SRI MANAKULA VINAYAGAR ENGINEERING COLLEGE

(An Autonomous Institution)
(Approved by AICTE, New Delhi & Affiliated to Pondicherry University)
(Accredited by NBA-AICTE, New Delhi, Accredited by NAAC with "A" Grade)
Madagadipet, Puducherry - 605 107

Department of Biomedical Engineering

Minutes of Fifth BoS Meeting

Venue

Seminar Hall, Department of BME
Sri Manakula Vinayagar Engineering College
Madagadipet, Puducherry – 605 107

Date & Time

17-09-2022 & 10.30 AM

2.A.9.1

2.A.9.2

Minutes of Board of Studies

The Fifth Board of Studies meeting for B.Tech.Biomedical Engineering was held on 17th September 2022 at 10.30 A.M in the Seminar Hall, Department of BME, Sri Manakula Vinayagar Engineering College with the Head of the Department in the Chair.

The following members were present for the BoS meeting

Sl.No.	Name of the Member with Designation and official Address	Responsibility in the BoS
1	**Dr.A.Vijayalakshmi** Professor and Head Department of Biomedical Engineering, Sri Manakula Vinayagar Engineering College, Puducherry	Chairman
2	**Dr A K Jayanthy** Professor Department of Biomedical Engineering, SRM Institute of Science and Technology, Kattankulathur	Academic Expert
3	**Dr.M.Arivamudhan** Professor, Department of Electronics and Communication Engineering Government College of Engineering, Dharmapuri-636704	Academic Expert
4	**Dr.R.Premkumar** Professor Department of Biomedical Engineering, Rajalakshmi Engineering College, Chennai	Academic Expert
5	**Mr.V.Ashok** Manager(Technical) Intel Technology India Pvt.Ltd. SRR Elite, Bellandur, Bengaluru, Karnataka 560103	Industry Expert
6	**Dr.A. Jayachitra** Professor Specialization: Process Control and Instrumentation	Internal Member
7	**Dr. P Arunagiri** Professor Specialization: Communication Systems	Internal Member
8	**Dr. S. B. Lenin** Associate Professor Specialization:VLSI Design	Internal Member
9	**Dr. N. Deepa** Assistant Professor Specialization:Applied Electronics	Internal Member

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10	**Mrs S Jayanthi** Assistant Professor: Specialization: Communication Systems	Internal Member
11	**Mr.P.M.Bharath** Assistant Professor Specialization:Embedded System Technologies	Internal Member
12	**Mr.R.Vignesh Raj** Assistant Professor Specialization:Nano Technology	Internal Member
13	**Mrs.S.Arunthathi** Assistant Professor Specialization: Medical Electronics	Internal Member
14	**Mr. M.Manthiralakshmanan** Assistant Professor Specialization: Medical Electronics	Internal Member
15	**Mr.S.Gowtham** Software Quality Engineer, Rockwell Automation India Pvt.Ltd., Bengaluru- 560 025	Alumni Member

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Agenda of the Meeting

Item No.	Particulars
BoS/UG/BME 5.1	To discuss about the appraisal of fourth BoS meeting and Confirmation of minutes of the meeting.
BoS/UG/BME 5.2	To discuss and approve the Curriculum Structure and Syllabi of VIII semester courses for B.Tech – Biomedical Engineering under Regulations R-2020.
BoS/UG/BME 5.3	To discuss and approve the Professional elective courses syllabi offered for VIII semester B.Tech – Biomedical Engineering under Regulations R-2020.
BoS/UG/BME 5.4	To review the syllabi for V Semester courses under Regulations R-2020 and VIII Semester courses under Regulations R-2019 for B.Tech- Biomedical Engineering.
BoS/UG/BME 5.5	To apprise the BoS members about the Professional elective courses offered for VIII semester of Regulations R-2019 and the Professional elective and Open elective courses offered for V semester under Regulations R-2020.
BoS/UG/BME 5.6	To discuss the Employability Enhancement courses offered for II and IV semesters for Autonomous Regulations 2020
BoS/UG/BME 5.7	To discuss the academic schedule of the Academic Year 2022-23.
BoS/UG/BME 5.8	To apprise the End Semester Examinations result conducted in May 2022.
BoS/UG/BME 5.9	To discuss and recommend the panel of examiners to the Academic Council.
BoS/UG/BME 5.10	Any other item with the permission of the chair.

