Adusumilli Gopala krishnaiah& Sugarcane Growers Siddharatha Degree College of Arts and Science

Autonomous College :: Aided College of Govt. of AP

NAAC 'A' Grade College

Vuyyuru, Krishna (Dt).,Andhra Pradesh-521165

VALUE ADDED COURSE

TITLE: PARTICLE PHYSICS

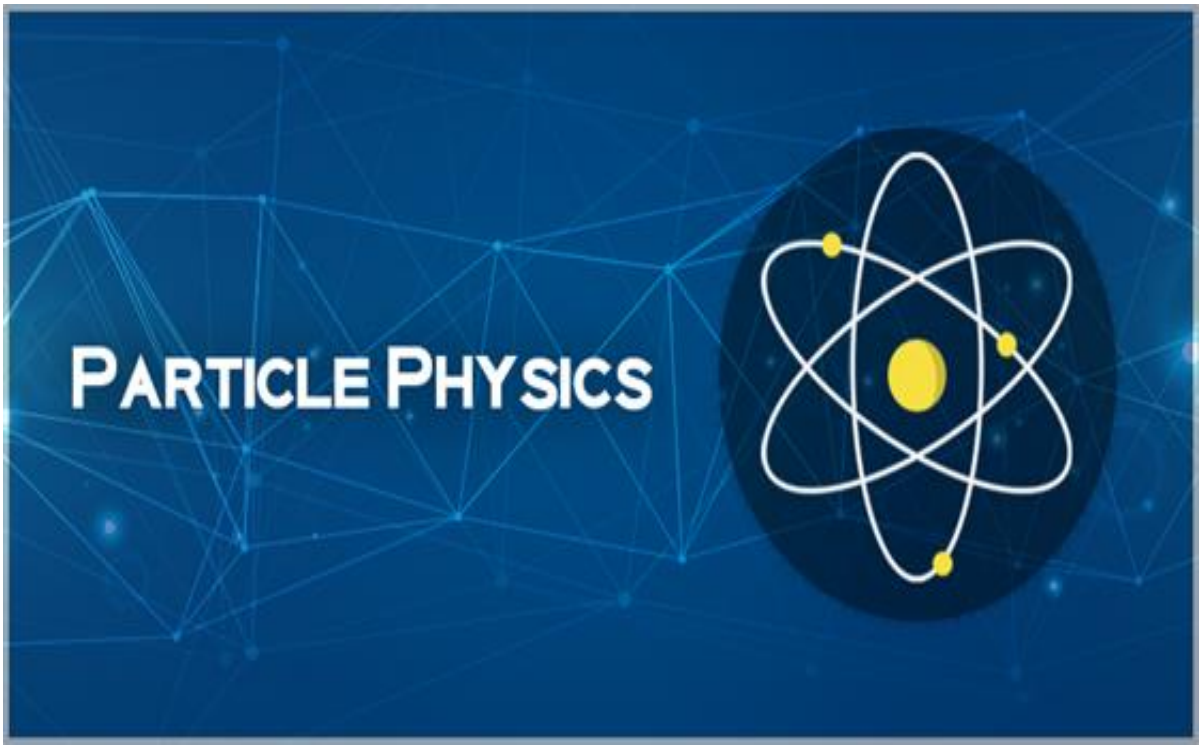
VAC CODE: PHYV2C

On 20thJAN, 2019TO 20thFEB 2019

Duration of the Course: 30 Days

Organized By

Department of PHYSICS



A.G. & S.G. Siddhartha Degree College of Arts & Science

Vuyyuru-521165, Krishna District, Andhra Pradesh
(Managed by: Siddhartha Academy of General & Technical Education, Vijayawada-10)
An Autonomous College in the Jurisdiction of Krishna University
Accredited by NAAC with "A" Grade

2018-2019

DEPARTMENT OF PHYSICS

Value Added Course/ Certificate Course

Title: PARTICLE PHYSICS

Name of the Lecturer	:	P.V.Ramana
Class	:	II MPCs
Duration of the Course	:	Thirty Days
VAC Code	:	PHYV2C

Objectives:

The goal of elementary-particle physics is to understand the world around us by identifying the elementary particles, understanding their properties, and learning how they interact.

