AC 7/6/2014
Item No. – 4.24

UNIVERSITY OF MUMBAI

Bachelor of Engineering

Biomedical Engineering (Fourth Year Sem VII & VIII)

Revised Course (Rev- 2012)

With effect from Academic Year 2015 -16

Under

FACULTY OF TECHNOLOGY

(As per Semester Based Credit and Grading System)

Preamble

To meet the challenge of ensuring excellence in engineering education, the issue of quality needs to be addressed, debated and taken forward in a systematic manner. Accreditation is the principal means of quality assurance in higher education. The major emphasis of accreditation process is to measure the outcomes of the program that is being accredited. In line with this Faculty of Technology of University of Mumbai has taken a lead in incorporating philosophy of outcome based education in the process of curriculum development.

Faculty of Technology, University of Mumbai, in one of its meeting unanimously resolved that, each Board of Studies shall prepare some Program Educational Objectives (PEO's) and give freedom to affiliated Institutes to add few (PEO's) and Course objectives and Course outcomes to be clearly defined for each Course, so that all faculty members in affiliated institutes understand the depth and approach of Course to be taught, which will enhance Learners's learning process. It was also resolved that, maximum senior faculty from colleges and experts from industry to be involved while revising the curriculum. I am happy to state that, each Board of studies has adhered to the resolutions passed by Faculty of Technology, and developed curriculum accordingly. In addition to outcome based education, semester based credit and grading system is also introduced to ensure quality of engineering education.

Semester based Credit and Grading system enables a much-required shift in focus from teacher-centric to Learners-centric education since the workload estimated is based on the investment of time in learning and not in teaching. It also focuses on continuous evaluation which will enhance the quality of education. University of Mumbai has taken a lead in implementing the system through its affiliated Institutes and Faculty of Technology has devised a transparent credit assignment policy and adopted ten points scale to grade Learners's performance. Credit and grading based system was implemented for First Year of Engineering from the academic year 2012-2013. Subsequently this system will be carried forward for Second Year Engineering in the academic year 2013-2014, for Third Year and Final Year Engineering in the academic years 2014-2015 and 2015-2016 respectively.

Dr. S. K. Ukarande
Dean,
Faculty of Technology,
Member - Management Council, Senate, Academic Council
University of Mumbai, Mumbai

Preamble

The overall technical education in our country is changing rapidly in manifolds. Now it is very much challenging to maintain the quality of education with its rate of expansion. To meet present requirement a systematic approach is necessary to build the strong technical base with the quality. Accreditation will provide the quality assurance in higher education and also to achieve recognition of the institution or program meeting certain specified standards. The main focus of an accreditation process is to measure the program outcomes, essentially a range of skills and knowledge that a Learner will have at the time of graduation from the program that is being accredited. Faculty of Technology of University of Mumbai has taken a lead in incorporating philosophy of outcome based education in the process of curriculum development.

I, as Chairman, Board of Studies in Electrical Engineering of University of Mumbai, happy to state here that, Program Educational Objectives (PEOs) were finalized for undergraduate program in Electrical Engineering, more than twenty senior faculty members from the different institutes affiliated to University of Mumbai were actively participated in this process. Few PEOs were finalized for undergraduate program in Electrical Engineering are listed below;

- To provide the overall strong technical foundation to formulate, solve and analyse engineering problems during undergraduate program.
- To prepare Learners to demonstrate an ability to identify, formulate and solve electrical based issues.
- To prepare Learners to demonstrate an ability in the area of design, control, analyse and interpret the electrical and electronics systems.
- To prepare Learners for successful career in industry, research and development.
- To develop the ability among Learners for supervisory control and data acquisition for power system application.
- To provide opportunity for Learners to handle the multidisciplinary projects.
- To create the awareness of the life-long learning and to introduce them to professional ethics and codes of professional practice.

The affiliated institutes may include their own PEOs in addition to the above list

To support the philosophy of outcome based education, in addition to stated PEOs, objectives and expected outcomes are also included in the curriculum. I know, this is a small step taken to enhance and provide the quality education to the stake holders.

