2018

[OBE DESIGN- ELECTRONICS DEPARTMENT]

DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY AURANGABAD-431 001

PREFACE

Outcome Based Education (OBE) is the educational approach which focuses on student centric education in the context of development of personal, social, professional and knowledge (KSA) requirements in one's career and life. It is the decade ago curriculum development methodology. The educational triangle of *LEARNING-ASSESSMENT-TEACHING* is the unique nature of the OBE approach. The curriculum practices such as Competency Based Curriculum, Taylor's Model of Curriculum Development, Spadys' Curriculum principles, Blooms taxonomy and further use of assessment methodologies like, Norm-reference testing and Criterion reference testing, etc is being practiced since decades. It is also interesting to know that, globally, different countries and universities adopts the curriculum development models/approaches such as, CDIO (Conceive-Design-Implement-Operate), Evidenced Based Education, Systems' Approach, etc as the scientific and systematic approaches in curriculum design.

The authorities of Dr. Babasaheb Ambedkar Marathwada University, Aurangabad (M.S.) in-lieu of accreditation standards of National Assessment and Accreditation Council, decided to opt for Outcomes Based Education (OBE). As the part of the decision, different meetings, workshops and presentations were held at the campus of university.

This document is the outcome of different meetings and workshops held at university level and department level. The detailed document is designed and the existing curriculum of the department is transformed in to the framework of OBE. This is the first step towards the implementation of OBE in the department. The document will serve all stakeholders in the effective implementation of the curriculum. The OBE is continuous process for quality enhancement and it will go a long way in order to enhance the competencies and employability of the graduates/Post-graduates of the university department.

Head of Department

INDEX

OUTCOME BASED EDUCATION

Faculty of Science & Technology

Department of Electronics

1. Mission:

Mission Statement

- Provide a platform for the students with broad spectrum of diversity to achieve Academic Excellence with in-built Employability in the area of Sensor Technology, Semiconductor Devices, Mechatronics, and Industrial Communication.
- Establish a unique learning environment to enable the students to face the challenges in the area of Sensor Technology, Semiconductor Devices, Mechatronics, and Industrial Communication.
- To design and offer the courses to impart technical and life skill as per the requirements of the region so as to improve employability and develop entrepreneurial capabilities.
- Adopt a perennial process for bringing in excellence in teaching pedagogy by providing ICT based state-of-the-art infrastructural facilitation
- Provide student centric learning environment and to establish platform for inclusive research leading to the development of creative thought process amongst research scholars keeping in mind societal needs.
- Provide ethical and value based education by promoting activities addressing the societal needs.

2. Vision:

Vision Statement

To structure the Department of Electronics to be an Epitome of Excellence in Research & Development the area of Sensor Technology, Semiconductor Devices, Mechatronics, and Industrial Communication by creating and imparting time responsive Quality Education to address Changing Scenario, keeping Research and Development at its core, for 'Anyone' at 'Anytime' and 'Anywhere'.

3. Title of the Program (s):

a. Master of Science (Electronics)

4. Program Educational Objectives:

The program educational objectives (PEO) are the statement that describes the career and professional achievement after the program of studies (graduation/ post-graduation). The PEO s are driven form question no. (ii) of the Mission statement (What is the purpose of organization). The PEOs can be minimum three and maximum five.

I. Are equipped with time relevant knowledge of Sensor Technology, Semiconductor Devices, Mechatronics, and Industrial Communication to address multi-disciplinary demands of R & D organizations, educational institutes and automated process in modern industries in capacity of Scientist, Education Professionals, System Developers and System Integrators.

II. Have sound background to practice advanced concepts of electronics in the areas sensor technology, Semiconductor Devices, Mechatronics, and Industrial Communication in R & D organizations, educational institutes, industry and Government settings meeting the growing expectations of stakeholders.

III. Have an ability to pursue higher studies and succeed in academic and professional careers.

IV. Have the ability to address professional demands individually and as a team member communicating effectively in technical environment using modern tools.

V. Recognize the need for and possess the ability to engage in lifelong learning and will be sensitive to consequences of their work both ethically and professionally for productive professional career.

5. Program Outcomes:

The program outcomes (PO) are the statement of competencies/ abilities. POs are the statement that describes the knowledge and the abilities the graduate/ post-graduate will have by the end of program studies.

Graduates of the M. Sc. (Electronics) program are expected to -

PO1. **The citizenship and society:** Apply broad understanding of ethical and professional skill in electronics technology in the context of global, economic, environmental and societal realities while encompassing relevant contemporary issues.