Methodology :

Teacher-centered Method

Duration: 30 Days

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Value Added Course / Certificate Course

Title: PARTICLE PHYSICS

Date: 20/1/2019 TO 20/2/2019

Date	Content	Module No
20/1/2019 TO 26/1/2019	fundamental particles and their searches, Accelerators and colliders	I
27/1/2019 TO 3/2/2019	Basic interactions , Relativity, antiparticles , Rotation, Isospin, Addition of Angular momentum	II
4/2/2019 TO 11/2/2019	Strong interactions, Electromagnetic interactions, Weak interactions	III
12/2/2019 TO 20/2/2019	Einstein mass energy relation	IV

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Vuyyuru-521165, Krishna District, Andhra Pradesh

Value Added Course / Certificate Course 2018-19

Student Enrolment Sheet

Class: II B.Sc (MPCs)

S. No	Roll No.	Name of the Student	Signature
1	1751602	V.Teja sri	V. Teja Sri
2	1751604	T.Preethi	T. Preethi
3	1751606	K.Raja Lakshmi	K. Raja Lakshmi
4	1751609	K.Pavan sai bhavani	K. Pavan Sai bhavani
5	1751614	V.Anand Babu	V. Anand Babu.
6	1751617	V.Divya	V. Divya
7	1751620	K.Anil	K. Anil
8	1751623	G.Sireesha	G. Sireesha
9	1751627	G.Aruna	G. Aruna
10	1751633	P.V.V.Chinna	P. V. V. Chinna
11	1751639	P.Janu	P. Janu
12	1751643	M.Tarun Sai	M. Tarun Sai
13	1751645	P.Suresh	P. Suresh
14	17516543	K.Vennela	K. Vennela.
15	1751659	N.Samba Siva Rao	N. Samba Siva Rao

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A.G. & S.G. Siddhartha Degree College of Arts & Science
Vuyyuru-521165, Krishna District, Andhra Pradesh

Department of Physics

Value Added Course / Certificate Course

Title: PARTICLE PHYSICS

Marks Lists

Class: II BSC, MPCS

S. No	Roll No.	Name of the Student	Marks
1	1751602	V.Teja sri	10
2	1751604	T.Preethi	10
3	1751606	K.Raja Lakshmi	09
4	1751609	K.Pavan sai bhavani	10
5	1751614	V.Anand Babu	09
6	1751617	V.Divya	09
7	1751620	K.Anil	10
8	1751623	G.Sireesha	09
9	1751627	G.Aruna	09
10	1751633	P.V.V.Chinna	09
11	1751639	P.Janu	09
12	1751643	M.Tarun Sai	09
13	1751645	P.Suresh	09
14	17516543	K.Vennela	10
15	1751659	N.Samba Siva Rao	10

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A.G. & S.G. Siddhartha Degree College of Arts & Science
Vuyyuru-521165, Krishna District, Andhra Pradesh

