

Additional Information for QIM 1.3.1- Institution integrates cross-cutting issues relevant to Professional Ethics, Gender, Human Values, Environment and Sustainability and other value framework enshrined in Sustainable Development Goals and National Education Policy – 2020 into the Curriculum.

Sample evidence for following-

List of courses which address the Gender, Environment and Sustainability, Human Value and Professional Ethics into the Curriculum

Sr No	Cross cutting issue	Course	Program	Additional Activities	Impact
1	Professional Ethics and Human values	Effective Communication	Engg	<ul style="list-style-type: none"> • Guest Lectures and • Invited talks by Industry experts. 	Students are well- groomed, and professional ethics are inculcated in them.
		Professional Skills	Engg		
		Professional Communication and Ethics	Engg		
		Business Ethics and corporate governance	MMS		
		Business Communication	MMS		
		Organizational Behavior	MMS		
		Entrepreneurship Management	MMS		
2	Gender	Entrepreneurship Management	MMS	<ul style="list-style-type: none"> • Webinars on gender sensitization 	All these efforts help us in sensitizing students towards Gender equality.
		Environmental Studies	Engg		
3	Environment and Sustainability	Environmental management	Engg	<ul style="list-style-type: none"> • Guest Lectures 	These efforts are helping progress towards green campus.
		Waste Management - process, concept and working	MMS		



Vidyalankar Institute of Technology

An Autonomous Institute affiliated to University of Mumbai

Bachelor of Technology

in

Biomedical Engineering

First Year Scheme & Syllabus

(As per AICTE guidelines, with effect from Academic Year 2022-23)

Preamble

To meet the challenge of ensuring excellence in engineering education, the issue of quality needs to be addressed, debated, and taken forward in a systematic manner. Therefore, autonomy for Vidyalankar Institute of Technology is not merely a transition from pre-cooked syllabi to self-designed curriculum. Autonomy curriculum of the Institute offers required academic flexibility with emphasis on industry requirements and market trends, employability and problem-solving approach which leads to improving competency level of learners with diverse strengths. In line with this, the curriculum framework designed is **Choice-Based Credit and Grading System (CBCGS)**. Number of credits for each category of courses learnt by learners, internships and projects is finalized considering the scope of study and the ability that a learner should gain through the programme. The overall credits and approach of curriculum proposed is in line with AICTE model curriculum.

The curriculum comprises courses from various categories like basic sciences, humanities and social sciences, engineering sciences, general education and branch specific courses including professional electives and open electives. The curriculum has core courses of branch of engineering positioned and sequenced to achieve sequential and integral learning of the entire breadth of the specific branch. These courses are completed by third year of the engineering programme that enables learners to prepare for higher education during their final year. Professional elective courses, that begins from third year of programme, offer flexibility and diversity to learners to choose specialization from a basket of recent developments in their field of technology. The selection of unique professional elective courses based on industrial requirements and organizing them into tracks is a salient feature of this curricula ensuring employability. Open Elective courses cover multi-disciplinary, special skill development, project management and similar knowledge that make learner capable to work in industrial environment.

For holistic development of learners, apart from technical courses, Humanities and Social Science courses develop the required soft-skills and attitude amongst learners. Our curriculum also introduces Social Service Internship and Internship with institutes abroad along with courses like Design Thinking, Wellness - Body, Mind & Spirit, Indian Traditional Knowledge System under General Education category. These general education courses aim to create balance in brain hemispheres and hence improve learners' clarity in thoughts and responses.

Additionally, curriculum provides add-on minor/honours degree that involves field/ domain study. Learner can avail this degree by completing requirement of additional 15 credits. Thus, the academic plan of VIT envisages a shift from summative to formative and competency-based learning system which will enhance learner's ability towards higher education, employability and entrepreneurship.

Chairman, Board of Studies
Department of Biomedical Engineering
Vidyalankar Institute of Technology

Chairman, Academic Council
Vidyalankar Institute of Technology

First Year B. Tech. Biomedical Engineering
Course Structure and Assessment guidelines

Semester: I

Course		Head of Learning	Credits	Assessment guidelines (Marks)			Total marks (Passing@40% of total marks)
Code	Name			ISA	MSE	ESE	
HS01T	Effective Communication	Theory	2	15	20	40	075
HS01P	Effective Communication Lab	Practical	1	25	-	25	050
BS02T	Engineering Mathematics-I	Theory	3	20	30	50	100
BS20T	Physics for Biomedical Engineering	Theory	2	15	20	40	075
BS20P	Physics for Biomedical Engineering Lab	Practical	1	25	-	25	050
ES04T	Structured Programming	Theory	2	15	20	40	075
ES04P	Structured Programming Lab	Practical	1	25	-	25	050
ES08T	Basic Electrical Engineering	Theory	2	15	20	40	075
ES08P	Basic Electrical Engineering Lab	Practical	1	25	-	25	050
ES02T	Engineering Mechanics	Theory	2	15	20	40	075
ES02P	Engineering Mechanics Lab	Practical	1	25	-	25	050
GEXXX*	Any GE course from the given list	As per course					

ISA=In Semester Assessment, MSE= Mid Semester Examination, ESE= End Semester Examination

* Refer to Appendix A for the list of General Education (GE) courses. Selection will be based on the subset of GE courses made available by the Institute for the semester.

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

First Year B. Tech. Biomedical Engineering
Course Structure and Evaluation Scheme

Semester: II

Course		Head of Learning	Credits	Assessment guidelines (Marks)			Total marks (Passing@40% of total marks)
Code	Name			ISA	MSE	ESE	
HS02T	Professional Skills	Theory	2	15	20	40	075
HS02P	Professional Skills Lab	Practical	1	25	-	25	050
BS04T	Engineering Mathematics-II	Theory	3	20	30	50	100
BS16T	Engineering Chemistry	Theory	2	15	20	40	075
BS16P	Engineering Chemistry Lab	Practical	1	25	-	25	050
ES01T	Engineering Graphics	Theory	2	15	20	40	075
ES01P	Engineering Graphics Lab	Practical	1	25	-	25	050
ES05T	Object-Oriented Programming	Theory	2	15	20	40	075
ES05P	Object-Oriented Programming Lab	Practical	1	25	-	25	050
GEXX*	Any GE course from the given list	As per course					
GEXX*	Any GE course from the given list	As per course					

ISA=In Semester Assessment, MSE= Mid Semester Examination, ESA= End Semester Examination
* Refer to Appendix A for the list of General Education (GE) courses. Selection will be based on the subset of GE courses made available by the Institute for the semester.

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Detailed Syllabus of First Year Semester-I

Course Name: Effective Communication

Course Code: HS01T

Category: Humanities, Social Sciences and Management Courses

Preamble:

This course introduces learners to the basics of Effective Communication and English language usage which will equip them with the requisite skillset for higher studies and placements. It considers the important foundational aspects of communication skills and English proficiency required for the workplace. It acquaints the learners with modern communication tools and the basics of public speaking before an audience.

Pre-requisites:

Nil

Course Objectives:

- To enable learners to gain understanding of the cyclic process, methods, channels, and barriers of communication.
- To facilitate learners in developing the skills of active listening, impactful public speaking, reading strategies, and effective writing.
- To create awareness of strengthening English proficiency for competitive exam preparation and the art of comprehension and summarization.
- To introduce strategies for creating effective presentations using modern ICT enabled tools.

Course Outcomes:

Learner will be able to:

CO1: Use verbal/non-verbal cues at social and workplace situations by learning the basics of communication skills.

CO2: Employ listening strategies to become effective listeners and powerful speakers for speaking at social, academic and business situations.

CO3: Improved verbal aptitude to be equipped for competitive examinations and placements.

CO4: Make effective presentations and present before an audience with confidence.

CO5: Use reading strategies for faster comprehension, summarization and evaluation of texts.

CO6: Develop awareness of contemporary digital tools of communication.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
2	-	2	-

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory	15	20	40	075

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	Fundamentals of Communication	Concept, Elements and Cycle of Communication Methods of Communication (Verbal and Nonverbal) Objectives and Channels of Communication (Formal and Informal) Barriers to Communication: Physical, Mechanical, Psychological, Semantic, Socio-cultural, Cross-cultural	10
2	Listening & Speaking	Techniques to improve Listening, Listening exercises Speech writing and delivery Different types of Speeches & Tips on Public Speaking	6
3	English Usage	Vocabulary Building (Etymology, Synonyms, Antonyms, One Word Substitutes) useful for TOEFL, GRE Grammar Proficiency Tests (Articles, Prepositions, Tenses, Punctuation) Identifying Common Errors in Writing Grammar Checkers and Sentence Correction Tools	4
4	Presentation Skills	Introduction to Presentation Skills Creating Presentations-Content Delivering Presentations before an audience Using Presentation Software-Modern Presentation Tools	4
5	Comprehension & Summarization	Comprehension & Reading Strategies Graphic Organizers (Mind Maps, Flow Charts, Tree Diagrams etc.) Summarization of technical passages within specified word limit	2
6	Communication Strategies for Virtual Age	Digital Content Creation Infographics, ICT Tools Social and Popular Media	4
Total			30

Suggested list of Assignments:

1. Written Assignment on Fundamentals of Communication (Individual)
2. Listening Activities and Exercises (Individual)
3. Aptitude test on Vocabulary and Grammar (Language Lab) (Individual)
4. Presentation on domain related topics (Group)
5. Comprehension & Summarization of technical passages
6. Digital Content Creation using ICT Tools

Suggested List of Value-Added Home Assignments:

1. <https://www.udemy.com/course/professional-communication-and-business-writing/> Udemy
2. <https://www.udemy.com/courses/business/communications/> Udemy

Suggested Online Courses:

1. Courses on Communication offered by Udemy
2. Business English for Non-Native Speakers Offered by The Hong Kong University of Science and Technology
[https://www.coursera.org/Specializations/Business English for Non-Native Speakers](https://www.coursera.org/Specializations/Business%20English%20for%20Non-Native%20Speakers)
3. English Communication Skills offered by University of Washington
<https://www.coursera.org/specializations/Business> English Communication Skill
4. <https://www.udemy.com/share/101wx6/Public> Relations: Media Communication Crisis
5. <https://www.udemy.com/share/101BkA/Basic> English Grammar and Structures

Reference Books:

1. Raman Meenakshi and Sangeeta Raman, "Communication Skills", OUP, 2016.
2. Kumar Sanjay and Pushp Lata, "Communication Skills", OUP, 2011.
3. Murphy Herta, "Effective Business Communication", McGraw Hill, 2017.
4. Kitty O Locker, "Business Communication- Building Critical Skills", McGraw Hill, 2013.
5. Lehman, Dufrene, Sinha, "BCOM" Cengage Learning, 2020.
6. K. Alex, "Soft Skills", S.Chand and Company, 2014.
7. Stanton Nicky, "Mastering Communication", Palgrave Master Series, 2009.
8. Alan Pease, "Body Language", Manjul Publications, 2014.
9. A. Kaul, "Effective Business Communication", Prentice Hall of India, 2015
10. Monippally, "Business Communication Strategies", Tata McGraw Hill, 2001.

Course Name: Effective Communication Lab

Course Code: HS01P

Category: Humanities, Social Sciences and Management

Preamble:

This course introduces learners to the basics of Communication Skills and English Language usage which will equip them with the requisite skillset for higher studies and placements. It considers the important foundational aspects of Professional Communication and English Proficiency. It acquaints the learners with modern communication tools and the basics of public speaking before an audience.

Pre-requisites:

Nil

Course Objectives:

- To equip learners with Active listening with focus on content, purpose, main idea, tone and pronunciation.
- To enable learners, develop Fluent speaking in different contexts and situations.
- To develop presentation skills in social, academic and professional situations using ICT tools.
- To facilitate faster reading skills for effective comprehension in a variety of texts.

Course Outcomes:

Learner will be able to:

CO1: Listen and comprehend all types of spoken discourse successfully.

CO2: Speak fluently and make effective professional presentations.

CO3: Read large quantities of text in a short time to comprehend, summarize and evaluate content.

CO4: Present themselves professionally in social, academic and professional situations.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
-	2	-	1

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Practical	25	-	25	050

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based

on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Suggested List of Practicals:

1. Ice Breakers/Introduction/Aptitude Test/English Proficiency Test
2. Extempore Speech Practice Session
3. Prepared Speech
4. Group Presentations on current and relevant topics
5. Situational Dialogue Writing and Delivery
6. Skits/Role play on Methods of Communication and Barriers of Communication
7. English Usage Practice on Grammar and Vocabulary
8. Virtual Lab

Suggested Online Courses:

1. Courses on Communication offered by Udemey
2. Business English for Non-Native Speakers Offered by The Hong Kong University of Science and Technology
3. Speak English Professionally: In Person, Online & On the Phone
[https://www.coursera.org/Specializations/Business English for Non-Native Speakers](https://www.coursera.org/Specializations/Business%20English%20for%20Non-Native%20Speakers)
4. <https://www.coursera.org/learn/speak-english-professionally>
5. Improve Communication with Genial.ly (Coursera Project)
6. [https://www.udemy.com/share/101BkA/Basic English Grammar and Structures](https://www.udemy.com/share/101BkA/Basic%20English%20Grammar%20and%20Structures)
7. Public Speaking with Canva (Coursera Project)

Reference Books:

1. Raman Meenakshi and Sangeeta Raman, "Communication Skills", OUP, 2016.
2. Kumar Sanjay and Pushp Lata, "Communication Skills", OUP, 2011.
3. Murphy Herta, "Effective Business Communication", McGraw Hill, 2017.
4. Kitty O Locker, "Business Communication- Building Critical Skills", McGraw Hill, 2013.
5. Lehman, Dufrene, Sinha, "BCOM" Cengage Learning, 2020.
6. K. Alex, "Soft Skills", S.Chand and Company, 2014.
7. Stanton Nicky, "Mastering Communication", Palgrave Master Series, 2009.
8. Alan Pease, "Body Language", Manjul Publications, 2014.
9. A. Kaul, "Effective Business Communication", Prentice Hall of India, 2015.
10. Monippally, "Business Communication Strategies", Tata McGraw Hill, 2001.

Course Name: Engineering Mathematics-I

Course Code: BS02

Category: Basic Science

Preamble:

The objective of the course is to develop the basic Mathematical skills of engineering learners that are imperative for effective understanding of engineering subjects. The topics introduced will serve as basic tools for specialized studies in many fields of engineering and technology. learners impart knowledge of De-Moivre's Theorem, Hyperbolic Functions, and Logarithm of Complex Numbers. The course clarifies the concept of Partial Differentiation and its applications. The course will enable learners to learn basics of Successive Differentiation, Matrices, system of linear equations, Expansions of function and Transcendental Equations.

Pre-requisites:

Nil

Course Objective:

- To recall and remember basics of Complex, Successive differentiation and transcendental equations
- To apply methods to solve engineering problems.
- To solve and evaluate the problems using Complex, Successive differentiation and transcendental equations
- To analyze problems based on System of Linear Equations

Course Outcomes:

Learner will be able to:

CO1: Illustrate the basic concepts of Complex Numbers and solve problems involving different forms and properties of Complex Numbers.

CO2: Apply the knowledge of complex numbers to solve problems in Hyperbolic Functions and Logarithmic function.

CO3: Illustrate the basic principles of Partial Differentiation, Homogeneous functions, and Composite functions.

CO4: Illustrate basic principles of Maxima and Minima and Successive Differentiation.

CO5: Apply principles of basic operations of Matrices, Rank, and echelon form of matrices to solve simultaneous equations.

CO6: Illustrate the concept of Transcendental Equations, linear algebraic equations, and Expansions of functions..

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
3	-	3	-

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory	20	30	50	100

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	Complex Numbers	Statement of D’Moivre’s Theorem. Expansion of $\sin n\theta$, $\cos n\theta$ in terms of sines and cosines of multiples of θ and Expansion of $\sin n\theta$, $\cos n\theta$ in powers of $\sin\theta$, $\cos\theta$, Powers and Roots of complex numbers.	7
2	Hyperbolic Function and Logarithm of Complex Numbers	Circular functions of complex number and Hyperbolic functions. Inverse Circular and Inverse Hyperbolic functions. Separation of real and imaginary parts of all types of Functions. Logarithmic functions, Separation of real and imaginary parts of Logarithmic Functions.	7
3	Partial Differentiation and Applications	Partial Differentiation: Function of several variables, Partial derivatives of first and higher order. Differentiation of composite function. Euler’s Theorem on Homogeneous functions with two independent variables (with proof). Deductions from Euler’s Theorem. Maxima and Minima of a function of two independent variables, Jacobians of two and three variables	8
4	Successive Differentiation & Expansion of Functions	Successive differentiation: nth derivative of standard functions. Leibnitz’s Theorem (without proof) and problems. Taylor’s Theorem (Statement only) and Taylor’s series, Maclaurin’s series (Statement only). Expansion of $\sin(x)$, $\cos(x)$, $\tan(x)$, $\sinh(x)$, $\cosh(x)$, $\tanh(x)$, $\log(1+x)$	8

Module No.	Module Name	Content	No. of Hours
5	Matrices	Rank of a Matrix using Echelon forms, reduction to normal form and PAQ form. System of homogeneous and non-homogeneous equations, their consistency and solutions.	8
6	Numerical Solutions of Transcendental Equations and linear algebraic equations,	Solution of Transcendental Equations: Solution by Newton Raphson method and Regula – Falsi method. Solution of system of linear algebraic equations, by Gauss Jacobi Iteration Method, Gauss Seidal Iteration Method.	7
Total			45

Text Books:

1. Ramana B.V., "Higher Engineering Mathematics", 12th edition, Tata McGraw Hill, 2017

Reference Books:

1. Dr. B.S. Grewal, "Higher Engineering Mathematics", 9th Edition, Khanna Publication, 2012
2. Erwin Kreyszig, "Advanced Engineering Mathematics", 9th Edition, Wiley Eastern limited, 2012
3. Srimanta Pal and Subidh C. Bhunia, "Advanced Engineering Mathematics", UK Edition, Oxford Press, 2015
4. H.K. Das, "Advanced Engineering Mathematics", 17th Edition, S, chand, 2008
5. Howard Anton and Christ Rorres "Elementary Linear Algebra with Applications", 5th edition, John Wiley 2012

Course Name: Physics for Biomedical Engineering

Course Code: BS20T

Category: Basic Science

Preamble:

Most of the engineering branches are being off spring of basic sciences where physics is playing a pivotal role in concept and understanding the foundation of core engineering branches. Physics prepares students to apply physics to tackle 21st century engineering challenges, and to apply engineering to address 21st century questions in physics.

The course will develop the student awareness in semiconductor devices and quantum Physics The student will develop an informed appreciation of the paradigm shift already in evidence in technologies behind modern services and products. He will possess basic physics knowledge to pursue simulation and modelling of the semiconductor systems.

Pre-requisites:

Nil

Course Objective:

- Identify and understand the fundamental physical principals underlying engineering devices and processes— a prerequisite to become successful engineers.
- To provide inclusive knowledge of fundamental physical principles encouraging engineering students to venture into the research field.
- To develop scientific temperament for scientific observations, recording, and inference drawing essential for technology studies.
- To give exposure to the topics of fundamental physics in semiconductor and Laser.

Course Outcomes:

Learner will be able to:

CO1: Understand the concept of thin film technology using interference and diffraction.

CO2: Understand the band theory of solids and the carrier concentration in solids

CO3: Analyse the charge distribution and charge transport processes in semiconductors

CO4: Apply the knowledge of Fermi level in semiconductors and applications of semiconductors in electronic devices

CO5: Understand different methods to generate ultrasonic waves

CO6: Illustrate the working principle of various lasers and quantum processes

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
2	-	2	-

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory	15	20	40	075

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

. Detailed Syllabus:

Module No.	Module Name	Module Contents	No. of Hours
01	Fundamentals of Optics	Interference by division of amplitude, Interference in thin film of constant thickness due to reflected and transmitted light; Wedge shaped film; Newton's rings. Diffraction: Fraunhofer diffraction at single slit, Diffraction Grating, resolving power of a grating; Determination of wavelength of light using plane transmission grating	5
02	Semiconductor Physics	Band theory of solids, Classification of semiconductors. Fermi-Dirac statistics, carrier concentration in semiconductors. Concept of Fermi energy level, its position and variation with temperature and impurity concentration.	5
03	Semiconductor Conductivity	Intrinsic carrier density, mobility, and conductivity. Carrier diffusion, drift, and resistance. Electrical conduction in extrinsic semiconductor. Diffusion length and mean lifetime. Hall Effect.	5
04	Semiconductor Devices	Physics of p-n junctions. Fermi level - in equilibrium, in forward and in reverse bias. Band bending in forward and reverse bias junction Introduction to two terminal devices – Rectifier diode, LED, Zener diode, PIN diode, Solar Cell, Schottky diode etc.	5
05	Physics of Sound	Ultrasonic Wave generation; Magnetostriction Oscillator; Piezoelectric Oscillator. Applications of ultrasonic: Eco sounding; NDT; ultrasonic cleaning(cavitation); ultrasonic	4

Module No.	Module Name	Module Contents	No. of Hours
		sensors; Industrial applications of ultrasonic (soldering, welding, cutting, drilling)	
06	Lasers	Radiation Matter Interactions, Einstein's coefficients. Basics of Laser- Population inversion, Pumping, Optical Resonator, Metastable state etc. Laser Beam Characteristics. Laser Systems - Ruby laser, He-Ne Laser, Semiconductor Laser, Nd-YAG Laser. Engineering applications of Laser.	4
07	Introduction to Quantum Physics	De Broglie hypothesis of matter waves; properties of matter waves. Physical interpretation of wave function Introduction to Schrodinger's equations	2
Total			30

Suggested Online Courses:

1. Physics of silicon solar cells Offered by École Polytechnique.
<https://www.coursera.org/learn/physics-silicon-solar-cells>
2. Semiconductor Physics Offered by University of Colorado Boulder
<https://www.coursera.org/learn/semiconductor-physics>

Text Books:

1. S.M. Sze, "Physics of Semiconductor Devices", John Wiley
2. B. Streetman, and S. Banerjee "Solid State Electronics", Prentice Hall India, 2006
3. R.P. Feynman, "The Feynman Lectures on Physics (Vol. 1-3)", Narosa 2008
4. I.S. Tyagi, "Principles of Quantum Mechanics", Pearson Education 2013
5. D.J. Griffiths, "Introduction to Quantum Mechanics", Pearson
6. R Shankar, "Principles of Quantum Mechanics", second edition.
7. Brij Lal and Subramaniam "Optics", S. Chand.

Reference Books / Articles

1. <http://dsc.discovery.com/tv-shows/curiosity/topics/10-ways-quantum-physics-will-change-world.htm>
2. <http://dsc.discovery.com/tv-shows/curiosity/topics/10-real-world-applications-of-quantum-mechanics.htm>
3. Leonard I. Schiff, "Quantum Mechanics", McGraw Hill/ Asia, Edition 3

Course Name: Physics for Biomedical Engineering Lab

Course Code: BS20P

Category: Basic Science

Preamble:

Most of the engineering branches are being offspring of basic sciences where physics plays a pivotal role in concept and understanding the foundation of core engineering branches. Physics prepares students to apply physics to tackle 21st century engineering challenges, and to apply engineering to address 21st century questions in physics.

Course Objectives:

- The course will develop the student awareness in semiconductor devices and quantum Physics
- The student will develop an informed appreciation of the paradigm shift already in evidence in technologies behind modern services and products.
- He will possess basic physics knowledge to pursue simulation and modelling of semiconductor systems.

Pre-requisites:

Nil

Course Outcome:

The students will be able to:

CO1: Understand the measurement techniques and usage of instruments in physics

CO2: Demonstrate competency and understanding of the basic concepts found in experimental Physics.

CO3: Construct and analyze the electronic circuits and computer programs

CO4: Estimate the error in measurements and the ability to prepare a valid laboratory record

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
-	2	-	1

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Practical	25	-	25	050

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Suggested List of Experiments

1. Half Wave Rectifier
2. Full Wave Rectifier
3. Electric Motor
4. Transformer
5. Transistor as a switch
6. Transistor in CB and CE mode
7. Energy Band of a Semiconductor
8. Hall Effect
9. Light Emitting Diode
10. Solar Cell
11. Zener Diode
12. PN-junction diode
13. Wavelength of LASER using grating
14. Divergence of LASER beam
15. Groove depth of CD using LASER
16. Determination of diameter of wire/hair or thickness of paper using Wedge shape film method.
17. Determination of refractive index of water using Newton's Ring.

Guidelines to conduct practical sessions:

1. The Laboratory work is to be conducted by a group of three-five students.
2. To encourage project-based learning in the curriculum students may either select one of the mini project topics from the list given or a topic of their choice after a review process by the subject faculty.
3. Each group along with subject faculty shall identify a potential area of mini project selected, on which the study can be conducted. They can perform the real or virtual experiments related to the topic selected in the laboratory along with regular experiments.
4. Students should prepare working model, power point presentation, posters etc. on the selected topics.
5. Project assessment will be done at the end of the semester.

Suggested List of Mini Projects/PBL (to name few):

1. Electric motor
2. Astable Multivibrator
3. Mini washing machine
4. Half wave and Full wave rectifier.
5. Build an electric Transformer.
6. Making Hologram
7. Zener diode as a voltage regulator
8. Cell phone charger using solar cell

Recommended Online Courses:

<https://vlab.amrita.edu/?sub=1&brch=282&sim=1512&cnt=1>

<https://vlab.amrita.edu/?sub=1&brch=282&sim=879&cnt=1>

<https://vlab.amrita.edu/index.php?sub=1&brch=189&sim=343&cnt=1>

<https://bop-iitk.vlabs.ac.in/basics-of-physics/List%20of%20experiments.html>

https://virtuallabs.merlot.org/vl_physics.html

<https://phet.colorado.edu>

<https://www.myphysicslab.com>

Reference Books / Articles

1. Applied Physics Lab Manual by Anoop Sing Yadav

Course Name: Structured Programming

Course Code: ES04T

Category: Engineering Science

Preamble:

To provide exposure to problem-solving by developing an algorithm, flowchart and implement the logic using C programming language.

Pre-requisites:

Nil

Course Objectives:

1. The course aims to provide exposure to problem solving through programming
2. It aims to train students the basic concepts of C programming language
3. The course involves a lab component to give students hands on experience with the concepts
4. It aims to provide exposure to handling data through files

Course Outcomes:

Learner will be able to:

CO1: Understand the fundamentals of a programming language.

CO2: Apply the control structures for code optimization and hence improving efficiency.

CO3: Decompose a problem and solve it using modular programming.

CO4: Demonstrate the use of derived and user derived data types for collection and processing of data.

CO5: Understand the concept of pointers and files to solve the problems related to dynamic and persistent data.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
2	-	2	-

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory	15	20	40	075

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of

the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	Fundamentals of C	Character Set, Identifiers and Keywords, Data Types, Constants and Variables Operators, Math Library Functions, Expressions, Pre-processor Directives	4
2	Input and Output	Unformatted and Formatted I/O Function scanf() Function printf() Concept of Field width, Precision and Flags Basic Programs Based on Computation	2
3	Control Structures	Conditional Branching - if, if-else statement, nested if-else, and switch-case statement. Looping – for loop, while and do-while loop, nested loops Unconditional Branching – break and continue statement	6
4	Functions	Introduction of Functions Declaration and definition of a Function Calling a Function and passing arguments to a Function Concept of Global and Local Variables Storage Classes –Auto , Extern , Static, Register Recursion	6
5	Arrays, Strings and Structures	Array-Concepts, Declaration, Definition, Accessing array element, One-dimensional and Multidimensional array. String- Basic of String, Array of String , Functions in string. h Structure- Declaration, Initialization, Nested structure, Operation on structures, Array of Structure.	6
6	Pointers and Files	Pointer: Pointer Variables, Reference and Dereference Operators, void Pointer, Call by Reference, Pointer Arithmetic, Pointer to Pointer, Pointers and Array, Passing Arrays to Function, Array of Pointers and Dynamic Memory Allocation. Files: Types of File, File operation- Opening, Closing, Creating, Reading, Processing File.	6
Total			30

Text Books:

1. K. R. Venugopal and Sudeep Prasad, "Mastering C", Tata McGraw Hill.
2. Behrouz Forouzan "A Computer Science –Structure Programming Approaches using C", Cengage Learning.
3. Byron S. Gottfried, Schaum's outlines "Programming with C"- Tata McGraw Hill.

Reference Books:

1. M. G. Venkateshmurthy, "Programming Techniques through C", Pearson Publication.
2. E. Balaguruswamy, "Programming in ANSI C", Tata McGraw- Hill Education.
3. Pradeep Day and Manas Gosh "Programming in C", Oxford University Press
4. Yashwant Kanetkar "Let Us C", BPB Publication

Course Name: Structured Programming Lab

Course Code: ES04P

Category: Engineering Science

Preamble:

To provide exposure to problem-solving by developing an algorithm, flowchart and implement the logic using C programming language.

Pre-requisites:

Nil

Course Objectives:

- Impart hands on experience with c programming
- Introduce various programming platforms like TurboC, CodeBlocks, Visual Studio
- Train the students towards developing solutions for real world problems using procedure oriented methodology

Course Outcomes:

Learner will be able to:

CO1: Demonstrate the use of datatypes and operators supported by C

CO2: Demonstrate the use of decision making and looping constructs

CO3: Decompose a problem and solve it using functions.

CO4: Develop application to handle large data using arrays and structure

CO5: Demonstrate use of pointers and files

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
-	2	-	1

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Practical	25	-	25	050

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Suggested List of Practicals:

Sr.no.	Suggested Topic(s)	No. of experiments
1	Computation Based Programs	1
2	Programs using if .. else and nested if .. else	2
3	Programs using switch case	2
4	Programs using for loop	3
5	Programs using while loop	2
6	Programs on Functions	2
7	Programs on Recursion	2
8	Programs using 1D and 2D Arrays	3
9	Programs using Strings	2
10	Programs on Structures	2
11	Programs using Call by Reference	1
12	Programs using Dynamic Memory Allocation	1
13	Programs on Files	2

Suggested List of Assignments:

1. Assignment on tokens
2. Assignment on decision making statements
3. Assignment on looping statements
4. Assignment on arrays
5. Assignment on functions
6. Assignment on structure
7. Assignment on file and pointers

Suggested List of Value-Added Home Assignments:

Practicing problem solving using c on online coding challenge platforms like HackerRank, TopCoder

Suggested Online Courses:

1. Online course on Coursera : <https://www.coursera.org/specializations/c-programming>
2. Online course on Edx : https://www.edx.org/course/c-programming-getting-started?index=product&queryID=e2368608f2fb78f99be968cfde1b511f&position=1&v=2&linked_from=autocomplete&c=autocomplete

Text Books:

1. K. R. Venugopal and Sudeep Prasad, "Mastering C", Tata McGraw Hill.
2. Byron S. Gottfried, "Schaum's outlines Programming with C", Tata McGraw Hill.

Reference Books:

1. M. G. Venkateshmurthy, "Programming Techniques through C", Pearson Publication.
2. E. Balaguruswamy, "Programming in ANSI C", Tata McGraw Hill Education.

Yashwant Kanetkar, "Let Us C", BPB Publication

Course Name: Basic Electrical Engineering

Course Code: ES08T

Category: Engineering Sciences

Preamble:

This course introduces learners to basic techniques for electrical circuit analysis.

Pre-requisites:

Nil

Course Objectives:

- To enable learners to gain understanding of the D.C circuit analysis and different network theorem
- To facilitate learners in developing the skills analysing single and three phase AC circuits.
- To create awareness of single-phase transformer working.
- To introduce electrical machines applications.

Course Outcomes:

Learner will be able to

CO1: Evaluate DC circuits using different network theorems.

CO2: Evaluate 1- Φ circuit and 3- Φ AC circuits.

CO2: Illustrate the constructional features and operation of 1- Φ transformer.

CO4: Understand different types of DC and AC motors.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
2	-	2	-

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory	15	20	40	075

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	DC Circuits (Only Independent Sources)	Kirchhoff's Laws, Ideal and practical voltage and current Sources, Source Transformation, Star-Delta / Delta-Star Transformations, Mesh and Nodal Analysis, Superposition Theorem Thevenin's Theorem, Norton's Theorem and Maximum Power Transfer Theorem.	10
2	AC Circuits	AC Circuits: Generation of alternating voltage, basic definitions, average and R.M.S. values, phasor and phase difference, sums on phasors. Single-phase ac series and parallel circuits consisting of R, L, C, RL, RC, RLC combinations, definitions -real, reactive and apparent power, admittance (Y), Series and parallel resonance, Q factor	8
3	Three Phase AC circuits	Generation of Three-Phase Voltages, voltage & current relationships in Star and Delta Connections, Power Measurement	3
4	Single Phase Transformer	Working principle, EMF equation, Transformer losses, Comparison between Actual (practical) and ideal transformer, Performance parameters, Phasor diagram	5
5	Motors and applications	DC motors, AC motors, Servo motors, Stepper motors, BLDC and their applications.	4
Total			30

Text Books:

1. V. N. Mittal and Arvind Mittal "Basic Electrical Engineering" Tata McGraw Hill, (Revised Edition)
2. Vincent Del Toro "Electrical Engineering Fundamentals", PHI Second edition, 2011
3. Edward Hughes "Hughes Electrical and Electronic Technology", Pearson Education (Tenth edition)
4. D P Kothari and I J Nagrath "Theory and Problems of Basic Electrical Engineering", PHI 13th edition 2011.
5. M. Naidu, S. Kamakshiah "Introduction to Electrical Engineering" McGraw-Hill Education, 2004
6. B.R Patil "Basic Electrical Engineering" Oxford Higher Education, Revised Second Edition, 2018

Reference Books:

1. B.L.Theraja "Electrical Engineering " Vol-I and II.
2. S.N.Singh, "Basic Electrical Engineering" PHI , 2011Book

Course Name: Basic Electrical Engineering Lab

Course Code: ES08P

Category: Engineering Sciences

Preamble:

This course introduces learners to basic techniques for electrical circuit analysis.

Pre-requisites:

Current Electricity, Electromagnetic Induction, Electromagnetism.
Complex numbers and Matrices

Course Objectives:

- To enable learners to gain hands on experimentation of the D.C circuit analysis and different network theorem.
- To facilitate learners in practically analyzing single and three phase AC circuits.
- To make learners experiment with single-phase transformer.
- To design electrical machines applications.

Course Outcomes:

Learner will be able to

CO1: Illustrate the behavior of DC circuits using network theorems.

CO2: Demonstrate the working of single-phase AC circuits

CO2: Show the voltage current relationships three phase AC circuits

CO4: . Illustrate the performance of single-phase transformer and machines.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
-	2	-	1

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Practical	25	-	25	050

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Suggested List of Practicals:

1. To measure output voltage across load resistor/current through load resistor and verify the result using Mesh and Nodal analysis.
2. To verify of Superposition Theorem.
3. To verify Thevenin's Theorem.
4. To verify Norton's Theorem.
5. To verify Maximum Power Transfer Theorem.
6. To find the resistance and inductance of a coil connected in series with a pure resistance
7. To find resonance conditions in a R-L-C series resonance circuit
8. To show relationship between phase and line, currents and voltages in three phase system (star & delta)
9. To measure Power and phase in three phase system by two wattmeter method.
10. To find the equivalent circuit parameters by conducting OC and SC test on single phase transformer

Suggested List of Mini project:

Simple applications using Electric motor.

Text Books:

1. V. N. Mittal and Arvind Mittal "Basic Electrical Engineering" Tata McGraw Hill, (Revised Edition)
2. Vincent Del Toro "Electrical Engineering Fundamentals", PHI Second edition, 2011
3. Edward Hughes "Hughes Electrical and Electronic Technology", Pearson Education (Tenth edition)
4. D P Kothari and I J Nagrath "Theory and Problems of Basic Electrical Engineering", PHI 13th edition 2011.
5. M. Naidu, S. Kamakshiah "Introduction to Electrical Engineering" McGraw-Hill Education, 2004
6. B.R Patil "Basic Electrical Engineering" Oxford Higher Education, Revised Second Edition, 2018

Reference Books:

1. B.L.Theraja "Electrical Engineering " Vol-I and II.
2. S.N.Singh, "Basic Electrical Engineering" PHI , 2011Book

Course Name: Engineering Mechanics

Course Code: ES02T

Category: Engineering Science

Preamble:

To improve the skill sets to understand forces and motions associated with particles and rigid bodies. This course also imparts and inculcate students to understand force system and its effects.

Pre-requisites:

Nil

Course Outcomes:

Learner will be able to:

CO1: Ability to understand and analyse forces, force systems and equilibrium.

CO2: Understand and verify law of Moments.

CO3: Determine the centroid of plane lamina.

CO4: Evaluate co-efficient of friction between the different surfaces in contact.

CO5: Understand and apply basic concepts of Kinematics of particles and kinematics of rigid bodies.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
2	-	2	-

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory	15	20	40	075

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No.	Module name	Content	No. of Hours
1	System of Coplanar Forces	Introduction to Force and Force systems (Concurrent, Parallel and General coplanar force system), resolution composition and resultant of force systems. Principle of transmissibility of a force, Moment of force about a point, Couples, Varignon's Theorem. Force couple system.	6
2	Centroid	First moment of Area, Centroid of Regular composite plane Laminae	4
3	Equilibrium	Equilibrium of rigid beams: Free body diagrams. Conditions of equilibrium. Types of supports & types of loads. Determination of supports reactions for different types of loads on the beams.	5
4	Friction	Coefficient of static and dynamic friction, Laws of friction, Angle of Friction, Angle of Repose. Concept of Cone of friction. Equilibrium of bodies on horizontal & inclined plane.	4
5	Kinematics of Particle	Uniformly accelerated motion along straight line, motion under gravity, Projectile Motion.	7
6	Kinematics of Rigid Bodies	Introduction to different types of motion a Rigid body performs viz. Translation, Rotation and General Plane motion. Concept of Instantaneous Centre of rotation (ICR) for the finding velocity. Locating ICR for multiple link mechanism. Velocity analysis of rigid body using ICR.	4
Total			30

Text Books:

1. A K Tayal, "Engineering Mechanics", 14th edition, Umesh Publication, 2010
2. K L Kumar, "Engineering Mechanics", 3rd edition, Tata McGraw-Hill, 2011
3. R. S. Khurmi, "Engineering Mechanics", 21st edition, S. Chand Publication, 2018

Reference Books:

1. R. C. Hibbeler, "Engineering Mechanics", 14th edition, Pearson Publication, 2020
2. Beer & Johnston, "Engineering Mechanics", 12th edition, Tata McGraw-Hill Education, 2019
3. F. L. Singer, "Engineering Mechanics", 2nd edition, Harper & Row Publication, 1975
4. W. G. McLean & E. W. Nelson, "Engineering Mechanics", 12th edition, Tata McGraw-Hill Education, 2020
5. J. L. Meriam and L. G. Kraige, "Engineering Mechanics (Statics)", 7th edition, Wiley Books, 2011

Course Name: Engineering Mechanics Lab

Course Code: ES02P

Category: Engineering Science

Preamble:

This course introduces the basic concepts of forces and centroids and techniques of finding their effects on rigid body. It introduces the phenomenon of friction and its effects. It introduces students to cognitive learning in applied mechanics and develops problem-solving skills in both theoretical and engineering oriented problems. After completing this course students can deal with the forces and motions associated with particles and rigid bodies.

Pre-requisites:

Nil

Course Outcome:

Learner will be able to:

CO1: Verify equations of equilibrium of coplanar force system.

CO2: Verify law of Moments.

CO3: Determine the centroid of plane lamina.

CO4: Evaluate co-efficient of friction between the different surfaces in contact.

CO5: Understand and be able to apply basic dynamic concepts of Kinematics of particles and rigid bodies.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
-	2	-	1

Examination Scheme:

ISA	MSE	End Sem Exam	Total
25	-	25	50

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

List of Experiments:

Sr. No.	Experiment Hours in Practical Session	Hours
1	Verification of principle of moment /Bell crank Lever - By using simulation software	02
2	Determination of support reactions of simply supported beam - By using simulation software	02

Sr. No.	Experiment Hours in Practical Session	Hours
3	Determination of coefficient of friction using inclined plane method - By using simulation software.	02
4	Projectile Motion - By using simulation software	02
5	Verification of Law of Polygon of Coplanar Concurrent Forces - By using simulation software	02
6	Determine the Centroid of plane lamina - By using simulation software	02
7	Determination of coefficient of kinetic friction using D-Alembert Principle - By using simulation software	02
8	Determination of Stiffness of Spring	02
9	Verification of Law of Polygon of Coplanar Non-Concurrent & Non-Parallel Forces - By using simulation software	02
10	Motion Curves - By using simulation software	02

List of Assignments:

Sr. No.	Assignment Hours in Practical Session	Hours
1	Resultant of coplanar Forces	02
2	Centroid	02
3	Equilibrium	02
4	Friction	02
5	Kinematics of Particle	02
6	Kinematics of Rigid Bodies	02

References:

1. Engineering Mechanics by R. C.Hibbeler.
2. Engineering Mechanics by Beer &Johnston, Tata McGrawHill
3. Engineering Mechanics by F. L. Singer, Harper& RawPublication
4. Engineering Mechanics by Macklin & Nelson, Tata McGrawHill
5. Engineering Mechanics by ShaumSeries
6. Engineering Mechanics (Statics) by Meriam and Kraige, WileyBools
7. Engineering Mechanics (Dynamics) by Meriam and Kraige, WileyBools

Detailed Syllabus of First Year Semester-II

Course Name: Professional Skills

Course Code: HS02T

Category: Humanities, Social Sciences and Management Courses

Preamble:

The course will groom learners in the areas of developing professional etiquettes, building digital profiles, imbibing workplace ethics, and organizational behavior. This course will also be an essential guide in building business communication and soft skills concepts.

Pre-requisites:

Nil

Course Objectives:

- To introduce the concepts of the job application process and digital profile building.
- To create awareness of professional etiquettes and corporate culture in tune with 21st Century soft skills.
- To enable learners to enrich their personality through self-awareness and SWOT analysis and understand various interpersonal skills required for the workplace.
- To build the foundations of professional ethics and corporate social responsibility among learners.

Course Outcomes:

Learner will be able to:

CO1: Apply the traits of a suitable candidate for a job/higher education, upon being trained in the techniques of holding a group discussion, facing interviews and writing resume.

CO2: Acquire basic proficiency in building a digital profile by demonstrating an awareness of professional and ethical responsibilities.

CO3: Understand the nuances of professional etiquettes and professionalism.

CO4: Enrich their personality through SWOT analysis, identify their personality traits and learning styles

CO5: Develop interpersonal skills to build effective professional relations.

CO6: Demonstrate awareness of contemporary issues, knowledge of ethical responsibilities and CSR.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
2	-	2	-

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory	15	20	40	075

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	Employment Skills	Job Application & Resume Writing Group Discussion Interview Skills Digital Profile Building (ePortfolio, LinkedIn)	10
2	Professional Etiquettes	Corporate Grooming and Workplace Etiquette Telephone Etiquette Netiquettes Digital Footprints, Social Media, Personal Profile Privacy	4
3	Interpersonal Skills	Assertiveness, Negotiation Leadership, Team Building Problem Solving, Decision Making Cultural and Emotional Intelligence	6
4	Ethics	Introduction to Ethics Plagiarism and Online Plagiarism Checker Patents Trademark and Copyrights and GI – Geographical Indicators Professional Ethics Corporate Social Responsibility (CSR) Information Confidentiality	4
5	Personality Enrichment	SWOT Analysis and JOHARI window Developing Positive Attitude Personality Types and Learning Styles Vision and Goal Setting Stress Management and Time Management	4
6	21 st Century Skills	Creative Thinking Critical Thinking Collaboration and Communication	2
Total			30

Suggested list of Assignments:

1. Draft a Cover Letter and a Resume in response to a job vacancy advertisement (Individual)
2. Role plays and documentation on Professional Etiquettes (Group)
3. Role Play and documentation on Interpersonal Skills (Group)
4. Analysis of case studies on Ethics (Individual)
5. SWOT Analysis (Individual)
6. Assignment on 21st Century Skills Group)

Suggested list of Online Courses:

1. LinkedIn Mastery: Creating an awesome profile - <https://www.udemy.com/course/linkedin-mastery-creating-an-awesome-profile/>
2. Soft Skills: The 11 Essential Career Soft Skills - <https://www.udemy.com/course/soft-skills-the-11-essential-career-soft-skills/>
3. Understanding Personality Types at Work - <https://www.udemy.com/course/understanding-personality-types-at-work/>
4. Speak English Professionally: In Person, Online & On the Phone - <https://www.coursera.org/learn/speak-english-professionally>
5. How to Write a Resume (Project Centered Course) <https://www.coursera.org/learn/how-to-write-a-resume>
6. Interviewing and Resume Writing in English Specialization <https://www.coursera.org/specializations/english-interview-resume>
7. Build Your Professional ePortfolio in English - <https://www.coursera.org/learn/eportfolio-english>

Reference Books:

1. Wallace and Masters, "Personal Development for Life and Work", Thomson Learning, 2021.
2. Dr. K.Alex, "Soft Skills", S. Chand and company, 2014.
3. Robbins Stephens, "Organizational Behaviour", Pearson Education, 2016.
4. Dorch, Patricia, "What Are Soft Skills?", Executive Dress Publisher, NewYork, 2013.
5. Francis Peter, "Soft Skills and Professional Communication", Tata McGraw Hill, 2019.
6. Kitty O Locker, "Business Communication- Building Critical Skills", McGraw Hill, Sixth Edition.
7. Chaturvedi and Chaturvedi, "Business Communication - Concepts Cases and Applications", Pearson, 2021.
8. Jones, "How to Speak Fluently", Indian Publishing House, 2021.

Course Name: Professional Skills Lab

Course Code: HS02P

Category: Humanities, Social Sciences and Management

Preamble:

The course, Professional Skills for the Workplace, will groom students in the areas of developing professional etiquettes, building digital profiles, imbibing workplace ethics, and organizational behaviour. This course will also be an essential guide in building business communication and soft skills concepts.

Pre-requisites:

Nil

Course Objectives:

Student will be able to:

- Apply the traits of a suitable candidate for a job/higher education, upon being trained in the techniques of holding a group discussion, facing interviews, and writing resume.
- Acquire basic proficiency in building a digital profile on LinkedIn, etc. and demonstrate an awareness of professional etiquettes through role play.
- Develop interpersonal skills to build effective professional relations by participating in seminars and quizzes.
- Demonstrate awareness of contemporary issues, knowledge of ethical responsibilities and CSR through case studies.
- Enrich their personality through SWOT analysis, identify their personality traits and learning styles through diagnostic tests.
- Demonstrate awareness of 21st century skills through poster presentation and discussions.

Course Outcome:

Student will be able to:

CO1: Observe and participate in Group Discussions and Mock Interviews on the lines of campus placement training.

CO2: Build a digital profile by demonstrating awareness of a professional persona.

CO3: Identify various interpersonal skills through participation in presentations and role play.

CO4: Differentiate between ethical and non-ethical behaviour through analysis of case studies.

CO5: Identify their personality traits and learning styles through activities like SWOT analysis.

CO6: Demonstrate awareness of 4 C's relevant to 21st Century Skills.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
-	2	-	1

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Practical	25	-	25	050

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Suggested list of Practicals:

1. Icebreakers – Introducing others
2. GD Practice Session 01
3. GD Practice Session 02
4. Final GD – ISA
5. Mock Interviews
6. Digital Profiling/ E-portfolio
7. Role Play on Professional Etiquettes
8. Quizzes on interpersonal skills
9. Case Studies on Ethics
10. Personality Enrichment – SWOT Analysis, JOHARI Window
11. Personality Enrichment - Identifying self-learning styles, MBTI test
12. Poster Presentation/Other activities on 21st Century Skills

Course Name: Engineering Mathematics-II

Course Code: BS04

Category: Basic Science

Preamble:

The objective of the course is to develop the basic Mathematical skills of engineering learners that are imperative for effective understanding of engineering subjects. The topics introduced will serve as basic tools for specialized studies in many fields of engineering and technology, impart fundamental knowledge of Differential Equations of First Order, Higher Order, Special functions like Beta and Gamma Function, Double and Triple Integration, DUIS, Rectification, Numerical solutions of Differential Equations and Numerical Integration.

Pre-requisites:

Fundamentals of Integration and Differential Equations.

Course Objective:

- To recall and remember basics of differential equations, integral Calculus
- To apply methods to solve engineering problems.
- To solve and evaluate the problems using Multiple Integration, Numerical Integration.
- To analyze problems based on Numerical Methods for solving differential Equations

Course Outcomes:

Learner will be able to:

CO1: Illustrate the concept of Exact Differential equation and solution of various types of First Order First Degree Differential Equations.

CO2: Illustrate the concept of Complementary Function and Particular Integral and solution of Linear Differential Equations with constant coefficients.

CO3: Illustrate the concepts of Beta, Gamma function and DUIS .

CO4: Illustrate the concept of Double Integral in Cartesian and Polar form, change the order of Integration, Evaluate Double Integral over a given region.

CO5: Illustrate the concept of changing to polar coordinates in double integrals. Application of double integrals to compute Area, Evaluation of Triple Integration.

CO6: Illustrate the concept of Numerical solution of Ordinary Differential Equation, and Numerical integration using various methods.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
3	-	3	-

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory	20	30	50	100
Practical	-	-	-	-

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	Differential Equations of First Order and First Degree	Exact differential Equations, Equations reducible to exact form by using integrating factors. Linear differential equations (Review), equation reducible to linear form, Bernoulli's equation	7
2	Linear Differential Equations with Constant Coefficients and Variable Coefficients of Higher Order	Linear Differential Equation with constant coefficient-complementary function, particular integrals of differential equation of the type $f(D)y = X$ where X is e^{ax} , $\sin(ax + b)$, $\cos(ax + b)$, x^m , m is positive integer, $e^{ax}V$, xV or X . Method of variation of parameters	8
3	Beta and Gamma Function and Differentiation under Integral Sign	Beta and Gamma functions and its properties. Differentiation under integral sign with constant limits of integration.	7
4	Multiple Integration-1	Double integration-definition, Evaluation of Double Integrals. (Cartesian & Polar), Evaluation of double integrals by changing the order of integration. Evaluation of integrals over the given region. (Cartesian & Polar)	8
5	Multiple Integration-2	Evaluation of double integrals by changing to polar coordinates. Application of double integrals to compute Area, Triple integration definition and evaluation (Cartesian, cylindrical and spherical polar coordinates).	8

Programme Scheme and Syllabus (2022) for First Year Bachelor of Technology (B.Tech.)
Biomedical Engineering

Module No.	Module Name	Content	No. of Hours
6	Numerical solution of ordinary differential equations of first order and first degree, and Numerical Integration	Numerical solution of ordinary differential equation using Euler's method and Runge-Kutta fourth order method Numerical integration-by Trapezoidal, Simpson's 1/3rd and Simpson's 3/8th rule .	7
Total			45

Text Books:

1. Ramana B.V., "Higher Engineering Mathematics", 12th edition, Tata McGraw Hill, 2017

Reference Books:

1. Dr. B.S. Grewal, "Higher Engineering Mathematics", 9th Edition, Khanna Publication, 2012
2. Erwin Kreyszig, "Advanced Engineering Mathematics", 9th Edition, Wiley Eastern limited, 2012
3. Srimanta Pal and Subidh C. Bhunia, "Advanced Engineering Mathematics", UK Edition, Oxford Press, 2015
4. H.K. Das, "Advanced Engineering Mathematics", 17th Edition, S. Chand, 2008
5. Howard Anton and Christ Rorres "Elementary Linear Algebra with Applications", 5th Edition, John Wiley 2012

Course Name: Engineering Chemistry

Course Code: BS16T

Category: Basic Science

Preamble:

This course imparts learners sound knowledge on the fundamentals of chemistry which can be applied in various courses and projects taken in Electronics and Computer Science, Electronics and Telecommunication and Biomedical Engineering.

Pre-requisites:

Basic Chemistry

Course Objectives:

1. The contents of this course will aid in quantification and understand the applications of several concepts in Chemistry.
2. To appreciate the need for and importance of engineering chemistry for industrial and domestic use.
3. To gain the knowledge on existing and future upcoming materials used in device fabrication.
4. To impart knowledge of green chemical technology and its applications.
5. To enhance the thinking capabilities in line with the modern trends in engineering and technology.

Course Outcomes:

Learner will be able to:

- CO1: Interpret properties, synthesis, and uses of important materials in various engineering applications.
CO2: Apply the fundamentals of electrochemistry in prevention & control measures related to corrosion of structures and devices.
CO3: Rationalise different types of batteries and their real-life engineering applications.
CO4: Analyse different spectroscopic techniques and study fundamentals of electromagnetic spectrum.
CO5: Associate Green Chemistry principles in product development knowledge.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
2	-	2	-

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory	15	20	40	075

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	Polymer Chemistry	Introduction to Polymer, Properties of Polymers- Molecular weight, numerical problems on molecular weight, Glass transition temperature Methods of polymerization, Synthesis, Properties and Uses of commercially important polymers, Study of Speciality polymers like Conducting polymers, Liquid Crystal Polymer etc., Applications of Polymers	6
2	Electrochemistry and Corrosion	Electrochemistry- Basics, Types of electrochemical cells, Electrochemical series and Galvanic series, Nernst equation, Numerical problems, Construction & Application of various electrodes Corrosion- Chemical and Electrochemical corrosion, Mechanism, Types- Differential aeration, Galvanic, Stress, Intergranular, Microbial, Soil corrosion etc., Prevention and control Measures, Case studies like- Corrosion in human body implants & Corrosion in electronic gadgets	6
3	Energy Storage systems	Fundamentals of Energy storage, primary cells and secondary cells, Types of Batteries, Construction and application of Li-Ion battery Fuel cells- principle, components of fuel cell, types of fuel cell, applications, advantages and disadvantages, hydrogen production and hydrogen storage system Numerical problems	4
4	Chemistry of Semiconductors	Silicon & Germanium - Physical and chemical properties, Isotopes, Chemistry of compounds like GaAs, GaP, InP. InGaAs, ZrO, HfO and applications in industry	3
5	Engineering Materials	Nanomaterials: Introduction, Graphene, Fullerenes, Carbon nanotubes, Electronic and Mechanical properties, Synthesis of CNT, Role of nano materials in electronics, Photonics, MEMS, Energy Nano-bio application	5

Module No.	Module Name	Content	No. of Hours
		Composite Materials: Types, properties, and industrial applications Shape Memory alloys: Principle, properties, super elasticity-One way and two-way shape memory effect, Austenite and martensite transformations, applications Smart Materials: Self-Assembled Nanostructures - Energy Harvesting Materials, Intelligent Materials – Magneto strictive Materials	
6	Spectroscopic techniques	Fundamentals of Spectroscopy, Electromagnetic spectrum, Different Forms of Spectroscopy, Beer-Lambert's law-Numerical problems, Techniques, Instrumentation and applications in Medicines and electronics	4
7	Green Chemistry	12 Principles of Green Chemistry & application in green computing & Green Electronics, Numerical problems	2
Total			30

Text Books:

1. Shashi Chawla, "A Textbook of Engineering Chemistry", Dhanpat Rai & Co. (PVT.) LTD., New Delhi (2004).
2. S. S. Dara, "Engineering Chemistry", Chand & Co, New Delhi (2006)
3. Jain and Jain, "Engineering Chemistry", Dhanpat Rai & Co (PVT.) LTD, New Delhi (2006).