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Chairman-BoS/BME
Dr A Vijayalakshmi

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SRI MANAKULA VINAYAGAR ENGINEERING COLLEGE

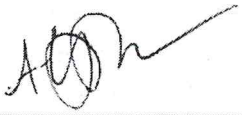
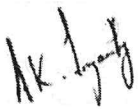
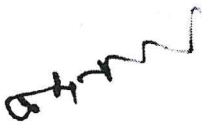
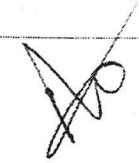
(An Autonomous Institution)
Puducherry - 605 107

Attendance for Fifth Board of Studies Meeting for the Programme

B.Tech – Biomedical Engineering

Date & Time: 17.09.2022 & 10.30 a.m

Board of Studies Members:

Sl.No.	Name of the Member with Designation and official Address	Responsibility in the BoS	Signature
1	**Dr.A.Vijayalakshmi,** Professor and Head Department of Biomedical Engineering, Sri Manakula Vinayagar Engineering College, Puducherry	Chairman	
2	**Dr A K Jayanthy** Professor Department of Biomedical Engineering, SRM Institute of Science and Technology, Kattankulathur	Academic Expert	
3	**Dr.M.Arivamudhan** Professor Department of Electronics and Communication Engineering, Government College of Engineering, Dharmapuri-636704	Academic Expert	
4	**Dr.R.Premkumar** Professor Department of Biomedical Engineering, Rajalakshmi Engineering College, Chennai	Academic Expert	
5	**Mr.V.Ashok** Manager(Technical) Intel Technology India Pvt.Ltd. SRR Elite, Bellandur, Bengaluru, Karnataka 560103	Industry Expert	
6	**Dr.A. Jayachitra** Professor Specialization: Process Control and Instrumentation	Internal Member	

7	**Dr. P. Arunagiri** Professor Specialization: Communication Systems	Internal Member	
8	**Dr. S. B. Lenin** Associate Professor Specialization: VLSI Design	Internal Member	17/9/22
9	**Dr. N. Deepa** Assistant Professor Specialization: Applied Electronics	Internal Member	17/9/22
10	**Mrs. S. Jayanthi** Assistant Professor Specialization: Communication Systems	Internal Member	17/9/22
11	**Mr.P.M.Bharath** Assistant Professor Specialization: Embedded System Technologies	Internal Member	
12	**Mr.R.Vignesh Raj** Assistant Professor Specialization: Nano Technology	Internal Member	
13	**Mrs. S. Arunthathi** Assistant Professor Specialization: Medical Electronics	Internal Member	
14	**Mr. M. Manthiralakshmanan** Assistant Professor Specialization: Medical Electronics	Internal Member	
15	**Mr.S.Gowtham** Software Quality Engineer, Rockwell Automation India Pvt.Ltd., Bengaluru- 560 025	Alumni Member	

Minutes of the Meeting

Dr.A.Vijayalakshmi, Chairman, BoS started the meeting by a warm welcome to the external experts, internal members and thanked them for accepting the invitation to conduct Fifth Board of Studies meeting on 17th September 2022.

The Chairman proceeded the meeting with the presentation on the agenda items:

BoS/UG/BME 5.1

The BoS Chairman reviewed fourth BoS meeting minutes with the members, its implementation and confirmed with the approval for the incorporation of minor modifications in the VII semester courses syllabi of Regulations 2020 as mentioned below:

- Virtual Bioinstrumentation (U20BMT718), unit 4 content was reduced.
- Professional Elective-IV, Nanotechnology in Medicine (U20BME720) syllabus was vast and reduced.
- Open Elective-IV Internet of things for Healthcare (U20BM0705) excluded some topics in unit 5 to reduce the syllabus.
- Medical Safety and Standards course is offered instead of MRI and its Clinical Applications Course (U19BME717)
- IV Semester Biosignal Processing course (U20BMT409) syllabus for unit 3 and unit 5 were modified.

