RV COLLEGE OF ENGINEERING®

(Autonomous Institution Affiliated to VTU, Belagavi)
R.V. Vidyaniketan Post, Mysore Road
Bengaluru – 560 059

Scheme and Syllabus of III & IV Semesters

(Autonomous System of 2018 Scheme)

Master of Technology (M.Tech)
in
BIO MEDICAL SIGNAL PROCESSING & INSTRUMENTATION

DEPARTMENT OF
ELECTRONIC &INSTRUMENTATION

R V COLLEGE OF ENGINEERNG®, BENGALURU-560 059
(Autonomous Institution Affiliated to VTU, Belagavi)

DEPARTMENT OF ELECTRONICS & INSTRUMENTATION ENGINEERING

M.Tech in BIO MEDICAL SIGNAL PROCESSING & INSTRUMENTATION

THIRD SEMESTER CREDIT SCHEME							
Sl. No.	**Course Code**	**Course Title**	**BoS**	**Credit Allocation**			
				L	**T**	**P**	**Total Credits**
1	18MBS31	Medical Imaging and Techniques	EI	4	1	0	5
2	18MBS3EX	Elective -E	EI	4	0	0	4
3	18MBS33	Internship	EI	0	0	5	5
4	18MBS34	Dissertation Phase I	EI	0	0	5	5
Total number of Credits							**19**
Total Number of Hours / Week							

III Semester			
GROUP E: CORE ELECTIVES			**Credits**
Sl. No.	**Course Code**	**Course Title**	
1.	18MBS3E1	Artificial Organs & Bio Materials	4
2.	18MBS3E2	Rehabilitation Engineering	4
3.	18MBS3E3	Ergonomics	4

FOURTH SEMESTER CREDIT SCHEME							
Sl. No.	**Course Code**	**Course Title**	**BoS**	**Credit Allocation**			
				L	**T**	**P**	**Total Credits**
1	18MBS41	Dissertation Phase II	EI	0	0	20	20
2	18MBS42	Technical Seminar	EI			2	2
Total number of Credits							**22**
Total Number of Hours / Week							

Semester: III		
MEDICAL IMAGING TECHNIQUES (Theory)		
Course Code:18MBS31		**CIE Marks: 100**
Credits: L:T:P: 4:1:0		**SEE Marks: 100**
Hours: 45L		**SEE Duration: 3Hrs**

Course Learning Objectives:	
1	Understand the principles of imaging techniques like X-rays, tomography, ultrasound, Radio nucleide and MRI.
2	Evaluate different imaging methodologies for diagnosing various human organs depending on the sensitivity, depth of penetration and resolution required.
3	Apply the imaging of soft tissues using ultrasound technique and other imaging techniques.
4	Apply Radio diagnostic techniques and IR imaging methods for various applications.

Unit-I	
Introduction: Basic imaging principle, Imaging modalities-Projection radiography, Computed Tomography, Nuclear medicine, Ultrasound imaging, Magnetic Resonance Imaging. **X-Ray :** Interaction between X-Rays and matter, Intensity of an X-Ray, Attenuation, X-Ray Generation and Generators, Beam Restrictors and Grids, Intensifying screens, fluorescent screens and Image intensifiers, X-Ray detectors, Conventional X-Ray radiography, Fluoroscopy, Angiography, Digital radiography, X-Ray image characteristics, Biological effects of ionizing radiation.	**09 Hrs**
Unit – II	
Computed Tomography : Conventional tomography, Computed tomography principle, Generations of CT machines – First, Second, Third, Fourth, Fifth, Sixth & Seventh, Projection function, Reconstruction algorithms – Back Projection Method, 2D Fourier Transform Method, Filtered Back Projection Method, Iteration Method, Parallel Beam Reconstruction, Fan Beam Reconstruction, Helical CT Reconstruction.	**09 Hrs**
Unit -III	
Ultrasound : Acoustic propagation, Attenuation, Absorption and Scattering, Ultrasonic transducers, Transducer Arrays, A mode, B mode, M mode scanners, Tissue characterization, Color Doppler flow imaging, Echocardiography. **Infra Red Imaging** Physics of thermography – imaging systems – pyroelectricvidicon camera clinical thermography – liquid crystal thermography	**09 Hrs**
Unit –IV	
Radio Nuclide Imaging: Interaction of nuclear particles and matter, Nuclear sources, Radionuclide generators, Nuclear radiation detectors, Rectilinear scanner, scintillation camera, SPECT, PET.	**09 Hrs**
Unit –V	
Magnetic Resonance Imaging : Angular momentum, Magnetic dipole moment, Magnetization, Larmor frequency, Rotating frame of reference, Free induction decay, Relaxation times, Pulse sequences, Generation and Detection of NMR Imager. Slice selection, Frequency encoding, Phase encoding, Spin-Echo imaging, Gradient-Echo imaging, Imaging safety, Biological effects of magnetic field, Introduction to Functional MRI.	**09 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1:	Understand the basic principles of various imaging methodologies.
CO2:	Apply an appropriate imaging technique for a specific medical application.
CO3:	Select a suitable imaging technique taking into account its characteristics.
CO4:	Analysis and evaluate the performance of different imaging techniques with respect to medical diagnostics.