Reference Books:

1. B.R. Puri and L.R. Sharma, "Principles of Physical Chemistry", 45th Edition, Vishal Publishing Co. 2012.
2. Peter Atkins, Physical Chemistry, XI th ed, Oxford, United Kingdom, Oxford University Press, 2017
3. Green Chemistry: A textbook- V. K. Ahluwalia, Alpha Science International
4. Concise Inorganic Chemistry – J. D. Lee
5. V.R.Gowariker, "Polymer Science", New Age International Publication
6. S.K.Kulkarni, "Introduction to Nanotechnology"
7. Fundamentals of Molecular Spectroscopy (4th edition)- C. N. Banwell, Elaine M. McCash, Tata McGraw Hill.
8. Elementary Organic Spectroscopy- Y.R. Sharma, S. Chand and Co.
9. William D. Callister, Materials Science and Engineering: An Introduction, Wiley
10. Mel Schwartz, Smart Materials, CRC Press New York, 2009
11. Dimitris C. Lagoudas, Shape Memory Alloys, Springer, New York, 2008
12. Micky Rakotondrabe, Smart Materials- Based Actuators at Micro/Nano-Scale, Springer

Course Name: Engineering Chemistry Lab

Course Code: BS16P

Category: Basic Science

Preamble:

This course imparts students sound knowledge on the fundamentals of chemistry which can be applied in various courses and projects taken in Electronics and Computer Science, Electronics and Telecommunication and Biomedical Engineering.

Pre-requisites:

Basic Chemistry

Course Objectives:

1. Students will develop and apply the appropriate lab skills.
2. The students will be able to apply chemical concepts to solve qualitative and quantitative problems in engineering.
3. Students will be able to present information in clear and effective manner. They will be able to work effectively in a diverse group to solve scientific problems.

Course Outcome:

The students will be able to:

CO1: Apply the knowledge of engineering materials into designing solutions to problems statements.

CO2: Analyse the principles of electrochemistry, in various applications like batteries, electroplating, electrolysis, etc.

CO3: Implement spectroscopy principles in qualitative and quantitative analysis of materials.

CO4: Relate the Green Chemistry principles in engineering projects, products.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
-	2	-	1

Examination Scheme:

ISE	MSE	ESE	Total
25	-	25	50

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the

course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Suggested List of Experiments

- To determine free acid pH of different solutions using pH meter
- To determine the Wavelength of Maximum Absorbance using colorimeter.
- To determine metal ion concentration using colorimeter.
- To determine Molecular weight of polymers by Oswald Viscometer.
- To synthesize UF, PF, Nylon 66.
- To synthesize biodegradable polymer.
- To determine Viscosity of oil by Redwood Viscometer
- To separate pigments using paper chromatography.
- To determine total, temporary, and permanent hardness of water sample by EDTA method.
- To construct the battery and measure potential difference across two terminals
- To identify the materials and learn their properties
- To set up a galvanic cell
- To set up an electrolytic cell and carry out electroplating
- To carry out etching of the Printed Circuit Board (PCB)
- To synthesize a nanomaterial and study its characterization
- To detect the adulteration in given milk sample
- Virtual experiment on Nanomaterial using open-source tool- www.nanohub.org
- Virtual experiments using open-source tool - <https://vlab.amrita.edu>

Suggested List of Mini Projects/PBL (to name few):

- Corn Ethanol: Using Corn to Make Fuel?
- Hydrogen Powered Cars: The Wave of the Future?
- Organic Chemistry and Your Cellphone: Organic Light-Emitting Diodes
- Biomaterials: materials that mimic nature
- Composite materials: steel-reinforced concrete, space shuttle thermal insulation tiles and lightweight carbon-fibre composites
- Batteries and fuel cells for electric vehicles
- Shape memory alloys

Recommended Online Courses:

1. Nanotechnology: A Maker's course offered by Duke University, North Carolina State University The University of North Carolina at Chapel Hill <https://www.coursera.org/learn/nanotechnology>
2. Fundamentals of Material Science offered by Shanghai Jiao Tong University <https://www.coursera.org/learn/fundamentals-of-materials-science>
3. Smart materials: Microscale and macroscale approaches offered by Peter the Great St. Petersburg Polytechnic University and Kazan National Research Technological University <https://www.coursera.org/learn/smart-materials-microscale-and-macroscale-approaches>

Course Name: Engineering Graphics

Course Code: ES01T

Category: Engineering Science

Preamble:

To improve the visualization skills of the students, with imparting the student's ability to read a drawing. This course also imparts and inculcate students to understand the theory of projection.

Pre-requisites: Basic Geometry

Course Outcomes:

Learner will be able to:

CO1: Understand conventional method and usage of CAD software.

CO2: Apply the basic principles of projections and visualization to communicate ideas graphically.

CO3: Construct the drawing of curves, points, straight lines, and planes using concept of projections.

CO4: Interpret the three-dimensional pictorial objects and represent in two-dimensional views.

CO5: Construct three dimensional shapes from two dimensional views using the concept of projections.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
2	-	2	-

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory	15	20	40	75

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	Introduction to Engineering Graphics and CAD	Introduction and importance of engineering graphics. Introduction of different types of the quadrants, method of projection, lines and dimensioning. Drawing instruments and their usage.	3

		Introduction Computer Aided Design and Drafting (CADD or CAD) software and operations, menu system and toolbars.	
2	Engineering Curve	Basic construction of cycloid, involutes, and helix of cylinder.	4
3	Projection of points, lines	Projections of lines, inclined to both the reference planes HP and VP as per the first angle projection method.	4
4	Projection of Planes	Projection of rectangular, triangular, square, pentagonal, hexagonal, and circular planes, inclined to both the reference planes HP and VP as per the first angle projection method.	4
5	Orthographic Projections	Drawing orthographic views from pictorial projections. Sectional orthographic Projections of a simple machine part as per the first angle projection method. - By drafting in the sketchbook as well as on CAD software. CAD Drawing: Applying dimensions to objects, applying annotations to drawings, setting up and use of layers, changing of the line properties, Printing setup and procedure. Different CAD Tools and usage- Draw tools, modify tools, properties, copy selection, dimensioning and editing (text height and arrow size).	9
6	Isometric Views	Drawing Isometric views from given views of simple blocks with plane, cylindrical surfaces, and circular holes. - By drafting in the sketchbook as well as on CAD software CAD Drawing: Switching to isometric drafting mode, switch /change to different ISO planes, ISO circles on different ISO planes, Different CAD Tools and usage- Draw tools, Modify tools, Properties of line.	6
Total			30

Text Books:

1. N.D. Bhatt, "Engineering Drawing (Plane and solid geometry)", 53rd Edition, Charotar Publishing House Pvt. Ltd., 2014
2. N.D. Bhatt & V.M. Panchal, "Machine Drawing", 50th edition, Charotar Publishing House Pvt. Ltd. 2014
3. Dhananjay A Jolhe, "Engineering Drawing" 1st edition, Tata McGraw Hill, 2017

Reference Books:

1. Prof. Sham Tickoo (Purdue University) & Gaurav Verma, "(CAD Soft Technologies): Auto CAD 2012 (For engineers and Designers)", Dreamtech Press New Delhi, 2012
2. "Learning AutoCAD", Autodesk Official Training Guide, 2009

Course Name: Engineering Graphics Lab

Course Code: ES01P

Category: Engineering Science

Preamble:

This course improves the visualization skills of the students, with imparting the student's ability to read a drawing. This course also imparts and inculcate students to understand the theory of projection.

Pre-requisites:

Nil

Course Objectives:

- To impart the knowledge of reading a drawing.
- To Use AutoCAD for daily working process.
- To teach basic utility of Computer Aided drafting (CAD) tool.

Course Outcome:

Student will be able to:

CO1: Apply the basic principles of projections in 2D drawings using a CAD software.

CO2: Create, Annotate, Edit and Plot drawings using basic AutoCAD commands and features.

CO3: Apply the concepts of layers to create drawing.

CO4: Apply basic AutoCAD skills to draw different views of a 3D object.

CO5: Apply basic AutoCAD skills to draw the isometric view from the given two views.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
-	2	-	1

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Practical	25	-	25	050

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Suggested List of Practicals:

Sr. No.	List of Practicals to be performed using AutoCAD
1	Draw: Types of the lines, circle, Polygons, dimensioning, and nameplate.
2	Draw: Bridge Rectifier Circuit
3	Draw: Projection of Planes
4	Draw: Orthographic Projection (without section)
5	Draw: Orthographic Projection (with section)
6	Problem Based Learning (PBL) /mini project on Orthographic Projections
7	Draw: Isometric Views
8	Problem Based Learning (PBL) /mini project on isometric views

Reference Books:

1. Narayana, K.L. & P Kannaiah (2008), Textbook on Engineering Drawing, Scitech Publisher.
2. Prof. Sham Tickoo (Purdue University) &GauravVerma, "(CAD Soft Technologies) : Auto CAD 2012 (For engineers and Designers)", Dreamtech Press NewDelhi.
3. Dhananjay A Jolhe, "Engineering Drawing" Tata McGraw Hill.
4. N.D. Bhatt, "Engineering Drawing (Plane and solid geometry)", Charotar Publishing House Pvt. Ltd.
5. N.D. Bhatt & V.M. Panchal, "Machine Drawing", Charotar Publishing House Pvt. Ltd.
6. Kendrol Phillips, "AutoCAD beginner's guide"

Course Name: Object Oriented Programming

Course Code: ES05T

Category: Engineering Science

Preamble:

The course aims to advance learners knowledge in problem solving and programming principles for real world applications through object-oriented programming using Java language. The course emphasizes data abstraction and object-oriented programming design through the implementation of classes, objects and related concept like Inheritance, Polymorphism, Exception Handling, Multithreading and Applets.

Pre-requisites:

Structured Programming (ES04T)

Course Objectives:

1. The course aims to provide exposure to problem solving through object oriented programming
2. It aims to train students the basic concepts of Java programming language
3. The course involves a lab component to give students hands on experience with OOP concepts
4. It aims to provide exposure to develop a web based application

Course Outcomes:

Learner will be able to:

CO1: Apply fundamental Programming Constructs.

CO2: Illustrate the concept of packages, classes, and objects.

CO3: Elaborate the concept of strings, arrays, and vectors.

CO4: Implement the concept of inheritance and interfaces.

CO5: Implement the notion of exception handling and multithreading.

CO6: Develop web based applications.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
2	-	2	-

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory	15	20	40	075

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	Introduction to Java	Features of Java, Platform Independence – Byte Code, JVM, JRE. Data Types Operators, Control Structures, Static Data, Static Function, 1D Array and 2D Array	5
2	Object Oriented Programming	Classes and Objects, Instance Variables, Constructors Object Passing Methods Method Overloading, Array of Objects	4
3	Inheritance	Concept and Types Constructors in Inheritance Method Overriding and Dynamic Method Dispatch, abstract and final keyword Interfaces – Concept and Significance Wrapper Classes – String, StringBuffer, Vector	8
4	Exception Handling	Concept of Exception, Types –Checked and Unchecked Use of throws keyword. try-catch-finally keywords. Throwing Exception manually User Defined Exceptions	5
5	Multithreaded Programming	Creating Thread – Different Methods Using Thread Methods, Thread Exceptions, Priorities Life Cycle of Thread Synchronization	5
6	Packages and Applets	Inbuilt Package, Importing Packages User Defined Packages, Naming Packages, Advantages of Packages Applet Basics, Applet Life Cycle Applet Drawing Methods,	5
Total			30

Text Books:

1. Herbert Schildt "JAVA: The Complete Reference", Oracle Press
2. Sachin Malhotra and Saurabh Chaudhary, "Programming in JAVA", Oxford University Press

Reference Books:

1. Ivor Horton "Beginning JAVA", Wiley, India
2. Dietal and Dietal "Java: How to program", Prentice Hall
3. Stevan Jolzner" JAVA Programming- Black Book", Dreamtech Press
4. Demics "Learn to Master Java Programming script", Staredu Solutions.

Course Name: Object Oriented Programming Lab

Course Code: ES05P

Category: Engineering Science

Preamble:

The course aims to advance learner's knowledge in problem solving and programming principles for real world applications through object-oriented programming using Java language. The course emphasizes data abstraction and object-oriented programming design through the implementation of classes, objects and related concepts like Inheritance, Polymorphism, Exception Handling, Multithreading and Applets.

Pre-requisites:

Structured Programming Lab (ES04P)

Course Objectives:

- Impart hands on experience with java programming using JDK
- Introduce programming platform like Eclipse, NetBeans, Visual Studio
- Train the students to write programs for solving real world problems using object oriented methodology
- Train the students to write web applications using applets in Java

Course Outcomes:

Learner will be able to:

CO1: Develop procedure oriented java applications using basic Programming Constructs and i/o.

CO2: Design java applications using class and objects

CO3: Demonstrate the use of predefined classes like String, Math, Scanner, Vector etc.

CO4: Develop java application to implement the concept of inheritance and interfaces.

CO5: Demonstrate the need and use of exception handling and multithreading.

CO6: Develop simple web-based applications using applets.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
-	2	-	1

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Practical	25	-	25	050

The assessment/evaluation guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to decide her/his assessment methodology based on the nature of the course. Faculty may propose the revised assessment methodology for his/her course.

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However, the revised assessment methodology shall be approved by a panel constituted at institute level and published to the learners before the commencement of the semester.

Suggested List of Practicals:

Sr.no.	Suggested Topic(s)	No. of experiments
1	Programs on Basic programming constructs like branching and looping	2
2	Program on accepting input through keyboard	2
3	Programs on class and objects	2
4	Program on method and constructor overloading.	2
5	Program on Packages	1
6	Program on String class	2
7	Program on String Buffer and Vectors.	2
8	Program on types of Inheritance.	1
9	Program on Multiple Inheritance. (interface)	1
10	Program on abstract class and abstract methods.	1
11	Program using super and final keyword.	1
12	Program on Exception handling.	2
13	Program on user defined exception.	1
14	Program on Multithreading.	2
15	Program on Graphics class.	1
16	Program on applet class.	1

Suggested List of Assignments:

1. Assignment on class and objects
2. Assignment on inheritance
3. Assignment on exception handling
4. Assignment on multithreading
5. Assignment on applets

Suggested List of Value-Added Home Assignments:

Practicing problem solving using Java on online coding challenge platforms like HackerRank, TopCoder

Suggested Online Courses:

1. Online course on Coursera : <https://www.coursera.org/specializations/object-oriented-programming>
2. Online course on Edx : https://www.edx.org/course/introduction-to-java-programming-starting-to-code?index=product&queryID=f7e6c0dd8a60ec2ad5fd69f3649948cb&position=1&v=2&linked_from=autocomplete&c=autocomplete

Text Books:

1. Herbert Schildt, "JAVA: The Complete Reference", Oracle Press
2. Sachin Malhotra and Saurabh Chaudhary, "Programming in JAVA", Oxford University Press

Reference Books:

1. Ivor Horton, "Beginning JAVA", Wiley, India
Vidyalankar Institute of Technology (An Autonomous Institute affiliated to University of Mumbai)

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2. Dietal and Dietal, "Java: How to program", Prentice Hall
3. Stevan Jolzner, "JAVA Programming- Black Book", Dreamtech Press
4. ScriptDemics, "Learn to Master Java Programming", Staredu Solutions.

Detailed Syllabus of General Education Courses

Course Name: Design Thinking

Course Code: GECI01

Category: General Education (Creativity and Innovation)

Preamble

Design thinking is a powerful tool for rethinking and revitalizing strategy—and for driving organizational performance. By placing customers' needs at the center of a product, service, process, or business model, you can reframe strategic challenges and develop more effective solutions. Drawing on right-brained creativity and left-brained analytics, the course on design thinking enables you to broaden your strategic perspective, find novel opportunities for innovation, and keep your business moving forward.

Pre-requisites:

NIL

Course Objectives:

- To provide knowledge on the concepts of Design Thinking
- To impart knowledge on the phases of Design Thinking
- To apply Design Thinking concepts

Course Outcomes:

Learner will be able to:

1. Understand the concepts of design thinking approaches
2. Create design thinking teams and conduct design thinking sessions
3. Apply both critical thinking and design thinking in parallel to solve problems
4. Apply design concept to their daily work

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Tutorial	Theory	Tutorial
2	1	2	1

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory + Tutorial	40	20	40	100

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of

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the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	Design Thinking Overview	What is different about design thinking, Design thinking skills, Design thinking mindset, Principles of Design thinking	2
2	General Approaches to Design Thinking	The basics of Design thinking, Design thinking frameworks, Design thinking team, Design thinking workshops and meeting – Characteristics and types	4
3	Design Thinking approach in stages	Apply design thinking framework, emphasize with customers/users, Define the problem, Ideate, Prototype, Test solution.	7
4	Design Thinking Techniques	Listening and emphasizing techniques – Engagement, Observation, showing empathy, Define and ideation techniques – Unpacking, Personas, Pattern recognition and connecting the dots, Prototype, and testing techniques – Types of prototypes, forms of testing in design thinking,	7
5	General Design Thinking Practices	Use of diagrams and maps in design thinking – empathy map, affinity diagram, mind map, journey map. Story telling techniques – Improvisation, scenarios, K-scripts	8
6	Adopt and Adapt Design thinking	Cautions and pitfalls – assumptions, pitfalls and cautions in design thinking workgroups, Best practises	2
Total			30

Reference Books:

1. Tim Brown "Change by Design - How Design Thinking Transforms Organisations and Inspires Innovations "
2. Larry J.Leifer, Michael Lewerick, and Patrick "The Design Thinking Toolbox: A Guide to Mastering the Most Popular and Valuable Innovation Methods"

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Course Name: Indian Constitution

Course Code: GEPS01

Category: General Education (Political Science)

Preamble:

This course introduces learners to the framework that demarcates fundamental political code, structure, procedures, powers, and duties of government institutions and sets out fundamental rights, directive principles, and the duties of citizens.

Pre-requisites:

NIL

Course Objective:

- To Understand what a constitution is and why it is necessary
- To Understand how constitution embodies certain ideals
- To understand the importance of fundamental rights as well as fundamental duties.
- To understand functioning of parliament

Course Outcomes:

Learner will be able to:

CO1: learner will be able to understand constitution principles

CO2: learner will be able to co-relate with political system

CO3: learner will be able to pursue the values of civic life

CO4: learner will be able to exercise their rights and duties

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
2	-	2	-

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory	25	-	50	075

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The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	Introduction	Historical background of constitution, Philosophy of constitution	3
		Citizenship at the commencement of the Constitution, Rights of citizenship of certain persons of Indian origin residing outside India, Persons voluntarily acquiring citizenship of a foreign State not to be citizens, Continuance of the rights of citizenship, Fundamental Duties	4
3	Fundamental Rights	Definition, Laws inconsistent with or in derogation of the fundamental rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Core issues (Uniform civil code, Article 370, Reservation)	4
4	Directive Principles of State Policy	Definition, Certain principles of policy to be followed by the State, Equal justice and free legal aid, Organisation of village panchayat, Right to work, to education and 10 public assistance in certain cases, Provision for just and humane conditions of work and maternity relief, Living wage, etc., for workers, Participation of worker; in management of industries, Uniform civil code for the citizens, Provision for free and compulsory education for children, Promotion of educational and economic interests of Scheduled Castes, Scheduled Tribes and other weaker sections, Protection and improvement of environment and safeguarding of forests and wild life, Protection of monuments and places and objects of national importance, Separation of judiciary from executive, Promotion of international peace and security	4
5	The Parliament	Constitution of Parliament, Composition of the Council of States, Composition of the House of the People, Duration of Houses of Parliament, Rights of Ministers and Attorney-General as respects Houses, Law making procedure, Amendment process and language	4
6	Judiciary	Establishment and Constitution of Supreme Court, High Courts for States, Subordinate Courts, Working of quasi – judicial bodies	4
7	Elections	Superintendence, direction and control of elections to be vested in an Election Commission, Power of Parliament to make provision with respect to elections to Legislatures, Power of Legislature of a State to make provision with respect to elections to such Legislature Bar to interference by Courts in electoral matters	4

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8	Landmark cases	Nanavati case, Shah Bano, Keshvanand Bharti, Vishakha Case etc	3
Total			30

Suggested Online Courses:

1. Constitutional Studies
https://onlinecourses.nptel.ac.in/noc20_lw03/preview
2. Constitution of India
<https://www.udemy.com/course/constitution-of-india/>

Reference Books:

1. D.C. Gupta – Indian Government and Politics
2. D.D. Basu – Introduction to the Constitution of India
3. P. M. Bakshi - The Constitution of India
4. M. V. Pylee - Constitutional History of India

Course Name: Universal Human Values

Course Code: GESB02

Category: General Education (Social and Behavioral Science)

Preamble:

The present education system has become largely skill-based. The prime emphasis is on science and technology. However, science and technology can only help to provide the means to achieve what is considered valuable in terms of facilities. Value Education is a crucial missing link in the present education system. Because of this deficiency, most of our efforts may prove to be counterproductive and serious crises at the individual, societal and environmental level are manifesting.

Values and skill complement each other. Values mean importance or participation and skills mean qualities, training, and capabilities. To fulfil our aspirations both values and skills are necessary. When we identify and set the right goals and produce in right direction, this is known as value domain, the domain of wisdom. Basically we must know what really is useful to achieve human happiness, the happiness to all and for all the time.

And when we learn and practices to actualize this goal to develop the techniques to make this happen in real life, in various dimensions of human Endeavour, this is known as domain of skills. Hence, there is an essential bonding between values and skills for the success of any human endeavour.

For a happy and successful life it is important to know, explore, verify and practice universal human values, professional ethics.

Course Objectives:

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

Course Outcomes:

Learner will be able to:

CO1: Learner will become more aware of themselves and their surroundings.

CO2: Learners will be more responsible in life and will able to handle critical problems.

CO3: Learners will develop better critical ability.

CO4: Learners will be more sensible towards commitment.

CO5: Learner will be able to apply human values in day to day life.

CO6: Learner will become a responsible citizen..

Programme Scheme and Syllabus(2022) for First Year Bachelor of Technology (B.Tech.)
Biomedical Engineering

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
2	-	2	-

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory	25	-	50	075

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	Introduction to Value Education	Need for Value Education, Basic Guidelines for Value Education, The Content of Value Education, The Process of Value Education, Starting to observe inside What is Self-exploration? What is its Purpose? Content of Self-exploration, Process of Self-exploration Natural Acceptance, What is the State today? What is the way out? What do we need to do?	5
2	The Basic Human Aspirations Continuous Happiness and Prosperity	Continuous Happiness and Prosperity Our Basic Aspirations Exploring Happiness and Prosperity A Look at the Prevailing Notions of Happiness and Prosperity, Some Possible Questions/Confusions Basic Requirements for Fulfilment of Human Aspirations What is our State today?, Why are we in this State? - Living with Wrong Assumptions, What is the Solution? The Need for Right Understanding Our Program: Understand and Live in Harmony at all Levels of Living , Our State today Our Natural Acceptance for Harmony at all Levels of our Living , Human and Animal Consciousness	5
3	Understanding the Human Being as Co-existence of Self ('I') and Body	Human Being is more than just the Body Understanding Myself as Co-existence of the Self and the Body ,Understanding Needs of the Self and Needs of the Body, Understanding the Activities in the Self and the Activities in the Body, Understanding the Self (I) as the Conscious Entity, the Body as the Material Entity Exercise on distinguishing Needs of the Self ('I') and Body	5

Programme Scheme and Syllabus(2022) for First Year Bachelor of Technology (B.Tech.)
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Module No.	Module Name	Content	No. of Hours
		<p>Exercise on Distinguishing Activities of the Self (I) and Body Understanding the Body as an Instrument of 'I' ('I' being the Seer, Doer and Enjoyer) Why should I study Myself?, Getting to know the Activities in the Self (I) How are the Activities in T Related! The Activities in 'I' are Continuous Effects of the Problem... What then is the Solution? Result of Realization and Understanding Living with Definiteness Our Body A Self-organized Unit Harmony of T with the Body: Sanyama and Svasthya What is our State today? What is the way out? Understanding and Living with Sayama Correct Appraisal of our physical needs</p>	
4	Harmony in the Family, Society,Nature-Understanding Values in Human Relationships	<p>Family as the Basic Unit of Human Interaction, Harmony in the Family.Justice (Nyaya),What is the State today? Values in Human Relationships,Trust (Visvasa) Respect (Sammāna) The Basis for Respect Assumed Bases for Respect Today The Problems due to Differentiation Difference between Attention' and 'Respect' What is the way out? Affection (Sneha) Care (Mamand) Guidance (Vatsalya) Reverence (Shraddha) Glory (Gaurava) Gratitude (Kritagayta) Love (Prema) Harmony from Family to World Family: Undivided Society Extending Relationship from Family to Society Identification of the Comprehensive Human Goal Where are we today? Programs Needed to Achieve the Comprehensive Human Goal: The Five Dimensions of Human Endeavour Education-Right Living (Siksha Sanskara) Health-Self-regulation (Svasthya-Sanyama) Justice-Preservation (Nyaya-Suraksha) Production-Work (Utpadana-Karya) Exchange-Storage (Vinimaya-Kosa) What is our State today? Harmony from Family Order to World Family Order: Universal Human Order The Four Orders in Nature Interconnectedness and Mutual Fulfilment (Parasparta aur Paraspara Purakata) Recyclability and Self-regulation in Nature Undertanding the Four Orders Things (Vastu) Activity (Kriya)</p>	5

Programme Scheme and Syllabus(2022) for First Year Bachelor of Technology (B.Tech.)
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Module No.	Module Name	Content	No. of Hours
		Innateness (Dharana) Natural Characteristic (Sabha) ,Basic Activity,Conformance Human Beings-our State today What is way out	
5	Implications of the Right Understanding	Values in Different Dimensions of Human Living Universal Values naturally emerging from the Right Understanding Definitiveness of Ethical Human Conduct Identification of Snama leading to Svatantrata and Swarajya Development of Human Consciousness Implications of Value-based Living Identification of Comprehensive Human Goal Vision for the Holistic Alternative Basis for Humanistic Education and Humanistic Constitution Universal Human Order and its Implications	5
6	Professional Ethics Journey towards the Holistic Alternative	Profession-In the Light of Comprehensive Human Goal Ensuring Competence in Professional Ethics- The current Scenario Inherent Contradictions and Dilemmas and their Resolution Appreciating the Need for Self-Exploration Facilitating the Understanding of Harmony at various Levels Steps for Evolution at the Individual Level Steps for Transition at the Level of Family Society and Profession Promoting Mass Awareness and moving towards Humanistic Education Evolving Holistic Models of Living Amending Policies, Programs and Social Systems in tune with Comprehensive Human Goal Is the Transition too Difficult? Concluding Remarks	5
Total			30

Reference Books:

- A Foundation course in Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria Excel books.

Course Name: Indian Traditional Knowledge System

Course Code: GESB03

Category: General Education (Social and Behavioral Science)

Preamble:

India has a vast tradition of Sanskrit texts dealing with various scientific thoughts. Number of treatises on the topics like Agriculture, Animal Husbandry, Chemistry, Astronomy, Mathematics, Botany, etc. focus on the development of thoughts in the concerned area.

This course aims at introducing a student with various treatises on physical as well as social sciences and their contribution to modern branches of sciences. Taking into consideration the vast scope of these sciences, major treatises will be introduced in the course thereby making a student to ponder over the ancient knowledge systems of India.

Pre-requisites:

NIL

Course Outcomes:

- To facilitate the learners with the concepts of Indian traditional knowledge and to make them understand the importance of roots of knowledge system.
- It aims at imparting basic principles of thought process, reasoning and inference

Course Outcomes:

Learner will be able to:

CO1: Understand and the rich history of Indian knowledge system

CO2: Understand the different areas of contribution from India.

CO3: Apply the different principals of traditional knowledge in modern systems.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
2	-	2	-

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory	25	-	50	075

Programme Scheme and Syllabus(2022) for First Year Bachelor of Technology (B.Tech.)
Biomedical Engineering

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	Review of Scientific Literature in Sanskrit	References of sciences/scientific knowledge through different textual sources etc.	6
2	Chemistry and Mathematics	Various treatises on Chemistry, Use of chemistry in medicines, Metallurgy, Use of chemistry for occult practices, Mathematical concepts through Shulbasutras, Development of different mathematical branches and treatises based on that, Development of astronomy, etc.	15
3	Dietetics	Study of different texts based on culinary art Nalapakadarpana, Bhojanakutuhalam, Supashastra, Modes of preservation of food, Dietary guidelines through branches of Ayurveda, Food and diseases, etc.	5
4	Agriculture, Astronomy, and Zoology	Study of krishisuktas, Krishiparashara, Brihatsamhita, Types of crops, Manures, Types of land- devamatraka, nadimatraka, Indian Astronomy, Use of animals in warfare, Animal husbandry, Animals for medicines, etc.	4
Total			30

Reference Books:

1. Nirmal Trikha "Scientific Knowledge in Sanskrit Literature"
2. S. Balachandra Rao "Indian Astronomy: An Introduction"
3. B. Seal "Ancient Indian Sciences"
4. Melissa Stewart "Science in Ancient India (Science of the Past)"
5. India's Contribution to World Culture – SudheerBirodkar
6. Ancient India – R. C. Majumdar
7. Ancient Indian Sciences – Swami ChidatmanJee Maharaj
8. Nalini sadhale, H. V. Balkundi and Y.L.Nene "KrishiParashara – Agriculture by Parashara " Asian Agri-History Foundation
9. Stella Kramrisch "The Art of India through the Ages"
10. K.Krishna Murthy "Early Indian Secular Architecture"
11. Raman Sukumar "The Asian Elephant: Ecology and Management" Cambridge University Press

Programme Scheme and Syllabus(2022) for First Year Bachelor of Technology (B.Tech.)
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Course Name: Voice Culture for Professional Speaking

Course Code: GEA01

Category: General Education (Arts)

Preamble:

Wide platter of General Education courses are offered to First Year Engineering students with an aim to focus on holistic personality development These courses will also help to create balance in brain hemispheres and thereby improve learners' clarity in thoughts and responses.

Pre-requisites:

NIL

Course Objectives:

- To develop the intellectual skills and competencies necessary to participate effectively in society and the world
- To develop broad knowledge of living and non-living world
- To develop ability to integrate knowledge, make informed ethical decisions and accept civic responsibilities

Course Outcomes:

Learner will be able to:

CO1: Improve their oratory skills when they step out in the corporate world as competent professionals.

CO2: Work towards developing holistic personality through critical and creative thinking

CO3: Complement technical knowledge by developing diversified perspectives on various aspects of learning.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
2	-	2	-

Assessment Guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory	25	-	50	075

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Programme Scheme and Syllabus(2022) for First Year Bachelor of Technology (B.Tech.)
Biomedical Engineering

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	Voice Culture for Professional Speaking	Introduction to Voice, Do's and don'ts for voice, General Reading session, Review of reading session. Good posture exercise, Relaxing the mind exercise, Tongue stretching exercise, breathing exercise or good fuller voice. Resonance, Improving resonance, voice clarity exercise, accent. Reading session – voice projection, understanding personality – traits, emotions, body language. Nonverbal communication, Thoughts – positive, negative and their effect on voice. Listening skill and exercise. Voice modulation, pitch, volume, tone, stress, speed, rhythm. Pronunciation – The Indian accent way, Presentation skills	12
Total			12

Recommended Online Courses:

Nil

Reference Books:

As suggested by resource person in session

Course Name: Financial Management for Beginners

Course Code: GEF02

Category: General Education (Finance)

Preamble:

Wide platter of General Education courses are offered to First Year Engineering students with an aim to focus on holistic personality development These courses will also help to create balance in brain hemispheres and thereby improve learners' clarity in thoughts and responses.

Pre-requisites:

NIL

Course Objectives:

- To develop the intellectual skills and competencies necessary to participate effectively in society and the world
- To develop broad knowledge of living and non-living world
- To develop ability to integrate knowledge, make informed ethical decisions and accept civic responsibilities

Course Outcomes:

Learner will be able to:

CO1: Take financial decisions wisely from early stage of earning

CO2: Work towards developing holistic personality through critical and creative thinking

CO3: Complement technical knowledge by developing diversified perspectives on various aspects of learning.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
2	-	2	-

Assessment Guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory	25	-	50	075

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Programme Scheme and Syllabus(2022) for First Year Bachelor of Technology (B.Tech.)
Biomedical Engineering

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	Financial Management for Beginners	Overview of Economics, macroeconomics, microeconomics, Money and its flow Overview of Share Market, Primary market, secondary market, nature of trading, scrips for short term and long-term investment Modes of Investments, Debt, equity, gold, property, assessment of investment type. Mutual Funds, Fund houses, mutual fund schemes, SIP, Magic of compounding Crypto and its future, maximum asset allocation in crypto Growing sectors from Engineering perspective	10
Total			10

Recommended Online Courses:

Nil

Reference Books:

As suggested by resource person in session

Programme Scheme and Syllabus(2022) for First Year Bachelor of Technology (B.Tech.)
Biomedical Engineering

Course Name: Four Pillars of Democratic Nation

Course Code: GEPS02

Category: General Education (Political Science)

Preamble:

Wide platter of General Education courses are offered to First Year Engineering students with an aim to focus on holistic personality development These courses will also help to create balance in brain hemispheres and thereby improve learners' clarity in thoughts and responses.

Pre-requisites:

NIL

Course Objectives:

- To develop the intellectual skills and competencies necessary to participate effectively in society and the world
- To develop broad knowledge of living and non-living world
- To develop ability to integrate knowledge, make informed ethical decisions and accept civic responsibilities

Course Outcomes:

Learner will be able to:

CO1: Understand how they can contribute towards each pillar of democracy.

CO2: Work towards developing holistic personality through critical and creative thinking.

CO3: Complement technical knowledge by developing diversified perspectives on various aspects of learning.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
2	-	2	-

Assessment Guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory	25	-	50	075

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Programme Scheme and Syllabus(2022) for First Year Bachelor of Technology (B.Tech.)
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Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	Four Pillars of Democratic Nation	The term 'Democracy', History of democracy, Indian Democracy, Responsibility of good citizen. Legislature – Six major functions of legislature Executive - President, Vice-President, Prime Minister, Cabinet Minister, Secretaries, and Civil services Judiciary – Indian Juridical system, Indian Constitution, Court structure Media - The basic right of freedom of speech and expression, Print Media and digital media	08
Total			08

Recommended Online Courses:

Nil

Reference Books:

As suggested by resource person in session

Programme Scheme and Syllabus(2022) for First Year Bachelor of Technology (B.Tech.)
Biomedical Engineering

Course Name: Railways – Wonders of Infrastructure

Course Code: GEWI01

Category: General Education (Wonders of Infrastructure)

Preamble:

Wide platter of General Education courses are offered to First Year Engineering students with an aim to focus on holistic personality development These courses will also help to create balance in brain hemispheres and thereby improve learners' clarity in thoughts and responses.

Pre-requisites:

NIL

Course Objectives:

- To develop the intellectual skills and competencies necessary to participate effectively in society and the world
- To develop broad knowledge of living and non-living world
- To develop ability to integrate knowledge, make informed ethical decisions and accept civic responsibilities

Course Outcomes:

Learner will be able to:

CO1: Understand reach of Indian Railways and how can engineers contribute towards it

CO2: Work towards developing holistic personality through critical and creative thinking

CO3: Complement technical knowledge by developing diversified perspectives on various aspects of learning.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
2	-	2	-

Assessment Guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory	25	-	50	075

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Programme Scheme and Syllabus(2022) for First Year Bachelor of Technology (B.Tech.)
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Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	Railways – Wonders of Infrastructure	History of civilization, Industrial revolution, early-stage steam engine, steam powered locomotives Liverpool to Manchester railways, Economic changes brought by railways. Indian Railways, Land and bridges, electrification, telecommunication, public sector undertakings, Reforms in railway sector.	06
Total			06

Recommended Online Courses:

Nil

Reference Books:

As suggested by resource person in session

Programme Scheme and Syllabus(2022) for First Year Bachelor of Technology (B.Tech.)
Biomedical Engineering

Course Name: IQ vs EQ

Course Code: GEPEW02

Category: General Education (Physical Education and Wellness)

Preamble:

Wide platter of General Education courses are offered to First Year Engineering students with an aim to focus on holistic personality development These courses will also help to create balance in brain hemispheres and thereby improve learners' clarity in thoughts and responses.

Pre-requisites:

NIL

Course Objectives:

- To develop the intellectual skills and competencies necessary to participate effectively in society and the world
- To develop broad knowledge of living and non-living world
- To develop ability to integrate knowledge, make informed ethical decisions and accept civic responsibilities

Course Outcomes:

Learner will be able to:

CO1: Understand strategies to enhance EQ as it is important in their personal as well as professional success.

CO2: Work towards developing holistic personality through critical and creative thinking

CO3: Complement technical knowledge by developing diversified perspectives on various aspects of learning.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
2	-	2	-

Assessment Guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory	25	-	50	075

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Programme Scheme and Syllabus(2022) for First Year Bachelor of Technology (B.Tech.)
Biomedical Engineering

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	IQ vs EQ	Introduction to Emotional Intelligence, the ability to understand, use, and manage your own emotions in positive ways to relieve stress, communicate effectively, empathize with others, overcome challenges and defuse conflict. Applications of EQ skills for mental health and wellbeing, self-awareness, self-motivation, active listening. The EQ view and Neuroscience of emotional intelligence, Intrinsic motivation and goal setting	08
Total			08

Recommended Online Courses:

Nil

Reference Books:

As suggested by resource person in session

Programme Scheme and Syllabus(2022) for First Year Bachelor of Technology (B.Tech.)
Biomedical Engineering

Course Name: Facets of Astronomy

Course Code: GENS01

Category: General Education (Natural Science)

Preamble:

Wide platter of General Education courses are offered to First Year Engineering students with an aim to focus on holistic personality development These courses will also help to create balance in brain hemispheres and thereby improve learners' clarity in thoughts and responses.

Pre-requisites:

NIL

Course Objectives:

- To develop the intellectual skills and competencies necessary to participate effectively in society and the world
- To develop broad knowledge of living and non-living world
- To develop ability to integrate knowledge, make informed ethical decisions and accept civic responsibilities

Course Outcomes:

Learner will be able to:

CO1: Develop an urge to research things that occur naturally on earth and in the universe.

CO2: Work towards developing holistic personality through critical and creative thinking

CO3: Complement technical knowledge by developing diversified perspectives on various aspects of learning.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
2	-	2	-

Assessment Guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory	25	-	50	075

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Programme Scheme and Syllabus(2022) for First Year Bachelor of Technology (B.Tech.)
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Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	Facets of Astronomy	Astrophysics: applying the laws of physics in space. Astrometry: mapping celestial bodies. Astrogeology: examining rocks, terrain, and material in space. Astrobiology: Searching for life outside Earth. Use of physics, mathematics, chemistry in astronomy Types of telescopes, Refractor Telescopes. Reflector Telescopes. Dobsonian Telescopes. Maksutov-Cassegrain Telescopes. The scientific study of celestial objects visible at night, Various celestial objects to observe.	05
Total			05

Recommended Online Courses:

Nil

Reference Books:

As suggested by resource person in session

Programme Scheme and Syllabus(2022) for First Year Bachelor of Technology (B.Tech.)
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Course Name: Various Dance Forms

Course Code: GEA02

Category: General Education (Arts)

Preamble:

Wide platter of General Education courses are offered to First Year Engineering students with an aim to focus on holistic personality development These courses will also help to create balance in brain hemispheres and thereby improve learners' clarity in thoughts and responses.

Pre-requisites:

NIL

Course Objectives:

- To develop the intellectual skills and competencies necessary to participate effectively in society and the world
- To develop broad knowledge of living and non-living world
- To develop ability to integrate knowledge, make informed ethical decisions and accept civic responsibilities

Course Outcomes:

Learner will be able to:

CO1: Differentiate between various dance forms

CO2: Work towards developing holistic personality through critical and creative thinking

CO3: Complement technical knowledge by developing diversified perspectives on various aspects of learning.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
2	-	2	-

Assessment Guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory	25	-	50	075

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

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Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	Various Dance Forms	Dance, Definition, History, music, rhythm. Basic understanding of the term ABHINAYA and definition of its four aspects. Technical terminology of dance. Acquaintance with the traditional costumes. Dance forms: Indian Classical dance, folk dance, Bollywood, Jazz and performances	08
Total			08

Recommended Online Courses:

Nil

Reference Books:

As suggested by resource person in session

Programme Scheme and Syllabus(2022) for First Year Bachelor of Technology (B.Tech.)
Biomedical Engineering

Course Name: Responsibility towards Sustainable Environment

Course Code: GESB06

Category: General Education (Social and Behavioral Science)

Preamble:

Wide platter of General Education courses are offered to First Year Engineering students with an aim to focus on holistic personality development These courses will also help to create balance in brain hemispheres and thereby improve learners' clarity in thoughts and responses.

Pre-requisites:

NIL

Course Objectives:

- To develop the intellectual skills and competencies necessary to participate effectively in society and the world
- To develop broad knowledge of living and non-living world
- To develop ability to integrate knowledge, make informed ethical decisions and accept civic responsibilities

Course Outcomes:

Learner will be able to:

CO1: Sensitize himself towards the need for promoting sustainable environment practices

CO2: Work towards developing holistic personality through critical and creative thinking

CO3: Complement technical knowledge by developing diversified perspectives on various aspects of learning.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
2	-	2	-

Assessment Guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory	25	-	50	075

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Programme Scheme and Syllabus(2022) for First Year Bachelor of Technology (B.Tech.)
Biomedical Engineering

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	Responsibility towards Sustainable Environment	Sustainability, Pillars of sustainability, social equity, economic development, environmental protection, cultural/human sustainability. Sustainable development, United nation's sustainable development goals. Sustainable Environment, long term health of ecosystem, renewable resources, Global warming, protection of species diversity and ecological structure, Low carbon economy. Being responsible towards sustainable environment, dos and don'ts, Smart City – city functions, economic growth, quality of life, technology used.	06
Total			06

Recommended Online Courses:

Nil

Reference Books:

As suggested by resource person in session

Programme Scheme and Syllabus(2022) for First Year Bachelor of Technology (B.Tech.)
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Course Name: Nutrition and Physical Wellness

Course Code: GEPEW03

Category: General Education (Physical Education and Wellness)

Preamble:

Wide platter of General Education courses are offered to First Year Engineering students with an aim to focus on holistic personality development These courses will also help to create balance in brain hemispheres and thereby improve learners' clarity in thoughts and responses.

Pre-requisites:

NIL

Course Objectives:

- To develop the intellectual skills and competencies necessary to participate effectively in society and the world
- To develop broad knowledge of living and non-living world
- To develop ability to integrate knowledge, make informed ethical decisions and accept civic responsibilities

Course Outcomes:

Learner will be able to:

CO1: Adapt healthy lifestyle and focus on overall wellbeing

CO2: Work towards developing holistic personality through critical and creative thinking

CO3: Complement technical knowledge by developing diversified perspectives on various aspects of learning

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
2	-	2	-

Assessment Guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory	25	-	50	075

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Programme Scheme and Syllabus(2022) for First Year Bachelor of Technology (B.Tech.)
Biomedical Engineering

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	Nutrition and Physical Wellness	Nutrition, Types of nutrition, Human need, Carbohydrates, proteins, vitamins, water, fats, minerals Well-balanced diet and its advantages Physical activities, daily exercises, need of stretching in working hours, best time and duration for physical activities, risk of taking supplements, dangers of following harmful fads. Physical wellness, finding time to move your body, warning sign by body, maintaining regular sleep schedule, maintaining ideal weight.	08
Total			08

Recommended Online Courses:

Nil

Reference Books:

As suggested by resource person in session

Appendix-A
General Education Sub-Categories

GE Sub-Category	GE Sub-Category Code
Arts	A
Social and Behavioral Science	SB
Creativity and Innovation	CI
Political Science	PS
Physical Education and Wellness	PEW
Finance	F
Natural Science	NS
Wonders of Infrastructure	WI

Courses under General Education (GE) Category

Course Code	Course Name	Credits
GEA01	Voice Culture for Professional Speaking	2
GEA02	Various Dance Forms	2
GEA03	Exploring Indian Art	2
GESB01#	Social Service Internship/ Project	3
GESB02	Universal Human Values	2
GESB03	Indian Traditional Knowledge System	2
GESB04	Corporate and Social Etiquettes	2
GESB05	Global Citizenship Education	2
GESB06	Responsibility towards sustainable environment	2
GESB07	Psychology	2
GECI01	Design Thinking	3
GECI02	Innovation and Entrepreneurship	1
GEPS01	Indian Constitution	2
GEPS02	Four Pillars of Democratic Nation	2
GEPEW01	Wellness – Body, Mind & Spirit	2
GEPEW02	IQ vs EQ	2
GEPEW03	Nutrition and Physical Wellness	2
GEF01	Basics of Finance & Legal aspects for Business	2
GEF02	Financial Management for beginners	2
GENS01	Facets of Astronomy	2
GENS02	Modern Farming	2
GEWI01	Railways - Wonders of Infrastructure	2
GE01\$	Internship with other Institutes (Credit Transfer)	4

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For GEB01- Social Service Internship/ Project: 2 hours / week slot will be provided during the semester (in regular timetable). Additional work of 60 hours needs to be completed during the semester (besides regular timetable) or after the semester (during inter semester break).

\$ GE01- Internship with other Institutes (Credit Transfer): Internship with other reputed institutes equivalent to 4 credits is recommended to be done by learner during second year inter semester break(i.e. summer break between semester 4 and semester 5)



Vidyalankar Institute of Technology

(Autonomous Institute Affiliated to the University of Mumbai)

Scheme and Detailed Syllabus

of

Third Year

in

Bachelor of Engineering

in

Biomedical Engineering

(Curriculum of REV- 2019 'C' Scheme of UoM)

With effect from Academic Year 2022-23

Program Structure for Third Year Biomedical Engineering
Vidyalankar Institute of Technology, Mumbai (w.e.f. 2022-2023)

Semester V

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned		
		Theory	Pract.	Theory	Pract.	Total
BMC501	Biomedical Instrumentation – I	3	--	3	--	3
BMC502	Digital Signal Processing	3	--	3		3
BMC503	Microcontrollers and Embedded Systems	4	--	4	--	4
BMC504	Medical Imaging – II	3	--	3	--	3
BMDO501X	Department Optional Course – 1	3	--	3	--	3
BML501	Biomedical Instrumentation – I Laboratory	--	2	--	1	1
BML502	Digital Signal Processing Laboratory	--	2	--	1	1
BML503	Microcontrollers and Embedded Systems Laboratory	--	2	--	1	1
BML504	Professional Communication and Ethics – II	--	2*+2	--	2	2
BMM501	Mini Project – 2 A	--	4\$	--	2	2
Total		16	14	16	07	23

Evaluation Scheme for Third Year Biomedical Engineering

Vidyalankar Institute of Technology (Autonomous status with effect from A.Y. 2022-23)

Semester V

Course Code	Course Name	Examination Scheme			
		ISA	MSE	ESE	Total
BMC501	Biomedical Instrumentation – I	20	30	50	100
BMC502	Digital Signal Processing	20	30	50	100
BMC503	Microcontrollers and Embedded Systems	20	30	50	100
BMC504	Medical Imaging – II	20	30	50	100
BMDO501X	Department Optional Course – 1	20	30	50	100
BML501	Biomedical Instrumentation – I Laboratory	25		25	50

BML502	Digital Signal Processing Laboratory	25		25	50
BML503	Microcontrollers and Embedded Systems Laboratory	25		25	50
BML504	Professional Communication and Ethics – II	25		25	50
BMM501	Mini Project – 2 A	25			25
Total		225	150	350	725

Total Contact Hours/week :29

Total Credit : 23

ISA=In Semester Assessment, MSE=Mid Semester Examination, ESE= End Semester Examination

* Theory class to be conducted for full class and \$ indicates workload of Learner (Not Faculty), students can form groups with minimum 2(Two) and not more than 4(Four). Faculty Load: 1 hour per week per four groups.

Sem. V: Department Optional Course –

- BMDO5011: Principles of Communication Engineering
- BMDO5012: Very Large Scale Integration
- BMDO5013: Tissue Engineering

Program Structure for Third Year Biomedical Engineering
Vidyalankar Institute of Technology, Mumbai (w.e.f. 2022-2023)
Semester VI

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned		
		Theory	Pract. /Tut.	Theory	Pract.	Total
BMC601	Biomedical Instrumentation – II	3	--	3	--	3
BMC602	Biomedical Digital Image Processing	3	--	3		3
BMC603	Data Analysis in Healthcare	3	--	3	--	3
BMC604	Biomechanics, Prosthetics and Orthotics	3	1	3	--	4
BMDO601X	Department Optional Course – 2	3	--	3	--	3
BML601	Biomedical Instrumentation – II Laboratory	--	2	--	1	1
BML602	Biomedical Digital Image Processing Laboratory	--	2	--	1	1
BML603	Data Analysis in Healthcare Laboratory	--	2	--	1	1
BML604	Patient- care Automation Laboratory	--	4	--	2	2
BMM601	Mini Project – 2 B	--	4 ^{\$}	--	2	2
Total		15	15	15	07	23

Evaluation Scheme for Third Year Biomedical Engineering
Vidyalankar Institute of Technology (Autonomous status with effect from A.Y. 2022-23)
Semester VI

CourseCode	Course Name	Examination Scheme			
		ISA	MSE	ESE	Total
BMC601	Biomedical Instrumentation – II	20	30	50	100
BMC602	Biomedical Digital Image Processing	20	30	50	100
BMC603	Data Analysis in Healthcare	20	30	50	100
BMC604	Biomechanics, Prosthetics and Orthotics	20+25(T)	30	50	125

BMDO601X	Department Optional Course – 2	20	30	50	100
BML601	Biomedical Instrumentation – II Laboratory	25		25	50
BML602	Biomedical Digital Image Processing Laboratory	25		25	50
BML603	Data Analysis in Healthcare Laboratory	25		25	50
BML604	Patient-care Automation Laboratory	25			25
BMM601	Mini Project – 2 B	25		25	50
Total		250	150	350	750

Total Contact Hours/week :30

Total Credit : 23

ISA=In Semester Assessment, MSE=Mid Semester Examination, ESE= End Semester Examination

Sem. VI: Department Optional Course – 2

- BMDO6011: Nuclear Medicine
- BMDO6012: Advanced Embedded Systems
- BMDO6013: Telemedicine

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned		
		Theory	Pract.	Theory	Pract.	Total
BMC501	Biomedical Instrumentation – I	3	--	3	--	3

Course Code	Course Name	Examination Scheme			
		ISA	MSE	ESE	Total
BMC501	Biomedical Instrumentation – I	20	30	50	100

Course Code	Course Name	Credits
BMC501	Biomedical Instrumentation - I	03
Course Objective	<ul style="list-style-type: none"> To understand the basic principles and working of diagnostic and therapeutic equipment. To develop skills enabling Biomedical Engineers to serve the health care industry To develop core competency and skill in the field of Biomedical Engineering, to design and develop new health care systems. 	
Course Outcome	<p>Learner will be able to...</p> <ul style="list-style-type: none"> Explain the principles of various analytical instruments used in hospital and laboratories. Demonstrate knowledge about various blood cell counting systems and blood gas analyzers. Demonstrate knowledge about various automated drug delivery systems. Explain the basics of pulmonary function analyzer, ventilators, and demonstrate the use of ventilation therapy and anesthesia machine. Explain the basic principle and working of hemodialysis machine. 	

Module	Contents	Hours
1.	<p>Basic principle, working and technical specifications of Analytical Instruments</p> <ol style="list-style-type: none"> Colorimeter Spectrophotometer Auto Analyzer Principles of Electrophoresis apparatus Principles of Chromatography ELISA concepts (direct and indirect), reader & washer. 	10

2.	Basic principle, working and technical specifications of Blood cell counter (Coulter and Pico-scale) Blood Gas Analyzer	04
3.	Automated drug delivery systems Infusion pumps, components of drug infusion systems, syringe and peristaltic pumps.	04
4.	Basic principle and working of Pulmonary Function Analyzer Respiration measurement technique: lung volume and capacities, spirometry, nitrogen washout, helium dilution,	06
5.	Basic principle and working of Ventilators Artificial ventilation, ventilator terms and its types, modes of ventilators, classification of ventilators, pressure volume flow and time diagrams. microprocessor controlled ventilator Basic principle and working of Anesthesia Machine Need for anesthesia, anesthesia machine: gas supply, flow and delivery system vapor delivery and humidification and patient breathing capnography.	10
6.	Basic principle, working and technical specifications of Hemodialysis machine Basic principle of dialysis, different types of dialyzer membranes, portable dialysers and various monitoring circuits.	05

Books Recommended:

Text books:

1. Handbook of Biomedical Instrumentation (Third edition): R S. Khandpur. (PH Pub)
2. Medical Instrumentation, Application and Design: J G. Webster. (John Wiley)
3. Biomedical Instrumentation and measurements : Leslie Cromwell, Fred J. Weibell, Enrich A. Pfeiffer. (PHI Pub)

Reference books:

1. Introduction to Biomedical Equipment Technology: Carr –Brown. (PH Pub)
2. Encyclopedia of Medical Devices and Instrumentation: J G. Webster. Vol I- IV (PH Pub)
3. Various Instruments Manuals.
4. Various internet websites.