PO2. **Environment and sustainability**: Apply broad understanding of impact of electronics technology in a global, economic, environmental and societal context and demonstrate the knowledge of, and need for sustainable development.

PO3. **Ethics:** Apply ability to develop sustainable practical solutions for electronics technology related problems within positive professional and ethical boundaries.

PO4. **Individual and team work:** Function effectively as a leader and as well as team member in diverse/ multidisciplinary environments.

PO5. **Communication:** Communicate effectively on complex electronics technology related activities with the scientific community in particular and with the 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.

PO6. **Project management and finance**: Demonstrate knowledge and understanding of the first principles of electronics technology and apply these to one's own work as a member and leader in a team, to complete project in any environment.

PO7. **Life-long learning**: Recognize the need for lifelong learning and have the ability to engage in independent and life-long learning in the broadest context of technological change.

Programme Specific Outcomes:

PSO1. **Domain knowledge:** Apply the knowledge of electronics fundamental, Sensor Technology, Semiconductor Devices, Mechatronics, and Industrial Communication for the solution of problems in complex electronics related problems.

PSO2. **Problem Analysis:** Identify electronics related problems at varied complexity and analyze the same to formulate/ develop substantiated conclusion using first principles of Sensor Technology, Semiconductor Devices, Mechatronics, Industrial Communication and scientific literature.

PSO3. **Design Development of solutions :** Design / develop solutions for problems at varied complexity in the area Sensor Technology, Semiconductor Devices, Mechatronics, and Industrial Communication to address changing challenges put forward by market demand/ stakeholder

PSO4. **Conduct Investigation of complex problems:** Use research-based knowledge and methods to design of experiments, analyze resulting data and interpret the same to provide valid conclusions.

PSO5. **Modern tools:** Create, select, and apply appropriate techniques, resources, and modern electronics and relevant IT tools including prediction and modelling to complex electronics technology related activities with clear understanding of the limitations

6. Course- Program outcome Matrix:

The Program Outcomes are developed through the curriculum (curricular/co-curricular-extra-curricular activities). The program outcomes are attained through the course implementation. As an educator, one must know, ***"to which POs his/her course in contributing?"***. So that one can design the learning experiences, select teaching method and design the tool for assessment. Hence, establishing the Corse-PO matrix is essential step in the OBE. The course-program outcomes matrix indicates the co-relation between the courses and program outcomes. The CO-PO matrix is the map of list of courses contributing to the development of respective POs.

The CO-PO MATRIX is provided in the below table.

Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4	PSO5
Electronics System				*			*	*	*	*	*
Industrial Power Electronics				*			*	*	*	*	*
Embedded System-I				*			*	*	*	*	*
Generic Elective 8086 Microprocessor/Optoelectronics				*			*	*	*	*	*
Research Methodology					*	*	*	*	*	*	*
Constitution of India	*	*	*								
Lab course 1											
Lab Course 2											
Review of literature					*	*	*	*	*	*	*
Embedded System-II											
Microcontroller interfacing				*			*	*	*	*	*
Generic Elective-II Sensors and actuators/Industrial Robotics/Signal conditioning circuits				*			*	*	*	*	*
Generic Elective-III Advanced Sensor Technology/Industrial processes & instrumentation/ Biomedical instrumentation				*			*	*	*	*	*
Lab course -3				*			*	*	*	*	*
Lab course-4				*			*	*	*	*	*

Research project					*	*	*	*	*	*	*
Programmable Logic controllers				*			*	*	*	*	*
ARM Microcontrollers				*			*	*	*	*	*
Generic Elective-IV Computational Modeling & simulations/ Applied hydraulics & pneumatics/ PC based instrumentation/ VLSI design, Tools & Technology				*			*	*	*	*	*
Generic Elective-V Characterization tools in Sensors/ Industrial Networking/Kinetic & dynamics of Robotics/Smart fusion technology based system design				*			*	*	*	*	*
Lab course-4				*			*	*	*	*	*
Research project	*	*	*		*	*	*	*	*	*	*
Communication Technology				*	*	*	*	*	*	*	*
Internet of Things				*			*	*	*	*	*
Generic Elective-VI Device fabrication technology/ Flexible manufacturing system/Mixed signal SoC Design/ HMI,SCADA basics and Databases				*			*	*	*	*	*
Lab course-5					*	*	*	*	*	*	*
Research project	*	*	*		*	*	*	*	*	*	*
Dissertation	*	*	*		*	*	*	*	*	*	*

7. Course Outcomes (for all courses):

The course outcomes are the statement that describes the knowledge & abilities developed in the student by the end of course (subject) teaching. The focus is on development of abilities rather than mere content. There can be 5 to 7 course outcomes of any course. These are to be written in the specific terms and not in general. The list of Course Outcomes is the part of ***Annexure-C*** attached herewith.

