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/2024-25/427 Date : 24th March, 2025

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

Sub : B.Sc (Biomedical Instrumentation) (Three 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. **9.3 (C) 3 (N)** and subsequently approved by the **Management Council** at its meeting held on **14th August, 2024 vide** Item No. **6** 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 **B.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 Program	Ordinance no. for Title	Ordinance no. for Eligibility	Duration
A	U.G. Certificate in Biomedical Instrumentation	O.GUA – 519 A	O.GUA – 520 A	One year
B	U.G. Diploma in Biomedical Instrumentation	O.GUA – 519 B	O.GUA – 520 B	Two year
C	B.Sc (Biomedical Instrumentation)	O.GUA – 519 C	O.GUA – 520 C	Three year
D	B.Sc (Hons) (Biomedical Instrumentation)	O.GUA – 519 D	O.GUA – 520 D	Four year

2/-

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No. AAMS_UGS/ICD/2024-25/427 Date: 24th March, 2025

Regulation No	
Duration	R.GUA – 546
Intake Capacity	R.GUA – 547
Scheme of examination	R.GUA – 548
Standard of Passing	R.GUA – 549
Credit Structure	R.GUA – 550 A
	R.GUA – 550 B
	R.GUA – 550 C
	R.GUA – 550 D
	R.GUA – 550 E
	R.GUA – 550 F
	R.GUA – 550 G
	R.GUA – 550 H

(Dr. Prasad Karande)
REGISTRAR

A.C/9.3(C)3(N)/01/11/2023
M.C/6/14/8/2024

****

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.Chadrashekhar 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 direcotr@dsw.mu.ac.in
6	The Director, Department of Information & Communication Technology, director.dict@mu.ac.in

AC-1/11/2023
Item No- 9.3 (C) - 3

As Per NEP 2020

University of Mumbai

Title of the program

A- U.G. Certificate in Biomedical Instrumentation
B- U.G. Diploma in Biomedical Instrumentation
C- B.Sc. (Biomedical Instrumentation)
D- B.Sc.(Hons.) (Biomedical Instrumentation)

(Garware Institute of Career Education and Development)

Syllabus for
Semester- Semester I and II

Ref: GR dated 20th April,2023 for Credit Structure of UG

(with effect from the academic year 2023-24 Progressively)

UNIVERSITY OF MUMBAI

(AS PER NEP 2020)

Sr. No.	Heading	Particulars	
1	Title of program O: GUA – 519 A	A	U.G. Certificate in Biomedical Instrumentation
	O: GUA – 519 B	B	U.G. Diploma in Biomedical Instrumentation
	O: GUA – 519 C	C	B.Sc. (Biomedical Instrumentation)
	O: GUA – 519 D	D	B.Sc.(Hons.) (Biomedical Instrumentation)
2	Eligibility O: GUA – 520 A	A	12th Science **OR** Passed Equivalent Academic Level 4.0 Admissions on the basis of Written Test & Interview. 50% passing marks in the Entrance assessment.
	O: GUA – 520 B	B	1. The candidate who has successfully completed U.G. Certificate in Biomedical Instrumentation. **OR** Passed Equivalent Academic Level 4.5 2. The candidate who's Under Graduate Certificate credits are 60% equivalent to U.G. Diploma in Biomedical Instrumentation & he/she earns minimum 8 Credits from U.G. Certificate in Biomedical Instrumentation with 12th Science 3. As per NEP criteria on the basis of RPL-Recognition of Prior Learning, Candidate to be admitted to 2nd Year subject to He/she securing minimum 50% in the 1st Year assessment of U.G. Certificate in Biomedical Instrumentation with 12th Science

	O: GUA – 520 C	C	1. The candidate who has successfully completed U.G. Diploma in Biomedical Instrumentation **OR** Passed Equivalent Academic Level 5.0 2. The candidate who's Under Graduate Diploma credits are 60% equivalent to B.Sc. (Biomedical Instrumentation) & he/she earns minimum 8 Credits from U.G. Diploma in Biomedical Instrumentation with 12th Science 3. As per NEP criteria on the basis of RPL-Recognition of Prior Learning, Candidate to be admitted to 3rd Year subject to He/she securing minimum 50% in the 2nd Year assessment of U.G. Diploma in Biomedical Instrumentation with12th Science
	O: GUA – 520 D	D	1. Candidate who has successfully completed B.Sc. (Biomedical Instrumentation) with minimum CGPA of 7.5 **OR** Passed Equivalent Academic Level 5.5
3	Duration of Program R: GUA-546	A	1 Year
		B	2 Years
		C	3 Years
		D	4 Years
4	R: GUA-547 Intake Capacity	30	
5	R: GUA-548 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: GUA-549	50% in each component	
7	Credit Structure R: GUA-550 A R: GUA-550 B R: GUA-550 C R: GUA-550 D R: GUA-550 E R: GUA-550 F R: GUA-550 G R: GUA-550 H	Attached herewith	
8	Semesters	A	Sem I & II
		B	Sem I, II, III, & IV
		C	Sem I, II, III, IV, V, & VI
		D	Sem I, II, III, IV, V, VI, VII & VIII
9	Program Academic Level	A	4.5
		B	5.0
		C	5.5
		D	6.0
10	Pattern	Semester	
11	Status	New	
12	To be implemented from Academic Year Progressively	From Academic Year 2023-24	

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

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

Preamble

1) **Introduction:**
This is an undergraduate Biomedical Instrumentation Science course. This is an allied health professional course. It is concerned with the basic understanding of working principle of diagnostic and therapeutic equipment's, 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. The syllabus of the course is revised as per new NEP format, with multiple entry and exit points.

2) Program Objectives:

1. To provide sound knowledge of basic sciences, human anatomy, human physiology, electrical and electronic systems, building a strong foundation for career advancement.
2. To develop a logical approach, analytical thinking and problem solving capabilities in order to make the learner competent to face and address the global challenges in their chosen field.
3. To impart technical knowledge and competency skills to perform in various areas like sales & marketing, product engineering, research-development, hospital administration, regulatory affairs and also to venture into entrepreneurship.
4. To develop proficiency in various soft skills and bring awareness about social obligations and professional ethics to pursue professional career in a healthcare industry.
5. Motivate to pursue research and specialization in a plethora of domains in the field of Biomedical Instrumentation, Bio sensors, IOT, critical care and other diagnostic and therapeutic equipments, etc.

3) Program outcome:

1. Students will have apt knowledge about human anatomy and basic of science.
2. They will be able to demonstrate a good understanding about diagnostic and therapeutic equipments
3. Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
4. Apply ethical principles and commit to professional ethics and responsibilities.
5. Communicate effectively on complex engineering activities with the technical and medical community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations and give and receive clear instructions.

