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
2020 – 2021

B. E. (BIOMEDICAL ENGINEERING)

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About the Programme

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.

Programme Educational Objectives (PEOs)

1. To produce graduates exhibiting a foundation of mathematics, science, and engineering fundamentals expertise at the interface of engineering and life sciences to solve biomedical engineering problems.
2. To produce capable graduates utilizing engineering experience in creating innovative solutions or enabling technologies for improvement of human health and health care.
3. To encourage the graduates to demonstrate the use of their multidisciplinary background to foster communication across professional and disciplinary boundaries with the highest professional and ethical standards.
4. To imbibe in the graduates an attitude for life-long learning to excel in professional career / higher studies

Programme Outcomes

Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

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.

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.

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.

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.

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.

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.

Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

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.

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 multidisciplinary environments.

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.

Key Features of the Curriculum

1. Choice based credit system
2. Open Electives for interdisciplinary learning & employment benefits
3. Credit transfer through MOOCs so as to enable students to learn at their own pace of interest.
4. Scope for earning additional credits through Majors and Minor certification
5. One semester industry internship

Through this program , 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. The curriculum of this new course is designed around 3 verticals- **Biomaterials, Bioinstrumentation and Medical Imaging.** They rest on a single horizontal - core training in physiology, anatomy, systems science, mathematics, circuits, instrumentation, mechanics, and algorithms.

Scheme of Teaching & Examination of Bachelor of Engineering (Biomedical Engineering)

Semester I

Sr. No.	Course code	Course Name	Hours/week			Credits	Maximum marks			ESE Duration (Hrs)
			L	T	P		Conti-nuous Evaluation	End Sem Exam	Total	
1.	MAT152	Differential Equations, Linear Algebra, Statistics & Probability	3	0	0	3	40	60	100	3Hrs
2.	MAP151	Computational Mathematics Lab	0	0	2	1	25	25	50	3Hrs
3.	PHT155	Physics of Materials	3	1	0	4	40	60	100	
4.	PHP155	Physics of Materials Lab	0	0	3	1.5	25	25	50	3Hrs
5.	BMT101	Fundamentals of Electrical & Electronics Engineering	3	0	0	3	40	60	100	
6.	BMP101	Fundamentals of Electrical & Electronics Engineering Lab	0	0	2	1	25	25	50	3Hrs
7.	MET151	Engineering Graphics and Design	1	0	0	1	40	60	100	
8.	MEP151	Engineering Graphics and Design Lab	0	0	4	2	50	50	100	
9.	HUT152	Constitution of India	2	0	0	0				
10.	PEP151	Yoga /sports	0	0	2	0				
		TOTAL	**12**	**1**	**13**	**16.5**				

Scheme of Teaching & Examination of Bachelor of Engineering (Biomedical Engineering)

Semester II

Sr. No.	Course code	Course Name	Hours/week			Credits	Maximum marks			ESE Duration (Hrs)
			L	T	P		Conti-nuous Evaluation	End Sem Exam	Total	
1.	MAT151	Calculus	3	1	0	4	40	60	100	3Hrs
2.	CST151	Programming for Problem solving	4	0	0	4	40	60	100	3Hrs
3.	CSP151	Programming for Problem solving Lab	0	0	2	1	25	25	50	
4.	CHT153	Biochemistry	3	1	0	4	40	60	100	3Hrs
5.	CHP153	Biochemistry Lab	0	0	3	1.5	25	25	50	
6.	BMT102	Human Anatomy and Physiology for Engineers-I	3	0	0	3	40	60	100	3Hrs
7.	IDT151	Creativity, Innovation and Design thinking	1	0	0	1	20	30	50	1.5 Hrs.
8.	HUT151	English	2	0	0	2	40	60	100	3Hrs
9.	HUP151	English lab	0	0	2	1	25	25	50	
		TOTAL	**16**	**2**	**7**	**21.5**				

Scheme of Teaching & Examination of Bachelor of Engineering (Biomedical Engineering)

Semester III

Sr. No.	Course code	Course Name	Hours/week			Credits	Maximum marks			ESE Duration (Hrs)
			L	T	P		Continuous Evaluation	End Sem Exam	Total	
1.	BMT201	Human Anatomy and Physiology for Engineers-II	3	0	0	3	40	60	100	3 Hrs
2.	BMT202	Digital Circuit Design	3	0	0	3	40	60	100	3 Hrs.
3.	BMP202	Digital Circuit Design Lab	0	0	2	1	25	25	50	
4.	MAT274	Random Variables & Partial differential equations	2	1	0	3	40	60	100	3 Hrs
5.	BMT203	Signals and Systems	3	1	0	4	40	60	100	
6.	BMT204	Data Structures and Algorithm	2	0	0	2	40	60	100	3 Hrs
7.	BMP204	Data Structures and Algorithm Lab	0	0	2	1	25	25	50	
8.	BMT205	Electronics Devices and Circuits	3	0	0	3	40	60	100	3 Hrs
9.	BMP205	Electronics Devices and Circuits lab	0	0	2	1	25	25	50	
		TOTAL	**16**	**2**	**6**	**21**				

