEdition.

Syllabus for Semester II
B. Tech. (Biomedical Engineering)

Course Code : CHP2007 **Course : Bioinformatics Lab**

L: 0 Hrs, T: 0 Hr., P: 2 Hrs Per Week **Total Credits : 1**

Course Outcomes

After the successful completion of the course, students shall be able

1. To understand the basics of chemical structure representation and molecular descriptors.
2. To familiarize students with chemical databases and their applications in bioinformatics.
3. To introduce computational methods used in bioinformatics, including molecular docking and/or QSAR (Quantitative Structure-Activity Relationship) analysis.
4. To provide hands-on experience with software tools commonly used in bioinformatics.
5. To develop skills in data analysis and interpretation for chemical data.

Module - 1 : Protein sequence analysis

Introduction of various bio-important structures, scope and applications of Computational biology, Molecular modeling.

Hands on Tutorials for the uses of soft-wares/programming for DNA and Protein sequence Analysis, Molecular modelling, etc.

Module - 2 : Molecular Docking

Future of computational modelling and prediction systems in molecular docking. Brief introduction about interactions of drugs with binding sites in human body cell.

Hand On Tutorials for the uses of software /programming for bio-informatics databases search, predictions of affinity, modelling, BLAST programs etc.

Text Books

1. Xinkun Wang, "Next-Generation Sequencing Data Analysis", CRC Press, 2016, ISBN 978148-2217896
2. Tamar Schlick, "Molecular Modelling and Simulation: An interdisciplinary discipline", Springer, 2nd edition, 2010, ISBN 9781441963505
3. Darren Flower, Jon Timmis, "In Silico Immunology", Springer Link, 2007, ISBN: 978-0- 387-39238.

Syllabus for Semester II
B. Tech. (Biomedical Engineering)

Course Code : BMT2002 **Course : Introduction to Digital Fabrication & 3D Printing**

L: 2 Hrs, T: 0 Hr., P: 0 Hrs Per Week **Total Credits : 2**

Course Objectives

The students will develop their skills in CAD Modelling, Exporting CAD Data to prototyping, Meshing and Postprocessing of RP Models

Course Outcomes

On successful completion of the course, the students will be able to:

1. Understand the significance of CAD CAM technologies in a reducing time to market for any product
2. Analyse and select different prototyping methods used for conversion of CAD data to physical model
3. Analyse and select the different materials and process for digital fabrication in various real-life application
4. Analyse and apply the technique of CAD and Reverse Engineering for Geometry Transformation in Additive Manufacturing

Syllabus

Module - 1 : Introduction to CAD and Concept Design

Introduction to Views, Concept of Projections, Design Process, Typical Design Cycle, Role of CAD and Modified Design Cycle, Introduction to CAD, Boundary Representation of Objects, CAD Geometry Representations, Geometric Transformations, 3D Modelling Software pre-requisites, working architecture.

Module - 2 : 3D printing Fundamentals

Need for time compression in product development, Need for Digital Fabrication Technologies. Historical Development of Prototyping methodologies, Advantages and Limitations, Classifications of Terminologies related to Digital Fabrication, Advantages and Limitations, Fundamental Automated Processes: Distinction between AM and CNC, other related technologies.

Module - 3 : Introduction to Solid, Liquid and Powder Based Process

Classification of different Prototyping based methods, Mechanisms, working, advantages, Limitations, Case Studies of Different Prototyping Process, Customized Implants and Prosthesis using Digital Fabrication- Introduction and Case Studies.

Module - 4 : Reverse Engineering and Digital Fabrication

Reverse Engineering Philosophy, Point Cloud Extraction, File Formats like STL, IGES etc, Re-engineering for Digital Representation, STL Format, STL File Problems, Features of various AM software's like Magics, Mimics, Solid View, View Expert, 3 D View, Velocity 2, Rhino, STL View 3 Data Expert and 3 D doctor, Surgi Guide, 3-matic, Simplant, Mesh Lab.