Reference Books	
1	Principles of Medical Imaging, K Kirk Shung, Michael B Smith &Benjamim M W Tsui, 1st edition 2012, Academic Press ,ISBN: 978-0126409703.
2	Medical Imaging Signals and Systems, Jerry L Prince & Jonathan M Links, 2006 edition, Pearson Prentice Hall, ISBN: 9780130653536.
3	The physics of medical imaging, Steve Webb, 1988, IOP Publishing Ltd,ISBN 0-85274-361-0.
4	Basics of MRI, Ray H Hashemi& William G Bradley Jr, 2nd edition, 2004, Lippincott Williams & Wilkins Publications, ISBN: 978-0781741576.

Scheme of Continuous Internal Evaluation (CIE); Theory (100 Marks)

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of two quizzes are conducted and each quiz is evaluated for 10 marks adding up to 20 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50 marks. A minimum of two assignments are given with a combination of two components among 1) solving innovative problems 2) seminar/new developments in the related course 3) Laboratory/field work 4) mini project.
Total CIE is 20+50+30=100 Marks.

Scheme of Semester End Examination (SEE) for 100 marks:

The question paper will have FIVE questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit.

Semester: III		
ARTIFICIAL ORGANS AND BIOMATERIALS **(Group E: Core Elective)**		
Course Code:18MBS3E1		**CIE Marks: 100**
Credits: L:T:P: 4:0:0		**SEE Marks: 100**
Hours: 45L		**SEE Duration: 3Hrs**

Course Learning Objectives:	
1	To understand the fundamental science and engineering principles relevant to materials.
2	To understand the interactions at the interface of material and biological systems.
3	To study the physical, mechanical and biological properties of materials which can be implanted in the human body and their bio-compatibility?
4	To acquaint the student with modern artificial organs devices and methods used to partially support or completely replace pathological organ.

Unit-I	
Structure of Biomaterials and Biocompatibility Definition and classification of biomaterials, mechanical properties, viscoelasticity, wound-healing process, body response to implants, blood compatibility	**09 Hrs**
Unit – II	
Implant materials Metallic implant materials, stainless steels, co-based alloys, Ti-based alloys, medical applications. **Polymeric implant materials** Polymerization, Basic Structure, Effect of Structural Modification on Properties, polyamides, Acrylic polymers, rubbers, high strength thermoplastics, medical applications. Biopolymers: Collagen and Elastin.	**09 Hrs**
Unit -III	
Tissue replacement implants Soft-tissue replacements, sutures, surgical tapes, adhesive, percutaneous and skin implants, maxillofacial augmentation, blood interfacing implants, hard tissue replacement implants, internal fracture fixation devices, joint replacements,visual and audio testing.	**09 Hrs**
Unit –IV	
Artificial Organs **Artificial Heart:**Structure and function, Prosthetic Cardiac Valves, Artificial lung (oxygenator). **Artificial Kidney:** Structure and function, Kidney disease, Renal failure, Mass transfer in dialysis, Clearance, Filtration, Permeability, Membranes, Hemofiltration.	**09 Hrs**
Unit –V	
Artificial Organs **Liver Support Systems:** Morphology & functions, Hepatic failure, Liver support systems, Hybrid Replacement procedures, Global Replacement of liver function, Bio-artificial systems. **Artificial Pancreas:** Structure and function, diabetes, insulin, insulin therapy, insulin administration & production systems.	**09 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1:	Understand the principles of material science engineering.
CO2:	Apply core concepts of material science to solve engineering problems.
CO3:	Analyze the structure and working of artificial organs.
CO4:	Design a prototype model using the biomaterial.

Reference Books	
1	The Biomedical Engineering Handbook, Joseph D Bronzino, Third Edition, 2006, CRC press, USA, ISBN: 0-8493-046-1
2	Biomaterials Science and Engineering, Park J.B, 2009, Plenum Press, ISBN: 978-1-4613-2769-1.
3	Biomaterials Science: An Introduction to Materials in Medicine,Buddy D. Ratner , Allan S. Hoffman, Frederick J. Schoen Jack E. Lemons, Academic Press Inc; 3rdedition,2012, 978-0123746269
4	Introduction to Biomedical Engineering, John Enderle, Joseph D. Bronzino, Susan M. Blanchard, 2009, Elsevier, ISBN:978-0-1223-8662-6.

Scheme of Continuous Internal Evaluation (CIE); Theory (100 Marks)

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of two quizzes are conducted and each quiz is evaluated for 10 marks adding up to 20 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50 marks. A minimum of two assignments are given with a combination of two components among 1) solving innovative problems 2) seminar/new developments in the related course 3) Laboratory/field work 4) mini project.
Total CIE is 20+50+30=100 Marks.

Scheme of Semester End Examination (SEE) for 100 marks:

The question paper will have FIVE questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit.

