

University of Mumbai

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Academic Authorities,
Meetings & Services (AAMS)
Room No. 128, M. G. Road, Fort,
Mumbai – 400 032.
Tel. 022-68320033

Re- accredited with A ++ Grade (CGPA 3.65) by NAAC
Category- I University Status awarded by UGC

No. AAMS_UGS/ICD/2024-25/444

Date : 24th March, 2025.

To,
The Director,
Garware Institute of Career Education
and Development,
Vidyanagari
Santacruz (East)
Mumbai – 400 098.

Sub : M. Sc (Biomedical Instrumentation) (Two year) (Sem I & II)

Sir,

With reference to the subject noted above, this is to inform you that the recommendations made by the **Advisory Committee & Board of Management** of Garware Institute of Career Education & Development at its Meeting held on **4th September, 2023** & resolution passed by the **Board of Deans** at its meeting held on **9th August, 2023** vide Item No. **9.2** have been accepted by the **Academic Council** at its meeting held on **1st November, 2023** vide Item no. **9.4 (A) 2 (N)** and subsequently approved by the **Management Council** at its meeting held on **5th February, 2024** vide Item No. **3** that in accordance therewith, in exercise of the powers conferred upon the Management Council under Section 74(4) of the Maharashtra Public Universities Act, 2016 (Mah. Act No. VI of 2017) the following program with Ordinance for Title of the Program, Eligibility and Regulation numbers for Duration of Program, Intake Capacity, Scheme of Examinations, Standard of Passing and Credit Structure along with syllabus of **M.Sc (Biomedical Instrumentation) (Sem I & II)** (Appendix – 'A') have been introduced and the same have been brought into force with effect from the academic year **2023-24**.

The New Ordinances & Regulations as per NEP 2020 is as follows :-

Sr. No	Name of the Programme	Ordinance no. for Title	Ordinance no for Eligibility	Duration
A	P.G Diploma in Biomedical Instrumentation	O.GPA – 3 A	O.GPA – 4 A	Two year
B	M. Sc (Biomedical Instrumentation)	O.GPA – 3 B	O.GPA – 4 B	
C	M.Sc. (Biomedical Instrumentation)	O.GPA – 3 C	O.GPA – 4 C	One year

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Date : 24th March, 2025.

: 2 :

Regulation Nos	
Duration	R. GPA - 6
Intake Capacity	R. GPA - 7
Scheme of examination	R. GPA - 8
Standard of Passing	R. GPA - 9
Credit Structure	R. GPA - 10 A
	R. GPA - 10 B


(Dr. Prasad Karande)
REGISTRAR

A.C/9.4(A)2(N)/01/11/2023
M.C/3/5/2/2024

Copy forwarded with Compliments for information to:-

- 1) The Chairman, Board of Deans
- 2) The Dean, Faculty of Science & Technology.
- 3) The Director, Board of Examinations and Evaluation,
- 4) The Director, Board of Students Development,
- 5) The Director, Department of Information & Communication Technology,
- 6) The Co-ordinator, MKCL.

Copy forwarded for information and necessary action to :-	
1	The Deputy Registrar, (Admissions, Enrolment, Eligibility and Migration Dept)(AEM), dr@eligi.mu.ac.in
2	The Deputy Registrar, Result unit, Vidyanagari drresults@exam.mu.ac.in
3	The Deputy Registrar, Marks and Certificate Unit,. Vidyanagari dr.verification@mu.ac.in
4	The Deputy Registrar, Appointment Unit, Vidyanagari dr.appointment@exam.mu.ac.in
5	The Deputy Registrar, CAP Unit, Vidyanagari cap.exam@mu.ac.in
6	The Deputy Registrar, College Affiliations & Development Department (CAD), deputyregistrar.uni@gmail.com
7	The Deputy Registrar, PRO, Fort, (Publication Section), Pro@mu.ac.in
8	The Deputy Registrar, Executive Authorities Section (EA) eau120@fort.mu.ac.in He is requested to treat this as action taken report on the concerned resolution adopted by the Academic Council referred to the above circular.
9	The Deputy Registrar, Research Administration & Promotion Cell (RAPC), rapc@mu.ac.in
10	The Deputy Registrar, Academic Appointments & Quality Assurance (AAQA) dy.registrar.tau.fort.mu.ac.in ar.tau@fort.mu.ac.in
11	The Deputy Registrar, College Teachers Approval Unit (CTA), concolsection@gmail.com
12	The Deputy Registrars, Finance & Accounts Section, fort draccounts@fort.mu.ac.in
13	The Deputy Registrar, Election Section, Fort drelection@election.mu.ac.in
14	The Assistant Registrar, Administrative Sub-Campus Thane, thanesubcampus@mu.ac.in
15	The Assistant Registrar, School of Engg. & Applied Sciences, Kalyan, ar.seask@mu.ac.in
16	The Assistant Registrar, Ratnagiri Sub-centre, Ratnagiri, ratnagirisubcentar@gmail.com
17	The Director, Centre for Distance and Online Education (CDOE), Vidyanagari, director@idol.mu.ac.in
18	Director, Innovation, Incubation and Linkages, Dr. Sachin Laddha pinkumanno@gmail.com
19	Director, Department of Lifelong Learning and Extension (DLLE), dlleuniversityofmumbai@gmail.com

Copy for information :-	
1	P.A to Hon'ble Vice-Chancellor, vice-chancellor@mu.ac.in
2	P.A to Pro-Vice-Chancellor pvc@fort.mu.ac.in
3	P.A to Registrar, registrar@fort.mu.ac.in
4	P.A to all Deans of all Faculties
5	P.A to Finance & Account Officers, (F & A.O), camu@accounts.mu.ac.in

To,

1	The Chairman, Board of Deans pvc@fort.mu.ac.in
2	Faculty of Humanities, Dean 1. Prof.Anil Singh Dranilsingh129@gmail.com Associate Dean 2. Dr.Suchitra Naik Naiksuchitra27@gmail.com 3.Prof.Manisha Karne mkarne@economics.mu.ac.in
	Faculty of Commerce & Management, Dean 1. Dr.Kavita Laghate kavitalaghate@jbims.mu.ac.in Associate Dean 2. Dr.Ravikant Balkrishna Sangurde Ravikant.s.@somaiya.edu 3. Prin.Kishori Bhagat kishoribhagat@rediffmail.com