5) Credit Structure of the program - (Parishisth-2)

R_____A

B.Sc. (Biomedical Instrumentation)											
Curriculum Framework											
FIRST YEAR											
Level	**Semester**	**Major**		**Minor**	**OE**	**VSC, SEC (VSEC)**	**AEC, VEC, IKS**	**OJT, FP, CEP, CC, RP**	**Cum. Cr./ Sem.**	**Cumulative**	
		Mandatory	**Electives**								
		4-6(4+2)			2+2	VSC 2+SEC 2	AEC 2, VEC 2, IKS 2	CC2			
4.5	I	Human Anatomy and Physiology (4 Credits)	--	--	Basics of IT (2 credits) And Basic Concepts of Psychology (2 Credits)	VSC: Basic Electrical Circuits for Biomedical Instrumentation (2 Credits) SEC: Introduction of Life Skills 1 (2 Credits)	AEC: English (2 Credits) VEC: Understanding India (2 Credits) IKS (2 credits)	Yoga (2 Credits)			
		4	**0**	**0**	**4**	**4**	**6**	**2**	**20**		
	II	Sensor Transducer and Signal Conditioning (4 Credits) And Medical Physics (2 Credits)	--	Digital Electronics (2 Credits)	Fundamentals of Chemistry (2 Credits) and Social Psychology (2 Credits)	VSC: Analytical Instrumentation (2 Credits) And SEC: Introduction to Life Skills 2 (2 Credits)	AEC: English-II (2 Credits) VEC: Environmental Science (2 Credits)	Sports (2 Credits)			
		6	**0**	**2**	**4**	**4**	**4**	**2**	**22**		
Cum Cr.		**10**	**0**	**2**	**8**	**8**	**10**	**4**	**42**		
Exit Option: Award of UG Certificate in Major with 40-44 Credits											

R_____B										
Level	**Semester**	**Major**		**Minor**	**OE**	**VSC,SEC (VSEC)**	**AEC, VEC, IKS**	**OJT, FP, CEP, CC, RP**	**Cum. Cr. / Sem.**	**Cumulative**
		Mandatory	**Electives**							
		6(4+2) – 8(2*4)		**4**	**2**	**VSC 2**	**AEC 2**	**FP 2 CC 2**		
5.0	III	Biomedical Instrumentation –I (4 Credits) Medical Imaging -I (2Credits)		Basic Electronics (Differential amplifiers Power Electronics) (4 Credits)	Human Rehabilitation Engineering (2 Credits)	Demonstration biomedical hazards and safety (2 Credits)	AEC: Marathi-I (2 Credits)	FP-Hospital Visits (2 Credits) + Zumba (2 Credits)	20	
		6	**0**	**4**	**2**	**2**	**2**	**4**	**20**	
		6 (4+2)		**4**	**2**	**VSC-2**	**AEC-2**	**FP-2 CC-2**		
	IV	Biomedical Instrumentation –II (4 Credits) Medical Imaging - II (2 Credits)		Microcontroller-8051 and Arduino (4 Credits)	Basics of Research methodology and Statistics (2 Credits)	Arduino Workshop (2 Credits)	Marathi-II (2 Credits)	CC-Co-Curricular activities (2 Credits) CEP Field / Hospital Visits (2 Credits)	20	
		6	**0**	**4**	**2**	**2**	**2**	**4**	20	
	Cum Cr.	**12**	**0**	**8**	**4**	**4**	**4**	**8**	**40**	
	Total Cr.	**22**	**0**	**10**	**12**	**12**	**14**	**12**	**82**	

R_____C

THIRD YEAR										
Level	**Semester**	**Major**		**Minor**	**OE**	**VSC,SEC (VSEC)**	**AEC, VEC, IKS**	**OJT, FP, CEP, CC, RP**	**Cum. Cr./ Sem.**	**Cumulative**
		Mandatory	**Electives**							
LEVEL 5.5		**8 (2*4) or 10(2*4+2)**	**4**	**4-6**		**VSC 2-4**		**FP/CEP 2**		
	V	Hospital Structure designing (4 Credits + Troubleshooting techniques (4 Credits)	Biomedical Image processing (4 Credits)	Wireless communication (4 Credits)		Project (4 Credits)		FP- Hospital visits (2 Credits)	22	UG Degree
	Cr.	**8**	**4**	**4**	**0**	**4**	**0**	**2**		
	VI	Embedded Systems in Medicine (4 Credits) + Hospital Waste management (4 Credits)	Reliability and Quality control (4 Credits)	Introduction to Raspberry Pi & Python (4 Credits)				Internship (4 Credits)	20	
	Cr.	**8**	**4**	**4**	**0**	**0**	**0**	**4**	**20**	
	Cum Cr.	**16**	**8**	**8**	**0**	**4**	**0**	**6**	**42**	
	Total Credits in 3rd Year	**38**	**8**	**18**	**12**	**16**	**14**	**18**	**124**	
Exit Option: Award of UG Degree in Major with 120-132 credits										

R_____D

FOURTH YEAR										
Level	**Semester**	**Major**		**Minor**	**OE**	**VSC, SEC (VSEC)**	**AEC, VEC, IKS**	**OJT, FP, CEP, CC, RP**	**Cum. Cr./ Sem.**	**Cumulative**
		Mandatory	**Electives**							
6.0	VII	**(2*4 +2*2) or (3*4 +2)**	**4**	**RM:4**						
		Advanced Digital image processing techniques in Biomedical instrumentation (4 Credits) + Advanced Prosthetics, Orthotics & Rehabilitation Techniques (2Credits) + Biomems (2 Credits) + Clinical Instrumentation and Patient Safety(4 Credits)	Hospital management (4 Credits)	Research Methodology (4 Credits)					20	
	Cum Cr.	**12**	**4**	**4**					**20**	
	8	(2*4 +2*2) or (3*4 +2)	4					OJT (4)		
	VIII	Neural networks and Artificial	IPR Issues, Standards and					Internship (4	20	

		intelligence in Biomedical instrumentation (4 Credits) + Tissue Engineering (4 Credits) + Robotics in Medicine (2 Credits) + Economics in Healthcare and project management (2 Credits)	Bioethics (4 Credits)					Credits)		
		12	**4**	**0**	**0**	**0**	**0**	**4**	**20**	
	Total Credits in 4th Yrs	**24**	**8**	**4**	**0**	**0**	**0**	**4**	**40**	
	Final Cum. Cr.	**62**	**16**	**22**	**12**	**16**	**14**	**22**	**164**	
Four Year UG Honours with Research Degree in Major and Minor with 164 Credits										

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

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

Credit structure and detailed syllabus with text books, reference books and evaluation pattern

			Assessment Pattern				
	Subject Code	**Subject**	**Internal Marks**	**External Marks**	**Total Marks**	**Total Hours**	**Total Credits**
SEMESTEr I		Major					
	BSCBIS1MJP1	Human anatomy and Physiology	50	50	100	60	4
		Open Elective					
	BSCBIS1MJP2	Basics of IT	25	25	50	30	2
	BSCBIS1MJP3	Basic Concepts of Psychology	25	25	50	30	2
	BSCBIS1MJP4	Basic Electrical circuits for Biomedical Instrumentation	25	25	50	30	2
	BSCBIS1MJP5	Introduction of Life skills-I	25	25	50	30	2
	BSCBIS1P6	English Language-I	25	25	50	30	2
	BSCBIS1P7	Foundation course-Understanding India	25	25	50	30	2
	BSCBIS1P8	IKS	50	--	50	30	2
	BSCBIS1P9	Yoga	50	--	50	60	2
	Total		**300**	**200**	**500**	**330**	**20**