Text Books

1. Chua C. K., Leong K. F. and LIM C. S. Rapid prototyping: Principles and Applications -, World Scientific publications, Third Edition, 2010.
2. CAD-CAM CAE Theory and Practice- Ibrahim Zaid

Reference Books

1. Liou L. W. and Liou F. W., "Rapid Prototyping and Engineering applications: A tool box for prototype development", CRC Press, 2007
2. Kamrani A. K. and Nasr E. A., "Rapid Prototyping: Theory and practice", Springer, 2006
3. Mahamood R. M., Laser Metal Deposition Process of Metals, Alloys, and Composite Materials,
4. Engineering Materials and Processes, Springer International Publishing AG 2018
5. Ehsan Toyserkani, Amir Khajepour, Stephen F. Corbin, "Laser Cladding", CRC Press, 2004

Syllabus for Semester II
B. Tech. (Biomedical Engineering)

Course Code : BMP2002 **Course : Introduction to Digital Fabrication & 3D Printing Lab**

L: 0 Hrs, T: 0 Hr., P: 2 Hrs Per Week **Total Credits : 1**

Course Objectives

The students will develop their hands-on skills in 3D modelling, Point Cloud Exporting to CAD, STL File Generation, Pre and Post Processing of STL Files

Course Outcomes

1. On successful completion of the course, the students will be able to
2. Demonstrate Proficiency in reading of drawings and interpreting the data from the drawing
3. Demonstrate proficiency in 3D modelling using any CAD software
4. Demonstrate ability to scan any physical 3D object and export the point cloud in CAD
5. Demonstrate ability to convert the 3D model into STL file and carry out pre-processing and post processing of STL file using any CAD software

Experiments on following Topics

1. Create orthographic representation and isometric representation of 3D objects and read and interpret data from them
2. Working on CAD software to draw primary shapes and create 3D drawings using different commands
3. Assembling Creative Designs in CAD Software
4. Simulation Processing the CAD data (Selection of Orientation, supports generation, Slicing, Tool path generation)
5. Working on reverse engineering machine, for point scanning and point plotting from physical product to CAD environment
6. Understand the conversion of point cloud from physical product to CAD for any given product
7. Convert the complete CAD model into STL file format with pre and post processing.
8. Converting CT/MRI scan data into STL file using 3D Doctor Software (Demo)

Syllabus for Semester II
B. Tech. (Biomedical Engineering)

Course Code : BMT2003 **Course : Computer Workshop**

L: 1 Hrs, T: 0 Hr., P: 0 Hrs Per Week **Total Credits : 1**

Course Objectives

The students will develop their skills in Data Pre-processing, Visualization and Analysis using Microsoft Excel, and Tableau.

Course Outcomes

On successful completion of the course, the students will:

1. Understand advanced Excel features for data visualization
2. Connect Tableau to multiple data sources, process and transform data to prepare it for reporting and visualization
3. Draw insights from data dashboards and visualizations that allows understanding and help a business make critical decisions

Syllabus

Unit - I : Introduction to data visualization

Different data visualization tools, Microsoft Excel functions, Add Ins. for data tools, Data Analysis Tab in Excel. Pivot Tables, Recording Macros. GUI of Microsoft Excel for better visualizations.

Unit - II : Introduction to Tableau

GUI of Tableau, Features of Tableau, building blocks of Tableau, connecting to data sources, getting data from excel files, using Tableau desktop.

Text Books

1. Communicating Data with Tableau by Ben Jones, Copyright © 2014 Ben Jones. All rights reserved. Printed in the United States of America. Published by O'Reilly Media, Inc., 1005 Gravenstein Highway North, Sebastopol, CA 95472.

Syllabus for Semester II
B. Tech. (Biomedical Engineering)

Course Code : BMP2003 **Course : Computer Workshop Lab**

L: 0 Hrs, T: 0 Hr., P: 2 Hrs Per Week **Total Credits : 1**

Course Objectives

The students will develop their hands-on skills in Data Pre-processing, Visualization and Analysis using Microsoft Excel and Tableau.

Course Outcomes

On successful completion of the course, the students will:

1. Execute advanced Excel features for data visualization.
2. Make reports for visualization.
3. Create data dashboards and visualizations for critical decisions in business.

Experiments on following Topics

1. Microsoft Excel functions, Add Ins. for data tools.
2. Data Analysis Tab in Excel.
3. Pivot Tables.
4. Recording Macros.
5. GUI of Microsoft Excel for better visualizations.
6. Tableau Desktop UI & Connecting to Data.
7. Making Visualizations.