The above modifications are approved by BoS members.

BoS/UG/BME 5.2

The Curriculum Structure and Syllabi of VIII semester courses for B.Tech - Biomedical Engineering Programme under Regulations R- 2020 were discussed and BoS members suggested the following modification:

S.No.	Regulation	Semester	Subject with Code	Unit	Particulars
1.	R-2020	VIII	Rehabilitation Engineering U20BMT820	1	Syllabus is vast and has to be reduced.

The BoS members accept the modification and approved the VIII semester courses Syllabi. (Annexure I)

BoS/UG/BME 5.3

Professional elective courses syllabi offered for VIII semester B.Tech – Biomedical Engineering under Regulations 2020 were discussed and the experts suggested the following modifications:

S.No.	Regulation	Semester	Subject with Code	Unit	Particulars
1.	R-2020	VIII	Human Assist Devices U20BME823	3	Asked to include cochlear implant topic in unit 3
2	R-2020	VIII	Wearable Systems U20BME825	5	Asked to exclude few topics

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	<table><tr><td>3</td><td>R-2020</td><td>VIII</td><td>Virtual Reality in Medicine U20BME830</td><td>5</td><td>Asked to modify the syllabus as case studies</td></tr></table> The BoS members resolved R-2020 Eighth semester Professional electives syllabi with above mentioned changes. **The modifications are incorporated and the Syllabi is given in Annexure II** and approved by BoS members.
BoS/UG/BME 5.4	The Syllabi for V Semester courses under Regulations R-2020 and VIII Semester courses under Regulations R-2019 for B.Tech- Biomedical Engineering were reviewed.
BoS/UG/BME5.5	Professional elective courses offered for VIII semester of Regulations 2019 and Professional elective, Open elective courses offered for V semester under Regulations 2020 were confirmed with the BoS members.
BoS/UG/BME 5.6	The Employability Enhancement courses offered for II and IV semesters under Autonomous Regulations 2020 were discussed and approved by the BOS members.
BoS/UG/BME 5.7	The academic schedule for the odd semester of the Academic Year 2022-23 were discussed with the BoS members, The modification in the Conduction of Continuous Assessment Tests schedule due to placement for VII semester students under Autonomous Regulations 2019 was discussed and approved by the members.
BoS/UG/BME 5.8	The End semester examinations result conducted in May 2022 and the schedule for seventh semester of B.Tech. Biomedical Engineering programme under Regulations 2019 and second and fourth semesters for Regulations 2020 were discussed.
BoS/UG/BME 5.9	The revised list of panel of examiners and question paper setters for the end semester examinations were discussed and confirmed with the members. **(Annexure - III)**
BoS/UG/BME 5.10	The department development activities for the odd semester of the Academic Year 2022-23 were presented to the BoS members.

Dr. A.Vijayalakshmi, Chairman – BoS and Head of Department, Biomedical Engineering, concluded the meeting at 12:30 pm with vote of thanks.

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Dr. A.Vijayalakshmi
Chairman-BoS/BME

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Annexure – I

ACADEMIC REGULATIONS 2020

CURRICULUM STRUCTURE

SEMESTER – VIII										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U20BMT820	Rehabilitation Engineering	PC	3	0	0	3	25	75	100
2	U20BME8XX	Professional Elective – V	PE	3	0	0	3	25	75	100
3	U20BME8XX	Professional Elective – VI	PE	3	0	0	3	25	75	100
Practical										
4	U20HSP804	Entrepreneurship Management	HS	0	0	2	1	100	-	100
Project Work										
5	U20BMW803	Project phase – II	PW	0	0	16	8	40	60	100
Employability Enhancement Course										
6	U20BMS809	Skill Development Course 9: NPTEL/MOOC-II	MC	0	0	0	-	100	-	100
							18	315	285	600