	Subject Code	Subject	Internal Marks	External Marks	Total Marks	Total Hours	Total Credits
		Major					
SEMESTEr II	BSCBIS2MJP10	Sensor Transducer and Signal conditioning	50	50	100	60	4
	BSCBIS2P11	Medical Physics	25	25	50	30	2
		Minor					
	BSCBIS2MRP12	Digital Electronics	25	25	50	30	2
		Open Elective					
	BSCBIS2P13	Fundamentals of Chemistry	25	25	50	30	2
	BSCBIS2P14	Social Psychology	25	25	50	30	2
	BSCBIS2P15	Analytical Instrumentation	25	25	50	30	2
	BSCBIS2P16	Introduction to life skills-II	25	25	50	30	2
	BSCBIS2P17	English –II	25	25	50	30	2
	BSCBIS2P18	Foundation Course-Environmental Science	25	25	50	30	2
	BSCBIS2P19	Sports	50	--	50	60	2
	Total		**300**	**250**	**550**	**360**	**22**

	Subject Code	Subject	Internal Marks	External Marks	Total Marks	Total Hours	Total Credits
SEMESTEr III		Major					
	BSCBIS3 MJP20	Biomedical Instrumentation –I	50	50	100	60	4
	BSCBIS3 MJP21	Medical Imaging- I	25	25	50	30	2
		Minor					
	BSCBIS3 MRP22	Basic Electronics (Differential amplifiers Power Electronics)	50	50	100	60	4
		Open Elective					
	BSCBIS3 P23	Human Rehabilitation Engineering	25	25	50	30	2
	BSCBIS3 P24	Demonstration biomedical hazards and safety	50	-	50	30	2
	BSCBIS3 P25	Advanced Indian Language (Marathi- I)	25	25	50	30	2
	BSCBIS3 P26	Hospital visits	50	--	50	--	2
	BSCBIS3 P27	Zumba	50	--	50	60	2
	Total		**325**	**175**	**500**	**300**	**20**

	Subject Code	Subject	Internal Marks	External Marks	Total Marks	Total Hours	Total Credits
SEMESTEr IV		Major					
	BSCBIS4 MJP28	Biomedical Instrumentation –II	50	50	100	60	4
	BSCBIS4 P29	Medical Imaging -II	25	25	50	30	2
		Minor					
	BSCBIS4 MRP30	Microcontroller-8051 and Arduino	50	50	100	60	4
		Open Elective					
	BSCBIS4 P31	Basics of Research methodology and Statistics	25	25	50	30	2
	BSCBIS4 P32	Arduino Workshop	50	--	50	60	2
	BSCBIS4 P33	Advanced Indian Language (Marathi- II)	25	25	50	30	2
	BSCBIS4 P34	Co-Curricular activities	50	--	50	30	2
	BSCBIS4 P35	Field / Hospital Visits	50	--	50	60	2
	Total		**325**	**175**	**500**	**360**	**20**

	Subject Code	Subject	Internal Marks	External Marks	Total Marks	Total Hours	Total Credits
Semester-V		Major					
	BSCBISMJ5P36	Hospital Structure designing	50	50	100	60	4
	BSCBIS5MJP37	Troubleshooting techniques	50	50	100	60	4
		Elective					
	BSCBIS5P38	Biomedical Image processing	50	50	100	60	4
		Minor					
	BSCBIS5MRP39	Wireless Communication assisted medical instrumentation	50	50	100	60	4
	BSCBIS5P40	Project	100	-	100	120	4
	BSCBIS5P41	Field /hospital visits	50	-	50	--	2
	Total		**350**	**200**	**550**	**300**	**22**

Semester-VI	Subject Code	Subject	Internal Marks	External Marks	Total Marks	Total Hours	Total Credits
		Major					
	BSCBIS6P42	Embedded Systems in Medicine	50	50	100	60	4
	BSCBIS6P43	Hospital Waste Management	50	50	100	60	4
		Elective					
	BSCBIS6P44	Reliability and Quality control	50	50	100	60	4
		Minor					
	BSCBIS6P45	Introduction to Raspberry Pi & Python	50	50	100	60	4
	BSCBIS6P46	Internship	100	-	100	120	4
	Total		**300**	**200**	**500**	**360**	**20**

Semester-VII	Subject Code	Subject	Internal Marks	External Marks	Total Marks	Total Hours	Total Credits
		Major					
	BSCBIS7MJP47	Advanced Digital image processing techniques in Biomedical instrumentation	50	50	100	60	4
	BSCBIS7MJP48	Advanced Prosthetics, Orthotics & Rehabilitation Techniques	25	25	50	30	2
	BSCBIS7MJP49	Biomems	25	25	50	30	2
	BSCBIS7MJP50	Clinical Instrumentation and Patient Safety	50	50	100	60	4
		Elective					
	BSCBIS7P51	Hospital management	50	50	100	60	4
		Minor					
	BSCBIS7MRP52	Research Methodology	50	50	100	60	4
	Total		**250**	**250**	**500**	**300**	**20**

	Subject Code	Subject	Internal Marks	External Marks	Total Marks	Total Hours	Total Credits
Semester-VIII	BSCBIS8MJP53	Neural networks and Artificial intelligence in Biomedical instrumentation	50	50	100	60	4
	BSCBIS8MJP54	Tissue Engineering	50	50	100	60	4
	BSCBIS8MJP55	Robotics in Medicine	25	25	50	30	2
	BSCBIS8MJP56	Economics in Healthcare and project management	25	25	50	30	2
		Elective					
	BSCBIS8P57	IPR Issues, Standards and Bioethics	50	50	100	60	4
	BSCBIS8P58	Internship	100	-	100	120	4
	Total		**300**	**200**	**500**	**360**	**20**

Sem.-I

Syllabus for first year B.Sc. Biomedical Instrumentation course as per NEP

Semester - I

Course: Human anatomy and Physiology

Course Objectives:

- To understand the human anatomy and functions of various body structure.
- To understand different physiological processes taking place inside human body.
- To understand the basics of instrumentation involved in measuring of biological parameter

Paper No.	Subject	Total Hours	Total Credits
BSCB IS1P1	**Human anatomy and Physiology:** **Unit 1:** **Cell, Blood and Alimentary System** Structure and function of cell, polarization and depolarization process ,Basic tissues and their functions Composition of blood, Types of Blood cells and their functions, Blood groups, Blood coagulation process All organs of Digestive systems, secretion and functions **Practical:** 1) In-vitro recognition of A, B, O blood groups by slide test. 2) To determine hemoglobin count in the blood by Sahli's method. **Unit 2:** **Cardiovascular and Respiratory System** Structure of heart, cardiac cycle, conducting and circulatory system of heart, Blood pressure and ECG ,Einthoven's triangle Anatomy of Respiratory system, Internal and External respiration process, Lung volume and capacities, Spirometer **Practicals:** To measure Blood Pressure using sphygmomanometer using occlusive cuff method. **Unit 3:** **Nervous system, Sensory Organs and Excretory system** Structure of Neuron, Anatomy of different parts of Nervous system and their function, Generation of Nerve conduction and action potential, Reflex actions Structure and function of Eye ,formation of image on retina Structure and function of Ear and hearing mechanism Structure of Nephron, Urine formation and functions of kidney **Practical demonstrations:** Visit to the hospital anatomy department	**60**	**4**

Course Outcome:

Learners will be able to :

- Understand structure and function of a cell, basic tissues and their functions.
- Know the composition of blood, blood cells with their functions, basics of blood counting, blood grouping and coagulation of blood.
- Understand organs of digestive system, secretions and their functions. To understand the process of digestion.
- Understand the anatomy of cardiovascular system the basics of blood pressure,ECG ,Einthoven's triangle.
- Understand the anatomy of respiratory system, internal and external respiration basics of lung volume and capacities.
- Understand structure of neuron, anatomy of different parts of nervous system and their functions, reflex action, distinguish different parts of eyes and ear, their structure and function, understand the hearing mechanism and image formation on retina.
- Understand anatomy of excretory system, structure and function of nephron, understand the process of urine formation.
- To know the functions of kidneys.