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned		
		Theory	Pract.	Theory	Pract.	Total
BMC502	Digital Signal Processing	3	--	3		3

CourseCode	Course Name	Examination Scheme			
		ISA	MSE	ESE	Total
BMC502	Digital Signal Processing	20	30	50	100

Course Code	Course Name	Credits
BMC502	Digital Signal Processing	03
Course Objectives	<ul style="list-style-type: none"> To build a strong base in signal and image processing through algorithm development. To develop competency in logical thinking, computer programming and knowledge application. To train and motivate for higher education and research in order to make contribution to state of the art health care for all. 	
Course Outcomes	<p>Learner will be able to...</p> <ul style="list-style-type: none"> Understand the fundamental techniques and applications in digital processing of bio-signals. Understand circular and linear convolution and their implementation using Z-transform and DFT. Understand and implement efficient computational techniques like FFT. Design FIR and IIR filters by different methods. 	

Module	Contents	Hours
1.	Basic elements of Digital Signal Processing, concepts of frequency in analog and digital signals, sampling theorem, discrete time signals and systems their properties, Z-transform and properties, Linear & circular convolution, Correlation, DTFT.	08
2.	Introduction to DFT, Properties of DFT, DIT and DIF, FFT algorithms, use of FFT in linear filtering, discrete cosine transforms.	08
3.	Review of design of analog Butterworth and Chebyshev filters, frequency transformation in analog domain, design of IIR digital filters using impulse invariance method, design of digital filters using bilinear transformation.	06

4.	Structure of FIR filters, linear phase filters, filter design using window technique, frequency sampling techniques, finite word length effects in digital filters, realisation of FIR & IIR filters, direct, cascade and parallel forms.	06
5.	Introduction to digital signal processors, architecture, features, addressing formats, functional mode, introduction to commercial processors, applications.	03
6.	Preliminaries, biomedical signals (ECG, EMG, EEG) origin & dynamics, statistical preliminaries, time domain filtering (synchronized averaging, moving average), time domain filtering (moving average filter to integration-derivative based operator), Frequency domain filtering (notch Filter), optimal filtering: Wiener filter, adaptive filtering, selecting appropriate filter	08

Text books:

1. Digital signal processing Principles Algorithms and Application – Proakis & Manolakis – Third edition PHI
2. Digital Signal Processing – Sanjit K. Mithra Tata Mc-graw Hill
3. Digital Signal Processing – S. Salivahanan, C. Gnanapriya, Tata McGraw Hill

Reference Books:

1. Digital signal processing – A.V. Oppenheim and R.W. Schafer - PHI
2. Understanding Digital Signal Processing – Richard G. Lyons - Pearson Publication
3. Biomedical Digital Signal Processing -- Willis J. Tompkins -- EEE, PHI, 2004
4. R M Rangayyan "Biomedical Signal Analysis: A case Based Approach", IEEE Press, John Wiley & Sons. Inc, 2002

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned		
		Theory	Pract.	Theory	Pract.	Total
BMC503	Microcontrollers and Embedded Systems	4	--	4	--	4

CourseCode	Course Name	Examination Scheme			
		ISA	MSE	ESE	Total
BMC503	Microcontrollers and Embedded Systems	20	30	50	100

Course Code	Course Name	Credits
BMC503	Microcontrollers and Embedded Systems	04
Course Objectives	<ul style="list-style-type: none"> To provide the knowledge about the 8051 microcontroller architecture and programming so that the learners can apply the this knowledge to design microcontroller-based application To make learners aware of the basics of embedded systems and real time operating system 	
Course Outcomes	<p>Learner will be able to...</p> <ul style="list-style-type: none"> Explain the fundamentals of embedded systems Apply the knowledge of 8051 Microcontroller architecture Apply the knowledge of 8051 programming in assembly and C language Design and analyse 8051 interfacing with external memory, input/output devices and PC Apply the concept of serial communication protocols Explain the concept of Real Time Operating Systems (RTOS) 	

Module	Contents	Hours
1.	Embedded systems: Definition, characteristics, constraints; processor embedded into a system; embedded hardware units and devices in a system; embedded software in a system; examples of embedded systems; design process in embedded system; classification of embedded systems.	04

2.	8051 Microcontroller Architecture: Introduction: Von Neumann and Harvard architecture, CISC and RISC architecture, comparison of microprocessor and microcontrollers; 8051 hardware block diagram, pin diagram, CPU timing and machine cycles; 8051 programmer model, SFRs and PSW; 8051 Memory organization, parallel I/O ports, integrated peripherals such as timers/counters, serial port, interrupt structure; 8051 Power saving modes.	12
3.	8051 Microcontroller Programming: 8051 assembly language programming process, programming tools; 8051 assembly language: addressing modes, instruction set; assembly language programming and embedded C programming.	12
4.	8051 Microcontroller Interfacing: 8051 interfacing (and related programs) with - external memory, keypad, LED, LCD, ADC and sensors, DAC, relays and d.c. motors, stepper motor; Interfacing 8051 with pc using RS232.	12
5.	Serial Communication Protocols: Operation of serial port, programming for asynchronous serial communication; Serial communication using the 'I2C', SPI; Introduction to USB & CAN bus.	06
6.	Real Time Operating Systems (RTOS): Introduction to RTOS concept, RTOS functions, System timer, process/tasks and task states; RTOS scheduler and algorithms; interrupt latency, interrupt response time as performance metrics; example of small RTOS based systems.	06

Books Recommended:

Text books:

1. The 8051 microcontrollers by Kenneth J Ayala, Cengage Learning.
2. The 8051 Microcontroller and Embedded Systems: Using Assembly and C by M A Mazidi, J G Mazidi and R D McKinlay, Pearson Education.
3. Using MCS-51 Microcontroller by Han-Way Huang, Oxford University Press.
4. 8051 microcontroller: Hardware, Software & Applications by V Udayashankara, M Mallikarjunaswamy, McGraw Hill Education.
5. Embedded Systems-Architecture, Programming and Design, Rajkamal, Tata McGraw Hill.

Reference Books:

1. Embedded Realtime Systems Programming by Sriram Iyer and Pankaj Gupta, Tata McGraw Hill.
2. Embedded Microcomputer Systems - Real Time Interfacing by Valvano, Cengage Learning.
3. Embedded System Design: A Unified Hardware/Software Introduction by Frank Vahid, Toney Givargis - John Wiley Publication.
4. An Embedded Software Primer by David E. Simon - Pearson Education.

NPTEL/Swayam Course:

Course: Microprocessors and Microcontrollers (Video) by Prof. Santanu Chattopadhyaya from IIT Kharagpur.

<https://nptel.ac.in/courses/108/105/108105102/>

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned		
		Theory	Pract.	Theory	Pract.	Total
BMC504	Medical Imaging – II	3	--	3	--	3

CourseCode	Course Name	Examination Scheme			
		ISA	MSE	ESE	Total
BMC504	Medical Imaging – II	20	30	50	100

Course Code	Course Name	Credits
BMC504	Medical Imaging - II	03
Course Objectives	<ul style="list-style-type: none"> To familiarize the learners with the various Imaging techniques in medicine operating principles and quality control aspects of various imaging modalities. To keep the learners abreast with the technological developments in the field of Medical Imaging. 	
Course Outcomes	<p>Learner will be able to...</p> <ul style="list-style-type: none"> Understand use of Ultrasound in medicine, distinguish various ultrasonic display system, understand the construction and operation of the ultrasonic transducer. Understand the Doppler effect and clinical applications of Doppler Techniques. Describe working principle and physics involved in Magnetic Resonance Imaging (MRI) Understand the hardware of MRI Machine, Spin echo Imaging, Pulse sequence, image reconstruction, resolution and SNR, Biological effects, and clinical applications. To understand the basic principle of Magnetic Resonance Spectroscopy. To understand principle and working of Endoscopy and Thermography systems and its clinical applications. 	

Module	Contents	Hours
1	Ultrasound Imaging Introduction, production and characteristics of ultrasound, interaction of ultrasound with matter. ultrasound transducers and instrumentation. real time ultrasound.	08
2	Doppler Ultrasound Doppler effect, continuous wave and pulsed wave doppler system, 2D-echo, clinical applications.	04
3	Physics of MRI Magnetic dipole moments, relaxation parameters, spin echo, magneticfield gradients, slice selection, phase and frequency encoding.	06
4	Magnetic Resonance Imaging Hardware: magnets, gradient coils, RF coils, spin echo imaging, inversionrecovery pulse sequence, image reconstruction, resolution and factors affecting signal-to-noise. safety considerations and biological effects of MRI, clinical applications.	09
5	Magnetic Resonance Spectroscopy (MRS) Basic principle of MRS, metabolites studied, STEAM and PRESS pulse sequences, chemical shift imaging, single-voxel and multivoxel MRS, water suppression techniques.	06
6	Endoscopy and Thermography Working principle, equipment, and its applications.	06

Books Recommended:

Textbooks:

1. *Christensen's Physics of Diagnostic Radiology*, Thomas S. Curry, James E. Dowdey, Robert C.Murry. Wolters Kluwer, Fourth Edition.
2. *Medical Imaging Physics*, William R. Hendee, E. Russell Ritenour. Wiley, Fourth Edition.
3. *Physics of Diagnostic Imaging*, David Dowsett, Patrick A Kenny, R Eugene Johnston. CRC Press,Second Edition.

Reference Books:

1. *Biomedical Technology and Devices*, James Moore, George Zouridakis. CRC Press, SecondEdition.
2. *The Biomedical Engineering Handbook*, Joseph D. Bronzino, CRC Press, Second Edition.
3. *MRI: The Basics*, Ray H. Hashemi, William G. Bradley, Christopher J. Lisanti. Lippincott Williams& Wilkins, Second Edition.

NPTEL/Swayam Links:

Medical Image Analysis, Dr. Debdoot Sheet, Indian Institute of Technology, KharagpurCourse
Link: <https://nptel.ac.in/courses/108/105/108105091/>

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned		
		Theory	Pract.	Theory	Pract.	Total
BMDO501X	Department Optional Course – 1	3	--	3	--	3

CourseCode	Course Name	Examination Scheme			
		ISA	MSE	ESE	Total
BMDO5011	Principles of Communication Engineering	20	30	50	100

Course Code	Course Name	Credits
BMDO501X	Principles of Communication Engineering	03
Course Objectives	<ul style="list-style-type: none"> To provide concepts, principles and techniques used in analog and digital communications. To cover a range of digital modulation techniques which are frequently used in modern communication systems. 	
Course Outcomes	<p>Learner will be able to...</p> <ul style="list-style-type: none"> Demonstrate concept of electronic communication system with effect of noise and modelling of noise Have in depth knowledge of amplitude modulation and understand the AM transmitters and Receiver system with characteristics. Exhibit basic operation of FM transmitter and receiver with types, analysis, advantages and disadvantages Understand and compare the different types of Analog pulse modulation techniques Understand the different types of Digital pulse modulation techniques with merits and demerits Understand and compare different types of digital transmission techniques and multiplexing techniques 	

Module	Contents	Hours
1.	<p>Introduction to communication system and noise:</p> <ul style="list-style-type: none"> Elements of communication system, types of communication system Noise definition, types, signal to noise ratio, noise factor, noise figure, noise temperature 	04
2.	<p>Amplitude Modulation Transmission and Receivers:</p> <ul style="list-style-type: none"> Definition, mathematical analysis of AM wave, different types of AM, spectrum, bandwidth, AM transmitter: high and low level AM transmitter, DSB and SSB transmitter (any one method) AM receiver: characteristics: sensitivity, selectivity, fidelity, double spotting, Image frequency and its rejection, dynamic range, super-heterodyne receiver, double conversion receiver 	07

3.	Frequency Modulation Transmission and Receivers: <ul style="list-style-type: none"> • Principles of FM waveform, spectrum, bandwidth • FM generation: direct and indirect FM transmitter • Principles of AFC, effect of noise in FM, noise triangle, pre-emphasis and de-emphasis • FM Receivers: block diagram • Types: simple slope detector, balanced slope detector, Foster Seeley discriminator, ratio detector, quadrature detector • Capture effect in FM receivers, difference between AM and FM system 	10
4.	Analog Pulse Modulation Techniques: <ul style="list-style-type: none"> • Analog modulation techniques: PAM, PWM, PPM – generation, detection, advantages, disadvantages. 	05
5.	Digital Pulse Modulation Techniques: <ul style="list-style-type: none"> • Digital pulse modulation techniques: PCM, DPCM, DM and ADM–generation, detection, advantages and disadvantages. 	05
6.	Digital Transmission Techniques and Multiplexing: <ul style="list-style-type: none"> • Digital transmission types: ASK, FSK, PSK - generation, detection, advantages and disadvantages. • Multiplexing techniques: concept of multiplexing, FDM, TDM, hierarchy, applications, advantages and disadvantages. 	08

Books Recommended:

Text books:

1. Electronic communication system – Wayne Tomasi, Pearson Education
2. Electronic communication system – Roy Blake, Thomson Learning
3. Electronic communication system - Kennedy and Devis, TMH

Reference Books:

1. Digital and Analog communication system – Leon W Couch, Pearson Education
2. Principles of communication system – Taub and Schilling ,TMH

1. Course Code	Course Name	Teaching scheme			Credit assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
BMDO5012	Very Large Scale Integration (Abbreviated asVLSI)	03	--	--	03	--	--	03

CourseCode	Course Name	Examination Scheme			
		ISA	MSE	ESE	Total
BMDO5012	Very Large-Scale Integration	20	30	50	100

Course Code	Course Name	Credits
BMDO5012	Very Large-Scale Integration	03
Course Objectives	<ul style="list-style-type: none"> To make the learner aware of fundamental concepts of Hardware Description Languages To make learner study working of MOSFET To make learner know the CMOS Circuits. The learner should be able to know the MOSFET fabrication processes 	
Course Outcomes	<p>Learner will be able to ...</p> <ul style="list-style-type: none"> To describe hardware description language used to model circuits. To develop some basic digital circuits using HDL To analyze the physics of MOS devices. To compare characteristics of various inverter circuits To compare the fabrication technology used in IC fabrication and how system clocking is designed. To design layouts for various digital gates applying the design rules 	

ModuleNo.	Contents	Hours
1.	Physics of MOSFET MOSFET, threshold voltage, linear and saturated operation, FET capacitance, Scaling of MOS circuits, types of scaling and limitations of scaling-short channel and hot electron effect.	05
2.	MOSFET Inverters: MOS Transistors, MOS transistor switches, Basic MOS inverter and its working, types of MOS invertors viz active and passive load nMOS inverters, CMOS inverter, voltage transfer characteristics, noise immunity and noise margins.	05

3.	Silicon Semiconductor Technology: Wafer processing, mask generation, oxidation, epitaxial growth, diffusion, ion implantation, photolithography, etching, metallization, basic nMOS and pMOS processes. Latch up in CMOS and CMOS using twin tub process.	07
4.	Introduction to VLSI Clocking and System Design: Clocking: CMOS clocking styles, Clock generation, stabilization and distribution. Low power CMOS Circuits: Various components of power dissipation in CMOS, limits on low power design, low power design through voltage scaling.	06
5.	Design rules and Layout NMOS and CMOS design rules and layout, Design of NMOS and CMOS inverters, NAND and NOR gates. Interlayer contacts, butting and buried contacts, stick diagrams, layout of inverter, NAND and NOR gates. Design of basic VLSI circuits, design of circuits like multiplexer, decoder, flip flops, using MOS circuits.	08
6.	Hardware Description Language Introduction to VHDL hardware description language, core features of VHDL, data types, different modeling styles and architectures of VHDL, Combinational and Sequential Logic design using VHDL	08

Books Recommended:

Text Books:

1. CMOS Digital Integrated Circuits, Kang, Tata McGraw Hill Publications, Third Edition
2. Introduction to VLSI design, E. D. Fabricus, McGraw Hill Publications, 1990
3. Basic VLSI Design, D.A. Pucknell and Eshraghian, Prentice Hall of India, 2005
4. Digital Design Principles and Practices, John F Wakerly, Prentice Hall of India, Third edition
5. Circuit Design with VHDL, Volnei A. Pedroni, Prentice Hall of India, 2009
6. Introduction to VLSI Circuits and Systems- John P. Uyemura, Wiley

Reference Books:

1. VHDL Programming by Examples, Douglas Perry, McGraw Hill Publications, 2008
2. Principles of CMOS VLSI Design : A Systems Perspective, Neil H.E. Weste, Kamran Eshraghian Addison Wesley Publications, Second edition, 1993

1. Course Code	Course Name	Teaching scheme			Credit assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
BMDO5013	Tissue Engineering (Abbreviated as TE)	03	--	--	03	--	--	03

CourseCode	Course Name	Examination Scheme			
		ISA	MSE	ESE	Total
BMDO5013	Tissue Engineering	20	30	50	100

Course Code	Course Name	Credits
BMDO5013	Tissue Engineering	03
Course Objective	<ul style="list-style-type: none"> To understand the basics and terminologies of tissue engineering. Learn importance of stem cells in tissue engineering To understand the basic concepts of cell culture To understand applications of tissue engineering in medical field 	
Course Outcome	Learner will be able... <ul style="list-style-type: none"> To get acquainted with cellular responses To understand role of extracellular matrix in tissue engineering To understand cell characteristics. To understand tissue culture and cryopreservation techniques. To understand the selection of various biomaterials for tissue engineering To understand tissue engineering applications 	

Module	Contents	Hours
1.	Introduction to Tissue Engineering: Fundamentals of stem cell tissue engineering, mechanical forces on cells, cell adhesion, cell migration, inflammatory and immune responses to tissue, cell death- biological description of apoptosis, tissue types.	07
2.	Extracellular Matrix: Structure, function, components, synthesis of the collagens, The ECM - cell binding and long-term contact.	05
3.	Measurement of cell characteristics: Cell morphology, cell number and viability, cell-fate processes, cell motility, cell function.	05
4.	Cell and tissue culture: Types of tissue culture, media, culture environment and maintenance of cells in -vitro, cryopreservation. problems with the culture, organ culture.	06
5.	Biomaterials in Tissue Engineering: Biodegradable polymers and polymer scaffold processing. biomimetic materials, nanocomposite scaffolds, gene therapy, bioreactors for tissue engineering.	06

6.	Tissue Engineering – regeneration: Skin, bone marrow, nervous system, muscle, ligaments and cartilage, cardiac muscles - myocardial tissue engineering, strategies to deliver stem cells to the damaged site.	10
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Books Recommended:

Text books:

1. Bernhard O. Palsson, Sangeeta N. Bhatia, "Tissue Engineering", Pearson Prentice Hall Publishers, 2009.
2. Joseph D. Bronzino, "The Biomedical Engineering Handbook", CRC Press LLC, 2006.
3. John P. Fisher, Antonios G. Mikos and Joseph D. Bronzino, "Tissue Engineering", CRC Press LLC, 2007.
4. W. W. Minuth, R. Strehl and K. Schumacher, "Tissue Engineering- Essentials for Daily Laboratory Work", Wiley-VCH Verlag GmbH & Co. KGaA, 2005.
5. Daniel Eberli, "Tissue Engineering for Tissue and Organ Regeneration", InTech, 2011.

Reference books:

1. Raphael Gorodetsky, Richard Schäfer, "Stem Cell Based Tissue Repair", RSC Publishing, 2011.
2. R. Lanza, I. Weissman, J. Thomson, and R. Pedersen, Handbook of Stem Cells, Two Volume, Volume 1-2: Volume 1-Embryonic Stem Cells; Volume 2-Adult & Fetal Stem Cells, 2004, Academic Press, 2004.
3. R. Lanza, J. Gearhart et. al. (Eds), "Essential of Stem Cell Biology", Academic press, 2009
4. J. J. Mao, G. Vunjak-Novakovic et al (Eds), Translational Approaches In Tissue Engineering & Regenerative Medicine", Artech House, INC Publications, 2008.
5. Naggy N. Habib, M.Y. Levicar, L. G. Jiao and N. Fisk, "Stem Cell Repair and Regeneration", volume-2, Imperial College Press, 2007.
6. Cato T. Laurencin, Lakshmi S. Nair, "Nanotechnology and Tissue engineering - The Scaffold", CRC Press, 2015.
7. Meyer, U., Meyer, Th., Handschel, J., Wiesmann, H.P., "Fundamentals of Tissue Engineering and Regenerative Medicine" Springer, 2009.
8. Lanza RP, Langer R, Vacanti J. "Principles of Tissue Engineering", Third edition. Academic Press. 2007.

NPTEL/Swayam Links:

Course 1: Tissue Engineering

<https://nptel.ac.in/courses/102/106/102106081/>

Course 2: Tissue Engineering

<https://nptel.ac.in/courses/102/106/102106036/>

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned		
		Theory	Pract.	Theory	Pract.	Total
BML501	Biomedical Instrumentation – I Laboratory	--	2	--	1	1

CourseCode	Course Name	Examination Scheme			
		ISA	MSE	ESE	Total
BML501	Biomedical Instrumentation – I Laboratory	25		25	50

Syllabus: Same as that of (BMC501) Biomedical Instrumentation- -I (BMI-I)

List of Experiments: (Any Seven)

1. Selection of wavelength for colorimeter and spectrophotometer
2. Find out the concentration of unknown sample using colorimeter and spectrophotometer
3. Design and implementation of 5V, 1A regulated power supply
4. Design and implementation of temperature controller circuit for hemodialysis machine
5. Design and implementation of pulse width modulator
6. Demonstration of ventilators
7. Demonstration of anesthesia machine
8. Calculations of lung volumes and capacities
9. Industry / hospital visit to be conducted.

Any other experiment based on syllabus which will help learner to understand topic/concept. Group

presentation on the latest technology in hospitals based on the topics covered in the syllabus.

Assessment:

In Semester Assessment (ISA)

ISA shall consist of minimum 7 experiments.

The final certification and acceptance of ISA ensures the satisfactory performance of laboratory work and minimum passing in the ISA.

Books Recommended:

Text books:

1. Handbook of Biomedical Instrumentation (Third edition): R S. Khandpur. (PH Pub)
2. Medical Instrumentation, Application and Design: J G. Webster. (John Wiley)
3. Biomedical Instrumentation and measurements: Leslie Cromwell, Fred J. Weibell, Enrich A. Pfeiffer. (PHI Pub)

Reference books:

1. Introduction to Biomedical Equipment Technology: Carr –Brown. (PH Pub)
2. Encyclopedia of Medical Devices and Instrumentation: J G. Webster. Vol I- IV (PH Pub)
3. Various Instruments Manuals.
4. Various internet websites

Oral examination will be based on suggested practical list and entire syllabus.

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned		
		Theory	Pract.	Theory	Pract.	Total
BML502	Digital Signal Processing Laboratory	--	2	--	1	1

CourseCode	Course Name	Examination Scheme			
		ISA	MSE	ESE	Total
BML502	Digital Signal Processing Laboratory	25		25	50

Course Code	Course Name	Credits
BML502	Digital Signal Processing Laboratory	01
Course Objectives	<ul style="list-style-type: none"> • To build a strong base in signal and image processing through algorithm development. • To develop competency in logical thinking, computer programming and knowledge application. • To train and motivate for higher education and research in order to make contribution to state of the art health care for all. 	
Course Outcomes	<p>Learner will be able to...</p> <ul style="list-style-type: none"> • Understand the fundamental techniques and applications in digital processing of bio-signals. • Understand circular and linear convolution and their implementation using Z-transform and DFT. • Understand and implement efficient computational techniques like FFT. • Design FIR and IIR filters by different methods. 	

Syllabus: Same as that of BMC502 Digital Signal Processing (Abbreviated as DSP)

List of Experiments (using Matlab / C / Labview / python / other platform)

1. Basics of programming
2. Simulations of standard signals
3. Concept of aliasing
4. Linear convolution circular convolution
5. Discrete Fourier Transform (DFT)
6. Design and simulation of FIR filter
7. IIR filters using Butterworth approximation
8. IIR filter using Chebyshev approximation
9. Pan-Tompkin algorithm for R-wave detection

Assessment:

In Semester Assessment (ISA)

ISA shall consist of minimum 7 experiments.

The final certification and acceptance of ISA ensures the satisfactory performance of laboratory work and minimum passing in the ISA.

Text books:

1. Digital signal processing Principles Algorithms and Application – Proakis & Manolakis – Third edition PHI
2. Digital Signal Processing – Sanjit K. Mithra Tata Mc-graw Hill
3. Digital Signal Processing – S. Salivahanan, C. Gnanapriya, Tata McGraw Hill

Reference Books:

1. Digital signal processing – A.V. Oppenheim and R.W. Schafer - PHI
2. Understanding Digital Signal Processing – Richard G. Lyons - Pearson Publication
3. Biomedical Digital Signal Processing -- Willis J. Tompkins -- EEE, PHI, 2004
4. R M Rangayyan "Biomedical Signal Analysis: A case Based Approach", IEEE Press, John Wiley & Sons. Inc, 2002

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned		
		Theory	Pract.	Theory	Pract.	Total
BML503	Microcontrollers and Embedded Systems Laboratory	--	2	--	1	1

CourseCode	Course Name	Examination Scheme			
		ISA	MSE	ESE	Total
BML503	Microcontrollers and Embedded Systems Laboratory	25		25	50

Course Code	Course Name	Credits
BML503	Microcontrollers and Embedded Systems Laboratory	01
Course Objectives	<ul style="list-style-type: none"> Give the students skills in both simulation and practical implementation of the basic building blocks of 8051 microcontroller-based applications including timers/counters, PWM generation, I/O techniques and requirements, DC motors, stepper motors, keyboard, display device and serial communications Give students skills in 8051 microcontroller programming. 	
Course Outcomes	<p>Learner will be able to...</p> <ul style="list-style-type: none"> Design different programs using C compilers for 8051 controller Design and develop 8051 embedded C programs for timer based applications Design and develop 8051 embedded C programs for control of DC motors and stepper motors Design and develop 8051 embedded C programs for interfacing keyboard and display device Design and develop 8051 embedded C programs for interfacing with the PC 	

Syllabus: Same as that of BMC503 Microcontrollers and Embedded Systems (Abbreviated as MES).

List of Laboratory Experiments:

Any eight experiments to be performed in hardware mode and/or software simulation mode.

1. To demonstrate basic I/O toggling and interrupts of 8051.
2. To generate precise delay and trigger pulses using 8051 timer.

3. To generate waveform and perform PWM using 8051 timer.
4. To interface 8051 with relay and DC motor (using H bridge) – demonstration through basic I/O toggling.
5. To control the speed of DC motor through PWM based MOSFET switching.
6. To interface 8051 with the stepper motor.
7. To interface 8051 with the seven-segment display.
8. To interface 8051 with the keyboard.
9. To interface 8051 with PC using UART and RS232 standard.

Any other experiment based on syllabus may be included, which would help the learner to understand topic/concept.

In Semester Assessment (ISA)

ISA shall consist of minimum 8 experiments.

The final certification and acceptance of ISA ensures the satisfactory performance of laboratory work and minimum passing in the ISA.

Books Recommended:

Textbooks:

1. The 8051 microcontrollers by Kenneth J Ayala, Cengage Learning.
2. The 8051 Microcontroller and Embedded Systems: Using Assembly and C by M A Mazidi, J G Mazidi and R D McKinlay, Pearson Education.
3. Using MCS-51 Microcontroller by Han-Way Huang, Oxford University Press.
4. 8051 microcontroller: Hardware, Software & Applications by V Udayashankara, M Mallikarjunaswamy, McGraw Hill Education.
5. Embedded Systems-Architecture, Programming and Design, Rajkamal, Tata McGraw Hill.

Reference Books:

1. Embedded Realtime Systems Programming by Sriram Iyer and Pankaj Gupta, Tata McGraw Hill.
2. Embedded Microcomputer Systems - Real Time Interfacing by Valvano, Cengage Learning.
3. Embedded System Design: A Unified Hardware/Software Introduction by Frank Vahid, Toney Givargis - John Wiley Publication.
4. An Embedded Software Primer by David E. Simon - Pearson Education.

NPTEL/Swayam Course:

Course: Microprocessors and Microcontrollers (Video) by Prof. Santanu Chattopadhyaya from IIT Kharagpur.
<https://nptel.ac.in/courses/108/105/108105102/>

Practical exam consists of performance of any one practical from the conducted experiments within this semester

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned		
		Theory	Pract.	Theory	Pract.	Total
BML504	Professional Communication and Ethics – II	--	2*+2	--	2	2

CourseCode	Course Name	Examination Scheme			
		ISA	MSE	ESE	Total
BML504	Professional Communication and Ethics – II	25		25	50

Course Code	Course Name	Credits
BML504	Professional Communication & Ethics - II	02
Course Objectives	<ul style="list-style-type: none"> • To discern and develop an effective style of writing important technical/business documents. • To investigate possible resources and plan a successful job campaign. • To understand the dynamics of professional communication in the form of group discussions, meetings, etc. required for career enhancement. • To develop creative and impactful presentation skills. • To analyse personal traits, interests, values, aptitudes and skills. • To understand the importance of integrity and develop a personal code of ethics. 	

Course Outcomes	<p>Learner will be able to...</p> <ul style="list-style-type: none"> • plan and prepare effective business/ technical documents which will inturn provide solid foundation for their future managerial roles. • strategize their personal and professional skills to build a professional image and meet the demands of the industry. • emerge successful in group discussions, meetings and result-oriented agreeable solutions in group communication situations. • deliver persuasive and professional presentations. • develop creative thinking and interpersonal skills required for effective professional communication. • apply codes of ethical conduct, personal integrity and norms of organizational behaviour.
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Module	Contents	Hours
1	<p>ADVANCED TECHNICAL WRITING :PROJECT/PROBLEMBASED LEARNING (PBL)</p> <p>1.1 Purpose and Classification of Reports: Classification on the basis of:</p> <ul style="list-style-type: none"> • Subject Matter (Technology, Accounting, Finance, Marketing, etc.) • Time Interval (Periodic, One-time, Special) • Function (Informational, Analytical, etc.) • Physical Factors (Memorandum, Letter, Short & Long) <p>1.2. Parts of a Long Formal Report:</p> <ul style="list-style-type: none"> • Prefatory Parts (Front Matter) • Report Proper (Main Body) • Appended Parts (Back Matter) <p>1.3. Language and Style of Reports</p> <ul style="list-style-type: none"> • Tense, Person & Voice of Reports • Numbering Style of Chapters, Sections, Figures, Tables and Equations • Referencing Styles in APA & MLA Format • Proofreading through Plagiarism Checkers <p>1.4. Definition, Purpose & Types of Proposals</p> <ul style="list-style-type: none"> • Solicited (in conformance with RFP) & Unsolicited Proposals • Types (Short and Long proposals) <p>1.5. Parts of a Proposal</p> <ul style="list-style-type: none"> • Elements • Scope and Limitations • Conclusion <p>1.6. Technical Paper Writing</p> <ul style="list-style-type: none"> • Parts of a Technical Paper (Abstract, Introduction, Research Methods, Findings and Analysis, Discussion, Limitations, Future Scope and 	06

	<p>References)</p> <ul style="list-style-type: none"> • Language and Formatting • Referencing in IEEE Format 	
2	<p>EMPLOYMENT SKILLS</p> <p>2.1. Cover Letter & Resume</p> <ul style="list-style-type: none"> • Parts and Content of a Cover Letter • Difference between Bio-data, Resume & CV • Essential Parts of a Resume • Types of Resume (Chronological, Functional & Combination) <p>2.2 Statement of Purpose</p> <ul style="list-style-type: none"> • Importance of SOP • Tips for Writing an Effective SOP <p>2.3 Verbal Aptitude Test</p> <ul style="list-style-type: none"> • Modelled on CAT, GRE, GMAT exams <p>2.4. Group Discussions</p> <ul style="list-style-type: none"> • Purpose of a GD • Parameters of Evaluating a GD • Types of GDs (Normal, Case-based & Role Plays) • GD Etiquettes <p>2.5. Personal Interviews</p> <ul style="list-style-type: none"> • Planning and Preparation • Types of Questions • Types of Interviews (Structured, Stress, Behavioural, Problem Solving & Case-based) • Modes of Interviews: Face-to-face (One-to one and Panel) Telephonic, Virtual 	06
3	<p>BUSINESS MEETINGS</p> <p>a. Conducting Business Meetings</p> <ul style="list-style-type: none"> • Types of Meetings • Roles and Responsibilities of Chairperson, Secretary and Members • Meeting Etiquette <p>3.2. Documentation</p> <ul style="list-style-type: none"> • Notice • Agenda • Minutes 	02
4	<p>TECHNICAL/ BUSINESS PRESENTATIONS</p> <p>a. Effective Presentation Strategies</p> <ul style="list-style-type: none"> • Defining Purpose • Analysing Audience, Location and Event • Gathering, Selecting &Arranging Material • Structuring a Presentation • Making Effective Slides • Types of Presentations Aids • Closing a Presentation • Platform skills <p>b. Group Presentations</p>	02

	<ul style="list-style-type: none"> • Sharing Responsibility in a Team • Building the contents and visuals together • Transition Phases 	
5	<p>INTERPERSONAL SKILLS</p> <p>a. Interpersonal Skills</p> <ul style="list-style-type: none"> • Emotional Intelligence • Leadership & Motivation • Conflict Management & Negotiation • Time Management • Assertiveness • Decision Making <p>5.2 Start-up Skills</p> <ul style="list-style-type: none"> • Financial Literacy • Risk Assessment • Data Analysis (e.g. Consumer Behaviour, Market Trends, etc.) 	08
6	<p>CORPORATE ETHICS</p> <p>6.1 Intellectual Property Rights</p> <ul style="list-style-type: none"> • Copyrights • Trademarks • Patents • Industrial Designs • Geographical Indications • Integrated Circuits • Trade Secrets (Undisclosed Information) <p>6.2 Case Studies</p> <ul style="list-style-type: none"> • Cases related to Business/ Corporate Ethics 	02

List of assignments:

(In the form of Short Notes, Questionnaire/ MCQ Test, Role Play, Case Study, Quiz, etc.)

1. Cover Letter and Resume
2. Short Proposal
3. Meeting Documentation
4. Writing a Technical Paper/ Analysing a Published Technical Paper
5. Writing a SOP
6. IPR
7. Interpersonal Skills
8. Aptitude test (Verbal Ability)

Note:

1. The Main Body of the project/book report should contain minimum 25 pages (excluding Front and Back matter).
2. The group size for the final report presentation should not be less than 5 students or exceed 7 students.
3. There will be an end-semester presentation based on the book report.

Assessment:

In Semester Assessment(ISA)

ISA shall consist of minimum 8 experiments.

The final certification and acceptance of ISA ensures the satisfactory performance of laboratory work and minimum passing in the ISA.

INTERNAL ORAL - 25 MARKS

Oral Examination will be based on a GD & the Project/Book Report presentation.

Group Discussion : 10 marks

Project presentation

Individual Presentation : 10 Marks

Group Dynamics : 5 Marks

Books Recommended:

Textbooks and Reference books:

1. Arms, V. M. (2005). *Humanities for the engineering curriculum: With selected chapters from Olsen/Huckin: Technical writing and professional communication, second edition*. Boston, MA: McGraw-Hill.
2. Bovée, C. L., & Thill, J. V. (2021). *Business communication today*. Upper Saddle River, NJ: Pearson.
3. Butterfield, J. (2017). *Verbal communication: Soft skills for a digital workplace*. Boston, MA: Cengage Learning.
4. Masters, L. A., Wallace, H. R., & Harwood, L. (2011). *Personal development for life and work*. Mason: South-Western Cengage Learning.
5. Robbins, S. P., Judge, T. A., & Campbell, T. T. (2017). *Organizational behaviour*. Harlow, England: Pearson.
6. Meenakshi Raman, Sangeeta Sharma (2004) *Technical Communication, Principles and Practice*. Oxford University Press
7. Archana Ram (2018) *Place Mentor, Tests of Aptitude For Placement Readiness*. Oxford University Press
8. Sanjay Kumar & PushpLata (2018). *Communication Skills a workbook*, New Delhi: Oxford University Press.

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned		
		Theory	Pract.	Theory	Pract.	Total
BMM501	Mini Project – 2 A	--	4\$	--	2	2

CourseCode	Course Name	Examination Scheme			
		ISA	MSE	ESE	Total
BMM501	Mini Project – 2 A	25			25

Course Objective	<ul style="list-style-type: none"> To acquaint with the process of identifying the needs and converting it into the problem. To familiarize the process of solving the problem in a group. To acquaint with the process of applying basic engineering fundamentals to attempt solutions to the problems. To inculcate the process of self-learning and research.
Course Outcome	<p>Learner will be able to:</p> <ul style="list-style-type: none"> Identify problems based on societal /research needs. Apply Knowledge and skill to solve societal problems in a group. Develop interpersonal skills to work as member of a group or leader. Draw the proper inferences from available results through theoretical/ experimental/simulations. Analyse the impact of solutions in societal and environmental context for sustainable development. Use standard norms of engineering practices Excel in written and oral communication. Demonstrate capabilities of self-learning in a group, which leads to life long learning. Demonstrate project management principles during project work.

Guidelines for Mini Project

- Students shall form a group of 3 to 4 students, while forming a group shall not be allowed less than three or more than four students, as it is a group activity.
- Students should do survey and identify needs, which shall be converted into problem statement for mini project in consultation with faculty supervisor/head of department/internal committee of faculties.
- Students shall submit implementation plan in the form of Gantt/PERT/CPM chart, which will cover weekly activity of mini project.
- A log book to be prepared by each group, wherein group can record weekly work progress, guide/supervisor can verify and record notes/comments.

- Faculty supervisor may give inputs to students during mini project activity; however, focus shall be on self-learning.
- Students in a group shall understand problem effectively, propose multiple solutions and select the best possible solution in consultation with guide/ supervisor.
- Students shall convert the best solution into a working model using various components of their domain areas and demonstrate.
- The solution to be validated with proper justification and report to be compiled in standard format of University of Mumbai.
- With the focus on self-learning, innovation, addressing societal problems and entrepreneurship quality development within the students through the Mini Projects, it is preferable that a single project of appropriate level and quality to be carried out in two semesters by all the groups of the students. Mini Project 2 in semesters V and VI.
- However, based on the individual student or group capability, with the mentor's recommendations, if the proposed Mini Project adhering to the qualitative aspects mentioned above gets completed in odd semester, then that group can be allowed to work on the extension of the Mini Project with suitable improvements/modifications or a completely new project idea in even semester. This policy can be adopted on a case by case basis.

Guidelines for Assessment of Mini Project:

In Semester Assessment (ISA)

- The review/ progress monitoring committee shall be constituted by head of departments of each institute. The progress of mini project to be evaluated on a continuous basis, minimum two reviews in each semester.
- In continuous assessment focus shall also be on each individual student, assessment based on individual's contribution in group activity, their understanding and response to questions.
- Distribution of Term work marks for both semesters shall be as below;

○ Marks awarded by guide/supervisor based on log book	10
○ Marks awarded by review committee	10
○ Quality of Project report	05

Review/progress monitoring committee may consider following points for assessment based on either one year or half year project as mentioned in general guidelines.

One-year project:

- In first semester entire theoretical solution shall be ready, including components/system selection and cost analysis. Two reviews will be conducted based on presentation given by students group.
 - First shall be for finalisation of problem
 - Second shall be on finalisation of proposed solution of problem.
- In second semester expected work shall be procurement of component's/systems, building of working prototype, testing and validation of results based on work completed in an earlier semester.
 - First review is based on readiness of building working prototype to be conducted.
 - Second review shall be based on poster presentation cum demonstration of working model in last month of the said semester.

Half-year project:

- In this case in one semester students' group shall complete project in all aspects including,
 - Identification of need/problem

- Proposed final solution
- Procurement of components/systems
- Building prototype and testing
- Two reviews will be conducted for continuous assessment,
- First shall be for finalisation of problem and proposed solution
- Second shall be for implementation and testing of solution.

Assessment criteria of Mini Project.

Mini Project shall be assessed based on following criteria;

1. Quality of survey/ need identification
 2. Clarity of Problem definition based on need.
 3. Innovativeness in solutions
 4. Feasibility of proposed problem solutions and selection of best solution
 5. Cost effectiveness
 6. Societal impact
 7. Innovativeness
 8. Cost effectiveness and Societal impact
 9. Full functioning of working model as per stated requirements
 10. Effective use of skill sets
 11. Effective use of standard engineering norms
 12. Contribution of an individual's as member or leader
 13. Clarity in written and oral communication
- In **one year, project**, first semester evaluation may be based on first six criteria's and remaining may be used for second semester evaluation of performance of students in mini project.
 - In case of **half year project** all criteria's in generic may be considered for evaluation of performance of students in mini project.

Guidelines for Assessment of Mini Project Practical/Oral Examination:

- Report should be prepared as per the guidelines issued by the University of Mumbai.
- Mini Project shall be assessed through a presentation and demonstration of working model by the student project group to a panel of Internal and External Examiners preferably from industry or research organizations having experience of more than five years approved by head of Institution.
- Students shall be motivated to publish a paper based on the work in Conferences/students competitions.

Mini Project shall be assessed based on following points;

1. Quality of problem and Clarity
2. Innovativeness in solutions
3. Cost effectiveness and Societal impact
4. Full functioning of working model as per stated requirements
5. Effective use of skill sets
6. Effective use of standard engineering norms
7. Contribution of an individual's as member or leader
8. Clarity in written and oral communicate

Semester – VI

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned		
		Theory	Pract. /Tut.	Theory	Pract.	Total
BMC601	Biomedical Instrumentation – II	3	--	3	--	3

CourseCode	Course Name	Examination Scheme			
		ISA	MSE	ESE	Total
BMC601	Biomedical Instrumentation – II	20	30	50	100

Course Code	Course Name	Credits
BMC601	Biomedical Instrumentation-II	03
Course Objective	<ul style="list-style-type: none"> To understand the basic principles and working of different Biomedical monitoring systems. To develop skills enabling Biomedical Engineers to serve the health care industry To develop core competency and skill in the field of Biomedical Engineering to design and develop new health care systems. 	
Course Outcome	<p>Learner will be able to...</p> <ul style="list-style-type: none"> Provide a better understanding about various bioelectrical signal recorders and patient safety along with greater emphasis on health care equipment and the advanced technologies such as Telemetry and Telemedicine. Demonstrate the principles of electronics used in designing various biomedical monitoring equipment. Understand the basic principles and working of audiometry equipments and hearing aids Provide a better understanding about foetal and neonatal monitoring systems. Acquire the ability to explain the various blood flow and cardiac output measurement devices. 	

Module	Contents	Hours
1.	Basic principle, working and technical specifications of ECG, EMG and EEG machines, LEAD configurations, 10-20 electrode system measuring techniques for EOG, ERG and phonocardiography, Patient Safety: Electric shock hazards, leakage currents, safety codes for electro-medical equipment.	08
2.	Arrhythmia and Patient monitoring: Cardiac arrhythmias, Stress test measurement, ambulatory monitoring instruments such as holter monitor. Basics of Telemetry, Multi-channel Telemetry.	08
3.	Basic principle and working of Patient Monitoring Systems Measurement of heart rate, pulse rate, blood pressure, temperature and respiration rate, apnea detector. Heart rate variability measurement. Point of care devices and their design considerations for homecare devices: glucometer.	08
4.	Basic principle and working of Audiometers and hearing aid Basic audiometer, pure tone and speech audiometer, evoked response audiometry, introduction to hearing aids and cochlear implants.	05
5.	Basic principle and working of Foetal and Neonatal Monitoring System Cardiotocograph, methods of monitoring of foetal heart rate, monitoring of labour activity, incubator and infant warmer, non-stress test monitoring.	05
6.	Basic principle and working of Blood flowmeters Electromagnetic, ultrasonic, NMR and laser doppler flowmetry, Measurement of Cardiac Output Indicator dilution, dye dilution and thermal dilution techniques.	05

Books Recommended:

Text books:

1. Handbook of Biomedical Instrumentation (Third edition): R S. Khandpur. (PH Pub)
2. Medical Instrumentation, Application and Design: J G. Webster. (John Wiley)
3. Biomedical Instrumentation and measurements: Leslie Cromwell, Fred J. Weibell, Enrich A. Pfeiffer. (PHI Pub)

Reference books:

1. Introduction to Biomedical Equipment Technology: Carr –Brown. (PH Pub)
1. Encyclopedia of Medical Devices and Instrumentation: J G. Webster. Vol I- IV (PH Pub)
2. Various Instruments Manuals.
3. Various internet websites.

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned		
		Theory	Pract. /Tut.	Theory	Pract.	Total
BMC602	Biomedical Digital Image Processing	3	--	3		3

CourseCode	Course Name	Examination Scheme			
		ISA	MSE	ESE	Total
BMC602	Biomedical Digital Image Processing	20	30	50	100

Course Code	Course Name	Credits
BMC602	Biomedical Digital Image Processing	03
Course Objectives	<ul style="list-style-type: none"> To be able to think about applying different Image processing techniques on a given image. To know the fundamental concepts of a digital image processing techniques To be able to analyze problem and design algorithms to solve the problems. 	
Course Outcomes	<p>Learner will be able to...</p> <ul style="list-style-type: none"> Acquire the fundamental concepts of a digital image processing system such as image acquisition, enhancement, segmentation, transforms, compression, morphology, representation and description. Analyze images in the spatial domain. Analyze images in the frequency domain through the Fourier transform. Apply the concepts of morphology, representation and description on images. Design and implement with MATLAB/C/Python algorithms for digital image processing. 	

Module	Contents	Time
1.	Basics of Image Processing: Image acquisition, processing, communication, display; electromagnetic spectrum; elements of visual perception - structure of the human eye, image formation in the eye, brightness adaptation and discrimination, image formation model, uniform and non-uniform sampling, quantization, image formats.	06
2.	Image Enhancement: Spatial domain - point processing techniques, histogram processing, neighbourhood processing, frequency domain techniques, 2D-DFT, properties of 2D-DFT, low pass, high pass, noise removal, homomorphic filters, basics of colour image processing.	09
3.	Image Segmentation: Basic relationships between pixels, neighbours, adjacency, connectivity, regions, boundaries, distance measures; detection of discontinuities, point, line and edges, edge linking, Hough transform, thresholding based segmentation, region-based segmentation.	06

4.	Image Transforms & Image Compression: DFT, FFT, DCT, DST, Hadamard, Walsh, Haar, basis functions and basis images, introduction to wavelet transform, fundamentals of image compression models, lossless compression, RLE, Huffman, LZW and arithmetic coding techniques, lossy compression - IGS coding, transformcoding, JPEG, JPEG 2000.	08
5.	Morphology, Representation and Description: Dilation, erosion, open, close, hit-or-miss, boundary extraction, region filling, thinning and thickening; chain codes, polygonal approximations, signatures; fourier descriptors, moments.	04
6.	Feature Recognition and Classification: Object recognition and classification, connected components labelling, features, statistical classification, structural/syntactic classification, applications in medical image analysis	06

Text books:

1. Digital Image Processing, Gonzalez and Woods - Pearson Education.
2. Fundamentals of Digital Image Processing, A.K. Jain – P.H.I.
3. Digital Image Processing and Analysis, Chanda Majumder - Printice Hall India.

Reference Books:

1. Digital Image Processing for Medical Applications, Geoff Dougherty, Cambridge University Press, 2009..
2. Digital Image Processing, William Pratt - John Wiley.

NPTEL/Swayam Course:

Course:

Digital Image Processing - NPTEL Lecture Videos by Prof. P.K. Biswas from IIT Kharagpur.

<http://www.nptelvideos.com/course.php?id=541>

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned		
		Theory	Pract. /Tut.	Theory	Pract.	Total
BMC603	Data Analysis in Healthcare	3	--	3	--	3

CourseCode	Course Name	Examination Scheme			
		ISA	MSE	ESE	Total
BMC603	Data Analysis inHealthcare	20	30	50	100

Course Code	Course Name	Credits
BMC603	Data Analysis in Healthcare	03
Course Objectives	<ul style="list-style-type: none"> To cover basic concepts and theory related to statistics. To focus on various statistical abilities such as analysis of variance, hypothesis testing, estimation, etc. 	
Course Outcomes	<p>The learner will be able to :</p> <ul style="list-style-type: none"> Understand the basic techniques and nomenclatures used for statistical analysis of data Describe the importance of normalizing data Apply statistical methods to sample data Analyze data using parametric statistical methods Develop a strong foundation for designing algorithms for computation. Design statistical models separately for parametric and non-parametric analysis. 	

Module	Contents	Hours
1	Descriptive statistics, probability and sampling distributions: Frequency distribution, measures of central tendency, measures of dispersion, basic probability and Bayes theorem, Binomial, Poisson and normal distributions, sampling distributions of sample mean, difference between two sample means, sample proportions and difference between two sample proportions	09
2	Estimation: Confidence intervals for population mean, difference between two population means, population proportion, difference between two population proportions, t-distribution, variance of normally distributed population, ratio of variances of two normally distributed populations, determination of sample size for estimating mean and proportions	06
3	Hypothesis testing: Type – I and II errors, hypothesis testing for population mean, difference between two population means, population proportions, difference between two population proportions, population variance and ratio of two population variances, power of test	06
4	Analysis of variance: Completely randomized design, randomized complete block design, repeated measures design, factorial experiment, regression and correlation, simple linear regression, correlation model, correlation coefficient, multiple regression, multiple correlation	06
5	Chi square distribution and analysis of frequency: Chi-square distribution and properties, test of goodness of fit, independence and homogeneity of data	06
6	Non-parametric analysis: Distribution free tests such as one sample sign test, rank sum test, Mann-Whitney U-test, Kruskal-Wallis test, cluster analysis, data mining methods	06

Books Recommended:

Text Books:

1. Biostatistics – A foundation for analysis in health sciences by Wayne W. Daniel, Seventh edition, Wiley India
2. Fundamentals of mathematical statistics by S. C. Gupta and V. K. Kapoor, second edition, Sultan Chand Publisher
3. Probability and statistics for engineers by J. Ravichandran, Wiley /India
4. Research Methodology Methods and Techniques by C. R Kothari and Gaurav Garg, Fourth Edition, New Age international publishers.

Reference Books:

1. Biostatistics – How it works by Steve selvin, Pearson education
2. An Introduction to Biostatistics by Sunder Rao and J. Richard, Third Edition, Prentice Hall of India
3. Probability and Statistics by Schaum's series

NPTEL/Swayam Course:

Course:

Introduction to Data Analytics by Prof. Nandan Sundarsanam – IIT-M and Prof. B. Ravindran – IIT-M

<https://nptel.ac.in/noc/courses/noc16/SEM2/noc16-mg06/>

Data analytics with Python by Prof. A. Ramesh - IIT Roorkee

<https://nptel.ac.in/courses/106/107/106107220/>

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned		
		Theory	Pract. /Tut.	Theory	Pract.	Total
BMC604	Biomechanics, Prosthetics and Orthotics	3	1	3	--	4

CourseCode	Course Name	Examination Scheme			
		ISA	MSE	ESE	Total
BMC604	Biomechanics, Prosthetics and Orthotics	20+25(T)	30	50	125

Course Code	Course Name	Credits
BMC604	Biomechanics, Prosthetics and Orthotics	03
Course Objectives	<ul style="list-style-type: none"> Recall the general characteristics, mechanical properties of bone and tissues. Analyze the forces at joints for various static and dynamic human activities; analyze the stresses and strains in biological tissues. Understand principles used in designing orthoses and prostheses Study different materials used for orthoses and prosthesis. 	
Course Outcomes	<p>Learner will be able to...</p> <ul style="list-style-type: none"> Explain the basic principles of Biomechanics Explain the mechanical behavior of Biological Tissues Explain about various joints and its movements Explain the techniques adopted for analyzing joint movements. Explain the general principles followed while designing Orthoses and prosthesis. Explain the applications of various Prosthetic and Orthotic devices. 	

Module	Contents	Time
	BIOMECHANICS	
1.	Force system: Classification of force system, equilibrium of force system, principle of biomechanics	02
2.	Tissue Biomechanics: Direct shear, bending and torque actions and the corresponding stresses and strains in biological tissues. stress relaxation and creep. Bone structure & composition, mechanical properties of bone, biomechanical evaluation of bone using three points and four points. Biomechanics of connective tissues (skin, tendon, ligaments, etc.) covering structure function, and physiological factors.	10
3.	Movement Biomechanics: Study of joints and movements, anatomical levers, gait analysis, gait cycle and gait parameters	04
4.	Joint analysis: Instrumentation for gait analysis: measurement devices-footswitches, instrumented walkway, motion analysis - Selspot, goniometers, joint monitoring sensors and joint monitoring parameters	05

	PROSTHETICS AND ORTHOTICS	
5.	Principles in designing orthoses and prostheses: Principles of three point pressure, total contact, partial weight bearing.	05
6.	Classification in prosthetics and orthotics: Lower extremity orthoses and prostheses, upper extremity orthoses and prostheses, spinal orthoses.	13

Tutorials: Eight tutorials are to be conducted from the below list.

1. Components of biomechanics
2. Role of biomechanics in exercises
3. Biomechanics and body movements
4. Gait cycle
5. Evaluation of gait parameters
6. Orthotic devices associated with sports injuries
7. Advancements in materials used for orthotic devices
8. Prosthetic rehabilitation
9. Advancements in materials used for prosthetic devices

Text books:

1. Basic Biomechanics- Susan J. Hall, MC Graw Hill.
2. Basics of Biomechanics" by Dr. Ajay Bahl and others
3. Basic Biomechanics of the Musculoskeletal System, M. Nordin, V. Frankel
4. Human Limbs and their substitutes – Atlas, C. V. Mosby
5. American Atlas of Orthopedics: Prosthetics, C. V. Mosby.
6. American Atlas of Orthopedics: Orthotics, C. V. Mosby
7. Biomechanics - Prof Ghista (Private Publication UAE)
8. Biomechanics – By White and Puyator (Private Publication UAE)

Reference Books:

1. Introductory Biomechanics: from cells to tissues by Ethier and Simmons
2. Biomechanics: Mechanical properties of living tissues by Y. C. Fung

NPTEL/Swayam Course:

1. Assistive Devices, Prosthesis and Orthosis, NPTEL Lecture Video by Dr Sujatha Srinivasan, IIT Madras.
<http://www.digimat.in/nptel/courses/video/112106248/L47.html>
2. Mechanics of Human Movement, Swayam, Lecture Video by Dr Sujatha Srinivasan, IIT Madras.
https://onlinecourses.nptel.ac.in/noc21_me52/preview

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned		
		Theory	Pract. /Tut.	Theory	Pract.	Total
BMDO601X	Department Optional Course – 2	3	--	3	--	3

Course Code	Course Name	Examination Scheme			
		ISA	MSE	ESE	Total
BMDO6011	Nuclear Medicine	20	30	50	100

Course Code	Course Name	Credits
BMDO6011	Nuclear Medicine	03
Course Objectives	<ul style="list-style-type: none"> To enable the students to understand the basic science of nuclear medicine, operating principles and quality control aspects of various nuclear medicine equipment. To keep the students abreast with the technological developments in the field of nuclear medicine. 	
Course Outcomes	<p>Learners will be able to</p> <ul style="list-style-type: none"> Explain the essential physics of nuclear medicine such as concepts of radioactivity, its measurement, interaction with matter and radionuclide production. Apply the principles of physics to understand working of various detectors and counting systems. Study principle of operation of different scanning system and their quality control function. Explain various Emission Tomography Techniques along with their Clinical Applications. Explain various aspects of radiation safety. Explain concept of radionuclide therapy and the function of radiotherapy equipment. 	