Semester: III		
REHABILITATION ENGINEERING **(Group E: Core Elective)**		
Course Code:18MBS3E2		**CIE Marks: 100**
Credits: L:T:P: 4:0:0		**SEE Marks: 100**
Hours: 45L		**SEE Duration: 3Hrs**

Course Learning Objectives:	
1	To develop an understanding of the various rehabilitation aid principle and its working.
2	Select the appropriate rehabilitation concept for various disabilities.
3	Compare the different methods of orthopedic prosthetics and orthotics for rehabilitation.
4	Design and develop orthotic and prosthetic

Unit-I	
Rehabilitation Fundamentals: Rehabilitation concepts, Engineering concepts in sensory rehabilitation, Engineering concepts in motor rehabilitation Future of engineering in Rehabilitation	**09 Hrs**
Unit – II	
Prosthetic And Orthotic Devices: Hand and arm replacement, different types of models for externally powered limb prosthetics, Lower limb, Upper limb orthotics, and material for prosthetic and orthotic devices, mobility aids.	**09 Hrs**
Unit -III	
Auditory And Speech Assist Devices: Types of deafness, hearing aids, application of DSP in hearing aids, Cochlear implants, Voice synthesizer, speech trainer.	**09 Hrs**
Unit –IV	
Visual Aids: Ultra sonic and laser canes, Intra ocular lens, Braille Reader, Tactile devices for visually challenged, Text voice converter, screen readers.	**09 Hrs**
Unit –V	
Medical Stimulator: Muscle and nerve stimulator, Location for Stimulation, Functional Electrical Stimulation, Sensory Assist Devices, Design issues	**09 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1:	Understanding of the various rehabilitation aid principles and its working.
CO2:	Apply the appropriate rehabilitation concept for various disabilities.
CO3:	Analyze and compare the different methods of selected rehabilitation aid for various disabilities.
CO4:	Design and develop orthotic and prosthetic rehabilitation aid.

Reference Books	
1	An Introduction to Rehabilitation Engineering, Rory A Cooper,2012, Taylor and Francis, London,ISBN-13 : 9781420012491
2	The Biomedical Engineering Handbook, Joseph D.Bronzino, FourthEdition ,Taylor & Francis, 2015, ISBN :1439825335, 9781439825334.
3	Advances in Bio Medical Engineering and Medical Physics,Levine.S.N.Editor, Inter University Publication, New York 1968.
4	Therapeutic Medical devices, Albert M.Cook and Webster J.G, Prentice Hall Inc., NewJersy, 1982.

Scheme of Continuous Internal Evaluation (CIE); Theory (100 Marks)

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of two quizzes are conducted and each quiz is evaluated for 10 marks adding up to 20 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50 marks. A minimum of two assignments are given with a combination of two components among 1) solving innovative problems 2) seminar/new developments in the related course 3) Laboratory/field work 4) mini project.
Total CIE is 20+50+30=100 Marks.

Scheme of Semester End Examination (SEE) for 100 marks:
The question paper will have FIVE questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit.

Semester: III		
ERGONOMICS **(Group E: Core Elective)**		
Course Code:18MBS3E3		**CIE Marks: 100**
Credits: L:T:P: 4:0:0		**SEE Marks: 100**
Hours: 45L		**SEE Duration: 3Hrs**

Course Learning Objectives:	
1	Define ergonomics and the various disciplines that contribute to the field.
2	Illustrate proper application of anthropometric measurements for analysis and design.
3	Design physical and psychosocial work systems and workplaces.
4	Create an awareness about the environmental factors affecting the employees.

Unit-I	
Introduction: Principles, Scope and Application of Ergonomics. **Applied Anthropometry** Static Dimensions,Dynamic (Functional) Dimensions, Use of Anthropometric Data.	**09 Hrs**
Unit – II	
Work-Space Design, and Seating Work-Space Envelopes for Seated Personnel,Work-Space Envelopes for Standing Personnel **Design of work surfaces** Horizontal Work Surface Area, Work-Surface Height: Seated**,** Work-Surface Height: Standing,General Principles of Seat Design**,** Specific Design Recommendations,Seat Designs for Specific Purposes, video display terminal (vdt) workstations.	**09 Hrs**
Unit -III	
Design of repetitive tasks Introduction to work-related musculoskeletal disorders ,Injuries to the upper body at work ,Review of tissue path mechanics and WMSDs, Disorders of the neck ,Carpal tunnel syndrome Tennis elbow (epicondylitis) ,Disorders of the shoulder Lower limbs, Ergonomic interventions, Trends in work-related musculoskeletal disorders.	**09 Hrs**
Unit –IV	
Vision, light and lighting Vision and the eye, Measurement of light, Lighting design considerations, Visual fatigue, eyestrain and near work, Psychological aspects of indoor lighting. **Heat, cold and the design of the physical environment** Fundamentals of human thermoregulation, Measuring the thermal environment ,Thermoregulatory mechanisms, Work in hot climates, Work in cold climates ,Skin temperature ,Protection against extreme climates, Comfort and the indoor climate ISO standards.	**09 Hrs**
Unit –V	
Hearing, sound, noise and vibration Ear protection, Design of the acoustic environment, Industrial noise control, Noise and communication The auditory environment outdoors, Effects of noise on task performance ,Non-auditory effects of noise on health ,Noise and satisfaction, Vibration.	**09 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1:	Understand the techniques, skills, and modern human factors and workplace ergonomics tools necessary for industrial and systems engineering practice.
CO2:	Apply basic knowledge of physical factors affecting human beings in relation to light, lighting, sound and noise, climate and vibrations.
CO3:	Analyse and reflect on the results of ergonomic analysis of product systems and draw conclusions and give recommendations.
CO4:	Design a system, component, or process to meet accepted human factors and workplace ergonomics standards

Reference Books	
1	Introduction to Ergonomics, Bridger, R.S. 3rd edition, 2008, McGraw Hill,. ISBN-13: 978-0849373060.
2	Human Factors in Engineering and Design, Sanders and McCormick, McGraw-Hill Book Co., Inc., New York, 7th Edition, 2013. ISBN 13: 9780070549012.
3	Fitting the task to Man, Grandjaen, 2008, Taylor Pub, ISBN-13: 978-0850663792.
4	A Guide to Human factors and Ergonomics, Martin Helander, 2006, TMH, ISBN-13: 978-0415282482.