8. Set Target levels for Attainment of Course Outcomes:

The course outcome attainment is assessed in order to track the graduates' performance w.r.t target level of performance. The CO-PO attainment is the tool used for continuous improvement in the graduates' abilities through appropriate learning & teaching strategies. In order to assess students' performance with respect to abilities (at the end of course teaching/by the end of program) the course outcome attainment are measured/calculated. In order to calculate the program outcome attainment, the course outcome attainment is calculated. Prior to that, the course-program outcome mapping is done.

9. Set Target level for Attainment of Program Outcomes:

The program outcome attainment is assessed in order to track the graduates' performance w.r.t target level of performance. The CO-PO attainment is the tool used for continuous improvement in the graduates' abilities through appropriate learning & teaching strategies. In order to assess students' performance with respect to abilities (at the end of course teaching/by the end of program) the course outcome attainment and program outcome attainment is measured/calculated. The program outcome attainment is governed by curricular, co-curricular and extra-curricular activities including the stakeholders' participation. The direct method and indirect method is adopted to calculate the PO attainment. The direct method implies the attainment by course outcomes contributing to respective program outcomes. And indirect method is the satisfaction/feed-back survey of stakeholders. In order to calculate the program outcome attainment, the course outcome attainment is calculated. Prior to that, the course-program outcome mapping is done.

The set target level is the set benchmark to ensure the continuous improvements in the learners/ graduates' performance.

10. Course Attainment Levels:

a. CO attainment is defined/set at three levels;
b. The CO attainment is based on end term examination assessment and internal assessment;
c. The Co attainment is defined at three levels in ascending order-
    i. e.g. For end term and internal examination;
    ii. Level-1: 20% students scored more than class average
    iii. Level-2: 30% students score more than class average;
    iv. Level-3: 40% students score more than class average.

d. The target level is set (e.g. Level-2). It indicates that, the current target is level-2; 30% students score more than class average. The CO attainment is measured and the results are obtained. Based on the results of attainment, the corrective measures/remedial action are taken.
e. CO Attainment= 80% (Attainment level in end term examination) + 20% (Attainment level in internal examination).

11.Program attainment Level:

a. PO attainment is defined at five levels in ascending order;
b. The PO attainment is based on the average attainment level of corresponding courses (Direct Method) and feed-back survey (Indirect method);
c. The PO attainment levels are defined / set as stated below;
    i. Level-1: Greater than 0.5 and less than 1.0 (0.5>1)- Poor
    ii. Level-2: 1.0>1.5-Average
    iii. Level-3: 1.5>2.0-Good
    iv. Level-4: 2.0>2.5-Very Good
    v. Level-5: 2.5>3.0 -Excellent
d. The PO attainment target level is set/defined (say, Level-4). It implies that, the department is aiming at minimum level-4 (very good) in the performance of abilities by the graduates. Based upon the results of attainment, the remedial measures are taken;
e. PO Attainment= 80% (Average attainment level by direct method) + 20% (Average attainment level by indirect method).

12. The Results of CO Attainment:

FOR EXAMPLE:

COURSE CODE/TITLE: ELET-214-1

e.g. For end term and internal examination;

i. Level-1: 20% students scored more than class average
ii. Level-2: 30% students score more than class average;
iii. Level-3: 40% students score more than class average

Average of Total Marks in Examination: 61.00

% Students score more than 61 is 4/12 i.e. 33.33% i.e. Levl-2

A (CO) ELET-214-1= 100(2)

=2.00

Hence, the attainment level is Level-2 and the set target level is Level-2 and therefore the CO is fully attained.