	Faculty of Science & Technology Dean 1. Prof. Shivram Garje ssgarje@chem.mu.ac.in Associate Dean 2. Dr. Madhav R. Rajwade Madhavr64@gmail.com 3. Prin. Deven Shah sir.deven@gmail.com
	Faculty of Inter-Disciplinary Studies, Dean 1. Dr. Anil K. Singh aksingh@trcl.org.in Associate Dean 2. Prin. Chadrashekhhar Ashok Chakradeo cachakradeo@gmail.com
3	Chairman, Board of Studies,
4	The Director, Board of Examinations and Evaluation, dboee@exam.mu.ac.in
5	The Director, Board of Students Development, dsd@mu.ac.in DSW directr@dsw.mu.ac.in
6	The Director, Department of Information & Communication Technology, director.dict@mu.ac.in

As Per NEP 2020

University of Mumbai



Title of the program

A- P.G. Diploma in Biomedical Instrumentation

B- M.Sc. (Biomedical Instrumentation)(Two Year) } 2023-24

C- M.Sc. (Biomedical Instrumentation) (One Year) - 2027-28

Garware Institute of Career Education and Development

Syllabus for Semester- Semester I and II

Ref: GR dated 16th May,2023 for Credit Structure of PG

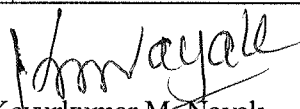
UNIVERSITY OF MUMBAI

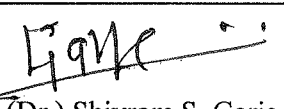


(AS PER NEP 2020)

Sr. No.	Heading	Particulars	
1	Title of program O: <u>GPA-3 A</u>	A	P.G. Diploma in Biomedical Instrumentation
	O: <u>GPA-3 B</u>	B	M.Sc. (Biomedical Instrumentation) (Two Year)
	O: <u>GPA-3 C</u>	C	M.Sc. (Biomedical Instrumentation) (One Year)
2	Eligibility O: <u>GPA-4 A</u>	A	Recognized degree of B.Sc. (Biomedical Instrumentation) OR B.Sc. Chemistry/Electronics/Physics/ or its equivalent. [Bridge course of 90 Hours] OR Passed Equivalent Academic Level 5.5 [Bridge course of 90 Hours]
	O: <u>GPA-4 B</u>	B	1. The candidate who has successfully completed P.G. Diploma in Biomedical Instrumentation. 2. The candidate whose Post Graduate Diploma credits are 60% equivalent to M.Sc. (Biomedical Instrumentation) & he/she earns minimum 8 Credits from P.G. Diploma in Biomedical Instrumentation. 3. As per NEP criteria on the basis of RPL- Recognition of Prior Learning, Candidate to be admitted to 2 nd Year subject to He/she securing minimum 50% in the 1 st Year assessment of PGDBI & proof of employment of Minimum 2 Years. With Compulsorily Science At H.S.C. Level. OR Passed Equivalent Academic Level 6.0
	O: <u>GPA-4 C</u>	C	B.Sc. (Biomedical Instrumentation) or B.Sc. Chemistry/Electronics/Physics/ or its equivalent. [Bridge course of 90 Hours] Graduate with 4-year U.G. Degree (Honours / Honours with Research) Or Equivalent Academic Level 6.0
3	Duration of Program	A	1 Year

	R: <u>GPA-6</u>	B	2 Years
		C	1 Year
4	R: <u>GPA-7</u> Intake Capacity	30	
5	R: <u>GPA-8</u> Scheme of Examination	NEP 50% Internal – Continuous Evaluation 50% External- Semester End Examination Individual Passing in Internal and External Examination	
6	Standards of Passing R: <u>GPA-9</u>	50% in each component	
7	Credit Structure R: <u>GPA-10 A</u> R : <u>GPA-10 B</u>	Attached herewith	
8	Semesters	A	Sem I & II
		B	Sem I, II, III, & IV
		C	Sem I & II
9	Program Academic Level	A	6.0
		B	6.5
		C	6.5
10	Pattern	Semester	
11	Status	New	
12	To be implemented from Academic Year Progressively	A	2023-24
		B	
		C	2027-28


 Dr. Keyurkumar M. Nayak,
 Director,
 UM-GICED


 Prof. (Dr.) Shivram S. Garje
 Dean, Faculty of Science

Preamble

1. Introduction

This is a post-graduate Master's level Science course in Biomedical Instrumentation. This is an allied health profession course. It is concerned with the advanced level understanding of procurement methods, installation and maintenance of the medical instruments. The course also deals with the collection of information needed, supervision of installation commissioning, testing, reporting and documentation of these instruments. **M.Sc. Biomedical Instrumentation Science** is two years duration course. The syllabus of the course is divided into two years and is career orienting in nature.

Need for this course:

The college is situated in a hilly area. The three districts namely Sindhudurga, Ratnagiri and Raigad which are the main feed areas. There are approximately 100+ hospitals run by government, public trusts and private ones. Apart from these there are several small setups. For every setup at least one technical person is required who has the basic knowledge of instruments.

The broad goal of this course is to teach the students about the theoretical and practical aspects of advanced techniques in Biomedical Instrumentation. To train the students to apply the knowledge gained to real-life situations in a meaningful way and to train students so that they will be employable in the field of Biomedical Instrumentation.

Advantages of the course:

- 1) The college is attached to a 700 bed multispecialty hospital within the premises. So, the students get hands-on experience on the latest technology in Medical field.
- 2) The course is job oriented. Students, who have completed B.Sc. Biomedical Instrumentation have already been placed in reputed hospitals and companies and are earning at par with an Engineering course. This is an advanced level course in the same field where students get to work in research dept., hospitals, laboratories, etc.
- 3) This course is equally adaptive for women employment as it is for men.

2. Program Objective: The aim of this program is:

A) KNOWLEDGE: At the end of the course the students shall be able:

1. To understand the concepts of frequency domain representation of signals, design and use of different digital filters, wavelets, cross correlation and auto correlation to bio signals.
2. To use software's like MATLAB/OCTAVE/SPSS etc for simulation and analysis of signals in biomedical applications
3. To make students familiar with various techniques of digital signal processing.
4. To select the appropriate rehabilitation concept for various disabilities.
5. To compare the different methods of orthopedic prosthetics and orthotics for rehabilitation.
6. To select proper sensory augmentation and substitution.
7. To understand and instruct various safety measures while using powered devices.
8. To understand to what extent robotic devices are useful in manufacturing artificial devices
9. To see the real problems whose solutions might change the current scenario in treatments
10. To match the advances in Science and technology to the clinical problems.