Module	Content	Hours
1.	<p>Basics of Nuclear Physics: Radioactivity, radioactive decay law, radioactive decay processes, decay scheme of Mo-99. Units of radioactivity measurement, interaction of radiation with matter</p> <p>Production of Radionuclide: Methods of radionuclide production: nuclear reactor, medical cyclotron & radionuclide generators</p>	09
	<p>Spectra of commonly used radio nuclides e.g Tc-99m, Cs-137.</p> <p>Radiopharmaceuticals: ideal radiopharmaceutical, methods of radio labelling</p>	

2.	<p>Detectors in Nuclear Medicine & Counting and Measuring System: Gas filled detectors, scintillation detectors and solid-state detectors, scintillation counting system, gamma ray spectrometry, radionuclide dose calibrator, properties of detectors.</p> <p>In Vitro Techniques (Brief Description): Introduction, single and double isotope method, radioimmunoassay, RIA counting system, liquid scintillation counting system, RIA applications.</p>	07
3.	<p>In Vivo Techniques: General principle, uptake monitoring system, rectilinear scanner, gammacamera fundamentals, position circuitry and working, computer interface, performance parameters, quality control functions</p>	06
4.	<p>Emission Tomography Techniques and Clinical Applications: Introduction, principles and applications of SPECT, principles and applications of PET, system performance parameters and quality control functions.</p> <p>Introduction to Hybrid Modalities: PET/CT, SPECT/CT</p> <p>Clinical Applications Clinical applications of PET, SPECT and hybrid modalities in cardiology, neurology and oncology.</p>	07
5.	<p>Radiation Safety: Natural & artificial radiation exposure, external & internal radiation hazard, methods of minimizing external exposure, methods of preventing internal exposure, evaluation of external & internal hazard, biological effects of radiation, radioactive waste management.</p>	06
6.	<p>Radionuclide Therapy: Choice of a radionuclide in therapeutic nuclear medicine, radiotherapy equipment: cobalt unit, proton beam therapy</p>	04

Books Recommended:

Text Books:

1. J. Harbert and A.F.G. Rocha, *Textbook of Nuclear medicine*, Second Edition, Lea & Febiger.
2. B.R. Bairy, Balvinder Singh, N.C. Rathod and P.V. Narurkar, *Handbook of Nuclear medicine Instruments*, Tata McGraw – Hill.
3. Gopal B. Saha, *Fundamentals of Nuclear Pharmacy*, Springer Science + Business Media
4. Ramesh Chandra, *Introductory Physics of Nuclear Medicine*, Lea & Febiger.
5. Simon R. Cherry, James A. Sorenson and Michael E. Phelps, *Physics in Nuclear Medicine*, Saunders, an imprint of Elsevier Inc.
6. Janet F. Eary and Winfried Brenner, *Nuclear Medicine Therapy*, informa healthcare

Reference Books:

1. William R. Hendee, *Medical Radiation Physics*, Year Book Medical Publishers
2. G. Hine, *Instrumentation of Nuclear medicine*, Academic Press
3. Glenn F. Knoll, *Radiation Detection & Measurement*, John Wiley & Sons.

NPTEL/Swayam Links:

Course 1: Nuclear Science and Engineering, Dr. Santanu Gosh, Indian institute of Technology, Delhi

<https://nptel.ac.in/courses/115/102/115102017/>

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned		
		Theory	Pract. /Tut.	Theory	Pract.	Total
BMDO601X	Department Optional Course – 2	3	--	3	--	3

CourseCode	Course Name	Examination Scheme			
		ISA	MSE	ESE	Total
BMDO6012	Advanced Embedded Systems	20	30	50	100

Course Code	Course Name	Credits
BMDO6012	Advanced Embedded Systems	03
Course Objectives	<ul style="list-style-type: none"> To impart the hardware and software concepts of Embedded System. To introduce the students with Real Time Operating System. To implement the embedded design, ARM Cortex M3 Microcontroller is covered in detail. 	
Course Outcomes	Learner will be able to: <ul style="list-style-type: none"> Explain the fundamentals of embedded systems Understand the characteristics and hardware of embedded system. Understand the software used for an embedded system. Understand interprocess communication. Understand the usage of the development and debugging tools. Explain the concept of Real Time Operating Systems (RTOS) using practical cases. 	

Module	Contents	Hours
1.	ARM Cortex M3: Overview of ARM family, comparison of RISC and CISC architectures. Cortex-M3 architecture, pipelining, BUS interfaces Programmers' model: register set, program status register, operation modes and states. Memory system and memory protection unit (MPU). Exceptions, interrupt architecture: Nested vectored interrupt controller, power management, watchdog timer and systick timer.	08

2.	Introduction to Embedded Systems and Embedded Hardware: characteristics and design metrics of embedded system, challenges in embedded system design, embedded processors, co-processors and hardware accelerators. Processor performance enhancement: pipelining and superscalar architecture. Types of memories and buffers, sensors (optical encoders, resistive sensors) and actuators (solenoid valves, relay/switch, opto-couplers). Power supply considerations in embedded systems: linear and switching voltage regulators, low power features, sleep mode, brown-out detection.	06
3.	Embedded Software – RTOS 01: Features of RTOS, advantages of RTOS, hard and soft real time systems, selecting an RTOS, Kernel architectures and features. Task/Processes and threads, task states, multitasking, interrupt latency. Context Switching: Cooperative multi-tasking and pre-emptive multi-tasking. Task Scheduler: FIFO, round robin, rate-monotonic scheduling, earliest- deadline first scheduling, fault-tolerant scheduling	08
4.	Embedded Software – RTOS 02: Inter-process communication: Semaphores and signals, shared memory communication, message based communication. Memory management, file systems, device management (device drivers), I/O and communications management. Event timers, task synchronization, priority inversion, deadlock. Software design methodologies: UML, FSM, DFG. Evaluating and optimizing operating system performance: response-time calculation, interrupt latency, time-loading, memory loading.	08
5.	FreeRTOS: Study of Kernel structure of FreeRTOS, functions for initialization, task creation, inter-task communication and resource management, memory management. System integration, testing and debugging methodology: Embedded product design life-cycle (EDLC), Hardware-software co-design testing & debugging: Boundary-scan/JTAG interface concepts, black-box testing, white-box testing.	05
6.	Case studies: Chocolate vending machine, washing machine, automotive systems, auto-focusing digital camera, air-conditioner.	04

Books Recommended:

Text books:

1. Embedded Systems Architecture Programming and Design: Raj Kamal, Tata McGraw Hill
2. Software Design for Real-Time Systems: Cooling, J E, *published by* Chapman and Hall in 1991 ...ISBN 978-0-442-31174-2
3. Embedded System Design: A unified Hardware/software Introduction by Frankvahid/TonyGivargis, Wiley India Edition
4. Real-Time Systems Design and Analysis: An Engineer's Handbook: Laplante, Phillip A by IEEEpress, Wiley-Interscience, A John Wiley and Sons Inc, Publications
5. Embedded / Real-Time Systems: Concepts, Design and Programming Black Book, New ed(MISL-DT)

Reference Books:

1. Embedded Realtime Systems Programming by Sriram Iyer and Pankaj Gupta, Tata McGraw Hill.
2. Dreamteach Software team, Programming for Embedded Systems, AVR 8515 manual
3. Bruce Powel Douglas, "Real-Time UML, Second Edition: Developing Efficient Object for Embedded Systems, 2nd edition, 1999, Addison-Wesley
4. An Embedded Software Primer by David E. Simon - Pearson Education, 2003

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned		
		Theory	Pract. /Tut.	Theory	Pract.	Total
BMDO601X	Department Optional Course – 2	3	--	3	--	3

Course Code	Course Name	Examination Scheme			
		ISA	MSE	ESE	Total
BMDO6013	Telemedicine	20	30	50	100

Course Code	Course Name	Credits
BMDO6013	Telemedicine	03
Course Objectives	<ul style="list-style-type: none"> • Learn the key principles for telemedicine and e-health care. • Understand telemedicine technology. • Know telemedicine standards, mobile telemedicine, and its applications. 	
Course Outcomes	<p>Learner will be able to...</p> <ul style="list-style-type: none"> • Explain the basic principles of healthcare in telemedicine • Discuss the role of telecommunication in Healthcare • Describe various Tele-medicine standards. • Explain the different Components of tele-radiology system • Discuss the various applications of telemedicine 	

Module	Contents	Hours
1.	Introduction to Telemedicine: Historical perspective and evolution of telemedicine, tele health, tele care, components of telemedicine system, global and indian scenario, ethical and legal aspects of telemedicine, safety and regulatory issues, laws governing telemedicine.	07
2.	Telemedicine Technology: Principles of multimedia – text, audio, video, data, data communications and networks, PSTN, POTS, ANT, ISDN, internet, air/wireless communications: GSM satellite, and micro wave, modulation techniques, integration and operational issues, communication infrastructure for telemedicine, LAN and WAN technology, satellite communications, mobile hand held devices and mobile communication, internet technology, video and audio conferencing, clinical data - local and centralized	06
3.	Telemedicine Standards: Data security and standards: encryption, cryptography, mechanisms of encryption, phases of encryption. Protocols: TCP/IP, ISO-OSI, standards to be followed DICOM, HL7, H.320 series (video phone based ISBN) T.120, H.324 (video phone based PSTN), Video conferencing, real-time telemedicine integrating doctors / hospitals, clinical laboratory data, radiological data, and other clinically significant biomedical data,	06
	administration of centralized medical data, security and confidentiality of medical records and access control, cyber laws related to telemedicine.	

4.	Mobile Based Tele-ECG: Need for mobile based TM, Tele-ECG development, Tele ECG scenario on the globe, extension of mobile based approach for other vitalsignals, cloud based tele-monitoring, personal monitoring, Impact of mobile based Tele-ECG.	06
5.	Mobile Telemedicine: Components of tele-radiology system: Image acquisition system display system, tele pathology, multimedia databases, color images of sufficient resolution, dynamic range, spatial resolution, compression methods, interactive control of color, medical information storage and management for telemedicine- patient information medical history, test reports, medical images diagnosis and treatment. Hospital information system – doctors, paramedics, facilities available. pharmaceutical information system.	07
6.	Telemedicine Applications: Telemedicine access to health care services – health education and self-care. introduction to robotics surgery, tele-surgery. tele- cardiology, telemedicine in neurosciences, electronic documentation, e-health services security and interoperability., telemedicine access to health care services, health education and self-care, business aspects – project planning, usage of telemedicine.	07

Text Books:

1. Norris, A.C. "Essentials of Telemedicine and Telecare", Wiley (ISBN 0-471-53151-0), First edition, 2002.
2. O'Carroll, P.W, Yasnoff W.A., Ward E.Ripp, L.H., Martin, E.L., "Public Health Informatics and Information Systems", Springer (ISBN 0-387-95474-0), 1st Edition, 2003.
3. Ferrer-Roca, O., Sosa-Iudicissa, M, "Handbook of Telemedicine", IOS Press (Studies in Health Technology and Informatics, Volume 54). (ISBN 90-5199-413-3), 3rd Edition, 2002.

Reference Books:

1. Simpson, W. "Video over IP- A practical guide to technology and applications", Focal Press(Elsevier). ISBN-10: 0-240-80557-7, 2006.
2. Wootton R. Craig, J., Patterson V. "Introduction to Telemedicine", Royal Society of Medicine Press Ltd (ISBN 1853156779), 2nd Edition, 2006.

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned		
		Theory	Pract. /Tut.	Theory	Pract.	Total
BML601	Biomedical Instrumentation – II Laboratory	--	2	--	1	1

CourseCode	Course Name	Examination Scheme			
		ISA	MSE	ESE	Total
BML601	Biomedical Instrumentation – II Laboratory	25		25	50

Course Code	Course Name	Credits
BML601	Biomedical Instrumentation – II Laboratory	01
Course Objective	<ul style="list-style-type: none"> To understand the basic principles and working of patient monitoring system. To develop skills enabling Biomedical Engineers to serve the health care industry To develop core competency and skill in the field of Biomedical Engineering, to design and develop new health care systems. 	
Course Outcome	Learner will be able to... <ul style="list-style-type: none"> Design and Implement filters for filtering of noise from signals. Design and Implement Instrumentation amplifier to amplify low amplitude signals. Design and Implement a regulated power supply. Design and Implement Pulse Width Modulator. Understand the working of ECG machine by recording ECG. Provide a better understanding about foetal monitoring systems. Test the hearing ability using an audiometer. 	

Syllabus: Same as that of (BMC601) Biomedical Instrumentation-II (BMI-II)

List of Laboratory Experiments: (Any Seven)

1. Design of instrumentation amplifier
2. Implementation of notch filter
3. Implementation of bandpass filter
4. Design and implementation of regulated power supply
5. Demonstration of ECG machine / monitor
6. Demonstration of foetal monitor
7. Demonstration of blood flow measurement
8. Testing of hearing ability using audiometer
9. Industry / hospital visit may be conducted

Any other experiment based on syllabus which will help learner to understand topic/concept.

Group Presentations on the latest technology in hospitals based on the topics covered in the syllabus.

In Semester Assessment (ISA):

ISA shall consist of minimum 7 experiments.

The final certification and acceptance of ISA ensures the satisfactory performance of laboratory work and minimum passing in the ISA.

Books Recommended:

Text books:

1. Handbook of Biomedical Instrumentation (Third edition): R S. Khandpur. (PH Pub)
2. Medical Instrumentation, Application and Design: J G. Webster. (John Wiley)
3. Biomedical Instrumentation and measurements: Leslie Cromwell, Fred J. Weibell, Enrich A. Pfeiffer. (PHI Pub)

Reference books:

1. Introduction to Biomedical Equipment Technology: Carr –Brown. (PH Pub)
2. Encyclopedia of Medical Devices and Instrumentation: J G. Webster. Vol I- IV (PH Pub)
3. Various Instruments Manuals.
4. Various internet websites

Practical and Oral examination will be based on suggested practical list and entire syllabus.

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned		
		Theory	Pract. /Tut.	Theory	Pract.	Total
BML602	Biomedical Digital Image Processing Laboratory	--	2	--	1	1

CourseCode	Course Name	Examination Scheme			
		ISA	MSE	ESE	Total
BML602	Biomedical Digital Image ProcessingLaboratory	25		25	50

Course Code	Course Name	Credits
BML602	Biomedical Digital Image Processing Laboratory	01
Course Objectives	<ul style="list-style-type: none"> To be able to think about applying different Image processing techniques on agiven image. To know the fundamental concepts of a digital image processing techniques To be able to analyze problem and design algorithms to solve the problems. 	
Course Outcomes	<p>Learner will be able to...</p> <ul style="list-style-type: none"> Acquire the fundamental concepts of a digital image processing system such asimage acquisition, enhancement, segmentation, transforms, compression, morphology, representation and description. Analyze images in the spatial domain. Analyze images in the frequency domain through the Fourier transform. Apply the concepts of morphology, representation and description on images. Design and implement with MATLAB/C/Python algorithms for digital imageprocessing. 	

Syllabus: Same as that of BMC602 Biomedical Digital Image Processing (Abbreviated as BDIP).

List of Experiments (using Matlab / C / Labview / python / other platform)

1. Point processing techniques (At least 4 experiments)
2. Spatial domain filtering
3. Histogram processing (Histogram stretching, equalisation and matching)
4. Frequency domain filtering (Plotting 2D-DFT, low pass and high pass (Ideal, Butterworth andGaussian) filters
5. Segmentation - gradient operators
6. Compression - JPEG
7. Morphology - dilation erosion

Any other experiment based on syllabus may be included, which would help the learner to understand topic/concept.

In Semester Assessment (ISA):

ISA shall consist of minimum 8 experiments.

The final certification and acceptance of ISA ensures the satisfactory performance of laboratory work and minimum passing in the ISA.

Text books:

1. Digital Image Processing, Gonzalez and Woods - Pearson Education.
2. Fundamentals of Digital Image Processing, A.K. Jain – P.H.I.
3. Digital Image Processing and Analysis, Chanda Majumder - Printice Hall India.

Reference Books:

1. Digital Image Processing for Medical Applications, Geoff Dougherty, Cambridge University Press, 2009..
2. Digital Image Processing, William Pratt - John Wiley.

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned		
		Theory	Pract. /Tut.	Theory	Pract.	Total
BML603	Data Analysis in Healthcare Laboratory	--	2	--	1	1

CourseCode	Course Name	Examination Scheme			
		ISA	MSE	ESE	Total
BML603	Data Analysis in Healthcare Laboratory	25		25	50

Course Code	Course Name	Credits
BML603	Data Analysis in Healthcare Laboratory	01
Course Objective	To conduct analysis of medical data using Statistical tools.	
Course Outcome	Learner will be able to <ul style="list-style-type: none"> • Plan the experiment for the given study • Form a sample of proper size • Use descriptive statistics to present the data • Apply statistical methods to analyse the data • Make inferences based on statistical theories 	

Syllabus: Same as that of BML603 Data Analysis in Healthcare (DAH)

Laboratory experiments may be conducted using Excel/ Python / R Studio /Tableau or any other Statistical tool/ software

List of experiments

1. Descriptive statistics and probability
2. Discrete probability distributions
3. Continuous probability distributions
4. Sampling distributions
5. Estimation
6. Hypothesis testing
7. Analysis of variance
8. Regression and Correlation
9. Chi square distribution and analysis of frequency
10. Anova
11. Kruskal-Wallis Test
12. Mann Whitney U-test

Any other experiment based on syllabus which will help students to understand topic/concept

In Semester Assessment (ISA):

ISA shall consist of minimum 7 experiments.

The final certification and acceptance of ISA ensures the satisfactory performance of laboratory work and minimum passing in the ISA.

Books Recommended:

Text books:

1. Biostatistics – A foundation for analysis in health sciences by Wayne W. Daniel, Seventh edition, Wiley India
2. Fundamentals of mathematical statistics by S. C. Gupta and V. K. Kapoor, second edition, Sultan Chand Publisher
3. Probability and statistics for engineers by J. Ravichandran, Wiley India

Reference Books:

1. Biostatistics – How it works by Steve Selvin, Pearson education
2. An Introduction to Biostatistics by Sunder Rao and J. Richard, Third Edition, Prentice Hall of India
3. Probability and Statistics by Schaum's series

NPTEL/Swayam Course:

Course:

Data Analysis and Decision Making - I by Prof. Raghunandan Sengupta, IIT Kanpur

<https://nptel.ac.in/courses/110/104/110104094/>

Descriptive Statistics with R Software By Prof. Shalabh, Prof. Prashant Jha IIT Kanpur, NIT Sikkim

https://onlinecourses.nptel.ac.in/noc21_ma37/preview

Oral examination will be based on suggested practical list and entire syllabus.

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned		
		Theory	Pract. /Tut.	Theory	Pract.	Total
BML604	Patient- care Automation Laboratory	--	4	--	2	2

CourseCode	Course Name	Examination Scheme			
		ISA	MSE	ESE	Total
BML604	Patient-careAutomationLaboratory	25			25

Course Code	Course Name	Credits
BML604	Patient-care Automation Laboratory	01
Course Objectives	<ul style="list-style-type: none"> To understand the fundamentals of automation and various components of automated instrumentation systems used in patient care such as sensors, data acquisition, data processing and visualization. To understand the working of these systems and should be able to determine hardware and software requirements for the automated systems. To understand how to design any application based on these systems. To understand the requirements of patient safety and design safety instrumented systems 	
Course Outcomes	<p>Learner will be able to ...</p> <ul style="list-style-type: none"> Demonstrate the use of analog circuits in automation of biomedical instruments. Demonstrate the use of digital circuits in automation of biomedical instruments. Demonstrate and explain the working of automated patient care devices and instrumentation by proper selection and designing criteria, developing user friendly interfaces/GUI to make stand-alone biomedical instruments. Explain the need of patient safety and use of safety features and devices in designing of the systems. 	

List of Experiments (any 7)

1. Conditional decision making and switching of output devices like relays/ motors
2. Usage of indicating components (displays/ LED/ alarms) in biomedical applications
3. Use of peristaltic pump for dispensing the doses
4. Design of heart rate measurement circuits using analog components
5. Design of low-cost body temperature measurement unit
6. Automation of rehabilitation devices using electronic/ mechanical components
7. Design syringe pump driving circuit
8. User friendly user interfaces for biomedical equipment
9. Patient feedback designs using patient switch (audiometer)
10. Patient safety using safety switch (traction machine)
11. Design and approaches for nerve and muscle stimulator using wave form generators

12. Design of bio-signal transmission using modulation techniques

Note: The above experiments can be performed using the freeware or available simulation software

No single solution to any design and it depends on the available analog or digital resources.

In Semester Assessment (ISA):

ISA shall consist of minimum 7 experiments.

The final certification and acceptance of ISA ensures the satisfactory performance of laboratory work and minimum passing in the ISA.

Books Recommended:

Text books:

1. Handbook of Biomedical Instrumentation (Third edition): R S. Khandpur. (PH Pub)
2. Medical Instrumentation, Application and Design: J G. Webster. (John Wiley)
3. Biomedical Instrumentation and Measurements: Leslie Cromwell, Fred J. Weibell, Enrich A. Pfeiffer. (PHIPub)

Reference books:

1. Introduction to Biomedical Equipment Technology: Carr – Brown. (PH Pub)
2. Encyclopedia of Medical Devices and Instrumentation: J G. Webster. Vol. I- IV (PH Pub)
3. Various Instruments Manuals.
4. Various internet websites

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned		
		Theory	Pract. /Tut.	Theory	Pract.	Total
BMM601	Mini Project – 2 B	--	4\$	--	2	2
Total		15	15	15	07	23

CourseCode	Course Name	Examination Scheme			
		ISA	MSE	ESE	Total
BMM601	Mini Project – 2 B	25		25	50

Course Code	Course Name	Credits
BMM601	Mini Project – 2 B	02
Course Objective	<ul style="list-style-type: none"> • To acquaint with the process of identifying the needs and converting it into the problem. • To familiarize the process of solving the problem in a group. • To acquaint with the process of applying basic engineering fundamentals to attempt solutions to the problems. • To inculcate the process of self-learning and research. 	
Course Outcome	<p>Learner will be able to:</p> <ul style="list-style-type: none"> • Identify problems based on societal /research needs. • Apply Knowledge and skill to solve societal problems in a group. • Develop interpersonal skills to work as member of a group or leader. • Draw the proper inferences from available results through theoretical/ experimental/simulations. • Analyse the impact of solutions in societal and environmental context for sustainable development. • Use standard norms of engineering practices • Excel in written and oral communication. • Demonstrate capabilities of self-learning in a group, which leads to life long learning. • Demonstrate project management principles during project work. 	

Guidelines for Mini Project

- Students shall form a group of 3 to 4 students, while forming a group shall not be allowed less than three or more than four students, as it is a group activity.
- Students should do survey and identify needs, which shall be converted into problem statement for mini project in consultation with faculty supervisor/head of department/internal committee of faculties.
- Students shall submit implementation plan in the form of Gantt/PERT/CPM chart, which will cover weekly activity of mini project.
- A log book to be prepared by each group, wherein group can record weekly work progress, guide/supervisor can verify and record notes/comments.
- Faculty supervisor may give inputs to students during mini project activity; however, focus shall be on self-learning.
- Students in a group shall understand problem effectively, propose multiple solution and select best possible solution in consultation with guide/ supervisor.
- Students shall convert the best solution into working model using various components of their domain areas and demonstrate.
- The solution to be validated with proper justification and report to be compiled in standard format of University of Mumbai.
- With the focus on the self-learning, innovation, addressing societal problems and entrepreneurship quality development within the students through the Mini Projects, it is preferable that a single project of appropriate level and quality to be carried out in two semesters by all the groups of the students. i.e. Mini Project 1 in semester III and IV. Similarly, Mini Project 2 in semesters V and VI.
- However, based on the individual students or group capability, with the mentor's recommendations, if the proposed Mini Project adhering to the qualitative aspects mentioned above gets completed in odd semester, then that group can be allowed to work on the extension of the Mini Project with suitable improvements/modifications or a completely new project idea in even semester. This policy can be adopted on case by case basis.

Guidelines for Assessment of Mini Project:

In Semester Assessment (ISA)

- The review/ progress monitoring committee shall be constituted by head of departments of each institute. The progress of mini project to be evaluated on continuous basis, minimum two reviews in each semester.
- In continuous assessment focus shall also be on each individual student, assessment based on individual's contribution in group activity, their understanding and response to questions.
- Distribution of Term work marks for both semesters shall be as below;

○ Marks awarded by guide/supervisor based on log book	10
○ Marks awarded by review committee	10
○ Quality of Project report	05

Review/progress monitoring committee may consider following points for assessment based on either one year or half year project as mentioned in general guidelines.

One-year project:

- In first semester entire theoretical solution shall be ready, including components/system selection and cost analysis. Two reviews will be conducted based on presentation given by students group.
 - First shall be for finalisation of problem
 - Second shall be on finalisation of proposed solution of problem.
- In second semester expected work shall be procurement of component's/systems, building of working prototype, testing and validation of results based on work completed in an earlier semester.
 - First review is based on readiness of building working prototype to be conducted.
 - Second review shall be based on poster presentation cum demonstration of working model in last month of the said semester.

Half-year project:

- In this case in one semester students' group shall complete project in all aspects including,
 - Identification of need/problem
 - Proposed final solution
 - Procurement of components/systems
 - Building prototype and testing
- Two reviews will be conducted for continuous assessment,
 - First shall be for finalisation of problem and proposed solution
 - Second shall be for implementation and testing of solution.

Assessment criteria of Mini Project.

Mini Project shall be assessed based on following criteria;

1. Quality of survey/ need identification
2. Clarity of Problem definition based on need.
3. Innovativeness in solutions
4. Feasibility of proposed problem solutions and selection of best solution
5. Cost effectiveness
6. Societal impact
7. Innovativeness
8. Cost effectiveness and Societal impact
9. Full functioning of working model as per stated requirements
10. Effective use of skill sets
11. Effective use of standard engineering norms
12. Contribution of an individual's as member or leader

13. Clarity in written and oral communication

- In **one year, project**, first semester evaluation may be based on first six criteria's and remaining may be used for second semester evaluation of performance of students in mini project.
- In case of **half year project** all criteria's in generic may be considered for evaluation of performance of students in mini project.

Guidelines for Assessment of Mini Project Practical/Oral Examination:

- Report should be prepared as per the guidelines issued by the University of Mumbai.
- Mini Project shall be assessed through a presentation and demonstration of working model by the student project group to a panel of Internal and External Examiners preferably from industry or research organisations having experience of more than five years approved by head of Institution.
- Students shall be motivated to publish a paper based on the work in Conferences/students competitions.

Mini Project shall be assessed based on following points;

1. Quality of problem and Clarity
2. Innovativeness in solutions
3. Cost effectiveness and Societal impact
4. Full functioning of working model as per stated requirements
5. Effective use of skill sets
6. Effective use of standard engineering norms
7. Contribution of an individual's as member or leader
8. Clarity in written and oral communication



Vidyalankar Institute of Technology

(Autonomous Institute Affiliated to the University of Mumbai)

Scheme and Detailed Syllabus

of

Final Year

in

Bachelor of Engineering

in

Biomedical Engineering

(Curriculum of REV- 2019 'C' Scheme of UoM)

With effect from Academic Year 2022-23

Program Structure for Final Year Biomedical Engineering
Vidyalankar Institute of Technology, Mumbai (w.e.f. 2022-2023)
Semester VII

Course Code	Course Name	Teaching Scheme(Contact Hours)		Credits Assigned		
		Theory	Pract. Tut.	Theory	Pract.	Total
BMC701	Biomedical Instrumentation – III	3	--	3	-	3
BMC702	Machine Learning	3	--	3	-	3
BMDO701X	Department Optional Course – 3	3	--	3	-	3
BMDO702X	Department Optional Course – 4	3	--	3	-	3
BMIO701	Institute Optional Course – 1	3	--	3	-	3
BML701	Biomedical Instrumentation – III Lab	--	2	--	1	1
BML702	Machine Learning Lab	--	2	--	1	1
BMDL701X	Department Optional Course – 3 Lab	--	2	--	1	1
BMP701	Major Project - I	--	6 [#]	--	3	3
Total		15	12	15	6	21

Evaluation Scheme for Final Year Biomedical Engineering
Vidyalankar Institute of Technology (Autonomous status with effect from A.Y. 2022-23)
Semester VII

Course Code	Course Name	Examination Scheme			
		ISA	MSE	ESE	Total
BMC701	Biomedical Instrumentation – III	20	30	50	100
BMC702	Machine Learning	20	30	50	100
BMDO701X	Department Optional Course – 3	20	30	50	100
BMDO702X	Department Optional Course – 4	20	30	50	100
BMIO701	Institute Optional Course	20	30	50	100

	- 1				
BML701	Biomedical Instrumentation – III Lab	25		25	50
BML702	Machine Learning Lab	25		25	50
BMDL701X	Department Optional Course – 3 Lab	25		25	50
BMP701	Major Project - I	25		25	50
Total		200	150	350	700

Total Contact Hours/week :27

Total Credit : 21

ISA=In Semester Assessment, MSE=Mid Semester Examination, ESE= End Semester Examination

indicates work load of Learner (Not Faculty), for Major Project

Sem. VII: Department Optional Course – 3

BMDO7011: Biological Modeling and Simulation
BMDO7012: Bioinformatics

BMDO7013: IoT based Systems

Sem. VII: Department Optional Course

– 4BMDO7021: Rehabilitation Engineering
BMDO7022: Lasers and Fibre Optics

BMDO7023: Networking and Information Systems in Medicine

Sem. VII: Institute Level Optional

Course –IILO1011: Product Lifecycle Management
ILO1012: Reliability Engineering

ILO1013: Management Information System
ILO1014: Design of Experiments

ILO1015: Operation Research

ILO1016: Cyber Security and Laws

ILO1017: Disaster Management and Mitigation Measures

ILO1018: Energy Audit and Management

ILO1019: Development Engineering

Program Structure for Final Year Biomedical Engineering
Vidyalankar Institute of Technology, Mumbai (w.e.f. 2022-2023)
Semester VIII

Course Code	Course Name	Teaching Scheme(Contact Hours)		Credits Assigned		
		Theory	Pract. /Tut.	Theory	Pract.	Total
BMC801	Hospital Management	3	--	3	--	3
BMDO801X	Department Optional Course – 5	3	--	3	--	3
BMDO802X	Department Optional Course – 6	3	--	3	--	3
BMIO801	Institute Optional Course - 2	3	--	3	--	3
BML801	Hospital Management Lab	--	2	--	1	1
BMDL801X	Department Optional Course – 5 Lab	--	2	--	1	1
BMP801	Major Project - II	--	12 [#]	--	6	6
Total		12	16	12	8	20

Evaluation Scheme for Final Year Biomedical Engineering
Vidyalankar Institute of Technology (Autonomous status with effect from A.Y. 2022-23)
Semester VIII

Course Code	Course Name	Examination Scheme			
		ISA	MSE	ESE	Total
BMC801	Hospital Management	20	30	50	100
BMDO801X	Department Optional Course – 5	20	30	50	100
BMDO802X	Department Optional Course – 6	20	30	50	100
BMIO801	Institute Optional Course - 2	20	30	50	100
BML801	Hospital Management Lab	25		25	50
BMDL801X	Department Optional Course – 5 Lab	25		25	50
BMP801	Major Project - II	100		50	150
Total		230	120	300	650

Total Contact Hours/week : 28

Total Credit :20

ISA=In Semester Assessment, MSE=Mid Semester Examination, ESE= End Semester Examination

Sem. VIII: Department Optional Course –

5 BMDO8011: Robotics in Medicine
BMDO8012: Healthcare Informatics
BMDO8013: Artificial Intelligence in
Medicine

Sem. VIII: Department Optional Course

– 6BMDO8021: Biomedical Microsystems
BMDO8022: Medical Device Regulations
BMDO8023: Ergonomics

Sem. VIII: Institute level Optional Course - II

ILO2021: Project
Management ILO2022:
Finance Management
ILO2023: Entrepreneurship Development and
Management ILO2024: Human Resource Management
ILO2025: Professional Ethics and Corporate Social Responsibility (CSR)
ILO2026: Research Methodology
ILO2027: IPR and Patenting
ILO2028: Digital Business
Management ILO2029:
Environmental Management
Students group and load of faculty per week.

Major Project 1 and 2 :

Students can form groups with minimum 2 (Two) and not more than 4
(Four) Faculty Load : In Semester VII – ½ hour per week per project
group In Semester VIII – 1 hour per week per project group

Semester – VII

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned		
		Theory	Pract. Tut.	Theory	Pract.	Total
BMC701	Biomedical Instrumentation – III	3	--	3	--	3

Course Code	Course Name	Examination Scheme			
		ISA	MSE	ESE	Total
BMC701	Biomedical Instrumentation – III	20	30	50	100

Course Code	Course Name	Credits
BMC701	Biomedical Instrumentation- -III	03
Course Objectives	<ul style="list-style-type: none"> • To understand the basic principles and working of life Saving Equipment. • To develop skills enabling Biomedical Engineers to serve the health care industry • To develop core competency and skill in the field of Biomedical Engineering, to design and develop new health care systems. 	
Course Outcomes	<p>Learner will be able to...</p> <ul style="list-style-type: none"> • Distinguish between the types of pacemakers on the basis of ICHD code and analyze the various circuits. • Apply the knowledge of electronics to analyze defibrillator circuits. • Explain the importance of use of Anesthesia machine and Capnograph during Surgery. • Explain the basic principle, working and applications of surgical equipment with safety aspects. • Explain the importance of measurement of oxygen saturation in human body and application of heart lung machine during surgery. 	

Module	Contents	Hours
1	Cardiac Pacemakers Need for a pacemaker, modes of operation, classification codes for pacemaker, external and implantable pacemaker, programmable pacemaker, Power sources for pacemakers, leads and electrodes, recent developments of Implantable Pacemakers.	09
2	Cardiac Defibrillator Need for defibrillator, D C defibrillator, modes of operation and electrodes, performance aspects of dc-defibrillator, implantable defibrillator, cardioverter.	08
3	Physiotherapy equipments Basic principle, working and technical specifications of 1.Shortwave Diathermy 2. Ultrasonic therapy unit 3. Nerve and Muscle Stimulator.	06
4	Surgical equipment Operation theatre Lights and Table. Surgical Diathermy machine, automated electrosurgical systems, electrodes used with surgical diathermy, safety aspects in electronic surgical units.	08
5	Heart Lung machine Heart Lung Machine and types of oxygenators	04
6	Oximeters Basics of oximeter, In-vitro and In-vivo oximetry, ear oximetry, pulse oximetry, skin reflectance oximeters, intravascular oximeters,	04

Books Recommended:

Text books:

1. Handbook of Biomedical Instrumentation (Third edition): R S. Khandpur. (PH Pub)
2. Medical Instrumentation, Application and Design: J G. Webster. (John Wiley)
3. Biomedical Instrumentation and measurements: Leslie Cromwell, Fred J. Weibell, Enrich A. Pfeiffer. (PHI Pub)

Reference books:

1. Introduction to Biomedical Equipment Technology: Carr –Brown.
2. Encyclopedia of Medical Devices and Instrumentation: J G. Webster. Vol I- IV
3. Various Instrument Manuals.
4. Various internet websites.

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned		
		Theory	Pract. Tut.	Theory	Pract.	Total
BMC702	Machine Learning	3	--	3		3

Course Code	Course Name	Examination Scheme			
		ISA	MSE	ESE	Total
BMC702	Machine Learning	20	30	50	100

Course Code	Course Name	Credits
BMC702	Machine Learning	03
Course Objectives	<ul style="list-style-type: none"> To build a strong base in artificial intelligence through algorithm development. To develop competency in logical thinking, computer programming and knowledge application. <p>To train and motivate for higher education and research in order to make contribution to state of the art health care for all</p>	
Course Outcomes	<p>Learner will be able to...</p> <ul style="list-style-type: none"> Understand the fundamental techniques and applications in neural networks, deep learning and machine learning Understand supervised and unsupervised learning, backpropagation and gradient descent algorithms Understand and implement efficient computational techniques using neural networks, deep learning and machine learning <p>Design and implementation of neural network models with deep learning and machine learning will be strong base for designing artificial intelligent systems</p>	

Module	Contents	Hours
1	Learning methods: Introduction , types of learning, supervised learning, unsupervised learning, statistical learning, reinforcement learning, elements of reinforcement learning, model-based learning, temporal difference learning, linear regression, least squares, linear regression for polynomial regression tasks, logistic regression, model selection and validation,	06
2	Clustering: Introduction, mixture densities, k-means clustering, expectation-maximization algorithm, supervised learning after clustering, spectral clustering, hierarchical clustering, choosing the number of clusters. Decision Trees: Introduction, univariate trees, rule extraction from trees, learning rules from data, multivariate trees, clustering, overfitting and evaluation	06
3	Design and analysis of machine learning experiments: Introduction, factors, response, and strategy of experimentation, response surface design, randomization, replication, and blocking, guidelines for machine learning experiments, cross-validation and resampling methods, measuring classifier performance	06
4	Introduction of artificial neural networks: structure and function of a biological neurons, artificial neuron models, concepts of neural network, single layer and multilayer perceptron, structure of an ANN, feed-forward neural network, gradient descent, back propagation, architectures of neural networks, optimisation of neural network model	07
5	Architecture and training the ANN: Type of learning the neural network, training of a single-layer neural network, delta rule, designing ANN models, radial basis function, overview of learning rules and parameters, activation functions, multilayer feed forward network, backpropagation networks, architecture, radial basis function network	07
6	Fundamentals of deep networks: Deep Learning, architectural principles of deep networks, parameters, layers, loss function , optimization algorithms, hyper parameters, building blocks of deep networks, architectures of deep networks, convolutional neural networks, architecture of convolutional neural networks, input layers, convolutional layers, pooling layers, fully connected layers, recurrent neural networks, architecture of recurrent neural network	07

Books Recommended:

Text books

1. Introduction to Machine Learning, 3rd edition, Ethem Alpaydin, PHI Learning Private Limited, New Delhi, 2015
2. Deep Learning by Josh Patterson and Adam Gibson, O'Reilly Media, Inc., Gravenstein Highway North, Sebastopol CA, 2017
3. Neural Networks and Learning Machines Third Edition, Simon Haykin, Pearson, Prentice Hall, 2009

Reference books

1. Machine learning in Action, Peter Harrington, dreamtech Press, New Delhi, 2012
2. Machine learning, Tom M, Mitchell, Mc Graw Hill Education (India) Private Limited New Delhi, 2013

Useful Links:

1. Course 1: Introduction to Machine Learning
<https://nptel.ac.in/courses/1061061392>.
2. Course 2: Introduction to Machine Learning
https://onlinecourses.nptel.ac.in/noc22_cs29/preview

Course Code	Course Name	Teaching Scheme			Credits Assigned			
		Theory	Pract.	Tut	Theory	Pract.	Tut	Total
BMDO7011	Biological Modeling and Simulation (Abbreviated asBMS)	3	--	-	3	--	-	3

Course Code	Course Name	Examination Scheme			
		ISA	MSE	ESE	Total
BMDO701X	Biological Modeling and Simulation	20	30	50	100

Course Code	Course Name	Credits
BMDO7011	Biological Modeling and Simulation	03
Course Objectives	<ul style="list-style-type: none"> To understand basic concepts of modeling for designing biological model. To simulate physiological processes for better understanding. To develop competency in terms of logical thinking, programming and application skills To train and motivate students for pursuing higher education and research for developing cutting edge technologies. 	
Course Outcomes	<p>A learner will be able to:</p> <ul style="list-style-type: none"> Categorise different types of biological models. Develop a model of a neuron using Hodgkin Huxley exp setup. Differentiate a spindle receptor and Golgi tendon bodies. Design a quantitative model for eye movement system. Understand a basic model of a thermoregulatory system. Understand the behaviour of immune system 	

Module	Contents	Time
1	Physiological modeling: Steps in modeling, purpose of modeling, lumped parameter models, distributed parameter models, compartmental modeling, modeling of circulatory system.	04
2	Model of neurons: Biophysics tools, Nernst Equation, Donnan Equilibrium, active transport (Pump) GHK equation, action potential, voltage clamp, channel characteristics, Hodgkin- Huxley conductance equations, simulation of action potential, electrical equivalent model of a biological membrane, impulse propagation- core conductor model, cable equations.	11
3	Neuromuscular system: Modeling of skeletal muscle, mono and polysynaptic reflexes, stretch reflex,reciprocal innervations, two control mechanism, Golgi tendon, experimental validation, Parkinson's syndrome.	06
4	Eye movement model: Four eye movements, quantitative eye movement models, validity criteria.	06
5	Thermo-regulatory systems: Thermoregulatory mechanisms, electrical model of thermoregulatory system, controller model, validation and application.	06
6	Modeling of other physiological systems. Modeling the immune response: Behavior of the immune system, linearized model of the immune response. Modeling of insulin glucose feedback system and Pulsatile insulin secretion	06

Books Recommended:

Text books:

1. Bioengineering, Biomedical, Medical and Clinical Engg.: A.Teri Bahil.
2. Signals and systems in Biomedical Engg.: Suresh R Devasahayam.
3. Bio-Electricity A quantitative approach by Barr and Ploncey

Reference Books:

1. Biomedical Engineering Handbook by Bronzino (CRC Press)

Course Code	Course Name	Teaching scheme			Credit assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
BMDO7012	Department Optional Course – 3 Bioinformatics (Abbreviated as BI)	03	--	--	03	--	--	03

Course Code	Course Name	Examination Scheme			
		ISA	MSE	ESE	Total
BMDO7012	Bioinformatics	20	30	50	100

Course Code	Course Name	Credits
BMDO7012	Bioinformatics	03
Course Objectives	<ul style="list-style-type: none"> The course introduces the students to the field of Bioinformatics. To make students aware about the methods to characterize and manage the different types of biological data. To introduce students to the basics of sequence alignment and analysis. 	
Course Outcomes	<p>Learner will be able to</p> <ul style="list-style-type: none"> Get introduced to the basic concepts of Bioinformatics and its significance in Biological data analysis. Apply knowledge of basic principles of mathematics and statistics. Apply existing software effectively to extract information from large databases and to use this information in computer modelling Apply problem-solving skills to multivariate methods in bioinformatics Search and apply bioinformatics tools to analyse and interpret biological data 	

Module	Contents	Hours
1	Introduction to bioinformatics and biological databases: Basic principles of genetics, cells, DNA and chromosome, genes and the genome, DNA sequencing, proteomics, discovery of gene sequence. Human genome project, biological databases and their classification, genome sequence databases, protein structure databases, composite databases.	08
2	Statistical methods used in bioinformatics: Basic statistical modelling and Bayesian inference, gene expression and microarray analysis, sequence alignment, sequence pattern discovery, combining sequence and expression information.	10
3	Algorithms in bioinformatics: Introduction, dynamic programming and sequence alignment, Needleman–Wunsch algorithm, Greedy algorithms for Genome rearrangement, string algorithm, breakpoint graph, approximation algorithm, FASTA and BLAST algorithms..	08
4	Multivariate Methods in Bioinformatics: Multivariate normal distribution, multivariate hypothesis tests, principle component analysis, orthogonal factor model, linear discriminant analysis, classification methods, Naïve Bayes classification.	06
5	Applications and tools of bioinformatics: Sequence alignment and dotplot, DNA sequence analysis, protein sequence analysis, database similarity search, phylogenetic analysis and tree construction, gene, protein and tissue microarray.	07

Recommended Online Courses (optional):

1. "Bioinformatics and Computational Biology" offered by IIT Kanpur
<https://piazza.com/iitk.ac.in/secondsemester2018/bse322a/>
2. "Network Analysis in Systems Biology" offered by Icahn School of Medicine at Mount Sinai, in New York City <https://www.coursera.org/learn/network-biology>
3. "Bioinformatics: Introduction and Methods" from Peking University.
<https://www.coursera.org/learn/bioinformatics-pku>
4. "Biology Meets Programming : Bioinformatics for Beginners", offered by UC San Diego
<https://www.coursera.org/learn/bioinformatics>

Books Recommended:*Text books:*

1. Basics of Bioinformatics, Rui Jiang, Xuegong Zhang, Michael Q. Zhang, Springer, E-book.
2. Introduction to Bioinformatics, Arthur M. Lesk, Oxford University Press, 2002, First Edition.

Reference Books:

1. Essential Bioinformatics, Jin Xiong, Cambridge University Press, 2006, First Edition.

Course Code	Course Name	Teaching scheme			Credit assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
BMDO7013	IoT Based Systems (Abbreviated as IoT)	03	--	--	03	--	--	03

Course Code	Course Name	Examination Scheme			
		ISA	MSE	ESE	Total
BMDO7013	IoT Based Systems	20	30	50	100

Course Code	Course Name	Credits
BMDO7013	IOT Based Systems	03
Course Objectives	<ul style="list-style-type: none"> • Learn the concepts of IOT • Identify different technologies and schemes • Learn different applications in IOT • Learn different protocols used in IOT • Learn how to analyze the data in IOT 	
Course Outcomes	<p>Learner will be able to</p> <ul style="list-style-type: none"> • Apply the concepts of IOT • Identify and select different technologies and scheme for IOT applications • Apply IOT to different applications • Analyze and evaluate protocols used in IOT systems • Analyze dataflow in IOT systems 	

Module	Contents	Hours
1	Introduction: History of IoT, Objects in IoT, Identifier in the IoT, Technologies in IoT. What are wireless sensors, Sensor family, Architecture of single node sensor.	04
2	IoT schemes and models: Block diagram of an IoT device (node), characteristics of IoT, functional blocks of IoT, communication models. IoT levels and deployment templates. IoT enabling technologies.	08
3	IoT stack: M2M stack and examples, IoT stack and examples, IoT stack variants, difference between IoT and M2M. IoT Access Technologies: Physical and MAC layers, IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11 and LoRaWAN.	08
4	Network and Communication Aspects: Network Layer Protocols: IPv4 and IPv6, Constrained nodes and Constrained networks Optimizing IP for IoT: From 6LoWPAN to 6Lo, routing over low power and lossy networks. Application Layer Protocols: CoAP and MQTT.	05
5	Components of IoT: IoT platform design methodology. IoT end device computing –boards based on microcontroller and SoC. Sensor technologies, sensor data communication protocols: UART, SPI, I2C.	06
6	IoT Case Studies: Home automation, smart cities, environment monitoring and control, agriculture, retail sector, healthcare and lifestyle, logistics and supply chain, access control and tracking.	08

Recommended Online Courses (optional):

- 1) Introduction To Internet Of Things
By Prof. Sudip Misra | IIT Kharagpur
https://onlinecourses.nptel.ac.in/noc22_cs52/preview
- 2) Introduction To Industry 4.0 And Industrial Internet Of Things
By Prof. Sudip Misra | IIT Kharagpur
https://onlinecourses.nptel.ac.in/noc22_cs52/preview

Books Recommended:*Text books:*

- 1) Internet of Things: A Hands-On Approach, Arshdeep Bahga, Vijay Madisetti, universitiespress.
- 2) IOT fundamentals, David, Gonzalo, Patrick, Cisco press.
- 3) Data and Computer communications, william stallings, Pearson Education.
- 4) Data communication and networking, Behrouz A. Forouzan, McGraw Hill Education
Communication Networks, Alberto Leon Garcia, McGraw Hill Education.

Reference Books:

- 1) Computer Networks, S. Tanenbaum, Pearson Education.
- 2) Computer Networking: A Top-Down Approach, J. F. Kurose and K. W. Ross, AddisonWesley.

Course Code	Course Name	Teaching scheme			Credit assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
BMDO7021	Department Level Optional Course –4							
	Rehabilitation Engineering (Abbreviated as RE)	03			03	--	--	03

Course Code	Course Name	Examination Scheme			
		ISA	MSE	ESE	Total
BMDO7021	Rehabilitation Engineering	20	30	50	100

Course Code	Course Name	Credits
BMDO7021	Rehabilitation Engineering	03
Course Objectives	<ul style="list-style-type: none"> To Introduce the socio-legal aspects of Rehabilitation Engineering To understand the importance of Orthotics, and Prosthesis To introduce learners to basics of Kinetics and Kinematics. To understand the flow properties of blood. To understand various upper and lower limb deformities. To understand the rehabilitation management of various deformities 	
Course Outcomes	<p>A learner will be able to</p> <ul style="list-style-type: none"> Understand the basic difference between Impairment, Disability and Handicap Understand the reasons for Amputation, need of Orthosis, Prosthesis. Understand the human joint's stability. Understand the flow pattern of blood in normal and abnormal conditions. Understand management of simple to complex deformities Understand the rehabilitation management during paralytic conditions of the limb 	

Module	Contents	Hours
1	<p>Introduction and socio-legal aspects of rehabilitation engineering: Medical rehabilitation, epidemiology of rehabilitation, preventive rehabilitation, impairment disability and handicap.</p>	03
2	<p>Orthotics, amputation, and prosthetics, activities of daily living (ADL): Orthotics: General principles of orthotics, biomechanics of orthotics, classification: upper & lower extremity orthotics, spinal orthotics Amputation & prosthetics: Causes of amputation, types of amputation, and levels of amputation for upper and lower extremity, preoperative and post-operative period. pre-prosthetic stage, endo & exo-skeletal prosthetics, classification of upper & lower limb prosthetics Activities of daily living: ADL grouping, Barthel's index of ADL, functional independence, measures, environmental control system, communication, ADL training.</p>	10
3	<p>Mechanical principles of Kinematics and Kinetics: Planar classification of position and motion, rotary and translatory motion, degree of freedom, kinematic chain theories of motion, levers, torque, parallel force, resolution of force, calculation of muscle and joint forces Clinical application on weight and center of gravity, applied weights and resistance, muscle force and leverage, joint forces, clinical application on stretching versus joint mobilization.</p>	06
4	<p>Flow properties of blood: An outline of blood rheology, constitutive equation of blood based viscometric data and Casson's equation, laminar flow of blood in a tube, fluid mechanical interaction of RBCs with a solid wall, thrombus formation and dissolution, medical application of blood rheology.</p>	06
5	<p>Common deformities and role of surgery in rehabilitation engineering. Types of deformities, management of 1st and 2nd degree deformities, common deformities of lower limb, treatment for partial foot deformities, deformities of the foot, arm Deformities, torticollis</p>	06
6	<p>An overview of rehabilitation of muscular dystrophy, paraplegia, and quadriplegia: Muscular dystrophy, Duchenne muscular dystrophy, rehabilitation, facioscapulohumeral muscular dystrophy Paraplegia: Etiology, mechanism of injury, identification of level of lesion, management of active spinal cord injury, rehabilitation, gait training Quadriplegia: Mobility, training, level of injury & outcome, management.</p>	08

Books Recommended:*Text books:*

1. BRUNNSTROM'S CLINICAL KINESIOLOG, By Laura K Smith, ElizabethLaurance Weiss;
Jaypee brothers Publication
2. Mechanical properties of living tissues by Y. C. Fung

Reference Books:

1. Textbook of Rehabilitation by S. Sundar,3rd edition Jaypee publication

Course Code	Course Name	Teaching scheme			Credit assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
BMDO7022	Lasers & Fiber Optics	03	--	--	03	--	--	03

Course Code	Course Name	Examination Scheme			
		ISA	MSE	ESE	Total
BMDO7022	Lasers & Fibre Optics	20	30	50	100

Course Code	Course Name	Credits
BMDO7022	Lasers & Fibre Optics	03
Course Objectives	<ul style="list-style-type: none"> To help the students to build up a detailed knowledge of the methods, fabrication, and applications of lasers & fiber optics in medical engineering. To create a platform for students to have deeper understanding on the fundamental principles of lasers and Optical fibers in bio-photonic systems. 	
Course Outcomes	<p>Learner will be able to:</p> <ul style="list-style-type: none"> Understand types of optical source and its emission properties. Analyze the various types of lasers and their medical applications Familiarize the fundamentals of optical fibers. Understand the interaction of laser with tissue along with its applications Understand and implement the use of lasers and optical fibers for surgery and sensing. 	