Value Added Course / Certificate Course - Attendance Register

Sl.No	Roll No	Student Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total
1	1751602	V.Teja sri	P	p	p	p	p	p	A	p	p	p	p	p	p	p	p	14
2	1751604	T.Preethi	p	p	p	p	p	p	p	A	p	p	p	p	p	p	p	14
3	1751606	K.Raja Lakshmi	A	p	p	p	p	p	p	p	p	p	p	p	p	p	p	14
4	1751609	K.Pavan sai bhavani	P	p	p	p	p	p	A	p	p	p	p	p	p	p	p	14
5	1751614	V.Anand Babu	P	p	p	p	p	p	p	p	p	p	A	p	p	p	p	14
6	1751617	V.Divya	P	p	p	p	p	p	p	p	p	A	p	p	p	p	p	14
7	1751620	K.Anil	P	p	p	p	p	A	p	p	p	p	p	p	p	p	p	14
8	1751623	G.Sireesha	P	p	p	p	p	p	p	p	p	p	A	p	p	p	p	14
9	1751627	G.Aruna	P	A	p	p	p	p	p	p	p	p	p	p	p	p	p	14
10	1751633	P.V.V.Chinna	P	p	p	p	p	p	p	A	p	p	p	p	p	p	p	14
11	1751639	P.Janu	P	p	p	p	p	p	p	p	p	p	p	p	A	p	p	14
12	1751643	M.Tarun Sai	P	p	p	p	p	p	p	p	p	p	p	p	p	p	p	15
13	1751645	P.Suresh	P	p	p	p	p	p	p	p	p	p	p	p	p	p	p	15
14	17516543	K.Vennela	P	p	p	p	p	p	p	p	p	p	p	p	p	p	p	15
15	1751659	N.Samba Siva Rao	P	p	p	A	p	p	p	p	p	p	p	p	p	p	p	14

Class / Section: II MPCs Year : IInd Department : PHYSICS
Paper: Lecturer:

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Signature of the Lecturer Signature
of the HOD

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Krishna

A.G. & S.G. Siddhartha Degree College of Arts & Science
Vuyyuru-521165, Krishna District, Andhra Prade

Value Added Course / Certificate Course - Attendance Register

Sl.No	Roll No	Student Name	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	Total
1	1751602	V.Teja sri	A	p	p	p	p	p	p	p	p	p	p	p	p	p	p	14
2	1751604	T.Preethi	p	p	p	A	p	p	p	p	p	p	p	p	p	p	p	15
3	1751606	K.Raja Lakshmi	P	p	p	p	p	p	p	p	p	A	p	p	p	p	p	14
4	1751609	K.Pavan sai bhavani	P	p	p	p	A	p	p	p	p	p	p	p	p	p	p	14
5	1751614	V.Anand Babu	P	p	p	p	p	p	p	p	p	A	p	p	p	p	p	14
6	1751617	V.Divya	P	p	p	p	p	p	p	p	p	p	p	A	p	p	p	14
7	1751620	K.Anil	P	p	p	p	p	p	A	p	p	p	p	p	p	p	p	14
8	1751623	G.Sireesha	P	p	p	p	A	p	p	p	p	p	p	p	p	p	p	14
9	1751627	G.Aruna	P	p	p	p	p	p	p	p	p	A	p	p	p	p	p	14
10	1751633	P.V.V.Chinna	P	p	p	p	p	p	A	p	p	p	p	p	p	p	p	14
11	1751639	P.Janu	P	p	p	p	p	p	p	p	p	p	A	p	p	p	p	14
12	1751643	M.Tarun Sai	P	p	p	p	p	p	p	p	p	p	p	p	A	p	p	14
13	1751645	P.Suresh	P	p	p	p	p	A	p	p	p	p	p	p	p	p	p	14
14	17516543	K.Vennela	P	p	p	p	p	p	p	p	p	p	A	p	p	p	p	14
15	1751659	N.Samba Siva Rao	P	p	p	p	p	p	p	p	p	p	A	p	p	p	p	14

Class / Section: II MPCS Year : 2nd Department : PHYSICS

Paper: Lecturer:

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A.G. & S.G. Siddhartha Degree College of Arts & Science
Vuyyuru-521165, Krishna District, Andhra Pradesh

Department of Physics

Value Added Course / Certificate Course

Title: PARTICLE PHYSICS

Feed Back Form

Name of the Student: T. Preethi

Class and Roll Number: 19S1 604

6. Is the programme interested to you (Yes/No) ✓
7. Have you attended all the session (Yes/No) ✓
8. Is the content of the program is adequate (Yes/No) ✓
9. Have the teacher covered the entire syllabus? (Yes/No) ✓
10. Is the number of hours adequate? ✓ (Yes/No)