Text books:

- Anatomy and Physiology in Health and Illness: Ross and Wilson. (ELBS Pub)
- Human Physiology :C.C. Chatterjee (CBS Pub.11th Edi.)

Reference Books:

- Physiology of Human Body. : Guyton. (Prism Book)
- Review of Medical Physiology: William Ganong. (Prentice Hall Int)
- Principles of Anatomy and Physiology: Tortora and Grabowski. (Harper collin Pub)
- Anatomy and Physiology: Elaine N Marieb. (Pearson Education)

Course: Basics of IT

Course Objectives:

- To make students aware of hardware and software devices, using computer and managing computer resources using disk management, task bar, command prompt, etc.
- To help students use Microsoft office and Libre office tool efficiently
- To make students aware of different networking topologies and google services.

BSCB IS1P2	**Basics of IT** Unit 1: Computer Hardware and Software: I/O devices, Operating systems, Device manager, Software Installation, Disk management, task manager. **Unit 2:** MS Office vs Libre office: Word, Excel, Power point, Outlook. **Unit 3:** Internet: Introduction to internet, command prompt, Ip address and MAC address, google drive, DNS servers and IP protocols **Demonstrations:** 1) Document creation:-Word 2) Data analysis-Excel 3) Power point presentation 4) Using Command line interface to check IP, Ping a server, directory	**30**	**2**

Course Outcomes:

- After completion of the course, students will be able to:
- Create and use Microsoft office tools efficiently.
- Create powerpoint presentations effectively
- Check IP address, MAC address and use command prompt.
- Gain knowledge on DNS servers, communication protocols, etc.

Reference books :

- Go with Microsoft office 365 by Shelley Gaskin
- Fundamentals of Computer and Information Technology-R.S. Salaria

Course: Basic Concepts of Psychology

Course Objectives:

- To prepare the students for basic and general aspects of psychology.
- To introduce various elements of memory.

BSCB IS1P3	**Basic Concepts of Psychology:** **Unit 1** The Science of Psychology a) What is Psychology? b) Psychology then: History of Psychology c) Psychology now: Modern Perspectives d) Types of Psychological professionals e) Scientific and Descriptive Methods **Unit 2** Memory as science a) Memory: Encoding, Storage, Retrieval b) Models of memory – LOP and PDP c) The information-processing model – sensory, short-term and long-term memory d) Retrieval of Long-Term Memories e) Forgetting	**30**	**2**

Course Outcome-

- A learner will be able to understand about basic and general aspects of psychology.
- A learner will be able to understand various elements of memory.

Reference Book:

- Ciccarelli S.K., (2018), Psychology (Fifth Edition), Pearson Education Limited (2018)

Course: Basic Electrical circuits for Biomedical Instrumentation

Course Objectives:

- To make students aware of single phase and three phase electrical connections.
- To make students aware of electrical safety in hospitals and equipment's.
- To make students learn AC to DC conversion and vice versa.
- To help students check equipment safety.

<table>
<tr><td>BSCB IS1P4</td><td>Basic Electrical circuits for Biomedical Instrumentation
Unit 1:
AC systems:
Single phase and 3 phase, Electrical earthing, Frequency, amplitude, stabilized power supply, UPS, Inverters, Transformers and its types, Isolation transformer and its use for electrical safety, Fuse and circuit breakers

Unit 2
DC Systems: Grounding, difference between earthing and grounding, batteries and its types, AC to DC rectifiers- half wave and full wave. Switches and its types

Practical Demonstrations:
● Use of multimeter.
● Testing of equipments.
● AC and DC waveforms on CRO.</td><td>30</td><td>2</td></tr>
<tr><td colspan="4">Course Outcome:
● Students will be able to know the basics of AC and DC systems
● They will be able to observe the sine wave and DC wave on CRO
● They will be able check multiple parameters using a multimeter.</td></tr>
<tr><td colspan="4">Reference books:
● Biomedical Engineering Handbook by Bronzino (CRC Press)
● Electrical circuits Vol-I by BL Theraja</td></tr>
<tr><td colspan="4">Course: Introduction of Life skills-I
Course Objectives:
● To develop the ability of creative thinking in students which will help themselves to look beyond their direct experiences and address in a perspective which is different from the obvious or the norm.
● To develop decision making and problem solving ability in students.
● To develop interpersonal skills for students</td></tr>
<tr><td>BSCB IS1P5</td><td>Introduction to Life Skills
Unit 1
Life Skills : Introduction
a) Self Awareness
b) Empathy
c) Communication Skills
d) The Interpersonal Skills
e) Stress Management

Practicals:
Health Promotion using Life Skill Approach
a) Activity 1-Self Awareness
b) Activity 2-Empathy
c) Activity 3-Communication Skills
d) Activity 4-The Interpersonal Skills
Activity 5-Stress Management</td><td>30</td><td>2</td></tr>
</table>

Course outcome:

- After the course, students will have improved communication skills.
- Students will be able to manage stress more efficiently.
- Students will develop more confidence.

Reference books:

- Chorghade S & Pangaonkar Shailesh (2018),Introduction to Life Skills ,Nathe Publication Limited
- Dr.Bharat S & Dr.K.V.Kishore Kumar (2005), Activity Manual For The Teachers On Health Promotion using Life Skills Approach, NIMHSNS Publication No.53.

Course: English Language-I

Course Objectives:

- To Bridge the gap for students who are having English as 2nd and 3rd language and help them write properly.
- To help students understand basics of English and construction of grammatically correct sentences.
- To develop the habit of reading and understanding the technicalities.

BSCBIS1P6	**English Language-I** **Unit 1:** Basics of English: Parts of Speech, Tenses, Voice (Active and passive), idioms and phrases, Introduction to dialogues and monologues **Unit 2:** Communication: Theory of communication and its 5 types, Modes of communication (verbal and non-verbal), Barriers and strategies, Inter personal and group communication **Unit 3:** Reading and understanding: Close reading, Comprehension, Summary, Paraphrasing, Analysis and interpretation **Assignment:** Read any of the following books • The diary of Anne Frank • Rich Dad Poor Dad • Think and grow rich	**30**	**2**

Course Outcome:

- Students will be able to differentiate between different parts of speech in a sentence.
- Understand tenses used and use it properly to construct paragraphs.
- Students will be able to communicate properly in verbal and non-verbal modes.

Reference Books:

- Nicholls, Anne. Mastering Public Speaking. Jaico Publishing House, 2003.
- Aggarwal, R.S. Quantitative Aptitude. S.Chand &Co., 2004.
- Leigh, Andrew and Michael Maynard. The Perfect Leader. Random House Business Books,1999.
- Whetton .A.David and Kim S. Cameron. Developing Management Skills. Pearson Education, 2007.
- K.R. Lakshminarayan. Developing Soft Skills. Scitech, 2009.

