RAMAIAH UNIVERSITY OF APPLIED SCIENCES

Programme Specifications

M.Sc. Programme

Programme: Nuclear Physics & Technology	Department: Physics

Faculty of Mathematical & Physical Sciences

M.S. Ramaiah University of Applied Sciences

University House, New BEL Road, MSR Nagar, Bangalore – 560 054

www.msruas.ac.in

Programme Specifications: M.Sc. in Nuclear Physics and Technology

Faculty	Faculty of Mathematical and Physical Sciences (FMPS)
Department	Physics
Programme	M.Sc. in Nuclear Physics and Technology
Dean of Faculty	Prof. Deepak A.S.
HOD	Dr. Vikas M. Shelar

1. Title of the Award

M.Sc. in Nuclear Physics and Technology

2. Modes of Study

Full-Time ☒

3. Awarding Institution /Body

M.S. Ramaiah University of Applied Sciences – Bangalore, India

4. Joint Award

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5. Teaching Institution

Faculty of Mathematical and Physical Sciences
M S Ramaiah University of Applied Sciences - Bangalore, India

6. Date of Programme Specifications

August 2019

7. Date of Programme Approval by the Academic Council of MSRUAS

August 2019

8. Next Review Date

August 2021

9. Programme Approving Regulatory Body and Date of Approval

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10. Programme Accrediting Body and Date of Accreditation

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11. Grade Awarded by the Accreditation Body

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12. Programme Accreditation Validity

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13. Programme Benchmark

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14. Rationale for the Programme

The energy consumption all over the world has been increasing and nuclear energy is still one of the best options as a viable source of energy. Though there are concerns about safety and nuclear waste management, nuclear energy is there to stay in the immediate future. Nuclear medicine has been successfully deployed especially in the treatment of cancer and this also opens up several job opportunities for nuclear physicists.

Indian nuclear power program, visualized by Dr. Bhabha in early fifties has been developed and successfully deployed with indigenous efforts. This has placed the country in an elite club of countries possessing advanced nuclear technology. The evolution and development of commercial nuclear technology in the country has passed through several technological revolutions. While developing and implementing the nuclear power program, the Indian industry capability in manufacturing and supply of high precision and specialized equipment has also been developed comparable to international standards. Nuclear power program is poised for a large expansion and there will be plenty of scope for physicists with a sound knowledge of reactor physics to play an important role in the years to come.

In our country, teaching/research in nuclear physics is being carried out in a number of universities and atomic energy establishments. Nuclear physics forms an important component of postgraduate physics courses in physics. After nearly two decades of IT revolution and its booming economic impact on the country, there is a positive trend and appreciation for the role and importance of basic sciences for further technological advancement. There is a need for qualified and competent post graduate students with sound knowledge in Physics in general and nuclear technology in particular. Although there are numerous institutions and universities which offer post graduate degree courses in Solid State Physics, vast majority of them offer more conventional content based academic curriculum which inherently lacks application oriented approach, which is essential to make the degree programme more fulfilling and professional from student career perspective.

The Faculty of Mathematical & Sciences of MSRUAS offers the M.Sc. Physics with specialization in Nuclear Physics and Technology course with an outcome based curriculum emphasizing the Critical, Analytical and Problem Solving skills to equip the students to pursue their scientific and research career with better preparedness and matured professional outlook. The presence of other allied Faculties of the University provides additional exposure to students the multi-disciplinary approach which is emerging as a key differentiator in the success of modern scientific and engineering endeavors.

15. Programme Aim

The aim of the programme is to train postgraduates with advanced knowledge and understanding of nuclear physics and technology with higher order critical, analytical, problem solving and research skills; ability to think rigorously and independently to meet higher level expectations of academia and research with sufficient transferrable skills.

16. Programme Objectives

The Programme objectives of M.Sc. Physics with specialization in Nuclear Physics and Technology are to:

- Impart higher level knowledge and understanding of Nuclear Physics and Technology
- Apply the theory of optoelectronics for newer applications
- Enable students to analyse mathematical models of physical systems for enhancement of system performance and arrive at limitations of physical systems
- Enhance students' ability to develop mathematical models of defined physical systems
- Prepare students to evaluate the soundness of concepts proposed
- Hone students' skills to pursue physics as a teaching and research career
- Train students in team work and in lifelong learning for continuous professional development

17. Intended Learning Outcomes of the Programme

The intended learning outcomes are listed under four headings:

1. Knowledge and Understanding, 2. Cognitive Skills 3. Practical Skills and 4. Capability/ Transferable Skills.

17.1 Knowledge and Understanding

After undergoing this programme, a student will be able to:

KU1: Identify the basic constituents of matter and describe the interactions between them

KU2: Enumerate the various types of nuclear reactors and distinguish them

KU3: Explain the techniques of nuclear waste management

KU4: Discuss the use of radioisotopes in medicine

17.2 Cognitive Skills

After undergoing this programme, a student will be able to:

CS1: Decipher the various factors involved in the design of different types of nuclear reactors

CS2: Suggest practical steps to deal with nuclear waste management

CS3: Provide technical know-how to medical personnel in nuclear radiation therapy