Table No. 1.0: CO Attainment Level

Course Code	CO attainment Value	Target Attainment Level	Fully Attained/Not attained	Remedial measures
ELET-111	1	2	Not Attained	Assignment, tutorials, exercise and Remedial coaching.
ELET-112	2	2	Fully Attained	
ELET-113	1	2	Not Attained	Assignment, tutorials, exercise and Remedial coaching.
ELET-114-1	3	2	Fully Attained	
ELET-115	3	2	Fully Attained	
IC001	2	2	Fully Attained	
ELER-131	3	2	Fully Attained	
ELEL-121	2	2	Fully Attained	
ELEL-122	0	2	Not Attained	Assignment, tutorials, exercise and Remedial coaching.
ELET-211	3	2	Fully Attained	
ELET-212	1	2	Not Attained	Assignment, tutorials, exercise and Remedial coaching.
ELET-213-1	3	2	Fully Attained	
ELET-214-1	2	2	Fully Attained	
ELER-231	0	2	Not Attained	Assignment, tutorials, exercise and Remedial coaching.
ELEL-221	3	2	Fully Attained	

13. The Results of PO Attainment:

The attainment of PO will be calculated after declaration of IInd year result in the Month of April-2019.

Table No. 2.0 PO Attainment Level

PO/PSO number	PO Attainment Value	Target Attainment level	Fully attained/ Not Attained	Remedial Measures

14. Planned Actions for Course Attainment:

15. Planned Actions for Program Outcome Attainment:

The first batch of M. Sc. Electronics is graduating in April 2019. The PO attainment for the corresponding batch shall be calculated on completion of the program.

ANNEXURE-B

THE RESULTS OF CO-PO ATTAINMENT

ANNEXURE-C
COURSE OUTCOMES

Course outcomes of various Courses:

Semester I

ELET 111 : Electronic Systems

After completion of the course students will be able to -

a) Apply the basic concepts in Analog electronics to solve the complex problems in electronic circuits
b) Analyze datasheets and circuit diagrams and identify circuits locks such as Op-amps Amplifiers filters
c) Design an electronics circuits using Op-amp and FET's
d) Design and develop a low cost prototype electronic circuit to address frequently occurring issues in Industries

ELET 112 Industrial Power Electronics

After completion of the course students will be able to -

a) Apply principles of SCR, Power MOSFET, IGBT, and UJT for various Industrial applications.
b) Design a single phase, three phase full wave and half wave rectifier circuits.
c) Analyse the complex problems in power Electronic circuits providing solution to problem.
d) Develop a prototype based power electronic circuits showing the best solution towards a particular problem.

ELET 113 Embedded Systems-I

After completion of the course students will be able to -

a) Design and develop automated system based on 8051 Microcontroller
b) Apply the basics of number system to solve arithmetic and logical operations of 8051 microcontroller.
c) Develop assembly language programming for 8051 microcontroller.
d) Analyze and debug assembly language programme for 8051 microcontroller

ELET 115 Research Methodology

After completion of the course students will be able to -

a) Compare and analyze research process
b) Do systematic literature survey, formulation of a research topic, study design, analysis and interpretation of data.
c) Design a research approach for a specific research issue of their choice.
d) Identify a suitable analytical method for a specific research approach.
e) Design and develop a research report.
f) Assess published quantitative research with regard to the statistical methods and approaches adopted
g) Create a research document for implementation research project

ELET 114 Generic Elective I

i] 8086 Microprocessor and interfacing

After completion of the course students will be able to -

a) Compare and analyze Microprocessor architecture, physical configuration of memory, logical configuration of memory, microprocessor programming and interfacing.
b) Analyze the process of Industrial automation
c) Design automation system process of using 8086 microprocessor
d) Develop a manufacturing unit for microprocessor based automated devices.
e) Develop 8086 microprocessor programming for various industrial controls

ii) Optoelectronics

After completion of the course students will be able to -

a) Apply basic principles of optoelectronics for various applications
b) Describe the semiconductor optical amplifiers and their applications
c) Analyse various types of photodiodes, photo detectors
d) Evaluate the carrier loss and noise in photo detector using mathematical equations.

Semester II

ELET 211 Embedded Systems –II

After completion of the course students will be able to -

a) Describe the evolution of PIC Microcontroller and Embedded Processors
b) Evaluate the PIC 18 registers, determine the contents of file register and status register.
c) Analyze various instructions and addressing modes in PIC 18 microcontroller for arithmetic and logical programming.
d) Develop a simple arithmetic and logical program to interface peripherals with PIC 18 Microcontroller

ELET 212 Microcontroller Interfacing

After completion of the course students will be able to -

a) Design and develop various Microcontroller interfacing modules fir various applications.
b) Analyze the various ADC/DAC circuits and its importance in 8051 Microcontroller.
c) Design and develop a various circuit using 8051 microcontroller for interfacing remotely placed peripheral by applying basics in Serial communication.
d) Develop a low cost prototype using 8051 microcontroller to address frequently occurring problems in Industries.

