

APJ ABDUL KALAM  
TECHNOLOGICAL  
UNIVERSITY

---

# SEMESTER V

---

## MINOR

---



*Sayed*  
PRINCIPAL  
ACE College of Engineering  
Thiruvallam P.O  
Thiruvananthapuram-695 027

RAT381	AI AND MACHINE LEARNING FOR ROBOTICS	CATEGORY	L	T	P	CREDIT
		VAC	3	1	0	4

**Preamble:** Modern day robotic application are able to mimic some of the critical operations that a human being is capable of. This was possible mainly due to the integration of Artificial Intelligence into robotic application. Artificial Intelligence can be applied to a wide range of engineering application and is a topic of study by itself. This course provides an introduction to the areas of AI that can be used for robotic application which include computer vision, path planning, object recognition etc.

**Prerequisite:** Nil

**Course Outcomes:** After the completion of the course the student will be able to

CO 1	Appreciate the role of AI in solving problems in different domains and their evolution of AI
CO 2	Explain the different learning techniques used in Machine learning
CO3	Recognize the need for multilayer neural network for solving complex tasks
CO4	Understand the fundamental concepts of Image processing and its application in computer vision
CO5	Explain the different ways of perception of the environment by a robot and its use in path planning

#### Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	2										2
CO 2	3	2	2									2
CO 3	3	2	2									2
CO 4	3	2	2									2
CO 5	3	2	2									2

#### Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	10	10	10
Understand	20	20	20



*Bayced*  
PRINCIPAL  
ACE College of Engineering  
Thiruvallam P.O  
Thiruvananthapuram-695 027

Apply	20	20	70
Analyse			
Evaluate			
Create			

#### Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

#### Continuous Internal Evaluation Pattern

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

**End Semester Examination Pattern:** There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

#### Course Level Assessment Questions

##### Course Outcome 1 (CO1):

1. Discuss the use of Machine learning technique for classifying objects
2. Elaborate on the various AI techniques that can be used in robotics applications

##### Course Outcome 2 (CO2):

3. Compare and contrast Supervised and Unsupervised Learning techniques
4. How is Stochastic Gradient Descent algorithm better compared to other traditional learning techniques

##### Course Outcome 3 (CO3):

5. Explain how Back propagation algorithm can be used for character recognition application
6. Explain the basic Recurrent Neural Network architecture and its applications

##### Course Outcome 4 (CO4):

7. Discuss the any two techniques used for Edge detection in image processing
8. What is segmentation and how is it used in Image processing applications



*Sayed*  
 PRINCIPAL  
 ACE College of Engineering  
 Thiruvallam P.O  
 Thiruvananthapuram-695 027



**Course Outcome 5 (CO5):**

9. Explain Robotic Perception and the challenges faced in robotic perception
10. How can AI be used in path planning for robotic applications

**MODEL QUESTION PAPER**

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY  
FIFTH SEMESTER B.TECH. DEGREE EXAMINATION**

**Course Code: RAT381**

**AI AND MACHINE LEARNING FOR ROBOTICS**

Max. Marks: 100

Duration: 3 Hours

**PART A**

Answer all questions, each carries 3 marks.

Marks

- |    |  |     |
|----|--|-----|
| 1  | Explain the Turing Test approach for the definition of AI. What are the additional capabilities required by an AI system to completely satisfy the total Turing Test | (3) |
| 2  | How can AI be used in natural Language Processing?   | (3) |
| 3  | "A machine learning algorithm is an algorithm that is able to learn from data" – What do we mean by the term 'learn' in the above statement                          | (3) |
| 4  | Explain the term 'Feature' under machine learning context  | (3) |
| 5  | What is a multilayer feed forward Network?   | (3) |
| 6  | What is the role of activation function in a neural network?   | (3) |
| 7  | Define Sampling pitch for a digital camera. Explain its effect on the quality of the image   | (3) |
| 8  | What is aliasing in a digital image? What is the use of PSF in aliasing?   | (3) |
| 9  | Explain Robotic perception and discuss the challenges faced in robotic perception  | (3) |
| 10 | Discuss the motion model for localization in robotics  | (3) |

**PART B**

Answer any one full question from each module, each carries 14 marks.

**MODULE I**

- |    |   |     |
|----|---|-----|
| 11 | a) Explain the contribution of Mathematics in the development of AI   | (8) |
|    | b) What are the different applications of AI in Natural Language Processing                                     | (6) |
| 12 | a) What are Expert Systems? What is the role of knowledge base and Inference Engine in a knowledge based System | (7) |
|    | b) What are the application areas of AI in a Robotics   | (7) |

**MODULE II**

- |    |   |      |
|----|---|------|
| 13 | a) Explain the kind of problems that can be solved using Machine Learning techniques  | (6)  |
|    | b) Explain the gradient descent Algorithm used in Machine Learning  |      |
| 14 | a) Explain Supervised and Unsupervised Learning techniques in machine learning. Discuss the advantages and disadvantages of each. | (14) |



*Sayeed*  
PRINCIPAL  
ACE College of Engineering  
Thiruvallam P.O  
Thiruvananthapuram-695 027

### MODULE III

- 15 a) With an example, explain the working of Back Propagation algorithm (14)  
16 a) What is a Convolutional Neural Network? Explain the functionality of each layer (14)

### MODULE IV

- 17 a) Explain the method of image segmentation using multilevel threshold (7)  
b) Explain the 'Snakes' method of detecting active contours (7)  
18 a) Explain region splitting and merging algorithm for segmentation (7)  
b) What is the use of Edge Linking and how it is carried out? (7)

### Module V

- 19 a) Explain the Monte-Carlo localization algorithm using a range scan sensor model (14)  
20 a) Discuss in detail the role of Machine learning in Robotic perception (14)

\*\*\*\*

## SYLLABUS

### Module 1 (9 Hours):

Artificial intelligence - Introduction, its importance, The Turing test, Foundations of artificial intelligence, A brief historical overview

Application areas of AI -natural language processing, vision and speech processing, robotics, expert systems -basic overview

### Module 2 (9 Hours):

Learning - Forms of learning, Supervised Learning Algorithms, Unsupervised Learning Algorithms, Reinforcement based learning - overview with basic elements agent, environment, action, state, reward only; Stochastic Gradient Descent, Challenges Motivating Deep Learning

### Module 3 (9 Hours):

Deep Feedforward Networks- Example: Learning XOR, Gradient-Based Learning, Hidden Units. Architecture Design, Back-Propagation and Other Differentiation Algorithms, Convolutional Networks -basic outline and functions of each layers only, Sequence Modeling: Recurrent and Recursive Nets -Need for sequence models, basic RNN architecture and types

Case study-line follower robot using CNN, Speech Recognition using RNN (overview only)

### Module 4 (9 Hours):

Machine vision - Introduction, Computer vision - Introduction, Image formation, Basic image processing operations - edge detection, texture, optical flow, segmentation. challenges in image detection, Image features optimization.