3. Learning Outcomes

At the end of the course the students shall be able to:

1. To design and use the applications of digital signal processing to the bio- signals.
2. Design supporting devices as per the need of the patient.
3. Repair and maintain various equipment
4. Design and develop orthotic and prosthetic.
5. Develop skills as a self-directed learner, recognize continuing educational needs.
6. Interact with clinicians and paramedics to improve the quality of technical services.
7. Select & use appropriate technical resources.

5) Credit Structure of the program – (Parishisth-1)

M. Sc. (Biomedical Instrumentation) (Course Structure as per NEP 2020)

R: GPA-10 A

Year	Level	Semester	Major		RM	OJT / FP	RP	Cum. Cr.	Degree
			Mandatory	Electives					
I	6.0	Sem I	Digital Image Processing techniques in Biomedical Imaging (4 Credits) Advanced Prosthetics, Orthotics & Rehabilitation Techniques (4 Credits) Biomedical Microsystem (4 Credits) Clinical Instrumentation and Patient Safety (2 Credits)	Project management (4 Credits) OR Product cycle management (4 Credits)	Research Methodology (4 Credits)				PG Diploma (after 3 Yr Degree)
			14	4	4	0	0	22	
		Sem II	Neural networks and Artificial intelligence in Biomedical instrumentation (4 Credits) Biomedical Instrumentation and Design (4 Credits) Robotics in Medicine (2 Credits) Hospital management (2 Credits)	Cyber security law (4 Credits) OR Biorheology (4 Credits)		On Job Training / Internship (4 Credits)			
			12	4	0	4	0	20	
Cum. Cr. For PG Diploma			26	8	4	4	-	42	

Exit option: PG Diploma (42 Credits) after Three Year UG Degree

R: GPA-10 B

Year	Level	Semester	Major		RM	OJT / FP	RP	Cum. Cr.	Degree
			Mandatory	Electives					
II	6.5	Sem III	Healthcare database management system (4 Credits) Computer networking in Medicine (4 Credits) Biomedical Informatics (2 Credits) IPR Issues, Standards and Bioethics (2 Credits)	Operation research OR Reliability Engineering (4 Credits)			Research Project (4 Credits)		PG Degree After 3- Yr UG Or PG Degree after 4- Yr UG
			12	4			4	20	
		Sem IV	Rehabilitation Engineering (4 Credits) Management Information System (4 Credits) Human Physiology (4 Credits)	Telemedicine OR Biomedical Modeling and Simulation (4 Credits)			Research Project (6 Credits)	22	
		Cum. Cr. For PG Diploma		24	8	-	-	10	
Cum. Cr. for 2 Yr PG Degree			50	16	4	4	10	84	
2 Years-4 Sem. PG Degree (84 credits) after Three Year UG Degree or 1 Year-2 Sem PG Degree (42 credits) after Four Year UG Degree									

Keyurkumar

Dr. Keyurkumar M. Nayak,
Director,

Garje
Prof. (Dr.) Shivram S. Garje
Dean, Faculty of Science

M. SC. (BIOMEDICAL INSTRUMENTATION)
(TWO YEARS FULL TIME)

	Subject Code	Core Subject	Assessment Patterns			Teaching Hours	
		Topics	Internal Assessment (50%)	External Assessment (50%)	Total Marks (CA) 100	Total Hours	Total Credits
		Mandatory Major					
S e m e s t e r - I	PGDBIS 1MJP1	Digital image processing techniques in Biomedical Imaging	50	50	100	60	4
	PGDBIS 1MJP2	Clinical Instrumentation and Patient Safety	50	50	100	60	4
	PGDBIS 1MJP3	Advanced Prosthetics, Orthotics & Rehabilitation Techniques	25	25	50	30	2
	PGDBIS 1MJP4	Biomedical Microsystem	25	25	50	30	2
	Electives						
	PGDBIS 1P5A	Project management	50	50	100	60	4
	PGDBIS 1P5B	Product cycle management	50	50	100	60	4
	Research Methodology						
	PGDBIS 1P6	Research Methodology	50	50	100	60	4
		Total	250	250	500	300	20

Semester - II							
	Mandatory Major						
S e m e s t e r - I I	PGDBIS 2MJP7	Neural networks and Artificial intelligence in Biomedical instrumentation	50	50	100	60	4PG
	PGDBIS 2MJP8	Biomedical Instrumentation And Design	50	50	100	60	4
	PGDBIS 2MJP9	Robotics in Medicine	25	25	50	30	2
	PGDBIS 2MJP10	Hospital management	25	25	50	30	2
	Electives						
	PGDBIS 2P11A	Cyber security law	50	50	100	60	4
	PGDBIS 2P11B	Biorheology	50	50	100	60	4
	On Job Training						
	PGDBIS 2P12	OJT	100		100	60	4
		Total	300	200	500	300	20
Semester - III							
S e m e s t e r - I I I	Mandatory Major						
	MSCBI S3MJP 13	Healthcare database management system	50	50	100	60	4
	MSCBI S3MJP 14	Computer networking in Medicine	50	50	100	60	4
	MSCBI S3MJP 15	Biomedical Informatics	25	25	100	30	2
	MSCBI S3MJP 16	IPR Issues, Standards and Bioethics	25	25	100	30	2
	Electives						
	MSCBI S3P17 A	Operation research	50	50	100	60	4
	MSCBI S3P17B	Reliability Engineering					
	Research Project						
MSCBI S3P18	RP	100		100	120	4	

		Total	300	200	500	360	20
Semester - IV							
Mandatory Major							
S e m e s t e r - I V	MSCBI S4MJP 19	Rehabilitation Engineering	50	50	100	60	4
	MSCBI S4MJP 20	Management Information System	50	50	100	60	4
	MSCBI S4MJP 21	Human Physiology	50	50	100	60	4
	Electives						
	MSCBI S4P22 A	Telemedicine	50	50	100	60	4
	MSCBI S4P22B	Biomedical Modeling and Simulation	50	50	100	60	4
	Research Project						
	MSCBI S4P23	RP	200		200	180	6
		Total	400	200	600	420	22

Abbreviations: Yr.: Year; Sem.: Semester; OJT: On Job Training; Internship/
Apprenticeship; FP:
Field projects; RM: Research Methodology; Research Project: RP; Cumulative Credits:
Cum. Cr.