Dr. M. V. Bhatkar
Chairman,
Board of Studies in Electrical Engineering,
University of Mumbai

Syllabus Scheme for B.E. Semester VII Biomedical Engineering

Course Code	Course Name	Teaching Scheme			Credits Assigned			
		Theory	Pract.	Tut	Theory	Pract.	Tut	Total
BMC701	Biomedical Instrumentation-III	4	2	-	4	1	-	5
BMC702	Medical Imaging – II	4	2	-	4	1	-	5
BMC703	Biomechanics Prosthesis and Orthosis	4	2	-	4	1	-	5
BMC704	Very Large Scale Integrated Circuits	4	2	-	4	1	-	5
BMC705	Networking and Information System in Medicine	4	2	-	4	1	-	5
BMP706	Project Stage – I	-	*	-	-	3	-	3
	TOTAL	**20**	**16**	**-**	**20**	**8**	**-**	**28**

* Learner is allotted 6hrs per week for the project work.

Course Code	Course Name	Examination scheme							
		Theory Marks				Term work	Pract.	Oral	Total
		Internal Assessment			End Sem exam				
		Test 1	Test 2	Avg.					
BMC701	Biomedical Instrumentation-III	20	20	20	80	25	-	25	150
BMC702	Medical Imaging – II	20	20	20	80	25	-	25	150
BMC703	Biomechanics Prosthesis and Orthosis	20	20	20	80	25	-	-	125
BMC704	Very Large Scale Integrated Circuits	20	20	20	80	25	-	-	125
BMC705	Networking and Information System in Medicine	20	20	20	80	25	-	25	150
BMP706	Project Stage – I	-	-	-	-	25	-	25	50
TOTAL				**100**	**400**	**150**	**-**	**100**	**750**

Course Code	Course Name	Teaching Scheme			Credits Assigned			
		Theory	Pract.	Tut	Theory	Pract.	Tut	Total
BMC701	Biomedical Instrumentation-III (abbreviated as BMI-III)	4	2	-	4	1	-	5

Course Code	Course Name	Examination scheme							
		Theory Marks				Term work	Pract.	Oral	Total
		Internal Assessment			End Sem exam				
		Test 1	Test 2	Avg.					
BMC701	Biomedical Instrumentation-III	20	20	20	80	25	-	25	150

Course Objectives	1. To understand the basic principle, working and design of various automated diagnostic equipments. 2. To develop skills enabling Biomedical Engineers to serve Hospitals, National and International Industries and Government Agencies. 3. To develop core competency in the field of Biomedical Engineering to gain technical expertise in biology and medicine for effective contribution in the development and improvement of health care solutions. 4. To study various medical instrumentation systems, drug delivery systems and health management systems.
Course Outcomes	A Learner will be able to 1. Demonstrate the principles of electronics used in designing various diagnostic equipment. 2. Have in-depth knowledge about different streams in Biomedical Engineering with greater emphasis on health care equipments and the advanced technologies such as Telemedicine, Telemetry, Medical Imaging, etc. 3. Exhibit competency in suggesting, designing and offering the apt, reliable and optimum solution after understanding customer's requirement completely. 4. Demonstrate ability of correlating theoretical concepts with their practical implementation while performing laboratory exercises and project work. 5. Provide a better technical support with exposure to the hospitals and health care industry. 6. Use modern methodologies, multi-disciplinary skill set and knowledge while working on real time projects that demand convergence of engineering, science and technology.

Module	Contents	Time
1.	**Physiotherapy, Electrotherapy Equipments**: Basic principle, working and technical specifications of Shortwave Diathermy, Ultrasonic therapy unit, Infrared and UV lamps, Nerve and Muscle Stimulator.	14
2.	**Surgical Instruments:** Surgical Diathermy machine, electrodes used with surgical diathermy, safety aspects in electronic surgical units, surgical diathermy analyzers.	10
3.	**Cardiac Pacemakers:** Modes of operation, leads and electrodes. Power supply sources. External and Implantable Pacemaker, Performance aspects of Implantable Pacemaker.	8
4.	**Cardiac Defibrillators:** DC defibrillator, Modes of operation and electrodes, Performance aspects of dc-defibrillator, defibrillator analyzers. Implantable defibrillator and defibrillator analyzer.	8
5.	**Hemodialysis Machine:** Basic principle of Dialysis and its type. Different types of dialyzer membrane, Portable type. Various monitoring circuits.	4
6.	**Laser Applications in Biomedical Engineering** Laser classifications, Types of Lasers, Medical Applications, Laser delivery Systems and safety.	4

Text books:

1. Handbook of Biomedical Instrumentation: R S. Khandpur. (PH Pub)
2. Medical Instrumentation, Application and Design: J G. Webster. (John Wiley)
3. Introduction to Biomedical Equipment Technology: Carr –Brown. (PH Pub)

Reference Books:

1. Encyclopedia of Medical Devices and Instrumentation: J G. Webster. Vol I- IV (PH Pub)
2. Various Instruments Manuals.
3. Various internet resources.