Module	Contents	Hours
1.	Introduction to optical radiation, emission & resonator: Spontaneous and stimulated emission, Einstein's coefficients, gain coefficient, laser oscillation conditions, population inversion, three and four level systems, rate equations, optical resonators and types, modes and mode stability criteria, losses in optical resonators-quality factor.	06
2.	Types of Lasers: Working principle of Ruby laser, dye laser, argon ion laser, solid state lasers-fundamental and higher harmonic generation. Detailed study of semiconductor lasers, Nd: YAG laser- flash lamp pumped and diode pumped lasers, He-Ne laser, CO ₂ laser, excimer laser, nitrogen laser, free electron laser, Ti: Sapphire laser, rare earth doped and photonic crystal fiber based lasers, soliton lasers. Chemical lasers, metal vapors lasers, medical applications of Lasers.	07
3.	Fundamentals of fiber optics: Classification of fibers- step index, graded index fiber, numerical aperture, modes in optical fiber, single mode and multimode fiber, V- parameter, evanescent modes, losses in fiber, dispersion in fiber, special fiber-polarization maintaining fiber, non-linear effects in optical fiber, fiber fabrication techniques, splicing.	07
4.	Photobiology & bioimaging: Interaction of light with cells and tissues, photo-processes in biopolymers, human eye and vision, optical fiber delivery system, Optical coherence tomography, Applications of bio-imaging: bio-imaging probes and fluorophores, Endoscopy.	06
5.	Optical sensors: MM and SM fibers for sensing, Lasers & LEDs suitable for sensing, PIN & APDs for fiber optic sensing. Principles of electro optic modulators bulk & integrated optic modulators, optical sensor types, advantages and disadvantages of fiber optic sensors, intensity modulated sensors, interferometric sensors, rotation sensors, bio sensors.	07
6.	Laser and fiber activated therapy: Photodynamic therapy, photo-sensitizers for photodynamic therapy, tissue engineering using light, Laser system in cardiovascular disease, gastroenterology, gynecology, neurosurgery, oncology, ophthalmology, orthopedics, otolaryngology (ENT), urology, lasers and fibers in skin treatment.	06

Books Recommended:

Textbooks:

- • Tu Vo Dinh, Biomedical Photonics: A Handbook- CRC Press, Boca Raton, FL 2003
- • V N Prasad, Introduction to Biophotonics, Wiley-Interscience, 2003
- • Orazio Svelto, Principles of Lasers, 4th Edn, Plenum Press, 1998
- • Dakin J and Culshaw B., (Ed), Optical fiber sensors, Vol I,II, III, Artech House, 1998
- • Francis T.S Yu, Shizhuo Yin (Eds), Fiber Optic Sensors, Marcel Dekker Inc., New York, 2002
- • Silfvast. W T., Laser Fundamentals, Cambridge University Press, New Delhi, 1998

Reference Books:

- • Lihong V and Hsin-IWU, Biomedical Optics-Principles, and Imaging - Wiley Interscience 1sted. 2007
- • Mark E.Brezinski, Optical Coherence Tomography-Principles and Applications-(AcademisPress 1st ed. 2006)
- • Rodney Cotterill, Biophysics –An Introduction (John Wiley Student edition)

- • Valery .V.Tuchin, A Handbook of Optical Biomedical diagnostics, SPIE press monograph volpm 107
- • Bahaa E. A Saleh & Malvin Carl Teich, Fundamentals of Photonics, John Wiley & Sons, 1991
- • Jeff Hecht, The Laser Guide Book, McGraw Hill, 1986
- • Koechner (W alter), Solid State Laser Engineering, Springer, 1992
- • Marvin J. Weber, Handbook of Lasers, CRC Press, 2001
- • Yariv A, Optical Electronics, 4thEdn, Holt, Rinehart and Winston, 1991

Course Code	Course Name	Teaching scheme			Credit assigned			
		Theory	Pract.	Tut.	Theory	Pract	Tut	Total
BMDO7023	Department Optional Course – 4 Networking and Information Systems in Medicine (Abbreviated asNISM)	03	--	--	03	--	--	03

Course Code	Course Name	Examination Scheme			
		ISA	MSE	ESE	Total
BMDO7023	Networking and Information Systems in Medicine	20	30	50	100

Course Code	Course Name	Credits
BMDO7023	Networking and Information Systems in Medicine	03
Course Objectives	<ul style="list-style-type: none"> To understand the fundamental component of computer Networking. To understand the functioning and configuration of various networking devices and components. To understand a concept about network security. Understand various Information system used in Healthcare System To understand the healthcare IT infrastructure Understand various IHE domains 	
Course Outcomes	<p>Learners will be able to:</p> <ul style="list-style-type: none"> Understand the fundamental components of computer networks and networking protocols. Understand IP addressing, functioning and configuration of various networking devices and components Understand concepts about network security Understand the PACS components, architecture and PACS tele radiology Understand HIS, RIS, integration of HIS/RIS/PACS, PACS archive storage Understand IHE and IHE domains 	

Module	Contents	Hours
1.	PACS Components; PACS generic workflow; PACS architectures: stand-alone, client-server, and web-based; PACS and teleradiology	06
2.	Introduction to RIS and HIS, HIS/RIS/PACS integration; PACS archive storage: RAID; HIPPA	06
3.	Integrating Healthcare Enterprise: IHE workflow model, IHE domains, IHE patient information reconciliation profile, IHE radiology information integration profile	06
4.	Performance of network/device parameters: bandwidth, throughput, jitter, latency network technology; types of cables and connectors, crossover and straight throughcables, colour coding of cables; OSI Model; TCP/IP, Addressing types (IP, MAC, Port& Specific)	08
5.	IP V4 addressing, subnetting, supernetting; IP V6 addressing; Detailed working of networking equipment: Hub, bridge , switch, router, modem	07
6.	Basic Security Concepts: Security Mechanism and security services, authentication, authorization, confidentiality, integrity, non-repudiation; Symmetric and asymmetric key cryptography, RSA algorithm	06

Books Recommended:

Textbooks:

1. PACS and Imaging Informatics by H.K. Huang, Second Edition, Wiley and Blackwell.
2. PACS: A Guide to the Digital Revolution by Keith J. Dreyer, Springer.
3. Data Communication and Networking by Behrouz A. Forouzan, McGraw Hill.
4. Computer Networks by A.S. Tanenbaum, Pearson Education.

Reference Books:

1. Governance of Picture Archiving and Communications Systems by Carrison K.S. Tong, Eric T.T.Wong (Medical Information Science Reference).
2. Practical Imaging Informatics, By Barton F. Branstetter, Springer.
3. PACS Fundamentals by Herman Oosterwijk.
4. Cryptography and Network Security By William Stalling, Pearsons.

Course Code	Course Name	Teaching scheme (Contact Hours)		Credits Assigned		
		Theory	Pract./Tut.	Theory	Pract./Tut.	Total
BMIO701	Product Life Cycle Management	3	--	3	--	3

Course Code	Course Name	Examination Scheme			
		ISA	MSE	ESE	Total
BMIO701	Product Life Cycle Management	20	30	50	100

Course Objectives	<ul style="list-style-type: none"> To familiarize the students with the need, benefits and components of PLM To acquaint students with Product Data Management & PLM strategies To give insights into new product development program and guidelines for designing and developing a product To familiarize the students with Virtual Product Development
Course Outcomes	<p>Upon successful completion of this course, the learner will be able to:</p> <ul style="list-style-type: none"> Gain knowledge about phases of PLM, PLM strategies and methodology for PLM feasibility study and PDM implementation. Illustrate various approaches and techniques for designing and developing products. Apply product engineering guidelines / thumb rules in designing products for moulding, machining, sheet metal working etc. Acquire knowledge in applying virtual product development tools for components, machining and manufacturing plant

Module	Detailed Contents	Hours
1	<p>Introduction to Product Lifecycle Management (PLM): Product Lifecycle Management (PLM), Need for PLM, Product Lifecycle Phases, Opportunities of Globalization, Pre-PLM Environment, PLM Paradigm, Importance & Benefits of PLM, Widespread Impact of PLM, Focus and Application, A PLM Project, Starting the PLM Initiative, PLM Applications PLM Strategies: Industrial strategies, Strategy elements, its identification, selection and implementation, Developing PLM Vision and PLM Strategy, Change management for PLM</p>	10

2	<p>Product Design: Product Design and Development Process, Engineering Design, Organization and Decomposition in Product Design, Typologies of Design Process Models, Reference Model, Product Design in the Context of the Product Development Process, Relation with the Development Process Planning Phase, Relation with the Post design Planning Phase, Methodological Evolution in Product Design, Concurrent Engineering, Characteristic Features of Concurrent Engineering, Concurrent Engineering and Life Cycle Approach, New Product Development (NPD) and Strategies, Product Configuration and Variant Management, The Design for X System, Objective Properties and Design for X Tools, Choice of Design for X Tools and Their Use in the Design Process</p>	09
3	<p>Product Data Management (PDM): Product and Product Data, PDM systems and importance, Components of PDM, Reason for implementing a PDM system, financial justification of PDM, barriers to PDM implementation</p>	05
4	<p>Virtual Product Development Tools: For components, machines, and manufacturing plants, 3D CAD systems and realistic rendering techniques, Digital mock-up, Model building, Model analysis, Modeling and simulations in Product Design, Examples/Case studies</p>	05
5	<p>Integration of Environmental Aspects in Product Design: Sustainable Development, Design for Environment, Need for Life Cycle Environmental Strategies, Useful Life Extension Strategies, End-of-Life Strategies, Introduction of Environmental Strategies into the Design Process, Life Cycle Environmental Strategies and Considerations for Product Design</p>	05
6	<p>Life Cycle Assessment and Life Cycle Cost Analysis: Properties, and Framework of Life Cycle Assessment, Phases of LCA in ISO Standards, Fields of Application and Limitations of Life Cycle Assessment, Cost Analysis and the Life Cycle Approach, General Framework for LCCA, Evolution of Models for Product Life Cycle Cost Analysis</p>	05

REFERENCES:

1. John Stark, "Product Lifecycle Management: Paradigm for 21st Century Product Realisation", Springererlag, 2004. ISBN: 1852338105
2. Fabio Giudice, Guido La Rosa, Antonino Risitano, "Product Design for the environment-A life cycle approach", Taylor & Francis 2006, ISBN: 0849327229
3. Saaksvuori Antti, Immonen Anselmie, "Product Life Cycle Management", Springer, Dreamtech, ISBN: 3540257314
4. Michael Grieve, "Product Lifecycle Management: Driving the next generation of lean thinking", Tata McGraw Hill, 2006, ISBN: 0070636265

Course Code	Course Name	Teaching scheme (Contact Hours)		Credits Assigned		
		Theory	Pract./Tut.	Theory	Pract./Tut.	Total
BMIO7012	Reliability Engineering	3	--	3	--	3

Course Code	Course Name	Examination Scheme			
		ISA	MSE	ESE	Total
BMIO7012	Reliability Engineering	20	30	50	100

Course Objectives	<ul style="list-style-type: none"> To familiarize the students with various aspects of probability theory To acquaint the students with reliability and its concepts To introduce the students to methods of estimating the system reliability of simple and complex systems To understand the various aspects of Maintainability, Availability and FMEA procedure
Course Outcomes	<p>Upon successful completion of this course, the learner will be able to:</p> <ul style="list-style-type: none"> Understand and apply the concept of Probability to engineering problems Apply various reliability concepts to calculate different reliability parameters Estimate the system reliability of simple and complex systems Carry out a Failure Mode Effect and Criticality Analysis

Module	Detailed Contents	Hours
1	<p>Probability theory: Probability: Standard definitions and concepts; Conditional Probability, Baye's Theorem.</p> <p>Probability Distributions: Central tendency and Dispersion; Binomial, Normal, Poisson, Weibull, Exponential, relations between them and their significance.</p> <p>Measures of Dispersion: Mean, Median, Mode, Range, Mean Deviation, Standard Deviation, Variance, Skewness and Kurtosis.</p>	08
2	<p>Reliability Concepts: Reliability definitions, Importance of Reliability, Quality Assurance and Reliability, Bath Tub Curve.</p> <p>Failure Data Analysis: Hazard rate, failure density, Failure Rate, Mean Time ToFailure (MTTF), MTBF, Reliability Functions.</p> <p>Reliability Hazard Models: Constant Failure Rate, Linearly increasing, Time Dependent Failure Rate, Weibull Model. Distribution functions and reliability analysis.</p>	08
3	<p>System Reliability:</p> <p>System Configurations: Series, parallel, mixed configuration, k out of n structure, Complex systems.</p>	05

4	Reliability Improvement: Redundancy Techniques: Element redundancy, Unit redundancy, Standby redundancies. Markov analysis. System Reliability Analysis – Enumeration method, Cut-set method, Success Path method, Decomposition method.	08
5	Maintainability and Availability: System downtime, Design for Maintainability: Maintenance requirements, Design methods: Fault Isolation and self-diagnostics, Parts standardization and Interchangeability, Modularization and Accessibility, Repair Vs Replacement. Availability – qualitative aspects.	05
6	Failure Mode, Effects and Criticality Analysis: Failure mode effects analysis, severity/criticality analysis, FMECA examples. Fault tree construction, basic symbols, development of functional reliability block diagram, Fault tree analysis and Event tree Analysis	05

REFERENCES:

1. L.S. Srinath, "Reliability Engineering", Affiliated East-West Press (P) Ltd., 1985.
2. Charles E. Ebeling, "Reliability and Maintainability Engineering", Tata McGraw Hill.
3. B.S. Dhillon, C. Singh, "Engineering Reliability", John Wiley & Sons, 1980.
4. P.D.T. Connor, "Practical Reliability Engg.", John Wiley & Sons, 1985.
5. K.C. Kapur, L.R. Lamberson, "Reliability in Engineering Design", John Wiley & Sons.
6. Murray R. Spiegel, "Probability and Statistics", Tata McGraw-Hill Publishing Co. Ltd

Course Code	Course Name	Teaching scheme (Contact Hours)		Credits Assigned		
		Theory	Pract./Tut.	Theory	Pract./Tut.	Total
BMIO7013	Management Information System	3	--	3	--	3

Course Code	Course Name	Examination Scheme			
		ISA	MSE	ESE	Total
BMIO7013	Management Information System	20	30	50	100

Course Objectives	<ul style="list-style-type: none"> The course is blend of Management and Technical field. Discuss the roles played by information technology in today's business and define various technology architectures on which information systems are built Define and analyze typical functional information systems and identify how they meet the needs of the firm to deliver efficiency and competitive advantage Identify the basic steps in systems development
Course Outcomes	<p>Upon successful completion of this course, the learner will be able to:</p> <ul style="list-style-type: none"> Explain how information systems Transform Business Identify the impact information systems have on an organization Describe IT infrastructure and its components and its current trends Understand the principal tools and technologies for accessing information from databases to improve business performance and decision making Identify the types of systems used for enterprise-wide knowledge management and how they provide value for businesses

Module	Detailed Contents	Hours
1	Introduction To Information Systems (IS): Computer Based Information Systems, Impact of IT on organizations, Importance of IS to Society. Organizational Strategy, Competitive Advantages and IS	04
2	Data and Knowledge Management: Database Approach, Big Data, Data warehouse and Data Marts, Knowledge Management Business intelligence (BI): Managers and Decision Making, BI for Data analysis and Presenting Results	07
3	Ethical issues and Privacy: Information Security. Threat to IS, and Security Controls	07

4	Social Computing (SC): Web 2.0 and 3.0, SC in business-shopping, Marketing, Operational and Analytic CRM, E-business and E-commerce – B2B B2C. Mobile commerce.	07
5	Computer Networks Wired and Wireless technology, Pervasive computing, Cloud computing model.	06
6	Information System within Organization: Transaction Processing Systems, Functional Area Information System, ERP andERP support of Business Process. Acquiring Information Systems and Applications: Various System development life cycle models.	08

REFERENCES:

- 1 Kelly Rainer, Brad Prince, Management Information Systems, Wiley
- 2 K.C. Laudon and J.P. Laudon, Management Information Systems: Managing the DigitalFirm, 10th Ed., Prentice Hall, 2007.
- 3 D. Boddy, A. Boonstra, Managing Information Systems: Strategy and Organization,Prentice Hall, 2008

Course Code	Course Name	Teaching scheme (Contact Hours)		Credits Assigned		
		Theory	Pract./Tut.	Theory	Pract./Tut.	Total
BMIO7014	Design of Experiments	3	--	3	--	3

Course Code	Course Name	Examination Scheme			
		ISA	MSE	ESE	Total
BMIO7014	Design of Experiments	20	30	50	100

Course Objectives	<ul style="list-style-type: none"> To understand the issues and principles of Design of Experiments (DOE) To list the guidelines for designing experiments To become familiar with methodologies that can be used in conjunction with experimental designs for robustness and optimization
Course Outcomes	<p>Upon successful completion of this course, the learner will be able to:</p> <ul style="list-style-type: none"> Plan data collection, to turn data into information and to make decisions that lead to appropriate action Apply the methods taught to real life situations Plan, analyse, and interpret the results of experiments

Module	Detailed Contents	Hours
1	Introduction 1.1 Strategy of Experimentation 1.2 Typical Applications of Experimental Design 1.3 Guidelines for Designing Experiments 1.4 Response Surface Methodology	06
2	Fitting Regression Models 2.1 Linear Regression Models 2.2 Estimation of the Parameters in Linear Regression Models 2.3 Hypothesis Testing in Multiple Regression 2.4 Confidence Intervals in Multiple Regression 2.5 Prediction of new response observation 2.6 Regression model diagnostics 2.7 Testing for lack of fit	08

3	Two-Level Factorial Designs 3.1 The 2^2 Design 3.2 The 2^3 Design 3.3 The General 2^k Design 3.4 A Single Replicate of the 2^k Design 3.5 The Addition of Center Points to the 2^k Design, 3.6 Blocking in the 2^k Factorial Design 3.7 Split-Plot Designs	07
4	Two-Level Fractional Factorial Designs 4.1 The One-Half Fraction of the 2^k Design 4.2 The One-Quarter Fraction of the 2^k Design 4.3 The General 2^{k-p} Fractional Factorial Design 4.4 Resolution III Designs 4.5 Resolution IV and V Designs 4.6 Fractional Factorial Split-Plot Designs	07
5	Response Surface Methods and Designs 5.1 Introduction to Response Surface Methodology 5.2 The Method of Steepest Ascent 5.3 Analysis of a Second-Order Response Surface 5.4 Experimental Designs for Fitting Response Surfaces	07
6	Taguchi Approach 6.1 Crossed Array Designs and Signal-to-Noise Ratios 6.2 Analysis Methods 6.3 Robust design examples	04

REFERENCES:

- 1 Raymond H. Myers, Douglas C. Montgomery, Christine M. Anderson-Cook, Response Surface Methodology: Process and Product Optimization using Designed Experiment, 3rd edition, John Wiley & Sons, New York, 2001
- 2 D.C. Montgomery, Design and Analysis of Experiments, 5th edition, John Wiley & Sons, New York, 2001
- 3 George E P Box, J Stuart Hunter, William G Hunter, Statics for Experimenters: Design, Innovation and Discovery, 2nd Ed. Wiley
- 4 W J Dimond, Practical Experiment Designs for Engineers and Scientists, John Wiley and Sons Inc. ISBN: 0-471-39054-2
- 5 Design and Analysis of Experiments (Springer text in Statistics), Springer by A.M. Dean, and D. T. Voss

Course Code	Course Name	Teaching scheme (Contact Hours)		Credits Assigned		
		Theory	Pract./Tut.	Theory	Pract./Tut.	Total
BMIO7015	Operations Research					
		3	--	3	--	3

Course Code	Course Name	Examination Scheme			
		ISA	MSE	ESE	Total
BMIO7015	Operations Research	20	30	50	100

Course Objectives	<ul style="list-style-type: none"> Formulate a real-world problem as a mathematical programming model. Understand the mathematical tools that are needed to solve optimization problems. Use mathematical software to solve the proposed models.
Course Outcomes	<p>Upon successful completion of this course, the learner will be able to:</p> <ul style="list-style-type: none"> Understand the theoretical workings of the simplex method, the relationship between a linear program and its dual, including strong duality and complementary slackness. Perform sensitivity analysis to determine the direction and magnitude of change of a model's optimal solution as the data change. Solve specialized linear programming problems like the transportation and assignment problems, solve network models like the shortest path, minimum spanning tree, and maximum flow problems. Understand the applications of integer programming and a queuing model and compute important performance measures

Module	Detailed Contents	Hours
1	<p>Introduction to Operations Research: Introduction, Structure of the Mathematical Model, Limitations of Operations Research</p> <p>Linear Programming: Introduction, Linear Programming Problem, Requirements of LPP, Mathematical Formulation of LPP, Graphical method, Simplex Method Penalty Cost Method or Big M-method, Two Phase Method, Revised simplex method, Duality, Primal – Dual construction, Symmetric and Asymmetric Dual, Weak Duality Theorem, Complimentary Slackness Theorem, Main Duality Theorem, Dual Simplex Method, Sensitivity Analysis</p> <p>Transportation Problem: Formulation, solution, unbalanced Transportation problem. Finding basic feasible solutions – Northwest corner rule, least cost method and Vogel’s approximation method. Optimality test: the stepping stone method and MODI method. Assignment Problem: Introduction, Mathematical Formulation of the Problem, Hungarian Method Algorithm, Processing of n Jobs Through Two Machines and m Machines, Graphical Method of Two Jobs m Machines Problem Routing Problem, Travelling Salesman Problem</p> <p>Integer Programming Problem: Introduction, Types of Integer Programming Problems, Gomory’s cutting plane Algorithm, Branch and Bound Technique. Introduction to Decomposition algorithms.</p>	14
2	<p>Queuing models: queuing systems and structures, single server and multi-server models, Poisson input, exponential service, constant rate service, finite and infinite population</p>	05
3	<p>Simulation: Introduction, Methodology of Simulation, Basic Concepts, Simulation Procedure, Application of Simulation Monte-Carlo Method: Introduction, Monte-Carlo Simulation, Applications of Simulation, Advantages of Simulation, Limitations of Simulation</p>	05
4	<p>Dynamic programming. Characteristics of dynamic programming. Dynamic programming approach for Priority Management employment smoothening, capital budgeting, Stage Coach/Shortest Path, cargo loading and Reliability problems.</p>	05
5	<p>Game Theory. Competitive games, rectangular game, saddle point, minimax (maximin) method of optimal strategies, value of the game. Solution of games with saddle points, dominance principle. Rectangular games without saddle point – mixed strategy for 2 X 2 games.</p>	05
6	<p>Inventory Models: Classical EOQ Models, EOQ Model with Price Breaks, EOQ with Shortage, Probabilistic EOQ Model,</p>	05

REFERENCES:

- 1 Taha, H.A. "Operations Research - An Introduction", Prentice Hall, (7th Edition), 2002.
- 2 Ravindran, A, Phillips, D. T and Solberg, J. J. "Operations Research: Principles andPractice", John Willey and Sons, 2nd Edition, 2009
- 3 Hiller, F. S. and Liebermann, G. J. "Introduction to Operations Research", Tata McGrawHill, 2002.
- 4 Operations Research, S. D. Sharma, KedarNath Ram Nath-Meerut
- 5 Operations Research, KantiSwarup, P. K. Gupta and Man Mohan, Sultan Chand & Sons

Course Code	Course Name	Teaching scheme (Contact Hours)		Credits Assigned		
		Theory	Pract./Tut.	Theory	Pract./Tut.	Total
BMIO7016	Cyber Security and Laws	3	--	3	--	3

Course Code	Course Name	Examination Scheme			
		ISA	MSE	ESE	Total
BMIO7016	Cyber Security and Laws	20	30	50	100

Course Objectives	<ul style="list-style-type: none"> To understand and identify different types of cybercrime and cyber law To recognize Indian IT Act 2008 and its latest amendments To learn various types of security standards and compliances
Course Outcomes	<p>Upon successful completion of this course, the learner will be able to:</p> <ul style="list-style-type: none"> Understand the concept of cybercrime and its effect on the outside world Interpret and apply IT law in various legal issues Distinguish different aspects of cyber law Apply Information Security Standards compliance during software design and development

Module	Detailed Contents	Hours
1	Introduction to Cybercrime: Cybercrime definition and origins of the world, Cybercrime and information security, Classifications of cybercrime, Cybercrime and the Indian ITA 2000, A global Perspective on cybercrimes.	4
2	Cyber offenses & Cybercrime: How criminals plan the attacks, Social Engineering, Cyber stalking, Cyber café and Cybercrimes, Botnets, Attack vector, Cloud computing, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication Service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Device-Related Security Issues, Organizational Security Policies and Measures in Mobile Computing Era, Laptops	9
3	Tools and Methods Used in Cyberline: Phishing, Password Cracking, Key loggers and Spywares, Virus and Worms, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks, Phishing, Identity Theft (ID Theft)	6

4	The Concept of Cyberspace : E-Commerce, The Contract Aspects in Cyber Law ,The Security Aspect of Cyber Law, The Intellectual Property Aspect in Cyber Law, The Evidence Aspect in Cyber Law , The Criminal Aspect in Cyber Law, Global Trends in Cyber Law , Legal Framework for Electronic Data Interchange Law Relating to Electronic Banking , The Need for an Indian Cyber Law	8
5	Indian IT Act: Cyber Crime and Criminal Justice: Penalties, Adjudication and Appeals Under the IT Act, 2000, IT Act. 2008 and its Amendments	6
6	Information Security Standard compliances SOX, GLBA, HIPAA, ISO, FISMA, NERC, PCI.	6

REFERENCES:

1. Nina Godbole, Sunit Belapure, *Cyber Security*, Wiley India, New Delhi
2. The Indian Cyber Law by Suresh T. Vishwanathan; Bharat Law House New Delhi
3. The Information Technology Act, 2000; Bare Act- Professional Book Publishers, NewDelhi.
4. Cyber Law & Cyber Crimes by Advocate Prashant Mali; Snow White Publications, Mumbai
5. Nina Godbole, *Information Systems Security*, Wiley India, New Delhi
6. Kenneth J. Knapp, *Cyber Security & Global Information Assurance* Information Science Publishing.
7. William Stallings, *Cryptography and Network Security*, Pearson Publication
8. Websites for more information is available on: The Information Technology ACT, 2008-TIFR: <https://www.tifrh.res.in>
9. Website for more information: A Compliance Primer for IT professional: <https://www.sans.org/reading-room/whitepapers/compliance/compliance-primerprofessionals-33538>

Course Code	Course Name	Teaching scheme (Contact Hours)		Credits Assigned		
		Theory	Pract./Tut.	Theory	Pract./Tut.	Total
BMIO7017	Disaster Management and Mitigation Measures					
		3	--	3	--	3

Course Code	Course Name	Examination Scheme			
		ISA	MSE	ESE	Total
BMIO7017	Disaster Management and Mitigation Measures	20	30	50	100

Course Objectives	<ul style="list-style-type: none"> • To understand physics and various types of disaster occurring around the world • To identify extent and damaging capacity of a disaster • To study and understand the means of losses and methods to overcome /minimizeit. • To understand role of individual and various organization during and after disaster • To understand application of GIS in the field of disaster management • To understand the emergency government response structures before, during and after disaster
Course Outcomes	<p>Upon successful completion of this course, the learner will be able to:</p> <ul style="list-style-type: none"> • Get to know natural as well as manmade disaster and their extent and possible effects on the economy. • Plan of national importance structures based upon the previous history. • Get acquainted with government policies, acts and various organizational structure associated with an emergency. • Get to know the simple do's and don'ts in such extreme events and act accordingly.

Module	Detailed Contents	Hours
1	<p>Introduction</p> <p>1.1 Definition of Disaster, hazard, global and Indian scenario, general perspective, importance of study in human life, Direct and indirect effects of disasters, long term effects of disasters. Introduction to global warming and climate change.</p>	03
2	<p>Natural Disaster and Manmade disasters:</p> <p>2.1 Natural Disaster: Meaning and nature of natural disaster, Flood, Flash flood, drought, cloud burst, Earthquake, Landslides, Avalanches, Volcanic eruptions, Mudflow, Cyclone, Storm, Storm Surge, climate change, global warming, sea level rise, ozone depletion</p> <p>2.2 Manmade Disasters: Chemical, Industrial, Nuclear and Fire Hazards. Role of growing population and subsequent industrialization, urbanization and changing lifestyle of human beings in frequent occurrences of manmade disasters.</p>	09
3	<p>Disaster Management, Policy and Administration</p> <p>3.1 Disaster management: meaning, concept, importance, objective of disaster management policy, disaster risks in India, Paradigm shift in disaster management.</p> <p>3.2 Policy and administration: Importance and principles of disaster management policies, command and coordination of in disaster management, rescue operations-how to start with and how to proceed in due course of time, study of flowchart showing the entire process.</p>	06
4	<p>Institutional Framework for Disaster Management in India:</p> <p>4.1 Importance of public awareness, Preparation and execution of emergency management program. Scope and responsibilities of National Institute of Disaster Management (NIDM) and National disaster management authority (NDMA) in India. Methods and measures to avoid disasters, Management of casualties, set up of emergency facilities, importance of effective communication amongst different agencies in such situations.</p> <p>4.2 Use of Internet and softwares for effective disaster management. Applications of GIS, Remote sensing and GPS in this regard.</p>	06
5	<p>Financing Relief Measures:</p> <p>5.1 Ways to raise finance for relief expenditure, role of government agencies and NGO's in this process, Legal aspects related to finance raising as well as overall management of disasters. Various NGO's and the works they have carried out in the past on the occurrence of various disasters, Ways to approach these teams.</p> <p>5.2 International relief aid agencies and their role in extreme events.</p>	09
6	<p>Preventive and Mitigation Measures:</p> <p>6.1 Pre-disaster, during disaster and post-disaster measures in some events in general</p> <p>6.2 Structural mapping: Risk mapping, assessment and analysis, sea walls and embankments, Bio shield, shelters, early warning and communication</p> <p>6.3 Non Structural Mitigation: Community based disaster preparedness, risk transfer and risk financing, capacity development and training, awareness and education, contingency plans.</p>	06
	6.4 Do's and don'ts in case of disasters and effective implementation of relief aids.	

REFERENCES:

1. 'Disaster Management' by Harsh K. Gupta, Universities Press Publications.
2. 'Disaster Management: An Appraisal of Institutional Mechanisms in India' by O.S. Dagur, published by Centre for land warfare studies, New Delhi, 2011.
3. 'Introduction to International Disaster Management' by Damon Copolla, Butterworth Heinemann Elsevier Publications.
4. 'Disaster Management Handbook' by Jack Pinkowski, CRC Press Taylor and Francis group.
5. 'Disaster management & rehabilitation' by Rajdeep Dasgupta, Mittal Publications, New Delhi.
6. 'Natural Hazards and Disaster Management, Vulnerability and Mitigation – R B Singh, Rawat Publications
7. Concepts and Techniques of GIS –C.P.Lo Albert, K.W. Yongg – Prentice Hall (India) Publications. (Learners are expected to refer reports published at national and International level and updated information available on authentic web sites)

Course Code	Course Name	Teaching scheme (Contact Hours)		Credits Assigned		
		Theory	Pract./Tut.	Theory	Pract./Tut.	Total
BMIO7018	Energy Audit and Management	3	--	3	--	3

Course Code	Course Name	Examination Scheme			
		ISA	MSE	ESE	Total
BMIO7018	Energy Audit and Management	20	30	50	100

Course Objectives	<ul style="list-style-type: none"> To understand the importance energy security for sustainable development and the fundamentals of energy conservation. To introduce performance evaluation criteria of various electrical and thermal installations to facilitate the energy management To relate the data collected during performance evaluation of systems for identification of energy saving opportunities.
Course Outcomes	<p>Upon successful completion of this course, the learner will be able to:</p> <ul style="list-style-type: none"> To identify and describe present state of energy security and its importance. To identify and describe the basic principles and methodologies adopted in energy audit of a utility. To describe the energy performance evaluation of some common electrical installations and identify the energy saving opportunities. To describe the energy performance evaluation of some common thermal installations and identify the energy saving opportunities To analyze the data collected during performance evaluation and recommend energy saving measures

Module	Detailed Contents	Hours
1	<p>Energy Scenario: Present Energy Scenario, Energy Pricing, Energy Sector Reforms, Energy Security, Energy Conservation and its Importance, Energy Conservation Act-2001 and its Features. Basics of Energy and its various forms, Material and Energy balance</p>	04
2	<p>Energy Audit Principles: Definition, Energy audit- need, Types of energy audit, Energy management (audit) approach-understanding energy costs, Bench marking, Energy performance, Matching energy use to requirement, Maximizing system efficiencies, Optimizing the input energy requirements, Fuel and energy substitution. Elements of monitoring& targeting; Energy audit Instruments; Data and information-analysis. Financial analysis techniques: Simple payback period, NPV, Return on investment(ROI), Internal rate of return (IRR)</p>	08
3	<p>Energy Management and Energy Conservation in Electrical System: Electricity billing, Electrical load management and maximum demand Control;Power factor improvement, Energy efficient equipments and appliances, star ratings. Energy efficiency measures in lighting system, lighting control: Occupancy sensors, daylight integration, and use of intelligent controllers. Energy conservation opportunities in: water pumps, industrial drives, induction motors, motor retrofitting, soft starters, variable speed drives.</p>	10
4	<p>Energy Management and Energy Conservation in Thermal Systems: Review of different thermal loads; Energy conservation opportunities in: Steam distribution system, Assessment of steam distribution losses, Steam leakages, Steam trapping, Condensate and flash steam recovery system. General fuel economy measures in Boilers and furnaces, Waste heat recovery, use of insulation- types and application. HVAC system: Coefficient of performance, Capacity, factors affecting Refrigeration and Air Conditioning system performance and savings opportunities.</p>	10
5	<p>Energy Performance Assessment: On site Performance evaluation techniques, Case studies based on: Motors and variable speed drive, pumps, HVAC system calculations; Lighting System: Installed Load Efficacy Ratio (ILER) method, Financial Analysis.</p>	04
6	<p>Energy conservation in Buildings: Energy Conservation Building Codes (ECBC): Green Building, LEED rating, Application of Non-Conventional and Renewable Energy Sources</p>	03

REFERENCES:

- 1 Handbook of Electrical Installation Practice, Geofry Stokes, Blackwell Science
- 2 Designing with light: Lighting Handbook, By Anil Valia, Lighting System
- 3 Energy Management Handbook, By W.C. Turner, John Wiley and Sons
- 4 Handbook on Energy Audits and Management, edited by A. K. Tyagi, Tata EnergyResearch Institute (TERI).
- 5 Energy Management Principles, C.B.Smith, Pergamon Press
- 6 Energy Conservation Guidebook, Dale R. Patrick, S. Fardo, Ray E. Richardson, Fairmont Press
- 7 Handbook of Energy Audits, Albert Thumann, W. J. Younger, T. Niehus, CRC Press
- 8 www.energymanagertraining.com
- 9 www.bee-india.nic.in

Course Code	Course Name	Teaching scheme (Contact Hours)		Credits Assigned		
		Theory	Pract./Tut.	Theory	Pract./Tut.	Total
BMIO7019	Development Engineering					
		3	--	3	--	3

Course Code	Course Name	Examination Scheme			
		ISA	MSE	ESE	Total
BMIO7019	Development Engineering	20	30	50	100

Course Objectives	<ul style="list-style-type: none"> • To understand the characteristics of rural Society and the Scope, Nature and Constraints of rural Development • To study Implications of 73rd CAA on Planning, Development and Governance of Rural Areas • An exploration of human values, which go into making a 'good' human being, a 'good' professional, a 'good' society and a 'good life' in the context of work life and the personal life of modern Indian professionals • To understand the Nature and Type of Human Values relevant to Planning Institutions
Course Outcomes	<p>Upon successful completion of this course, the learner will be able to:</p> <ul style="list-style-type: none"> • Apply knowledge for Rural Development. • Apply knowledge for Management Issues. • Apply knowledge for Initiatives and Strategies • Develop acumen for higher education and research. • Master the art of working in group of different nature. • Develop confidence to take up rural project activities independently

Module	Contents	Hours
1	<p>Introduction to Rural Development: Meaning, nature and scope of development; Nature of rural society in India; Hierarchy of settlements; Social, economic and ecological constraints for rural development Roots of Rural Development in India Rural reconstruction and Sarvodaya programme before independence; Impact of voluntary effort and Sarvodaya Movement on rural development; Constitutional direction, directive principles; Panchayati Raj - beginning of planning and community development; National extension services.</p>	08
2	<p>Post-Independence Rural Development: Balwant Rai Mehta Committee - three tier system of rural local Government; Need and scope for people's participation and Panchayati Raj; Ashok Mehta Committee - linkage between Panchayati Raj, participation and rural development.</p>	04
3	<p>Rural Development Initiatives in Five Year Plans: Five Year Plans and Rural Development; Planning process at National, State, Regional and District levels; Planning, development, implementing and monitoring organizations and agencies; Urban and rural interface - integrated approach and local plans; Development initiatives and their convergence; Special component plan and sub-plan for the weaker section; Micro-eco zones; Data base for local planning; Need for decentralized planning; Sustainable rural development.</p>	06
4	<p>Post 73rd Amendment Scenario: 73rd Constitution Amendment Act, including - XI schedule, devolution of powers, functions and finance; Panchayati Raj institutions - organizational linkages; Recent changes in rural local planning; Gram Sabha - revitalized Panchayati Raj; Institutionalization; resource mapping, resource mobilization including social mobilization; Information Technology and rural planning; Need for further amendments.</p>	04
5	<p>Values and Science and Technology Material development and its values; the challenge of science and technology; Values in planning profession, research and education. Types of Values Psychological values — integrated personality; mental health; Societal values — the modern search for a good society; justice, democracy, rule of law, values in the Indian constitution; Aesthetic values — perception and enjoyment of beauty; Moral and ethical values; nature of moral judgment; Spiritual values; different concepts; secular spirituality; Relative and absolute values; Human values— humanism and human values; human rights; human values as freedom, creativity, love and wisdom.</p>	10
6	<p>Ethics: Canons of ethics; ethics of virtue; ethics of duty; ethics of responsibility; Work ethics; Professional ethics; Ethics in planning profession, research and education</p>	04

References:

1. ITPI, Village Planning and Rural Development, ITPI, New Delhi
2. Thooyavan, K.R. Human Settlements: A 2005 MA Publication, Chennai
3. Gol, Constitution (73rd Gol, New Delhi Amendment) Act, Gol, New Delhi
4. Planning Commission, Five Year Plans, Planning Commission
5. Planning Commission, Manual of Integrated District Planning, 2006, Planning Commission New Delhi
6. Planning Guide to Beginners
7. Weaver, R.C., The Urban Complex, Doubleday.
8. Farmer, W.P. et al, Ethics in Planning, American Planning Association, Washington.
9. How, E., Normative Ethics in Planning, Journal of Planning Literature, Vol.5, No.2, pp. 123-150.
10. Watson, V., Conflicting Rationalities: -Implications for Planning Theory and Ethics, Planning Theory and Practice, Vol. 4, No.4, pp.395 – 407

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned		
		Theory	Pract. Tut.	Theory	Pract.	Total
BML701	Biomedical Instrumentation – III Lab	--	2	--	1	1

Course Code	Course Name	Examination Scheme			
		ISA	MSE	ESE	Total
BML701	Biomedical Instrumentation – III Lab	25		25	50

Course Code	Course Name	Credits
BML701	Biomedical Instrumentation- -III	01
Course Objectives	<ul style="list-style-type: none"> • To understand the basic principles and working of life Saving Equipment. • To develop skills enabling Biomedical Engineers to serve the health care industry • To develop core competency and skill in the field of Biomedical Engineering, to design and develop new health care systems. 	
Course Outcomes	Learner will be able to... <ul style="list-style-type: none"> • Design and implement basic Pacemaker circuits. • Design and implement basic oscillator circuits for Surgical Diathermy. • Demonstrate the knowledge of application techniques of physiotherapy machines. • Demonstrate the knowledge of application technique of oximeter 	

Syllabus: Same as that of (Course Code) Biomedical Instrumentation- -III (BMI-III)

List of Experiments: (Any Seven)

1. Implementation and testing of basic circuit of pacemaker.
2. Implementation of NAND Gate Oscillator in Surgical Diathermy.
3. Implementation of RLC Over damped system.
4. Implementation of OT lights.
5. Demonstration of Defibrillator.
6. Demonstration of Pacemaker.
7. Demonstration of Surgical Diathermy
8. Demonstration of Ultrasonic Diathermy
9. Demonstration of Nerve and Muscle Stimulator
10. Demonstration of Oximeter.
11. Industry / Hospital visits may be conducted.

Any other experiment based on syllabus which will help learner to understand topic/concept. Group

Presentation on the latest technology in hospitals based on the topics covered in the syllabus.

In Semester Assessment (ISA):

ISA shall consist of minimum 7 experiments.

The final certification and acceptance of ISA ensures the satisfactory performance of laboratorywork and minimum passing in the ISA.

Books Recommended:

Text books:

1. Handbook of Biomedical Instrumentation (Third edition): R S. Khandpur. (PH Pub)
2. Medical Instrumentation, Application and Design: J G. Webster. (John Wiley)
3. Biomedical Instrumentation and measurements: Leslie Cromwell, Fred J. Weibell, Enrich A. Pfeiffer. (PHI Pub)

Reference books:

1. Introduction to Biomedical Equipment Technology: Carr –Brown. (PH Pub)
2. Encyclopedia of Medical Devices and Instrumentation: J G. Webster. Vol I- IV (PH Pub)
3. Various Instruments Manuals.
4. Various internet websites.

Oral examination will be based on entire syllabus.

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned		
		Theory	Pract. Tut.	Theory	Pract.	Total
BML702	Machine Learning Lab	--	2	--	1	1

Course Code	Course Name	Examination Scheme			
		ISA	MSE	ESE	Total
BML702	Machine Learning Lab	25		25	50

BMC702	Machine Learning	03
Course Objectives	<ul style="list-style-type: none"> To build a strong base in artificial intelligence through algorithm development. To develop competency in logical thinking, computer programming and knowledge application. To train and motivate for higher education and research in order to make contribution to state of the art health care for all 	
Course Outcomes	<p>Learner will be able to...</p> <ul style="list-style-type: none"> Understand the fundamental techniques and applications in neural networks, deep learning and machine learning Understand supervised and unsupervised learning, back propagation and gradient descent algorithms Understand and implement efficient computational techniques using neural networks, deep learning and machine learning Design and implementation of neural network models with deep learning and machine learning will be strong base for designing artificial intelligent systems 	

Syllabus: Same as that of (BMC702) Machine Learning (ML)

List of Experiments: (Any Seven)

- 1 Implement the activation functions used in the neural network
 - 2 Implement ANDNOT and XOR function using McCulloch-Pitts neural net
 - 3 Implementation of learning rules for neural network
 - 4 Implementation of backpropagation with gradient descent algorithm neural network
 - 5 Design and implement the neural network model for estimation problem.
 - 6 Design and implement the neural network model for classification problem
 - 7 Optimize the neural network model for estimation problem.
 - 8 Optimize the neural network model for classification problem.
 - 9 Design and implement the neural network model for estimation problem with deep learning
 - 10 Design and implement the neural network model for estimation problem with deep learning
- Any other experiment based on syllabus which will help learner to understand topic/concept.

In Semester Assessment (ISA):

ISA shall consist of minimum 7 experiments.

The final certification and acceptance of ISA ensures the satisfactory performance of laboratory work and minimum passing in the ISA.

Text books

1. Introduction to Machine Learning, 3rd edition, Ethem Alpaydin, PHI Learning Private Limited, New Delhi, 2015
2. Deep Learning by Josh Patterson and Adam Gibson, O'Reilly Media, Inc., Gravenstein Highway North, Sebastopol CA, 2017
3. Neural Networks and Learning Machines Third Edition, Simon Haykin, Pearson, Prentice Hall, 2009

Reference books

1. Machine learning in Action, Peter Harrington, dreamtech Press, New Delhi, 2012
2. Machine learning, Tom M, Mitchell, Mc Graw Hill Education (India) Private Limited New Delhi, 2013

Practical examination will be based on experiments and related topics in the laboratory sessions.

Course Code	Course Name	Teaching scheme			Credit assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
BMDL7011	Biological Modelling and Simulation Lab (Abbreviated as BMS Lab)	--	02	--	--	01	--	01

Course Code	Course Name	Examination Scheme			
		ISA	MSE	ESE	Total
BMDL7011	Biological Modelling and Simulation Lab	25		25	50

Course Code	Course Name	Credits
BMDL7011	Biological Modelling and Simulation Lab	01
Course Objective	<ul style="list-style-type: none"> To understand basic approach of modeling for designing biological model. To simulate physiological processes for better understanding. To develop competency in terms of logical thinking, programming and application skills To train and motivate students for pursuing higher education and research for developing cutting edge technologies. 	
Course Outcome	Learner will be able to: <ul style="list-style-type: none"> Apply concept of physiological modelling to model thermometer system. Virtually understand biophysical laws for calculation of membrane potential under different equilibrium conditions and develop simulation programs for understanding neuronal functions. Simulate mathematical model for the eye movement Electrically simulate model of thermoregulatory system Understand the usage of, and the assumptions behind biological models 	

List of Laboratory Experiments (Any Seven)

1. Simulations thermometer system using MATLAB
2. Simulation of Nernst/Goldman Equation using MATLAB(**Two practicals**)
3. Simulation of eye movement using MATLAB
4. Simulation using HHSim (**Two practicals**)
5. Simulation using Neurons in Action (**Two practicals**)
6. Developing a model of a neuron using NEURON
7. Electrical simulation of thermoregulatory model

Any other experiment / assignment / presentation based on syllabus which will help students to understand topic/concept.

In Semester Assessment(ISA):

ISA shall consist of minimum 7 experiments.

The final certification and acceptance of ISA ensures the satisfactory performance of laboratory work and minimum passing in the ISA.

Books Recommended:

Text Books:

1. Bioengineering, Biomedical, Medical and Clinical Engg.: A.Teri Bahil.
2. Signals and systems in Biomedical Engg.: Suresh R Devasahayam.
3. Bio-Electricity A quantitative approach by Barr and Ploncey

Reference Books:

1. Biomedical Engineering Handbook by Bronzino (CRC Press)

Oral examination will be based on entire syllabus.

Course Code	Course Name	Teaching scheme			Credit assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
BMDL7012	Bioinformatics Lab (Abbreviated as BI Lab)	--	02	--	--	01	--	01

Course Code	Course Name	Examination Scheme			
		ISA	MSE	ESE	Total
BMDL7012	Bioinformatics Lab	25		25	50

Course Code	Course Name	Credits
BML7012	Bioinformatics Lab	01
Course Objectives	<ul style="list-style-type: none"> The course introduces the students to the field of Bioinformatics. To make students aware about the methods to characterise and manage the different types of biological data. To introduce students to the basics of sequence alignment and analysis. 	
Course Outcomes	<p>Learner will be able to</p> <ul style="list-style-type: none"> Get introduced to the basic concepts of Bioinformatics and its significance in Biological data analysis. Apply knowledge of basic principles of mathematics and statistics. Apply existing software effectively to extract information from large databases and to use this information in computer modelling Apply problem-solving skills to multivariate methods in bioinformatics Search and apply bioinformatics tools to analyse and interpret biological data 	

Syllabus: Same as that of BMD07012 Bioinformatics

List of Tutorials: (any seven Tutorials based on following topics)

1. Steps in DNA sequencing
2. Different methods of DNA sequencing
3. Discovery of Gene Sequence.
4. Types of Proteomics
5. Mendel's postulates and laws of inheritance
6. Steps of dynamic programming
7. Classification of biological databases
8. Steps in Hypothesis Testing
9. Types of statistical models
10. Important Algorithms in Bioinformatics

Any other tutorial based on syllabus may be included, which would help the learner to understand topic/concept. A power point presentation on any of the topics in syllabus should be carried out.

In Semester Assessment (ISA):

ISA shall consist of minimum 7 tutorials.

The final certification and acceptance of ISA ensures the satisfactory performance of laboratory work and minimum passing in the ISA.

Books Recommended:*Text books:*

1. Basics of Bioinformatics, Rui Jiang, Xuegong Zhang, Michael Q. Zhang, Springer, E-book.
2. Introduction to Bioinformatics, Arthur M. Lesk, Oxford University Press, 2002, First Edition.

Reference Books:

1. Essential Bioinformatics, Jin Xiong, Cambridge University Press, 2006, First Edition.

Oral examination will be based on entire syllabus.

Course Code	Course Name	Teaching scheme			Credit assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
BMDL7013	IOT Based Systems Lab	--	02	--	--	01	--	01

Course Code	Course Name	Examination Scheme			
		ISA	MSE	ESE	Total
BMDL7013	IOT Based Systems Lab	25		25	50

Course Code	Course Name	Credits
BMDL7013	IOT Based Systems Lab	01
Course Objectives	<ul style="list-style-type: none"> Learn the concepts of IOT Identify different technologies and schemes Learn different applications in IOT Learn different protocols used in IOT Learn how to analyze the data in IOT 	
<ul style="list-style-type: none"> Course Outcomes 	Learner will be able to <ul style="list-style-type: none"> Apply the concepts of IOT Identify and select different technologies and scheme for IOT applications Apply IOT to different applications Analyze and evaluate protocols used in IOT systems Analyze dataflow in IOT systems 	

Syllabus: Same as that of (Course Code) Bioinformatics

List of Experiments: (any seven Experiments based on following list)

- 1) To demonstrate I/O operations, interrupts, ADC and other onboard features using any one hardware platform (Arduino/Raspberry Pi/BeagleBone/ESP32).
- 2) To demonstrate interfacing various sensors and storing data on-board [and on-board processing of data] using any one hardware platform (Arduino/Raspberry Pi/BeagleBone/ESP32).

- 3) To demonstrate interfacing various sensors and communicating data using Internet using any one hardware platform (Arduino/Raspberry Pi/BeagleBone/ESP32).
- 4) To demonstrate CoAP protocol (client – server model) with SOC platform as server.
- 5) To demonstrate CoAP protocol (client – server model) with SOC platform as client.
- 6) To demonstrate MQTT broker (publish - subscribe model) with SOC platform as broker.
- 7) To demonstrate MQTT broker (publish - subscribe model) with SOC platform as publisher.
- 8) To demonstrate the use of cloud storage.
- 9) To demonstrate the use/role of cloud computing.

Any other Experiment based on syllabus may be included, which would help the learner to understand topic/concept.

In Semester Assessment (ISA):

ISA shall consist of minimum 7 tutorials.

The final certification and acceptance of ISA ensures the satisfactory performance of laboratory work and minimum passing in the ISA.

Books Recommended:

Books Recommended:

Text books:

1. Internet of Things: A Hands-On Approach, Arshdeep Bahga, Vijay Madisetti, universities press.
2. IOT fundamentals, David, Gonzalo, Patrick, Cisco press.
3. Data and Computer communications, William Stallings, Pearson Education.
4. Data communication and networking, Behrouz A. Forouzan, McGraw Hill Education
Communication Networks, Alberto Leon Garcia, McGraw Hill Education.

Reference Books:

1. Computer Networks, S. Tanenbaum, Pearson Education.
2. Computer Networking: A Top-Down Approach, J. F. Kurose and K. W. Ross, Addison Wesley.

Oral examination will be based on entire syllabus.

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned		
		Theory	Pract. Tut.	Theory	Pract.	Total
BMP701	Major Project - I	--	6 [#]	--	3	3

Course Code	Course Name	Examination Scheme			
		ISA	MSE	ESE	Total
BMP701	Major Project - I	25		25	50

Course Code	Course Name	Credits
BMP701	Major Project-I	03
Course objective	<ul style="list-style-type: none"> To apply the knowledge gained during Curriculum to develop and design problem statement. Conduct literature survey. Design Circuit/ Flow chart of the statement. Documentation and project report writing. 	
Course Outcome	<p>Learner will be able to</p> <ul style="list-style-type: none"> Review literature to define problem statement Apply knowledge of the engineering fundamentals acquired during the curriculum and beyond Develop and create design using appropriate design methodologies considering the various health, society and environmental needs. Write problem statement, Design concept in prescribed format. Learn the behavioral science by working in a group. 	

Project Guidelines:

- Learner is allotted 6 hrs per week for the project work
- Learners should carry out literature survey /visit industry / analyze current trends and identify the problem for Project and finalize in consultation with Guide/Supervisor.
- Group of maximum four students will be completing a comprehensive project work.
- Learners should use multiple literatures and understand the problem.
- Learners should attempt solution to the problem by experimental/simulation methods.
- The solution to be validated with proper justification and compile the report in standard format
- Learner may use this opportunity to learn different computational techniques as well as some model development.

Faculty Load:

1. In semester VII – 1/2 (half) period of 1/2 hour per week per project group
2. Each faculty is permitted to take (guide) maximum 4 (Four) project groups

In Semester Assessment (ISA):

ISA should be examined by approved internal faculty appointed by the head of the institute based on the following:

- Scope and objective of the project work.
- Extensive Literature survey.
- Progress of the work (Continuous assessment)
- Report in prescribed University format.

Guidelines for Assessment of Project Stage- I

1. Project I should be assessed through a presentation jointly by Internal and External Examiners approved by the University of Mumbai
2. Project stage I should be assessed based on following points
 - Quality of problem selected
 - Literature Survey
 - Clarity of Problem definition and Feasibility of problem solution
 - Relevance to the specialization / Industrial trends
 - Clarity of objective and scope
 - Quality of Project Design
 - Compilation of Project Report
 - Quality of Written and Oral Presentation

Semester – VIII

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned		
		Theory	Pract. /Tut.	Theory	Pract.	Total
BMC801	Hospital Management	3	--	3	--	3

Course Code	Course Name	Examination Scheme			
		ISA	MSE	ESE	Total
BMC801	Hospital Management	20	30	50	100

Course Code	Course Name	Credits
BMC801	Hospital Management	03
Course Objectives	<ul style="list-style-type: none"> • To understand the basic principles used for designing of various departments in the hospital. • To understand the role of Biomedical Engineer in hospital and basic develop skills enabling to serve hospitals. • To understand the overall functioning of various departments in the hospital. 	
Course Outcomes	<p>Learner will be able to...</p> <ul style="list-style-type: none"> • Apply the management concepts used specifically in hospital. • Explain the management structure and its functions in hospital. • Demonstrate the knowledge about the principles of designing and commissioning of clinical services in the hospital. • Demonstrate the knowledge about the roles and responsibilities of Biomedical Engineer in hospital. • Demonstrate the knowledge about the functions of other Engineering and auxiliary services in the hospital. • Apply environment and waste management concepts in healthcare industry. 	

Module	Contents	Hours
1	Process of management: Principles of management, leadership, motivation, time management, H.R. management (recruitment, performance appraisal, training and development,), effective communication, accounting - types of Budget.	07
2	Organization of the hospital and hospital planning: Management structure, types of hospitals, governing body, hospital committee and hospital functionaries, duties and responsibilities of various positions. Guiding principles in planning hospital facilities and services and planning the hospital building	04
3	Clinical services: (Location, layout, equipment, personnel, and functions): OUT patient, IN patient (wards), intensive care, pathology laboratory & blood bank, radiology, physiotherapy, surgical operation theatre, emergency (casualty).	10
4	Biomedical engineering department: (Location, layout, equipment, personnel, and its main functions) Roles and responsibilities of a biomedical engineer in hospitals, Equipment management: maintenance types: routine(preventive) and breakdown, maintenance contracts (CMC and AMC) Purchase management: Purchase system (centralized, decentralized, local purchase), types of purchase, purchase procedures: selection of suppliers, tendering procedures, analyzing bids, price negotiations Material's (store) management: Functions of store manager, materials handling, flow of goods/FIFO, inventory control: lead-time, buffer stock, reorder level, two bin system, EOQ	09
5	Other engineering services: Engineering services (electrical, mechanical and civil): responsibilities and functions. Hospital ventilation and air conditioning, medical gas system, hospital information system.	05
6	Environment and waste management: Hospital infection control, central sterile service department (CSSD), biomedical waste management, disaster management.	04

Books Recommended:

Text Books:

1. Hospital Management by Dr. Pradya Pai
2. Hospital Planning, Designing and Management: Kundurs G D, Gopinath, A katakam (Private PubBangalore)

Reference Books:

1. Computers in Medicine: R. D. Lele (TMH Pub)
2. Hospital Care and Hospital Management AICTE Journal Vol. 1,2,3 by Dr. Kalanidhi. (AICTE PubBangalore)
3. Careers in Biomedical: Shantanu Thatte.