Sem. – I

M.Sc. (Biomedical Instrumentation) First Year Syllabus as per NEP 2020

SEMESTER – I

Semester 1	Subject Digital image processing techniques in Biomedical Imaging	Category Major	Hours 60	Total Credits 4
Course Objective: · To understand the basics of bio-medical image processing systems. · To study the concept of medical images obtained with ionizing and non-ionizing radiation. · To develop computer aided diagnosis in analysing and quantifying biomedical data. Course Outcome: · A learner will be able to Apply image processing concepts for medical images. · Analyse Morphology, Segmentation techniques and implement them in images. ● Knowledge in the techniques of Digital Image Processing, including Image Enhancement in the Spatial and Frequency Domain, Compression, Morphology and Segmentation. · Do quantitative analysis and visualization of medical images of numerous modalities such as · PET, MRI, PACS, CT, or Ultrasound.				
Unit 1- Introduction and Basics of Image Processing Steps in Digital Image Processing, Components, Elements of Visual Perception, Structure of the human eye, Image formation in the eye Image Sensing and Acquisition, Sampling and Quantization , Image formats				20
Unit-2 Image Enhancement Spatial Domain: Gray level transformations, Histogram processing, Basics of Spatial Filtering, Smoothing and Sharpening Spatial Filtering. Frequency Domain: Introduction to Fourier Transform– Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters, Homomorphic filtering, Color image enhancement.				20
Unit 3 Image Segmentation Basic relationships between pixels - Neighbours, Adjacency, Connectivity, Regions, Boundaries, Distance measures; Detection of discontinuities, Point, Line, Edge detection, Edge linking, Hough transform, Thresholding-based segmentation, Region-based segmentation				20
Text Books: 1. J. G. Proakis, D. G. Manolakis: Digital Signal Processing: Principles, Algorithms, and Applications, Prentice Hall, 2007, 4th Edition 2. S. K. Mitra: Digital Signal Processing: A Computer Based Approach, McGraw Hill Higher Education, 2006, 3rd edition Reference Books: 1. Digital Signal Processing by S. Salivahanan 2. Digital Signal Processing By N.G. Palan				

Semester 1	Subject Advanced Prosthetics, Orthotics & Rehabilitation Techniques	Category Major	Hours 30	Total Credits 2
Course Objectives: - Identify the role of Rehabilitation Engineering in clinical practice. Know about various types of disability and its rehabilitation models - To study the need of Orthotics, Prosthesis and how it helps in quality life in an individual - To study various design considerations of Artificial devices that supports the human sensory organs Course Outcome: - A learner will be able to understand the basic differences between Orthotics and Prosthesis. - Design supporting devices as per the need of the patient. Understand and instruct various safety measures while using powered devices. Understand to what extent robotic devices are useful in manufacturing artificial devices				
Unit 1- Introduction Introduction to Rehabilitation techniques, concepts in sensory rehabilitation, concepts in motor rehabilitation, emerging trends in Rehabilitation. Qualitative and quantitative description of the action of muscle in relation to the human movement, Gait cycle and Analysis, Various types of joint movements, Patterns, Sliding Filament Theory, Forward and Inverse dynamics of multi joint muscle driven system.				10
Unit 2- Prosthetics, Orthotics And Rehabilitation Robotics Prosthetics: Introduction, upper, lower and external, internal prosthetics. Orthotics: Functional electrical stimulation (FES), ambulatory aids, aids for daily living, prosthetics using Myo-electric signal control. Intelligent prosthetic knee, Hierarchically controlled prosthetic hand, myoelectric hand, Orthotic knee joint, Battery powered and controlled Orthosis and prosthesis, HAS-hybrid assistive system for walking.				10
Unit 3-Mobility Aids Types of Mobility Aids, Walking frames, Parallel bars, Rollators, Quadri pods, Tripods & walking sticks, Crutches Different types of wheelchairs and Wheelchair safety. Sensorial Prosthesis And Artificial Organs: Sensory rehabilitation technology, Retinal rehabilitation, and Spinal cord.				10
Text Books: 1. Rehabilitation Medicine – Dr. S. Sunder Jaypee Medical publications New Delhi Reference Books: 1. Physical rehabilitation – Susan D. O'Sullivan, Thomas J Smitz. 5th edition 2. Rory. A. Cooper- Rehabilitation Engineering Applied to Mobility and Manipulation, First Edition CRC Press, 2010				

Semester 1	Subject Biomedical Micro System	Category Major	Hours 30	Total Credits 2
Course Objectives: • To understand various fabrication technologies 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 Outcome: • A learner will be able to 1. Use the knowledge of MEMS to develop various miniaturized biomedical devices.				
Unit 1: Fabrication techniques in MEMS: Bulk micromachining, Surface micromachining, and LIGA Cleaning processes: RCA, Piranha Deposition processes for metals: e-beam evaporation, thermal evaporation and DC Sputter Deposition processes for dielectrics: Physical (RF Sputter) and Chemical Techniques (CVD: APCVD, LPCVD, PECVD, and HWCVD). Polymers coating techniques: spinning, spraying and electrode position				10
Unit 2: Photolithography: Light sources (UV, DUV, and EUV), photoresist, mask design and fabrication using EBL, dark and bright field photo-mask, different projection systems in lithography, detailed study of lithography process, study of fabrication processes like optical grating structure, SiO ₂ cantilever, SiN _x cantilever and basics of EBL <u>Etching Processes</u> : Dry (RIE, DRIE) and wet etching Doping – ion implantation and diffusion <u>Soft lithography</u> : Micro contact Printing, Imprinting or hot embossing, and Replica Molding Surface characterization techniques: AFM, SEM, Profilometer, Elipsometer, Fluorimeter				10
Unit 3 :Drug Delivery Devices and Microsystem packaging Overview of drug delivery systems, Types of drug delivery systems, Different parts of drug delivery system, MEMS based drug delivery systems: Implantable drug delivery systems (IDDS), Micro needles and its fabrication, Micro particles for oral drug delivery				10
Text Books: 1. MEMS & Microsystems: Design, Manufacture, and Nanoscale Engineering, 2nd Edition Tai-Ran Hsu, ISBN: 978-0-470-08301-7 2. MEMS and Microsystems: Design and Manufacture," McGraw-Hill, Boston, 2002 (ISBN 0-07-239391-2). Reference Books: 1. "Fundamentals of Micro fabrication" Marc Madou, by, CRC Press, 1997. Gregory Kovacs, 2. "Fundamentals of BioMEMS and Medical Micro devices", Steven S. Saliterman, (SPIE Press Monograph Vol. PM153 by Wiley Inter science Reference Books: 1. "Microsystem Technology", W. Menz, J. Mohr, O. Paul, WILEY-VCH, ISBN 3-527- 29634-4 2. "Electro Mechanical System Design", James J. Allen, Taylor & Francis Group, LLC, ISBN-0-8247-5824-2, 2005 3. "MICROSYSTEM DESIGN", Stephen D. Senturia, KLUWER ACADEMIC PUBLISHERS, eBook ISBN: 0-306-47601-0 6. "Introduction to Micro fabrication", Sami Franssila John Wiley & Sons Ltd, ISBN 0-470- 85106-6				