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Semester IV

Sr. No.	Course code	Course Name	Hours/week			Credits	Maximum marks			ESE Duration (Hrs)
			L	T	P		Continuous Evaluation	End Sem Exam	Total	
1.	BMT206	Network analysis and Synthesis	3	0	0	3	40	60	100	3Hrs
2.	BMT207	Digital Signal Processing	3	0	0	3	40	60	100	3Hrs.
3.	BMP207	Digital Signal Processing Lab	0	0	2	1	25	25	50	
4.	BMT208	Microprocessor and Microcontroller	3	0	0	3	40	60	100	3Hrs
5.	BMP208	Microprocessor and microcontroller Lab	0	0	2	1	25	25	50	
6.	BMT209	Analog Circuits	3	1	0	4	40	60	100	3Hrs
7.	BMP209	Analog Circuits Lab	0	0	2	1	25	25	50	
8.	BMP210	Project-I	0	0	2	1	25	25	50	
9.	BMT211	Open elective - I / MOOC's	3	0	0	3	40	60	100	3 Hrs.
10.	CHT252	Environmental Sciences	2	0	0	0				
		TOTAL	**17**	**1**	**8**	**20**				

Scheme of Teaching & Examination of Bachelor of Engineering (Biomedical Engineering)

Semester V

Sr. No.	Course code	Course Name	Hours/week			Credits	Maximum marks			ESE Duration (Hrs)
			L	T	P		Conti-nuous Evaluation	End Sem Exam	Total	
1.	BMT301	Programme Elective -I	3	0	0	3	40	60	100	3 Hrs
2.	BMP301	Programme Elective - I Lab	0	0	2	1	25	25	50	
3.	BMT302	Biomaterials	3	0	0	3	40	60	100	3 Hrs
4.	BMT303	FPGA Design for Healthcare applications	3	1	0	4	40	60	100	3 Hrs
5.	BMP303	FPGA Design for Healthcare applications lab	0	0	2	1	25	25	50	
6.	BMT304	Biomedical Sensors and Measurement Devices	3	0	0	3	40	60	100	3 Hrs
7.	BMP304	Biomedical Sensors and Measurement Devices Lab	0	0	2	1	25	25	50	
8.	BMT305	Open Elective - II / MOOC's	3	0	0	3	40	60	100	3 Hrs
9.	MBT391-1	Business Management and Entrepreneurship	3	0	0	3	40	60	100	3 Hrs
10.	HUT351	Professional Skill Development	2	0	0	0				
		TOTAL	**20**	**1**	**6**	**22**				

Sr. No.	Course Code	Program Elective –I
1	BMT301-1	Biomedical Microsystems
2	BMT301-2	Medical Robotics & Automation
3	BMT301-3	Biostatistics

Scheme of Teaching & Examination of Bachelor of Engineering (Biomedical Engineering)

Semester VI

Sr. No.	Course code	Course Name	Hours/week			Credits	Maximum marks			ESE Duration (Hrs)
			L	T	P		Conti-nuous Evaluation	End Sem Exam	Total	
1.	BMT306	Programme Elective -II	3	0	0	3	40	60	100	3Hrs
2.	BMP306	Programme Elective - II Lab	0	0	2	1	25	25	50	
3.	BMT307	Medical Imaging	3	0	0	3	40	60	100	3Hrs
4.	BMT308	Machine Learning	3	0	0	3	40	60	100	3Hrs
5.	BMP308	Machine Learning Lab	0	0	2	1	25	25	50	
6.	BMT309	Biocontrol Systems	3	0	0	3	40	60	100	3Hrs
7.	BMT310	Biomechanics	3	0	0	3	40	60	100	3Hrs
8.	BMP311	Project -II	0	0	2	1	25	25	50	
9.	BMT312	Open Elective - III / MOOC's	3	0	0	3	40	60	100	3Hrs
10.	BMP 313	Comprehensive Viva	0	0	2	1	50		50	
		TOTAL	**18**	**0**	**8**	**22**				

Sr. No.	Course Code	Program Elective –II
1	BMT306-1	Bioinformatics
2	BMT306-2	Biomedical Image Processing
3	BMT306-3	Advanced Bio-Materials

Scheme of Teaching & Examination of Bachelor of Engineering (Biomedical Engineering)

Semester VII

Sr. No.	Course code	Course Name	Hours/week			Credits	Maximum marks			ESE Duration (Hrs)
			L	T	P		Conti-nuous Evaluation	End Sem Exam	Total	
1.	BMT401	Programme Elective -III	3	0	0	3	40	60	100	3Hrs
2.	BMT402	Programme Elective -IV	3	0	0	3	40	60	100	3Hrs
3.	BMT403	Analytical & Diagnostic Equipments	3	0	0	3	40	60	100	3Hrs
4.	BMP404	Medical Equipments Lab	0	0	2	1	25	25	50	
5.	BMT405	Design and Manufacturing of Implants and prostheses	3	0	0	3	40	60	100	3Hrs
6.	BMP405	Design and Manufacturing of Implants and prostheses lab	0	0	2	1	25	25	50	
7.	BMT406	Open Elective-IV (Industry Module) / MOOC's	3	0	0	3	50		50	3Hrs
8.	BMP407	Industry Internship Evaluation (6-8 weeks)	0	0	2	0	50		50	
9.	BMT408	Biomedical Engineering: Legal & Ethical Perspective	2	0	0	0				
10.	BMP409	Project - III	0	0	10	5	50		50	
		TOTAL	**17**	**0**	**16**	**22**				