Course: Foundation Course- understanding India

Course Objectives:

- To make students aware and accept the multicultural diversity on Indian society, with reference to demographic composition like religion, caste, sex, etc.
- To make students aware of the disparities arising in Indian society due to unequal sex ration, female foeticide, casteism and ways to overcome such issues.
- To help students understand pros and cons of globalization, liberalization, privatization.

BSCB IS1P7	**Understanding India** **Unit – 1** **Overview of Indian Society** Understand the multi-cultural diversity of Indian society through its demographic composition: population distribution according to religion, caste, and gender; Appreciate the concept of linguistic diversity in relation to the Indian situation; Understand regional variations according to rural, urban and tribal characteristics; Understanding the concept of diversity as difference **Unit 2:** Concept of Disparity Understand the concept of disparity as arising out of stratification and inequality; Explore the disparities arising out of gender with special reference to violence against women, female foeticide (declining sex ratio); Appreciate the inequalities faced by people with disabilities (physical and mental disabilities); Understand conflicts arising out of casteism, communalism, regionalism and linguism and examine their causes and effects **Unit 3:** The Indian Constitution Philosophy of the Constitution as set out in the Preamble; The structure of the Constitution-the Preamble, Main Body and Schedules; Fundamental Duties of the Indian Citizen; tolerance, peace and communal harmony as crucial values in strengthening the social fabric of Indian society; Basic features of the Constitution; The Universal Declaration of Human Rights; Human Rights constituents with special reference to Fundamental Rights stated in the Constitution **Unit 4:** Globalization and Indian Society Understanding the concepts of liberalization, privatization and globalization; Growth of information technology and communication and its impact manifested in everyday life; Impact of globalization on industry: changes in employment and increasing migration; Changes in agrarian sector due to globalization; rise in corporate farming and increase in farmers' suicides	**30**	**2**

Course Outcome:

- At the end of the course, students will have a better understanding on the unity in diversity fabric of the Indian society.
- The students will be able to understand the need to overcome atrocities happening in the society in the name female foeticide, religion, caste discrimination, etc.

Reference Books:

- Foundation Course by Manan Prakashan
- Foundation Course by Sheth Publishers

Course: Indian Knowledge Systems (IKS)-Sushruta

Course Objectives :

- To make students aware of the ancient Indian technology
- To make students aware of the traditions and customs followed in India and how they had scienctific purpose attached to it.

	IKS- Sushruta 1. Ancient instruments 2.Medieval instruments 3. Recent instruments	**30**	**2**

Course Outcome:

- After the course, students will be able to understand the rich heritage of the Indian society.
- The students will be able to know the customs followed and how it had relevance as per modern science.
- How cultural heritage was more advanced than any other society.

Reference Book:

- Sushruta Samhita by Kaviraj Bhishagratna

Course: Yoga

Course Objectives:

To develop physical fitness awareness for students

To help students have mental stability, stress management by practicing meditation and yoga.

BSCB IS1P8	**Yoga** a) Yoga meaning and definitions b) Rules and regulations for yoga c) Miss conception about yoga d) Yoga & Health **Practical-** **Level 1** 1. Padmasana 2. Ardha Chakrasana 3. Makarasana 4. Uittina Dwipadasana **Level 2** 1. Vajrasana 2. Yoga Mudrasana 3. Bhujangasana 4. Surya Namaskara **Level 3** **1.** Paschimottanasana	**60**	**2**

	2. Pada Hastasana 3. Shalabhasana 4. Pavana Muktasana **Level 4** **1**. Vakrasana 2. Trikonasana 3. Dhanurasana 4. Shawasana **Level 5** 1. Utrasana 2. Vrikshasana 3. Shashankasana 4. Deep Breathing Practice **Level 6** **1.** Badha Konasana 2. Janu Shirashasana 3. Gomukhasana 4. Nadishodhna Pranayama		
Course outcome: ● Students will be able to perform different yogasanas which will aid in their physical fitness. ● They will have a more balance life with physical and mental fitness.			
References: Yoga should be performed under the guidance of a certified yoga trainer.			

Sem.-II

<table>
<tr><th colspan="4">Semester - II</th></tr>
<tr><td colspan="4">Course: Sensor Transducer and Signal conditioning
Course Objectives:
● To make students aware of different sensors and their working principles.
● To make students aware of the concept of Noise, amplification, and signal conditioning.
● To make students aware of different Bio potential electrodes and chemical sensors.
● To provide a thorough understanding of principle and working of transducers and sensors used for measuring displacement, motion, force, pressure, temperature, biopotentials, biochemical concentrations.</td></tr>
<tr><td>BSCB IS2P9</td><td>Unit 1:
Sensors: Temperature, Motion, Pressure, Displacement, Weight sensors, Magnetic sensors, Flow Sensors, Optical Sensors, Ranging sensors and Special sensors.

Unit 2:
Analog and Digital Signal conditioning: Signal conditioning, Loading effects, Bridges for measurement techniques, Wheatstone, Wein, Kelvin’s, Maxwell bridge and Hey bridge, Applications of Attenuators, Amplifiers and Passive filters in signal conditioning, Op-amp based signal conditioning circuits, Inverting and Non-Inverting Amplifiers, Linearization, Differential amplifiers and Instrumentation amplifiers
Digital measuring techniques, Sample and Hold Circuits, Comparator, Buffers, D/A Conversion and A/D Conversion, Weighted Resistor DAC, R2R ladder DAC, Dual Slope, Parallel-comparator Successive Approximation ADC techniques, Single channel and multi-channel Data Acquisition System (DAS).

Unit 3:
Bio-potential electrodes and Chemical sensors: Electrodes Electrolyte Interface, Half-Cell Potential, Polarization, Polarizable and Non Polarizable, Electrodes, Calomel Electrode, Electrode Circuit Model, Electrode Skin-Interface and Motion Artifact. Body Surface Electrodes. Internal Electrodes: Needle and Wire Electrodes (Different Types). Microelectrodes: Metal, Supported Metal Micropipette (Metal Filled Glass And Glass Micropipette Electrodes)
Blood gas and Acid- Base Physiology, Potentiometric Sensors (pH, pCO2 Electrodes, Amperometric Sensors (pO2), ISFETS, Transcutaneous Arterial O2 and CO2 Tension Monitoring. Fiber Optic Sensors: Principle of Fiber Optics, Fiber Optic Sensors - Temperature, Chemical, Pressure. Biosensor: Classifications and types with examples.
Practicals:
1) Study of CRO
2) To study the characteristics of a light dependent resister.
3) To study principle and working of a capacitive Transducer.</td><td>60</td><td>4</td></tr>
</table>

	4) To study pH electrode. Interface Load Cell with Arduino and display weight 5) Measurement of distance using LVDT plot ac and dc characteristics 6) Design signal conditioning circuit using Op-Amp and temperature sensor.		