Semester 1	Subject Clinical Instrumentation and Patient Safety	Category Major	Hours 60	Total Credits 4
Course Objectives: • Improve performance to avoid patient injury, achieving efficacious treatment Course Outcome: • Select the clinical suitability to the impact of the device on the environment • Device more reliable medical equipment incorporating safety goals				
Unit 1-Clinical Engineering History & Role Of Clinical Technician Organization of clinical engineering department in a hospital, Roles and functions of Clinical technology in a Hospital, General safety rules in clinical environment Patient Safety & Risk Management Model Factors causing various medical errors, Clinical Technician: Well suited for patient safety, Root cause analysis (RCA), Health care failure mode analysis (HFMEA), JCAHO standards, Risk management: Its basics & process, Role of clinical engineer in Risk management.				20
Unit 2- Patient-Hospital And Medical Device Safety Programs Silver bullet model, Process analysis methodology, JCAHO environment of care The safety committee in Hospitals and its role Components of Hospital safety program The system risk model(SRM), Description of SRM, Direct and root cause failure				20
• Unit 3: • Clinical Information Management System And Advanced Diagnostics Clinical Information system (CIS) • Physiological monitoring process • PMS and CMS architecture • Remote diagnostics using Technical assistance center and • LAN network				20
Text Books: 1. Clinical Engineering Handbook, Joseph Dyro, The Biomedical Engineering series, Elsevier 2. John G. Webster- Medical Instrumentation Applications and Design 3rd edition John Wiley and Sons. Inc. 1999				

Semester 1	Subject Project Management	Category Elective	Hours 60	Total Credits 4
Course Objectives: - 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 Outcome: - Apply selection criteria and select an appropriate project from different options. - Write a work breakdown 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				
Unit 1: Defining: Project charter, Project scope, Inclusion and Exclusion, Budget				15
Unit 2: Planning: Resource management, Vendor management, work breakdown structure, risk analysis, project constraints, deliverables, Scheduling				15
Unit 3 Execution monitoring and controlling : Execution and tracking, monitoring deliverables, Risk assessment, gathering and analyzing data, maintain issue log verify and manage changes to the project				15
Unit 4 Closing: Ensure project deliverables confirm to quality standards, types of closures, Resource release, funds closure, archiving, lessons learnt, final closure				15
Text Books 1. Jack Meredith & Samuel Mantel, Project Management: A managerial approach, Wiley India, 7 th Ed. 2. A Guide to the Project Management Body of Knowledge (PMBOK® Guide), 5th Ed, Project Management Institute PA, USA 3. Gido Clements, Project Management, Cengage Learning. 4. Gopalan, Project Management , Wiley India 5. Dennis Lock, Project Management, Gower Publishing England, 9 th Ed.				

Semester 1	Subject Product cycle management	Category Elective	Hours 60	Total Credits 4
Course Objectives: · 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 Outcome: · 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				
Unit 1-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				20
Unit 2- 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				20
Unit 3- 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				20
Text Books: 1. John Stark, —Product Lifecycle Management: Paradigm for 21st Century Product Realisation, Springer-Verlag, 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. SaaksvuoriAntti, 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				

Semester 1	Subject Research Methodology	Category RM	Hours 60	Total Credits 4
Course Outcomes: · 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 Outcome: · 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 analyse research findings				
Unit 1- Descriptive Statistics Population and Sample collection, Data and Types of data, Methods of data collections, Data Presentation-Textual, Tabular and Graphical, Measures of central tendency: computation of means, median and mode from grouped and ungrouped data. Measure of dispersion: computation of Range, Quartile Deviation, Standard deviation, variance and their coefficients.				20
Unit 2- Correlation And Regression Measurement Correlation, Types of Correlation, Methods for finding correlation: Scatter Diagram Method, Karl Pearson's correlation co-efficient method, Spearman's Rank Correlation co-efficient, Regression Analysis, Regression co-efficient, Lines of regressions, Properties of regression co-efficient. SAMPLING TECHNIQUES: Sample, Population, Sampling, Methods of Sampling, Sampling and Non-Sampling errors. TESTS OF SIGNIFICANCE: Introduction, Null Hypothesis, Alternative Hypothesis, Test of Hypothesis, Type -I and Type-II Errors, Level of Significance, Degree of Freedom, One Tail and two tail test, standard error. Small Sample Test : Student's t-test, F-Test, Chi square test for Goodness of Fit, Independence of two Attributes, Homogeneity, One way and Two-way Analysis of Variance (ANOVA)				20
Unit 3- Research Tools MS EXCEL and R-Soft software: Introduction to MS-EXCEL and R-Soft software, statistical functions in MS EXCEL and R-Soft software. Introduction R Programming language, Drawing Graphs, Working with Data, Pivot tables and charts. Data Analysis using MS Excel such as graphs, statistical functions and tools, Calculation in Excel.				20
Text Books: 1.Fundamentals of Biostatistics by Irfan Ali Khan and Atiya Khanum UKaaZ Publication 2.Biostatistics: A Foundation for Analysis in The Health Science by Wayne W Daniel, Wiley Series in Probability and Statistic. Reference Books: 1. Introduction to Biostatics and Computer science - Y. I. Shah, Dr. A. R. Paradkar, and M. G. Dhaygude, Nirali Prakashan, Pune.				