Sr. No.	Course Code	Program Elective –III	Sr. No.	Course Code	Program Elective –IV
1	BMT401-1	Physiological Modeling and Simulation	1	BMT402-1	Introduction to Telemedicine
2	BMT401-2	Advanced Bio-Mechanics	2	BMT402-2	Hospital Engineering and Management
3	BMT401-3	Bio-Nanotechnology	3	BMT402-3	Bio-Fabrication Technology

Scheme of Teaching & Examination of Bachelor of Engineering (Biomedical Engineering)

Semester VIII

Sr. No.	Course code	Course Name	Hours/week			Credits	Maximum marks			ESE Duration (Hrs)
			L	T	P		Conti-nuous Evaluation	End Sem Exam	Total	
1.	BMT410	Program Elective -V	3	0	0	3	40	60	100	3 Hrs.
2.	BMT411	Program Elective -VI	3	0	0	3	40	60	100	3 Hrs
3.	BMP412	Project –IV	0	0	18	9	50	50	100	
		OR								
4.	BMP413	Internship / Incubation (six months)				15				
		TOTAL	**6**	**0**	**18**	**15**				

Sr. No.	Course Code	Program Elective – V
1	BMT410-1	Acoustics and optical Imaging
2	BMT410-2	Body Area Networks and Mobile Healthcare
3	BMT410-3	Molecular Biology and Genetics

Sr. No.	Course Code	Program Elective – VI
1	BMT411-1	Biomedical Hazards & Safety
2	BMT411-2	Rehabilitation Engineering
3	BMT411-3	Tissue Engineering

Syllabus for Semester BE I
(Biomedical Engineering)

Course Code : MAT152 **Course : Differential Equation, Linear Algebra, Statistics & Probability**

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 Matrices. 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 learn:

1. The effective mathematical tools for the solutions of ordinary differential equations that model physical processes.
2. The essential tool of matrices in a comprehensive manner.
3. The ideas of probability and various discrete and continuous probability distributions and the basic ideas of statistics including measures of central tendency, correlation and regression.

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.

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.

Module 3:Basic 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.

Module 4: Basic Probability: (8 hours)

Probability spaces, conditional probability, independence; Discrete random variables, Binomial distribution, Poisson distribution, Normal distribution. Relation between binomial, Poisson and Normal distributions.

Module 5: Matrices (10 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.

Topics for Self Learning

Application of Differential Equations.Textbooks/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 Vidhyarthi Griha Prakashan, Pune - 411030 (India).
9. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.

Syllabus for Semester BE I
(Biomedical Engineering)

Course Code : MAP151 **Course : Computational Mathematics Lab**

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

Course Outcomes

The Computational Mathematics Lab course will consist of experiments demonstrating the principles of mathematics relevant to the study of science and engineering. Students will show that they have learnt laboratory skills that will enable them to properly acquire and analyze the data in the lab and draw valid conclusions. At the end of the Course the students will learn to:

1. Develop skills to impart practical knowledge in real time.
2. Understand principle, concept, working and application of areas in mathematics and compare the results obtained with theoretical calculations.
3. Understand basics of mathematics, and report the results obtained through proper programming.

The Lab turns will be utilized for performing the experiments based on the following list:

1. Calculus.
2. Ordinary Differential Equations.
3. Statistics.
4. Linear Algebra

References

1. Computational Mathematics Lab Manual written by the Teaching Faculty of Mathematics Department, RCOEM.

A minimum of 8 experiments to be performed based on the above list.

Syllabus for Semester BE I
(Biomedical Engineering)

Course Code : PHT155 **Course : Physics of Materials**

L: 03 Hrs, T: 1 Hr., P: 0 Hrs Per Week **Total Credits : 4**

Course Objectives

1. To provide basic knowledge of materials in sensors, electronic and electrical systems
2. To understand the governing mechanisms in engineering materials

Course Outcomes

The students will understand and work with,

1. Modern theory of solids
2. Quantum mechanical descriptions of the electronic conduction processes
3. Semiconducting and Dielectric materials
4. Magnetic materials and superconductivity

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, Confinement, Tunneling, Hydrogen Atom, Periodic Table, Light-matter interaction, Applications of lasers in biomedical instrumentation

Module 3:Modern Theory of Solids

Molecular Orbital Theory of Bonding, Band theory of solids, Energy band formation, Concepts in Statistical Mechanics, Quantum Theory of metals, Metal-Metal contacts, Thermionic Emission, Phonons, Thermal and Electrical conductivity

Module 4: Semiconductors

Intrinsic and Extrinsic Semiconductors, Carrier concentrations, Drift mobility, Recombination, Diffusion and conduction equations, Continuity Equation, Optical Absorption, Piezoresistivity, Junction physics, Applications in bioelectric sensors

Module 5: Dielectric Materials and Insulation

Polarization and relative permittivity, Type of polarization, Frequency dependence, 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, Josephson Effect, Flux quantization, 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, Springer2006

Syllabus for Semester BE I
(Biomedical Engineering)

Course Code : PHP155 **Course : Physics of Materials**

L: 0 Hr, T: 0 Hr., P: 3 Hrs Per Week **Total Credits : 1.5**

Course Outcomes

The physics laboratory will consist of general physics experiments and study of materials properties illustrating the principles of physics relevant to the study of biomedical engineering. During the training in the Physics Lab, the students will be able,

1. To develop skills for experimental verification of physics laws
2. To analyze the results using the mathematical techniques
3. To learn the measurement of materials properties
4. To synthesize the nanoparticles and write the project reports