ELET 213 Generic Elective II

i] Sensors and Actuators

After completion of the course students will be able to -

a) Compare and analyze Sensors and characteristics of sensors
b) Classify sensors and sensor systems
c) Analyze the system based on sensor and actuators.
d) Design and develop sensor devices
e) Test chemical and Physical Sensors

ii) Industrial robotics

After completion of the course students will be able to -

a) Apply basics principles of robotics for various Industrial applications
b) Apply various robotics command to develop codes for various applications.
c) Design and develop programs for robotic system by assembling robotic component.
d) Assess the Hazards and possible threats while dealing with the Robots in Industries to ensure safety.

iii) Signal conditioning circuits

After completion of the course students will be able to -

a) Describe the type of signal conditioning & its importance in electronic circuits.
b) Evaluate various terminologies used signal conditioning circuit.
c) Assess signal conditioning for specific applications.
d) Design and developed a signal conditioning circuit for resistive, inductive and capacitive sensors.

ELET 214 Generic Elective III

i] Advanced sensor Technology

After completion of the course students will be able to –

a) Classify sensor materials and technologies.
b) Analyze the system based on sensor and actuators.
c) Design experiments for sensor calibration
d) Develop sensor devices and sensor networks.
e) Design and develop sensor devices

ii] Industrial Processes and Instrumentation

After completion of the course students will be able to –

a) Describe the various terminologies in control systems
b) Analyse the results obtained from instruments to take appropriate action

c) Understand various indicators in industrial process instrumentation
d) Design flow charts various operations in process control.

iii] Biomedical Instrumentation

After completion of the course students will be able to –

a) Assess the importance of Biomedical instrumentation and its applications
b) Analyse the data obtained from various biomedical instruments
c) Apply the appropriate techniques used in Biomedical field for specific applications.
d) Describe the EEG, EMG, techniques with all their relevant aspects.

Semester III

ELET 311 Programmable Logic Controllers

After completion of the course students will be able to –

a) Evaluate PLCs for various applications
b) Apply and explain basic concepts of ladder logic, its relationships with PLC instruction sets.
c) Develop a simple ladder logic program for timer and counter applications
d) Design a small prototype based production line using PLC

ELET 312 ARM Microcontroller

After completion of the course students will be able to –

a) Describe various architectural features of ARM.
b) Analyze RISC, CISC, instruction sets, pipe-lining concepts.
c) Develop a logical program using basic instructions to interface I/O devices
d) Design a simple system application using ARM microcontroller.

ELET 313] Generic Elective IV

i] Applied Hydraulics and Pneumatics

After completion of the course students will be able to –

a) Describe the key aspects and physical properties used in hydraulics and pneumatics
b) Describe the functionality, advantages, disadvantages and applications of valves, servos and motors.

c) Analyse the results, draw the graphs after performing hydraulic and pneumatic experiments
d) Analyze the possible failure that may occur in Hydraulic and pneumatic systems.

ii] PC Based instrumentation

After completion of the course students will be able to –

a) Describe the various components of personal computers, working principle of serial, parallel communication used in computers
b) Analyze with data acquisition techniques in virtual instrumentation.
c) Control and monitor temperature, pressure, torque and load using personal computer.
d) Design and develop a simple application using PID controller.

iii] VLSI Design, Tools and Technology

After completion of the course students will be able to –

a) Draw and explain simple and complex logic gates in CMOS.
b) Describe the process of IC fabrication
c) Derive and describe the current voltage equations, characteristics of MOSFETs
d) Design and simulate NAND, NOR gate and draw their transient response.

ELET 314 Generic Elective V

i] Characterization tools in sensors

After completion of the course students will be able to –

a) Describe the various spectroscopy techniques and their applications.
b) Performed experiments with X-Ray diffraction technique and its applications
c) Perform structural, profile analysis, particle size analysis of samples from data obtained using various spectroscopy techniques.
d) Analyse the graph obtained from XRD technique, perform its interpretation.

ii] Industrial Networking

After completion of the course students will be able to –

a) Describe hardware, software components of network and its applications.
b) Describe industry open protocol, its applications their advantages and disadvantages.
c) Troubleshoot common network and control issue.
d) Design and establish a wireless network using Zigbee and Bluetooth modems

iii] Kinematics and Dynamics of Robotics

After completion of the course students will be able to –

a) Describe the principles of Kinematics and Dynamics of Robotics and its applications
b) Evaluate the safety issues while dealing with the Robots in various applications
c) Describe the principles of Robot programming and design a Robotic system for a simple task
d) Design and develop robotics control circuits for various applications