Program Name	: Diploma in Automation and Robotics
Program Code	: AO
Semester	: Fourth
Course Title	: Python Programming
Course Code	: 22478

1. RATIONALE

Robotics industry needs to build microcontroller based applications which are developed using Python. This course deals with concept of programming to enhance programming skills of diploma students. This course will enable the students to inculcate programming concepts and methodology to solve engineering problems.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Develop a program using Python to solve problems

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

1. Develop a python program using conditional statements and operators.
2. Perform Data Structure operations.
3. Develop a function and module for given problem.
4. Develop Python program using classes and inheritance.
5. Develop Python program to handle exception.

4.   TEACHING AND EXAMINATION SCHEME

| Teaching Scheme			Credit (L+T+P)	Examination Scheme											
				Paper Hrs.	Theory						Practical					
					ESE		PA		Total		ESE		PA		Total	
L	T	P			Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
3	-	2	5	3	70	28	30*	00	100	40	25@	10	25	10	50	20

(*): Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the UOs required for the attainment of the COs.

Legends: *L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit, ESE - End Semester Examination; PA - Progressive Assessment*
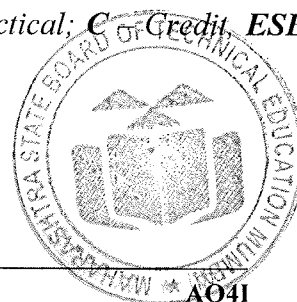
5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the center of this map..
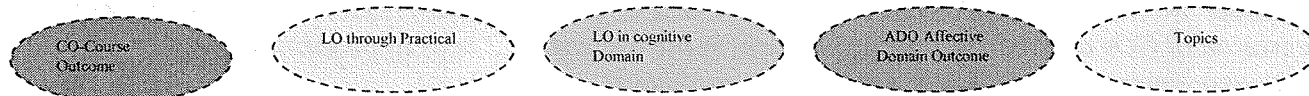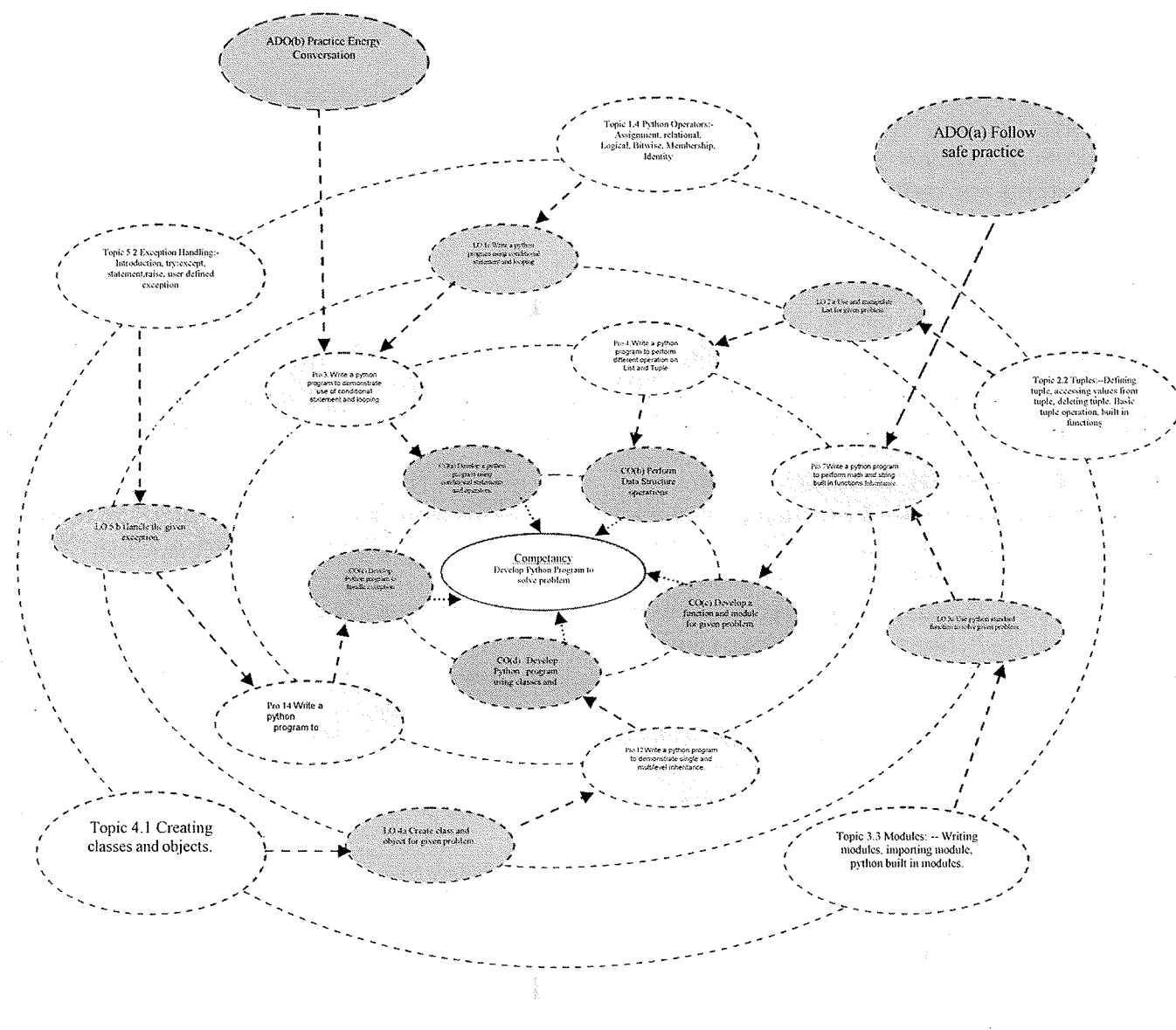
6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx.Hrs. Required
1	Write simple program using script mode and Interactive mode.	I	2*
2	Write a python program using operators.	I	2
3	Write a python program to demonstrate use of conditional statement and looping	I	2*
4	Write a python program to perform different operation on List and Tuple	II	2*
5	Write a python program to perform different operation on Set.	II	2*
6	Write a python program to perform different operation on dictionaries.	II	2
7	Write a python program to perform math and string built in functions.	III	2
8	Develop a program to demonstrate user defined function.	III	2*
9	Develop a program to demonstrate built in module.	III	2*
10	Write a python program to demonstrate built in packages(Numpy, pandas, matplotlib) and user defined packages.	III	2*
11	Write a python program on method overloading and overriding.	IV	2
12	Write a python program to demonstrate single and multilevel inheritance.	IV	2*
13	Write a python program to perform file operation.	V	2
14	Write a python program to handle exception.	V	2*
15	Installation of Python libraries for robotics.	V	2*
16	Write a Python program on 4 axis robotic arm.	V	2
		Total	32