The laboratory will consist of the following general physics experiments, the measurement of materials properties and the synthesis of the nanoparticles

General Physics

1. Measuring scales and error estimation
2. Verification of Ohm's law and linear least square fitting method
3. Verification of Newton's law of cooling
4. Simple harmonic motion
5. Magnetic flux measurement using the graphical method of integration
6. Dispersive power of prism
7. Compound Microscopes Materials Lab:
8. Determination of energy gap of semiconducting materials
9. Seeback effect
10. Thermal Conductivity of Metals
11. Dielectric constant measurement
12. Magnetic materials and characterization
13. Hall effect

Synthesis of Nanoparticles for Biomedical Applications

1. Preparation of Magnetic oxide, Fe2O3,nanoparticles
2. Ferro fluid preparation methods
3. Preparation of Semiconducting nanoparticles (ZnO,Ti2O)
4. Preparation of Metallic (Au, Ag)nanoparticles

Reference Books

1. Lab manual prepared by Physics Department, RCOEM, Nagpur
2. Semiconductor Nanocrystals and Metal Nanocrystals, Physical Properties and Device Applications, Eds. Tupei Chen, Yang Liu, CRC Press2017
3. Clinical Applications of Magnetic Nanoparticles, Eds. Nguyên T. K. Thanh, CRC Press 2018

Syllabus for Semester BE I
(Biomedical Engineering)

Course Code : BMT101 **Course : Fundamentals of Electrical and Electronics Engineering**

L: 03hrs, T: 00 Hr., P: 00 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 eddy current 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 Semi Conductor 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 Book

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 Education.

Syllabus for Semester BE I
(Biomedical Engineering)

Course Code : BMP101 **Course : Fundamentals of Electrical and Electronics Engineering Lab**

L: 00 Hrs, T: 00 Hr., P: 02 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 BMT101 Syllabus

Syllabus for Semester BE I
(Biomedical Engineering)

Course Code:MET151 **Course : Engineering Graphics and Design**

L:1Hr.,T:0 Hr.,P:0Hr .,Per week **Total Credits : 01**

Course Outcomes

The expected learning outcome is that, the students shall be able to

1. Draw and interpret technical drawing
2. Convert 2 - D to 3 - D drawing and viceversa.
3. Represent the various positions of planes and solids in different orientations.
4 Develop the solid surface for sheet metal working.

UNIT 1 : Introduction to Engineering Drawing

Principles of Engineering Graphics and their significance, usage of drawing instruments, Lettering and dimensioning.

UNIT 2 : Orthographic Projections

Principles of Orthographic Projections-Conventions: Projections of Points and lines (line inclined to both planes)Projections of planes (inclined to both the planes),Introduction to Auxiliary Planes;

UNIT 3 : Projections of Solids

Inclined to both the Planes-Auxiliary Views; Draw simple annotation, dimensioning and scale. Floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc.

UNIT 4 : Sections and Sectional Views of Right Angular Solids

Prism, Cylinder, Pyramid Cone-Auxiliary Views; Development of surface of Right Regular solids-Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids, objects from industry and dwellings(foundation to slab only)

UNIT 5 : Isometric Projections

Principles of Isometric projection-Isometric Scale, Isometric Views, Conventions; Isometric Views of Simple Solids; Conversion of Orthographic views to Isometric Views/Projection.

Text / Reference Books

i) Bhatt N. D. Panchal V. M. & Ingle P.R., (2014) Engineering Drawing, Charotar Publishing House.

ii) Jolhe D. A. (2016) Engineering Drawing with an Introduction to Auto CAD", Tata McGraw- Hill Publishing Co.Ltd.,New Delhi.

iii) Narayan K.L. & P. Kannaiah (2008),Text book on Engineering Drawing, Scitech Publishers.

iv) Shah, M.B. & Rana B.C. (2008), Engineering Drawingand Computer Graphics, Pearson Education.

v) Agrawal B & Agrawal C.M.(2012),Engineering Graphic, TMH Publication.

vi) Corresponding set of CAD Software Theory and User Manuals.

Syllabus for Semester BE I
(Biomedical Engineering)

Course Code : MEP151 **Course Name : Engineering Graphics & Design Lab**

L: 0 Hr, T: 0 P:4 Hr., Per Week **Total Credits : 02**

Course Outcomes

Students are prepared for actual work situations through practical training in a new state of the art computer designed CAD laboratory using engineering software. The student will learn to:

1. Draw and interpret technical drawing
2. Plan the sheet layout for the given drawing
3. Convert 2-D to 3-D drawing and vice versa
4. Represent the various positions of planes and solids in different orientations.
5. Develop the solid surface for sheet metal working
6. Use & demonstrate drafting package.

UNIT 1 : Introduction to Engineering Drawing

Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloids, Hypocycloid and involutes; Introduction to Scales.

UNIT 2 : Orthographic Projections

Principles of Orthographic Projections-Conventions-Projections of Points and lines inclined to both planes; Projections of planes-Auxiliary Planes.

UNIT 3 : Projections of Solids

Inclined to both the Planes Auxiliary Views; Draw simple annotation, dimensioning and scale, Floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc.

UNIT 4 : Sections and Sectional Views of Right Angular Solids

Prism, Cylinder, Pyramid, Cone- Auxilary Views; Development of surfaces of Right Regular Solids Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids, objects from industry and dwellings (foundation to slab only)

UNIT 5 : Isometric Projections

Principles of Isometric projection-Isometric Scale, Isometric Views, Conventions; Isometric Views of Simple Solids; conversion of Orthographic views to Isometric views / Projection.