Case study- application of AI in ball Tracking in football game, crop monitoring using drones, traffic sign detection, pedestrian detection



  
PRINCIPAL  
ACE College of Engineering  
Thiruvallam P.O  
Thiruvananthapuram-695 027



**Module 5 (9 Hours):**

Robotics - Robotic perception, Localization and mapping, Machine learning in robot perception, Application domains

Case study- Use of AI in typical pick and place task, localization of a differential drive robot

**Textbooks:**

1. Ian Goodfellow, YoshuaBengio, Aaron Courville, Deep Learning, MIT Press, 2016
2. Stuart J. Russell and Peter Norvig, Artificial Intelligence - A Modern Approach Third Edition, 2016
3. Bishop, C. ,M., Pattern Recognition and Machine Learning, Springer, 2006.
4. Berthold Klaus, Paul Horn "Robot vision" The MIT Press, 1987.
5. Richard Szeliski, "Computer Vision: Algorithms and Applications", 2010.
6. Grigorescu, Sorin, et al. "A survey of deep learning techniques for autonomous driving." *Journal of Field Robotics* 37.3 (2020): 362-386.


**Reference Books:**

1. Robin R. Murphy – Introduction to AI Robotics, The MIT Press
2. Chandra S.S.V, AnandHareendran S. - Artificial Intelligence and Machine Learning, PHI
3. *Simon J. D. Prince* - Computer Vision – Models, Learning and Inference Cambridge University Press

**Course Contents and Lecture Schedule**

No	Topic	No. of Lectures
<b>1</b>		
1.1	Artificial intelligence - Introduction, its importance, The Turing test, Foundations of artificial intelligence, A brief historical overview (Ref 2, chapter 1 section 1.3).	4
1.2	Application area of AI: natural language processing, vision and speech processing, robotics, expert systems--basic overview only	3
<b>2</b>		
2.1	Learning - Forms of learning, (Ref 2 Chapter 18 section 18.1.1),	2
2.2	Supervised Learning Algorithms, Unsupervised Learning Algorithms, Reinforcement based learning-- overview with basic elements agent, environment, action, state, reward only; (Ref 2, Chapter 20, section 20.1) Stochastic Gradient Descent, Challenges Motivating Deep Learning (Ref 1, chapter 5 sections 5.7 – 9 and 5.11,	7



  
PRINCIPAL  
ACE College of Engineering  
Thiruvallam P.O.  
Thiruvananthapuram-695 027

	Ref 2 Chapter 18 section 18.2),).	
<b>3</b>		
3.1	Deep Feedforward Networks, Convolutional Networks-basic outline and functions of each layers only, Sequence Modeling: Recurrent and Recursive Nets - Need for sequence models, basic RNN architecture and types(Ref 1 chapter 6, 9, 10, Ref 3 - chapter 5).  Case study-line follower robot using CNN, Speech Recognition using RNN overview	9
<b>4</b>		
4.1	Machine vision - Introduction (Ref 4, chapter 1), Computer vision - Introduction (Ref 5 chapter 1, section 1.2),	2
4.2	Image formation, Basic image processing operations - edge detection, texture, optical flow, segmentation. (Ref 4, 5) challenges in image detection, Image features optimization.	5
4.3	Case study- application of AI in ball Tracking in football game, crop monitoring using drones, traffic sign detection, pedestrian detection	2
<b>5</b>		
5.1	Robotics - Robotic perception, Localization and mapping, Machine learning in robot perception, Application domains (Ref 2, chapter 25 sections 25.1, 25.3.1, 25.3.3, 25.8)	7
5.2	Case study- Use of AI in typical pick and place task, localization of a differential drive robot	2



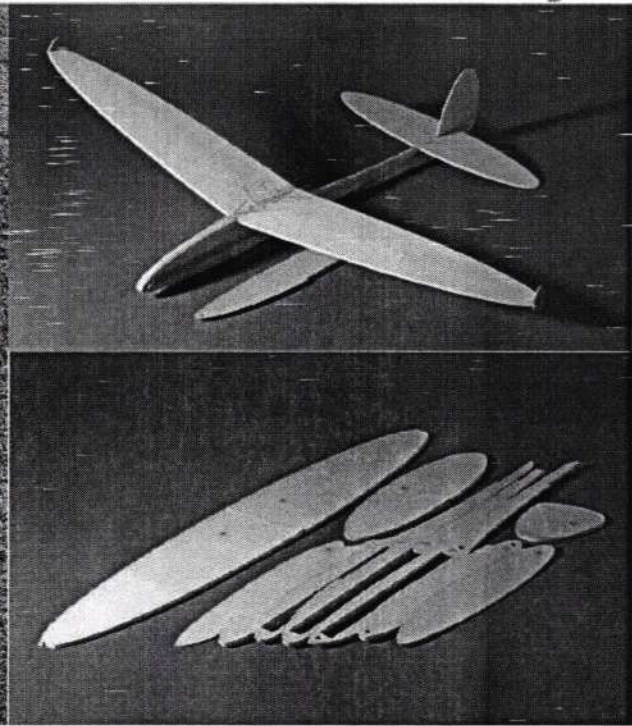
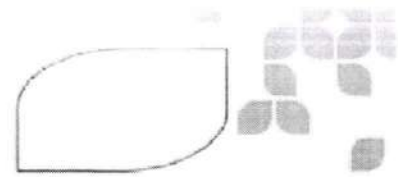
*Sayed*  
**PRINCIPAL**  
 ACE College of Engineering  
 Thiruvallam P.O  
 Thiruvananthapuram-695 027





INSPIRED  
BY PURPOSE

# Aeromodelling & Water Rocketry



Duration: 21/02/2022 - 25/02/2022

Resource Person  
Mr. Sanjay Satish

Convener (HOD)  
Mr. Sabu S. Joseph

Coordinator  
(Assistant Professor)  
Mr. Al Ameen H.