Internal Assessment (IA):

Two tests must be conducted which should cover at least 80% of syllabus. The average marks of both the tests will be considered for final Internal Assessment.

End Semester Examination:

Question paper will comprise of 6 questions, each carrying 20 marks.
The Learners need to solve total 4 questions.
Question No.1 will be compulsory and based on entire syllabus.
Remaining question (Q.2 to Q.6) will be selected from all the modules.

Term Work:

Term work consists of minimum eight experiments. The distribution of the term work shall be as follows:

Laboratory work (Experiments and Journal) :20 marks
Attendance (Practical and Theory) :05 marks

The final certification and acceptance of term-work ensures the satisfactory performance of laboratory work and completion of journal. Term work assessment must be based on the overall performance of the learner.

Course Code	Course Name	Teaching Scheme			Credits Assigned			
		Theory	Pract.	Tut	Theory	Pract.	Tut	Total
BMC702	Medical Imaging-II (abbreviated as MI-II)	4	2	-	4	1	-	5

Course Code	Course Name	Examination scheme							
		Theory Marks				Term work	Pract.	Oral	Total
		Internal Assessment			End Sem exam				
		Test 1	Test 2	Avg.					
BMC702	Medical Imaging-II	20	20	20	80	25	-	25	150

Course Objectives	1. To familiarize the learners with the various Imaging techniques in medicine operating principles and quality control aspects of various imaging modalities. 2. To keep the learners abreast with the technological developments in the field of Medical Imaging
Course Outcomes	A Learner will able to 1. Understand essential physics, concepts of Medical Imaging and how they are employed in diagnosis and therapy. 2. Get familiar with the current techniques of medical Imaging along with their clinical applications. 3. To apprehend the importance of radiation constructive utilization and safety.

Module	Contents	Time
1.	**Principle of Computed tomography** Scanner configurations/generations, CT system: Scanning unit(gantry), detectors, data acquisition system, spiral CT, scanner parameters, CT Number Reconstruction techniques, Radon Transform, Filtered Back projection, Fourier Reconstruction Technique, Iterative reconstruction Technique, Image quality and artifacts, Clinical applications of CT	10
2.	**Advancements in CT** Multi-detector computed tomography (MDCT), Flat panel detectors CT-Angiography contrast agents in CT	06
3.	**Nuclear Magnetic Resonance:** Physics of MRI, Relaxation Parameters and Spin Echoes, Magnetic Field Gradients, Slice selection and Frequency Encoding	06
4.	**Magnetic Resonance Imaging** Hardware: Magnets, Gradient systems, RF coils, Fourier Reconstruction techniques, Image contrast, Resolution and Factors affecting signal-to-noise. Safety Considerations/Biological Effects of MRI	10

5.	Pulse sequences in MRI,Contrst agents MR Angiography,Perfusion MRI, Clinical applications	08
6.	**Magnetic Resonance Spectroscopy (MRS)** Basic Principle of MRS and localization techniques, Chemical Shift Imaging, Single-voxel and Multivoxel MRS, Water Suppression techniques	08

Text books:

1. Physics of Diagnostic Radiology :Christensen
2. Medical Imaging Physics William .R.Hendee

Reference Books:

1. Biomedical Technology and Devices by James Moore .
2. Biomedical Engineering Handbook by Bronzino
3. Physics of Diagnostic images –Dowsett

Internal Assessment (IA):

Two tests must be conducted which should cover at least 80% of syllabus. The average marks of both the tests will be considered for final Internal Assessment.

End Semester Examination:

Question paper will comprise of 6 questions, each carrying 20 marks.
The Learners need to solve total 4 questions.
Question No.1 will be compulsory and based on entire syllabus.
Remaining question (Q.2 to Q.6) will be selected from all the modules.

Term Work:

Term work consists of minimum eight experiments. The distribution of the term work shall be as follows:

Laboratory work (Experiments and Journal) :20 marks
Attendance (Practical and Theory) :05 marks

The final certification and acceptance of term-work ensures the satisfactory performance of laboratory work and completion of journal. Term work assessment must be based on the overall performance of the learner.