Course Outcome:

The learner will be able to :

- Explain different components of a generalized medical instrumentation system, input transducer properties, and instrument characteristics.
- Apply the knowledge of principles of various types of transducers and sensors including motion, displacement, force, pressure sensors to different medical applications. Apply the knowledge of principles of various types of temperature sensors to different medical applications.
- Apply the knowledge of the various biopotential electrodes for measuring different types of biopotentials.
- Apply the principles of various chemical sensors for measuring concentration of biochemical analytes.
- Explain the principles of various biosensors and their medical applications
- To impart technical knowledge and competency skills to perform in various areas like sales & marketing, product engineering, research-development, hospital administration, regulatory affairs and also to venture into entrepreneurship.

Text Books:

- Kalasi H.S.- Electronic Instrumentation
- A.K. Sawhney- Electrical & Electronic Measurement & Instrumentation.
- Medical Instrumentation-Application and Design by John G. Webster.
- Instrument Transducer – An Intro to their performance and design, Hermann K P. Neubert.
- Biomedical sensors – fundamentals and application by Harry N, Norton.
- Biomedical Transducers and Instruments, Tatsuo Togawa, Toshiyo Tamma and P. Ake Öberg.
- Electronics in Medicine and Biomedical Instrumentation by Nandini K. Jog PHI **Second Edition 2013.**

Reference Books:

- Principles of applied Biomedical Instrumentation by La Geddes and L.E. Baker.
- Biomedical Instrumentation and Measurement by Leslie Cromwell, Fred. J. Weibell and Pfeiffer.
- Principles of Biomedical Instrumentation and Measurement, Richard Aston, Merril Publishing Co.,
- Columbus, 1990.
- Measurement Systems, Application and Design, Ernest O. Doeblin, McGraw-Hill, 1985.
- Handbook of Modern Sensors – Physics, Design and Application, Jacob Fraden, AIP press.
- Transducers for Biomedical Measurements: Principles and Applications, Richard S.C. Cobbold, John
- Wiley & Sons, 1974.

Course : Medical Physics

Course Objectives:

- To make the students aware about the LASER technology, its principle, types, etc.
- To study the basics of Nuclear Physics, different terminologies associated with it, Interaction of radioactive substances and how to use it for the benefit of the mankind

BSCBIS2P10	**Unit 1:** **Optics and Laser** Properties of light, Total internal reflection of light, Electromagnetic spectrum, Optical fibre- structure, functioning and classification. (CO_2 ,Nd:YAG) Laser- concept, properties and application in healthcare **Unit 2:** **Nuclear Physics** Isotopes, Nuclear Forces, Binding Energy, Mass Defect, Nuclear reactions (Fission and Fusion), Nuclear reactors, Radioactivity, alpha, beta, gamma radiations, Half-life, Mean life of radioactive substances , Radioisotopes, Natural and artificial Radioactivity, Radionuclides in medicine and technology Interaction of radiation with Biological things (Cells, tissues) **Unit 3**: **Radiation Detector** Interaction of radiation with matter, Types and properties of Radiation. Types of Radiation Detectors- Scientilator, Gas- Filled, Semiconductor, **Assignments on above topics**	**30**	**2**

Course Outcome:

After the course, students will be able to:

- 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. •
- Explain concept of radionuclide therapy and the function of radiotherapy equipment.
- To explain interactions of ionizing radiation with matter

Reference Books:

- A text book of Optics, Revised Edition , Subramanyam,Brij Lal, Avadhanulu, S. Chand and Co. Pvt. Ltd
- Engineering Physics Seventh Enlarged, Revised Edition, M.N. Avadhanulu and P.G. Kshirsagar, S. Chand and Company Ltd.
- 3.Handbook of Biomedical Instrumentation-3rd Edition-R.S.Khandpur
- 4.Atomic and Nuclear Physics –A.B.Gupta
- 5.Medical Imaging Physics-Wiliam R.Hendee,E.Russell Ritenour

Course: Digital Electronics

Course Objectives:

- To make learner aware of basics of Digital circuits, logic design, various Logic Families and Flip-flops.
- Learner should be able to design various counters, registers and know their applications.
- Learner should be able to design sequential circuits as a state machine.

BSCBIS2P11	**Unit 1:** **Analog Devices:** Active and Passive devices Resistors, Inductors and Capacitors, principle of operations, equations, PNP and NPN transistors, semiconductor devices, open and closed circuits **Unit-2:** **Number System and Codes**: Decimal, Binary, Hexadecimal, Octal, BCD, conversion of one code to another, Complements (one's and two's), Addition and Subtraction, Multiplication. Logic Gates and Boolean Algebra: Truth Tables, OR, AND, NOT, XOR, XNOR, Universal (NOR and NAND) Gates, Boolean Theorems, DeMorgan's Theorems, Principle of duality. **Unit 3:** **Combinational Logic Analysis and Design**: Standard representation of logic functions (SOP and POS), Karnaugh map minimization, Multiplexers (2:1, 4:1) and Demultiplexers (1:2,4:1), Adder (half and full) and subtractor, Encoder (8 to 3) and Decoder (3 to 8) **Unit-4** **Sequential logic design:** Latch, Flip flop (FF), S-R FF, J-K FF, T and D type FFs, Clocked FFs, Registers, Counters (ripple, synchronous and asynchronous, ring, modulo-N), **Demonstrations** 1) To verify and design AND, OR, NOT and XOR gates using NAND gates 2) Design a Full adder and a full subtractor circuit 3) To verify the truth tables for different flip flops Transistor working	**30**	**2**

Course outcome:

Learner will be able to:

- Describe various number systems, logic gates and logic families.
- Apply Boolean algebra, K-maps for Logic reduction and implementations in SOP and POS form
- Develop combinational circuits such as code converter circuits, parity generator checker circuits and magnitude comparator circuits. Also, circuits using multiplexers, de-multiplexers, and decoders.
- Design synchronous sequential circuits and asynchronous counters using flip flops
- Design various registers using flip flops.

Text book:
Digital Electronics by S.S.Bhatti
Reference books

- Student Reference Manual for Electronic Instrumentation Laboratories by Stanley Wolf, and Richard F.M. Smith, Prentice Hall of India Pvt. Ltd. New Delhi
- Electronics Shop Practices, Equipment and Materials By Clyde N. Herrick Prentice Hall Inc
- Electronic Instruments and Systems: Principles, Maintenance and troubleshooting by R. G. Gupta Tata McGraw Hill Edition 2001
- 4. Modern Electronic Equipment: Troubleshooting, Repair and Maintenance by Khandpur, TMH 5. Electronic Instrumentation and Measurement Techniques by WD Cooper, AD Helfrick, Prentice Hall of India Pvt. Ltd. New Delhi

Course: Fundamentals of Chemistry
Course Objectives:

- This course is designed to give the student an understanding in the chemistry used in the daily life
- To introduce the student to chemistry in dairy technology, food and beverage.
- To teach the student chemistry in soap, edible oil industry
- To introduce the student to the techniques of energy storage and polymers used in new green energy sources