Patron  
Dr. Farrukh Sayeed  
Principal





# INSTITUTIONAL COURSE CERTIFICATE OF COMPLETION

**CADD  
CENTRE**  
Riding Drive, 4th Floor

Awarded to : SOORYAKRISHNAN B

In : AutoCAD

At : ACE College Of Engineering

By : CADD Centre Training Services, Thiruvananthapuram, Kesavadasapuram

During : Jul-2018 Duration : 40 Hrs Student ID: C180753360



Managing Director

Alagar Rajan C

Careless, Please

14-11-2018

DATE OF ISSUE



This course is offered by CADD Centre on the software developed by the respective companies. All brand names and trademarks belong to respective owners. Institutional Courses are specially designed for meeting the academic curriculum requirements. The course offered at the institutes, by qualified trainers and supporting study materials.

Corporate Office : 8<sup>th</sup> Floor, GEE GEE Crystal, Office No. 8C & 8D, #91, Dr. Rajalakshmi Salai, Mylapore, Chennai 600 004, India.

[www.caddcentre.com](http://www.caddcentre.com)

An ISO 9001 - 2015 Certified Company

*Sayed*  
PRINCIPAL  
ACE College of Engineering  
Thiruvallam P.O.  
Thiruvananthapuram-695



**ITBG - Knowledge Services Group**

GSTIN : 32AABCK1319E4Z5

Phone: 0471-2724765 || Helpline No. +91 9188665545 || E-mail: iteg@keltron.org || Website Link : ksg.keltron.in

KSG/01/INTP/22-01/L0962

07.01.2022

**CERTIFICATE**

Certified that the Student has completed the Internship Program conducted at KELTRON as per the particulars given below:

Name of the Student	Ms. ARYA MURUGAN D M
Name & Address of the College/Institution at which the Student is Studying	ACE College of Engineering, Karinkadamugal, Thiruvallom P O, Thiruvananthapuram-695027
University/Board, which the Institution is Affiliated to	A P J Abdul Kalam Technological University (KTU), Kerala
Branch/Discipline of Study	B. Tech in Electrical & Electronics Engineering
Student's Registration No.	ACE19EE004
Semester / Year of Study	5 <sup>th</sup> Semester
Name & Address of the Institution/Centre where the Internship Program was conducted	Keltron Knowledge Centre (01), Syrian Church Road, Spencer Junction, Trivandrum Kerala - 695001
Online Portal Registration No.	Not Applicable
Roll No./Register No.	K21011110102
Program Category	INTERNSHIP
Period & Duration of the Program	06.12.2021 to 12.12.2021 (1 Week)
Area of Exposure	Scope of Electrical Designing & Drafting, House Wiring Concepts, Electrical Services and Load Scheduling
Status	COMPLETED SUCCESSFULLY

*Mridula*

Authorized Signatory  
(Knowledge Services)



*Sayed*  
PRINCIPAL  
ACE College of Engineering  
Thiruvallam P.O  
Thiruvananthapuram-695 027

Temp.No: KSG/INTP/Type: 1/2 01 04 2019

Regd. Office : Keltron House, Vellayambalam, Thiruvananthapuram, Kerala State, India. Pin:695 033, Tel: 0471-4094444  
Visit us at our website :<http://www.keltron.org>

Doc. No : KSG/LH02-20/009/(2500)





## TECHBYHEART INDIA PRIVATE LIMITED

Reg. Office: 54/2967 B1, 1st Floor, Kohinoor Building, Kadavanthra, Kochi - 682020, Kerala  
CIN : U72900KL2020PTC062652, Tel.No: 9074027038

Ref: TBH/INT/DM/2022-23/05/02

Date: 15-05-2022

### TO WHOMSOEVER IT MAY CONCERN

This is to certify that Sreedev A S, student of ACE College of Engineering has successfully completed an internship programme on Digital Marketing from 1<sup>st</sup> May 2022 to 15<sup>th</sup> May 2022 at Techbyheart India Pvt Ltd.

We found him extremely inquisitive and hardworking. He was very much interested in learning the functions of our core division and also willing to put his best efforts and get into the depth of the subjects to understand it better.

We wish him every success in life.

For Techbyheart India Pvt Ltd

Human Resources



PRINCIPAL  
ACE College of Engineering  
Thiruvallam P.O.  
Thiruvananthapuram-695 027

EST 102	PROGRAMING IN C	CATEGORY	L	T	P	CREDIT	YEAR OF INTRODUCTION
		ESC	2	1	2	4	2019

**Preamble:** The syllabus is prepared with the view of preparing the Engineering Graduates capable of writing readable C programs to solve computational problems that they may have to solve in their professional life. The course content is decided to cover the essential programming fundamentals which can be taught within the given slots in the curriculum. This course has got 2 Hours per week for practicing programming in C. A list showing 24 mandatory programming problems are given at the end. The instructor is supposed to give homework/assignments to write the listed programs in the rough record as and when the required theory part is covered in the class. The students are expected to come prepared with the required program written in the rough record for the lab classes.

**Prerequisite:** NIL

**Course Outcomes:** After the completion of the course the student will be able to

CO 1	Analyze a computational problem and develop an algorithm/flowchart to find its solution
CO 2	Develop readable* C programs with branching and looping statements, which uses Arithmetic, Logical, Relational or Bitwise operators.
CO 3	Write readable C programs with arrays, structure or union for storing the data to be processed
CO 4	Divide a given computational problem into a number of modules and develop a readable multi-function C program by using recursion if required, to find the solution to the computational problem
CO 5	Write readable C programs which use pointers for array processing and parameter passing
CO 6	Develop readable C programs with files for reading input and storing output

readable\* - readability of a program means the following:

1. Logic used is easy to follow
2. Standards to be followed for indentation and formatting
3. Meaningful names are given to variables
4. Concise comments are provided wherever needed



*Sayed*  
PRINCIPAL  
ACE College of Engineering  
Thiruvallam P.O  
Thiruvananthapuram-695 027



### Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	☑	☑	☑	☑		☑				☑	☑	☑
CO2	☑	☑	☑	☑	☑					☑		☑
CO3	☑	☑	☑	☑	☑					☑		☑
CO4	☑	☑	☑	☑	☑					☑	☑	☑
CO5	☑	☑			☑					☑		☑
CO6	☑	☑			☑					☑		☑


### Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination Marks
	Test 1 (Marks)	Test 2 (Marks)	
Remember	15	10	25
Understand	10	15	25
Apply	20	20	40
Analyse	5	5	10
Evaluate			
Create			

### Mark distribution

Total Marks	CIE Marks	ESE Marks	ESE Duration
150	50	100	3 hours



  
 PRINCIPAL  
 ACE College of Engineering  
 Thiruvallam P.O.  
 Thiruvananthapuram-695 027

#### Continuous Internal Evaluation Pattern:

Attendance : 10 marks

Continuous Assessment Test 1 (for theory, for 2 hrs) : 20 marks

Continuous Assessment Test 2 (for lab, internal examination, for 2 hrs) : 20 marks

**Internal Examination Pattern:** There will be two parts; Part A and Part B. Part A contains 5 questions with 2 questions from each module ( $2.5 \text{ modules} \times 2 = 5$ ), having 3 marks for each question. Students should answer all questions. Part B also contains 5 questions with 2 questions from each module ( $2.5 \text{ modules} \times 2 = 5$ ), of which a student should answer any one. The questions should not have sub-divisions and each one carries 7 marks.

**End Semester Examination Pattern:** There will be two parts; Part A and Part B. Part A contains 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which a student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

#### Sample Course Level Assessment Questions

**Course Outcome 1 (CO1):** Write an algorithm to check whether largest of 3 natural numbers is prime or not. Also, draw a flowchart for solving the same problem.

**Course Outcome 2 (CO2):** Write an easy to read C program to process a set of n natural numbers and to find the largest even number and smallest odd number from the given set of numbers. The program should not use division and modulus operators.

**Course Outcome 3 (CO3):** Write an easy to read C program to process the marks obtained by n students of a class and prepare their rank list based on the sum of the marks obtained. There are 3 subjects for which examinations are conducted and the third subject is an elective where a student is allowed to take any one of the two courses offered.

**Course Outcome 4 (CO4):** Write an easy to read C program to find the value of a mathematical function f which is defined as follows.  $f(n) = n! / (\text{sum of factors of } n)$ , if n is not prime and  $f(n) = n! / (\text{sum of digits of } n)$ , if n is prime.

**Course Outcome 5 (CO5):** Write an easy to read C program to sort a set of n integers and to find the number of unique numbers and the number of repeated numbers in the given set of numbers. Use a function which takes an integer array of n elements, sorts the array using the Bubble Sorting Technique and returns the number of unique numbers and the number of repeated numbers in the given array.

**Course Outcome 6 (CO6):** Write an easy to read C program to process a text file and to print the Palindrome words into an output file.



*Sayed*  
PRINCIPAL  
ACE College of Engineering  
Thiruvallam P O  
Thiruvananthapuram-695 027



Model Question paper

QP CODE:

PAGES:3

Reg No: \_\_\_\_\_

Name : \_\_\_\_\_

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY FIRST SEMESTER B.TECH DEGREE EXAMINATION,  
MONTH & YEAR**

**Course Code: EST 102**

**Course Name: Programming in C (Common to all programs)**

**Max.Marks:100**

**Duration: 3 Hours**

**PART A**

**Answer all Questions. Each question carries 3 Marks**

1. Write short note on processor and memory in a computer.
2. What are the differences between compiled and interpreted languages? Give example for each.
3. Write a C program to read a Natural Number through keyboard and to display the reverse of the given number. For example, if "3214567" is given as input, the output to be shown is "7654123".
4. Is it advisable to use *goto* statements in a C program? Justify your answer.
5. Explain the different ways in which you can *declare & initialize* a single dimensional array.
6. Write a C program to read a sentence through keyboard and to display the count of white spaces in the given sentence.
7. What are the advantages of using functions in a program?
8. With a simple example program, explain *scope* and *life time* of variables in C.
9. Write a function in C which takes the address of a single dimensional array (containing a finite sequence of numbers) and the number of numbers stored in the array as arguments and stores the numbers in the same array in reverse order. Use pointers to access the elements of the array.
10. With an example, explain the different modes of opening a file. (10x3=30)

**Part B**

**Answer any one Question from each module. Each question carries 14 Marks**

11. (a) Draw a flow chart to find the position of an element in a given sequence, using linear searching technique. With an example explain how the flowchart finds the position of a given element. (10)  
(b) Write a pseudo code representing the flowchart for linear searching. (4)

**OR**



*Sayed*  
PRINCIPAL  
ACE College of Engineering  
Thiruvallam P.O  
Thiruvananthapuram-695 01

12. (a) With the help of a flow chart, explain the bubble sort operation. Illustrate with an example. (10)  
(b) Write an algorithm representing the flowchart for bubble sort. (4)

13. (a) Write a C program to read an English Alphabet through keyboard and display whether the given Alphabet is in upper case or lower case. (6)  
(b) Explain how one can use the builtin function in C, *scanf* to read values of different data types. Also explain using examples how one can use the builtin function in C, *printf* for text formatting. (8)

OR

14. (a) With suitable examples, explain various operators in C. (10)  
(b) Explain how characters are stored and processed in C. (4)
15. (a) Write a function in C which takes a 2-Dimensional array storing a matrix of numbers and the order of the matrix (number of rows and columns) as arguments and displays the sum of the elements stored in each row. (6)  
(b) Write a C program to check whether a given matrix is a diagonal matrix. (8)

OR

16. (a) Without using any builtin string processing function like *strlen*, *strcat* etc., write a program to concatenate two strings. (8)  
(b) Write a C program to perform bubble sort. (6)
17. (a) Write a function namely *myFact* in C to find the factorial of a given number. Also, write another function in C namely *nCr* which accepts two positive integer parameters *n* and *r* and returns the value of the mathematical function  $C(n,r) = \frac{n!}{r! \times (n-r)!}$ . The function *nCr* is expected to make use of the factorial function *myFact*. (10)  
(b) What is recursion? Give an example. (4)

OR

18. (a) With a suitable example, explain the differences between a structure and a union in C. (6)  
(b) Declare a structure namely *Student* to store the details (*roll number*, *name*, *mark\_for\_C*) of a student. Then, write a program in C to find the average mark obtained by the students in a class for the subject *Programming in C* (using the field *mark\_for\_C*). Use array of structures to store the required data (8)
19. (a) With a suitable example, explain the concept of pass by reference. (6)  
(b) With a suitable example, explain how pointers can help in changing the content of a single dimensionally array passed as an argument to a function in C. (8)