Course Code	Course Name	Teaching Scheme			Credits Assigned			
		Theory	Pract.	Tut	Theory	Pract.	Tut	Total
BMC703	Biomechanics Prosthesis and Orthosis (abbreviated as BPO)	4	2	-	4	1	-	5

Course Code	Course Name	Examination scheme							
		Theory Marks				Term work	Pract.	Oral	Total
		Internal Assessment			End Sem exam				
		Test 1	Test 2	Avg.					
BMC703	Biomechanics Prosthesis and Orthosis	20	20	20	80	25	-	-	125

Course Objectives	1. To recall the general characteristics, mechanical properties of bone and tissues. 2. To analyze the forces at joints for various static and dynamic human activities; analyze the stresses and strains in biological tissues. 3. To understand principles used in designing orthoses and prostheses. 4. To study different materials used for orthoses and prosthesis. 5. To understand the fabrication of prostheses and orthoses.
Course Outcomes	A learner will be able to 1. Understand the definition of biomechanics, prostheses orthoses and its classification and design principles. 2. Develop a better understanding of how mechanical principles influence human motion during everyday life.

Module	Contents	Time
	BIOMECHANICS	
1.	**Force system:** Classification of force system. Equilibrium of force system.	02
2.	**Tissue Biomechanics**: Direct shear, bending and torque actions and the corresponding stresses and strains in biological tissues. Stress relaxation and creep. Bone structure & composition, Mechanical properties of bone, Fracture mechanism & crack propagation in bones. Soft connective (skin, tendon, ligaments, etc.) covering structure function, and physiological factors.	12
3.	**Movement Biomechanics:** Study of joints and movements. Anatomical levers, Gait Analysis.	08
4.	**Joint analysis**: Instrumentation for gait analysis: Measurement devices-footswitches, instrumented	07

	walkway, Motion analysis- interrupted light photography, film/video, Selspot, Goniometers.	
	PROSTHETICS AND ORTHOTICS	
5.	**Principles in designing orthoses and prostheses:** Principles of three point pressure, total contact, partial weight bearing.	06
6.	**Classification in prosthetics and orthotics:** Lower Extremity orthoses and prostheses, Upper Extremity orthoses and prostheses. Spinal orthoses.	13

List of Experiments:

1. To study the concurrent coplanar force system.
2. To study the Stress – Strain relation of Mild steel
3. To study the Classification of the human bones
4. To study different types of joints in human body and joint movements
5. To study the Classification of Muscles
6. To simulate elbow joint using bell crank lever.
7. To study the human gait cycle
8. To study the Gait Cycle Parameters
9. Fabrication of PTB/socket.

The concerned teachers of the Course BPO can arrange the visit in rehabilitation centre.

Text books:

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

Reference Books:

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

Internal Assessment (IA):

Two tests must be conducted which should cover at least 80% of syllabus. The average marks of both the tests will be considered for final Internal Assessment.

End Semester Examination:

Question paper will comprise of 6 questions, each carrying 20 marks.
The Learners need to solve total 4 questions.
Question No.1 will be compulsory and based on entire syllabus.
Remaining question (Q.2 to Q.6) will be selected from all the modules.

Term Work:
Term work consists of minimum eight experiments. The distribution of the term work shall be as follows:

Laboratory work (Experiments and Journal)	:20 marks
Attendance (Practical and Theory)	:05 marks

The final certification and acceptance of term-work ensures the satisfactory performance of laboratory work and completion of journal. Term work assessment must be based on the overall performance of the learner.

Course Code	Course Name	Teaching Scheme			Credits Assigned			
		Theory	Pract.	Tut	Theory	Pract.	Tut	Total
BMC704	Very Large Scale Integrated Circuits (abbreviated as VLSI)	4	2	-	4	1	-	5

Course Code	Course Name	Examination scheme							
		Theory Marks				Term work	Pract.	Oral	Total
		Internal Assessment			End Sem exam				
		Test 1	Test 2	Avg.					
BMC704	Very Large Scale Integrated Circuits	20	20	20	80	25	-	-	125

Course Objectives	1. To introduce to various fabrication technologies for electronic devices. 2. To expose to hardware description language which will help them to understand and design various tools for the devices.
Course Outcomes	A Learner will be able to 1. Understand the technology behind the integrated circuits and will be able to design them as for various VLSI applications.