Scheme of Continuous Internal Evaluation (CIE); Theory (100 Marks)

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of two quizzes are conducted and each quiz is evaluated for 10 marks adding up to 20 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50 marks. A minimum of two assignments are given with a combination of two components among 1) solving innovative problems 2) seminar/new developments in the related course 3) Laboratory/field work 4) mini project.
Total CIE is 20+50+30=100 Marks.

Scheme of Semester End Examination (SEE) for 100 marks:

The question paper will have FIVE questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit.

INTERNSHIP						
Course Code	**:**	**18MBS33**		**CIE Marks**	**:**	**100**
Credits	**:**	**L:T:P**	**0:0:5**	**SEE Marks**	**:**	**100**
Hours/week	**:**	**10Hrs**		**SEE Duration**	**:**	**3 Hrs**

GUIDELINES FOR INTERNSHIP

Course Learning Objectives (CLO):

The students shall be able to:

(1) Understand the process of applying engineering knowledge to produce product and provide services.

(2) Explain the importance of management and resource utilization

(3) Comprehend the importance of team work, protection of environment and sustainable solutions.

(4) Imbibe values, professional ethics for lifelong learning.

1) The duration of the internship shall be for a period of 8 weeks on full time basis between II semester final exams and beginning of III semester.
2) The student must submit letters from the industry clearly specifying his / her name and the duration of the internship on the company letter head with authorized signature.
3) Internship must be related to the field of specialization or the M.Tech program in which the student has enrolled.
4) Students undergoing internship training are advised to report their progress and submit periodic progress reports to their respective guides.
5) Students have to make a presentation on their internship activities in front of the departmental committee and only upon approval of the presentation should the student proceed to prepare and submit the hard copy of the internship final report. However interim or periodic reports and reports as required by the industry / organization can be submitted as per the format acceptable to the respective industry /organizations.
6) The reports shall be printed on bond paper – 80GSM, back to back print, with soft binding – A4 size with 1.5 spacing and times new roman font size 12.
7) The broad format of the internship final report shall be as follows
    - Cover Page
    - Certificate from College
    - Certificate from Industry / Organization
    - Acknowledgement
    - Synopsis
    - Table of Contents
    - Chapter 1 - Profile of the Organization – Organizational structure, Products, Services, Business Partners, Financials, Manpower, Societal Concerns, Professional Practices,
    - Chapter 2 - Activities of the Department -
    - Chapter 3 – Tasks Performed – summaries the tasks performed during 8 week period
    - Chapter 4 – Reflections – Highlight specific technical and soft skills that you acquired during internship
    - References & Annexure

Course Outcomes:

After going through the internship the student will be able to:

CO1: Apply engineering and management principles

CO2: Analyze real-time problems and suggest alternate solutions

CO3: Communicate effectively and work in teams

CO4: Imbibe the practice of professional ethics and need for lifelong learning.

Scheme of Continuous Internal Evaluation (CIE):

A committee comprising of the Head of the Department / Associate Dean, Associate Professor, Assistant Professor and Guide would review the presentation and the progress reports in two phases. The evaluation criteria shall be as per the rubrics given below:

Scheme for Semester End Evaluation (SEE):

The evaluation will be done by ONE senior faculty from the department and ONE external faculty member from Academia / Industry / Research Organization. The following weightages would be given for the examination. Evaluation will be done in batches, not exceeding 6 students.

(1) Explanation of the application of engineering knowledge in industries 35%

(2) Ability to comprehend the functioning of the organization/ departments 20%

(3) Importance of resource management, environment and sustainability 25%

(4) Presentation Skills and Report 20%

Dissertation Phase 1						
Course Code	**:**	**18MBS34**		**CIE Marks**	**:**	**100**
Credits	**:**	**L:T:P**	**0:0:5**	**SEE Marks**	**:**	**100**
Hours	**:**	**10**		**SEE Duration**	**:**	**3 Hours**

Course Learning Objectives:

The students shall be able to

1. Understand the method of applying engineering knowledge to solve specific problems.
2. Apply engineering and management principles while executing the project
3. Demonstrate good verbal presentation and technical report writing skills.
4. Identify and solve complex engineering problems using professionally prescribed standards.

GUIDELINES

1. Major project will have to be carried out by only one student in his/her area of interest.
2. Each student has to select a contemporary topic that will use the technical knowledge of their program of specialization.
3. Allocation of the guides preferably in accordance with the expertise of the faculty.
4. The project can be carried out on-campus or in an industry or an organization with prior approval from the Head of the Department.
5. The standard duration of the project is for 16 weeks, however if the guide and the evaluation committee of the department, after the assessment feel that the work is insufficient and it has to be extended, then the student will have to continue as per the directions of the guide and the committee.
6. It is mandatory for the student to present his/her work in one of the international conferences or publish the research finding in a reputed unpaid journal with impact factor.