OR

20. (a) Differentiate between sequential files and random access files? (4)



*Sayed*  
PRINCIPAL  
ACE College of Engineering  
Thiruvallam P.O  
Thiruvananthapuram-695 027



(b) Using the prototypes explain the functionality provided by the following functions. (10)

*rewind()*

i. *fseek()*

ii. *ftell()*

iii. *fread()*

iv. *fwrite()*

(14X5=70)

## SYLLABUS

### Programming in C (Common to all disciplines)

#### Module 1

##### Basics of Computer Hardware and Software

Basics of Computer Architecture: processor, Memory, Input & Output devices

Application Software & System software: Compilers, interpreters, High level and low level languages

Introduction to structured approach to programming, Flow chart Algorithms, Pseudo code (*bubble sort, linear search - algorithms and pseudocode*)

#### Module 2

##### Program Basics

Basic structure of C program: Character set, Tokens, Identifiers in C, Variables and Data Types, Constants, Console IO Operations, printf and scanf

Operators and Expressions: Expressions and Arithmetic Operators, Relational and Logical Operators, Conditional operator, size of operator, Assignment operators and Bitwise Operators. Operators Precedence

Control Flow Statements: If Statement, Switch Statement, Unconditional Branching using goto statement, While Loop, Do While Loop, For Loop, Break and Continue statements. (Simple programs covering control flow)

#### Module 3

##### Arrays and strings

Arrays Declaration and Initialization, 1-Dimensional Array, 2-Dimensional Array

String processing: In built String handling functions (strlen, strcpy, strcat and strcmp, puts, gets)

Linear search program, bubble sort program, simple programs covering arrays and strings

#### Module 4

##### Working with functions

Introduction to modular programming, writing functions, formal parameters, actual parameters Pass by Value, Recursion, Arrays as Function Parameters structure, union, Storage Classes, Scope and life time of variables, *simple programs using functions*



*Sayed*  
PRINCIPAL  
ACE College of Engineering  
Thiruvallam P.O.  
Thiruvananthapuram-695 027

## Module 5

### Pointers and Files

Basics of Pointer: declaring pointers, accessing data through pointers, NULL pointer, array access using pointers, pass by reference effect

File Operations: open, close, read, write, append

Sequential access and random access to files: In built file handling functions (*rewind()*, *fseek()*, *ftell()*, *feof()*, *fread()*, *fwrite()*), *simple programs covering pointers and files.*

### Text Books

1. Schaum Series, Gottfried B.S., Tata McGraw Hill, Programming with C
2. E. Balagurusamy, McGraw Hill, Programming in ANSI C
3. Asok N Kamthane, Pearson, Programming in C
4. Anita Goel, Pearson, Computer Fundamentals

### Reference Books

1. Anita Goel and Ajay Mittal, Pearson, Computer fundamentals and Programming in C
2. Brian W. Kernighan and Dennis M. Ritchie, Pearson, C Programming Language
3. Rajaraman V, PHI, Computer Basics and Programming in C
4. Yashavant P, Kanetkar, BPB Publications, Let us C

### Course Contents and Lecture Schedule

Module 1: Basics of Computer Hardware and Software		(7 hours)
1.1	Basics of Computer Architecture: Processor, Memory, Input & Output devices	2 hours
1.2	Application Software & System software: Compilers, interpreters, High level and low level languages	2 hours
1.3	Introduction to structured approach to programming, Flow chart	1 hours
1.4	Algorithms, Pseudo code ( <i>bubble sort, linear search - algorithms and pseudocode</i> )	2 hours
Module 2: Program Basics		(8 hours)
2.1	Basic structure of C program: Character set, Tokens, Identifiers in C, Variables and Data Types, Constants, Console IO Operations, printf and scanf	2 hours
2.2	Operators and Expressions: Expressions and Arithmetic Operators, Relational and Logical Operators, Conditional operator, sizeof operator, Assignment operators and Bitwise Operators. Operators Precedence	2 hours



  
PRINCIPAL  
ACE College of Engineering  
Thiruvallam P.O  
Thiruvananthapuram-695 027



2.3	<b>Control Flow Statements:</b> If Statement, Switch Statement, Unconditional Branching using goto statement, While Loop, Do While Loop, For Loop, Break and Continue statements.(Simple programs covering control flow)	4 hours
<b>Module 3: Arrays and strings:</b>		<b>(6 hours)</b>
3.1	Arrays Declaration and Initialization, 1-Dimensional Array, 2-Dimensional Array	2 hours
3.2	<b>String processing:</b> In built String handling functions( <i>strlen, strcpy, strcat and strcmp, puts, gets</i> )	2 hours
3.3	Linear search program, bubble sort program, <i>simple programs covering arrays and strings</i>	3 hours
<b>Module 4: Working with functions</b>		<b>(7 hours)</b>
4.1	Introduction to modular programming, writing functions, formal parameters, actual parameters	2 hours
4.2	Pass by Value, Recursion, Arrays as Function Parameters	2 hours
4.3	structure, union, Storage Classes, Scope and life time of variables, <i>simple programs using functions</i>	3 hours
<b>Module 5: Pointers and Files</b>		<b>(7 hours)</b>
5.1	<b>Basics of Pointer:</b> declaring pointers, accessing data through pointers, NULL pointer, array access using pointers, pass by reference effect	3 hours
5.2	<b>File Operations:</b> open, close, read, write, append	1 hours
5.3	<b>Sequential access and random access to files:</b> In built file handling functions ( <i>rewind(), fseek(), ftell(), feof(), fread(), fwrite()</i> ), <i>simple programs covering pointers and files.</i>	2 hours

#### C PROGRAMMING LAB (Practical part of EST 102, Programming in C)

**Assessment Method:** The Academic Assessment for the Programming lab should be done internally by the College. The assessment shall be made on 50 marks and the mark is divided as follows: Practical Records/Outputs - 20 marks (internal by the College), Regular Lab Viva - 5 marks (internal by the College), Final Practical Exam – 25 marks (internal by the College).

The mark obtained out of 50 will be converted into equivalent proportion out of 20 for CIE computation.