Module	Contents	Time
1.	Introduction to VHDL hardware description language, core features of VHDL, data types, concurrent and sequential statements, data flow, behavioral, structural architecture. Architecture of Xilinx XC4000 FPGA family	08
2.	Combinational and Sequential Logic design using VHDL .Using VHDL combinational circuit design examples- multipliers, decoders and encoders, cascading comparator. VHDL sequential circuit design features. Implementation of counters and registers in VHDL	08
3.	Very Large Scale Integration (VLSI) Technology Physics of NMOS, PMOS, enhancement and depletion mode transistor, MOSFET, threshold voltage, flatband condition, linear and saturated operation, FET capacitance, short channel and hot electron effect.	08
4.	MOS Transistors, MOS transistor switches, Basic MOS inverter and its working, types of MOS invertors viz active load nMOS inverter, MOSFET Inverter with E-nMOS as pull up, MOSFET Inverter with D- nMOS as pull up, MOSFET Inverter with pMOS as pull up, cmos inverter, voltage transfer characteristics, noise immunity and noise margins, power and area considerations ,Parameter measurement in MOS circuits	08
5.	Silicon Semiconductor Technology Wafer processing, mask generation, oxidation,	08

	epitaxy growth diffusion, ion implantation, lithography, etching, metalization, basic NMOS and PMOS processes. Latch up in CMOS and CMOS using twin tub process. Scaling of MOS circuits, types of scaling and limitations of scaling.	
6.	Design rules and Layout NMOS and CMOS design rules and layout, Design of NMOS and CMOS inverters, NAND and NOR gates. Interlayer contacts, butting and buried contacts, stick diagrams, layout of inverter, NAND and NOR gates. Design of basic VLSI circuits Design of circuits like multiplexer, decoder, priority encoder, Flip flops, shift registers using MOS circuits	08

List of Experiments:

1. Study of NMOq W modulation of NMOS channel (Using ORCAD or similar software)
2. Study of CMOS Inverter characteristics (Using ORCAD or similar software)
3. Basic Logic gates (using VHDL)
4. Binary to gray and Gray to Binary code conversion(using VHDL)
5. Binary to Excess-3 code conversion(using VHDL)
6. Implementation of 4:1/8:1 Mux(using VHDL)
7. Implementation of 3:8 Deoder(using VHDL)
8. Implementation of one bit Half Adder a Full adder (using VHDL)
9. Implementation of 4 bit full adder using half adder as component(using VHDL)
10. Implementation of JK flip flop(using VHDL)

Text books:

1. Introduction to VLSI design, E. D. Fabricus, McGraw Hill Publications, first edition, 1990
2. Basic VLSI Design D.A. Pucknell and Eshraghian,
3. Digital Design Principles and Practises John F Wakerly,
4. CMOS Digital Integrated Circuits, Kang , Tata McGraw Hill Publications

Reference Books:

1. VHDL Programming by Examples Douglas Perry, , Tata McGraw Hill Publications, 2002
2. Principles of CMOS VLSI Design : ASystems Perspective Neil H.E. Weste, Kamran Eshraghian second edition, Addison Wesley Publications, 1993
3. Digital Integrated Circuits: A Desiqn Perspective, Rabaey Jan M., Chandrakasan Anantha, Nikolic Borivoje, second edition, Prentice Hall of India

Internal Assessment (IA):

Two tests must be conducted which should cover at least 80% of syllabus. The average marks of both the tests will be considered for final Internal Assessment.

End Semester Examination:

Question paper will comprise of 6 questions, each carrying 20 marks.
The Learners need to solve total 4 questions.

Question No.1 will be compulsory and based on entire syllabus.
Remaining question (Q.2 to Q.6) will be selected from all the modules.

Term Work:

Term work consists of minimum eight experiments. The distribution of the term work shall be as follows:

Laboratory work (Experiments and Journal)	:20 marks
Attendance (Practical and Theory)	:05 marks

The final certification and acceptance of term-work ensures the satisfactory performance of laboratory work and completion of journal. Term work assessment must be based on the overall performance of the learner.