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PROFESSIONAL ELECTIVE COURSES

Professional Elective – V (Offered in Semester VIII)		
Sl. No.	**Course Code**	**Course Title**
1	U20BME821	Tissue Engineering
2	U20BME822	Pattern Recognition and Expert Systems in Medicine
3	U20BME823	Human Assist Devices
4	U20BME824	Bio MEMS
5	U20BME825	Wearable Systems
Professional Elective – VI (Offered in Semester VIII)		
Sl. No.	**Course Code**	**Course Title**
1	U20BME826	Brain Computer Interface and Applications
2	U20BME827	Neural Networks
3	U20BME828	Acoustics and Optical Imaging
4	U20BME829	Clinical Engineering
5	U20BME830	Virtual Reality in Medicine

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U20BMT820	REHABILITATION ENGINEERING	L	T	P	C	Hours
		3	0	0	3	45

Course Objectives

- To interactively and effectively introduce students to the field of rehabilitation and discuss the principles of rehabilitation.
- To provide insight into the orthopedic prosthetics and orthotics in rehabilitation.
- To learn therapeutic Exercise Techniques and Understand types and concepts of wheelchairs.
- To gain knowledge on assist devices for management of communicational impairments.
- To describe the essential principles, methods, and strategies of assessment of individuals with disabilities in VR settings and robotic developments.

Course Outcomes

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

CO1- Understand the quality and safety standards in design of devices for user needs. **(K2)**
CO2- Describe the applications of different orthosis and prosthesis for various disabilities. **(K3)**
CO3-Compare the different therapeutic exercises and design an orthopaedic wheelchair. **(K2)**
CO4-Interpret the techniques and aids for impairments related to sensory and motor functions. **(K3)**
CO5-Explore the use of Robots and Virtual Reality tool in rehabilitative curative care. **(K4)**

UNIT I FUNDAMENTALS OF REHABILITATION (9 Hrs)

Introduction to Rehabilitation Engineering - Epidemiology of Rehabilitation, Health, Levels of Prevention, Preventive Rehabilitation, Diagnosis of Disability, Functional Diagnosis, Importance of Psychiatry in Functional diagnosis, Impairment disability handicap, Primary & secondary Disabilities-Rehabilitation team, Classification of members-The human component, Principles of Assistive Technology Assessment, Principles of Rehabilitation Engineering- Key Engineering Principles, Key Ergonomic Principles.

UNIT II PROSTHETIC AND ORTHOTICS DEVICES (9 Hrs)

Prosthetics: Hand and Arm replacement, body powered prosthetics, externally powered limb prosthetics, Myoelectric hand and arm prosthetics - FES System: Restoration of hand function; restoration of standing and walking. Hybrid Assistive systems (HAS) Active prostheses. Active Above knee Prosthesis, intelligent hand prosthesis (MARCUS). **Orthotics:** General orthotics, Classification of orthotics-functional & regional, General principles of Orthosis, Callipers- FO, AFO, KAFO, HKAFO.

UNIT III THERAPEUTIC DEVICES AND WHEELCHAIRS (9 Hrs)

Therapeutic exercise: Co-ordination exercises, Frenkels exercises, Gait -Pathological Gaits, Gait Training, Relaxation exercises, Methods for training Relaxation, Strengthening exercises - Strength training, Types of Contraction, Mobilisation exercises, Endurance exercises.

Wheelchair: History and Categories of Wheelchairs, Seating Assessment, Wheelchair Structure and Component Design, Ergonomics of wheel chair propulsion, Power Wheelchair Electrical System- Wheel chair transportation.

UNIT IV MANAGEMENT OF COMMUNICATION IMPAIRMENTS (9 Hrs)

Speech Impairment: Introduction to communication, Aphasia, Types of aphasia, Treatment of aphasic patient.

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Visual impairment: Categories of visual impairment - Cortical & retinal implants - Auditory Information Display, Blind mobility aids, reading writing & graphics access, Braille Reader, Tactile devices for visually challenged. **Auditory impairment:** Hearing functional assessment, Types of deafness - Surgical and non-surgical hearing aids, Cochlear implants.