*Sayed*  
 PRINCIPAL  
 ACE College of Engineering  
 Thiruvallam P.O  
 Thiruvananthapuram-695 027

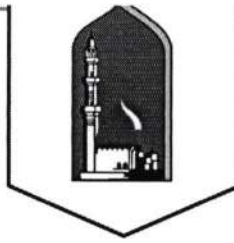
### LIST OF LAB EXPERIMENTS

1. Familiarization of Hardware Components of a Computer
2. Familiarization of Linux environment – How to do Programming in C with Linux
3. Familiarization of console I/O and operators in C
  - i) Display "Hello World"
  - ii) Read two numbers, add them and display their sum
  - iii) Read the radius of a circle, calculate its area and display it
  - iv) Evaluate the arithmetic expression  $((a - b / c * d + e) * (f + g))$  and display its solution. Read the values of the variables from the user through console.
4. Read 3 integer values and find the largest among them.
5. Read a Natural Number and check whether the number is prime or not
6. Read a Natural Number and check whether the number is Armstrong or not
7. Read n integers, store them in an array and find their sum and average
8. Read n integers, store them in an array and search for an element in the array using an algorithm for Linear Search
9. Read n integers, store them in an array and sort the elements in the array using Bubble Sort algorithm
10. Read a string (word), store it in an array and check whether it is a palindrome word or not.
11. Read two strings (each one ending with a \$ symbol), store them in arrays and concatenate them without using library functions.
12. Read a string (ending with a \$ symbol), store it in an array and count the number of vowels, consonants and spaces in it.
13. Read two input each representing the distances between two points in the Euclidean space, store these in structure variables and add the two distance values.
14. Using structure, read and print data of n employees (*Name, Employee Id and Salary*)
15. Declare a union containing 5 string variables (*Name, House Name, City Name, State and Pin code*) each with a length of C\_SIZE (user defined constant). Then, read and display the address of a person using a variable of the union.
16. Find the factorial of a given Natural Number n using recursive and non recursive functions
17. Read a string (word), store it in an array and obtain its reverse by using a user defined function.
18. Write a menu driven program for performing matrix addition, multiplication and finding the transpose. Use functions to (i) read a matrix, (ii) find the sum of two matrices, (iii) find the product of two matrices, (iv) find the transpose of a matrix and (v) display a matrix.
19. Do the following using pointers
  - i) add two numbers
  - ii) swap two numbers using a user defined function
20. Input and Print the elements of an array using pointers
21. Compute sum of the elements stored in an array using pointers and user defined function.
22. Create a file and perform the following
  - iii) Write data to the file
  - iv) Read the data in a given file & display the file content on console
  - v) append new data and display on console
23. Open a text input file and count number of characters, words and lines in it; and store the results in an output file.



  
PRINCIPAL  
ACE College of Engineering  
Thiruvallam P.O.  
Thiruvananthapuram-695 027






ID : FB61153

## CERTIFICATE OF PARTICIPATION

This certificate is awarded to


-----RESHMA SURESH BABU-----

for active participation in the online training - **Blended Learning**  
for **Higher Education** organized by **ICT, MH Trust** in association  
with **GEG Thiruvananthapuram** on **14th March 2022**

 Google  
Educator Group

 @gegtvm



  
PRINCIPAL  
ACE College of Engineering  
Thiruvallam P.O.  
Thiruvananthapuram-695 027



# Thangal Kunju Musaliar College of Engineering Kollam, Kerala-691005

## Certificate of Participation

This is to certify that Prof.AFSAL. S, ASSISTANT PROFESSOR in the Department of Electronics and Communication Engineering of ACE COLLEGE OF ENGINEERING has participated in the Online Faculty Development Program on "Digital Circuit Design Using Verilog HDL" sponsored by Technical Education Quality Improvement Programme- phase II, organised by Department of Electronics & Communication Engineering, from 07-09-2020 to 12-09-2020.

Prof. Anu Assis  
Course Coordinator

Dr. Sajeeb R.  
TEQIP Coordinator

Prof. Abid Hussain M  
Head of Department

Dr. T.A.Shahul Hameed  
Principal



PRINCIPAL  
ACE College of Engineering  
Thiruvallam P.O.  
Thiruvananthapuram-695 027





# CERTIFICATE

TYRANNUS INNOVATIVE ENGINEERING & RESEARCH ACADEMY

SATHYANJAN.R (ACE19EC016)

has successfully undergone a **5** days long internship program from **22.11.2021** to **26.11.2021** at TIERA Pvt Ltd. During this period he/she had gained rich insights into

**Industrial - IOT Based Automation Using LabView**

and has successfully completed a mini project on the topic

**Industrial Solution for Automation in Temperature Monitoring using  
LabVIEW**

Dr. Akash Rajan  
CEO, TIERA Pvt. Ltd  
Vibration Analyst Level III

Shino G Babu  
Director, TIERA Pvt. Ltd  
Certified LabView Developer

Verification Number: 09542323921570

Issued by: Certifier Viewed by: Verified



PRINCIPAL  
ACE College of Engineering  
Thiruvallam P.O  
Thiruvananthapuram-695 027

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
EET435	RENEWABLE ENERGY SYSTEMS	OEC	2	1	0	3

**Preamble:** Objective of this course is to inculcate in students an awareness of new and renewable energy sources.

**Prerequisite:** Students who have taken EET383 MINOR are not eligible to take this course.

**Course Outcomes:** After the completion of the course the student will be able to

CO 1	Choose the appropriate energy source depending on the available resources.
CO 2	Explain the concepts of solar thermal and solar electric systems.
CO 3	Illustrate the operating principles of wind, and ocean energy conversion systems.
CO 4	Outline the features of biomass and small hydro energy resources
CO 5	Describe the concepts of fuel cell and hydrogen energy technologies

**Mapping of course outcomes with program outcomes**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2					1	2					
CO 2	3											
CO 3	3					1	1					
CO 4	3					1	1					
CO 5	3											

**Assessment Pattern**

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	25	25	50
Understand	20	20	40
Apply	5	5	10
Analyse			
Evaluate			
Create			

**Mark distribution**

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours



*Sayed*  
 PRINCIPAL  
 ACE College of Engineering  
 Thiruvallam P.O  
 Thiruvananthapuram-695 021



### Continuous Internal Evaluation Pattern:

Attendance	: 10 marks
Continuous Assessment Test (2 numbers)	: 25 marks
Assignment/Quiz/Course project	: 15 marks

**End Semester Examination Pattern:** There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have a maximum of 2 subdivisions and carry 14 marks.