6. Do you have any suggestions for enhancing or reducing the number of weeks designed for the program? (Yes/No) ✓

8. On the whole, is the program useful in terms of enriching your knowledge? (Yes/No) ✓

8. Do you have any suggestions on the program? (Yes/No) ✓

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Vuyyuru-521165, Krishna District, Andhra Pradesh

2018- 2019

Department of Physics

Value Added Course / Certificate Course

Title: PARTICLE PHYSICS

Feed Back Form

Name of the Student: V. Tesa Sri

Class and Roll Number: 17 51602

6. Is the programme interested to you (Yes/No)
7. Have you attended all the session (Yes/No)
8. Is the content of the program is adequate (Yes/No)
9. Have the teacher covered the entire syllabus? (Yes/No)
10. Is the number of hours adequate? (Yes/No)

6. Do you have any suggestions for enhancing or reducing the number of weeks designed for the program? (Yes/No)

8. On the whole, is the program useful in terms of enriching your knowledge? (Yes/No)

8. Do you have any suggestions on the program? (Yes/No)

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Vuyyuru-521165, Krishna District, Andhra Pradesh

Value Added Course / Certificate Course

Title: PARTICLE PHYSICS

Test Exercise:

1. How much of our universe is made of matter or energy, which we do not know about?
2. How do we see “quarks” in a detector?
3. The particles carrying the strong force are the
4. Which of the following technological innovations was invented at CERN
5. Our universe is dominated by…
6. What are the fundamental particles of an atom?
7. What are fermions?
8. What are bosons?
9. What are mesons?
10. What is super string?

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Value Added Course / Certificate Course

Title: PARTICLE PHYSICS

Key:

1).96%

2). Via “jets” of hadrons they generate

3.) gluons

4). World Wide Web

5.) Dark energy

6) Quarks, gluons and electrons

7)) Fundamental particles of matter

8) Subatomic particles that carry forces

9) A type of composite particle produced by high energy

10) A hypothesis which attempts to explain the elementary particles of nature

2) PARTICLE PHYSICS

Module No -1

Elementary particle physics studies the fundamental building blocks of nature. But what fundamental does mean? By fundamental we mean objects that are simple and structureless, not made of anything smaller.

During the past century the word “fundamental” was addressed firstly to the atom. The word “atom” was introduced by Democritus (400 BC) who described the matter as composed by small and indivisible particles (“atom” comes from greek a-temno, which can not be divided). The internal structure of the atom was discovered and protons, neutrons and electrons became the building blocks of matter. After 1960, scattering experiments of high energy particles on nucleons lead to the discovery of the quarks, which are thought now as the fundamental consituents of matter.

Modern particle physics research is focused on subatomic particles, including atomic constituents, such as electrons, protons, and neutrons (protons and neutrons are composite particles called baryons, made of quarks), that are produced by radioactive and scattering processes; such particles are photons, neutrinos, and muons, as well as a wide range of exotic particles. All particles and their interactions observed to date can be described almost entirely by the Standard Model.

Module No -2

Exchange Particles

- When two particles interact, there cannot be instantaneous action at a distance
  - This means one particle needs to "know" that the other is there
- This is the idea behind **exchange** (or **virtual**) particles
- When two particles exert a force on each other, a virtual particle is created
- Virtual particles only exist for a short amount of time and carry the fundamental force between each particle
- A force can be **attractive** or **repulsive**. An analogy of exchange particles would be:
  - Two people are on skateboards and a ball is passed between them. Due to this, they start to move away from each other. The ball represents an exchange particle creating **repulsion**
  - However, if one person throws a boomerang to the other, they will start to move closer together. The boomerang represents an exchange particle creating **attraction**
- Each fundamental interaction is transmitted by its own exchange particle
  - These are also called **gauge bosons**

Fundamental Interaction	Exchange Particle
Strong	pion(π^+, π^-, π^0) (between nucleons) gluon (between quarks)
Weak	W^+, W^-, Z^0
Electromagnetic	Photon, γ

- Since gravity is so weak, it only has a noticeable effect on large masses, therefore, gravity does not play a part in particle interactions
- The theorised exchange particle for the gravitational force is the graviton, however, this has not yet been discovered

Mass-Energy Relation

According to the special theory of relativity, E = mc2 is the relationship between mass and energy. The function of mass is energy. The more mass a body has, the more energy it gains or releases.