CS4: Design and simulate electronic circuits for measuring instruments used in nuclear physics

17.3 Practical Skills

After undergoing this programme, a student will be able to:

PS1: Perform measurements related to nuclear physics

PS2: Conduct experiments with a variety of scientific equipment with minimum guidance

PS3: Design PC based instrumentation

PS4: Use MATLAB and other Software

17.4 Capability /Transferable Skills

After undergoing the programme, a student will be able to

TS1: Communicate and present ideas clearly and concisely

TS2: Perform under constraints to meet the desired objectives

TS3: Build, work and lead teams effectively

TS4: Adopt a reflective approach to personal development and embrace the philosophy of continual professional development

18. Programme Structure

The M.Sc. Physics with specialization in Nuclear Physics and Technology programme will be delivered in semester scheme.

Semester 1

Sl. No.	Course Code	Course Title	Theory (h/W/S)	Tutorials (h/W/S)	Practical (h/W/S)	Max. Marks	Total Credits
1	19PHY511A	Mathematical Methods of Physics	3	2		100	4
2	19PHY512A	Classical Mechanics	3	2		100	4
3	19PHY513A	Quantum Mechanics	3	2		100	4
4	19PHY514A	General Physics Laboratory-1			4	50	2
5	19PHY515A	Computer Laboratory			4	50	2
6	19PHY516A	Seminar			4	50	2
Total			**9**	**6**	**12**	**450**	**18**

Semester 2

Sl. No.	Course Code	Course Title	Theory (h/W/S)	Tutorials (h/W/S)	Practical (h/W/S)	Max. Marks	Total Credits
1	19PHY521A	Electronics and devices	3	2		100	4
2	19PHY522A	Electrodynamics	3	2		100	4
3	19PHY523A	Statistical Mechanics and Thermodynamics	3	2		100	4
5	19PHY524A	Electronics Laboratory			4	50	2
6	19PHY525A	General Physics Laboratory -2			4	50	2
7	19PHY526A	Seminar			4	50	2
Total			**9**	**6**	**12**	**450**	**18**

Semester 3

Sl. No.	Course Code	Course Title	Theory (h/W/S)	Tutorials (h/W/S)	Practical (h/W/S)	Max. Marks	Total Credits
1	19PHY531A	Atomic and Molecular Physics	3	2		100	4
2	19PHY532A	Nuclear and Particle Physics	3	2		100	4
3	19PHY533A	Solid State Physics-1	3	2		100	4
4	19PHY571A	Nuclear Physics	3	2		100	4
5	19PHY590A	Research Methodology	2			50	2
6	19PHY534A	Advanced Physics Laboratory			4	50	2
Total			**14**	**8**	**4**	**500**	**20**

Semester 4

Sl. No.	Course Code	Course Title	Theory (h/W/S)	Tutorials (h/W/S)	Practical (h/W/S)	Max. Marks	Total Credits
1	19PHY572A	Reactor Safety and Nuclear Waste Management	3	2		100	4
2	19PHY573A	Nuclear Electronics and Nuclear Medicine	3	2		100	4
3	19PHY598A	Internship*			8	100	4
	19PHY599A	Seminar					
4	19PHY600A	Dissertation			24	300	12
Total			**6**	**4**	**32**	**600**	**24**

* Internship can be done during the vacation period for a maximum period of 8 weeks

19. Assessment and Grading

Performance in every theory course will be assessed on the following two components:

Theory Courses with 4 and 3 credits

Component - 1: 50 Marks

Part A: Two term tests will be conducted. Average of 2 tests will be considered (25% weightage).

Part B: A student needs to submit assignment/s (25% weightage).

Component - 2: 50 Marks

A Written Examination for 100 marks will be conducted. Obtained marks out of 100 are scaled down to 50 marks.

Theory Courses with 3 or 4 credits with laboratory component integrated

Component - 1: 50 Marks

Part A: Two term tests will be conducted. Average of 2 tests will be considered (25% weightage).

Part B: A student needs to submit assignment/s (15% weightage) and perform laboratory examination (10% weightage).

Component - 2: 50 Marks

A Written Examination for 100 marks will be conducted. Obtained marks out of 100 are scaled down to 50 marks.

Theory Courses with 2 credits

Component - 1: 25 Marks

A student needs to submit assignment/s (50% weightage).

Component - 2: 25 Marks

A Written Examination for 50 marks will be conducted. Obtained marks out of 50 are scaled down to 25 marks.

Seminars with 2 credits

Component - 1: 25 Marks

A student needs to submit a report on the seminar topic given (50% weightage).

Component - 2: 25 Marks

A student is required to give a presentation on the topic given (50% weightage).

Seminars with 4 credits

Component - 1: 50 Marks
A student needs to submit a report on the seminar topic given (50% weightage).

Component - 2: 50 Marks
A student is required to give a presentation on the topic given (50% weightage).

Laboratories with 1 or 2 credits

Component - 1: 25 Marks
A student needs to submit a record for the experiments conducted (50% weightage).

Component - 2: 25 Marks
Laboratory examination will be conducted at the end of semester (50% weightage).

