Total 74 pages

Shri Mata Vaishno Devi University
श्री माता वैष्णो देवी विश्वविद्यालय
Kakryal, Katra-182320 (J&K),India
School of Physics

Minutes of the 10th Meeting of Board of Studies of SoP

held on

31/07/2023

(Hybrid Mode)

(1)

Ref. no. SMVDU/SoP/23/309 Dated: 02-08-2023

Shri Mata Vaishno Devi University

श्री माता वैष्णो देवी विश्वविद्यालय

Kakryal, Katra-182320 (J&K),India

School of Physics

SMVDU/SoP/2023/ **Dated:**

Minutes of the 10th meeting of Board of Studies (BoS) of School of Physics (SoP) held on 31/07/2023 at 12.00 noon in hybrid mode

The 10th meeting of board of Studies (BoS) of School of Physics (SoP), SMVDU was held on 31/07/2023 at 12:00 noon in hybrid mode (External members attended the meeting through online mode due to paucity of time and other commitments at their end). Agenda of this meeting (which was finalized after multiple rounds of consultations held internally with all the faculty members of the school), was circulated to all the worthy members of the board. Following members attended the meeting:

S. No.	Name	Affiliation
1.	Dr. S.K. Wanchoo	Associate Professor & Head, SoP Chairman (Ex-Officio)
2.	Prof. D.K. Pandya (online mode)	Visiting Professor, Adjunct Professor, Department of Physics, IIT Jammu (Former Professor of Physics, IIT Delhi), External Member Expert
3.	Prof. Geeta Bhatt (online mode)	Director, NCWEB, University of Delhi, formerly Associate Professor, Department of Instrumentation, Bhaskaracharya College of Applied Science, University of Delhi.
4.	Dr.Yugal Khajuria	Associate Professor, SoP
5.	Dr. Kamni	Assistant Professor, SoP
6.	Dr. Ram Prakash	Assistant Professor, SoP
7.	Dr. Pankaj Biswas	Assistant Professor, SoP Member Secretary, BoS of SoP
8.	Dr. Deepa Singh	Assistant Professor, (contract) SoP

Dr. Jitendra Sharma and Dr. M. A. Mir being on leave could not attend the meeting and were granted leave of absence.

At the outset, the Chairman BoS on behalf of School of Physics placed on record deep sense of appreciation and gratitude to Prof. D.K. Pandya, IIT Jammu and Prof. Saumitra Mukherjee, JNU, New Delhi for providing constant guidance to the school which has greatly helped the school in

2

shaping its academic programmes, particularly the integrated program. He further stated that the fresh constitution of the BoS has recently been approved by the Competent Authority and has been notified vide No. SMVDU/AA/22/3048 dated: 30/12/2022 for a period of three years. He further informed the Board that recognizing the important contributions made by Prof. Pandya. University has once again nominated him for the BoS and he thanked him for accepting be to on the Board. Chairman then accorded warm welcome to Prof. Geeta Bhat from University of Delhi for accepting the invitation to be on BoS of the School and expressed confidence that her vast experience and presence will enrich the academic programs of the School.

Accordingly, based on the deliberations those were held during the meeting, the resolutions on individual agenda items are as follows:

Agenda Item No. 10.1:

To confirm the minutes of the 9th Meeting of BoS, SoP held on 31st October, 2022.

Resolution: The Board confirmed the minutes of its 9th meeting held on 31st October, 2022 which stand circulated vide No. SMVDU/SoP/22/352 dated 07/11/2022. **[Annexure-I]**

Agenda Item No. 10.2:

To consider and approve the detailed course contents of the courses for the semesters VII & VIII applicable for the Integrated B.Sc. (Hons.) – M.Sc. Physics batches admitted in 2020-21 & 2021-22.

Resolution: The Board resolved to approve the detailed course contents for the courses being offered in VII and VIII semesters for Integrated B.Sc. (Hons) Physics – M.Sc. Physics batches admitted in AY 2020-21 & 2021-22. This structure and contents shall also be applicable to students admitted during AY 2023-24 & AY 2024-25 directly to the first year of the two year M.Sc. Physics program. **[Annexure-II]**

Agenda Item No. 10.3:

To consider and approve the minor changes in the course structure of the semester VI applicable for the Integrated B.Sc. (Hons.) – M.Sc. Physics batch admitted in 2021-22.

Resolution: After due deliberations the Board approved the proposed credit reduction in the weight-age of the elective course as proposed in the agenda from 4 to 3 offered by other schools and increased credit weight-age for the Numerical Computation Lab from 0-0-4 = 2 to 0-0-6 = 3.

Agenda Item No. 10.4:

To consider and approve the course structure and detailed course contents of the courses for the semester III & IV applicable for the Integrated B.Sc. – M.Sc. Physics batch admitted in 2022-23 under NEP 2020.