BSCBIS2P12	**Unit –I** Dairy Products: Composition of milk and milk products. Analysis of fat content, minerals in milk and butter. Estimation of added water in milk. Beverages: Analysis of caffeine in coffee and tea, detection of chicory in coffee, chloral hydrate in toddy, determination of methyl alcohol in alcoholic beverages. Food additives, adulterants, and contaminants- Food preservatives like benzoates, propionates, sorbates, disulphites. Artificial sweeteners: Aspartame, saccharin, dulcin, sucralose, and sodium cyclamate. Flavors: Vanillin, alkyl esters (fruit flavors), and monosodium glutamate. Artificial food colorants: Coal tar dyes and non-permitted colors and metallic salts. Analysis of pesticide residues in food. **Unit-2** Vitamins: Classification and Nomenclature. Sources, deficiency diseases, and structures of Vitamin A1, Vitamin B1, Vitamin C, Vitamin D, Vitamin E & Vitamin K1 Oils and fats: Composition of edible oils, detection of purity, rancidity of fats and oil. Tests for adulterants like argemone oil and mineral oils. Halphen test. Soaps & Detergents: Definition, classification, manufacturing of soaps and detergents, composition and uses Oils and fats: Composition of edible oils, detection of purity, rancidity of fats and oil. Tests for adulterants like argemone oil and mineral oils. Halphen test. Soaps & Detergents: Definition, classification, manufacturing of soaps and detergents, composition	**30**	**2**

	and uses **Unit-3** Chemical and Renewable Energy Sources: Principles and applications of primary & secondary batteries and fuel cells. Basics of solar energy, future energy storer. Polymers: Basic concept of polymers, classification and characteristics of polymers. Applications of polymers as plastics in electronics, automobile components, medical fields and aerospace materials. Problems of plastic waste management. Strategies for the development of environment-friendly polymers		
Course outcome: ● Analyze the fat content and minerals in milk, butter and other dairy products ● Know about various food preservatives, adulterants, additives and their analysis ● Know about the Sources, role and deficiency symptoms of Vitamins ● Learn the importance of renewable energy sources ● Be aware of the applications of polymers as plastics in various fields and strategies for development of environment friendly polymers			
Text Books ● B. K. Sharma: Introduction to Industrial Chemistry, Goel Publishing, Meerut (1998) ● Medicinal Chemistry- Ashtoush Kar. ● Analysis of Foods – H.E. Cox: 13 ● Fred Billmeyer: Textbook of polymer science; Willey 3rd addition			
Course: Social Psychology **Course objectives:** To make students aware about what is social psychology and its importance. To help students connect the role of instrumentation in psychology.			
BSCBIS2P13	**Social Psychology:** **Unit 1** Man as social animal a) Social Psychology: what it is and what it does b) A brief look at history: the origins and early development of Social Psychology c) Research as the route to increased knowledge d) The role of theory in Social Psychology **e**) The Quest for Knowledge and Rights of Individuals: Seeking an Appropriate Balance **Practical Instrumentation** 1) Tachistoscope 2) Muller –Lyer apparatus 3) Finger dexterity board 4) Memory drum apparatus 5) Mirror drawing apparatus 6) Habbit interference board	**30**	**2**

Course outcome:

After the course, students will be able to :

- Use and implement importance instrumentation in psychology
- Develop an increased quest for knowledge

Books for Reference

- Aronson, E., Wilson, T. D., & Akert, R. M. (2007). Social Psychology. (6thed), New Jersey: Pearson Education prentice Hall
- Baumeister, R. F., & Bushman, B. J. (2008). Social Psychology and Human Nature. International student edition, Thomson Wadsworth USA
- Delamater, J. D., & Myers, D. J. (2007). Social Psychology. (6thed.), Thomson Wadsworth International student edition, USA
- Franzoi, S. L. (2003). Social Psychology. (3rd ed.). New York McGraw Hill co.
- Kenrick, D. T., Newberg, S. L., & Cialdini, R. B. (2007). Social Psychology: Goals in Interacton. (4thedi.). Pearson Education Allyn and Bacon, Boston
- Taylor, S. E., Peplau, L. A., & Sears, D. O. (2006). Social Psychology. (12thed.). New Delhi: Pearson Education

Course: Analytical Instrumentation

Course objectives:

- This course is designed to give the student an understanding in the operation and care of instruments used in the laboratories of industry.
- To introduce the student to principles and theory of instrument analysis.
- To teach the student the correct operation of chemical instruments.
- To introduce the student to the techniques of troubleshooting instruments in the chemical laboratory.
- To emphasize the safe use of chemical instrumentation.
- To teach the student to solve problems related to the use of chemical instruments.

BSCBIS2P14	**Unit 1** **Molecular Spectroscopy:** Ultraviolet-Visible (UV-Vis) spectroscopy: principle, instrumentation and applications. Infra-Red spectroscopy: principle, instrumentation and applications. Colorimeter. **Unit 2** **Atomic spectroscopy:** Theory, instrumentation and application of flame photometry and atomic absorption spectroscopy. Unit 3 **Chromatography**: Theory and application of paper and thin layer chromatography, Column chromatography: Principle, instrumentation and application of Gas Liquid chromatography and High Performance Liquid Chromatography	**30**	**2**

Course outcome:

- At the end of the course, a student will be able to:
- Select the required instruments for spectroscopic analysis.
- Understand the effects of different constituent in a process outcome and analysis the performance of various on-line or off-line instruments.
- Apply the basic knowledge of chromatography in equipment maintenance.
- Describe and differentiate between online and offline process and Identifies suitable instruments for analysis gaseous, liquid or solid substance.

Reference Books:

- Skoog, Holler and Crouch, Instrumental Analysis,, Cengage Learning, India edition, 2007
- Skoog & Lerry, Instrumental Methods of Analysis, Saunders College Publications, New York, 4th edition,
- H.H.Willard et al., Instumental Methods of Analysis, CBS Publishers, 7th edition
- Jeffery G.H. et al., Vogel's Text of Quantitative Chemical Analysis, Longman Scientific and Technical, New York, 5th edition.

Course: Introduction to life skills – II

Course Objectives:

- To develop ability to analyze information and experiences in an objective manner by using critical thinking life skill.
- To develop the ability of creative thinking in students which will help themselves to look beyond their direct experiences and address in a perspective which is different from the obvious or the norm.
- To develop decision making and problem solving ability in students.
- To develop ability which involves recognizing emotions in others, being aware of how emotions influence behaviour and being able to respond emotions appropriately.

BSCBIS2P15	**Introduction to Life skills -II** **Unit 1:** **Applications of Life Skills** Unit 1 **Life Skills : Applications** a)Problem Solving b)Critical Thinking c) Coping with Emotions d)Creative Thinking e)Decision Making **Practicals:** **Health Promotion using Life Skill Approach** a)Activity 1-Problem solving b)Activity 2-Critical Thinking c) Activity 3-Coping with emotions d) Activity 4-Creative Thinking e) Activity 5-Decision making	**30**	**2**

Course Outcome :

- A learner will be able to analyze information and experiences in an objective manner by using critical thinking life skill.
- A learner will be able to develop the ability of creative thinking.
- A learner will be able to develop decision making and problem solving abilities.
- A learner will be able to develop ability which involves recognizing emotions in others, being aware of how emotions influence behaviour and being able to respond emotions appropriately.