Course Code	Course Name	Teaching scheme			Credit assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
BMDO8011	Department Optional Course –5 Robotics In Medicine (Abbreviated as RIM)	03	--	--	03	--	--	03

Course Code	Course Name	Examination Scheme			
		ISA	MSE	ESE	Total
BMDO8011	Department Optional Course –5 Robotics In Medicine (Abbreviated as RIM)	20	30	50	100

Course Code	Course Name	Credits
BMDO8011	Robotics In Medicine	03
Course Objectives	<ul style="list-style-type: none"> To make the learner aware of fundamental concepts of Robotics To make learner study direct and Inverse Kinematics of Robots To make learner know the Trajectory and Motion planning. To make the learner know the Biomedical applications of robotics 	
Course Outcomes	<p>Learner will be able to...</p> <ul style="list-style-type: none"> To describe direct and inverse kinematics of robots. To describe workspace envelop and trajectory planning for robots To apply various image processing tools for robotic manipulation To implement motion planning solutions using various algorithms To illustrate medical applications of robots 	

Module No.	Contents	Hours
1	Introduction: Automation and robots, classification, application, specification and notations.	04
2	Direct Kinematics: Dot and cross products, co-ordinate frames, rotations, homogeneous coordinates, link co-ordinates, arm equation and arm matrix derivation (two axis, three axis and	10

	four axis SCARA), configuration of five axis and six axis robots (arm matrix derivation and equation not expected)	
3	<p>Inverse kinematics:</p> <p>General properties of solutions of inverse kinematics, methods for finding solution, tool configuration vector and inverse kinematics solution for two axis, three axis and four axis robots.</p> <p>Workspace analysis, work envelope and examples, workspace fixtures, trajectory planning, pick and place operations, continuous path motion, interpolated motion, straight-line motion.</p>	08
4	<p>Robot vision:</p> <p>Image representation, template matching, polyhedral objects, shape analysis, segmentation (thresholding, region labelling, shrink operators, swell operators, Euler numbers, perspective transformation, structured illumination, camera calibration).</p>	06
5	<p>Task planning:</p> <p>Task level programming, uncertainty, configuration, space, gross motion, planning, Grasp planning, fine-motion planning, simulation of planar motion, source and goal scenes, task planner simulation.</p>	06
6	<p>Applications in biomedical engineering:</p> <p>Application in rehabilitation: clinical and surgery</p>	05

Books Recommended:

Text Books:

1. Fundamentals of Robotics-Analysis and control, Robert Shilling, Prentice Hall of India
2. Introduction to Robotics, Saeed B Niku, Pearson Education
3. Robotics, Fu, Gonzales and Lee, McGraw Hill, Second Edition, 2011
4. "Introduction to Robotics-Mechanics & Control" John J. Craig, Pearson Education, India, Third Edition, 2009

Reference Books:

1. Robotics and AI, Staughard, , Prentice Hall Of India.
2. Industrial Robotics Grover, Wiess, Nagel, Oderey, McGraw Hill.
3. Robotics and Mechatronics, Walfram Stdder, Mc Graw Hill, NewYork, 2008
4. Robot Engineering, Klafter, Chmielewski, Negin. Prentice Hall Of India.
5. Robotics and Control. Mittal, Nagrath, Tata McGraw Hill publications

Course Code	Course Name	Teaching scheme			Credit assigned			
		Theory	Pract.	Tut.	Theory	Pract	Tut	Total
BMDO8012	Department Optional Course –5 Healthcare Informatics (Abbreviated as HCI)	03	--	--	03	--	--	03

Course Code	Course Name	Examination Scheme			
		ISA	MSE	ESE	Total
BMDO8012	Department Optional Course –5 Healthcare Informatics (Abbreviated as HCI)	20	30	50	100

Course Code	Course Name	Credits
BMDO8012	Healthcare Informatics	03
Course Objectives	<ul style="list-style-type: none"> To understand the healthcare interoperability semantic and syntactic. To understand the standards of healthcare interoperability standards for Medical Images and Medical Messages. 	
Course Outcomes	<p>Learners will be able to:</p> <ul style="list-style-type: none"> Understand Healthcare interoperability standards Fabricate HL7 Messages Understand and Design UML Diagrams Understand semantic interoperability through DICOM Edit and Compare DICOM file 	

Module	Contents	Hours
1	Healthcare interoperability: Standards in healthcare system, categorizing standards, standard development, various healthcare informatics standards, need for a Lingua Franca, electronic health records, interoperability modelling basics.	05
2	HL7 Version 2 (Part-I) Message syntax, delimiters, segment definition, message header MSH, patient identification details (PID), patient visit (PV1), request and specimen details (OBR), result details (OBX).	04
3	HL7 Version 2 (Part-II) Z-Segments, data, simple data types, complex data types, codes and identifiers, names and addresses, other complex data types.	04
4	DICOM standard: Introduction, DICOM Grammar: VRs, DICOM data dictionary, DICOM objects, DICOM information hierarchy, modules, IODs and IEs.	07
5	DICOM Communications: DICOM SOPs, unit identification on n/w, services and data, DIMSE Example: C- Echo, storage, query: find, C-Find IOD, C-Find DIMSE, C-Cancel, modality Worklist, Basic DICOM retrieval: C-Get, advanced DICOM retrieval: C-Move, DICOM: ping, push and pull.	09
6	DICOM Associations Association establishment, transfer syntax, application context, DICOM Media: Files, Folders, and DICOMDIRs DICOM File format, DICOM file services, storing DICOM data in PACS.	10

Books Recommended:

Textbooks:

1. Principles of Health Interoperability HL7 and SNOMED (Health Information Technology Standards) by Tim Benson, Springer Publication.
2. Digital Imaging and Communication in Medicine (DICOM) by Oleg S. Pianykh, Springer Publication.
3. The CDATM Book, By Keith Boone, Springer Publication.

Reference Books:

1. Informatics in Medical Imaging, George C. Kagadis, Steve G. Langer, CRC Press.

Course Code	Course Name	Teaching scheme			Credit assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
BMDO8013	Department Optional Course –5 Artificial Intelligence in Medicine (Abbreviated as AIM)	03	--	--	03	--	--	03

Course Code	Course Name	Examination Scheme			
		ISA	MSE	ESE	Total
BMDO8013	Department Optional Course –5 Artificial Intelligence in Medicine (Abbreviated as AIM)	20	30	50	100

Course Code	Course Name	Credits
BMDO8013	Artificial Intelligence in Medicine	03
Course Objectives	<ul style="list-style-type: none"> • To understand basics of Artificial Intelligence, Intelligent Agents. • To conceptualize search techniques. • To understand expert system in Artificial Intelligence 	
Course Outcomes	<p>Learner will be able to...</p> <ul style="list-style-type: none"> • Develop a basic understanding of intelligent agents in artificial intelligence • Choose an appropriate problem-solving method and knowledge representation technique • Comprehend the concept of propositional logic • Understand Reasoning and Knowledge Representation • Develop basic understanding of expert system and it's applications • Learn AI applications in health care 	

Module	Contents	Hours
1	Basics of Artificial Intelligent: Definition and concept of Artificial Intelligence, stages of AI, intelligent agents in artificial intelligence, foundations of AI and applications, current trends in AI	04
2	Problem Spaces, and Search: Breadth first search, depth first search techniques, iterative deepening, bidirectional search, best first search, Heuristic search, Hill Climbing, A* Search, Problem reduction and game playing: Introduction, problem reduction, game playing, alphabeta pruning, two-player perfect information games	10
3	Logic concepts: Introduction, propositional calculus, propositional logic, natural deduction system, axiomatic system, semantic tableau system in proportional logic, resolution refutation in proportional logic, predicate logic	07
4	Knowledge Representation: Problems in representing knowledge, knowledge representation using propositional and predicate logic, logical consequences, syntax and semantics of an expression, semantic Tableau. Forward and backward reasoning. Proof methods, substitution and unification, conversion to clausal form, normal forms, resolution, refutation, deduction, theorem proving, inferencing, monotonic and non-monotonic reasoning.	08
5	Expert system and applications: Introduction phases in building expert systems, expert system versus traditional systems, rule-based expert systems blackboard systems truth maintenance systems,application of expert systems	06
6	AI in Healthcare: Benefits of AI in medicine, AI and Medical visualization, Medical Expert system, Applying AI to EHR Data, Artificial Intelligence in Medical Imaging	04

Books Recommended:

Text Books:

- 1 Stuart J. Russell and Peter Norvig, "**Artificial Intelligence: A Modern Approach**", Fourth Edition" Pearson Education, 2020.
- 2 Saroj Kaushik, "**Artificial Intelligence**", Cengage Learning, First edition, 2011
- 3 Itisha Gupta and Garima Nagpal, "**Artificial Intelligence and Expert System**", Laxmi Publications, 1st Edition 2018

Reference Books:

- 1 Nils J. Nilsson, Principles of Artificial Intelligence, Narosa Publication.

- 2 Deepak Khemani, A First Course in Artificial Intelligence, McGraw Hill Publication
- 3 Patrick H. Winston, Artificial Intelligence, 3rd edition, Pearson Education.
- 4 Elaine Rich and Kevin Knight, "**Artificial Intelligence**", Third Edition, McGraw Hill Education, 2017.

Useful Links:

- 1 <https://nptel.ac.in/courses/106/105/106105078/>
- 2 <https://archive.nptel.ac.in/courses/106/105/106105077/#>
- 3 <https://nptel.ac.in/courses/106/105/106105079/>

Course Code	Course Name	Teaching scheme			Credit assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
BMDO8021	Department Optional Course –6 Biomedical Microsystems (Abbreviated as BM)	03	--	--	03	--	--	03

Course Code	Course Name	Examination Scheme			
		ISA	MSE	ESE	Total
BMDO8021	Department Optional Course –6 Biomedical Microsystems (Abbreviated as BM)	20	30	50	100

Course Code	Course Name	Credits
BMDO8021	Biomedical Microsystems	03
Course Objectives	<ul style="list-style-type: none"> To understand various fabrication techniques for MEMS devices. To apply the knowledge of MEMS in Biomedical field. To understand recent advancements in Biomedical Engineering for a successful career in the area of nanotechnology. 	
Course Outcomes	<p>Learner will be able to...</p> <ul style="list-style-type: none"> Understand basic property and select appropriate material for MEMS application Develop or modify the MEMS processes for a simple MEMS device in order to reduce the fabrication time. Understand different microfabrication techniques and choose appropriate technique Analyse Micro total analysis system with designing of its components Demonstrate working principles of Bio Nano-sensors and drug delivery devices with types and fabrication Understand packaging techniques used in MEMS 	

Module	Contents	Hours
1.	<p>Introduction to miniaturization:</p> <ul style="list-style-type: none"> • Difference between Microelectronics and MEMs, Block diagram of MEMS and BIOMEMS, examples. Introduction to generalised processes used. • Clean room: definition, classification, air flow system • Safety in handling hazardous materials in clean room • Scaling Laws in Miniaturization • Substrates and Wafers: CZ process and float zone process, Wafer types • Materials: Properties and applications of single crystal silicon, SiO₂, Si₃N₄, SiC, Polysilicon, Glass • Wafer cleaning processes: RCA, Piranha • Positive and negative photoresist, mask, material properties of PMMA, SU8 • Different projection systems, • Surface characterization techniques: AFM, SEM, TEM, Ellipsometer, Profilometer 	06
2.	<p>MEMS Fabrication Processes</p> <ul style="list-style-type: none"> • Photolithography: Definition, steps, light sources (UV, DUV, EUV) • PVD: definition, types: Evaporation (Thermal and E-beam) and Sputtering (DC and RF), advantages, disadvantages, Material properties of Al • CVD: definition, reaction steps, types: APCVD, LPCVD, PECVD, and HWCVD, advantages, disadvantages • Oxidation: Thermal • Polymers coating techniques: spinning, spraying and electrodeposition • Doping: definition, types: Ion implantation and Diffusion, advantages, disadvantages • Etching: types: Dry etching (RIE, DRIE) and wet etching (isotropic and anisotropic), advantages, disadvantages, specific etchants 	07
3.	<p>Microfabrication Techniques</p> <ul style="list-style-type: none"> • Bulk micromachining: definition, advantages and disadvantages, Examples: pressure sensor, dissolved wafer process • Surface micromachining: definition, advantages and disadvantages Examples: pressure sensor, cantilever • Non polysilicon surface micromachining: SOI fabrication • LIGA: definition, process steps, examples, advantages and disadvantages • X-ray lithography: Synchrotron radiation, X-ray mask • Molding techniques: Injection, compression, hot embossing • Soft lithography: Definition, SAMs, Types: Micro Contact Printing, Material properties of PDMS, Gold, Conducting polymers • Micro molding techniques: Replica molding, Microtransfer molding, Micromolding in capillaries and Solvent-assisted micromolding 	07

4.	MICRO TOTAL ANALYSIS SYSTEMS (μTAS) <ul style="list-style-type: none"> • Flow techniques in μ-fluidics: pressure driven force, electro-osmosis, electrophoresis • Micropump, microvalves: types and fabrication • Microchannels: Types and fabrication (SU8, glass, silicon) 	07
	<ul style="list-style-type: none"> • Separation techniques: capillary electrophoresis, electrochromatography, isoelectric focusing • Detection techniques: fluorescence, chemiluminescence 	
5.	MICRO/ NANO BIOSENSORS AND DRUG DELIVERY DEVICES <ul style="list-style-type: none"> • Biosensor: definition, block diagram • Classification based on the basis of detection techniques: electric, magnetic, optical, thermal, mechanical, and chemical • Basic steps involved in the development of biosensors: surface modification, immobilization, integration with transducer • Design, fabrication of cantilever for antibody detection • Hypodermic needles, transdermal patches: disadvantages • Micro needles: solid, hollow, polymer, silicon (fabrication) • Nano particles for drug delivery 	06
6	MICROSYSTEM PACKAGING <ul style="list-style-type: none"> • Packaging materials • Levels of packaging • Comparison between IC and MEMS packaging • Packaging technologies: Die preparation, surface bonding, wire bonding, sealing • Pressure sensor packaging 	06

Text Books:

1. MEMS & MICROSYSTEMS Design and Manufacture, Tai-Ran Hsu, TATA McGraw-Hill.
2. Fundamentals of Microfabrication, Marc Madou, CRC Press.

Reference Books:

1. Fundamentals of BioMEMS and Medical Microdevices, Steven S. Saliterman, (SPIE Press Monograph Vol. PM153 by Wiley Interscience
2. Microsystem Technology", W. Menz, J. Mohr, O. Paul, WILEY-VCH, ISBN 3. 527-29634-4
3. Electro Mechanical System Design", James J. Allen, Taylor & Francis Group, LLC, ISBN-0-8247 -5824-2, 2005
4. MICROSYSTEM DESIGN, Stephen D. Senturia, KLUWER ACADEMIC PUBLISHERS, eBook ISBN: 0-306-47601-0

Course Code	Course Name	Teaching scheme			Credit assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
BMDO8022	Medical Devices Regulations (Abbreviated as MDR)	03	--	--	03	--	--	03

Course Code	Course Name	Examination Scheme			
		ISA	MSE	ESE	Total
BMDO8022	Medical Devices Regulations (Abbreviated as MDR)	20	30	50	100

Course Code	Course Name	Credits
BMDO8022	Medical Devices Regulations	03
Course Objectives	<ul style="list-style-type: none"> To familiarize the learners with the regulatory aspects of medical devices and instruments. To keep the learners abreast with the technological developments in the field of Medical devices regulatory affairs. 	
Course Outcomes	<p>Learner will be able to:</p> <ul style="list-style-type: none"> Discuss credibility & authorities of approvals, medical devices life cycle, risk based classification and risk based approach for regulatory controls. Explain principles of safety and effectiveness, quality management system, Various standards (American, European, BIS), risk management, cyber security and clinical evaluation. Describe technical documentation required by regulators, essential requirements checklist, risk management summary report, manufacturing information, regulated product submissions and regulatory submission repository. Highlight premarket phase like design controls, information management during premarket phase, R&D planning stage, design & development process stage and product identification & traceability. Perform regulatory submissions, approvals and registration. Launch the product, do post market surveillance, look after product obsolescence, oversee quality management system and regulatory system & processes. 	

Module	Contents	Hours
1.	Overview of regulatory framework for medical devices: Credibility and authority of approvals, medical devices life cycle, risk-based classification, risk-based approach for regulatory controls. Introduction to International Regulatory Requirements & Device Pathways.	07
2.	Safety & Effectiveness: Principles of safety and effectiveness, Quality management system, Standards, Risk management, Cybersecurity, Clinical evaluation. Classification of Biomedical Instruments, based on safety standards, Approach to Bioethics	07
3.	Technical Documentation: Technical documentation required by regulators, Essential requirements checklist, Risk management summary report, Manufacturing information, Regulated product submissions, Regulatory submission repository	07
4.	Premarket phase: Design controls, Information management during premarket phase, R&D planning stage, Design & development process stage, product identification & traceability, Case study	06
5.	Regulatory submissions, approvals and registration: Administrative provisions, regulatory submission and approval, International scenario	06
6.	Post market phase: Product launch, continued regulatory compliance, Post market surveillance, Product obsolescence, Quality management system, Regulatory system, and processes. Types of medical device audits. Medical device Compliance Audit	06

Books Recommended:

Textbooks:

1. Medical device regulatory practices, Val Theisz, PAN Satnford Publishing
2. Handbook of Medical Device regulatory affairs in Asia, edited by Jack Wong and Raymond KYTong
3. Medical Device Regulations: Global Overview and Guiding Principles, Michael Cheng, WorldHealth Organization.

Reference Books:

1. Daniel A. Vallero - Biomedical Ethics for Engineers_ Ethics and Decision Making in Biomedical and Biosystem Engineering (Biomedical Engineering Series)-Academic Press
2. Encyclopedia of Medical Devices and Instrumentation: John G. Webster. Vol. I, II, III, IV (MarcelDekkar Pub).
3. Ethics for Biomedical Engineers, Jong Yong Abdiel Foo, Stephen J. Wilson, Andrew P. Bradley, Winston Gwee, Dennis Kwok-Wing Tam (auth.) , Springer-Verlag New York

Course Code	Course Name	Teaching scheme			Credit assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
BMDO8023	Department Optional Course –6 Ergonomics (Abbreviated as ERG)	03	--	--	03	--	--	03

Course Code	Course Name	Examination Scheme			
		ISA	MSE	ESE	Total
BMDO8023	Department Optional Course –6 Ergonomics (Abbreviated as ERG)	20	30	50	100

Course Code	Course Name	Credits
BMDO8023	Ergonomics	03
Course Objectives	<ul style="list-style-type: none"> To understand various fabrication techniques for MEMS devices. To apply the knowledge of MEMS in Biomedical field. To understand recent advancements in Biomedical Engineering for a successful career in the area of nanotechnology. 	
Course Outcomes	<p>Learner will be able to...</p> <ul style="list-style-type: none"> Understand basic property and select appropriate material for MEMS application Develop or modify the MEMS processes for a simple MEMS device in order to reduce the fabrication time. Understand different microfabrication techniques and choose appropriate technique Analyse Micro total analysis system with designing of its components Demonstrate working principles of Bio Nano-sensors and drug delivery devices with types and fabrication Understand packaging techniques used in MEMS 	

Module	Contents	Hours
1.	Introduction to Ergonomics <ul style="list-style-type: none"> • Definition of Ergonomics and its application and overview. • Ergonomics in systems design, and steps to performing a task analysis. In class practice performing a task analysis. 	08
2.	Design Man Machine Environment System Design <ul style="list-style-type: none"> • Overview of Human body and its sub systems. • Understanding musculoskeletal system and its function in terms of manual activities • Understanding nervous system, human sensory organs and their limitations. • Basic Bio mechanics and its application in design 	09
3.	Muscle Use and Anthropometry and Workspace <ul style="list-style-type: none"> • Anthropometry and its application • Issues of cognition, perception and performance. • Study of work posture and its impact on human performance. • Physical environment and their impact on human performance • Muscular work including dynamic and static work, nervous control of movement, skilled work and ways to improve work efficiency. • Use of anthropometric data in ergonomics. • Principles of workspace design, including seated work, standing work, work reaches and working heights, the office environment and visual work 	10
4.	Occupational stress and Musculoskeletal disorders; Safety and health issues Cognitive aspects of user-system interaction: <ul style="list-style-type: none"> • Perception, information processing, user behaviour, error and risk perception; 	04
5.	Principles of human factors in visual communication <ul style="list-style-type: none"> • Visual display in different planes- static shape, size, font type and dynamic characters of display 	04
6	Environmental factors influencing human performance <ul style="list-style-type: none"> • Participatory ergonomics aspects 	04

Books Recommended:

Text Books:

1. Bridger, R., Introduction to Ergonomics, 3rd Ed., CRC Press, Taylor & Francis Group, 2009.
2. Sanders, M., McCormick, E., Human Factors in Engineering and Design, 7th Ed., McGraw-Hill International Editions: Psychology Series, 2013
3. Wicknes, C., Gordon, S., Liu, Y., and Gordon-Becker, S., An Introduction to Human Factors Engineering, Longman, New York, 2015
4. Chakrabarti, D., Indian Anthropometric Dimensions for ergonomic design practice, National Institute of Design, Ahmedabad, 1997
5. Salvendy, G. (ed.), Handbook of Human Factors and ergonomics, 4th Ed., John Wiley & Sons, Inc., 2012

6. Dul, J., Weerdmeester, B., Ergonomics for beginners, a quick reference guide, 3rd Ed., CRC Press, Taylor & Francis Group, 2008.

Reference Books:

1. J. Dul, and B. Weerdmeester, Ergonomics for beginners, a quick reference guide, Taylor & Francis, 1993.
2. E. Grandjean : Fitting the task to the man, Taylor & Francis Ltd. 1980.
3. J. Ansel, Visual ergonomics in the workplace, Taylor & Francis, London, 1998
4. W. Karwowski and W. S. Marras, The Occupational Ergonomics handbook, CRC Press, New York, 1999.
5. M. S. Sanders and E. J. McCormick, Human Factors in Engineering and Design, McGraw-Hill, Inc., 1993.
6. K. Kroemer, H. B. Kroemer and K. E. Kroemer, Ergonomics- How to Design for Easy and Efficiency, Prentice Hall Englewood Cliffs, NJ 07632, 1994.

Course Code	Course Name	Teaching scheme (Contact Hours)		Credits Assigned		
		Theory	Pract./Tut.	Theory	Pract./Tut.	Total
ILO 8021	Project Management	3	--	3	--	3

Course Code	Course Name	Examination Scheme			
		ISA	MSE	ESE	Total
ILO 8021	Project Management	20	30	50	100

Course Objectives	<ul style="list-style-type: none"> To familiarize the students with the use of a structured methodology/approach for each and every unique project undertaken, including utilizing project management concepts, tools and techniques. To appraise the students with the project management life cycle and make them knowledgeable about the various phases from project initiation through closure.
Course Outcomes	<p>Upon successful completion of this course, the learner will be able to:</p> <ul style="list-style-type: none"> Apply selection criteria and select an appropriate project from different options. Write work break down structure for a project and develop a schedule based on it. Identify opportunities and threats to the project and decide an approach to deal with them strategically. Use Earned value technique and determine & predict status of the project. Capture lessons learned during project phases and document them for future reference

Module	Detailed Contents	Hours
1	<p>Project Management Foundation: Definition of a project, Project Vs Operations, Necessity of project management, Triple constraints, Project life cycles (typical & atypical) Project phases and stagegate process. Role of project manager, Negotiations and resolving conflicts, Project management in various organization structures, PM knowledge areas as per Project Management Institute (PMI)</p>	05
2	<p>Initiating Projects: How to get a project started, selecting project strategically, Project selection models (Numeric /Scoring Models and Non-numeric models), Project portfolio process, Project sponsor and creating charter; Project proposal. Effective project team, Stages of team development & growth (forming, storming, norming & performing), team dynamics.</p>	06

3	<p>Project Planning and Scheduling: Work Breakdown structure (WBS) and linear responsibility chart, Interface; Co-ordination and concurrent engineering, Project cost estimation and budgeting, Top down and bottoms up budgeting, Networking and Scheduling techniques. PERT, CPM, GANTT chart, Introduction to Project Management Information System (PMIS).</p>	08
4	<p>Planning Projects: Crashing project time, Resource loading and levelling, Goldratt's critical chain, Project Stakeholders and Communication plan Risk Management in projects: Risk management planning, Risk identification and risk register, Qualitative and quantitative risk assessment, Probability and impact matrix. Risk response strategies for positive and negative risks</p>	06
5	<p>5.1 Executing Projects: Planning monitoring and controlling cycle, Information needs and reporting, engaging with all stakeholders of the projects, Team management, communication and project meetings 5.2 Monitoring and Controlling Projects: Earned Value Management techniques for measuring value of work completed; Using milestones for measurement; change requests and scope creep, Project audit 5.3 Project Contracting Project procurement management, contracting and outsourcing,</p>	08
6	<p>6.1 Project Leadership and Ethics: Introduction to project leadership, ethics in projects, Multicultural and virtual projects 6.2 Closing the Project: Customer acceptance; Reasons of project termination, Various types of project terminations (Extinction, Addition, Integration, Starvation), Process of project termination, completing a final report; doing a lessons learned analysis; acknowledging successes and failures; Project management templates and other resources; Managing without authority; Areas of further study.</p>	06

REFERENCES:

1. Project Management: A managerial approach, Jack Meredith & Samuel Mantel, 7th Edition, Wiley India
2. A Guide to the Project Management Body of Knowledge (PMBOK® Guide), 5th Ed, Project Management Institute PA, USA
3. Project Management, Gido Clements, Cengage Learning
4. Project Management, Gopalan, Wiley India
5. Project Management, Dennis Lock, 9th Edition, Gower Publishing England

Course Code	Course Name	Teaching scheme (Contact Hours)		Credits Assigned		
		Theory	Pract./Tut.	Theory	Pract./Tut.	Total
ILO 8022	Finance Management	3	--	3	--	3

Course Code	Course Name	Examination Scheme			
		ISA	MSE	ESE	Total
ILO 8022	Finance Management	20	30	50	100

Course Objectives	<ul style="list-style-type: none"> To familiarize the students with the use of a structured methodology/approach for each and every unique project undertaken, including utilizing project management concepts, tools and techniques. To appraise the students with the project management life cycle and make them knowledgeable about the various phases from project initiation through closure.
Course Outcomes	<p>Upon successful completion of this course, the learner will be able to:</p> <ul style="list-style-type: none"> Understand Indian finance system and corporate finance Take investment, finance as well as dividend decisions

Module	Detailed Contents	Hours
1	<p>Overview of Indian Financial System: Characteristics, Components and Functions of Financial System.</p> <p>Financial Instruments: Meaning, Characteristics and Classification of Basic Financial Instruments — Equity Shares, Preference Shares, Bonds-Debentures, Certificates of Deposit, and Treasury Bills.</p> <p>Financial Markets: Meaning, Characteristics and Classification of Financial Markets — Capital Market, Money Market and Foreign Currency Market</p> <p>Financial Institutions: Meaning, Characteristics and Classification of Financial Institutions — Commercial Banks, Investment-Merchant Banks and Stock Exchanges</p>	06
2	<p>Concepts of Returns and Risks: Measurement of Historical Returns and Expected Returns of a Single Security and a Two-security Portfolio; Measurement of Historical Risk and Expected Risk of a Single Security and a Two-security Portfolio.</p> <p>Time Value of Money: Future Value of a Lump Sum, Ordinary Annuity, and Annuity Due; Present Value of a Lump Sum, Ordinary Annuity, and Annuity Due; Continuous Compounding and Continuous Discounting.</p>	06

3	<p>Overview of Corporate Finance: Objectives of Corporate Finance; Functions of Corporate Finance—Investment Decision, Financing Decision, and Dividend Decision.</p> <p>Financial Ratio Analysis: Overview of Financial Statements—Balance Sheet, Profit and Loss Account, and Cash Flow Statement; Purpose of Financial Ratio Analysis; Liquidity Ratios; Efficiency or Activity Ratios; Profitability Ratios; Capital Structure Ratios; Stock Market Ratios; Limitations of Ratio Analysis.</p>	09
4	<p>Capital Budgeting: Meaning and Importance of Capital Budgeting; Inputs for Capital Budgeting Decisions; Investment Appraisal Criterion—Accounting Rate of Return, Payback Period, Discounted Payback Period, Net Present Value(NPV), Profitability Index, Internal Rate of Return (IRR), and Modified Internal Rate of Return (MIRR)</p> <p>Working Capital Management: Concepts of Meaning Working Capital; Importance of Working Capital Management; Factors Affecting an Entity's Working Capital Needs; Estimation of Working Capital Requirements; Management of Inventories; Management of Receivables; and Management of Cash and Marketable Securities.</p>	10
5	<p>Sources of Finance: Long Term Sources—Equity, Debt, and Hybrids; Mezzanine Finance; Sources of Short Term Finance—Trade Credit, Bank Finance, Commercial Paper; Project Finance.</p> <p>Capital Structure: Factors Affecting an Entity's Capital Structure; Overview of Capital Structure Theories and Approaches— Net Income Approach, Net Operating Income Approach; Traditional Approach, and Modigliani-Miller Approach. Relation between Capital Structure and Corporate Value; Concept of Optimal Capital Structure</p>	05
06	<p>Dividend Policy: Meaning and Importance of Dividend Policy; Factors Affecting an Entity's Dividend Decision; Overview of Dividend Policy Theories and Approaches— Gordon's Approach, Walter's Approach, and Modigliani-Miller Approach</p>	03

REFERENCES:

1. Fundamentals of Financial Management, 13th Edition (2015) by Eugene F. Brigham and Joel F. Houston; Publisher: Cengage Publications, New Delhi.
2. Analysis for Financial Management, 10th Edition (2013) by Robert C. Higgins; Publishers: McGraw Hill Education, New Delhi.
3. Indian Financial System, 9th Edition (2015) by M. Y. Khan; Publisher: McGraw Hill Education, New Delhi.
4. Financial Management, 11th Edition (2015) by I. M. Pandey; Publisher: S. Chand (G/L) & Company Limited, New Delhi.

Course Code	Course Name	Teaching scheme (Contact Hours)		Credits Assigned		
		Theory	Pract./Tut.	Theory	Pract./Tut.	Total
ILO8023	Entrepreneurship Development and Management					
		3	--	3	--	3

Course Code	Course Name	Examination Scheme			
		ISA	MSE	ESE	Total
ILO8023	Entrepreneurship Development and Management	20	30	50	100

Course Objectives	<ul style="list-style-type: none"> To acquaint with entrepreneurship and management of business Understand Indian environment for entrepreneurship Idea of EDP, MSME
Course Outcomes	<p>Upon successful completion of this course, the learner will be able to:</p> <ul style="list-style-type: none"> Understand the concept of business plan and ownerships Interpret key regulations and legal aspects of entrepreneurship in India Understand government policies for entrepreneurs

Module	Detailed Contents	Hours
1	<p>Overview of Entrepreneurship: Definitions, Roles and Functions/Values of Entrepreneurship, History of Entrepreneurship Development, Role of Entrepreneurship in the National Economy, Functions of an Entrepreneur, Entrepreneurship and Forms of Business Ownership</p> <p>Role of Money and Capital Markets in Entrepreneurial Development:Contribution of Government Agencies in Sourcing information for Entrepreneurship</p>	04
2	<p>Business Plans and Importance of Capital to Entrepreneurship: Preliminary and Marketing Plans, Management and Personnel, Start-up Costs and Financing aswell as Projected Financial Statements, Legal Section, Insurance, Suppliers and Risks,Assumptions and Conclusion, Capital and its Importance to the Entrepreneur</p> <p>Entrepreneurship and Business Development: Starting a New Business, Buying an Existing Business, New Product Development, Business Growth and the Entrepreneur Law and its Relevance to Business Operations</p>	09
3	<p>Women's Entrepreneurship Development, Social entrepreneurship-role and need, EDP cell, role of sustainability and sustainable development for SMEs, case studies, exercises</p>	05

4	Indian Environment for Entrepreneurship: key regulations and legal aspects, MSMED Act 2006 and its implications, schemes and policies of the Ministry of MSME, role and responsibilities of various government organisations, departments, banks etc., Role of State governments in terms of infrastructure developments and support etc., Public private partnerships, National Skill development Mission, Credit Guarantee Fund, PMEGP, discussions, group exercises etc.	08
5	Effective Management of Business: Issues and problems faced by micro and small enterprises and effective management of M and S enterprises (risk management, credit availability, technology innovation, supply chain management, linkage with large industries), exercises, e-Marketing	08
6	Achieving Success In The Small Business: Stages of the small business life cycle, four types of firm-level growth strategies, Options – harvesting or closing small business Critical Success factors of small business	05

REFERENCES:

1. Poornima Charantimath, Entrepreneurship development- Small Business Enterprise, Pearson
2. Education Robert D Hisrich, Michael P Peters, Dean A Shapherd, Entrepreneurship, latest edition, The McGrawHill Company
3. Dr TN Chhabra, Entrepreneurship Development, Sun India Publications, New Delhi
4. Dr CN Prasad, Small and Medium Enterprises in Global Perspective, New century Publications, New Delhi
5. Vasant Desai, Entrepreneurial development and management, Himalaya Publishing House
6. Maddhurima Lall, Shikah Sahai, Entrepreneurship, Excel Books
7. Rashmi Bansal, STAY hungry STAY foolish, CIIE, IIM Ahmedabad
8. Law and Practice relating to Micro, Small and Medium enterprises, Taxmann Publication Ltd.
9. Kurakto, Entrepreneurship- Principles and Practices, Thomson Publication
10. Laghu Udyog Samachar
11. www.msme.gov.in
12. www.dcmesme.gov.in
13. www.msmetraining.gov.in

Course Code	Course Name	Teaching scheme (Contact Hours)		Credits Assigned		
		Theory	Pract./Tut.	Theory	Pract./Tut.	Total
ILO8024	Human Resource Management	3	--	3	--	3

Course Code	Course Name	Examination Scheme			
		ISA	MSE	ESE	Total
ILO8024	Human Resource Management	20	30	50	100

Course Objectives	<ul style="list-style-type: none"> To introduce the students with basic concepts, techniques and practices of the human resource management To provide opportunity of learning Human resource management (HRM) processes, related with the functions, and challenges in the emerging perspective of today's organizations To familiarize the students about the latest developments, trends & different aspects of HRM To acquaint the student with the importance of inter-personal & inter-group behavioural skills in an organizational setting required for future stable engineers, leaders and managers
Course Outcomes	<p>Upon successful completion of this course, the learner will be able to:</p> <ul style="list-style-type: none"> Understand the concepts, aspects, techniques and practices of the human resource management. Understand the Human resource management (HRM) processes, functions, changes and challenges in today's emerging organizational perspective. Gain knowledge about the latest developments and trends in HRM. Apply the knowledge of behavioural skills learnt and integrate it with in inter personal and intergroup environment emerging as future stable engineers and managers.

Module	Detailed Contents	Hours
1	<p>Introduction to HR</p> <ul style="list-style-type: none"> Human Resource Management- Concept, Scope and Importance, Interdisciplinary Approach Relationship with other Sciences, Competencies of HR Manager, HRM functions Human resource development (HRD): changing role of HRM – Human resource Planning, Technological change, Restructuring and rightsizing, Empowerment, TQM, Managing ethical issues 	05
2	<p>Organizational Behaviour (OB)</p> <ul style="list-style-type: none"> Introduction to OB Origin, Nature and Scope of Organizational Behaviour, Relevance to Organizational Effectiveness and Contemporary issues 	07

	<ul style="list-style-type: none"> • Personality: Meaning and Determinants of Personality, Personality development, Personality Types, Assessment of Personality Traits for Increasing Self Awareness • Perception: Attitude and Value, Effect of perception on Individual Decision- making, Attitude and Behaviour • Motivation: Theories of Motivation and their Applications for Behavioural Change (Maslow, Herzberg, McGregor); • Group Behaviour and Group Dynamics: Work groups formal and informal groups and stages of group development, Team Effectiveness: High performing teams, Team Roles, cross functional and self-directed team. <p>Case study</p>	
3	<p>Organizational Structure & Design</p> <ul style="list-style-type: none"> • Structure, size, technology, Environment of organization; Organizational Roles & conflicts: Concept of roles; role dynamics; role conflicts and stress. • Leadership: Concepts and skills of leadership, Leadership and managerial roles, Leadership styles and contemporary issues in leadership. • Power and Politics: Sources and uses of power; Politics at workplace, Tactics and strategies. 	06
4	<p>Human resource Planning</p> <ul style="list-style-type: none"> • Recruitment and Selection process, Job-enrichment, Empowerment – Job Satisfaction, employee morale • Performance Appraisal Systems: Traditional & modern methods, Performance Counselling, Career Planning • Training & Development: Identification of Training Needs, Training Methods 	05
5	<p>Emerging Trends in HR</p> <ul style="list-style-type: none"> • Organizational development; Business Process Re-engineering (BPR), BPR as a tool for organizational development, managing processes & transformation in HR. Organizational Change, Culture, Environment • Cross Cultural Leadership and Decision Making: Cross Cultural Communication and diversity at work, Causes of diversity, managing diversity with special reference to handicapped, women and ageing people, intra company cultural difference in employee motivation 	06
6	<p>HR & MIS: Need, purpose, objective and role of information system in HR, Applications in HRD in various industries (e.g. manufacturing R&D, Public Transport, Hospitals, Hotels and service industries)</p> <p>Strategic HRM: Role of Strategic HRM in the modern business world, Concept of Strategy, Strategic Management Process, Approaches to Strategic Decision Making; Strategic Intent – Corporate Mission, Vision, Objectives and Goals</p> <p>Labor Laws & Industrial Relations: Evolution of IR, IR issues in organizations, Overview of Labor Laws in India; Industrial Disputes Act, Trade Unions Act, Shops and Establishments Act</p>	10

REFERENCES:

1. Stephen Robbins, Organizational Behavior, 16th Ed, 2013
2. V S P Rao, Human Resource Management, 3rd Ed, 2010, Excel publishing
3. Aswathapa, Human resource management: Text & cases, 6th edition, 2011
4. C. B. Mamoria and S V Gankar, Dynamics of Industrial Relations in India, 15th Ed, 2015, Himalaya Publishing, 15th edition, 2015
5. P. Subba Rao, Essentials of Human Resource management and Industrial

- relations, 5th Ed,2013, Himalaya Publishing
6. Laurie Mullins, Management & Organizational Behavior, 2016, Pearson Publications

Course Code	Course Name	Teaching scheme (Contact Hours)		Credits Assigned		
		Theory	Pract./Tut.	Theory	Pract./Tut.	Total
ILO8025	Professional Ethics and Corporate Social Responsibility (CSR)					
		3	--	3	--	3

Course Code	Course Name	Examination Scheme			
		ISA	MSE	ESE	Total
ILO8025	Professional Ethics and Corporate Social Responsibility (CSR)	20	30	50	100

Course Objectives	<ul style="list-style-type: none"> To understand professional ethics in business To recognized corporate social responsibility
Course Outcomes	<p>Upon successful completion of this course, the learner will be able to:</p> <ul style="list-style-type: none"> Understand rights and duties of business Distinguish different aspects of corporate social responsibility Demonstrate professional ethics Understand legal aspects of corporate social responsibility

Module	Detailed Contents	Hours
1	Professional Ethics and Business: The Nature of Business Ethics; Ethical Issues in Business; Moral Responsibility and Blame; Utilitarianism: Weighing Social Costs and Benefits; Rights and Duties of Business	04
2	Professional Ethics in the Marketplace: Perfect Competition; Monopoly Competition; Oligopolistic Competition; Oligopolies and Public Policy Professional Ethics and the Environment: Dimensions of Pollution and Resource Depletion; Ethics of Pollution Control; Ethics of Conserving Depletable Resources	08
3	Professional Ethics of Consumer Protection: Markets and Consumer Protection; Contract View of Business Firm's Duties to Consumers; Due Care Theory; Advertising Ethics; Consumer Privacy Professional Ethics of Job Discrimination: Nature of Job Discrimination; Extent of Discrimination; Reservation of Jobs.	06

4	Introduction to Corporate Social Responsibility: Potential Business Benefits—Triple bottom line, Human resources, Risk management, Supplier relations; Criticisms and concerns—Nature of business; Motives; Misdirection. Trajectory of Corporate Social Responsibility in India	05
5	Corporate Social Responsibility: Articulation of Gandhian Trusteeship Corporate Social Responsibility and Small and Medium Enterprises (SMEs) in India, Corporate Social Responsibility and Public-Private Partnership (PPP) in India	08
6	Corporate Social Responsibility in Globalizing India: Corporate Social Responsibility Voluntary Guidelines, 2009 issued by the Ministry of Corporate Affairs, Government of India, Legal Aspects of Corporate Social Responsibility—Companies Act, 2013.	08

REFERENCES:

1. Business Ethics: Texts and Cases from the Indian Perspective (2013) by Ananda Das Gupta; Publisher: Springer.
2. Corporate Social Responsibility: Readings and Cases in a Global Context (2007) by Andrew Crane, Dirk Matten, Laura Spence; Publisher: Routledge.
3. Business Ethics: Concepts and Cases, 7th Edition (2011) by Manuel G. Velasquez; Pearson, New Delhi.
4. Corporate Social Responsibility in India (2015) by Bidyut Chakrabarty, Routledge, New Delhi.

Course Code	Course Name	Teaching scheme (Contact Hours)		Credits Assigned		
		Theory	Pract./Tut.	Theory	Pract./Tut.	Total
ILO8026	Research Methodology	3	--	3	--	3

Course Code	Course Name	Examination Scheme			
		ISA	MSE	ESE	Total
ILO8026	Research Methodology	20	30	50	100

Course Objectives	<ul style="list-style-type: none"> To understand Research and Research Process To acquaint students with identifying problems for research and develop research strategies To familiarize students with the techniques of data collection, analysis of data and interpretation
Course Outcomes	<p>Upon successful completion of this course, the learner will be able to:</p> <ul style="list-style-type: none"> Prepare a preliminary research design for projects in their subject matter areas Accurately collect, analyze and report data Present complex data or situations clearly Review and analyze research findings

Module	Detailed Contents	Hours
01	<p>Introduction and Basic Research Concepts</p> <p>1.1 Research – Definition; Concept of Construct, Postulate, Proposition, Thesis, Hypothesis, Law, Principle. Research methods vs Methodology</p> <p>1.2 Need of Research in Business and Social Sciences</p> <p>1.3 Objectives of Research</p> <p>1.4 Issues and Problems in Research</p> <p>1.5 Characteristics of Research: Systematic, Valid, Verifiable, Empirical and Critical</p>	09
02	<p>Types of Research</p> <p>2.1. Basic Research</p> <p>2.2. Applied Research</p> <p>2.3. Descriptive Research</p> <p>2.4. Analytical Research</p> <p>2.5. Empirical Research</p> <p>2.6 Qualitative and Quantitative Approaches</p>	07

03	Research Design and Sample Design 3.1 Research Design – Meaning, Types and Significance 3.2 Sample Design – Meaning and Significance Essentials of a good sampling Stages in Sample Design Sampling methods/techniques Sampling Errors	07
04	Research Methodology 4.1 Meaning of Research Methodology 4.2. Stages in Scientific Research Process: a. Identification and Selection of Research Problem b. Formulation of Research Problem c. Review of Literature d. Formulation of Hypothesis e. Formulation of research Design f. Sample Design g. Data Collection h. Data Analysis i. Hypothesis testing and Interpretation of Data j. Preparation of Research Report	08
05	Formulating Research Problem 5.1 Considerations: Relevance, Interest, Data Availability, Choice of data, Analysis of data, Generalization and Interpretation of analysis	04
06	Outcome of Research 6.1 Preparation of the report on conclusion reached 6.2 Validity Testing & Ethical Issues 6.3 Suggestions and Recommendation	04

REFERENCES:

1. Dawson, Catherine, 2002, Practical Research Methods, New Delhi, UBS PublishersDistributors.
2. Kothari, C.R.,1985, Research Methodology-Methods and Techniques, New Delhi, WileyEastern Limited.
3. Kumar, Ranjit, 2005, Research Methodology-A Step-by-Step Guide for Beginners, (2nded),Singapore, Pearson Education

Course Code	Course Name	Teaching scheme (Contact Hours)		Credits Assigned		
		Theory	Pract./Tut.	Theory	Pract./Tut.	Total
ILO8027	IPR and Patenting	3	--	3	--	3

Course Code	Course Name	Examination Scheme			
		ISA	MSE	ESE	Total
ILO8027	IPR and Patenting	20	30	50	100

Course Objectives	<ul style="list-style-type: none"> To understand intellectual property rights protection system To promote the knowledge of Intellectual Property Laws of India as well as International treaty procedures To get acquaintance with Patent search and patent filing procedure and applications
Course Outcomes	<p>Upon successful completion of this course, the learner will be able to:</p> <ul style="list-style-type: none"> understand Intellectual Property assets assist individuals and organizations in capacity building work for development, promotion, protection, compliance, and enforcement of Intellectual Property and Patenting

Module	Detailed Contents	Hours
01	<p>Introduction to Intellectual Property Rights (IPR): Meaning of IPR, Different category of IPR instruments - Patents, Trademarks, Copyrights, Industrial Designs, Plant variety protection, Geographical indications, Transfer of technology etc.</p> <p>Importance of IPR in Modern Global Economic Environment: Theories of IPR, Philosophical aspects of IPR laws, Need for IPR, IPR as an instrument of development</p>	05
02	<p>Enforcement of Intellectual Property Rights: Introduction, Magnitude of problem, Factors that create and sustain counterfeiting/piracy, International agreements, International organizations (e.g. WIPO, WTO) active in IPR enforcement</p> <p>Indian Scenario of IPR: Introduction, History of IPR in India, Overview of IPR laws in India, Indian IPR, Administrative Machinery, Major international treaties signed by India, Procedure for submitting patent and Enforcement of IPR at national level etc.</p>	07
03	<p>Emerging Issues in IPR: Challenges for IP in digital economy, e-commerce, human genome, biodiversity and traditional knowledge etc.</p>	05

04	Basics of Patents: Definition of Patents, Conditions of patentability, Patentable and non-patentable inventions, Types of patent applications (e.g. Patent of addition etc.), Process Patent and Product Patent, Precautions while patenting, Patentspecification Patent claims, Disclosures and non-disclosures, Patent rights and infringement, Method of getting a patent	07
05	Patent Rules: Indian patent act, European scenario, US scenario, Australiascenario, Japan scenario, Chinese scenario, Multilateral treaties where India is a member (TRIPS agreement, Paris convention etc.)	08
06	Procedure for Filing a Patent (National and International): Legislation and Salient Features, Patent Search, Drafting and Filing Patent Applications, Processing of patent, Patent Litigation, Patent Publication, Time frame and cost, Patent Licensing, Patent Infringement Patent databases: Important websites, Searching international databases	07

REFERENCE BOOKS:

1. Rajkumar S. Adukia, 2007, A Handbook on Laws Relating to Intellectual Property Rights in India, The Institute of Chartered Accountants of India
2. Keayla B K, Patent system and related issues at a glance, Published by National Working Group on Patent Laws
3. T Sengupta, 2011, Intellectual Property Law in India, Kluwer Law International
4. Tzen Wong and Graham Dutfield, 2010, Intellectual Property and Human Development: Current Trends and Future Scenario, Cambridge University Press
5. Cornish, William Rodolph & Llewelyn, David. 2010, Intellectual Property: Patents, Copyrights, Trade Marks and Allied Right, 7th Edition, Sweet & Maxwell
6. Lous Harns, 2012, The enforcement of Intellectual Property Rights: A Case Book, 3rd Edition, WIPO
7. Prabhuddha Ganguli, 2012, Intellectual Property Rights, 1st Edition, TMH
8. R Radha Krishnan & S Balasubramanian, 2012, Intellectual Property Rights, 1st Edition, ExcelBooks
9. M Ashok Kumar and mohd Iqbal Ali, 2-11, Intellectual Property Rights, 2nd Edition, Serial Publications
10. Kompal Bansal and Praishit Bansal, 2012, Fundamentals of IPR for Engineers, 1st Edition, BSPublications
11. Entrepreneurship Development and IPR Unit, BITS Pilani, 2007, A Manual on Intellectual Property Rights,
12. Mathew Y Maa, 2009, Fundamentals of Patenting and Licensing for Scientists and Engineers, World Scientific Publishing Company
13. N S Rathore, S M Mathur, Priti Mathur, Anshul Rathi, IPR: Drafting, Interpretation of Patent Specifications and Claims, New India Publishing Agency
14. Vivien Irish, 2005, Intellectual Property Rights for Engineers, IET
15. Howard B Rockman, 2004, Intellectual Property Law for Engineers and scientists, Wiley-IEEE Press

Course Code	Course Name	Teaching scheme (Contact Hours)		Credits Assigned		
		Theory	Pract./Tut.	Theory	Pract./Tut.	Total
ILO 8028	Digital Business Management	3	--	3	--	3

Course Code	Course Name	Examination Scheme			
		ISA	MSE	ESE	Total
ILO 8028	Digital BusinessManagement	20	30	50	100

Course Objectives	<ul style="list-style-type: none"> To familiarize with digital business concept To acquaint with E-commerce To give insights into E-business and its strategies
Course Outcomes	<p>Upon successful completion of this course, the learner will be able to:</p> <ul style="list-style-type: none"> Identify drivers of digital business Illustrate various approaches and techniques for E-business and management Prepare E-business plan

Module	Detailed content	Hours
1	<p>Introduction to Digital Business- Introduction, Background and current status, E-market places, structures, mechanisms, economics and impacts, Difference between physical economy and digital economy.</p> <p>Drivers of digital business- Big Data & Analytics, Mobile, Cloud Computing, Social media, BYOD, and Internet of Things (digitally intelligent machines/services), Opportunities and Challenges in Digital Business</p>	09
2	<p>Overview of E-Commerce</p> <p>E-Commerce- Meaning, Retailing in e-commerce-products and services, consumer behavior, market research and advertisement</p> <p>B2B-E-commerce-selling and buying in private e-markets, public B2B exchanges and support services, e-supply chains, Collaborative Commerce, Intra business EC and Corporate portals</p> <p>Other E-C models and applications, innovative EC System-From E-government and learning to C2C, mobile commerce and pervasive computing</p> <p>EC Strategy and Implementation-EC strategy and global EC, Economics and Justification of EC, Using Affiliate marketing to promote your e-commerce business, Launching a successful online business and EC project, Legal, Ethics and Societal impacts of EC</p>	06

3	Digital Business Support services: ERP as e –business backbone, knowledgeTope Apps, Information and referral system Application Development: Building Digital business Applications and infrastructure	06
4	Managing E-Business- Managing Knowledge, Management skills for e-business, managing Risks in e –business, Security Threats to e-business -Security Overview, Electronic Commerce Threats, Encryption, Cryptography, Public Key and Private Key Cryptography, Digital Signatures, Digital Certificates, Security Protocols over Public Networks: HTTP, SSL, Firewall as Security Control, Public Key Infrastructure (PKI) for Security, Prominent Cryptographic Applications	06
5	E-Business Strategy- E-business Strategic formulation- Analysis of Company's Internal and external environment, Selection of strategy, E-business strategy into Action, challenges and E-Transition (Process of Digital Transformation)	04
6	Materializing e-business: From Idea to Realization- Business plan preparation Case Studies and presentations	08

References:

1. A textbook on E-commerce, Er Arunrajan Mishra, Dr W K Sarwade, Neha Publishers & Distributors, 2011
2. E-commerce from vision to fulfilment, Elias M. Awad, PHI-Restricted, 2002
3. Digital Business and E-Commerce Management, 6th Ed, Dave Chaffey, Pearson, August 2014
4. Introduction to E-business-Management and Strategy, Colin Combe, ELSVIER, 2006
5. Digital Business Concepts and Strategy, Eloise Coupey, 2nd Edition, Pearson
6. Trend and Challenges in Digital Business Innovation, Vinocenzo Morabito, Springer
7. Digital Business Discourse Erika Darics, April 2015, Palgrave Macmillan
8. E-Governance-Challenges and Opportunities in : Proceedings in 2nd International Conference theory and practice of Electronic Governance
9. Perspectives the Digital Enterprise –A framework for Transformation, TCS consulting journal Vol.5
10. Measuring Digital Economy-A new perspective- DoI:10.1787/9789264221796-en OECD Publishing

Course Code	Course Name	Teaching scheme (Contact Hours)		Credits Assigned		
		Theory	Pract./Tut.	Theory	Pract./Tut.	Total
ILO8029	Environmental Management	3	--	3	--	3

Course Code	Course Name	Examination Scheme			
		ISA	MSE	ESE	Total
ILO8029	Environmental Management	20	30	50	100

Course Objectives	<ul style="list-style-type: none"> Understand and identify environmental issues relevant to India and global concerns Learn concepts of ecology Familiarise environment related legislations
Course Outcomes	<p>Upon successful completion of this course, the learner will be able to:</p> <ul style="list-style-type: none"> Understand the concept of environmental management Understand ecosystem and interdependence, food chain etc. Understand and interpret environment related legislations

Module	Detailed Contents	Hours
1	Introduction and Definition of Environment: Significance of Environment Management for contemporary managers, Career opportunities, Environmental issues relevant to India, Sustainable Development, the Energy scenario	10
2	Global Environmental concerns : Global Warming, Acid Rain, Ozone Depletion, Hazardous Wastes, Endangered life-species, Loss of Biodiversity, Industrial/Man-made disasters, Atomic/Biomedical hazards, etc.	06
3	Concepts of Ecology: Ecosystems and interdependence between living organisms, habitats, limiting factors, carrying capacity, food chain, etc.	05
4	Scope of Environment Management, Role and functions of Government as a planning and regulating agency Environment Quality Management and Corporate Environmental Responsibility	10
5	Total Quality Environmental Management, ISO-14000, EMS certification.	05
6	General overview of major legislations like Environment Protection Act, Air (P & CP) Act, Water (P & CP) Act, Wildlife Protection Act, Forest Act, Factories Act, etc.	03

REFERENCES:

1. Environmental Management: Principles and Practice, C J Barrow, Routledge Publishers London, 1999
2. A Handbook of Environmental Management Edited by Jon C. Lovett and David G. Ockwell, Edward Elgar Publishing
3. Environmental Management, **T V Ramachandra and Vijay Kulkarni, TERI Press**
4. Indian Standard Environmental Management Systems — Requirements With Guidance For Use, Bureau Of Indian Standards, February 2005
5. Environmental Management: An Indian Perspective, S N Chary and Vinod Vyasulu, Macmillan India, 2000
6. Introduction to Environmental Management, Mary K Theodore and Louise Theodore, CRC Press Environment and Ecology, Majid Hussain, 3rd Ed. Access Publishing, 2015

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned		
		Theory	Pract. /Tut.	Theory	Pract.	Total
BML801	Hospital Management Lab	--	2	--	1	1

Course Code	Course Name	Examination Scheme			
		ISA	MSE	ESE	Total
BML801	Hospital Management Lab	25		25	50

Course Code	Course Name	Credits
BML801	Hospital Management	01
Course Objectives	<ul style="list-style-type: none"> To understand the basic principles used for designing of various departments in the hospital. To understand the role of Biomedical Engineer in hospital and basic develop skills enabling to serve hospitals. To understand the overall functioning of various departments in the hospital. 	
Course Outcomes	<p>Learner will be able to...</p> <ul style="list-style-type: none"> Apply the management concepts used specifically in hospital. Explain the management structure and its functions in hospital. Demonstrate the knowledge about the principles of designing and commissioning of clinical services in the hospital. Demonstrate the knowledge about the roles and responsibilities of Biomedical Engineer in hospital. Demonstrate the knowledge about the functions of other Engineering and auxiliary services in the hospital. Apply environment and waste management concepts in healthcare industry. 	