Note

i. *A suggestive list of* **PrOs** *is given in the above table. More such PrOs can be added to attain the COs and competency. A judicial mix of minimum 12 or more practical need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.*

ii. *The 'Process' and 'Product' related skills associated with each PrO is to be assessed according to a suggested sample given below:*

S. No.	Performance Indicators	Weightage in %
1	Correct Logic	20
2	Debug ,test and execution of program	40
3	Quality of input output display(Formatting)	10
4	Answer to sample questions.	20
5	Submission of report in time.	10
	Total	100
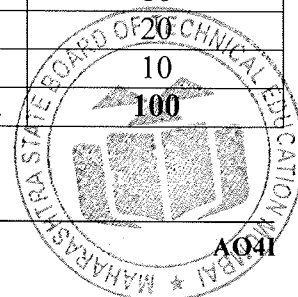
The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

a. Follow safety practices.
b. Practice good housekeeping.
c. Demonstrate working as a leader/a team member.
d. Maintain tools and equipment.
e. Follow ethical Practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organizing Level' in 2nd year
- 'Characterizing Level' in 3rd year.

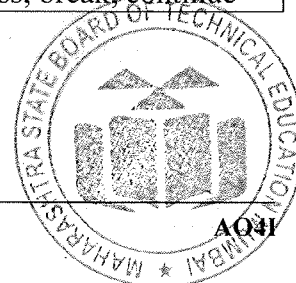## 7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

Sr. No.	Equipment Name with Broad Specifications	PrO. S. No.
1	Computer System (Any computer system with basic configuration)	All
2	Python Interpreter/ IDE	

## 8. UNDERPINNING THEORY COMPONENTS

The following topics are to be taught and assessed in order to develop the sample UOs given below for achieving the COs to attain the identified competency. More UOs could be added.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Basic Of Python	1a. Installation of Python 1b. Develop python program using different operators. 1c. Write a python program using conditional statement and looping	1.1 Python Features 1.2 Python building blocks:-Identifier, keywords, Indentation, variables, comments 1.3 Python Data Types:- Number, string, Tuple, List, Sets, Dictionaries 1.4 Python Operators:- Assignment, relational, Logical, Bitwise, Membership, Identity 1.5 Conditional statement:- if, if….else, nested if 1.6 Looping :- while, for, nested loop 1.7 Loop manipulation:- pass, break, continue