Syllabus for Semester II
B. Tech. (Biomedical Engineering)

Course Code : HUT2001 **Course : Foundational Literature of Indian Civilization**

L: 2 Hrs, T: 0 Hr., P: 0 Hrs Per Week **Total Credits : 2**

Course Outcome

At the end of the course the students will be able to achieve the following:

1. Understand the Indian knowledge system and its scientific approach
2. Get introduced to the Vedic corpus and recognize the multi-faceted nature of the knowledge contained in the Vedic corpus
3. Understand the salient features of the philosophical systems of the Vedic and non-Vedic schools
4. Develop a basic understanding of the ancient wisdom recorded in various Indian literary work

Syllabus

Module - 1 : Overview of Indian Knowledge System

Importance of ancient knowledge, defining IKS, IKS classification framework, Historicity of IKS, Some unique aspects of IKS.

Module - 2 : The Vedic Corpus

Introduction of Vedas, four Vedas, divisions of four Vedas, six Vedangas, Distinct features of Vedic life.

Module - 3 : Indian Philosophical Systems

Development and unique features,Vedic schools of philosophy, Samkhya and Yoga School of philosophy, Nayay and Vaisesika school of philosophy, Purva-mimamsa and Vedanta schools of Philosophy, Non-vedic philosophies: Jainism, Buddhism, and other approaches

Module - 4 : Indian wisdom through ages

Panchtantras, Purans: contents and issues of interests, Itihasa: uniqueness of the two epics (Ramayan and Mahabharata), Key issues and messages from Ramayana, Mahabharata – a source of worldly wisdom; Indian ancient Sanskrit literature: Kalidas, Vishakadutta, Bhavbhuti, Shudraka*

*any one text as decided by the course teacher

Reference Material

1. B. Mahadevan, Vinayak Rajat Bhar, Nagendra Pavana R. N., "Introduction to Indian Knowledge System: Concepts and Applications" PHI, 2022
2. S.C. Chatterjee and D.M. Datta, An introduction to Indian Philosophy, University of Calcutta, 1984

Syllabus for Semester II
B. Tech. (Biomedical Engineering)

Course Code : PET/PEP1001 **Course : Sports : Yoga - Recreation**

L: 1 Hrs, T: 0 Hr., P: 2 Hrs Per Week **Total Credits : 2**

Aim of the Course

The course aims at creating awareness about the fundamentals of Physical Education, Sports, Yoga, Recreation and its effectiveness to promote Health and wellness through Healthy Lifestyle.

Course Objectives

To impart the students with basic concepts of Sports, Yoga and Recreational activities for health and wellness. To familiarize the students with health-related Exercise and evaluate their Health-related Fitness.

To make Overall growth & development with team spirit, social values and leadership qualities among students through various sports, games and Yogic activities.

To create Environment for better interaction and recreation among students as neutralizer for stress through various minor and recreational games.

Course Outcomes

On completion of the course, students will be able to:

Understand fundamental skills, basic principle and practices of sports and Yoga.

Practically learn the principles of implementing general and specific conditioning of physical exercises and yoga. Develop Health-related fitness and Body-mind co-ordination through various fitness activities, sports, recreational games and yoga.

Practice Healthy & active living with reducing Sedentary Life style.

Course Content

Module - 1 : Theory : Introduction

Meaning, Definition and Importance of Health & Wellness Dimensions of Health and Wellness Factors influencing Health and Wellness Physical Fitness, Nutrition, Habits, Age, Gender, Lifestyle, Body Types Health & Wellness through Physical Activities, Sports, Games, Yoga and Recreation activities Causes of Stress & Stress relief through Exercise and Yoga Safety in Sports

Module - 2 : Practical- Exercises for Health and Wellness

Warm-Up and Cool Down - General & Specific Exercises, Physical Fitness Activities

Stretching Exercises, General & Specific Exercises for Strength, Speed, Agility, Flexibility, coordinative abilities, Cardiovascular Exercises, Assessment of BMI, Relaxation techniques, Physical Efficiency Tests

Module - 3 : Yoga

Shukshma Vyayam, Suryanamaskar, Basic Set of Yogasanas – Sitting, standing, supine and prone position, Basic Set of Pranayama & Meditation

References

1. Russell, R.P. (1994). Health and Fitness Through Physical Education. USA: Human Kinetics.
2. Uppal, A.K. (1992). Physical Fitness. New Delhi: Friends Publication.
3. AAPHERD "Health related Physical Fitness Test Manual."1980 Published by Association drive Reston Virginia
4. Kumar, Ajith. (1984) Yoga Pravesha. Bengaluru: Rashtrothanna Prakashana.
5. Dr. Devinder K. Kansal, A Textbook of Test Evaluation, Accreditation, Measurements and Standards (TEAMS 'Science)