UNIT 6 : Overview of Computer Graphics

Demonstrating knowledge of the theory of CAD software such as(the Menu System Toolbars Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, crosshairs, Coordinate Systems), Dialog boxes and windows, Shortcut menus (Button Bars), The command Line

(wherever applicable), The Status Bar, Different methods of zoom as used in CAD, select and erase objects; Isometric Views of lines, Planes, Simple and compound solids).

UNIT7:Customization & CAD Drawing

Setting up drawing page and the printer, including scale settings, Setting up of units and Drawing limits; ISO and ANSI standards for coordinate dimensioning ;Orthographic constraints, map to objects, manually and automatically, Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles.

UNIT 8 : Annotations Layering & Other Functions

Applying dimensions to objects, applying annotations to drawings; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print command; orthographic projection techniques.

UNIT 9 : Demonstration of a simple team design project that illustrates

Geometry And Topology Of Engineered Components Creation Of Engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; Meshed topologies for engineering , Introduction to Building Information Modeling(BIM), Drafting and design package, 3D Printing.

List of sheets

1. Curves(ellipse, Parabola, hyperbola, Cycloid, involute)
2. Line, Planes, Solids
3. Application of Section and development of solids
4. Orthgraphic Projection
5. Isometric
6. Auto CAD practice sheet 1
7. Auto CAD practice sheet
8. Blueprint sheet

Text/ Reference Books

i) Bhatt N.D. Panchal V.M.& Ingle P.R.,(2014),Engineering drawing, Charotar Publiishing house.

ii) Jolhe D.A.,(2016) Engineering drawing with an Introduction to AutoCAD",Tata McGraw-Hill Publishing Co. Ltd., New Delhi.

iii) Shah M.B.& Rana B.C.(2008),Engineering drawing and Computer Graphic, Pearson Education.

iv) Agarwal B & Agarwal C.M.(2012),Engineering Graphics, TMH PUBLICATION

v) Narayana, K.L & PKannaiah (2008), Text Book on Engineering Drawing, Scitech Publishers.

vi) (Concesponding set of) CAD Software Theory and USER Manuals.

Syllabus for Semester BE I
(Biomedical Engineering)

Course Code : HUT152 **Course Name : Constitution of India**

L: 02 Hrs, T: 0 P:0 Hr., Per Week **Total Credits : 0**

Course outcome

1. Students will understand the role of constitution in democratic India
2. Students will be responsible students by knowing their fundamental rights and duties
3. Students will develop better understanding of democratic functions of the government of India
4. Students will form better understanding of system of governance for effective participation

Course content

1. Meaning of the constitution law and constitutionalism
2. Historical perspective of the Constitution of India
3. Salient features and characteristics of the Constitution of India
4. Scheme of the Fundamental Rights
5. The scheme of the Fundamental Duties and its legal status
6. The Directive Principles of State Policy – Its importance and implementation
7. Federal structure and distribution of legislative and financial powers between the Union and the States
8. Parliamentary Form of Government in India – The constitution powers and status of the President of India
9. Union Executive: structure, functions
10. Judiciary: Structure, role with special reference to PIL, writ petitions, strengthening of democracy & social Justice
11. Amendment of the Constitutional Powers and Procedure
12. Emergency Provisions: National Emergency, President Rule, Financial Emergency
13. Local Self Government – Constitutional Scheme in India
14. Provisions of civil services: Characteristics, functions, merits and demerits
15. Democratic principles in industry

Book

1. Durga Das Basu "An Introduction to Constitution of India" 22nd Edition, LexisNexis

Syllabus for Semester BE I
(Biomedical Engineering)

Course Code : PEP151 **Course Name : Yoga / Sports**

L: 00hrs, T: 0 P:2 Hrs., Per Week **Total Credits : 0**

Course outcome

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

1. Understand fundamental skills and basic rules of games offered by the Physical Education Department of RCOEM.
2. Obtained health related physical fitness.
3. Develop body-mind co-ordination through games and yoga.
4. Changed sedentary life styles towards active living.

Brief Objectives of Sports/Yoga Practical Classes

It has long been proven that a healthy body leads to a healthy mind. With a strong belief in this, Physical Education Department at RCOEM will conduct Sports/Yoga Classes with the objective of maintaining health, fitness and wellness of students as well as create awareness about need for good health and physical fitness.

The objective would also be to make the all-round development with team spirit, social values as well as to identify and develop leadership qualities in students through various sports activities. Sports activities would also be conducted with the objective to provide better interaction and recreation to the students which is an important neutralizer for stress. Additionally, the objective would be to evaluate the health related fitness of students so as to recommend and conduct specific Yoga and Sports activities. The emphasis is on participation, with healthy competition.

Programme Outline

- **Sports :**

1. Introduction to sports, offered by the department.
2. Health and safety issues related to sports; knowledge, recognition and ability to deal with injuries and illness associated with sports.
3. Practicing the fundamental skills and bringing awareness of basic rules and regulations.
4. Conduction of small recreational games and activities.

- **Yoga :** Includes various sitting, standing and lying Asanas, Suryanamaskars and Pranayamas. Physical
- **Efficiency Tests :** This includes 6 health related physical fitness tests.