Sem. – II

Semester 2	Subject Neural networks and Artificial intelligence in Biomedical instrumentation	Category Major	Hours 60	Total Credits 4
Course Objective: - To understand the basic concepts of artificial neural network (ANN) - To study the various ANN Models, study single layer and multilayer feed forward neural networks, familiarize about the support vector machine and adaptive resonance theory, - To study the basic concepts of Fuzzy sets and system, learn ANN in biomedical applications Course Outcome: - A Learner will be able to apply concepts of ANN in Biomedical applications, apply concepts of Fuzzy Sets in Biomedical applications				
Unit 1-Introduction to Neural Networks: Introduction Humans and Computers, Organization of the Brain, Biological Neuron, Types of medical and biological data, Objective of Neural networks, Biological, Characteristics of ANN, Historical Developments, Potential Applications of ANN. Classification of neural networks Fundamental of Artificial Neural Networks: Artificial Neuron Model, McCulloch-Pitts Model, Types of Neuron Activation Function, ANN Architectures, Learning Strategy, Learning Rules.				20
Unit 2 Artificial Intelligence: Definition, Intelligent machines, Foundation & history of artificial intelligence, Intelligent Agents, Benefits & risks of AI. Fuzzy System: Introduction, Fuzzy rule, Fuzzy inference Engine: Left and Right hand side of computation, Mamdani-style inference, Sugeno-style inference, Type 1 and Type 2 fuzzy system, Fuzzy C Mean clustering, Application of fuzzy logic in biomedical engineering.				20
Unit 3-Machine Learning Definition, Types of Learning: Supervised, Unsupervised, Active, Passive, Batch learning Hybrid Intelligent Systems, Natural Expert System, Neuro – Fuzzy System, ANFIS – Adaptive Neuro – Fuzzy Inference System, Evolutionary, neural and fuzzy system Genetic Algorithm: Introduction to optimization, Principle of natural selection, Simple genetic algorithm, Operators and parameters, Crossover, encoding methods, mutation.				20
Text Books: 1. Artificial Intelligence: A Guide to Intelligent Systems by Michael Negnevitsky, Pub: Addison Wesley Reference Books 1. Artificial Intelligence: A Modern Approach By: Stuart J. Russell and Peter Norvig. Publisher: Prentice Hall 2. Understanding Machine Learning By: Shai Shalev-Shwartz Shai Ben-David. Publisher: Cambridge University Press 3. Machine Learning by Tom M. Mitchell, Pub: McGraw-Hill				

Semester 2	Subject Biomedical Instrumentation And Design	Category Major	Hours 60	Total Credits 4
Course objectives: - To make students understand various types of medical instruments, their working principles, and applications. - To teach the students design concepts of some of the medical equipment. - To make students know instruments used in ICU, ICCU units. Instruments used for diagnosis of various disorders in body. - To understand concepts of telemedicine Course Outcome: - Students can design electro diagnostic instruments, understand use of medical equipment in various departments in the hospital and instrument's used for diagnostic, therapeutic, diagnosis, monitoring purposes				
Unit-1 Classification on the basis of applications and their working principles, techniques of blood pressure measurement, measurement of heart rate, measurement techniques for body temperature, respiration rate meter, Apnea detector. Specifications and design of ECG, EMG, EEG, PPG amplifiers and filters.				20
Unit-2 Intensive and coronary care units: Special care units, ICU/CCU equipment, bedside monitors circuits, central monitoring consoles, physiological telemetry & 4 Emergency equipment: Introduction and design concepts of cardiac pacemaker and defibrillator, types and application techniques, analysis of pacemaker and defibrillator waveform, Respiratory and pulmonary function monitoring equipment, clinical lab equipment				20
Unit-3 Therapeutic and general equipment: Ultrasound therapy, short wave therapy, nerve and muscle stimulator, infant incubator, haemodialysis machine, heart lung machine, cobalt therapy & 6 Analysis and processing of biosignals, suppression of artifacts in bio signals, extracting features of in bio signals, telemedicine				20
Text Books 1. - John G. Webster- Medical Instrumentation Applications and Design 3rd edition John Wiley and Sons. Inc. 1999 - Joseph J Carr, Joseph M. Brown- Introduction to Biomedical equipment technology, Pearson Education. Inc. 4th edition, 2008				

Semester 2	Subject Robotics in Medicine	Category Major	Hours 30	Total Credits 2
Course Objective: - To Understand Control of actuators in Robotic Mechanisms, robotic sensors and Kinematics of Robotic Arms - Learn the various sensor and actuators required for its functions Course Outcome: - It helps the learner to design a Robot for various applications like Surgery, therapy and clinical Applications. - Identify the fundamental concepts in robotic systems - Classify the conditions required for testing and control of autonomous robots				
Unit – 1 Robotics, Basic components, Classification, Performance characteristics, Drives and control systems, Electric, hydraulic and pneumatic actuators , control loops using current amplifier and voltage amplifiers.				10
Unit – 2 Sensors and vision systems: Transducers and sensors, Tactile sensors Proximity and range sensors, vision systems, Image processing and analysis, image data reduction, segmentation feature extraction, Object recognition.				10
Unit – 3 End effects, type Mechanical grippers, vacuum cups magnetic grippers, robot end effectors interface software for industrial robots. Positive stop program, point to point program and continuous path program. Applications of robots in biomedical field.				10
Text Books: - Richard D. Klafter, Thomas A. Chmielewski and Michael Negin, —Robotic Engineering: an integrated Approach, Prentice-Hall India,India, 2003. K. S. Fu, R. C. Gonzalez and C. S. G. Lee, —Robotics: Control, Sensing, Vision, and Intelligence, McGraw Hill, Singapore, 1987. Reference Books: - Robert J. Schilling, —Fundamentals of Robotics: Analysis and Control, Prentice-Hall India, India, 2005. - Saeed B. Niku, —Introduction to Robotics: Analysis, Systems, Applications, Pearson, India, 2003. - John J. Craig, —Introduction to Robotics: Mechanics and Control, Third Edition, Pearson, India , 2009.				