Books for Study:

- Chorghade S & Pangaonkar Shailesh (2018),Introduction to Life Skills ,Nathe Publication Limited
- Dr.Bharat S & Dr.K.V.Kishore Kumar (2005) ,Activity Mannual For The Teachers On Health Promotion using Life Skills Approach, NIMHSNS Publication No.53

Course: English – II

Course objectives:

- To improve the vocabulary of the students
- To improve the technical writing skills and business communication skills in students

BSCBIS2P17	**Unit 1** **Vocabulary building:** Synonyms, antonyms, legal language, Expansion of an idea, Oral presentation. **Unit 2:** **Technical Writing Skills:** Documenting, Report Writing, Making notes, Letter writing, Abstract writing, Tender **Unit 3:** **Technology and Business communication:** Role, effects and advantages of technology in Business Communication like email, text messaging, instant messaging and modern techniques like video conferencing, social networking, Strategic importance of e-communication. **Assignment:** ● 7 Habits of highly effective people ● The Alchemist	**30**	**2**

Course outcome:

At the end of the course, students would have developed:

- Better email writing skills
- A better knowledge of using technology and social networking for professional works

Reference books:

- The black book English vocabulary.
- 500 social media marketing tips by Andrew Macarthy

Course: Environmental Science.

Course objectives:

- To help students know about ecology and balance in environment.
- To promote a sense within students to work out ways to prevent environmental degradation
- To make student aware of different laws and regulations to maintain a balanced ecological system

BSCBIS2P18	**Unit 1:** **Ecology** A. Importance of Environment Studies in the current developmental context; B. Understanding concepts of Environment, Ecology and their interconnectedness; C. Environment as natural capital and connection to quality of human life; D. Environmental Degradation – causes and impact on human life; Sustainable development – concept and components; poverty and environment **Unit 2:** **Dealing with Environmental Concerns** A. Concept of Disaster and general effects of Disasters on human life – physical, psychological, economic and social effects; B. Some locally relevant case studies of environmental disasters; C. Dealing with Disasters – Factors to be considered in Prevention, Mitigation (Relied and Rehabilitation) and disaster Preparedness; D. Human Rights issues in addressing disasters – issues related to compensation, equitable and fair distribution of relief and humanitarian approach to resettlement and rehabilitation **Unit 3:** **Approaches to Understanding Ecology** A. Understanding approaches to ecology : Anthropocentrism, Biocentrism and Eco centrism, Ecofeminism and Deep Ecology; B. Environmental Principles – 1 : The Sustainability Principle; The Polluter Pays Principle; The Precautionary Principle; C. Environmental Principles – 2 : The Equity Principle; Human Rights Principles; The Participation Principle	**30**	**2**

Course outcome:

At the end of the course, students will have a better understanding on:

- Pollution prevention, Ecological balance, need for bio degradable materials
- Managing human rights issues during disaster management
- Dealing with environmental disasters

Reference Books:

- Foundation Course by Manan Prakashan
- Foundation Course by Sheth Publishers

Course: Sports

Course objectives:

- To encourage students towards sports
- To develop team management, leadership and sportsmanship within students.
- To help students recognize success and failures are part of life.

BSCBIS2P19	**Sports** Physical Education, Sports and Games(Indoor & Outdoor) **Activities:** Teacher should teach basic skills of respective game, with that provide opportunity to every student to enhance their physical abilities and skills. Higher emphasize will be given to grace of movement. In initial classes physical education director has to observe following things. 1. Grace of movement 2. Initial knowledge and interest of the game 3. Process of learning skill 4. Decision making capacity while playing 5. Understanding his/her role while playing 6. Leadership quality while playing 7. Sportsmen spirit 8. Followership in the team 9. Emotional balance in the ground 10. Effort of student Physical Education Director observes every student and performance of student graded as A – Excellent, B – Good, C – Undecided, D- Poor, E – Very Poor After grading, initially Physical Education Director has to teach skill of respective game and at the end of the session everyday has to provide opportunity to play team game. Teacher has to emphasis developing social values while teaching the game. Basic rules and regulations of the Game will be taught to students. At the end of the semester 10 values which were explained earlier again will be observed by the physical education director and each value will be awarded marks subjectively.	**60**	**2**

Course outcome:

- Students will get familiarize with a particular sport
- Students will be social and will be involved in outdoor activities.
- It will help develop their interpersonal skills like communication, leadership, etc.

Reference: This activity has to be performed under guidance of a sports person.

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 = ∑CG / ∑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 = ∑CG / ∑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

R ALLOWED TO KEEP TERMS (ATKT)

A. A learner shall be allowed to keep term for Semester II irrespective of 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.

OR

C. A learner shall be allowed to keep term for Semester III wherever applicable irrespective of 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

F. A learner shall be allowed to keep term for Semester V wherever applicable if he/she passes each of Semester I, Semester II, Semester III and Semester IV.

OR

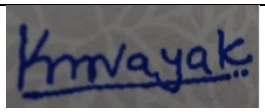
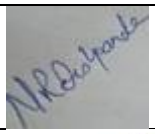
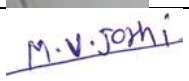
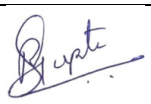
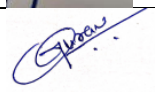
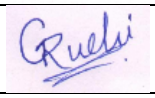
G. A learner shall be allowed to keep term for Semester V wherever applicable irrespective of number of heads/courses of failure in the Semester I, Semester II, Semester III, and Semester IV.

H. The result of Semester VI wherever applicable OR final semester shall be kept in abeyance until the learner passes each of Semester I, Semester II, Semester III, Semester IV, Semester V wherever applicable.

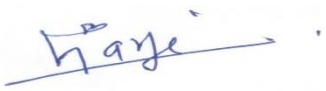
OR

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

UNIVERSITY OF MUMBAI'S
GARWARE INSTITUTE OF CAREER EDUCATION & DEVELOPMENT
COURSE COMMITTEE MEETING FOR
B.SC. (Biomedical Instrumentation)
Held on 26th June, 2023 at 3.00 pm

Sr.No.	Name	Sign
01	Dr. Keyurkumar M. Nayak (Director, University of Mumbai's Garware Institute of Career Education and Development), BOS Chairman	
02	Dr. Neha Deshpande- Asso. Proffessor, A.G. College, Pune (Academics) Ex.Chairperson (SVJCT)	
03	Mr. Mandar Joshi- Course Coordinator, SVJCT's, SEI	
04	Mr. Rohan Gupte- Member Secretary- BOS, SVJCT's SSEI	
05	Mr. Shripad Thakurdesai- Director, Electromedics (Industry)	
06	Prof. Dr. Satish Sharma- Dept. of Electronics and Computer Sc. ,RTM Nagpur University (Academics)	Present
07	Prof. Gauri Kulkarni- Retd. Prof.Dept. of Physics, SPPU (Academics)	Present
08	Dr. Manali Godase- Vice Principal, D.J.Sanghvi college, Sangli (Academics)	Present
09	Mr. Neelesh Shinde- (CTO, Jupiter hospital, Pune) (Industry)	
10	Mr. Omkar Gurav- Sr. Biomedical Engg. Vihan Enterprises (Alumni)	
11	Ms. Ruchi Gandhi – Sr.Biomedical Engineer, Infigo eyecare (Alumni)	

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



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

Appendix B

Justification for (B.Sc. Biomedical Instrumentation Science)

1.	Necessity for starting the course	The University of Mumbai's Garware Institute of Career Education & Development plans to introduce four years Full time B.Sc. (Biomedical Instrumentation Science). 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 is Four years (Eight Semesters). 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

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

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