Syllabus for Semester BE II
(Biomedical Engineering)

Course Code : MAT151 **Course : Calculus**

L: 03hrs, T: 1 Hr., P: 0 Hrs Per Week **Total Credits: 4**

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 learn:

1. The fallouts of Mean Valve Theorems that is fundamental to application of analysis to Engineering problems, to deal with functions of several variables that are essential in most branches of engineering.
2. Basics of improper integrals, Beta and Gamma functions, Curve ool of power series and Fourier series for learning advanced Engineering Mathematics.
3. Multivariable Integral Calculus and Vector Calculus and their applications to Engineering problems.

Syllabus

Module 1: Calculus: (7 hours)

Rolle's theorem, Mean value theorems, Taylor's and Maclaurin series expansions; Indeterminate forms and L'Hospital's rule; radius of curvature (Cartesian form), evolutes and involutes

Module 2:Multivariable Calculus (Differentiation) (8 hours)

Limit, continuity and partial derivatives, Eulers Theorem, chain rule , total derivative, Jacobians, total derivative, Maxima, minima and saddle points; Method of Lagrange multipliers.

Module 3 Calculus: (6 hours)

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

Module 4:Sequences and series: (7 hours)

Convergence of sequence and series, tests for convergence, power series, Fourier series: Half range sine and cosine series, Parseval's theorem.

Module 5: Multivariable Calculus (Integration) (7 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: areas and volumes by (double integration) Center of mass and Gravity (constant and variable densities).

Module 6 : Vector Calculus(7 hours)

Vector Differentiation, Directional derivatives, total derivative , Gradient, curl and divergence. Vector integration , Theorems of Green, Gauss and Stokes.

Topics for self learning

Maxima and minima for function of one variable, Geometrical interpretation of Partial Differentiation (Tangent plane and Normal line) , Applications of definite integrals to evaluate perimeter, area, surface areas and volumes of revolutions.

Textbooks/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. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
5. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
6. A text book of Applied Mathematics Volume I & II, by P. N. Wartikar and J. N. Wartikar, Pune Vidhyarthi Griha Prakashan, Pune-411030 (India).

Syllabus for Semester BE II
(Biomedical Engineering)

Course Code : CST151 **Course : Programming For Problem Solving**

L: 4hrs, T: 0 Hr., P: 0 Hrs Per Week **Total Credits : 4**

Course Outcomes

On successful completion of course student will learn:

1. To formulate simple algorithms for arithmetic and logical problems, translate the algorithms to programs (in C language), test and execute the programs and correct syntax and logical errors.
2. To implement conditional branching, iteration and recursion, to decompose a problem into functions and synthesize a complete program using divide and conquer approach.
3. To use arrays, pointers, structures and I/O operations for the formulation of algorithms and programs.
4. To apply programming to solve matrix addition, multiplication problems and searching & sorting problems.

UNIT-I: Introduction to Programming

Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.) Idea of Algorithm : Steps to solve logical and numerical problems. Representation of Algorithm: Flowchart / Pseudocode with examples. Arithmetic expressions and precedence

UNIT-II: C Programming Language

Introduction to C language: Keywords, Constant, Variable, Data types, Operators, Types of Statements, Preprocessor Directives, Decision Control Statement-if, if-else, Nested if-else statement, Switch case, Loops and Writing and evaluation of conditionals and consequent branching.

UNIT-III: Arrays and Basic Algorithms

Arrays: 1-D, 2-D, Character arrays and Strings. Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)

UNIT-IV: Functions and Recursion

User defined and Library Functions, Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference. Recursion: As a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.

UNIT-V: Pointers and Structures

Structures, Defining structures, Array of Structures, Introduction to pointers, Defining pointers, Pointer arithmetic, pointer operators, Use of Pointers in self-referential structures, notion of linked list (no implementation)

UNIT-VI: File handling

Streams in C, Types of Files, File Input/ Output Operations: Modes of file opening, Reading and writing the file, Closing the files, using fflush().

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 BE II
(Biomedical Engineering)

Course Code : CSP151 **Course : Programming For Problem Solving Lab**

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

Course Outcomes

On successful completion of course student will be able to:

1. Understand the fundamentals of C programming and choose the loops and decision making statements to solve and execute the given problem.
2. Implement different Operations on arrays also design functions to solve the given problem using C programming.
3. Understand pointers, structures, unions and apply them to develop programs.
4. Implement file Operations in C programming for a given application.

Syllabus

Practicals based on CST151 Syllabus.

Syllabus for Semester BE II
(Biomedical Engineering)

Course Code : CHT153 **Course Name : Biochemistry**

L: 03hrs, T: 1 P:0hr., Per Week **Total Credits : 4**

Course Outcomes

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

1. To understand the basic concepts of the quantitative analysis.
2. To apply the knowledge to understand the structure and function of biological molecules.
3. To understand the role of bio-molecules in biological system.
4. Demonstrate an understanding of the principles of a wide range of biophysical and biochemical techniques.
5. To understand spectroscopic methods used for qualitative and quantitative analyses.
6. To gain the information about role of water in biological system.

Syllabus

Module 1: Introduction to Biochemistry [6 Hours]

Introduction to Biochemistry, weak acid and bases, pH, buffers, Handerson - Hasselbalch equation, physiological buffers in living systems, Energy in living organism, Kinetics of biological systems; Michaelis- Menten equation.