Semester 2	Subject Hospital Management	Category Major	Hours 30	Total Credits 2
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Course Objective: · To understand various features like hospital management, planning and design of various divisions in a hospital. ● Also emphasize is given on patient safety and certain Legal aspects Course Outcome: · The learner will be able to understand the complete designing of the hospital, its safety for patients, Also helps in understanding the supporting units in a hospital and hoe to deal various legal matters in a hospital ● Maintain various medical records and waste management. ● Identify various activities of departments like out/in patient and nursing.	
Unit 1 - Hospital Management System Role of Hospitals in Health Care, Hospital Planning and Design, Effective Hospital Management, Planning, Organizing, Controlling, Financial Management The Role of Hospital Administrator, Medical Records, Hospital Utilization Statistics, Materials Management, Marketing of Health Services, Evaluation of Hospital Services, Ethical and Legal Aspects of Hospital Administration, Disaster Management	10
Unit 2- Hospital Services & Information System: Biomedical department service,Radiology and Imaging Services, Laboratory Services Operation Theatre Suite,Pharmacy ,Central Sterile Supply Department (CSSD)Hospital Linen and Laundry Service.,Outpatient Services, The Nursing Unit and Nursing services	10
Unit 3- Biomedical Waste Management: Hospital Waste & Effect of Hospital Waste on Environment and Health Generation and Segregation Transport and Storage Treatment and Disposal of Waste Assignments	10
Text Books: 1.Electrical safety in Healthcare facility – H. H. Roth 2. Hospital Planning, Design and Management-Kunders Reference Books: 1. Biomedical Ethics for Engineers- Domiel A Vallero 2. Computer in Medicine – R. D. Lele	

Semester 2	Subject Cyber security law	Category Elective	Hours 60	Total Credits 4
Course Objectives: · To understand and identify different types cybercrime and cyber law · To recognized Indian IT Act 2008 and its latest amendments · To learn various types of security standards compliances Course Outcome: · Understand the concept of cybercrime and its effect on 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.				
Unit1: 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. Cyber offenses & Cybercrime: Social Engg, Cyber stalking, Cybercafé 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.				20
Unit 2: Tools and Methods Used in Cyberline: Phishing, Password Cracking, Key loggers and Spywares, Virus and Worms, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Over Flow, Attacks on Wireless Networks, Phishing, Identity Theft. Indian IT Act: Cyber Crime and Criminal Justice : Penalties, Adjudication and Appeals Under the IT Act, 2000,IT Act. 2008 and its Amendments				20
Unit 3: 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 Information Security Standard compliances: SOX, GLBA, HIPAA, ISO, FISMA, NERC, PCI.				20
Text Books: 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, New Delhi. Reference Books: 1. Cyber Law & Cyber Crimes By Advocate Prashant Mali; Snow White Publications, Mumbai 2. Nina Godbole, Information Systems Security, Wiley India, New Delhi 3. Kenneth J. Knapp, Cyber Security &Global Information Assurance Information Science Publishing.				

Semester 2	Subject Biorheology	Category Elective	Hours 60	Total Credits 4
Course Objective: · To understand various characteristics of tissue such as elasticity, Viscosity, Plasticity and also types of viscosity and Stress strain characteristics of tissue. · Also how tissues can be modelled will be understood. Course Outcome: · From the terms elasticity, plasticity and viscosity, and using Stress Strain Curve ,tissue modelling can be achieved.				
Unit1: Introduction to rheology and recap of basic equations of continuum mechanics (kinematics of deformation and stress analysis). Constitutive equations: General theory of constitutive equations Tissue and cell elasticity: Continuum approach (linear theory, nonlinear theory, strain energy function, prestress; examples) b. Tissue and cell elasticity: Microstructural approach (microstructural models of living tissues), statistical approach (thermodynamics of elastic deformation, rubber elasticity), examples				20
Unit 2: Tissue and cell viscoelasticity: Phenomenological approach (stress relaxation, creep, hysteresis, frequency and temperature effects), examples. Linear viscoelasticity: Continuum approach, lumped models, empirical models (power law, fractional calculus), structural damping, examples. Microstructural and molecular approach, polymer chain dynamics, examples				20
Unit 3: Elements of nonlinear viscoelasticity: Examples of empirical, semi empirical and molecular approaches in studies of living tissues Elements of tissue plasticity and viscoplasticity:(permanent deformation, hysteresis, yield stress), empirical and lumped models of plastic and viscoplastic behaviour of living tissues.				20
Text Books: 1. Fung, Y. C. Biomechanics – Mechanical Properties of Living Tissues, 2nd edition, Springer: New York, 1993. 2. Fung, Y. C. Biomechanics – Motion, Flow and Growth, Springer: New York, 1990. 3. Fung, Y. C. Bio dynamics – Circulation, Springer, 1984. Reference Books: 1. M. R. King (editor). Principles of Cellular Engineering: Understanding the Bio molecular Interface. Elsevier Academic Press, 2006. 2. Abé, H., K. Hayashi, and M. Sato (editors). Data Book on Mechanical Properties of Living Cells, Tissues, and Organs, Springer: Tokyo, 1996.				

PASSING PERFORMANCE GRADING :

The Performance Grading of the learner shall be on ten point scale be adopted uniformly.

Letter Grades and Grade Point

Semester GPA/ Program CGPA Semester / Program	% of Marks	Alpha-Sign/Letter Grade Result	Grading Point
9.00 – 10.00	90.0 - 100	O (Outstanding)	10
8.00 - < 9.00	80.0 < 90.0	A+ (Excellent)	9
7.00 - < 8.00	70.0 < 80.0	A (Very Good)	8
6.00 - < 7.00	60.0 < 70.0	B+ (Good)	7
5.50 - < 6.00	55.0 < 60.0	B (Average)	6
5.00 - < 5.50	50.0 < 55.0	C (Pass)	5
Below 5.00	Below 50	F (Fail)	0
AB (Absent)		Absent	

NOTE : VC : Vocational Courses, SEC : Skill Enhancement Courses, AEC : Ability Enhancement Courses, VEC : Value Education Courses, VSC : Vocational Skill Course, IKS : Indian Knowledge System, OJT: On The Job Training, FP: Field Projects.

The performance grading shall be based on the aggregate performance of Internal Assessment and Semester End Examination.