UNIT V RECENT TRENDS IN REHABILITATION (9 Hrs)

Rehabilitation Robots- Automated gait training devices, Automated training devices for the upper extremities, Devices for arm assistance. Virtual Reality Applications- virtual environments in the treatment of motor skills impairments-VR based tele-rehabilitation.

Text Books

1. Dr. S. Sunder, "Textbook of Rehabilitation", 4th Edition, Jaypee Medical Publications, New Delhi. 2019.
2. Joseph D.Bronzino,"The Biomedical Engineering Handbook", 3rd Edition, CRC Press, 2006.
3. Rory A Cooper, An Introduction to Rehabilitation Engineering, Taylor & Francis, CRC press, 2006.

Reference Books

1. Marion A Hersh, Michael A, Johnson, "Assistive Technology for Visually impaired and blind people", Springer Publications, First edition, 2008.
2. Sashi S Kommu; Rehabilitation Robotics,1 edition, CRC Press, 2007.
3. Suzanne Robitaille, "The illustrated guide to Assistive technology and devices–Tools and gadgets for living independently", Demos Health New York, First edition, 2010.
4. Patrice L. (Tamar) Weiss, Emily A. Keshner, Mindy F. Levin, "Virtual Reality for Physical and Motor Rehabilitation", 2014.
5. Susan B O'Sullivan, Thomas J Schmitz, Physical Rehabilitation. 5th Edition, Davis publications, 2007.

Web Resources

1. https://en.wikipedia.org/wiki/Rehabilitation_engineering
2. https://www.embs.org/about-biomedical-engineering/our-areas-of-research/rehabilitation-engineering/
3. https://bme.unc.edu/rehabilitation-engineering/
4. https://youtu.be/-y2jDL-diz0
5. https://youtu.be/s3rEAIwLEXM?t=2

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	1	2	1	-	2	1	1	1	1	-	-	-	-	1
2	3	3	3	2	2	2	2	2	2	1	1	1	3	3	3
3	3	3	3	2	2	2	2	2	2	1	1	-	1	2	1
4	3	3	3	3	2	2	1	2	2	2	2	1	1	3	2
5	2	2	2	2	3	2	3	2	2	2	2	-	1	2	2

Correlation Level: 1- Low; 2 - Medium; 3 – High.

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Annexure –II

PROFESSIONAL ELECTIVE - V

		L	T	P	C	Hrs
U20BME823	HUMAN ASSIST DEVICES	3	0	0	3	45

Course Objectives

- To Introduce the concepts of Cardiac assist devices.
- To Learn various sensory and renal devices.
- To Apply design tools for ear analysis devices.
- To understand the functions of Prosthetic devices.
- To gain knowledge in nerve stimulator devices

Course Outcomes

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

CO1 – Understand the concepts of Cardiac assist devices **(K2)**
CO2 – Classify the various sensory and renal devices **(K2)**
CO3 – Infer the merits of human assist system and its influence to environment ear devices. **(K2)**
CO4 – Apply processing conditions to functional Prosthetic devices **(K3)**
CO5 – Gain knowledge in nerve stimulator devices **(K2)**

UNIT I CARDIAC ASSIST DEVICES (9 Hrs)

Principle of External counter pulsation techniques, intra-aortic balloon pump, Auxiliary ventricle and schematic for temporary bypass of left ventricle, prosthetic heart valves.

UNIT II SENSORY AND RENAL DEVICES (9 Hrs)

Classification of Visual Impairments, Prevention and cure of visual impairments, Visual Augmentation, Tactile vision substitution, auditory substitution and augmentation, tactile auditory substitution, Assistive devices for the visual impaired. Artificial Renal: Dialysis action, Membrane, Dialysate, Monitoring Systems, Wearable Artificial Kidney, Implanting Type - Modeling and analysis.

