Department of Physics

Central University of Kerala

Minutes of the Board of Studies Meeting

7th December 2020

Present: Prof. Vijayan, IIT, Madras

Prof. Chandrasekhar, NIT, Calicut

Prof. K J Thomas, Department of Physics, CUK

Dr. Swapna S Nair (Head, Chairman) Department of Physics, CUK

Dr. Subasa C Sahoo, Department of Physics, CUK

Dr. Manikantan Raangaswamy, Dept. of Mathematics, CUK

Prof. Deshdev Sahadev, Qazar Technology Pvt. Ltd, Retired Professor IIT, Kanpur) (Invited Ex-officio member from Industry, interaction via email)

Apologies: Prof. K Jayaraj, Vice Chancellor, Calicut University

Board of Studies of the Dept of Physics, CUK met online on 7th Dec 2010 at 11 a.m. to discuss various aspects of the PG curriculum which include the following agenda items.

Agenda of the BoS meeting:

1. Addition of four new electives for approval
2. Consider MOOC course as optional electives
3. To Consider the possibility of fixing criteria that the students should earn minimum 6 credits from the electives offered within the department (already in the previous BoS minutes)
4. Discussion on the probable curriculum development in future so as to equip the students for industry positions/Start Up ventures
5. Adding provisions in the existing curriculum for an institute/industry visit/study tour
6. Any modifications to the existing syllabus of the core and elective courses

Agenda Item 1:

BoS have critically gone through the course structure of the newly proposed electives and the structure is modified and the corrections /modifications are added/incorporated in the course and the same is attached as Annexure 1. Suggestion to prescribe Books and References as separately.

Agenda Item 2:

BoS decided to list out about five electives from the MOOC list approved by the Faculty Council with Faculty Advisor's suggestion and make it compulsory to choose from those

courses .. This is to ensure that the electives are suitable for a specialized programme such as M. Sc. Physics.

Agenda Item 3:

(Redundant as it is already in the previous minutes)**Agenda Item 4:**

BoS suggested to form a committee of experts from the Industry, national laboratories, and members of the faculty to discuss the possibilities, and even commitments from the Industry/Labs to host the students selected based on their interest and report in the next meeting.

Agenda Item 5: The board of studies has recommended a study tour (1 to 3 days) to visit an industry/institute like VSSC, BARC, DRDO, NPOL etc. as part of the curriculum, as this involved financial commitments, the recommendation will be placed in the academic Council meeting for approval.

Agenda Item 6:

BoS suggested to add two or three Text books for each paper while the other books can be kept as references. For the electives, it is suggested to include the latest books which cover new/advanced developments in the field. In the core courses, it is suggested to add the recent editions of the books.. Based on the recommendations, the course structure is modified.

It is also suggested to change the Open Electives as "Electives for Other departments". (already stated above). The following references are added as per the recommendation of the BoS.

QM – HC Verma, Zakurai

Mathematical Physics – Prof. V. Balakrishnan

Molecular Spectroscopy – Banwell

Atomic Spectroscopy – White

Statistical Mechanics – Pathria

General Suggestions:

It is also suggested to include learning objectives and "learning Outcome" for each course. This will define the purpose of a course to the students and other stake holders.

BoS opined that among about 40 students, it is always ineffective to cater a project to each student, and some students may be less keen to do research as a career after M. Sc. For such students a way out is t suggested to allow students to take electives equivalent to the total credit or more of that of the Dissertation. But as there are no Core/Elective(double status) paper is offered at the department, some electives need to be raised to the Core/Elective(double status) to keep up the minimum core credit to be earned (60 credits). As this is new for CBCS system existing in CUK, the recommendation may be placed in the

AC. Who will teach additional electives Is a question here. They have to be obtained from the regular elective courses offered during 3rd and 4th Semesters.

BOS also proposed to initiate a Journal from the Department and publish selected work from M. Sc. projects, apart from other articles, which would be a good incentive for students to accomplish higher levels.

Course outcomes are added to each of the courses in the syllabus.

Authorised Signature

Course Code	Title	Credits
PHY 5025	Soft Matter Physics	3
PHY 5026	Microwave Measurements and Characterization	3
PHY 5027	Semiconductor Devices	3
PHY 5028	Computational Quantum Mechanics	3
PHY 5029	Electrodynamics of Superconductors	3
PHY 5030	Computational Electromagnetics	3
PHY 5031	Simulation of Electronic Circuits	3
PHY 5032	Nuclear Instrumentation	3
PHY 5033	Introduction to Nonlinear Optics	3
PHY 5034	Introduction to General Theory of Relativity	3
PHY 5035	Mechanics of Solids and Fluids	3
PHY 5036	Applications of Lasers	
PHY 5037	Quantum Transport in Low Dimensional Systems	3
PHY 5038	Summer Project	3
	Open Electives (for Other Departments)	
PHY 5039	Molecular and Optical Physics	3
PHY 5040	Concepts of Modern Physics	3
PHY 5041	Basic Electronics for Scientists	3
PHY 5042	Modern Optics	3
PHY 5043	Machine Learning for Physicists	3
PHY 5044	Introduction to Nanoscience and Nanotechnology	3
PHY 5045	Nanoscale Materials and Devices : Synthesis and Characterization	3

PHY5043 **Machine Learning for Physicists**

Course Code	PHY5043	Semester	
Course Title	*Machine Learning for Physicists*		
Credits	3	Type	Elective

Course Outcome

The aim of this course is to familiarise students to the areas of artificial intelligence which are useful in computational physics, and in their application in software industry. Students acquire practical skills needed in moving to fields outside physics, especially in data science, and it enhances their employability. Topics included are, but not limited to, the following.

Course Structure

1. Overview of machine learning and AI. 2. Overview of computational aspects of optimisation, linear algebra and statistics.3. Methods of regression and applications 4. Introduction to neural networks, and training data with back propagator algorithms 5. Support vector machines and classification 6. Unsupervised learning, k-Means algorithm, dimensionality reduction and principal component analysis 7. Application to Ising model and other examples from physics 8. Hands-on practice using Matlab, or Python tools, and standard data sets.

Suggested Books

1. Trevor Haste, et.al., *The Elements of Statistical Learning,* Springer (2008)

2. Aurelien Geron, *Hands-on Machine Learning with Scikit-Learn and Tensor Flow*, O'Reilly (2017)

3. Joel Franklin, *Computational Methods for Physics*, Cambridge (2013)

4. Pankaj Mehta, "A high bias low-variance introduction to Machine Learning for physicists", *Physics Reports,* (2019) 1-124