Dissertation

Component - 1: 100 Marks
Part A: A student is required to give a pre-project presentation (40% weightage).

Part B: A student is required to give a mid-term project presentation (60% weightage).

Component - 2: 200 Marks
Part A: A student is required to give a final project presentation (50 Marks) and is required to submit a report on the work carried out (100 Marks)

Part B: A student is required to submit a journal article in the given format from the work carried out (50 marks)

Pass Criteria

A student is required to score a minimum of 40% marks in Semester end examination and 40% marks overall in each course for successful completion of a course and for earning the corresponding credit(s).

20. Teaching and Learning Methods

The course delivery comprises of combination of few or all of the following:

1. Face to Face Lectures using Audio-Visuals
2. Workshops, Group Discussions, Debates, Presentations
3. Demonstrations
4. Guest Lectures
5. Laboratory/Field work
6. Industry Visit
7. Seminars/Conferences
8. Group Exercises
9. Project Exhibitions

21. Student Support for Learning

Student are given the following support:

1. Course Notes
2. Reference Books in the Library
3. Magazines and Journals
4. Internet Facility
5. Computing Facility
6. Laboratory Facility
7. Workshop Facility
8. Staff Support
9. Lounges for Discussions
10. Any other support that enhances their learning

22. Quality Control Measures

The following are the Quality Control Measures:

1. Review of Course Notes
2. Review of Question Papers and Assignment Questions
3. Student Feedback
4. Moderation of Assessed work
5. Opportunities for the students to see their assessed work
6. Review by External Examiners and External Examiners Reports
7. Staff Student Consultative Committee Meetings
8. Student Exit Feedback
9. Subject Assessment Board
10. Programme Assessment Board

23. Curriculum Map

Module Code	Intended Learning Outcomes											
	Knowledge and Understanding				Cognitive (Thinking) Skills (Critical, Analytical, Problem Solving, Innovation)				Practical skills			
	KU1	KU2	KU3	KU4	CS1	CS2	CS3	CS4	PS1	PS2	PS3	PS4
19PHY511A	X				X						X	X
19PHY512A	X				X						X	X
19PHY513A	X				X						X	X
19PHY521A	X										X	X
19PHY522A		X									X	X
19PHY523A		X		X			X		X	X	X	X
19PHY531A	X	X	X	X	X	X	X	X	X	X	X	X
19PHY532A	X	X	X	X	X	X	X	X	X	X	X	X
19PHY533A	X	X	X	X	X	X	X	X	X	X	X	
19PHY571A			X		X	X	X	X	X	X	X	X
19PHY572A			X	X	X	X	X	X	X		X	X
19PHY573A			X	X	X	X	X	X	X		X	X
19PHY590A	X	X	X	X	X	X	X	X				
19PHY598A	X	X	X	X	X	X	X	X	X			
19PHY599A	X	X	X	X	X	X	X	X				
19PHY516A	X	X	X	X	X	X	X	X				
19PHY526A	X	X	X	X	X	X	X	X				
19PHY514A				X	X	X	X	X				
19PHY515A								X	X	X	X	X
19PHY524A								X	X	X	X	X
19PHY525A								X	X	X	X	X
19PHY534A								X	X	X	X	X
19PHY600A	X	X	X	X	X	X	X	X	X	X	X	X

24. Capability/ Transferable Skills Map

Module Code	Group work	Self-learning	Research Skills	Written Communication Skills	Verbal Communication Skills	Presentation Skills	Behavioral Skills	Information Management	Personal management / Leadership
19PHY511A		X	X	X	X	X		X	
19PHY512A		X	X	X	X	X		X	
19PHY513A		X	X	X		X		X	
19PHY521A		X	X	X	X	X		X	
19PHY522A		X	X	X	X	X		X	
19PHY523A		X	X			X			
19PHY531A		X	X	X	X	X		X	
19PHY532A		X	X	X	X	X		X	
19PHY533A		X	X	X	X	X		X	
19PHY571A		X	X	X	X	X		X	
19PHY572A		X	X	X	X	X		X	
19PHY573A		X	X	X	X	X		X	X
19PHY590A		X	X	X	X	X		X	X
19PHY598A		X					X	X	X
19PHY599A	X	X			X	X	X	X	X
19PHY516A	X	X	X		X	X	X		X
19PHY526A	X	X	X	X	X	X	X	X	X
19PHY514A		X	X	X	X	X	X	X	X
19PHY515A	X	X	X		X	X	X		X
19PHY524A	X	X	X	X	X	X	X	X	X
19PHY525A	X	X	X		X	X	X		X
19PHY534A	X	X	X	X	X	X	X	X	X
19PHY600A	X	X	X	X	X	X	X	X	X

25. Co-curricular Activities

Student are encouraged to take part in co-curricular activities like seminars, conferences, symposium, paper writing, attending industry exhibitions, project competitions and related activities for them to enhance their knowledge and network.

26. Cultural and Literary Activities

To remind and ignite the creative endeavors annual cultural festivals are held and the students are made to plan and organize the activities.

27. Sports and Athletics

Students are encouraged to develop a habit of taking part in outdoor and indoor games on daily basis.