UNIT III HEARING AIDS (9 Hrs)

Hearing aids: Common tests – audiograms, air conduction, bone conduction, masking techniques, hearing aids – principles, drawbacks in the conventional unit, Cochlear Implants, DSP based hearing aids.

UNIT IV PROSTHETIC DEVICES (9 Hrs)

Hand and arm replacement – Different types of models, externally powered limb prosthesis, feedback in orthotic system, functional electrical stimulation, sensory assist devices.

UNIT V NERVE STIMULATOR DEVICES (9 Hrs)

Electrotherapy, Transcutaneous electrical nerve stimulator, Interferential current, Galvanic stimulation, Uses, safety aspects. Deep brain stimulation. Bio-feedback - Efficacy ratings - Major modalities – Applications.

9.A.9.15

Text Books

1. John G. Webster – Bioinstrumentation – John Wiley & Sons (Asia) Pvt Ltd, 2004.
2. R.S. Khandpur, "Handbook of Biomedical Instrumentation", Tata McGraw Hill, 3rd Edition, Edition-2014.
3. Rory A Cooper, An Introduction to Rehabilitation Engineering, Taylor and Francics, CRC Press,2006

Reference Books

1. Albert M. Cook and Webster J.G, "Therapeutic Medical Devices", Prentice Hall Inc., New Jersey, 1982.
2. Soonhwa Seok, Edward L. Meyen, Boaventura DaCosta, "Handbook of Research on Human Cognition and Assistive Technology: Design, Accessibility and Transdisciplinary Perspectives", Paratext, USA, 2010.
3. Joseph D.Bronzino, The Biomedical Engineering Handbook, Third Edition: Three Volume Set, CRC Press, 2006
4. Short Textbook of Prosthetics and Orthotics- R Chinnathurai- Jaypee Brothers Medical Publishers (P) Ltd,2010
5. Dr. S. Sunder, "Textbook of Rehabilitation", 4th Edition, Jaypee Medical Publications, New Delhi. 2019.

Web References

1. https://youtu.be/vM_lxxVLhkg
2. https://youtu.be/JLVpOsVjieE
3. https://youtu.be/d2RHnB5T5eM
4. https://youtu.be/oN95Idnh9Q4
5. https://youtu.be/ZfLmNOF1JNM

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	-	1	-	-	1	-	3	-	-	-	3	3	2	2
2	3	1	2	-	1	1	-	3	-	-	-	3	3	2	2
3	3	2	2	-	1	1	-	3	-	-	-	3	3	2	2
4	3	2	2	2	2	1	-	3	-	-	-	3	3	2	2
5	3	2	2	2	2	1	-	3	-	-	-	3	3	2	2

Correlation Level: 1- Low; 2 - Medium; 3 – High.

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U20BME825	WEARABLE SYSTEMS	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To Study about sensors and its application in wearable systems
- To Learn about applications of wearable systems
- To Acquire knowledge on energy harvesting
- To gain knowledge on wireless health systems
- To provide knowledge on wearable systems applications

Course Outcomes

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

CO1 - Able to acquire the knowledge about the need of wireless health systems sensors. **(K2)**
CO2 - Provides signal processing for wearable systems. **(K3)**
CO3 - Explains the need of energy harvesting. **(K2)**
CO4 - Gain knowledge about wireless health systems. **(K2)**
CO5 - Explain the applications of wearable systems. **(K3)**

UNIT I SENSORS FOR WEARABLE SYSTEMS **(9 Hrs)**

Need for wearable systems, Sensors for wearable systems-Inertia movement sensors, Respiration activity sensor, Inductive plethysmography, Impedance plethysmography, pneumography, Wearable ground reaction force sensor, GSR, Radiant thermal sensor, Wearable motion sensors, CMOS – Based Biosensors, E-Textiles, Bio compatibility

UNIT II SIGNAL PROCESSING **(9 Hrs)**

Wearability issues -physical shape and placement of sensor, Technical challenges - sensor design, signal acquisition, Constraint on sampling frequency for reduced energy consumption, light weight signal processing, Rejection of irrelevant information, Data mining

UNIT III ENERGY HARVESTING FOR WEARABLE DEVICES **(9 Hrs)**

Solar cell, Vibration based, Thermal based, Human body as a heat source for power generation, Hybrid thermoelectric photovoltaic energy harvests, Thermopiles.