Module 2: Introduction to Biomolecules [8 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 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, Dialysis, Homogenization, Adsorption, Absorption, Partition, Centrifuge- types & application, Density Gradient centrifugation, Sedimentation, Sedimentation coefficient.

Module 4: Biophysical and Biochemical Techniques [7Hours]

General principles and application of Paper chromatography, Thin layer chromatography, Gas chromatography, High performance liquid chromatography.

Module 5: Material Characterization using different Spectroscopic Techniques [7 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.

Module 6: Role of water in biological systems[7 Hours]

Impurities in natural water, hardness and alkalinity, Desalination of water using Reverse Osmosis. Properties of water and their applications in biological systems, Weak Interactions in Aqueous Systems, Hydrogen Bonding, Hydrophilic and Hydrophobic Interactions, van der Waals Interactions, Colligative Properties of Aqueous Solutions, Osmosis, Water as a reactant.

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. ChandPublications.
4. P. C. Jain and Monica Jain, Engineering Chemistry, Dhanpat RaiPublication.
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. O. P. Agrawal.

Syllabus for Semester BE II
(Biomedical Engineering)

Course Code : CHP153 **Course Name : Biochemistry Lab**

L: 00 Hrs, T: 00 P:3 Hr., Per Week **Total Credits : 1.5**

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 ofconcentration.
2. To find out types of alkalinity and estimation of their extent in the watersample.
3. Estimation of hardness present in the water sample by complexometric titration method using EDTA.
4. Determination of COD in waste watersample.
5. Determination of BOD in waste watersample.
6. To study effect of bondings of water molecules with electrolyte (NaCl/KCl) and non- electrolyte solute (Soap) in the solution through Surface TensionDetermination.
7. Synthesis of Drug/Polymer and itsstudy.
8. Separation of different organic compounds by paperchromatography.
9. Estimation of urea inblood.
10. Estimation of carbohydrate in blood.
11. Determination of Fe content in foodsample.
12. Demonstrations of laminar flowequipment
13. Spectroscopic/Colorimetric determine of wavelength of maximum absorption of chemical/biological compound in solution and determination of concentration using Lambert-Beer's Law.

14. Demonstration of chromatographic techniques: Gas chromatography,HPLC
15. 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.ChandPublications.
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.
6. D. M. Vasudevan and Subir Kumar Das, Practical Textbook of Biochemistry for Medical Students, Jaypee Brothers Medical Publishers (P) Ltd., 2013.
7. Geetha Damodaran K, Practical Biochemistry, Jaypee Brothers Medical Publishers (P) Ltd., 2011

Syllabus for Semester BE II
(Biomedical Engineering)

Course Code : BMT102 **Course Name : Human Anatomy and Physiology for Engineers - I**

L: 03hrs, T: 00 Hr., Per Week **Total Credits:3**

Course Outcomes

After completion of the course student will be able to:

1. Understand human physiology at a cellular, tissue, and organ systems level.
2. Recognize the integration and control of the different physiological systems and their roles in maintaining homeostasis.
3. Appreciate the structural and functional aspects of Human Anatomy
4. Understand the process of development and aging of organ systems

Syllabus

Module – 1 Fundamentals of Anatomy, Cells and Tissues

Introduction to Human Body; Cell Level Organization; Types of cell and their function; Tissue Level Organization; Types of Tissue and there function

Module – 2 Integumentary System and Special senses

Structure and Function of Skin; Accessory structures of skin; Skin Wound Healing; Development and Aging of Integumentary System; Anatomy and Physiology of Olfaction, Gustation, Vison, Hearing and Equilibrium senses; Aging of senses

Module – 3 Skeletal System

Structure and Function of Bone and the Skeletal System; Bone formation; Fracture and Repair; Types of Bones; Structure and Function of Axial and Appendicular Skeleton; Joint and its classification; Types of Movements at Synovial Joints and Types of Synovial Joints; Aging of Joints

Module – 4 Muscular System

Overview of Muscular Tissue; Skeletal Muscle Tissue; Working of Muscle Fibers; Metabolism; Control of Muscle Tension; Types of Muscle Fiber and Tissue; Regeneration; Development and Aging of Muscle.

Module – 5 Digestive System

Overview of the Digestive System; Layers of the GI Tract; Neural Innervation of the GI Tract; Structure and Function of Organs of Digestive system; Phases of Digestion; Development and Aging

Module – 6 Excretory system

Overview of Renal Physiology; Anatomy and Physiology of the Kidney; Glomerular Filtration; Reabsorption and Secretion; Waste Management of in other body system; Aging of Urinary System

Text Book

1. Principles of Anatomy & Physiology, 13th Edition, Gerard J. Tortora and Bryan Derrickson, John Wiley & Sons, Inc
2. Human Anatomy & Physiology Standalone Book, Marieb, Human Anatomy & Physiology, 11th Edition, Pearson.

Reference Books

1. Atlas of Human Anatomy Professional Edition, 7th Edition, Frank H. Netter
2. Ross & Wilson Anatomy and Physiology in Health and Illness, 13th Edition.
3. Clinical Anatomy: Applied Anatomy for Students and Junior Doctors, 14th Edition.
4. Gray's Anatomy for Students, 4th Edition.