Unit– II Python Data Structure	2a. Use and manipulate List for given problem. 2b. Use and manipulate Tuple for given problem 2c. Use and manipulate Set for given problem 2d. Use and manipulate Dictionaries for given problem.	2.1 List :- defining list, accessing values from list, deleting values, updating list,. Basic List operations, Built in list functions 2.2 Tuples:--Defining tuple, accessing values from tuple, deleting tuple. Basic tuple operation, built in functions. 2.3 Sets:- Defining set, accessing values from set, deleting set, updating set. Basic set operation, Built in functions. 2.4 Dictionaries:- Defining ,accessing values , deleting values, updating dictionaries. Basic operations, Built in functions.
Unit– III Python function, module and packages	3a. Use python standard function to solve given problem. 3b. Develop user defined function for given problem. 3c. Write python module for given problem. 3d. Write Python packager given problem	3.1 Built in functions(maths, string) 3.2 User defined function: - function definition, function calling, function arguments and parameter passing, Return statement, scope of variables(Global and Local) 3.3 Modules: -- Writing modules, importing module, python built in modules. 3.4 Python packages:-- writing packages, using standard packages (Numpy, matplotlib, pandas scipy) and user defined packages.
Unit– IV Python OOP	4a. Create class and object for given problem. 4b. Write python code for data hiding. 4c. Write a program to use inheritance.	4.1 Creating classes and objects. 4.2 Data Hiding 4.3 Method overloading and overriding. 4.4 Inheritance
Unit-V File Handling, Exception Handling and Python Libraries for Robotics	5a. Read and data data on file. 5b. Handle the given exception. 5c.Install Python libraries.	5.1 File Handling:- Opening file in different modes, accessing file content, reading and writing file, closing file, renaming file. 5.2 Exception Handling:- Introduction, try: except, statement, raise, user defined exception. 5.3 Python Libraries:-- opencv, pybotics,DART

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' and above of Bloom's 'Cognitive Domain Taxonomy'
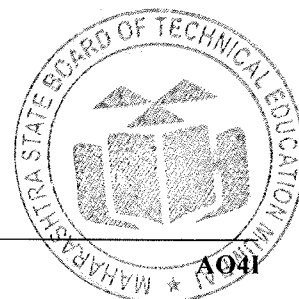
9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Basic Of Python	08	02	04	08	14
II	Python Data Structure	12	02	06	08	16
III	Python function, module and packages	12	02	02	10	14
IV	Python OOP	08	02	04	08	14
V	File Handling, Exception Handling and Python Libraries for Robotics	08	02	02	08	12
	Total	48	10	18	42	70

Legends: *R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)*
<u>*Note*</u>*: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of LOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.*

10. SUGGESTED STUDENT ACTIVITIES
Other than the classroom and laboratory learning, following are the suggested student-related *co-curricular* activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:
   a. Prepare journals based on practical performed in laboratory.
   b. Undertake microprojects using object oriented concept

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)
These are sample strategies, which the teacher can use to accelerate the attainment of the various learning outcomes in this course:
   a. Massive open online courses (***MOOCs***) may be used to teach various topics/subtopics.
   b. *'L' in item No. 4* does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
   c. About *15-20% of the topics/subtopics* which are relatively simpler or descriptive in nature is to be given to the students for *self-directed learning* and assess the development of the COs through classroom presentations (see implementation guideline for details).
   d. With respect to item No.10, teachers need to ensure to create opportunities and provisions for *co-curricular activities*..
   e. Video programs/YouTube may be used to teach various topics and sub topics.
   f. Demonstrate students thoroughly before they start doing the practice.
   g. Encourage students to refer to different books and websites to have a deeper understanding of the subject.
   h. Observe continuously and monitor the performance of students in the Lab.
   i. Encourage students to use front/rear panel control of electronic instruments.
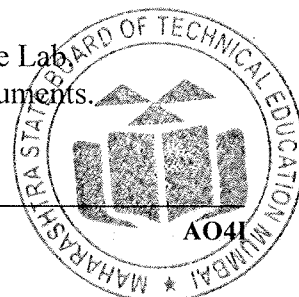
j.   Encourage students to visit nearby electronic instruments repair workshop units or manufacturing industries.
k.   Instruct students to safety concern of handling electronic instruments and also to avoid any damage to the electronic instruments.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student assigned to him/her in the *Only one micro-project* is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project is group-based. However, in the fifth and sixth semesters, it should preferably be *individually* undertaken to build up the skill and confidence in every student to become a problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should *not exceed three.*

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain a dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than *16 (sixteen) student engagement hours* during the course. The student ought to submit a micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects are given here. Similar micro-projects could be added by the concerned faculty:

a.   Create simple calculator.
b.   Currency converter
c.   Tic Tac Toe Game
d.   Quiz Game
e.   Reminder Application
f.   Time Converter
g.   Ball catching game
h.   Any other micro-projects suggested by subject faculty on similar line.

13.   SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Python Programming	Rao, K. Nageswara Shaikh Akbar	*Scitech Publications(India) Pvt, Ltd.* *ISBN:9789385983450*
2	Learning Python	Lutz, Mark	5th Edition, O'Reilly Publication ISBN-13: 978-1449355739
3	Python Essential Reference	Beazley, David	4th Edition, Addison-Wesley Professional, ISBN: 9780672329784

14.   SUGGESTED SOFTWARE/LEARNING WEBSITES

a.   https://www.javatpoint.com/python-tutorial
b.   https://www.tutorialspoint.com/python/index.htm
c.   https://www.w3schools.com/python/
d.   https://pypi.org/project/pybotics/
e.   https://spoken-tutorial.org