UNIT IV WIRELESS HEALTH SYSTEMS **(9 Hrs)**

Need for wireless monitoring, Definition of Body area network, BAN and Healthcare, Technical Challenges- System security and reliability, BAN Architecture – Introduction, Wireless communication techniques.

UNIT V APPLICATIONS OF WEARABLE SYSTEMS **(9 Hrs)**

Medical Diagnostics - Medical monitoring of patients with chronic disease, Hospital patients, Elderly patients, Multi parameter monitoring, Neural recording.

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Text Books

1. Helena Jelinkova, "Lasers for medical applications: Diagnostics, Therapy and Surgery", 1st edition, Woodhead Publishing, 2013.
2. Markolf. H.Neimz, "Laser tissue interactions-Fundamentals and applications", 3rd edition, Springer, 2014.
3. Subhas Chandra Mukhopadhyay and Tarikul Islam, "Wearable Sensors Applications, design and implementation", IOP Publishing Ltd, 2017.

Reference Books

1. Orazio Svelto and David C. Hanna, "Principles of lasers", 5th edition, Springer, 2010.
2. William T. Silfvast, "Laser fundamentals", 2nd edition, Cambridge University Press, 2009.
3. Bonfiglio, Annalisa, De Rossi, Danilo, "Wearable Monitoring Systems", 1st Edition, Springer US, 2011.
4. Hang, Yuan-Ting, "wearable medical sensors and systems" , Springer – 2013.
5. Mehmet R. Yuce, Jamil Y. Khan, "Wireless Body Area Networks Technology, Implementation and Applications", Pan Standard Publishing, Singapore, 2012.

Web References

1. https://en.wikipedia.org/wiki/Smart_wearable_system
2. https://www.ncbi.nlm.nih.gov/pubmed/15227552
3. https://www.researchgate.net/publication/232811306_Smart_wearable_systems_Curren status_and_future_challenges
4. https://youtu.be/tpTnraEagw4
5. https://m.youtube.com/watch?v=Mj1aH7CkNCw

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	2	2	3	-	-	-	-	-	-	3	3	2	2
2	3	3	2	2	3	-	-	-	-	-	-	3	3	2	2
3	3	3	2	3	3	-	-	-	-	-	-	3	3	2	2
4	3	3	2	3	2	-	-	-	-	-	-	3	3	2	2
5	3	3	2	3	3	-	-	-	-	-	-	3	3	2	2

Correlation Level: 1- Low; 2 - Medium; 3 – High.

2.A.9.18

U20BME830	VIRTUAL REALITY IN MEDICINE	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To understand the basic concept of virtual reality.
- To get an adequate knowledge of types aspects in VR.
- To know the types of VR based training.
- To get a basic knowledge of medical model of operation.
- To gain a knowledge about how the expert system used in medical applications.

Course Outcomes

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

CO1 – Understand the basic concept of pattern recognition. **(K2)**
CO2 – Gain knowledge of pattern recognition using statistical approach. **(K2)**
CO3 – Recognize the pattern using syntactic approach. **(K2)**
CO4 – Gain knowledge on the basics of Artificial Intelligence. **(K3)**
CO5 – Apply the VR planning system in medical application with case studies. **(K3)**

UNIT I INTRODUCTION **(9 Hrs)**

Virtual Reality-VR in Medicine-Principles of VR-forms of Reality-Reality Systems- Immersion-Presence-Illusions of presence-Reality tradeoffs-Basic Design Guide lines.

UNIT II VISUAL AND AUDITORY RESPONSE **(9 Hrs)**

Visual sense and perception-Visual display technology- Rendering in computer graphics-Application of visual display in medical VR-Auditory sense and perception-Auditory display technology-Auditory rendering- Application of auditory display in medical VR.