Resolution: The Board after detailed deliberations approved the course structure and detailed course contents for the courses proposed to be offered in semesters III and IV applicable to the batch of students admitted in 2022-23 to the Integrated B.Sc. - Physics-M.Sc. Physics under NEP 2020. However, it was resolved that there should be more weight-age for Lab work vis-à-vis theory course for course titled "Measurement and Analysis" (IV Semester) considering the nature of the course. Accordingly, it was resolved to revise the theory course credits to 2 and lab course credits to 2. **[Annexure-III]**

Agenda Item No. 10.5:

To consider and approve the course structure and detailed course contents of the courses for the semester I to IV applicable for the Integrated B.Sc. – M.Sc. Physics batch to be admitted in AY 2023-24 under NEP 2020.

Resolution: The Board resolved to approve the course structure and detailed contents only for the semesters I and II after due deliberations. This is only applicable to the batch of students to be admitted in AY 2023-24 to the Integrated B.Sc. - Physics-M.Sc. Physics programme under NEP 2020 and has been prepared on the outcome based model of education as per recent instructions received from academic affairs wing of the University. **[Annexure-IV]**

Agenda Item No. 10.6:

To consider and approve proposed new Pre-Ph.D. courses.

Resolution: The Board after detailed deliberations resolved to approve three courses proposed for the pre-Ph.D. course work. Prof. Pandya proposed that the course coordinator/ course instructors, particularly in case of course on characterization techniques, should give actual data based assignments to the students for better learning and to be able to do the basic analysis of data in a meaningful manner. This proposal was agreed to for implementation. Furthermore, based on the suggestion, it was agreed that for such multi-techniques based courses preferably more than one instructor may be assigned based on their expertise of specific technique(s), thus enabling the students a better understanding of the technique(s) and data analysis. **[Annexure-V]**

Agenda Item No. 10.7:

To present stakeholder feedback on our curriculum as mandated by DIQA, SMVDU for the purpose of NAAC process.

Resolution: The Board appreciated the first ever exercise of this nature by the School based on the instructions received from DIQA, SMVDU vide no. SMVDU/DQA/2023/418-421 dated 06.06.2023 regarding the stakeholder feedback on curriculum development as per prescribed format received from their end. Board was informed that the School has obtained the feedback from students (current as well as alumni) and faculty and has carried out analysis thereof (**Annexure-VI**). Based on this exercise, minor changes wherever required have been incorporated in the agenda items of this meeting. Board resolved to approve the same for further submission to DIQA. Board further directed that this should be made into a regular annual exercise which is mainly based on feedback from passing out batches and important alumni.

Agenda Item No. 10.8:

To report changes in credits and/ or L-T-P of courses offered by other schools.

Resolution: Board was informed that some Schools such as School of Mathematics had made changes in L-T-P scheme of courses offered to the students of Integrated B.Sc. (Hons.) - M.Sc. Physics 2020 batch. This was done by merging and Lab and theory courses into a single course without altering the overall credits. Similarly, in the VI semester under open elective category students had to opt for a 3 credit course in lieu of 4 credits. This was due to the reason that all other schools were offering this course with 3 credits only. Similarly, in their III semester they were to opt for an open elective of 4 credits, however, the only option available at that time was of a course offered by School of Economics having 6 credits. While effecting these changes, it has been ensured that students do not fall short on total credits required for award for Degree. The board noted this information and resolved to ratify the same.

Agenda Item No. 10.9:

To report about the procurement of items for various Labs.

Resolution: BoS, SoP was pleased to note that the School has utilized the allocated budget as far as possible for FY 2022-23 and has acquired most of the items as had been approved by BoS at its 7th meeting.

Agenda Item No. 10.10:

To report the organization of a half day event "Science is Fun" jointly with IAPT. The event had been sponsored by IAPT-RC-02.

Resolution: BoS, SoP appreciated the organization of this activity jointly with the Indian Association of Physics Teachers (IAPT-RC-02), to reveal the joy of learning through hands-on-science held on 27.01.2023 being attended by over 200 participants from the University.

Agenda Item No. 10.11:

To report the qualification in the prelim round of NEAST-2023 by Akshita, B.Sc. (Hons.) Physics Sem-IV student.

Resolution: BoS, SoP was happy and expressed satisfaction over the achievement of Ms. Akshita of B.Sc. (Hons.) Physics Sem-IV who qualified the prelim round of NAEST 2023 conducted as part of the annual National Anveshika Experimental Skills Test (NAEST-2023) under the able guidance and coordination of Prof. H.C. Verma (Padma Shri) former professor of Physics at IIT, Kanpur. Prof. Pandya, suggested that she should share her experiences with other students of the School so as to motivate them to take part in such events in future.