### Course Level Assessment Questions

#### Course Outcome 1 (CO1):

1. Write short notes on the advantages and disadvantages of any three types of non conventional energy sources. (K1, PO1)
2. What are the points to be considered while constructing a house for energy efficiency? (K2, PO1, PO6, PO7)

#### Course Outcome 2 (CO2)

1. Explain construction of solar flat plate collector with a neat diagram. (K2, PO1)
2. Draw the block diagram of a solar thermal electric plant and explain its working. (K1, PO1)
3. Discuss the effect of temperature and insolation on the characteristics of solar cell. Draw the P-V characteristics of Solar cell under varying temperature and irradiation level. (K3, PO1)

#### Course Outcome 3 (CO3):

1. Derive the expression for power in the wind turbine. (K1, PO1, PO6, PO7)
2. Classify tidal power plants and brief explain any two of them. (K1, PO1, PO6, PO7)
3. With the help of a block diagram explain the working of a hybrid OTEC. (K2, PO1, PO6, PO7)

#### Course Outcome 4 (CO4):

1. What are the factors that affect biogas generation? (K1, PO1, PO6, PO7)
2. Compare the construction and performance of floating drum type and fixed dome type biogas plants with the help of neat sketches. (K2, PO1, PO6, PO7)
3. Discuss the selection criteria of turbines for a small hydro project. (K1, PO1, PO6, PO7)



  
PRINCIPAL  
ACE College of Engineering  
Thiruvallam P.O  
Thiruvananthapuram-695 027

**Course Outcome 5 (CO5):**

1. What is small hydro power? How is it classified? Obtain an expression for the power that can be generated from a small hydro power station. (K1, PO1)
2. Explain the hydrogen energy system with necessary diagram. (K2, PO1)
3. What do you mean by the conversion efficiency of a fuel cell? (K1, PO1)

**Model Question Paper**

**Total Pages:2**

Reg No.: \_\_\_\_\_

Name: \_\_\_\_\_

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**

**SEVENTH SEMESTER B.TECH DEGREE EXAMINATION**

**Course Code: EET435**

**Course Name: RENEWABLE ENERGY SYSTEMS**

Max. Marks: 100

Duration: 3 Hours

**PART A**

*Answer all questions, each carries 3 marks.*

- 1 Differentiate between flat plate collectors and solar concentrators.
- 2 Discuss advantages and limitations of conventional energy sources.
- 3 With the help of a block diagram explain the working of a hybrid OTEC.
- 4 List out the advantages and disadvantages of a tidal power plant.
- 5 Discuss the different types of wind turbine rotors used to extract wind power.
- 6 The Danish offshore wind farm has a name plate capacity of 209.3 MW. As of January 2017 it has produced 6416 GWh since its commissioning 7.3 years ago. Determine the capacity factor of above wind farm.
- 7 What are the factors that affect biogas generation
- 8 Discuss the process of biomass to ethanol conversion
- 9 What are the components of micro hydel power plant.
- 10 Enumerate the design and selection of different types of turbines used for small hydro plants



  
PRINCIPAL  
ACE College of Engineering  
Thiruvallam P.O  
Thiruvananthapuram-695 027



## PART B

Answer any one full question from each module. Each question carries 14 marks

### Module 1

- 9 a) With the aid of a neat diagram, explain the working of a central tower collector type solar thermal electric plant (9)
- b) Define (i) Open Circuit Voltage (ii) Short circuit Current (iii) Fill factor and (iv) Efficiency of the solar cell (5)
- 10 a) Compare the components and working of a standalone and grid connected PV system (5)
- b) How energy resources are classified. Compare conventional and non conventional sources of energy resources (9)

### Module 2

- 11 What are the site selection criteria for OTEC? Draw the block diagram and explain the working of Anderson cycle based OTEC system. Explain how biofouling affects efficiency of energy conversion and how can it be minimised? (14)
- 12 Explain the principle of operation of a tidal power plant. How it is classified? Draw the layout of a double basin tidal power plant and label all the components. Explain the function of each component (14)

### Module 3

- 13 a) Prove that the maximum wind turbine output can be achieved when  $V_d = \frac{1}{3} V_u$  (10)  
 $V_d = \frac{1}{3} V_u$ , where  $V_d$  and  $V_u$  are down-stream and up-stream wind velocity respectively
- b) What is pitch control of wind turbine? Explain. (4)
- 14 a) Determine the power output of a wind turbine whose blades are 12m in diameter and when the wind speed is 6m/s, the air density is about 1.2kg/m<sup>3</sup> and the maximum power coefficient of the wind turbine is 0.35. (5)
- b) Explain the parts, their function and working of a wind power plant. What are the site selection criteria of a wind power plant? (9)

### Module 4



*Sayed*  
PRINCIPAL  
ACE College of Engineering  
Thiruvallam P.O.  
Thiruvananthapuram-695 027

- 15 a) With a neat schematic diagram , explain the biomass gasification based electric power generation system (5)
- b) Explain the how urban waste is converted into useful energy (9)
- 16 a) Compare the construction and performance of floating drum type and fixed dome type biogas plants with the help of neat sketches (10)
- b) Explain the importance of biomass programme in India (4)

### Module 5

- 15 a) Explain the operation of a phosphoric acid fuel cell with the help of a suitable diagram (7)
- b) What are the different methods used for the production and storage of hydrogen (7)
- 16 a) Draw the layout of a mini hydro project and explain its working (7)
- b) Describe the working and constructional features of PEM fuel cell (7)

\*\*\*\*\*

## Syllabus

### Module 1

Introduction, Classification of Energy Resources- Conventional Energy Resources - Availability and their limitations- Non-Conventional Energy Resources – Classification, Advantages, Limitations; Comparison.

SOLAR THERMAL SYSTEMS- Principle of Conversion of Solar Radiation into Heat – Solar thermal collectors. – Flat plate collectors. Solar concentrators (parabolic trough, parabolic dish, Central Tower Collector).

SOLAR ELECTRIC SYSTEMS- Solar Thermal Electric Power Generation – Solar Photovoltaic – Solar Cell fundamentals - characteristics, classification, .construction. Solar PV Systems – stand-alone and grid connected- Applications .