UNIT III VIRTUAL REALITY FOR REHABILITATION AND MEDICAL TRAINING **(9 Hrs)**

Rationale for the use of VR in rehabilitation-VR supported physiotherapy-VR supported psychotherapy- Introduction in VR for medical Training-Tool based applications-phantom based applications.

UNIT IV MEDICAL MODEL OPERATION **(9 Hrs)**

Medical imaging-segmentation-model conversion-mesh reduction and smoothing-modeling organ variability-Integration of pathologies-generation of vascular structures-biomechanical parameters-organ texture generation.

UNIT V APPLICATIONS OF VR **(9 Hrs)**

Case studies: Surgical planning-Augmented reality in surgery-Image guided surgery-mass spring models-continuum mechanics-finite element method-advantages and disadvantages of MSM and FEM.

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Text Books

1. Robert Reiner, Matthias Harder's, "Virtual Reality in Medicine" Springer 2012.
2. The VR Book "Human centered for Virtual Reality", Jason Jerald, Association for computing machinery and Morgan & clay pool publishers, 2016.
3. Matthias Harder's "Surgical scene generation for virtual reality based training in Medicine", Springer 2008.

Reference Books

1. John Vince, "Introduction to Virtual Reality", Springer-Verlag Ltd., 2004.
2. William R.Sherman, Alan B.Craig, "Understanding Virtual Reality–Interface, Application, , The Morgan Kaufmann series, 2003.
3. C.Burdea&PhilippeCoiffet,"VirtualRealityTechnology",SecondEdition,Gregory,JohnWiley&Sons, Inc.,2008.
4. Andrew Davison, "Killer Game Programming in Java", OreillySPD,2005.
5. Virtual and Augment realities for Dummies, Paul Mealey, John wiley and sons 2018.

Web References

1. https://youtu.be/Nq3mPFgpREE?t=7
2. https://youtu.be/J2uQ19baVYM?t=3
3. https://youtu.be/pJnvYjn42fE
4. https://youtu.be/OyB1fkJ_rlY?t=9
5. https://youtu.be/taUqCm6Lcmo?t=6

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	-	-	-	-	-	-	-	-	3	3	2	-
2	3	1	2	-	-	-	-	-	-	-	-	3	2	1	-
3	3	2	1	-	-	-	-	-	-	-	2	2	3	1	1
4	3	2	2	-	-	2	-	-	-	-	-	3	3	1	1
5	3	2	1	-	-	2	-	-	-	-	3	3	3	2	-

Correlation Level: 1- Low; 2 - Medium; 3 – High.

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Annexure –III

SRI MANAKULA VINAYAGAR ENGINEERING COLLEGE

(An Autonomous Institution)
(Approved by AICTE, New Delhi & Affiliated to Pondicherry University)
(Accredited by NBA-AICTE, New Delhi, Accredited by NAAC with "A" Grade)
Madagadipet, Puducherry - 605 107

Department of Biomedical Engineering
Panel of Examiners

S. No.	Name of the Examiner	Highest Qualification	Specialization	Experience (in Years)	Communication Address	Email ID with Mobile Number
1.	Dr.P.Shanmugaraja	Ph.D	Medical Electronics	26	Professor, Department of Electronics and Instrumentation, Annamalai University, Chidambaram	psraja70@gmail.com 9443275120
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20	Dr.P.Muthu	Ph.D	Biomedical Engineering	16	Assistant Professor Department of Nano science and Technology, SRM Institute of Science and Technology Kattankulathur.	muthup@srmist.edu.in 9486338640
21	Dr. Prasath Alias Surendhar. S	Ph.D	Biomedical Engineering	8	Associate Professor Department of Biomedical Engineering Aarupadai Veedu Institute of Technology Rajiv Gandhi Salai (OMR) Paiyanoor-603 104	prasaths.bme@gmail.com 8754581937
22	Dr. A. Uma Maheswari	Ph.D	Biosignals and Systems	15	Assistant Professor, Department of ECE, University College of Engineering, Panruti.	umamaheswaritrk@gmail.com 8838553935
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