Course Outcomes:

After going through this course the students will be able to

CO1: Conceptualize, design and implement solutions for specific problems.
CO2: Communicate the solutions through presentations and technical reports.
CO3: Apply project and resource managements skills, professional ethics, societal concerns
CO4: Synthesize self-learning, sustainable solutions and demonstrate life-long learning

Scheme of Continuous Internal Examination (CIE)

Evaluation will be carried out in THREE Phases. The evaluation committee will comprise of: guide, two senior faculty members, one industry member and Head of the Department.

Phase	Activity	Weightage
4th week	Topic approval along with Synopsis	20%
8th week	Literature survey with Problem Statement	20%
12th week	Motivation and Objectives	20%
15th week	Preliminary report for the approval of selected topic along with methodology.	40%

CIE Evaluation shall be done with marks distribution as follows:

- Selection of the topic 10%
- Literature review and framing of objectives 25%
- Defining the brief methodology along with the algorithm development/experimental setup 25%
- Presentation 20%
- Report writing 20%

Scheme for Semester End Evaluation (SEE):

The evaluation will be done by ONE senior faculty from the department and ONE external faculty member from Academia / Industry / Research Organization. The following weightages would be given for the examination. Evaluation will be done in batches, not exceeding 6 students.

1. Brief write-up about the project 5%
2. Formulation of Project Objectives & Methodology 20%
3. Presentation 25%
4. Report 20%
5. Viva Voce 30%

Dissertation Phase II						
Course Code	**:**	**18MBS41**		**CIE Marks**	**:**	**100**
Credits	**:**	**L:T:P**	**0:0:20**	**SEE Marks**	**:**	**100**
Hours/Week	**:**	**40**		**SEE Duration**	**:**	**3 Hours**

Course Learning Objectives:

The students shall be able to

1. Understand the method of applying engineering knowledge to solve specific problems.
2. Apply engineering and management principles while executing the project
3. Demonstrate good verbal presentation and technical report writing skills.
4. Identify and solve complex engineering problems using professionally prescribed standards.

GUIDELINES

1. Major project will have to be done by only one student in his/her area of interest.
2. Each student has to select a contemporary topic that will use the technical knowledge of their program of specialization.
3. Allocation of the guides preferably in accordance with the expertise of the faculty.
4. The project can be carried out on-campus or in an industry or an organization with prior approval from the Head of the Department.
5. The standard duration of the project is for 16 weeks, however if the guide and the evaluation committee of the department, after the assessment feel that the work is insufficient and it has to be extended, then the student will have to continue as per the directions of the guide and the committee.
6. It is mandatory for the student to present his/her work in one of the international conferences or publish the research finding in a reputed unpaid journal with impact factor.

Course Outcomes:

After going through this course the students will be able to

CO1: Conceptualize, design and implement solutions for specific problems.
CO2: Communicate the solutions through presentations and technical reports.
CO3: Apply project and resource managements skills, professional ethics, societal concerns
CO4: Synthesize self-learning, sustainable solutions and demonstrate life long learning

Scheme of Continuous Internal Examination (CIE)

Evaluation will be carried out in THREE Phases. The evaluation committee will comprise of: guide, two senior faculty members, one industry member and Head of the Department.

Phase II	Activity	Weightage
5th week	Review and refinement of Objectives and methodology.	20%
10th week	Mid-term progress review shall check the compliance with the objectives and methodology presented in Phase I, review the work performed.	40%
15th week	Oral presentation, demonstration and submission of project report. Outcome and publication	40%

CIE Evaluation shall be done with marks distribution as follows:

- Review of formulation of objectives and methodology 10%
- Design and simulation/ algorithm development/experimental setup 25%
- Conducting experiments / implementation / testing / analysis 25%
- Demonstration & Presentation 20%
- Report writing 20%

Scheme for Semester End Evaluation (SEE):

The evaluation will be done by ONE senior faculty from the department and ONE external faculty member from Academia / Industry / Research Organization. The following weightages would be given for the examination. Evaluation will be done in batches, not exceeding 6 students.

1. Brief write-up about the project 5%
2. Formulation of Project Objectives & Methodology 20%
3. Experiments / Analysis Performed; Results & Discussion 25%
4. Report 20%
5. Viva Voce 30%

TECHNICAL SEMINAR						
Course Code	**:**	**18MBS42**		**CIE Marks**	**:**	**50**
Credits	**:**	**L:T:P**	**0:0:2**	**SEE Marks**		**50**
Hours/Week	**:**	**4**		**SEE Duration**		**30 min**

Course Learning Objectives (CLO):

The students shall be able to:

(1) Understand the technological developments in their chosen field of interest
(2) Explain the scope of work and challenges in the domain area
(3) Analyze these engineering developments in the context of sustainability and societal concerns.
(4) Improve his/her presentation skills and technical report writing skills

GUIDELINES

1) The presentation will have to be done by individual students.
2) The topic of the seminar must be in one of the thrust areas with in-depth review and analysis on a current topic that is relevant to industry or on-going research.
3) The topic could be an extension or complementary to the project
4) The student must be able to highlight or relate these technological developments with sustainability and societal relevance.
5) Each student must submit both hard and soft copies of the presentation.