Syllabus: Same as that of BMC801 Hospital Management (HM).

List of Experiments and Assignments: (Any Four Experiments and Any Four Assignments)

1. Design of Registration form of hospital.
2. Prepare an organization chart for multi-speciality hospital
3. Prepare budget using EXCEL sheet for purchase of hospital equipment.
4. Preparation of Comparative Statement in Excel for purchase of medical equipment. **(Any Two)**
5. Design the layout of Outpatient Department in hospital.
6. Design the layout of ICU in hospital.
7. Design the layout of Surgical Operation Theatre Complex in hospital.
8. Design the layout of Radiology Department in hospital.
9. Design the layout of Pathology Laboratory and Blood Bank Department in hospital.
10. Design the layout of Physiotherapy Department in hospital.
11. Design the layout of Central Sterile Supply Department in hospital.

Any other experiment based on syllabus which will help learner to understand topic/concept.Group

Presentation based on the assigned topic by visiting a hospital.

Books Recommended:

Text Books:

1. Hospital Management by Dr. Pradya Pai,
2. Hospital Planning, Designing and Management: Kundurs G D, Gopinath, A Katakam (Private PubBangalore)

Reference Books:

1. Computers in Medicine: R. D. Lele (TMH Pub)
2. Hospital Care and Hospital Management AICTE Journal Vol. 1,2,3 by Dr. Kalanidhi. (AICTE PubBangalore)
3. Careers in Biomedical: Shantanu Thatte.

In Semester Assessment (ISA):

ISA shall consist of minimum 4 experiments, 4 assignments and presentation.The

The final certification and acceptance of ISA ensures the satisfactory performance of laboratory work and minimum passing in the term work.

Oral examination will be based on suggested practical list and entire syllabus.

Course Code	Course Name	Teaching scheme			Credit assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
BMDL8011	Robotics In Medicine Laboratory (Abbreviated as RIM Lab)	--	02	--	--	01	--	01

Course Code	Course Name	Examination Scheme			
		ISA	MSE	ESE	Total
BMDL8011	Robotics In Medicine Laboratory (Abbreviated as RIM Lab)	25		25	50

Course Code	Course Name	Credits
BMDL8011	Robotics In Medicine Laboratory	01
Course Objectives	<ul style="list-style-type: none"> To make the learner aware of fundamental concepts of Robotics To make learner study direct and Inverse Kinematics of Robots To make learner know the Trajectory and Motion planning. To make the learner know the Biomedical applications of robotics 	
Course Outcomes	<ul style="list-style-type: none"> To describe direct and inverse kinematics of robots. To describe workspace envelop and trajectory planning for robots To apply various image processing tools for robotic manipulation To implement motion planning solutions using various algorithms To illustrate medical applications of robots 	

Syllabus: Same as that of BMD08011 Hospital Management (HM).

List of Experiments: (Any Seven)

Students can perform any other experiment/Mini project/ Seminar/ Scholarly paper review based on the theory syllabus. The coding can be done in MATLAB/SCILAB/Python/C

1. Fundamental and Composite Rotations of Mobile frame with respect to fixed frame
2. Homogeneous Transformations and Screw Transformations
3. Kinematic configurations and Link Coordinate Transformations matrix(Arm Matrix)
4. Direct Kinematics of 2-3 axis Planar Robot and find the location of Tool tip.
5. Direct Kinematic Analysis of 4,5 Axis Robot
6. Inverse Kinematics of robots and prove that there are multiple ways to reach a particular point.
7. Develop Work Envelop for 2,3 axis Robot

8. To study segmentation using edge detection technique
9. Straight line trajectory planning-BDA Algorithm
10. Template Matching
11. Gross motion planning is a part of task planning of robot. Suggest any method of gross motion planning so that the task can be completed without hitting obstacles
12. Presentation/ Seminar/Case study on Biomedical Application of robotics

In Semester Assessment(ISA):

ISA shall consist of minimum 4 experiments, 4 assignments and presentation.The

The final certification and acceptance of ISA ensures the satisfactory performance of laboratory work and minimum passing in the ISA.

Oral examination will be based on suggested practical list and entire syllabus.

Course Code	Course Name	Teaching scheme			Credit assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
BMDL8012	Department Optional Course – 5 Lab Healthcare Informatics Laboratory (Abbreviated as HCI Lab)	--	02	--	--	01	--	01

Course Code	Course Name	Examination Scheme			
		ISA	MSE	ESE	Total
BMDL8012	Department Optional Course – 5 Lab Healthcare Informatics Laboratory (Abbreviated as HCI Lab)	25		25	50

Course Code	Course Name	Credits
BMDL8012	Healthcare Informatics Laboratory	01
Course Objectives	<ul style="list-style-type: none"> To understand the healthcare interoperability semantic and syntactic. To understand the standards of healthcare interoperability standards for Medical Images and Medical Messages. 	
Course Outcomes	Learners will be able to: <ul style="list-style-type: none"> Fabricate HL7 Messages Edit and Compare DICOM file. 	

Syllabus: Same as that of BMD08012 Healthcare Informatics (HCI).

List of Experiments: (Any Seven)

- To find term/ Concept and ID or Vocabulary codes.
- Identifying and Chapters of Health Level 7 for trigger Event and message types and message.
- Structure should be sent to cover each requirement.
- Reading and editing segment.
- Create Health Level 7 Message.
- Create Patient Information Database from Health Level 7 Messages.
- To Study DICOM Validation Tool (DVTK).
- Edit DICOM File using hex-Editor.
- Creating Database of a patient.
- Comparing DICOM file.

Any other experiment based on syllabus which will help learner to understand topic/concept.

In Semester Assessment(ISA):

ISA shall consist of minimum 7 experiments.

The final certification and acceptance of ISA ensures the satisfactory performance of laboratory work and minimum passing in the ISA.

Books Recommended:*Textbooks:*

1. Principles of Health Interoperability HL7 and SNOMED (Health Information Technology Standards) by Tim Benson, Springer Publication.
2. Digital Imaging and Communication in Medicine (DICOM) by Oleg S. Pinykh, Springer Publication.
3. The CDATM Book, By Keith Boone, Springer Publication.

Reference Books:

1. Informatics in Medical Imaging, George C. Kagadis, Steve G. Langer, CRC Press.

Course Code	Course Name	Teaching scheme			Credit assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
BMDL8013	Department Optional Course – 5 Lab Artificial Intelligence in Medicine (Abbreviated as AIM)	--	02	--	--	1	--	1

Course Code	Course Name	Examination Scheme			
		ISA	MSE	ESE	Total
BMDL8013	Department Optional Course – 5 Lab Artificial Intelligence in Medicine (Abbreviated as AIM)	25		25	50

Course Code	Course Name	Credits
BMDL8013	Artificial Intelligence in Medicine	01
Course Objectives	<ul style="list-style-type: none"> To understand the basic techniques to build intelligent systems To apply appropriate search techniques used in problem solving 	
Course Outcomes	Learner will be able to... <ul style="list-style-type: none"> Identify languages and technologies for Artificial Intelligence Understand and implement searching techniques Create a knowledge base Design and implement expert systems 	

Suggested List of Experiments

Sr. No.	Title of Experiment
1.	Introduce AI programming language
2.	Knowledge representation and create knowledge base
3.	One case study on AI applications published in IEEE/ACM/Springer or any prominent journal.
4.	Assignments on State space formulation and PEAS representation for various AI applications
5.	Uninformed search methods.
6.	Informed search methods.
7.	Game playing algorithms.
8.	First order Logic

Note: Any other practical/assignments covering the syllabus topics and subtopics can be conducted.

In Semester Assessment (ISA):

ISA shall consist of minimum 7 experiments.

The final certification and acceptance of ISA ensures the satisfactory performance of laboratory work and minimum passing in the ISA.

Books Recommended:

Text Books:

- 1 Stuart J. Russell and Peter Norvig, "**Artificial Intelligence: A Modern Approach**", Fourth Edition" Pearson Education, 2020.
- 2 Saroj Kaushik, "**Artificial Intelligence**", Cengage Learning, First edition, 2011
- 3 Itisha Gupta and Garima Nagpal, "**Artificial Intelligence and Expert System**", Laxmi Publications, 1st Edition 2018

Reference Books:

- 1 Nils J. Nilsson, Principles of Artificial Intelligence, Narosa Publication.
- 2 Deepak Khemani, A First Course in Artificial Intelligence, McGraw Hill Publication
- 3 Patrick H. Winston, Artificial Intelligence, 3rd edition, Pearson Education.
- 4 Elaine Rich and Kevin Knight, "**Artificial Intelligence**", Third Edition, McGraw Hill Education, 2017.

Oral examination will be based on suggested practical list and entire syllabus

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned		
		Theory	Pract. /Tut.	Theory	Pract.	Total
BMP801	Major Project - II	--	12 [#]	--	6	6

Course Code	Course Name	Examination Scheme			
		ISA	MSE	ESE	Total
BMP801	Major Project - II	100		50	150

Course Code	Course Name	Credits
BMP801	Major Project-II	06
Course objective	<ul style="list-style-type: none"> • Implement the concept of Project Stage-I • Use advanced tools for Implementation • Rectify/ Debug the design and Submit project report. 	
Course Outcome	Learner will be able to <ul style="list-style-type: none"> • Debug/ Rectify the design incurred during implementation • Write Analysis, Results, Design in prescribed format • Learn the behavioural science by working in a group 	

Project Guidelines:

1. The students have already under gone project assignment in their seventh semester and in this semester the students are expected to continue the project work of stage I and should attempt solution to the problem.
2. Learner is allotted 12 hrs per week for the project work
3. Report should be prepared as per the guidelines issued by the University of Mumbai
4. Learners should be motivated to publish a paper based on the work in Conferences/students competitions
5. Project Groups: Learners can form groups not more than 4 (Four)

Faculty Load:

1. In semester VIII - 1 (One) periods of 1 hour each per week per project group
2. Each faculty is permitted to take (guide) maximum 4 (Four) project groups.

In Semester Assessment (ISA):

The ISA should be examined by approved internal faculty appointed by the head of the institute based on following:

- Scope and objective of the project work.
- Extensive Literature survey.
- Progress of the work (Continuous assessment)
- Report in prescribed University format.

Guidelines for Assessment of Project Stage- II

1. Project II should be assessed through a presentation jointly by Internal and External Examiners approved by the University of Mumbai
2. Project stage II should be assessed based on following points
 - Quality of problem selected
 - Clarity of Problem definition and Feasibility of problem solution
 - Relevance to the specialization / Industrial trends
 - Clarity of objective and scope
 - Quality of work attempted
 - Validation of results
 - Compilation of Project Report
 - Quality of Written and Oral Presentation



Vidyalankar Institute of Technology

An Autonomous Institute affiliated to University of Mumbai

Master

of

Management Studies

First Year Scheme & Syllabus

(As per AICTE guidelines, with effect from the Academic Year 2022-23)

Preamble

Industry maintains trust in the higher education system, with employers continuing to require university degrees as a primary requirement for entry into the professional world. The academic reforms recommended by the UGC in the recent past have led to overall improvement in the higher education system. However, in the backdrop of the fast disruption and changing scenario, management education needs to be revisited and revised. Department of Management Studies recognizes the gap that is often manifested between the knowledge, skill sets and attitude requirements by the industry and what conventional management education imparts. To bridge this gap, we diligently mapped the existing curriculum against nationally and internationally acclaimed Top Tier Management Institutes. A new syllabus keeping in mind autonomy is proposed to remain in tandem with developments in the field of management education at the national and global levels.

The future of management and business can be sustained only if business is carried out in an ethical and responsible way. Sustainable development is no longer a choice but the only way of taking mankind forward. Sustainable development is not an isolated subject. It needs to be the underlying theme in every domain and practice. Also, the concept of lifelong learning is becoming a career necessity rather than a discretionary luxury. No longer is learning new skills something people do only when pursuing a significant career change, but simply being relevant, competitive, and in-demand requires an ongoing commitment to lifelong learning.

Chairman, Board of Studies

Department of Management Studies

Vidyalankar Institute of Technology

Chairman, Academic Council

Vidyalankar Institute of Technology

STRUCTURE OF POST GRADUATE MANAGEMENT PROGRAM:

Sr. No	Category	Credits Proposed
1	Core	38
2	Open Electives	06
3	General Education	04
4	Life Enrichment	Audit Only
5	Specialisation Core	29
6	Specialisation Electives	06
7	Internship/Projects/Field Work	04
8	Minor Degree Electives (Cross Specialisation)	09
	Total	96

The Autonomous curriculum for MMS is developed considering the current industry needs in terms of skill sets demanded under new business environment. The course structure is designed keeping in mind learner aspirations and corporate expectations. The programme offers six types of courses spread across two years viz:

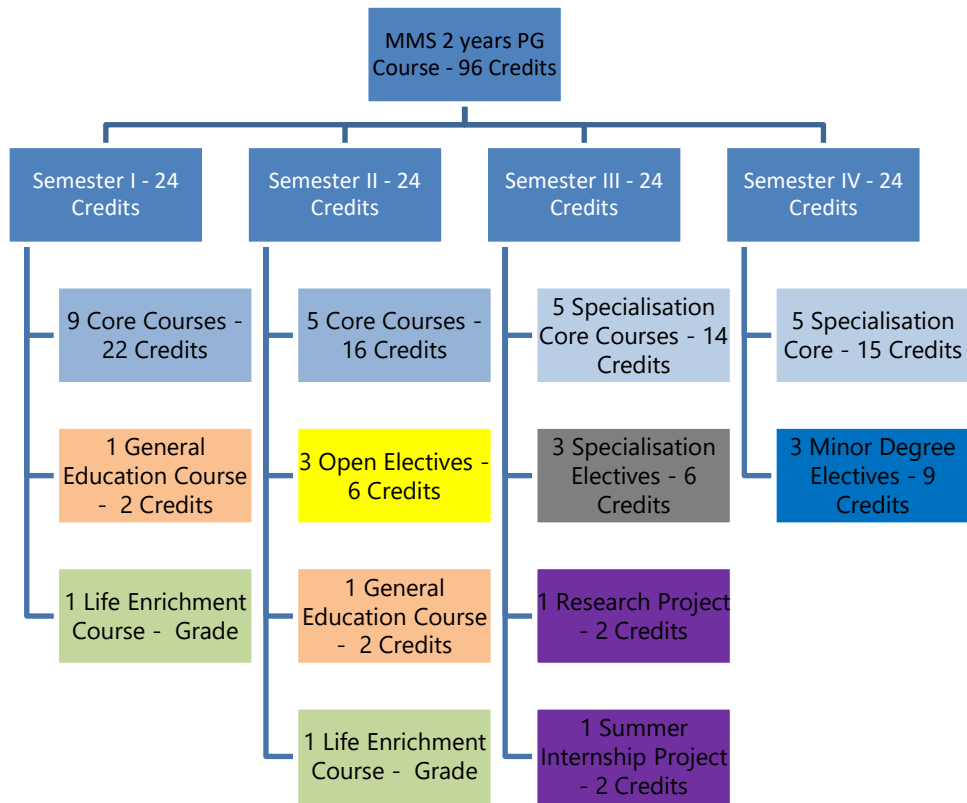
1. **Core Courses:** These are foundational and general management courses to help the learner to acquire tools, techniques, skills and concepts used in business. Core courses comprise of courses focusing on business administration areas like accounting, marketing, Communication, Leadership etc.
2. **Open Elective Courses:** These are courses offered in first year of the programme that allows learners to choose a bouquet of courses of their choice in the areas of general or functional management. These courses are offered keeping in mind industry needs for enabling the learners to position themselves in their areas of expertise during 2nd year.
3. **General Education Courses:** To facilitate holistic and multidisciplinary education, novel and engaging course options will be offered to learners, in addition to courses of 1st year. The emphasis of these courses is to develop proactive thinking to apply the knowledge in the dynamic and socio-economic business ecosystem.
4. **Life Enrichment Courses:** These courses are offered to support learners' physical, social, emotional, and cognitive well-being in addition to the academic and general education courses. The life enrichment courses will foster learners personal growth and creativity as these courses are essential for their overall quality of life.
5. **Specialisation Core:** Specialisation core courses focus on rigorous grounding corresponding to the area of selected specialisation. It helps the learners to develop proficiency in selected specialization after completing the core and open elective courses of business and management in 1st year.
6. **Specialisation Electives:** Learners can select the electives from their chosen specialisation to explore and strengthen their area of expertise. It endeavours to strengthen learners chosen specialisation by selecting these electives to build the skill sets for learners through an integrated framework of theoretical and practical training for gaining deeper understanding in their selected specialisation.

7. **Minor Degree Electives:** To develop more than one expertise in the 2nd year the learner can select three minor degree electives from other than the chosen specialisation. It will provide the opportunities to learner to explore cross-disciplinary and interdisciplinary courses in business and management.

Learner is expected to complete requirement of 96 credits (with minimum credits under each category as mentioned above) for MMS degree.

Learners can choose to avail Minor Degree (Cross Specialisation) by completing requirements of 09 credits by selecting Minor Degree Electives from any one specialisation other than the selected specialisation.

Courses proposed under various categories:



Department: Management Studies

Nature of the Programme: - MMS (Master of Management Studies) is a 2 years' full time Master's Degree course

Semester Structure:

- **Semester I:** August to Dec – A common base of knowledge essential for all management professionals. The first semester shall be consisting of 10 courses - nine core and one general education course.
- **Semester II:** - Jan to May - Learners in the second semester endeavour to attain further skill sets through an integrated framework, which guides them towards their desired field through subtle introduction of relevant courses. The second semester would consist of 10 courses of which six courses would be core, three courses would be open electives and one general education course. It shall offer courses in the area of general management as well as specialisation to provide the foundation for finalizing their functional specialisation.
- **Summer Training in Corporate** – June and July 8 Weeks – It is most influential source of practical managerial insights, validation of management concepts, and valuable market knowledge.
- **Semester III:** - August to Dec – Learners shall start the specialisation during the semester III. This semester shall provide the depth of functional specialisation post their summer training in corporate and dealing with the research project or field project during the semester. It shall consist of five specialisation core, three specialisation elective courses and one Research Project/ Field Project in respective specialisation.
- **Semester IV:** Jan to May – Since it is the last semester of the professional course carries minimum courses and one comprehensive project to enable learners to delve deep into their specialisation as well cross specialisation. It shall consist of five specialisation core and three minor degree elective courses which can be selected from same specialisation or cross specialisation.

STRUCTURE OF POST GRADUATE MANAGEMENT PROGRAM**FYMMS - Semester I**

Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Lecture	Practical	Tutorial	Lecture	Practical	Tutorial	Total
MS01	Financial Accounting and Analysis	3	-	-	3	-	-	3
MS02	Organisational Behaviour	3	-	-	3	-	-	3
MS03	Operations Management	3	-	-	3	-	-	3
MS04	Marketing Management	3	-	-	3	-	-	3
MS05	Business Statistics	3	-	-	2	-	-	2
MS06	MS Office - Word, Excel and PowerPoint	-	3	-	-	2	-	2
MS07	Business Communication	3	-	-	2	-	-	2
MS08	Managerial Economics	3	-	-	2	-	-	2
MS09	Business Ethics & Corporate Governance	3	-	-	2	-	-	2
MSGEXX	General Education Course 1	3	-	-	2	-	-	2
MSLEXX	Life Enrichment Course 1	3	-	-	Grade will be assigned			
Total		33	3	-	22	2	-	24

FYMMS - Semester I – Assessment Guidelines:

Course Code	Course	Scheme	Assessment Guidelines					
			Lecture		Practical		Tutorial	
			Max Marks	Passing %	Max Marks	Passing %	Max Marks	Passing %
MS01	Financial Accounting and Analysis	ISA	30	50	-	-	-	-
		MSE	10		-	-	-	-
		ESE	60		-	-	-	-
MS02	Organisational Behaviour	ISA	30	50	-	-	-	-
		MSE	10		-	-	-	-
		ESE	60		-	-	-	-
MS03	Operations Management	ISA	30	50	-	-	-	-
		MSE	10		-	-	-	-
		ESE	60		-	-	-	-
MS04	Marketing Management	ISA	30	50	-	-	-	-
		MSE	10		-	-	-	-
		ESE	60		-	-	-	-
MS05	Business Statistics	ISA	30	50	-	-	-	-
		MSE	10		-	-	-	-
		ESE	60		-	-	-	-
MS06	MS Office - Word, Excel and PowerPoint	ISA	-	-	-	50	-	-
		MSE	-		-		-	
		ESE	-		100		-	-
MS07	Business Communication	ISA	30	50	-	-	-	-
		MSE	10		-	-	-	-
		ESE	60		-	-	-	-
MS08	Managerial Economics	ISA	30	50	-	-	-	-
		MSE	10		-	-	-	-
		ESE	60		-	-	-	-
MS09	Business Ethics and Corporate Governance	ISA	30	50	-	-	-	-
		MSE	10		-	-	-	-
		ESE	60		-	-	-	-
MSGEXX	General Education Course 1	As per course						
MSLEXX	Life Enrichment Course 1	As per course						

*ISA- In Semester Assessment, MSE – Mid Semester Examination, ESE – End Semester Examination

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

FYMMS - Semester II

Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Lecture	Practical	Tutorial	Lecture	Practical	Tutorial	Total
MS10	Corporate Finance	3	-	-	3	-	-	3
MS11	Business Research	3	-	-	3	-	-	3
MS12	Strategic Management	3	-	-	3	-	-	3
MS13	Decision Making Through Simulation ® BizLab	3	-	-	3	-	-	3
MS14	Leadership	3	-	-	2	-	-	2
MS15	Design Thinking and Innovation	3	-	-	-	2	-	2
MSOEXX	Open Elective I	3	-	-	2	-	-	2
MSOEXX	Open Elective II	3	-	-	2	-	-	2
MSOEXX	Open Elective III	3	-	-	2	-	-	2
MSGEXX	General Education Course 1	3	-	-	2	-	-	2
MSLEXX	Life Enrichment Course 1	3	-	-	Grade will be assigned			
Total		33	-	-	22	2	-	24

First Year Second Semester Open Electives (OE):

Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Lecture	Practical	Tutorial	Lecture	Practical	Tutorial	Total
MSOE01	Selling and Negotiation Skills	3	-	-	2	-	-	2
MSOE02	Human Resource Management	3	-	-	2	-	-	2
MSOE03	Corporate Sustainability	3	-	-	2	-	-	2
MSOE04	Management Information System	3	-	-	2	-	-	2
MSOE05	Cost and Management Accounting	3	-	-	2	-	-	2
MSOE06	Entrepreneurship Management	3	-	-	2	-	-	2
MSOE07	Operations Research	3	-	-	2	-	-	2
MSOE08	International Business	3	-	-	2	-	-	2

First Year General Education Courses (GE):

Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Lecture	Practical	Tutorial	Lecture	Practical	Tutorial	Total
MSGEO1	Indian Cinema Global Perspective	3	-	-	2	-	-	2
MSGEO2	Corporate Etiquettes	3	-	-	2	-	-	2
MSGEO3	Waste Management - Process, Concept and Working	3	-	-	2	-	-	2

First Year Life Enrichment Courses (LE):

Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Lecture	Practical	Tutorial	Lecture	Practical	Tutorial	Total
MSLE01	Mumbai Heritage Study and Visit	3	-	-	Grade will be assigned			
MSLE02	Film Appreciation	3	-	-				
MSLE02	Mindfulness and Resilience	3	-	-				
MSLE04	Performing Arts	3	-	-				

FYMMS - Semester II - Assessment Guidelines

Course Code	Course	Scheme	Assessment Guidelines					
			Lecture		Practical		Tutorial	
			Max Marks	Passing %	Max Marks	Passing %	Max Marks	Passing %
MS10	Corporate Finance	ISA	30	50	-	-	-	-
		MSE	10		-	-	-	-
		ESE	60		-	-	-	-
MS11	Business Research	ISA	30	50	-	-	-	-
		MSE	10		-	-	-	-
		ESE	60		-	-	-	-
MS12	Strategic Management	ISA	30	50	-	-	-	-
		MSE	10		-	-	-	-
		ESE	60		-	-	-	-
MS13	Decision Making Through Simulation ® BizLab	ISA	-	-	-	-	-	-
		MSE	-		-	-	-	-
		ESE	-		100	50	-	-
MS14	Leadership	ISA	30	50	-	-	-	-
		MSE	10		-	-	-	-
		ESE	60		-	-	-	-
MS15	Design Thinking and Innovation	ISA	-	50	-	-	-	-
		MSE	-		-	-	-	-
		ESE	-		100	50	-	-
MSOE01	Selling and Negotiation Skills	ISA	30	50	-	-	-	-
		MSE	10		-	-	-	-
		ESE	60		-	-	-	-
MSOE02	Human Resource Management	ISA	30	50	-	-	-	-
		MSE	10		-	-	-	-
		ESE	60		-	-	-	-
MSOE03	Corporate Sustainability	ISA	30	50	-	-	-	-
		MSE	10		-	-	-	-
		ESE	60		-	-	-	-
MSOE04	Management Information System	ISA	30	50	-	-	-	-
		MSE	10		-	-	-	-
		ESE	60		-	-	-	-
MSOE05	Cost & Management Accounting	ISA	30	50	-	-	-	-
		MSE	10		-	-	-	-
		ESE	60		-	-	-	-
MSOE06	Entrepreneurship Management	ISA	30	50	-	-	-	-
		MSE	10		-	-	-	-
		ESE	60		-	-	-	-
MSOE07	Operations Research	ISA	30	50	-	-	-	-
		MSE	10		-	-	-	-
		ESE	60		-	-	-	-

Course Code	Course	Scheme	Assessment Guidelines					
			Lecture		Practical		Tutorial	
			Max Marks	Passing %	Max Marks	Passing %	Max Marks	Passing %
MSOE08	International Business	ISA	30	50	-	-	-	-
		MSE	10					
		ESE	60		-	-	-	-
MSGE01	Indian Cinema Global Perspective	ISA	100	50	-	-	-	-
		MSE	-		-	-	-	-
		ESE	-		-	-	-	-
MSGE02	Corporate Etiquette	ISA	100	50	-	-	-	-
		MSE	-		-	-	-	-
		ESE	-		-	-	-	-
MSGE03	Waste Management - Process, Concept and Working	ISA	100	50	-	-	-	-
		MSE	-		-	-	-	-
		ESE	-		-	-	-	-
MSLE01	Mumbai Heritage Study and Visit	Audit Course						
MSLE02	Film Appreciation	Audit Course						
MSLE02	Mindfulness and Resilience	Audit Course						
MSLE04	Performing Arts	Audit Course						

*ISA- In Semester Assessment, MSE – Mid Semester Examination, ESE – End Semester Examination

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Detailed syllabus of First Year Semester-I

Course Name: Financial Accounting and Analysis

Course Code: MS01

Category: Core

Preamble:

This course will help students to understand the basic concepts and fundamentals used in financial accounting. Obtaining a working knowledge of financial accounting and analysis will enable a student to understand the financial information conveyed about an organization so that better decisions can be made.

Objectives:

1. To develop skills to understand, evaluate and use financial information in business decision making
2. To develop an understanding of the important tools and techniques used in analysing financial information

Pre-requisites:

N.A. as this is the first semester course.

Course Outcome:

Student will be able to:

1. Understand and apply the basic concepts, conventions, principles and standards of accounting in preparing the financial statements.
2. Understand in detail about the items of the corporate financial statements and their reporting formats.
3. Interpret trends and analyse the financial statements.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Tutorial	Theory	Tutorial
3	--	3	--

Detailed Syllabus

Module No.	Module Name	Content	No. of Hours
1	Introduction to Accounting	Meaning and necessity of accounting, Types of Accounting, Accounting cycle, Concepts and Conventions used in accounting, Capital and revenue expenditure, Deferred revenue expenditure, capital and revenue receipts	06
2	Accounting Process	Journal, Ledger, Trial Balance, and T Form of Financial Statements, Process of accounting, an overview of Financial Statements – Income Statement, Balance Sheet	06
3	Corporate Financial Statements	Detailed discussion and understanding of various items in Revised Schedule VI of Corporate Financial Statements and Notes to Accounts	12
4	Cash Flow Statement	Understanding the structure of Cash flow statement considering the Indirect Method	4
5	Annual Report	Reading of Annual Report, Presentation and analysis of audit reports and directors report, corporate governance report	4
6	Financial Analysis	Economy-Industry-Company Analysis, Top-down and bottom-up approach, Different macro-economic variable	2

Module No.	Module Name	Content	No. of Hours
7	Ratio Analysis	Introduction to Ratio Analysis – Profitability, Liquidity, Operational efficiency and Capital Structure Ratios	3
8	Cash Flow Analysis	Measuring operating, financing and investing cash flows Cash flows and life cycle state of a company	3
Total			40

Suggested List of Practice Assignments:

1. Preparation of Final Accounts with Adjustments and Revised Schedule VI Financial Statements
2. Cash Flow Statement preparation with Indirect Method
3. Ratio Analysis
4. Cash flow Analysis

Skill Set Acquired:

1. Students will be able to make the financial statements i.e. Income Statement, Balance Sheet and Cash Flow Statement using Microsoft Excel
2. Students will be able to analyse financial statements using Microsoft Excel
3. Students will be introduced to pre-packaged accounting software

Text-Books:

1. Financial Accounting for Management by Dinesh Harsolkar
2. Accounting- Text and Cases by Robert Anthony, David Hawkins and Kenneth Merchant, 13th Edition, McGraw Hill
3. Financial Management – M. Y. Khan and P. K. Jain

Reference-Books:

1. Financial Accounting for Managers by T.P. Ghosh, 4th Edition, Taxmann
2. Financial Accounting by R. Narayanaswamy, 6th Edition, PHI
3. Fundamentals of Financial Management – James Van Horne

E- Resources:

1. https://www.icaai.org/post.html?post_id=12433
2. <https://www.inderscience.com/jhome.php?jcode=ijaf>
3. <https://indianaccounting.org/currentissues.php>

MOOCs:

1. <https://nptel.ac.in/courses/110/106/110106135/>
2. <https://www.udemy.com/course/financial-reporting-and-analysis-cfa-l1/>
3. https://onlinecourses.nptel.ac.in/noc20_mg22/preview

Course Name: Organisational Behaviour

Course Code: MS02

Category: Core

Preamble:

This course will help students to understand how and why people behave in organizations as they do, either as individuals or in groups and how their behaviours affect their performance and performance of the organization as a whole.

Objectives:

1. To help students to understand human behaviour in organizations and equip them to enhance their performance as well as performance of the people reporting to them.

Pre-requisites:

N.A. as this is the first semester course.

Course Outcome:

Student will be able to:

1. Understand the basic concepts and principles of human behaviour.
2. Analyse and apply the principles and concepts of human behaviour to effectively modify their and their team members' behaviour.
3. Evaluation and application of principles such as motivation, leadership, organisation structure and organisational culture for enhanced performance.

Course Scheme

Contact Hours		Credits Assigned	
Theory	Tutorial	Theory	Tutorial
3	--	3	--

Detailed Syllabus

Module No.	Module Name	Content	No. of Hours
1	Introduction to OB	Understand the nature & scope of organisational behaviour at individual, group, organisational and societal levels.	3
2	Meaning and Determinants of Personality	Comprehend the meaning and determinants of personality and its effects on human behavior to be able to use the same for managing people of their team. To be able to manage people with negative personality traits.	4
3	Perception, Attitude & Values	Concept of perception and its effects on decision making at various processes of organisation. Effects of values and attitude on work.	3
4	Motivation concept and theories	Understand and distinguish between various theories of motivation and their applications in organisations/workplace.	6
5	Group Behaviour and Group Dynamics	Understand the concept of group dynamics, team effectiveness, team roles and conflict management.	4

Module No.	Module Name	Content	No. of Hours
6	Organisation structure and design	Understand the impact of organisation structure and design on organisational behaviour and how different designs lead to organisational effectiveness. Understanding the interplay between organisation size, technology environment and strategy for determining organisation structure.	4
7	Bases of Power and politics	Identify the different bases of power individual uses in organisation. Understand the various political tactics people uses in organisation.	4
8	Leadership	Concept and styles of leadership	4
9	Organisational Development	Concept and practice of change management and organisational development, Understanding OD interventions and its use strategically	4
10	Ego Defense Mechanism	Understanding the concept of defense mechanism, types of defense mechanism and role of defense mechanism for interpersonal relations and group dynamics	4
Total			40

Skill Set Acquired:

1. Modifying behaviour of self and others for efficient and effective performance
2. Application of organisational structure and design concept for bringing effective performance

Text-Books:

1. Organizational Behavior – L. M. Prasad (Sultan Chand)
2. Organisational Behaviour – Dipak Kumar Bhattacharya – Oxford Publications

Reference-Books:

1. Understanding Organizational Behavior – Udai Pareek
2. Organizational Behavior – Stephen Robbins
3. Organizational Behavior – Fred Luthans

E- Resources:

1. www.hbps.com
2. www.hrkatha.com

MOOCs:

1. <https://nptel.ac.in/courses/110/106/110106145/>

Course Name: Operations Management

Course Code: MS03

Category: Core

Preamble:

To expose a student of Management to operations principles.

Objectives:

1. To expose a student of Management to operations principles.
2. To understand basic operating principles in product and service industry
3. To be able to apply different analytical techniques of operations Management in different industry sectors like hotel, hospital, mall, BPO, Airlines, manufacturing, consulting etc

Pre-requisites:

Exposure to MS-excel

Course Outcome:

Student will be able to:

1. Understand the basic concepts and learn how to apply the same.
2. Understand characteristics of equipment, machines and workflow.
3. Understand how, when, what and how much to order, stock and cost implications.
4. Understand measurement of time management.
5. Understand quality and control methods, understand sources of variation and identify them on charts, process improvement.

Course Scheme

Contact Hours		Credits Assigned	
Theory	Tutorial	Theory	Tutorial
3	--	3	--

Detailed Syllabus

Module No.	Module Name	Content	No. of Hours
1	Introduction to Operations Management	applications in product and service industry, use of competitive advantage	4
2	Process analysis in Industry	Process analysis in Industry	4
3	Facility location	characteristics of equipment, machines and workflow	4
4	Inventory Management	EOQ, ABC analysis, Discount policy	4
5	capacity utilization	Capacity and introduction to aggregate planning, PPC	4
6	Basics of MRP	Basics of MRP	4
7	Sequencing techniques	Sequencing techniques	4
8	Introduction to Service Operation management	Introduction to Service Operation management	4

Module No.	Module Name	Content	No. of Hours
9	Work study and method study	Work study and method study	4
10	QC and SQC	QC and SQC	4
Total			40

Suggested List of Tutorials (NA):**Skill Set Acquired:**

1. To be able to apply different analytical techniques of operations Management in different industry sectors like hotel, hospital, mall, BPO, Airlines, manufacturing, consulting etc

Text-Books:

1. Theory & Problems in Production & Operations Management- S N Chary, Tata McGraw Hill
2. Production & Operations Management -Kanishka Bedi , Oxford University Press

Reference-Books:

1. Production and Operations Management-S N Chary, Tata McGraw Hill
2. Production and Operations Management- Chunawalla & Patel, Himalaya Publishing
3. Operations Management for competitive advantage-Chase & Jacob, McGraw-Hill/Irwin

E- Resources:

1. www.longdom.org/information-technology-software-engineering.html
2. I.E.E.E
3. /repo.ijert.org
4. www.springer.com/journal/13042

Course Name: Marketing Management

Course Code: MS04

Category: Core

Preamble:

Introduce the student to the basic elements of the marketing management terms, implementation of studied term in the industry and related process.

Objectives:

1. To introduce the student to the basic elements of the marketing management terms, implementation of studied term in the industry and related process.
2. The students will be exposed to the marketing concepts that will enable them to acquaint with contemporary marketing practices
3. Learn the art and science of choosing target markets and getting, keeping and growing customers through creating, delivering, and communicating superior customer value.

Pre-requisites:

N.A. as this is the first semester course

Course Outcome:

Student will be able to:

1. Help the student to identify and solve many business problems by using a marketing perspective, as a universal concept.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Tutorial	Theory	Tutorial
3	--	3	--

Detailed Syllabus

Module No.	Module Name	Content	No. of Hours
1	Introduction to Marketing Concept	Evolution of Marketing from Production to Sustainability & Customer Orientation	4
2	Understanding the Basics	Concept of Need, Want and Demand Concept of Product and Brand Business Environment in India Demand States & Marketing Tasks Company Orientation towards the Market Place	4
3	Marketing Environment	Marketing Environment and Evaluation of Market Opportunities like Services, Rural & International	4
4	Market Research	Market Research & Marketing Information Systems and Demand Forecasting and Market Potential Analysis	4
5	buying behaviour process.	Consumer Buying Process & Organizational Buying Behaviour	4
6	Pillars of Marketing	- Market Segmentation, Target Marketing, Positioning & Differentiation	4
7	Marketing Mix	Marketing Mix and Product Decisions – Product Life Cycle, & Brand	4

Module No.	Module Name	Content	No. of Hours
8	New Product Development Process	New Product Development Process	4
9	Distribution Decisions	Logistics & Channel Decisions (Retail, Ecommerce, etc.)	2
10	Promotion Decisions	– Integrated Marketing Communications Concept: Advertising, Sales Promotions, Public Relations, Direct Marketing; Communication Tools	2
11	Personal Selling & Sales Management	Personal Selling & Sales Management	2
12	Overview of Marketing Strategies	BCG, Ansoff, GE, Shell Model, Porter Generic Model, 5 Forces Model, PLC, 7s Model of Marketing, A Little Model, Value Chain Model	2
Total			40

Skill Set Acquired:

The module will help the student to identify and solve many business problems by using a marketing perspective, as a universal concept.

Text-Books:

1. Marketing Management (A South Asian Perspective) by Philip Kotler, Kevin Lane Keller, Abraham Koshy
2. Marketing Management by R. Varshney, S. Chand
3. Marketing Management by Rajan Saxena, Tata McGraw Hill

Reference-Books:

1. Basic Marketing by Jr., William Perreault, Joseph Cannon and E. Jerome McCarthy
2. Marketing Management – Planning, Implementation and Control by V.S. Ramswamy and S. Namakumari
3. Business Marketing Management by M. Hutt, Cengage Learning

E- Resources:

1. Journal of Consumer Research (www.scimagojr.com/ Journal of Consumer Research)
2. Journal of marketing (www.scimagojr.com/ Journal of marketing)
3. Journal of Marketing Research (www.scimagojr.com/ Journal of Marketing Research)
4. Marketing Science (www.scimagojr.com/ Marketing Science)

Course Name: Business Statistics

Course Code: MS05

Category: Core

Preamble:

Statistics as a subject is an important branch of knowledge and is devoted to various techniques of collection, presentation, analysis, and interpretation of data. The subject provides tools for making decisions when conditions of uncertainty prevail. The syllabi of the course in Statistics are framed in such a way that the students at the end of the course, can be thorough in statistical techniques, can apply statistical tools judiciously to a variety of data sets to arrive at some valid conclusions.

Objectives:

1. To extract meaningful information from piles of raw data and make an inference about nature of a population based on observations of a sample taken from that population.
2. To do forecasting for planning for a businessman.

Pre-requisites:

N.A. as this is the first semester course.

Course Outcome:

Student will be able to:

1. To know the different statistical tools & techniques.
2. Learn the managerial applications of statistics.
3. Solve business problems with the help of fundamental statistical and theoretical backgrounds.
4. Formulate various testing methods using statistical backgrounds in business problems for managerial decision making.
5. Determine the suitability of using correlation and regression analysis in solving business problems

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Tutorial	Theory	Tutorial
3	--	2	--

Detailed Syllabus

Module No.	Module Name	Content	No. of Hours
1	Introduction to Statistics	Meaning and Definition, functions, scope and limitations. Descriptive Statistics: Collection and presentation of data: Methods of data collection, Data presentation using tables & charts, Frequency distribution.	3
2	Measures of central tendency	Mean, Median, Mode. Measures of dispersion - Range, Quartile Deviation, Mean Deviation, Standard Deviation. Absolute & relative measures, Measures of Variation :Range, Inter-quartile range, Mean Deviation, Standard deviation and variance	6
3	Probability and Its Distribution	Concept of probability and its uses in business decision-making; Random variable - addition rule - conditional probability -	4

Module No.	Module Name	Content	No. of Hours
		multiplication theorem – Bayes' theorem , Probability distribution - Binomial, Poisson, Normal	
4	Sampling Distribution	Introduction to sampling distributions, Sampling distribution of mean and proportion, Sampling techniques, Sampling Errors, Sampling Distribution of mean and proportion	4
5	Hypothesis Testing	Formulation of Hypotheses, Application of Z-test, t-test, F-test, Chi-Square test and ANOVA for testing the difference of means of more than two samples.	6
6	Time series Analysis	Components of Time Series, Techniques of measuring seasonal variations – Simple Average Method, Moving Averages Method. Least Square Method of Trend Analysis, Applications of Time Series in Business Forecasting.	3
7	Correlation	Correlation Analysis: Types of Correlation, Methods of Studying Correlation: Karl Pearson's correlation coefficient - Spearman's Rank correlation coefficient – Concurrent deviation method	2
8	Regression Analysis	Regression analysis: Regression lines, Regression equations, Coefficient of Determination & Estimation. Multiple Regression (Theory Only)	2
Total			30

Suggested List of Assignment:

1. Solving complex managerial problems associated with business.
2. Collection and editing of primary and secondary data.
3. Classifying and tabulating the data.
4. Diagrammatic representation of statistical data problems based on simple and subdivided bar diagrams, pie diagram.
5. Graphical representation of statistical data
6. Learn how to test hypothesis using Microsoft Excel.
7. Calculation of product moment correlation coefficient, correlation ratio, rank correlation.

Skill Set Acquired:

1. Students will be able to make the statistical interpretation of the experiment results obtained.
2. Students will be able to conduct testing for parameters when sampling is done from one and two normal distributions.
3. Students will be introduced to identifying and working with patterns in data.
4. Students will get an idea of conducting the sample surveys and selecting appropriate sampling techniques

Text-Books:

1. Statistics for Management by Richard Levin and David Rubin
2. Statistics for Managers by Levine, Stephen, Krihbiel, Berenson
3. Business Statistics by J.K. Thukral

Reference-Books:

1. Statistics for Business and Economics by Thomas A. Williams, David R. Anderson, Dennis J. Sweeney, 11th Edition, Cengage Learning.
2. Applied Business Statistics by Black Ken 7th Edition, Wiley.

E- Resources:

1. The Journal of the American Statistical Association (JASA)
2. Journal of Business & Economics Statistics - <https://www.tandfonline.com/toc/ubes20/current>

MOOCs:

1. <https://www.classcentral.com/course/swayam-business-statistics-12992>
2. <https://www.mooc-list.com/course/business-statistics-and-analysis-capstone-coursera>
3. <https://www.classcentral.com/course/linkedin-learning-excel-2007-business-statistics-39780>

Course Name: MS Office - Word, Excel and PowerPoint

Course Code: MS06

Category: Core

Preamble:

This course will help students to learn the essential and advanced Microsoft Office Skills in Excel, Word, PowerPoint.

Objectives:

1. To understand the basics of working on MS Excel, Word and PowerPoint
2. To learn to make professional presentations and documentations with the help of MS Office.

Pre-requisites:

N.A. as this is the first semester course

Course Outcome:

Student will be able to:

1. Create professional documents using MS Word.
2. Create and manage presentation using MS Power Point.
3. Modify and format a worksheet using MS Excel

Course Scheme:

Contact Hours		Credits Assigned	
Practical	Tutorial	Practical	Tutorial
3	--	2	--

Detailed Syllabus

Module No.	Module Name	Content	No. of Hours
1	MS Word	Getting Started with word, Character, Paragraph Formatting, Tables, Styles, Sectioning, Graphics, Mail Merges, Review, Printing	04
2	MS Excel	Creating workbooks, page set ups, Formulas and Functions, Sorting, filtering, Pivot Tables, Shortcuts, Lookup functions	07
3	MS PowerPoint	Text and bullet editing, adding graphics, Smart art, tables, charts, adding media, transitions, animation, preparing presentation	04
Total			15

Suggested List of Practical (15 Hours):

1. MS Word
2. MS Excel
3. MS PowerPoint

Skill Set Acquired:

1. Students will be able to work on making professional documents using MS Word
2. Students will be able to work on making professional spreadsheets using MS Excel
3. Students will be able to work on making professional presentations using MS PowerPoint

Text-Books and Reference-Books:

1. Learn Microsoft Office 2019: A comprehensive guide to getting started with Word, PowerPoint, Excel, Access, and Outlook by Linda Foulkes

E- Resources:

1. <https://support.microsoft.com/en-us/office>

MOOCs:

1. <https://www.udemy.com/course/microsoft-office-excel-word-access-powerpoint/>
2. <https://www.niit.com/india/short-term-courses/information-technology/working-with-ms-office-2013>

Course Name: Business Communication

Course Code: MS07

Category: Core

Preamble:

This course is design to teach communication skills to management students to prepare them for managerial positions at top organizations. Leadership roles require a candidate to have constructive communication skills to keep every member of a team aligned towards the goals and objectives of a project or the overall values of an organization.

Objectives:

1. Communication is essential in building and maintaining human relationships.
2. In business, communication is essential for the smooth and efficient conduct of day-to-day transactions/activities.

Pre-requisites:

N.A. as this is the first semester course.

Course Outcome:

Student will be able to:

1. Learn How to make communication effective and attractive.
2. Learn the Mechanics behind the communication process, difficulties experienced in communication.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Tutorial	Theory	Tutorial
3	--	2	--

Detailed Syllabus

Module No.	Module Name	Content	No. of Hours
1	Introduction & Process of Communication	Nature, function & scope; The 7 Cs of communication, classification, components and models of communication; Problems in communication	03
2	Channels of communication	Formal v/s Informal, Upward, Downward, Horizontal, Grapevine; Barriers to communication, Public Speaking: Preparation, Attire, Posture and Delivery techniques	04
3	Verbal and Non-verbal communication	Verbal and Non-verbal communication: Listening, Kinesics, Paralanguage, Proxemics	05
4	Meetings	Types; purpose, Group Discussions: Do's and Don'ts; Committees: Types, Advantages and disadvantages, effectiveness	02
5	Written communication	Business letters, Types, Essentials, Format, common errors. e-mail: format, language and courtesy, common errors, Report Writing: Types of Reports, requirements, format	02

Module No.	Module Name	Content	No. of Hours
6	Communication and Culture:	Intercultural sensitivities, Business etiquette when dealing with people from different nationalities, Impact of modern Technology on Business Communication: the paperless office, use of modern devices	04
Total			30

Suggested List of Class Activities: (10 Hours)

1. Channels of communications
2. Verbal and Non-Verbal communication
3. Meetings: Role play
4. Public Speaking
5. Communication and Culture

Skill Set Acquired:

1. Students will be able communicate effectively in group interactions
2. Students will be able to write the business report effectively
3. Students will be able to understand cultural diversity and Business etiquette

Text-Books

1. Business Communication: Principles, Methods & Techniques by Singh Nirmal
2. Developing Communication Skills by Krishna Mohan & Meera Banerji.

Reference-Books:

1. Business Communication by Raman & Singh, Oxford University Press
2. Business Communication by Madhukar R. K., Vikas Publishing House

E- Resources:

1. <https://www.upgrad.com/blog/why-communication-skills-are-important-for-mba/>

MOOCs:

1. <https://www.coursera.org/specializations/effective-business-communication>
2. <https://www.coursera.org/learn/business-english-skills-how-to-navigate-tone-formality-directness-in-emails>

Course Name: Managerial Economics

Course Code: MS08

Category: Core

Preamble:

Managerial Economics is the use of economic theory and mathematical and statistical techniques in order to examine how a firm can make optimal managerial decisions given the constraints it faces. This course introduces fundamental microeconomic and macroeconomic concepts relevant to financial analysis and investment management. Microeconomic factors such as a firm's competitive (or non-competitive) environment and its pricing strategy may be critical inputs for cash flow forecasting and bottom up security selection approaches. Economic output, global trade flows, monetary and fiscal policies, and the business cycle are key considerations for conducting top own investment analysis and economic forecasting

Objectives:

1. To have a basic understanding of various macroeconomic concepts.
2. To enable the students to understand both the theory and practice of managerial economics.
3. To introduce theories and concepts in micro-economics for managerial decision making,
4. To help the students in applying the knowledge so acquired in policy planning and managerial decision making.

Pre-requisites:

N.A. as this is the first semester course.

Course Outcome:

Student will be able to:

1. Critically assess and describe the environment and the main determinants of demand and competition facing the firm.
2. Distinguish between the different market structures and pricing practices available to and used by firms.
3. Use the tools of economic theory to explain optimal production and pricing decisions by the firm in each market structure.
4. Understand Business Cycles, GDP measures, Inflation and Deflation, and Unemployment measure
5. Understand Monetary System – Basics of Monetary and Fiscal Policy, Economic Growth and Development
6. Understand International Trade and Capital Flows Currency Exchange Rates, describe various exchange rate regimes.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Tutorial	Theory	Tutorial
3	-	2	-

Detailed Syllabus

Module No.	Module Name	Content	No. of Hours
Micro-Economics			

Module No.	Module Name	Content	No. of Hours
1	Topics in Demand and Supply Analysis	Calculate and interpret price, income, and cross-price Elasticities of demand, compare substitution and income effects, distinguish between normal goods and inferior goods, phenomenon of diminishing marginal returns, economies of scale and diseconomies of scale	5
2	The Firm and Market Structures	Characteristics of perfect competition, monopolistic competition, oligopoly, and pure monopoly, relationships between price, marginal revenue, marginal cost, economic profit, and the elasticity of demand under each market structure, optimal price and output for firms, factors affecting long-run equilibrium, pricing strategy, type of market structure within which a firm operates	6
Macro-Economics			
3	Aggregate Output, Prices, and Economic Growth	Gross domestic product (GDP) using expenditure and income approaches, compare nominal and real GDP and calculate GDP deflator, compare GDP, national income, personal income, and personal disposable income, fundamental relationship among saving, investment, the fiscal balance, and the trade balance. IS and LM curves and how they combine to generate the aggregate demand curve, causes of movements along and shifts in aggregate demand and supply curves, distinguish between the following types of macroeconomic equilibria	6
4	Understanding Business Cycles	Business cycle and its phases, theories of the business cycle, unemployment and compare measures of unemployment, explain inflation, hyperinflation, disinflation, and deflation, inflation measures, including their uses and limitations, distinguish between cost-push and demand-pull inflation	6
5	Monetary and Fiscal Policy	Compare monetary and fiscal policy, functions and definitions of money, theories of the demand for and supply of money, the Fisher effect, roles and objectives of central banks, qualities of effective central banks, monetary transmission mechanism, relationships between monetary policy and economic growth, inflation, interest, and exchange rates, roles and objectives of fiscal policy, tools of fiscal policy, including their advantages and disadvantages	6
International Economics			
6	International Trade and Capital Flows	Compare gross domestic product and gross national product, distinguish between comparative advantage and absolute advantage, compare types of trade and capital restrictions and their economic implications, describe the balance of payments accounts including their components; explain how decisions by consumers, firms, and governments affect the balance of payments; describe functions of World Bank, the International Monetary Fund, and the World Trade Organization	6
7	Currency Exchange Rates	Exchange rate and distinguish between nominal and real exchange rates and spot and forward exchange rates, calculate and interpret the percentage change in a currency relative to another currency, explain the arbitrage relationship between spot rates, forward rates, and interest rates, calculate and interpret a forward discount or premium, describe exchange rate regimes	5
Total			30

Suggested List of Classroom Assignments:

1. Understand how prices get determined in markets, how market participants benefit in the form of consumer surplus and producer surplus, and the consequences of government intervention.
2. Derive the equilibrium conditions for cost minimization and profit maximization.
3. List the different goals and constraints that firms face.
4. Explain gross domestic product (GDP) using expenditure and income approaches
5. Compare GDP, national income, personal income, and personal disposable income
6. Explain the relationships between monetary policy and economic growth, inflation, interest, and exchange rates

Skill Set Acquired:

1. Understand why there is a role for the government to play in market economies.
2. Apply the economic way of thinking to individual decisions and business decisions.
3. Measure the responsiveness of consumers' demand to changes in the price of a good or service, the price of other goods and services, and income.
4. Understand the different costs of production and how they affect short and long run decisions.

Text-Books:

1. Managerial Economics and Business Strategy by Michael R. Baye.
2. Managerial Economics by Yogesh Maheshwari.
3. Managerial Economics by Gupta G.S.

Reference-Books:

1. Managerial Economics by Keat, P., Young, P.K. and Erfle, S., 7 th Edition, Prentice Hall.
2. Managerial Economics: Principles and Worldwide Applications by Salvatore D., 7 th Edition, Oxford University Press..

E- Resources:

1. Managerial Economics Journal - <http://www.managerial.zarz.agh.edu.pl/>
2. MDE (Managerial and Decision Economics) - <https://onlinelibrary.wiley.com/journal/10991468>

MOOC:

1. <https://www.coursera.org/specializations/managerial-economics-business-analysis>
2. <https://www.edx.org/learn/managerial-economics>
3. <https://nptel.ac.in/courses/110/101/110101005/>

Course Name: Business Ethics and Corporate Governance

Course Code: MS09

Category: Core

Preamble:

This course is design to imbibe into students the importance of fair transactions, ethical conduct and conscientious decision making.