Syllabus for Semester BE II
(Biomedical Engineering)

Course Code : IDT151 **Course : Creativity, Innovation & Design Thinking**

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

Course Outcomes

1. Be familiar with processes and methods of creative problem solving
2. Enhance their creative and innovative thinking skills
3. Practice thinking creatively and innovative design and development

Syllabus

UNIT I. Introduction:

Making a case for creativity, Creative thinking as a skill, Valuing diversity in thinking: Thinking preferences, Creativity styles, Creativity in problem solving

UNIT 2. Pattern Breaking

Thinking differently , Lateral thinking, Mind stimulation: games, brain-twisters and puzzles, Idea-collection processes, Brainstorming/Brainwriting, The SCAMPER methods, Metaphoric thinking, Outrageous thinking , Mapping thoughts, Other (new approaches)

UNIT 3.

Using Math and Science, Systematic logical thinking, Using math concepts, Eight-Dimensional (8D) Approach to Ideation: Uniqueness, Dimensionality, Directionality, Consolidation, Segmentation, Modification, Similarity, Experimentation

UNIT4. Systematic Inventive Thinking

Systematic inventive thinking: The TRIZ methodology, Decision and Evaluation: Focused thinking framework, Six thinking hats , Ethical considerations

UNIT 5. Design for Innovation

Introduction to design for interaction, nine lessons for innovation, difference in creativity and innovation, Building blocks for innovation.

UNIT 6.Intellectual Property

Introduction to intellectual property: Patents, Copyrights©, Trademarks ®, Trade Secret, Unfair Competition.

Reference Books and Text Book

1. Creative Problem Solving for Managers - Tony Proctor - Routledge Taylor & Francis Group
2. 101 Activities for Teaching creativity and Problem Solving - By Arthur B Vangundy - Pfeiffer
3. H. S. Fogler and S.E. LeBlanc, Strategies for Creative Problem Solving, Prentice Hall
4. E. Lumsdaine and M. Lumsdaine, Creative Problem Solving, McGraw Hill,
5. J. Goldenberg and D. Mazursky, Creativity in product innovation. Cambridge University Press, 2002.

Course Assignments for internal continuous assessment of 20 Marks (NO T1 and T2)

- Brain teasers (aka Puzzle Busters, to be solved individually)• Cartoon captions (small teams)
- TRIZ, a systematic ideation method, reading (individual)
- Book readings and discussions (small teams)
- Small teams presentations on innovation: (1) innovative individual, (2) innovative company, (3) innovative movie / game, (4) sustainable innovation, (5) innovation in business, (6) innovation in art, (7) innovation in architecture, (8) innovative nation, (9) innovation in science, and (10) innovation in engineering.
- Large groups hands-on projects
- Eight-dimensional (8D) ideation method examples
- Large teams videos

Syllabus for Semester BE II
(Biomedical Engineering)

Course Code HUT151 **Course : English**

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

Course Objectives

The main objective of the subject is to enhance the employability skills of engineering students as well as communication skills at work place. The sub-objectives are:

1. To develop vocabulary of students.
2. To orient students in basic writing skills.
3. To orient students in functional grammar.
4. To orient students in the process of effective writing.
5. To provide practice and improve students' oral communication skills.

Course Outcomes

1. Students will have good word power.
2. Students will acquire basic writing skills.
3. Students will understand functional grammar and its usage.
4. Students will organize and express their thoughts effectively through written communication.
5. Students will learn oral communication skills in order to handle themselves effectively in an interview and group discussion

Syllabus

Module -1: Vocabulary Building

1.1. The concept of Word Formation

1.2. Root words from foreign languages and their use in English

1.3. Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives

1.4. Synonyms, Antonyms and standard abbreviations

Module -2: Basic Writing Skills

2.1. Sentence Structures

2.2. Use of phrases and clauses in sentences

2.3. Importance of proper punctuation

2.4. Creating coherence

2.5. Organizing principles of paragraphs in documents

2.6. Techniques for writing precisely

Module -3: Identifying Common Errors in Writing

3.1. Subject-verb agreement

3.2. Noun-pronoun agreement

3.3. Misplaced modifiers

3.4. Articles

3.5. Redundancies

3.6. Clichés

Module -4: Nature and Style of sensible Writing

4.1. Describing

4.2. Defining

4.3. Classifying

4.4. Providing examples or evidence

Module -5: Writing Practices

5.1. Comprehension

5.2. Précis Writing

5.3. Essay Writing

5.4. Letter Writing

5.5. Email Writing

Module -6: Oral Communication

6.1. Listening Comprehension.

6.2. Pronunciation, Intonation, Stress and Rhythm

6.3. Common Everyday Situations: Conversations and Dialogues

6.4. Communication at Workplace

6.5. Interviews

6.6. Formal Presentations

Books

1. Communication Skills. Sanjay Kumar and Pushp Lata. 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 BE II
(Biomedical Engineering)

Course Code : HUP151 **Course : English**

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

Course objective

1. To enhance competency of communication in English among learners.

Course outcomes

1. Students learn presentation and public speaking skills
2. Students learn to practice effective strategies for Personal Interview and Group Discussions
3. Students learn and effectively apply language skills – listening, speaking, reading and writing

List of Practicals (2 hours each for each batch) based on unit 6 (oral communication).

1. Common Everyday Situations: Conversations and Dialogues
2. Pronunciation, Intonation , Stress, and Rhythm
3. Formal Presentations: Orientation
4. Formal Presentations : Practice Session
5. Interviews :Orientation
6. Interviews: Practice Session
7. Communication at Workplace: Group Discussion-Orientation
8. Communication at Workplace: Practice Session

NOTES