The term **"mass-energy relation"** refers to the fact that mass and energy are the same and may be changed into one another. Einstein proposed this concept. However, he was not the first to do so. With his theory of relativity, he accurately described the relationship between mass and energy. The equation is written as E=mC2 and is known as Einstein's **mass-energy** equation.

Where E is the object's equivalent kinetic energy, m is the object's mass (Kg), and c is the speed of light (c = 3 x 108 m/s).

Module No -3

Furthermore, the mass-energy relation indicates that the body's rest mass will drop if energy is released from the body due to such a conversion. Ordinary chemical reactions involve such a transfer of rest energy to other types of energy, while nuclear reactions involve significantly bigger conversions.

Even though a system's overall mass changes, its total energy and momentum stay constant, according to the **mass-energy relation.** Consider an electron colliding with a proton. Both particles' mass is destroyed, but a tremendous amount of energy in photons is generated. The concept of the mass-energy equation was important in the development of atomic fusion and fission theories.

Einstein's **mass-energy relation** is derived in the following way:

Consider an object travelling at around the speed of light. A unified force is acting upon it. Energy and momentum are induced in it due to the applied force. The increase in momentum of the object = mass x velocity of the body because the force is constant.

We know,

Energy acquired= Force x Distance through which force acts

E = F x d…… (1)

Also,

the momentum gained = the force x the time it takes for the force to act.

P = F x t

As, momentum = mass x velocity,

The momentum gained P = m x c

Hence, Force= (m x c)/t ……. (2)

When we combine equations (1) and (2), we get E = mc2.

The equation is used to calculate binding energy in an atomic nucleus. Binding energy is calculated by subtracting the sum of the masses of protons and neutrons from the masses of various nuclei. The energy released during nuclear reactions is calculated using binding energy measurements.

Derivation II

At whatever point an article is in speed, it appears to get heavier. The accompanying condition gives the increment in mass because of speed.

m= m0/ [(1−v2)/c2]

Where,

m-mass of the article at the voyaging speed

m0-mass of the article at a fixed position

v-speed of the article

c-speed of the light

We know, a moving object has active energy, and it is given by

E= ½ (mv2)

All-out energy moved by the item is roughly equivalent to dynamic energy and expansion in mass because of speed.

$E \cong (mc^2) + ½ (mv2)$

$E-(mc^2) = ½ (mv2)$, for little v/c

E= Relativistic dynamic energy + mc^2

The relativistic dynamic energy includes kinetic energy and rest mass energy

$E= 0+mc^2$

$E= mc^2$

Module No -4

Conclusion

Mass-energy relation expresses that each article has specific energy even in a fixed position. A fixed body doesn't have active energy. It just has expected energy and likely compound and nuclear power. As indicated by the field of applied mechanics, the amount of this multitude of points is more modest than the result of the particle's mass and the square of the speed of light.

Mass-energy relation implies mass and energy are very similar and can be changed over into one another. Einstein put this thought forward, yet he was not quick to uncover this. He portrayed the connection between mass and energy precisely utilising his relativity hypothesis. The condition is known as Einstein's mass-energy condition and is communicated as,

$E = mc^2$

where E= comparable dynamic energy of the article,

m = mass of the item (Kg) and

c = speed of light (roughly = 3 x 108 m/s)

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(AUTONOMOUS) VUYYURU A.P
(Accredited at "A" level by NAAC, Bengaluru)

Department of Physics

VALUE ADDED COURSE: ***PARTICLE PHYSICS***

CERTIFICATE

This is to Certify that . Son/Daughter of Shri/Smt

has Successfully completed value added course in ***PARTICLE PHYSICS***
Conducted by the Department of Physics from 20-01-2019 to 20-02-2019 . We wish him/her bright future

Co-ordinator *Head of Department* *Principal*