Objectives:

1. To have an in-depth knowledge of the issues concerning Morals, Values, Ideologies and Ethics in personal, professional and business lives.
2. To prepare the budding managers and entrepreneurs to develop themselves into better corporate citizens.

Pre-requisites:

N.A. as this is the first semester course.

Course Outcome:

Student will be able to:

1. Learn compulsive connection between Business and Ethics
2. Learn the theoretical knowledge of Ethics, Integrity and Ideologies which will be applicable in practice

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Tutorial	Theory	Tutorial
3	--	2	--

Detailed Syllabus

Module No.	Module Name	Content	No. of Hours
1	Ethics : Types, Characteristics	Need, Theories, Merits and Limitations, Moral disintegration in contemporary times and need for it to be controlled	03
2	Role and Features of Business	How Business and Ethics are to be conjoined used integrally to each other. Merits of using Ethics in Business.	04
3	Theory of Ethics	Management of Ethics - Ethics analysis [Hosmer model]; Ethical dilemma; Ethics in practice - Ethics for managers; Role and function of Ethical managers- Comparative ethical behaviour of managers; Code of ethics; Competitiveness, organizational size, profitability and ethics; Cost of Ethics in Corporate ethics evaluation	06
4	Business and Ecology	Environmental issues in the Indian context and case studies. Green Judicial Activism, Green Tribunal, Economic & Environmental Sustainability	03
5	Compliance and Legal Aspects of ethics	General and Business Ethics in particular. Political and Legal Environment. Indian Constitution and Ethics, Indian Legal framework, Competition Law, Indian Culture and Values, Concept of Karma, Dharma and Good Conduct	04
6	Environment of Ethics	Economic Environment, Economic Growth and Business, Relationship between Profitability and Ethics, Role of Chambers of Commerce & Industry in furthering the cause of Ethical aspects of Business, FICCI, CII, IMC etc.	06

Module No.	Module Name	Content	No. of Hours
		Ethics in International Scenario, Ethics and Globalisation, Etiquettes and International mores.	
7	Corporate Governance and Ethics	Code of Conduct, Citizen's Charter, Employee Welfare, Labour Legislations and Privileges, Collective Bargaining, Fair Wage, Sexual Harassment at Workplace, Vishaka V State of Rajasthan guidelines, Future of Governance in Business.	04
Total			30

Skill Set Acquired:

1. Students will gain knowledge of Law and natural justice in business
2. Students will gain strong theoretical knowledge of Ethics, Integrity and Ideologies

Text-Books

1. Ethics in Management by S. A. Sherlekar, Himalaya Publishing House
2. Ethics by Chandrashekhar

Reference-Books:

1. Corporate Governance by Satheesh Kumar
2. The Ethics of Management by Hosmer and Richard

E- Resources:

1. <https://www.inderscience.com/jhome.php?jcode=ijbge>
2. <https://www.springer.com/journal/10551/updates/17211284>

MOOCs:

1. <https://www.coursera.org/lecture/change-for-the-finance-professional/defining-corporate-governance-qfDfl>
2. https://onlinecourses.swayam2.ac.in/cec19_mg24/preview

Detailed syllabus of First Year Semester-II

Course Name: Corporate Finance

Course Code: MS10

Category: Core

Preamble:

This course will help students to understand the basic concepts and fundamentals used in corporate finance. Obtaining a working knowledge and underlying principles of corporate finance techniques will help learner in taking financial decisions.

Objectives:

1. To develop skills to understand, evaluate and use financial information in business decision making
2. To develop an understanding of the important tools and techniques used in analysing financial information

Pre-requisites:

N.A. as this is the first semester course.

Course Outcome:

Student will be able to:

1. Understand the basic concepts corporate finance like time value of money, dividend policy, sources of finance.
2. Learn and apply various evaluation techniques like NPV, IRR, PI, payback period etc. for evaluating capital expenditure decisions.
3. Analyse the financial statements of companies using ratios, cash flow analysis.
4. Prepare working capital estimates with respect to inventory, cash, receivables and payables.
5. Calculate the cost of capital and design capital structure for business.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Tutorial	Theory	Tutorial
3	--	3	--

Detailed Syllabus

Module No	Module Name	Content	No. of Hours
1	Introduction to Corporate Finance	Objectives, Functions and Decisions of financial management, Indian Financial system - Functions of the financial system; Regulatory system, Concept of Time Value of Money	4
2	Capital Budgeting	Investment (Project) identification, feasibility analysis with sensitivities, constraints and long-term cash flow projection	6
3	Ratio Analysis	Financial performance analysis using Ratio Analysis	6
4	Working Capital Management	Estimation and Financing, Inventory Management, Receivables Management, Cash Management	9
5	Financial Planning and Forecasting	Meaning and importance of financial planning, Approaches to financial planning, Computation of external financing requirements, Sources of Finance - Short Term and Long Term	3
6	Cost of Capital	Net income approach; Net operating income approach; MM approach; Traditional approach, Calculation of Cost of Capital	6

Module No	Module Name	Content	No. of Hours
7	Planning and Designing Capital structure	Capital Structure Planning and Designing capital structure based on EBIT and EPS/MPS approach, Factors affecting capital structure, Operating, financial and total leverage	3
8	Dividend Policy	Factors affecting dividend policy decision; Dividend decision models; Walter model; Gordon model; MM approach	3
Total			40

Suggested Classroom Assignments:

1. Time Value of Money
2. Capital Budgeting
3. Ratio Analysis
4. Working Capital Management (Cash Budget and Inventory Management)
5. Dividend Policy

Skill Set Acquired:

1. Students will be able to analyse financial statements i.e. Income Statement, Balance Sheet and Cash Flow Statement using Microsoft Excel by making common size statements, comparative statements
2. Students will be able to evaluate Capital Budgeting decisions using basic functions of Microsoft Excel
3. Students will be able to prepare cash budget, working capital estimates using basic functions of Microsoft Excel

Text-Books:

1. Financial Management by M.Y. Khan and P.K. Jain, McGraw Hill
2. Financial Management by Prasanna Chandra, PHI

Reference-Books:

1. Financial Management by I. M. Pandey, 4th Edition, Vikas
2. Principles of Corporate Finance by Myers and Brealey, McGraw Hill

E- Resources:

1. https://www.icai.org/post.html?post_id=16954
2. <https://onlinelibrary.wiley.com/journal/10991158>

MOOCs:

1. <https://nptel.ac.in/courses/110/107/110107144/>
2. <https://nptel.ac.in/courses/110/105/110105156/>

Course Name: Business Research

Course Code: MS11

Category: Core

Preamble:

This course will help students to understand the various ways in which research can be done to investigate organisational problems related to customers, markets, competitors, and/or employees and to use that information for effective decision-making ensuring business success.

Objectives:

1. To understand the importance of research and various methods that researcher used to investigate problems.

Pre-requisites:

No pre-requisites required for this course.

Course Outcome:

Student will be able to:

1. Understand the process of investigating a problem and deriving solutions through research
2. Apply modern analytical tools for business management decision
3. Interpret the data to make meaningful decisions
4. Evaluate business problems/challenges and overcome the same by formulating/creating research plans

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Tutorial	Theory	Tutorial
3	--	3	--

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	Introduction to Research	Meaning of research, Types of research- Exploratory research, Conclusive research, The process of research; Research applications in social and business sciences, Features of a Good research study	1.5
2	Research Problem and Formulation of Research Hypotheses	Defining the Research problem, Management Decision Problem vs. Management Research Problem, Problem identification process, Components of the research problem, Types of Research hypothesis	4
3	Research Design	Meaning of Research Designs, Nature and Classification of Research Designs, Exploratory Research Designs: Secondary Resource analysis, Case study Method, Expert, opinion survey, Focus group discussions, Descriptive Research Designs, Cross-sectional studies and Longitudinal studies, Experimental Designs, Errors affecting, Research Design	6
4	Primary and Secondary Data	Classification of Data; Secondary Data: Uses, Advantages, Disadvantages, Types and sources; Primary Data Collection: Observation method, Focus Group Discussion, Personal Interview method	3

Module No.	Module Name	Content	No. of Hours
5	Attitude Measurement and Scaling	Types of Measurement Scales, Classification of Scales: Single item vs. Multiple Item scale, Comparative vs. Non-Comparative scales, Measurement Error, Criteria for Good Measurement	4
6	Questionnaire Design	Questionnaire method; Types of Questionnaires; Process of Questionnaire, Designing; Advantages and Disadvantages of Questionnaire Method	1.5
7	Sampling and Data Processing	Sampling concepts- Sample vs. Census, Sampling vs. Non Sampling error; Sampling Design- Probability and Non Probability Sampling design; Determination of Sample size- Sample size for estimating population mean, Determination of sample size for estimating the population proportion Data Editing- Field Editing, Centralized in house editing; Coding- Coding Closed ended structured Questions, Coding open ended structured Questions; Classification and Tabulation of Data	4
8	Univariate and Bivariate Analysis of Data	Descriptive vs. Inferential Analysis, Descriptive Analysis of Univariate data-Analysis of Nominal scale data with only one possible response, Analysis of Nominal scale data with multiple category responses, Analysis of Ordinal Scaled Questions, Measures of Central Tendency, Measures of Dispersion; Descriptive Analysis of Bivariate data	4
9	Testing of Hypotheses	Concepts in Testing of Hypothesis – Steps in testing of hypothesis, Test Statistic for testing hypothesis about population mean; Tests concerning Means- the case of single population; Tests for Difference between two population means; Tests concerning population proportion- the case of single, population; Tests for difference between two population proportions	4
10	Chi-Square Analysis and ANOVA	Chi square test for the Goodness of Fit; Chi square test for the independence of variables; Chi square test for the equality of more than two population proportions, Analysis of Variance - Completely randomized design in a one-way ANOVA; Randomized block design in two way ANOVA; Factorial design	4
11	Research Report Writing and Ethics in Research	Types of research reports – Brief reports and Detailed reports; Report writing: Structure of the research report- Preliminary section, Main report, Interpretations of Results and Suggested Recommendations; Report writing: Formulation rules for writing the report: Guidelines for presenting tabular data, Guidelines for visual Representations. Meaning of Research Ethics; Clients Ethical code; Researchers Ethical code; Ethical Codes related to respondents; Responsibility of ethics in research	4
Total			40

Suggested List of Classroom Assignment

1. Measures of Central Tendency, Measures of Dispersion; Descriptive Analysis of Bivariate data
2. Steps in testing of hypothesis
3. Chi square test for the Goodness of Fit
4. Analysis of Variance - Completely randomized design in a one-way ANOVA; Randomized block design in two-way ANOVA; Factorial design
5. Research report writing

Skill Set Acquired:

1. Use of Microsoft excel and SPSS software for quantitative data analysis and research
2. Use of software such as Atlasti for qualitative data analysis
3. Ability to use systematic research process for investigating various organisational problems

Text-Books:

1. Business Research Methods – Cooper Schindler
2. Research Methodology Methods & Techniques – C. R. Kothari
3. Statistics for Management – Richard L Levin

Reference-Books:

1. Research methodology by D. K. Bhattacharya – Excel Publication
2. Research Methods for business students by Saunders – Pearson
3. Business Research Methods by William G. Zikmund

E- Resources:

1. [Journal of Business Research https://www.journals.elsevier.com/journal-of-business-research](https://www.journals.elsevier.com/journal-of-business-research)

MOOCs:

1. <https://nptel.ac.in/courses/110/107/110107080/>

Course Name: Strategic Management

Course Code: MS12

Category: Core

Preamble: This course will help students to understand the critical concepts and models in areas of general management. The subject provides knowledge about corporate level strategies with cross functional perspective

Objectives:

1. To appreciate the role of Strategic thinking in changing business environment.
2. To understand the process of Strategy Formulation, Implementation & Evaluation

Pre-requisites:

N.A. as this is the first semester course.

Course Outcome:

Student will be able to:

1. Understand and evaluate external business environment for effective strategy formulation.
2. Identify strategic gaps in the market and filling them with unique advantage.
3. Understand organizational growth options, strategizing and implementing them.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Tutorial	Theory	Tutorial
3	--	3	--

Detailed Syllabus

Module No.	Module Name	Content	No. of Hours
1	Introduction to Strategic Management	Strategic formulation and implementation & evaluation, Globalization, addressing a VUCA environment with a bottom – up approach (Volatile, Uncertain, Complex and Ambiguous time)	4
2	Tools for strategic formulation	PESTEL & SWOT, BCG matrix / GE matrix, 7S, McKinsey models, Ansoff matrix, Grand strategy, Porter's Generic strategies and Value chain	8
3	Internal Competences & Resources	Core, Distinctive, Strategic & Threshold Competence, Competence vs Capability, Resource Analysis, Value Chain Analysis, Strategic Outsourcing Core competence and synergy, Distinctive competencies, VRIO analysis, Red – Blue - Purple Ocean strategy – Blue - Purple Ocean strategy	8
4	Competing in Global Markets	Differences in Cultural, Demographic and Markets, Multi Country and Global competition concepts, Strategy Options Competing in Emerging Markets	8
5	Mergers	Mergers and Acquisitions, Strategic alliance & Joint Ventures, Vertical Integration, Offensive, Defensive Strategies	8
6	Strategy and Control	Strategy Evaluation and Control Types of Control, Evaluation & Control Criteria Pre & Post Implementation, Change management and Turn – around strategies	4
Total			40

Skill Set Acquired:

1. Understanding the concept of strategic management (knowing)
2. Understanding external business environment for effective strategy formulation and its implementation

Text-Books:

1. Strategic Management: Formulation, Implementation & Control by Pierce & Robinson, Tata McGraw – Hill
2. Strategic Management: Concepts & Cases by David Fred R, Pearson – Prentice Hall, N. Delhi

Reference-Books:

1. Strategic Management: A Book on Business Policy & Corporate Planning by Cherunilam Francis, Himalaya Publishing House, Mumbai, 2008
2. Explaining Corporate Strategy by Johnson & Scholes, Pearson Education, Delhi, Oxford University Press

E- Resources:

1. Renee Mauborgue, W. Chan Kim, Blue Ocean Strategy, Harvard Business Review, 2005
2. Gary Hamel, C.K. Prahalad, Competing for the Future, Harvard Business Review, 1994

MOOCs:

1. <https://www.coursera.org/learn/strategic-management>
2. <https://nptel.ac.in/courses/110/108/110108047/>

Course Name: Leadership

Course Code: MS14

Category: Core

Preamble: This course will help students to understand the basic concepts of leadership by focusing on what it means to be a good leader. Emphasis in the course is on the practice of leadership. Students will assess their leadership skills and traits to improve their own leadership performance.

Objectives:

1. To help students to understand leadership in organisation, qualities of a performing leaders and to enable the students imbibe some of the qualities for being a good leader.

Pre-requisites:

N.A. as this is the first semester course.

Course Outcome:

Student will be able to:

1. Exercise an understanding of the fundamental ways leadership is practiced in on-going organizations.
2. Analyse fundamental leadership practices relevant to contemporary organizations.
3. Evaluate potential leadership philosophy, traits, skills, behaviours, and develop/create a leadership portfolio.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Tutorial	Theory	Tutorial
3	--	2	--

Detailed Syllabus

Module No.	Module Name	Content	No. of Hours
1	Understanding Leadership	Defining Leadership; Global Leadership Attributes; Practicing Leadership	4
2	Understanding styles and philosophy	Theories of leadership such as, trait theory, behavioural theory, task versus relationship, contingent leadership theories, situational leadership theory, Transactional and Transformational leadership theory etc.	4
3	Identifying and engaging people's strength	Explore how strengths can make one a better leader. Understand the concept of strength; Describe the historical background of strengths-based leadership. Examine how to identify strengths; Review measures used to assess strengths; Examine strengths-based leadership in practice	4
4	Developing Leadership skills	Understanding administrative skills and their use in practice. Understanding interpersonal skills and their use in practice. Understanding conceptual skills and their use in practice.	8
5	Getting Things Done	Creating resources, building efficient and effective social networks, principles of interpersonal influence	8
6	Leading Teams	Principles of leading effective teams	4
7	Creating a Vision and building a	Process of vision articulation and implementation, understand the concept of constructive climate, review factors considered to establish constructive climate	4

Module No.	Module Name	Content	No. of Hours
	Constructive Climate		
8	Ethics in Leadership	Values of leaders, character of leaders, goals and action of leaders, honesty of the leader	4
Total			40

Suggested List of Tutorials (10 Hours): N.A.**Skill Set Acquired:**

1. Understanding leadership as a concept (knowing)
2. Becoming a leader i.e., developing your identity/self-concept as a leader and enhancing your own leadership skills (being and doing)
3. Developing leadership at an organizational level (creating and enabling)

Text-Books:

1. Leadership by J. M. Burns; Harper and Row
2. Leadership: Theory and Practice by P Northouse; Sage Publication

Reference-Books:

1. Power: Why some people have it and others don't by Jeffery Pfeffer; Harper Business
2. Leadership in organisations by G. Yukl, Pearson Education
3. The science of leadership: Lessons from research for organisational leaders by J. Barling, Oxford University Press

E- Resources:

1. <https://www.journals.elsevier.com/the-leadership-quarterly>
2. <https://www.emeraldgrouppublishing.com/journal/lodj>

MOOCs:

1. <https://nptel.ac.in/courses/110/106/110106151/>

Course Name: Design Thinking and Innovation

Course Code: MS15

Category: Core

Preamble:

Design Thinking is an innovative approach to address intractable problems that businesses face. One of the key elements of Design Thinking is its human centred approach that has revolutionized a range of industries from technology to services, health care to urban planning and beyond. Design Thinking not only supports but also enhance business strategy of companies across sectors.

Objectives:

1. To focus on successful Design Thinking approaches adopted by world class organisations to achieve and sustain a competitive advantage.
2. It provides hands on exercise to equip participants with latest tools and techniques in Design Thinking.

Pre-requisites:

Basics from courses like financial reporting and analysis, Managerial Economics, Financial Management.

Course Outcome:

Student will be able to:

1. Understand the process of Design Thinking for nurturing innovation
2. Learn how to be both analytical and creative in order to generate solutions for challenging problems
3. Inculcate a unique methodology to solve 'wicked problems'

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
3	--	0	2

Detailed Syllabus

Module No.	Module Name	Content	No. of Hours
1	Innovation Imperatives	Innovation: What & Why?, Types of Innovations, Strategic Advantages through innovations, Digital Disruption and Technology Evolution, Innovation Adoption, Diffusion Model	07
2	New Product/Service Development Frameworks	NPD Processes, Fuzzy Front End (FFE) of Innovation & NPD	05
3	Customer-Centric Innovation: Design Thinking	Design Thinking Tools: Empathize, Define, Ideate, Prototype, Test, when to use Design Thinking and When NOT to, Alternatives of Design Thinking	07
4	Developing A Product/Service	Design Thinking, Lean, Agile, Industrial Design concepts/aspects in Products, Intellectual Property, Design Thinking for Sustainability, TRIZ	06
5	Managing Innovation	Aspects of innovation management, Models of innovation management, Innovation project lifecycle, Key success factors and characteristics of a successful innovation project	05

Module No.	Module Name	Content	No. of Hours
6	Collaborative Innovation	Ideation and Collaboration, Bigger Pool of Ideas, Inclusive Workplace, Framework for collaborative innovation	05
7	Leading Disruptive Innovation	Data Analytics for Innovation, Rapid prototyping technologies, Designing for growth and scale, Interwoven nature of Design, Strategy, and Technology, Open innovation	05
Total			40

Suggested Assignment:

An assignment, on which participants will address a business issue currently being faced or considered by their organisation or society and come out with actionable solutions/recommendations. Participants will provide details of their project stating their proposed approach and methodology.

Skill Set Acquired:

1. Students will Learn to integrate technology, business demands, and customer needs to innovate.
2. Use design thinking to develop innovative products. Bring business impact.

Text-Books:

1. Design Thinking: The Handbook by Falk Uebernickel, Li Jiang, Walter Brenner, Britta Pukall

Reference-Books:

1. HBR's 10 Must Reads on Design Thinking by Harvard Business Review
2. Hands-On Financial Modeling with Microsoft Excel 2019 by Shmuel Oluwa, Packt

E- Resources:

1. <https://journals.sagepub.com/doi/10.1177/8756972819853129>

MOOCs:

1. <https://www.edx.org/course/design-thinking-and-creativity-for-innovation>
2. <https://www.coursera.org/learn/uva-darden-design-thinking-innovation>

Course Name: Selling and Negotiation Skills

Course Code: MSOE01

Category: Open Elective

Preamble:

This is a course that examines the role of personal selling in the business process and how salespeople carry out their duties. It will review the different aspects of the sales task and how to accomplish these jobs effectively and efficiently. The course will require considerable interaction because it focuses on developing and maintaining relationships with customers, managing the sales process of finding, concerting, and keeping customers while achieving the organization's goals.

Objectives:

1. Sensitize the students with the concepts and importance of selling and negotiation skills.
2. The module is designed to introduce the students to the basic elements of the selling.
3. The module will give the students a broad understanding regarding different models used for effective selling and negotiations.
4. It also creates awareness among the students about the basic qualities, traits and skills that they need to imbibe to be an effective management professional.

Pre-requisites:

Need & understanding of Marketing Management

Course Outcome:

Student will be able to:

1. Understand and appreciate the skills and competencies required to be an effective salesperson.
2. Use the tools required to be an effective salesperson to close sales effectively
3. Understand and appreciate what it takes to be a good negotiator.
4. Manage conflict in the negotiation process.
5. Understand the advantages and limitations of various negotiation strategies.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Tutorial	Theory	Tutorial
3	--	2	--

Detailed Syllabus

Module No	Module Name	Content	No. of Hours
1	Introduction	Meaning, Definition & Importance of Negotiation in Management, Types of Negotiation.	5
2	Negotiation Framework	Understanding Negotiation Framework including Legal Aspects, Negotiation Process, Skills of a Negotiator	5
3	Negotiation Models	BATNA, Dyad, ZOPA, 9 Grid & Strategies, Understanding Barriers to Agreement.	5
4	Intro to Marketing	Introduction to Marketing & Selling Concepts & Traits of a Successful Salesperson.	5

Module No	Module Name	Content	No. of Hours
5	Selling Models	Understanding Successful Selling Process & 7 Steps Model, Customer Focussed Selling.	5
6	Various Stakeholders	Selling to Various Stakeholders such as Dealers, Suppliers, Vendors, Channel Partners, Superiors, Subordinates, Team- Mates & Peers.	5
7	Customer Selling	Selling to Customers – B2C, B2B, C2C, Products, Services, Intangibles & Projects.	5
8	Strategic Selling	Strategic Selling for Start-ups and Body Language for Negotiation & Selling.	5
Total			40

Skill Set Acquired:

1. Students will understand the processes and elements involved in relationship selling.
2. Students will demonstrate an understanding of the importance of ethical behavior in relationship selling and sales management.
3. Students will demonstrate an understanding of the characteristics of a sales presentation.
4. Students will understand the process of negotiation, closing methods, and time and territory management
5. Students will identify key issues in recruitment, sales training, compensation and incentives and performance evaluation.
6. Students will learn to use LAARC in working with teammates & clients.

Text-Books:

1. The Essentials of Negotiation – Harvard Business School Press
2. Negotiations Selling by Sameer Kulkarni – Excel Books
3. Negotiation & Selling by R. K. Srivastava – Excel Books

Reference-Books:

1. Negotiation Handbook by P. J. Cleary – Printice Hall of India
2. ABC's of Selling Skills by Charles M. Futrell – McGraw Hill
3. Sales Management Analysis and Decision Making by Thomas Ingram & Raymond LaFarge – Published by DRYDEN

E- Resources:

1. Sales Negotiation Training: Essential Negotiation Skills for Sales Professionals
2. The Only Four Page Guide to Negotiating You'll Ever Need - HBR article
3. Step into my parlor: A survey of strategies and techniques for effective negotiation - Terry Anderson

MOOC:

1. <https://www.coursera.org/learn/negotiation-skills>
2. <https://www.naukri.com/learning/selling-and-negotiation-skills-course-iical32>
3. <https://www.classcentral.com/course/negotiation-4336>

Course Name: Human Resource Management

Course Code: MSOE02

Category: Open Elective

Preamble:

This subject will help student to understand how people related activities can be linked to business strategy of an organisation. It will enable students to design effective HR processes to ensure strategic contribution of these processes towards individual and organisational performance.

Objectives:

1. To facilitate learning in modern concepts, techniques and practices in the management of human resources
2. To expose the student to different functional areas of Human Resource Management to enhance the organisational effectiveness

Pre-requisites:

Organisational Behaviour of Sem I.

Course Outcome:

Student will be able to:

1. Understand and analyse the various HR processes and how they are linked to individual and organisational performance
2. Enable individuals in achieving their personal goals and create a conducive work environment
3. Design/create effective HR processes to help the organisation meet its goals and objectives

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Tutorial	Theory	Tutorial
3	--	2	--

Detailed Syllabus

Module No	Module Name	Content	No. of Hours
1	Introduction to Human Resource Management	Understand the scope of HRM and its relationship with other processes in organisation.	5
2	Manpower Planning	Understanding the process of manpower planning through understanding the concept of job analysis, job description, job evaluation etc.	5
3	Performance Management	Understanding the process of performance management and Designing an effective performance appraisal system for employees. Understanding the process (do's and don'ts) of giving performance feedback.	6
4	Training and Development	Understand the steps required to analyze needs, develop and evaluate an employee training and development programs in organizations.	4
5	Career and Succession Planning	Process of succession planning for organisation and career planning for individual employees. Different types of innovative career planning initiatives taken by organisations.	5

Module No	Module Name	Content	No. of Hours
6	Organisational Change	Understanding the concept of change management, the different models of change management. Implementing the processes to bring the required change in the organisation.	5
7	Organisational Development	Concept of organisational development with its application in the organisation for its growth and development. Understanding different interventions of OD and implementing the same for organisational effectiveness.	5
8	HRD strategies for long term planning and growth	Understanding how HR plays a strategic role in the organisation and deriving HR strategies for business results.	5
Total			40

Skill Set Acquired:

1. Students will be able to effectively assist in designing HR processes of organisation where they work and be an enabler for the business results.
2. Students will be able to effectively engage line managers for the HR processes making the HR process efficient and effective.

Text-Books:

1. Human Resource Management – P. Subba Rao

Reference-Books:

1. Personnel Management – C.B. Mammoria
2. Human Resource Management – Dessler - Prentice Hall India
3. Human Resource Management - VSP Rao – Excel
4. Human Resource Management – Dr. P Jyothi and Dr. D.N. Venkatesh – Oxford Publications

E- Resources:

1. Human Resource Management Journal <https://onlinelibrary.wiley.com/journal/17488583>
2. The International Journal of Human Resource Management <https://www.tandfonline.com/toc/rijh20/current>,
South Asian Journal of Human Resource Management <https://journals.sagepub.com/home/hrm>

MOOCs:

1. <https://www.mooc-list.com/course/human-resources-analytics-coursera>
2. https://www.coursera.org/learn/wharton-social-human-capital?ranMID=40328&ranEAID=XMWjHIUEYs&ranSiteID=XMWjHIUEYs-UpwYHkbIF4DcjMeX61IExQ&siteID=XMWjHIUEYsUpwYHkbIF4DcjMeX61IExQ&utm_content=10&utm_medium=partners&utm_source=linkshare&utm_campaign=XMWjHIUEYs

Course Name: Corporate Sustainability

Course Code: MSOE03

Category: Open Elective

Preamble:

This course explores corporate sustainability from the perspective of large, multinational corporations. Main focus is on the management tools available to corporations and how they can drive sustainability into a company at all levels, providing a balance between environmental stewardship, social well-being, and economic prosperity.

Objectives:

1. The importance to each individual corporate entity of corporate sustainability.
2. Key drivers and inhibitors, both external and internal to the corporation, of the natural environmental and social aspects of corporate sustainability.
3. The roles of social and natural environmental risk, and product and process innovation, in developing corporate sustainability.

Pre-requisites:

N.A. as this is the first semester course.

Course Outcome:

Student will be able to:

1. Define sustainability and identify major sustainability challenges.
2. Identify, act on, and evaluate their professional and personal actions with the knowledge and appreciation of interconnections among economic, environmental, and social perspectives.
3. Recognize the global implications of their actions.
4. Apply concepts of sustainable development to address sustainability challenges in a global context.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Tutorial	Theory	Tutorial
3	--	2	--

Detailed Syllabus

Module No.	Module Name	Content	No. of Hours
1	Introduction to the course	Meaning, Objective, Scope, taking the perspective of a multi-national company, Understanding the Sustainability Challenge-The Systemic Level and Business Level, Their Implications for business.	8

Module No.	Module Name	Content	No. of Hours
2	Importance of Corporate Sustainability	Assessing the Strategic Opportunity, Managing Sustainability Transitions across Business Functions, successful cases of organizations focusing on a business model designed around sustainability principles and mind-sets.	8
3	Seizing the Strategic Opportunity	Managing Sustainability Transitions across Business Functions, the challenges related to the management of the integration of sustainability-related processes in business organizations.	8
4	Corporate Stakeholder Engagement	Multilateral engagement, Government engagement, NGO's – influence and engagement, Trade associations (WBCSD), Stakeholder interests and engagement	8
5	Transitioning Organizations to Sustainable Enterprises	Developing the Road-Map, Approach the challenge of developing a roadmap to realize the stakeholder value creation potential in sustainability transitions at three different levels, initiatives related to transformational change in the organizations.	8
Total			40

Skill Set Acquired:

1. Current best practice in corporate sustainability.
2. Identify, analyse and solve, within the context of economic sustainability, issues within a corporation that relate to its natural environmental and social sustainability.
3. Make a case to a range of stakeholders, including managers, boards, and owners addressing specific corporate sustainability issues.
4. Develop appropriate policies and plans to address these issues.

Text-Books:

1. Corporate Sustainability in Practice: A Guide for Strategy Development and Implementation by Paolo Taticchi, Melissa Demartini
2. Corporate Sustainability, Social Responsibility and Environmental Management: An Introduction to Theory and Practice with Case Studies by Mark Anthony Camilleri.

Reference-Books:

1. How to Succeed as an Independent Consultant by Holtz, Herman.
2. Strategy for Sustainability: A Business Manifest by Adam Werbach.

E- Resources:

1. Global Journal of Management and Business Research: D Accounting and Auditing
2. Indian Journal of Finance - <http://www.indianjournaloffinance.co.in/>
3. IVEY Business Journal- <https://iveybusinessjournal.com/publication/corporate-sustainability-what-is-it-and-where-does-it-come-from/>

MOOC:

1. <https://www.coursera.org/learn/corp-sustainability>
2. <https://www.edx.org/course/introduction-to-corporate-sustainability-social-in>
3. <https://www.classcentral.com/course/corp-sustainability-10667>

Course Name: Management Information System

Course Code: MSOE04

Category: Open Elective

Preamble:

Cost management in accounting is a form of management accounting that is designed to help business owners in the prediction of business expenses incurred for day-to-day activities. The purpose of this form of accounting is to avoid going over budget so that businesses can hold onto as much of their revenues as possible. Each company irrespective of its size is always in need of a talented Cost Management Accountant.

Objectives:

1. To understand the basic concept data and information, Framework / structure and role of Information and Information Systems for business.
2. Determining Information Needs for an individual & Organization for decision making process.
3. To understand the requirement & analysis of MIS across the functions of the Management and Sectors of the industry and business.
4. To emphasis the Information System Development Process and Security /Privacy of MIS.

Pre-requisites:

Need & understanding of Management Information System

Course Outcome:

Student will be able to:

1. Understand the role of information system in various organization.
2. Prepare Sector wise application of Information System.
3. Understand Role of Information System in analysing as well as decision making process
4. To understand the application of MIS across the function and different industrial sector.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Tutorial	Theory	Tutorial
2	--	2	--

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	Basic Information	concepts and definitions Framework and role of Information & Information Systems (IS) in an organization, system concept Characteristics of Information & Organization with respect to organization form, structure, philosophy, hierarchy etc	6
2	Types of Information System (IS)	Transaction Processing System for Operational Control, Management Information System for Management Control, Decision Support System and Executive Information Systems for Strategic Management, Knowledge Base Information System (Artificial Intelligent/ Expert System)	8

Module No.	Module Name	Content	No. of Hours
		Determining Information Needs for an Organization/Individual Manager, Overview of use of data and Information, analysis of information, Value of information for decision making and decision making processes etc	
3	MIS across the functions of the Management and Sectors	Marketing Information Systems Manufacturing Information Systems Human Resource Information Systems Financial Information Systems Information System Required across the Sectors.	6
4	Strategic roles of IS	Use of Information for Customer Bonding and Business Alliance Breaking Business Barriers –Business Processes Reengineering Improving Business Quality – Creating Virtual Company – Using Internet Strategically Building Knowledge and Creating Company – Challenges of Strategic of IS – Enterprise –wide systems and E-Business Applications for business & competitive advantages	6
5	IS planning methodologies	Enterprise Management Information Resource Management Technology Management IS planning methodologies – Critical Success factors Business Systems Planning – Computer Aided Planning Tools.	6
6	Information System Development and Security Information	System development Process and Models Sensitize students to the need for information security, Concepts such as confidentiality, Integrity and Availability, Types of threats and risk, overview of some of the manual, procedural and automated controls in real life IT environments. Computer Crime –Privacy Issues	8
Total			40

Suggested List of Tutorials:

1. Have the knowledge of the core activities in the systems development process.
2. Define an IT infrastructure and describe its components.
3. Acquire the knowledge of MS-Access as a database tool to manage the organization information.
4. Understand the role of information systems in organizations, the strategic management processes, and the implications for the management.

Skill Set Acquired:

1. Acquire the knowledge of different types of management information systems.
2. Understand the processes of developing and implementing information systems.
3. Understand about the importance of managing organizational change associated with information systems implementation.
4. Understand the basic concepts and technologies used in the field of management information systems.
5. Be familiar with the ethical, social, and security issues of information systems.

Text-Books:

1. Principal of Information System by Ralph M. Stair and Georg Raynold.
2. Management Information System- Managing the Digital Firm by Laudon and Laudon.
3. Analysis and Design of Information Systems by James Senn.

Reference-Books:

1. Analysis and Design of Information Systems by James Senn
2. MIS a Conceptual Framework by Davis and Olson
3. A Management Information Systems by O'Brien, James Tata McGraw Hill.

E- Resources:

1. Information Systems - <https://www.journals.elsevier.com/information-systems>
2. Journal of Management Information System - <https://www.tandfonline.com/loi/mmis20>
3. Journal of Management Information System-
<https://www.scimagojr.com/journalsearch.php?q=15700&tip=sid>

MOOC:

1. <https://www.edx.org/course/introduction-to-management-information-systems-mis>
2. https://onlinecourses.swayam2.ac.in/cec21_ge05/preview
3. https://onlinecourses.nptel.ac.in/noc20_mg60/preview

Course Name: Cost and Management Accounting

Course Code: MSOE05

Category: Open Elective

Preamble:

Cost management in accounting is a form of management accounting that is designed to help business owners in the prediction of business expenses incurred for day-to-day activities. The purpose of this form of accounting is to avoid going over budget so that businesses can hold onto as much of their revenues as possible. Each company irrespective of its size is always in need of a talented Cost Management Accountant.

Objectives:

1. To explain the approach of management accounting in taking financial decisions.
2. To highlight the importance of cost in the business decisions and to impart the knowledge on Costing methods and techniques
3. To acquire knowledge and understanding of the concepts, techniques and practices of cost and management accounting and to develop skills for decision making.
4. To develop various skills among the students related with budget and budgetary control.

Pre-requisites:

Financial Accounting

Course Outcome:

Student will be able to:

1. Understand how cost accounting arises out of the need to make business decisions.
2. Understand the Advantages and disadvantages of keeping inventory in an operation.
3. Prepare cost estimates for allocation and apportionment of overheads, including between reciprocal service departments
4. Understand about practical uses of Activity Based costing.
5. Use the different costing systems in practical scenario.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Tutorial	Theory	Tutorial
3	--	2	--

Detailed Syllabus

Module No.	Module Name	Content	No. of Hours
1	Introduction to Cost & Management Accounting	Distinction and relationship among financial accounting, cost accounting and management accounting Role of Cost in decision making Analysis and classification of cost.	8
2	Elements of cost	Materials, Labour and Overheads, Allocation and apportionment of overheads, Preparation of cost sheet.	8
3	Introduction to different costing techniques	Methods of costing – with special reference to job costing, process costing, services costing. Marginal Costing and Cost-Volume-Profit Analysis, Marginal costing versus absorption costing, Computation	8

Module No.	Module Name	Content	No. of Hours
		of breakeven point, margin of safety and P/V Ratio Differential Costing and Incremental Costing.	
4	Budgeting and Budgetary Control	Concept of budget, budgeting and budgetary control, Types of budgets.	8
5	Others	Standard Costing and Variance Analysis, Responsibility Accounting and Transfer Pricing, Activity Based Costing & Activity Based Management, Target Costing, Lifecycle Costing, Environmental Costing, Service Costing.	8
Total			40

Suggested List of Tutorials:

1. Preparation of both the operating and financial budgets.
2. Analysing the relationship between the cost-volume and profit
3. Explains break-even sales price, break-even sales volume, the total contribution margin, the unit contribution margin, margin of safety, security ratio, profit margin concepts.
4. Apply cost accounting methods for both manufacturing and service industry.
5. Evaluate the costs and benefits of different conventional and contemporary costing systems.

Skill Set Acquired:

1. Understanding about profit planning, make or buy decisions, cost reduction and cost control.
2. Students would be able to determine standard cost and its types, determine total standard cost and variances and its applicability.
3. Students would be able to understand the concept of operating costing and its applicability in service industry i.e hotel, hospital, transport, etc.
4. Analyse and provide recommendations to improve the operations of organisations through the application of Cost and Management accounting techniques.
1. Students would be able to get a clear picture of absorption costing, marginal costing, break even analysis. They will be able to take a decision while solving the problems.

Text-Books:

1. Cost Accounting for Managerial Emphasis – Horngren, Datar, Foster.
2. Management Accounting – Robert Kaplan, Anthony A. Atkinson.
3. Cost and Management Accounting – Ravi. M. Kishore.

Reference-Books:

1. Cost Accounting: Theory and Practices: B. Banerjee (PHI) 12th Edition.
2. Cost Management: A Strategic Approach – S.C. Vaidya& S. Gill (Macmillan)
3. Cost Accounting by Khan. M.Y & Jain, P.K, Mcgraw Hill Education (India) Private Ltd.

E- Resources:

1. SCM – Society of Cost Management - <http://costmgmt.org/online-resources/>
2. The Management Accountants - <https://icmai.in/icmai/news/209.php>
3. Management Accounting Research - <https://www.journals.elsevier.com/management-accounting-research>

MOOC:

1. <https://www.classcentral.com/course/swayam-management-accounting-14177>
2. <https://www.udemy.com/course/cost-and-managerial-accounting-part-1/>
3. <https://www.edx.org/learn/cost-accounting>

Course Name: Entrepreneurship Management

Course Code: MSOE06

Category: Open Elective

Preamble:

To re-orient the outlook of students towards new business ventures and start-ups and also to help them to look at these as a possible career option

Objectives:

1. To acquaint the students with both the theory and practice of Entrepreneurship.
2. To expose the students to the finer nuances of the subject.
3. To re-orient the outlook of students towards new business ventures and start-ups and also to help them to look at these as a possible career option.

Pre-requisites:

N.A. as this is the first semester course.

Course Outcome:

Student will be able to:

1. To gain an understanding of entrepreneurship, as well as to realise and harness the potential of new ventures and start-ups.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Tutorial	Theory	Tutorial
3	--	2	--

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	Entrepreneurial Perspective	Concept of entrepreneur, entrepreneurship and enterprise, advantages of entrepreneurship, Nature and development of entrepreneur and entrepreneurship	4
2	Entrepreneurial Perspective	Opportunity -based entrepreneurship, social entrepreneurship, entrepreneurship by Dalits technopreneur ship	4
3	Entrepreneurs, managers and intrapreneurs: similarities and differences	Entrepreneurs, managers and intrapreneurs: similarities and differences	4
4	Innovation, creativity and entrepreneurship	Innovation, creativity, and entrepreneurship	4
5	The Entrepreneurial Environment	Analysis of business opportunities in both the domestic and global economies, including the analysis of PEST factors	4
6	The Entrepreneurial Environment	Quick-start routes to establish a business (franchising, ancillarising and acquisitioning), Support organisations for an entrepreneur and their role	4

Module No.	Module Name	Content	No. of Hours
7	Legal framework for starting a business in India	The Make in India Campaign, the Digital India Campaign and the opportunities for start-ups in India	4
8	The Enterprise Launching	Product / Project identification • Preparing a Business Plan	4
9	Business financing	venture capital finance and private equity	4
10	International variations in entrepreneurship	International variations in entrepreneurship (including cultural and political differences) Indian Family Business: genesis, features, issues and challenges	4
Total			40

Suggested List of Tutorials (NA):

Skill Set Acquired:

To be able to apply different analytical techniques of operations Management in different industry sectors like hotel, hospital, mall, BPO, Airlines, manufacturing, consulting etc

Text-Books:

1. Entrepreneurship Management by P N Singh and J C Saboo.
2. Entrepreneurship by Rajeev Roy
3. Entrepreneurship by Robert Hisrich, Michael Peters and Dean Shepperd

Reference-Books:

1. Beyond Entrepreneurship by James C Collins and William C Lazier
2. Dynamics of Entrepreneurial Development by Vasant Desai
3. Entrepreneurship Development in India by B Ghosh

E- Resources:

1. www.longdom.org/information-technology-software-engineering.html
2. I.E.E.E
3. /repo.ijiert.org
4. www.springer.com/journal/13042

Course Name: Operation Research

Course Code: MSOE07

Category: Open Elective

Preamble:

Operation Research (OR) is a discipline to aid decision making and improving efficiency of the system by applying advanced analytical methods. In current scenario it has become a professional discipline that deals with the application of scientific methods for decision-making, and especially to the allocation of scarce resources. This course offers a unique blend of traditional coursework, practical skills, and real world problem solving experience designed to position students for success in today's competitive world.

Objectives:

1. To know optimizing techniques.
2. To understand the need of using OR as a quantitative approach for effective decision making.

Pre-requisites:

Basic of statistics.

Course Outcome:

Student will be able to:

1. Provide hands-on training to the students in the form of practical's and project work, to address some significant issues faced by industries.
2. Develop transferable skills including an analytical approach to problem solving, logical argument and deductive reasoning to make the students well equipped to work on complex issues.
3. Impart comprehensive knowledge and understanding of theoretical fundamentals in operational research.
4. To understand its use in decision making in business.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Tutorial	Theory	Tutorial
3	--	2	--

Detailed Syllabus

Module No.	Module Name	Content	No. of Hours
1	Introduction to OR	Concepts, Application Potential to Diverse Problems in Business & Industry, Scope and Limitations.	3
2	Linear Programming	Concepts, Formulation of Models - Diverse Problems – Graphical Explanation of Solution - Maximisation / Minimisation – Simplex Algorithm – Use of Slack /Surplus / Artificial Variables – Big M Method- Interpretation of the Optimal Tableau - (Unique Optimum, Multiple Optimum, Unboundedness, Infeasibility & Redundancy Problems). Primal /Dual Inter-relation - Post-Optimal Sensitivity Analysis - Dual Simplex Method - Problems Limitations of LP	3
3	Transportation problem	Concepts, Formulation of Model - Solution Procedures for IFS and Optimality Check - Balanced / Unbalanced - Maximization / Minimization - Case of Degeneracy - Prohibited Routing Problems - Post-Optimal Sensitivity Analysis.	6

Module No.	Module Name	Content	No. of Hours
4	Assignment Problem	Concepts, Formulation of Model - Hungarian Method of Solution, Maximisation / Minimisation - Balanced / Unbalanced – Prohibited Assignments - Problems.	6
5	Game theory	Game Theory - Concepts - 2 – person - N-person games - Zero – sum. Saddle point Mixed Strategy - Sub-games, Graphical Methods - for $m \times 2$ or $2 \times n$ games	6
6	Decision Theory	Decision Theory - Under Risk, Uncertainty, Decision tree. Classical News Paper boys problem (EMV, EVPI) Problem	6
7	Simulation	Concepts - Areas of Application - Application to Problems in Queuing, Inventory, New Product, Profitability, Maintenance etc.	4
8	Queuing Theory	Concepts - Types of Queuing Systems, Problems based on the results of following models (M/M/1) Single Channel Queue with Poisson Arrival Rate, and Negative Exponential Service Time, With and Without Limitations of Queue Size (M/G/1) → Single Channel with Poisson Arrival Rate, and General Service Time.	3
9	Network Analysis	Minimal Spanning Tree Problem - Shortest Route Problem - Maximal Flow in Capacitated Network - Concepts and Solution Algorithm as Applied to Problem - Project Planning & Control by use of CPM/PERT Concepts. Definitions of Project - Jobs, Events - Arrow Diagrams - Time Analysis and Derivation of the Critical Path – Concepts of Floats (total, free, interfering, independent) - Crashing of a CPM Network - Probability Assessment in PERT Network.	3
Total			40

Suggested List of Classroom Assignment:

1. Perform sensitivity analysis to identify the direction and magnitude of change of a linear programming model's optimal solution as the input data change.
2. Formulate real-world problems as a linear programming model.
3. Solution of Shortest Path Problem.
4. Crashing of the Project.
5. Identify the features of different types of decision-making environments and the appropriate decision making tools to be used in each type.
6. Understand the theory and concepts of project planning and associated cost-benefit analysis.

Skill Set Acquired:

1. Identify the features of different types of decision-making environments and the appropriate decision making tools to be used in each type.
2. Learn skills to aid management decision making.
3. Identify and demonstrate the dynamic nature of the environment in which the organization is functioning and the implications of the competitive market.
4. Student's will develop their mathematical skills involves in order of operation.
5. Courses like Linear Algebra, Operation Research, Numerical can make the students efficient for industry involvement.

Text-Books:

1. Operation Research – An Introduction- HamdyTaha

2. Quantitative Techniques in Management -N D Vohra
3. Operations Research Theory and Applications- J K sharma

Reference-Books:

1. Operations Research by Hilier, Liberman, 10th Edition, Tata McGraw Hill.
2. Principles of Operations Research, with applications to managerial decisions by Wagner, 2nd Edition, Prentice Hall of India.

E- Resources:

1. Operation research Forum <https://www.springer.com/journal/43069>
2. Operational Research- An International Journal <https://www.springer.com/journal/12351>

MOOCs:

1. <https://www.certifiedanalytics.org/>
2. <https://www.classcentral.com/course/swayam-operations-research-14219>
3. https://onlinecourses.nptel.ac.in/noc19_ma29/preview

Course Name: International Business

Course Code: MSOE08

Category: Open Elective

Preamble:

This course will help students to understand the basic concepts and fundamentals used in international business. Obtaining a working knowledge of international business and its underlying principles will enable a student to develop perspective of an international manager.

Objectives:

1. To develop skills to understand, evaluate decision making in the context of international management
2. To develop the analytical ability of the student to attain an insight into international business

Pre-requisites:

N.A.

Course Outcome:

Student will be able to:

1. Understand the basic concepts, principles, and scope of international business.
2. Evaluate country attractiveness, impact on business models.
3. Understand cultural differences and impact on business operations.
4. Understand international finance decisions and impact on operations.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Tutorial	Theory	Tutorial
3	--	2	--

Detailed Syllabus

Module No.	Module Name	Content	No. of Hours
1	Introduction	Objective, Scope, Perlmutter's EPRG Model	04
2	Country Analysis	PESTEL analysis, The Atlas of Economic Complexity, Porters Diamond, Country Risk analysis	06
3	Cross Cultural Management	Hofstede's Cultural Dimension, CAGE Framework Pankaj Ghemawat, Culture and Leader Effectiveness: The GLOBE Study	06
4	Mode of Entry	Market/Country Entry Strategic Alliances/- JV / M&A	06
5	Investment Decisions	Drivers of FDI – Special emphasis on emerging markets, Offshore Banking, Forex Management – ADR-GDR's- EU bonds	05
6	WTO Regional Trade Agreements	Building Blocks of WTO, Major agreements of WTO	06
7	Managing of Multinationals	Organization Structure -Matrix -Geographic -Product -Expatriate Management -Staffing of Subsidiaries, Integration Response Models -Types of subsidiaries -Control of subsidiaries, Global manufacturing	07

Module No.	Module Name	Content	No. of Hours
		and supply chain - Optimizing of Supply chain - Offshoring V/S Outsourcing	
Total			40

Skill Set Acquired:

1. Students will be able to evaluate country attractiveness, impact on business models
2. Students will be able to understand international finance decisions and impact on operations
3. Students will be able to understand cultural differences and impact on business operations

Text-Books:

1. International Business by Mike W. Peng; Klaus E. Meyer - Cengage Learning
2. International Business Environment, The: Text and Cases by J Stewart Black ; Anant K Sundaram – Prentice Hall India

Reference-Books:

1. International Business: Challenges and Choices by Alan Sitkin, Nick Bowen – Oxford Press
2. International Management by Arvind V Pathak – McGraw Hill

E- Resources:

1. <https://www.inderscience.com/jhome.php?jcode=ejim>
2. <https://link.springer.com/journal/41267/volumes-and-issues>

MOOCs:

1. <https://www.coursera.org/learn/international-business>
2. <https://nptel.ac.in/courses/110/107/110107145/>

Course Name: Indian Cinema Global Perspective

Course Code: MSGE01

Category: General Elective

Preamble:

This course designed to expose the students to identify the crafting of regional, national and global identity through film narratives. Further, the course also explores the ideological link between the spectator and the screen.

Objectives:

1. To impart knowledge about the basics of Indian Cinema and the global perspective
2. To enable students to understand historical and theoretical ways of thinking about cinema

Pre-requisites:

N.A.

Course Outcome:

Student will be able to:

1. Investigate elements of gender, caste, local nuances of cinema at the regional, national and global level
2. Produce critical thinking, analytical reasoning and awareness of socio-political-cultural histories in relation to Indian cinema

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Tutorial	Theory	Tutorial
3	--	2	--

Detailed Syllabus

Module No	Module Name	Content	No. of Hours
1	Introduction and demonstration of Silent cinema era in India and Abroad	Querying the "Traditional" Roots of Silent Cinema in Asia Indian Cinema Abroad: Historiography of Transnational Cinematic Exchanges	08
2	Regional Cinema	Speculations on the Regions in 'Regional Cinema'	06
3	Hindi Cinema	"The Developmental Aesthetic" in Ideology of the Hindi Film: A Historical Construction.	06
4	Parallel Cinema	The Region in Parallel Cinema & The Provincialising North	06
5	Global Perspective	Cinema and global perspective	04
Total			30

Course Name: Corporate Etiquette

Course Code: MSGE02

Category: General Elective

Preamble:

This course designed to make students gain mannerisms that could align with the corporate culture and values. It will help the students to enhance non-verbal communication within the corporate set-up.

Objectives:

1. To understand Body language and the influence of it
2. To learn details of business dining skills and mannerisms it
3. To develop skills to effectively interact with International and government diplomats

Pre-requisites:

N.A. as this is the first semester course.

Course Outcome:

Student will be able to:

1. Understand Body language and the influence of it
2. Learn details of business dining skills and mannerisms it
3. Develop skills to effectively interact with International and government diplomats

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Tutorial	Theory	Tutorial
3	--	2	--

Detailed Syllabus

Module No	Module Name	Content	No. of Hours
1	The First Impression	Effective Professional Introduction, Making a First Impression, the first time, Minimizing Uneasiness Use of Business Cards, Remember the names	03
2	Body Language	Levels of conversations, Start and End of Conversations, Types of Handshake, Eye Contact Body Language, Maintaining Posture,	03
3	Internal Office Etiquettes	Office Conduct and respect, Communications and professionalism, Time Management, Working out of the office, Eating at the Workplace, Do's and Don'ts in an office meeting	03
4	Email Etiquettes	Business Email Etiquette, Proper use for forwarding to Cc and BCC, Grammar, Acronyms and auto-correct, Navigating unexplored social-network territory at work, Top technology tips and netiquette	03
5	Dressing Etiquette	Constructing a Personal brand, Essentials of Grooming, Business Casual and techniques, Understanding Dress Codes, Accessorizing professionally, Personal Style – Male and Female Travel/ outdoor Etiquettes	03

Module No	Module Name	Content	No. of Hours
6	Dining Etiquette	Eating Out Ordering in a Restaurant, Handling the Napkin, Plates and Glassware, Dining- Dos and Don'ts, Body Language at a business lunch/dinner Host and Guest Etiquettes, Toasting, Handling table mishaps, Paying the Bill, Tipping	03
7	Telephonic Etiquette	Appropriate Greetings and Introduction, Sensitivity to the tone of voice, Professional business communication, Active listening, Telephonic Interruptions, Use of speakerphone Dealing with Voice Mail, Do's and Don'ts Mobile Phones	03
8	Writing Etiquette	Business Letter Writing Skills, Formal Letters, Informal Letters, Headings and Introductions, Focus points, Reader-Friendly writing, Business tone, Privacy and compliance	03
9	Managing multi-cultures	Understanding Culture in people management, Multi-cultural organization, Cultural practices and perspectives, Cultural Differences and behaviors	03
10	International Standards and Government Diplomats	International standard Etiquettes, Interacting with Government Diplomats, Diplomatic Etiquette and Protocol, General Rules, Important Points, Preparation Tips	03
Total			30

Course Name: Waste Management Process, Concept and Working

Course Code: MSGE03

Category: General Elective

Preamble:

This course designed to teach learners about Waste Management which is a wide interdisciplinary area which comprises the study of handling waste from the moment someone creates it to its final destination.

Objectives:

1. To study waste disposal and management
2. To build new waste management solutions.

Pre-requisites:

N.A. as this is the first semester course.

Course Outcome:

Student will be able to:

1. Understand Body language and the influence of it
2. Learn details of business dining skills and mannerisms it
3. Develop skills to effectively interact with International and government diplomats

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Tutorial	Theory	Tutorial
3	--	2	--

Detailed Syllabus

Module No	Module Name	Content	No. of Hours
1	Waste Management Introduction, Process, Concept and Working	It covers key elements of the waste management system, such as its technical, environmental, social, financial and institutional aspects. Case Studies on appropriate and already applied solutions	30
Total			30