Course Outcomes:

After going through this course the student will be able to:

CO1: Identify topics that are relevant to the present context of the world
CO2: Perform survey and review relevant information to the field of study.
CO3: Enhance presentation skills and report writing skills.
CO4: Develop alternative solutions which are sustainable

Scheme of Continuous Internal Evaluation (CIE): Evaluation would be carried out in TWO phases. The evaluation committee shall comprise of Head of the Department / Associate Dean, Associate Professor, Assistant Professor and Guide. The evaluation criteria shall be as per the rubrics given below:

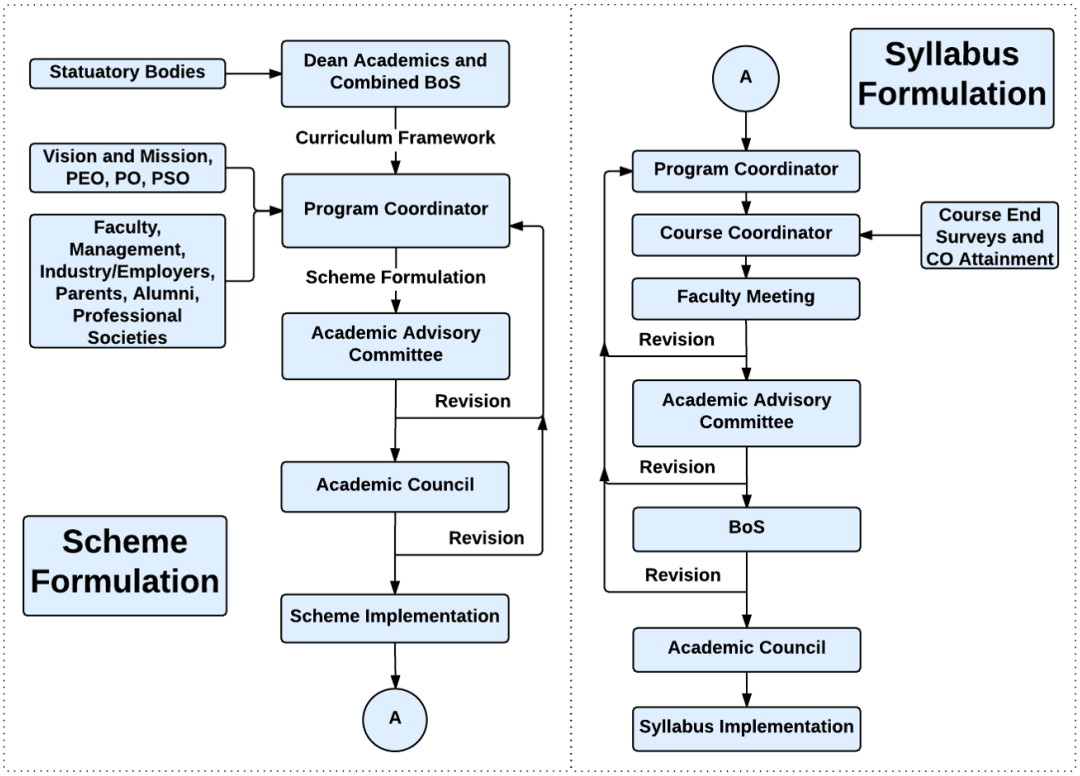
Scheme for Semester End Evaluation (SEE):

The evaluation will be done by ONE senior faculty from the department and ONE external faculty member from Academia / Industry / Research Organization. The following weightages would be given for the examination. Evaluation will be done in batches, not exceeding 6 s

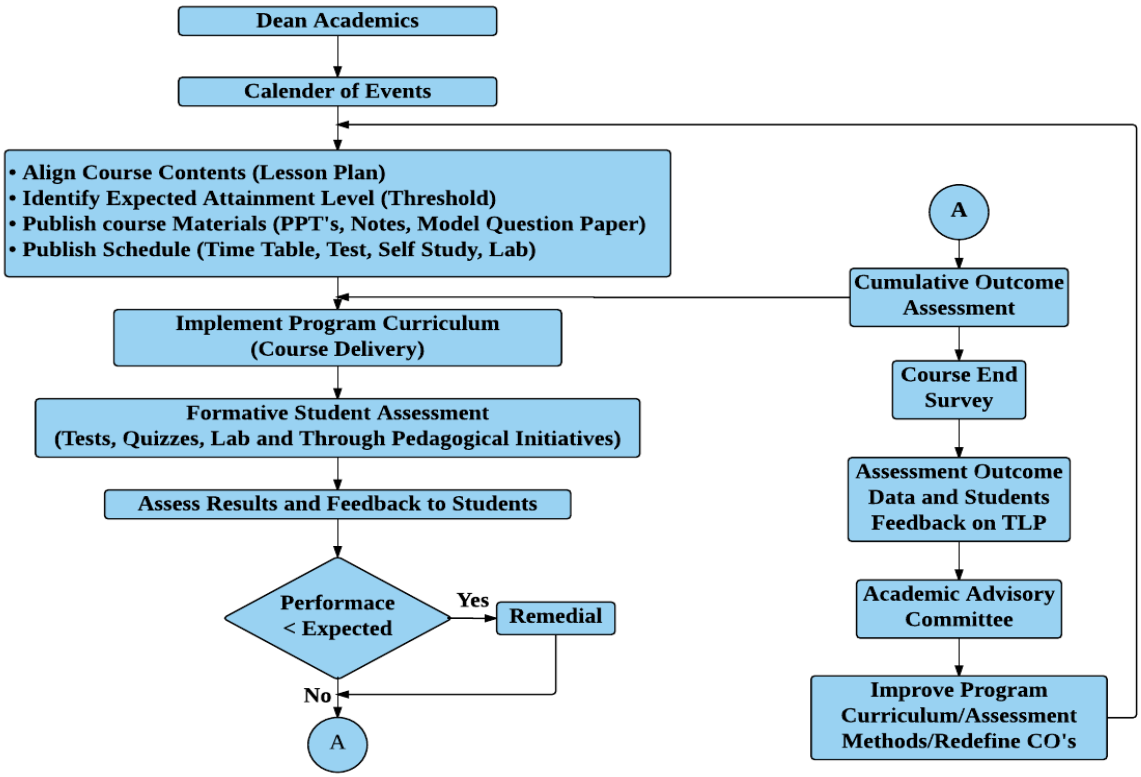
Rubrics for Evaluation:

1) Topic – Technical Relevance, Sustainability and Societal Concerns 15%
2) Review of literature 25%
3) Presentation Skills 35%
4) Report 25%

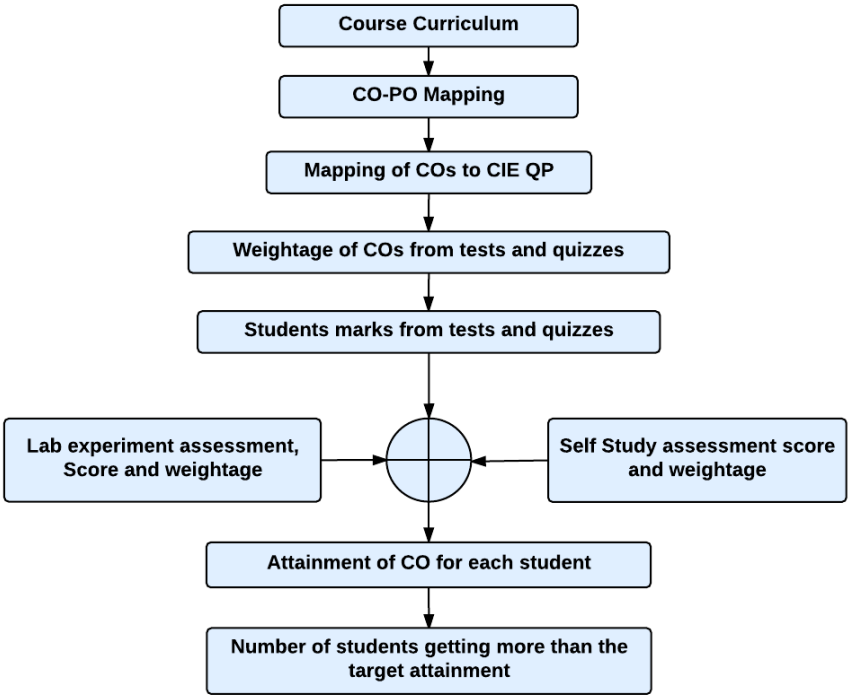
Curriculum Design Process



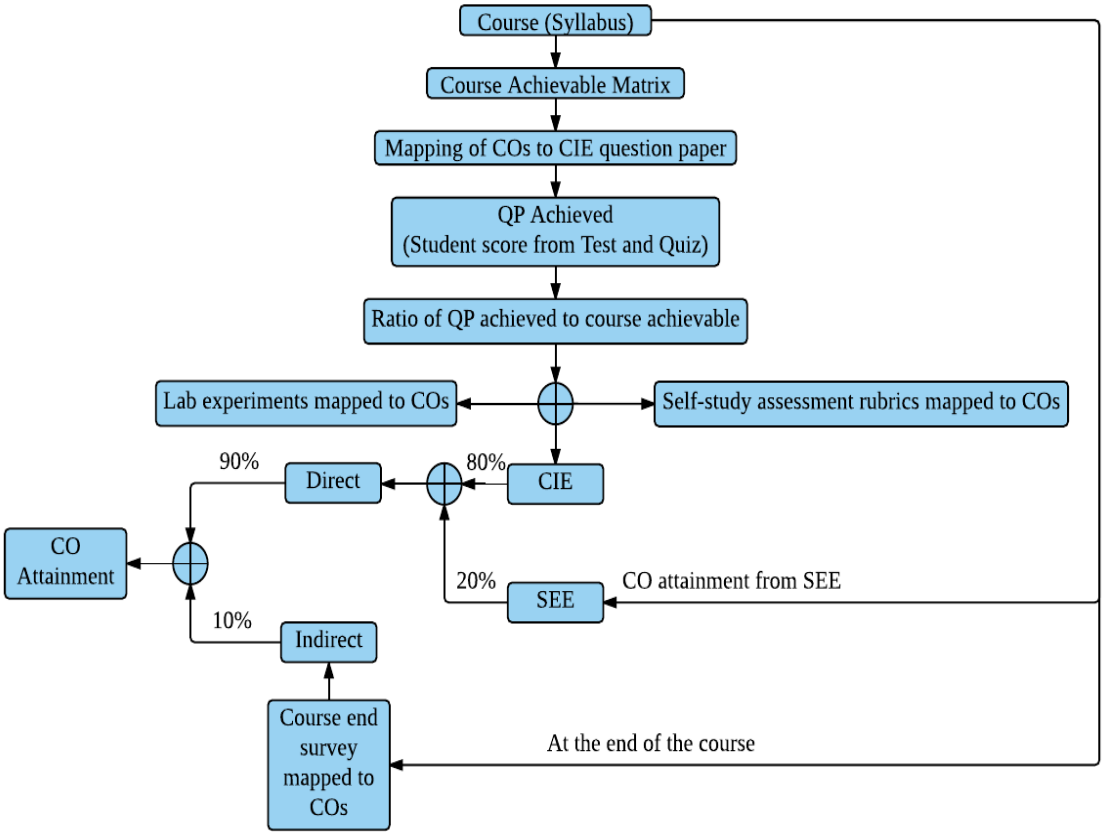
Academic Planning And Implementation



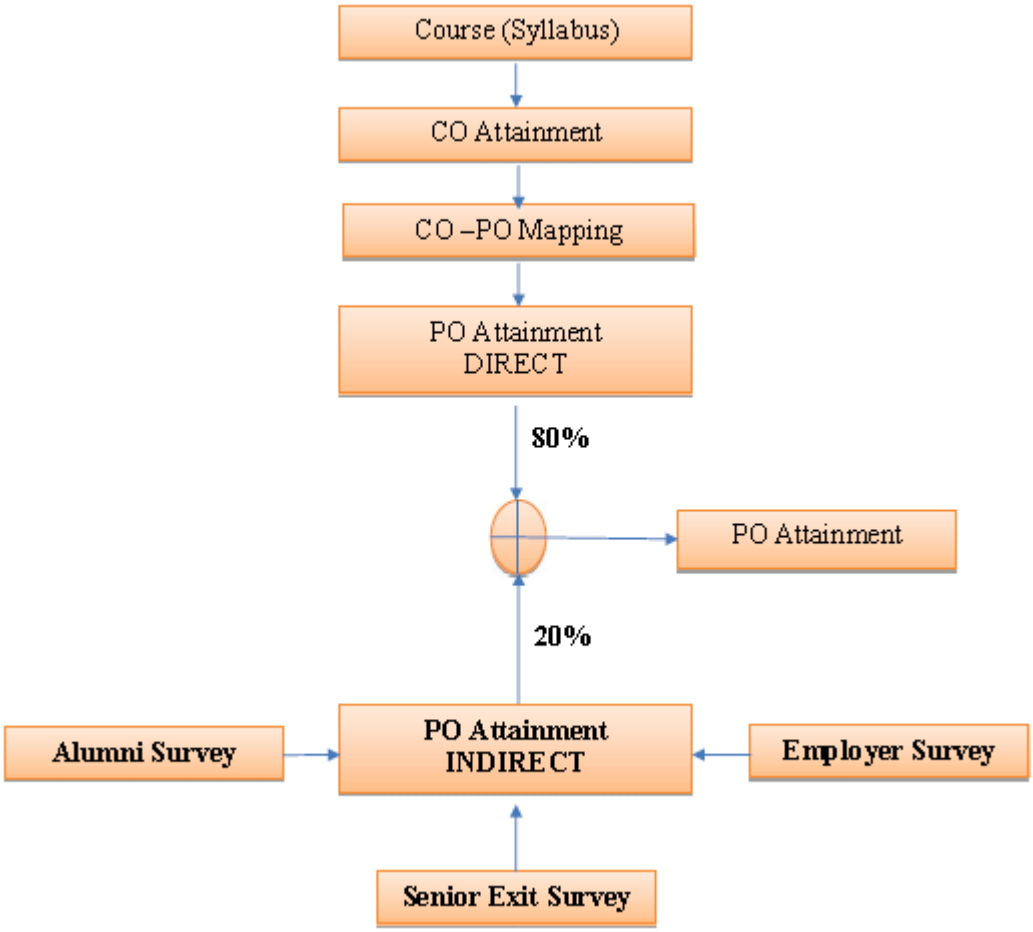
Process For Course Outcome Attainment



Final CO Attainment Process



Program Outcome Attainment Process



PROGRAM OUTCOMES (PO)

M. Tech. in Biomedical Signal Processing & Instrumentation Program graduates will be able to:

PO1: An ability to independently carry out research /investigation and development work to solve practical problems

PO2:ability to write and present a substantial technical report/document

PO3: Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program

PO4: Develop innovative techniques for health care applications using modern engineering hardware, and software simulation tools.

PO5: Adapt interdisciplinary research leading to successful biomedical professionals, with an aptitude for life-long learning.

PO6: Practice intellectual integrity, ethical research, and become capable of developing functional prototypes worth the patenting and technology transfer.