The Semester Grade Point Average (SGPA) will be calculated in the following manner: $SGPA = \frac{\sum CG}{\sum C}$ for a semester, where C is Credit Point and G is Grade Point for the Course/ Subject,

The Cumulative Grade Point Average (CGPA) will be calculated in the following manner: $CGPA = \frac{\sum CG}{\sum C}$ for all semesters taken together.

PASSING STANDARD:

Passing 50% in each subject /Course separate Progressive Evaluation (PE)/Internal Evaluation and Semester-End/Final Evaluation (FE) examination.

- A. Carry forward of marks in case of learner who fails in the Internal Assessments and/ or Semester-end examination in one or more subjects (whichever component the learner has failed although passing is on total marks).
- B. A learner who PASSES in the Internal Examination but FAILS in the Semester-end Examination of the Course shall reappear for the Semester-End Examination of that

Course. However, his/her marks of internal examinations shall be carried over and he/she shall be entitled for grade obtained by him/her on passing.

- C. A learner who PASSES in the Semester-end Examination but FAILS in the Internal Assessment of the course shall reappear for the Internal Examination of that Course. However, his/her marks of Semester-End Examination shall be carried over and he/she shall be entitled for grade obtained by him/her on passing

ALLOWED TO KEEP TERMS (ATKT)

- A. A learner shall be allowed to keep term for Semester II irrespective of the number of heads/courses of failure in the Semester I.
- B. A learner shall be allowed to keep term for Semester III wherever applicable if he/she passes each of Semester I and Semester II.

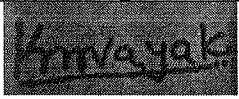
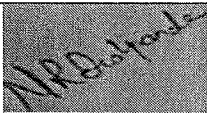
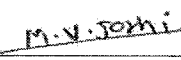
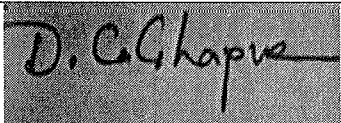
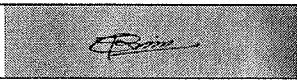
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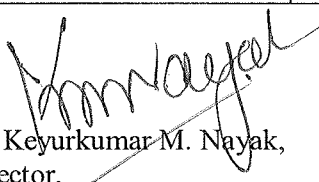
- C. A learner shall be allowed to keep term for Semester III wherever applicable irrespective of the number of heads/courses of failure in the Semester I & Semester II.
- D. A learner shall be allowed to keep term for Semester IV wherever applicable if he/she passes each of Semester I, Semester II and Semester III.

OR

- E. A learner shall be allowed to keep term for Semester IV wherever applicable irrespective of number of heads/courses of failure in the Semester I, Semester II, and Semester III

Syllabus
M.SC. (Biomedical Instrumentation)
(Semester I and II)
Team of Creation of Syllabus
Dt. 26th June, 2023

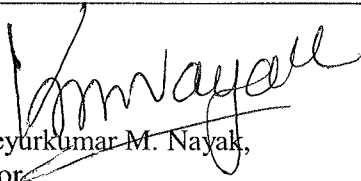
Name	College Name	Sign
Dr. Keyurkumar M. Nayak	Director, University of Mumbai's Garware Institute of Career Education and Development, BOS Chairman	
Dr. Neha Deshpande	Associate Professor, A. G. College, Pune Chairperson, Executive Committee, SVJCT's SEI	
Mr. Mandar Joshi	Course coordinator, SVJCT	
Ms. Pradnya Gokhale	Assistant Prof., SVJCT's SEI	
Dr. Niranjana Khambete	Manager, Clinical Engineering, Dinnanath Mangeshkar Hospital and Research center, Pune	
Dr. A. D. Shaligram	Emirates Professor, Dept. of Electronic science, SPPU, CEO, Research Park Foundation, SPPU	
Dr. Gourish Naik	Professor, School of Physical and Applied sciences, Goa University	
Prof. Dr. Damayanti Gharpure	Head, Dept. of Electronic science, SPPU	
Mr. Rajanish Waghase	Industry Expert	
Mr. Hariom Wable	Alumni Student, SVJCT	
Mr. Shubham Ranim	Alumni Student, SVJCT	

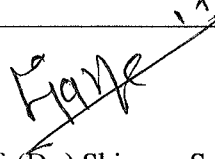

Dr. Keyurkumar M. Nayak,
Director,
UM-GICED


Prof. (Dr.) Shivram S. Garje
Dean, Faculty of Science

Justification for (M.Sc. Biomedical Instrumentation Science)

1.	Necessity for starting the course	The University of Mumbai's Garware Institute of Career Education & Development plans to introduce two years Full time M.Sc. (Biomedical Instrumentation). The training course in the field of Medical area is designed to give the students a comprehensive knowledge of the advanced level understanding of procurement methods, installation and maintenance of the medical instruments. The course also deals with the collection of information needed, supervision of installation commissioning, testing, reporting and documentation of these instruments.
2.	Whether the UGC has recommended the course:	Yes, UGC has recommended the course as per gazette no. DL(N)-04/0007/2003-05 dated 11th July 2014. UGC encourages the incorporation of skill oriented and value-added courses to develop skilled manpower.
3.	Whether all the courses have commenced from the academic year 2023-2024	Yes, it would be commencing from the Academic year 2023-24 as per NEP 2020. However, the course was launched in the year 2017.
4.	The courses started by the University are self-financed, whether adequate number of eligible permanent faculties are available?	Yes, this course is self-financed. The expert visiting faculty from industries come to teach this course.
5.	To give details regarding the duration of the Course and is it possible to compress the course?	The duration of the course in Two years (Four Semester). It cannot be further compressed
6.	The intake capacity of each course and no. of admissions given in the current academic year:	The intake capacity of this course is 30 students. The admission procedure is still ongoing.
7.	Opportunities of Employability/ Employment available after undertaking these courses:	The students completing this course have career opportunities as Hospital Administrator, Laboratory instrument technical assistant, Technology manager, Laboratory manager, Research associate, Medical record technician, Laboratory assistant, etc. This is primarily because careers in the Medical industry require a lot of special skills


 Dr. Keyurkumar M. Nayak,
 Director,
 UM-GICED


 Prof. (Dr.) Shivram S. Garje
 Dean, Faculty of Science