Course Code	Course Name	Teaching Scheme			Credits Assigned			
		Theory	Pract.	Tut	Theory	Pract.	Tut	Total
BMC705	**Networking and Information System in Medicine (abbreviated as NISM)**	4	2	-	4	1	-	5

Course Code	Course Name	Examination scheme							
		Theory Marks				Term work	Pract.	Oral	Total
		Internal Assessment			End Sem exam				
		Test 1	Test 2	Avg.					
BMC705	**Networking and Information Systems in Medicine**	20	20	20	80	25	-	25	150

Course Objectives	1. To understand the fundamental component of computer Networking. 2. To understand the functioning and configuration of various networking devices and components. 3. To understand a concept about network security. 4. To understand the healthcare IT infrastructure and also the prevalent standards in healthcare informatics.
Course Outcomes	A Learner will be able to 1. Design and configure basic computer network. 2. Understand the information system of healthcare.

Module	Contents	Time
	Networking Technology	
1.	LAN, MAN, WAN, Performance of network/device parameters Ethernet Technology: Ethernet types, Types of cables and connectors, Crossover and straight through cables, Colour coding of cables OSI Model, TCP/IP, Addressing types (IP, MAC & Port)	08
2.	IP V4 addressing, Subnetting, Supernetting, IP V6, Detailed working of networking equipment: HUB, Switch, Router, Modem, Bridge; Packet switching, Circuit switching.	08
3.	Basic Security Concepts Security Mechanism and security services, Authentication, Authorization, Confidentiality, Integrity, Symmetric and Asymmetric Key cryptography, RSA algorithm	06
	Information Systems in Medicine	
4.	PACS Components, Generic workflow, PACS architectures stand-alone, client-server, and Web-based, PACS and Teleradiology, Enterprise PACS and ePR System with Image Distribution	10

5.	Introduction to RIS and HIS, HIS/RIS/PACS integration, PIR, Storage Area Network, Network Attached storage, RAID, PACS Server & Archive and operating systems	08
6.	Introduction to Healthcare informatics standard HL7 and DICOM, IHE, IHE Domains, Legal issues in PACS, HIPAA.	08

List of Experiments:

1. Study of various networking cables, demonstration of crimping of cables and configuring networking parameters for computer.
2. Tutorial on IP addressing.
3. Introduction and basic commands used in various network simulation software.
4. Internetwork Communcation through Router and Switch, See the Mac Table of each switch and Routing table of Router
5. Static routing configuration.
6. Generating the HL7 message format.

Text books:

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

Reference Books:

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

Internal Assessment (IA):

Two tests must be conducted which should cover at least 80% of syllabus. The average marks of both the tests will be considered for final Internal Assessment.

End Semester Examination:

Question paper will comprise of 6 questions, each carrying 20 marks.
The Learners need to solve total 4 questions.
Question No.1 will be compulsory and based on entire syllabus.
Remaining question (Q.2 to Q.6) will be selected from all the modules.

Term Work:

Term work consists of minimum eight experiments. The distribution of the term work shall be as follows:

Laboratory work (Experiments and Journal) :20 marks
Attendance (Practical and Theory) :05 marks

The final certification and acceptance of term-work ensures the satisfactory performance of laboratory work and completion of journal. Term work assessment must be based on the overall performance of the learner.

Course Code	Course Name	Teaching Scheme			Credits Assigned			
		Theory	Pract.	Tut	Theory	Pract.	Tut	Total
BMP706	Project Stage - I	-	*	-	-	3	-	3

* Learner is allotted 6hrs per week for the project work.

Course Code	Course Name	Examination scheme							
		Theory Marks				Term work	Pract.	Oral	Total
		Internal Assessment			End Sem exam				
		Test 1	Test 2	Avg.					
BMP706	Project Stage - I	-	-	-	-	25	-	25	50

Guidelines for Project

- Learners should do literature survey/visit industry/analyze current trends and identify the problem for Project and finalize in consultation with Guide/Supervisor. Learners should use multiple literatures and understand the problem. Learners should attempt solution to the problem by experimental/simulation methods. The solution to be validated with proper justification and compile the report in standard format.

Guidelines for Assessment of Project I

- Project I should be assessed based on following points
  - Quality of problem selected
  - Clarity of Problem definition and Feasibility of problem solution
  - Relevance to the specialization
  - Clarity of objective and scope
- Project II should be assessed through a presentation jointly by Internal and External Examiners approved/appointed by the University of Mumbai

Project Guidelines

Project Groups: Learners can form groups with minimum 2 (Two) and not more than 4 (Four)

Faculty Load: In semester VII – 1/2 (half) period of 1/2 hour per week per project group

Each faculty is permitted to take (guide) maximum 4 (Four) project groups.