### Module 2

ENERGY FROM OCEAN- Ocean Thermal Energy Conversion (OTEC)- Principle of OTEC system- Open Cycle (Claude cycle), Closed Cycle (Anderson cycle) and Hybrid cycle. Site-selection criteria- Biofouling- Advantages & Limitations of OTEC.

TIDAL ENERGY – Principle of Tidal Power- Components of Tidal Power Plant (TPP)- Classification-single basin- double basin types –Limitations -Environmental impacts.



*Sayed*  
**PRINCIPAL**  
 ACE College of Engineering  
 Thiruvallam P.O  
 Thiruvananthapuram-695 027



### Module 3

WIND ENERGY- Introduction- Basic principles of Wind Energy Conversion Systems (WECS) wind speed measurement-Classification of WECS- types of rotors. wind power equation -Betz limit. Electrical Power Output and Capacity Factor of WECS- Advantages and Disadvantages of WECS -site selection criteria.

### Module 4

BIOMASS ENERGY- Introduction- Biomass fuels-Biomass conversion technologies -Urban waste to Energy Conversion- Biomass Gasification- Biomass to Ethanol Production- Biogas production from waste biomass- factors affecting biogas generation-types of biogas plants – KVIC and Janata model-Biomass program in India.

### Module 5

SMALL HYDRO POWER- Classification as micro, mini and small hydro projects - Basic concepts and types of turbines- selection considerations.

EMERGING TECHNOLOGIES: Fuel Cell-principle of operation –classification- conversion efficiency and losses - applications .Hydrogen energy -hydrogen production -electrolysis - thermo chemical methods -hydrogen storage and utilization.

### Text Books

1. G. D. Rai, “ Non Conventional Energy Sources”, Khanna Publishers, 2010.
2. Rao S. and B. B. Parulekar, Energy Technology, Khanna Publishers, 1999

### Reference Books

1. G.N. Tiwari: Solar Energy-Fundamentals, Design, Modelling and Applications, Narosa Publishers, 2002
2. Earnest J. and T. Wizelius, Wind Power Plants and Project Development, PHI Learning, 2011.
3. Sab S. L., Renewable and Novel Energy Sources, MI. Publications, 1995.
4. Sawhney G. S., Non-Conventional Energy Resources, PHI Learning, 2012.
5. Tiwari G. N., Solar Energy- Fundamentals, Design, Modelling and Applications, CRC Press, 2002.
6. A.A.M. Saigh (Ed): Solar Energy Engineering, Academic Press, 1977
7. Abbasi S. A. and N. Abbasi, Renewable Energy Sources and Their Environmental Impact, Prentice Hall of India, 2001..
8. Boyle G. (ed.), Renewable Energy - Power for Sustainable Future, Oxford University Press, 1996




  
PRINCIPAL  
ACE College of Engineering  
Thiruvallam P.O  
Thiruvananthapuram-695 027

9. Earnest J. and T. Wizelius, Wind Power Plants and Project Development, PHI Learning, 2011.
10. F. Kreith and J.F. Kreider: Principles of Solar Engineering, McGraw Hill, 197
11. F. Kreith and J.F. Kreider: Principles of Solar Engineering, McGraw Hill, 1978 62.
12. Khan B.H, Non Conventional Energy resources Tata McGraw Hill, 2009.

### Course Contents and Lecture Schedule

No	Topic	No. of Lectures (35 hours)
<b>1</b>	<b>INTRODUCTION (7 HOURS)</b>	
1.1	Classification of Energy Resources- Conventional Energy - Resources - Availability and their limitations	1
1.2	Non-Conventional Energy Resources – Classification, Advantages, Limitations, Comparison.	1
1.3	SOLAR THERMAL SYSTEMS- Principle of Conversion of Solar Radiation into Heat – Solar thermal collectors.	1
1.4	Flat plate collectors. Solar concentrators (parabolic trough, parabolic dish, Central Tower Collector)	1
1.5	SOLAR ELECTRIC SYSTEMS- Solar Thermal Electric Power Generation	1
1.6	Solar Photovoltaic – Solar Cell fundamentals - characteristics, classification, construction.	1
1.7	Solar PV Systems – stand-alone and grid connected- Applications	1
<b>2</b>	<b>ENERGY FROM OCEAN (7 hours)</b>	
2.1	Ocean Thermal Energy Conversion (OTEC)- Principle of OTEC system-	1
2.2	Open Cycle (Claude cycle), Closed Cycle (Anderson cycle)	1
2.3	Hybrid cycle. Site-selection criteria	1
2.4	Biofouling- Advantages & Limitations of OTEC	1
2.5	TIDAL ENERGY – Principle of Tidal Power- Components of Tidal Power Plant (TPP)-	1
2.6	Classification-single basin- double basin types –Limitations and environmental impacts	2
<b>3</b>	<b>WIND ENERGY (7 hours)</b>	
3.1	Introduction- Basic principles of Wind Energy Conversion Systems (WECS)	1
3.2	Wind speed measurement	1




  
 PRINCIPAL  
 ACE College of Engineering  
 Thiruvallam P.O  
 Thiruvananthapuram-695 027



3.3	Classification of WECS- types of rotors	2
3.4	Wind power equation -Betz limit	1
3.5	Electrical Power Output and Capacity Factor of WECS	1
3.6	Advantages and Disadvantages of WECS -site selection criteria	1
<b>4</b>	<b>BIOMASS ENERGY (6 hours)</b>	
4.1	Urban waste to Energy Conversion	1
4.2	Biomass Gasification- Biomass to Ethanol Production	1
4.3	Biogas production from waste biomass	2
4.4	Types of biogas plants – KVIC and Janata model	1
4.5	Biomass program in India.	1
<b>5</b>	<b>SMALL HYDRO POWER (8 hours)</b>	
5.1	Classification as micro, mini and small hydro projects	1
5.2	Basic concepts and types of turbines- selection considerations.	2
5.3	EMERGING TECHNOLOGIES: Fuel Cell-principle of operation	1
5.4	Classification- conversion efficiency and losses - applications	1
5.5	Hydrogen energy -hydrogen production	1
5.6	Electrolysis -thermo chemical methods	1
5.7	Hydrogen storage and utilization.	1



  
**PRINCIPAL**  
 ACE College of Engineering  
 Thiruvallam P.O.  
 Thiruvananthapuram-695 027