Agenda Item No. 10.12:

To report the successful defence of Ph.D. thesis by research students of the school since 31st, October, 2022:

Resolution: BoS, SoP expressed satisfaction and noted that two students, namely, Ms. Parul Sharma (18DPH002) under the supervision of Dr. Kamni and Ms. Pooja Khajuria, (18DPH001) under the supervision of Dr. Ram Prakash, have qualified for award of Ph.D. Degree since the 9th meeting of BoS.

Agenda Item No. 10.13:

To report the selection of two students of Integrated B.Sc. (Hons.) – M.Sc. Physics VI Semester students in Summer Research Fellowship Programme-2023 (SRFP-2023) offered by Joint Science Education Panel of three Science Academies of India.

Resolution: BoS, SoP was delighted to note that the school has been encouraging its students to apply and participate in National level events and activities. The Board unanimously resolved to congratulate Ms. Ritika Baigra, 20IBY029 (for securing SRF at Indian Institute of Science, Banglore) and Mr. Piyush Bhardwaj, 20IBY028 (for securing SRF at Institute of Physics, Bhubaneswar) under the programme operated by Joint Science Education Pannel of the three premier Science Academies of India.

Agenda Item No. 10.14:

Resignation of Dr. V. K. Singh from the services of the University.

Resolution: BoS noted the information regarding tendering of his resignation from the services at this University. The Board resolved to appreciate the services rendered by Dr. Vivek K. Singh at this University.

Agenda Item No. 10.15:

Any other agenda item (s) with the permission of the chair.

Agenda item no. 10.15.1

To consider and approve creation of supernumerary seats in Integrated B.Sc. Physics – M.Sc. Physics programme w.e.f. 2023-24.

Resolution: University has implemented reservation policy as applicable in the UT of J&K w.e.f AY 2023-24 and accordingly has asked all the schools to propose supernumerary seats to compensate for the vacancies, if any, against the reserved category seats so as put the available infrastructure to full use. Their seats shall be available under UR category only and shall (being supernumerary in nature) not affect the number of seats under any other category. After due deliberations, the Board approved the proposal and decided that the number of supernumerary seats shall be floating in nature year on year and shall be equal to the no of vacancies arising out of the less response under reserved category seats without affecting the quota allocated to any particular category. Board suggested that these supernumerary seats should be filled from amongst the remaining applicants who could not be offered admission due to non-availability of vacant seats in their parent category. It was further suggested that University may evolve a uniform SoP for all the programs for the purpose.

Agenda item no. 10.15.2

To report and ratify the budget estimates as submitted to the finance wing of the University for the FY 2023-24.

Resolution: The Board was informed that the School was asked to submit the budget estimate for the FY 2023-24 by the Finance section of the University. Accordingly, after due deliberations among the faculty members of the school the same was prepared and submitted for the approval of the Competent Authority. The main focus of this year's proposal is to repair the faulty equipments and experimental setups as far as possible. Board noted the reported positions and decided to ratify the same.

The decisions taken by the BoS of SoP as listed hereinabove were finally recommended for discussion and approval in the next scheduled Academic Council meeting of the University.

Shri Mata Vaishno Devi University

श्री माता वैष्णो देवी विश्वविद्यालय

Kakryal, Katra-182320 (J&K),India

School of Physics

Dr.Yugal Khajuria
Assoc. Professor
Member

(on Leave)
Dr. Jitendra Sharma
Asstt. Professor
Member

Dr. Kamni
Asstt. Professor
Member

27/8/2023
Dr. Ram Prakash
Asstt.Professor
Member

Dr. Pankaj Biswas
Asstt. Professor
Member

Dr. Deepa Singh
Asstt. Professor (Contract)

02/08/2023
Dr. S. K. Wanchoo
Assoc. Professor & Head, SoP
Chairman

(Minutes have been confirmed via email copy of the same is enclosed)
Prof. Geeta Bhatt
Director, NCWEB,
University of Delhi
Member Expert (External)

Prof. D.K. Pandaya
Adjunct Professor, IIT Jammu
Member Expert (External)

Submitted for your kind consideration and necessary action for approval of the same in the forthcoming Academic Council meeting.

02/08/23
Dr. Pankaj Biswas
Member Secretary BoS, SoP

Head, SoP:

To

All members for the information.

Copy to:

1. Dean (AA) for information.
2. Registrar, SMVDU for information & placing of the same b efore Academic Council.
3. PS to VC for kind information of the Hon'ble Vice Chancellor.
4. Concerned file.

HoD Physics <hod.physics@smvdu.ac.in>

Draft Minutes of 10th meeting of BoS of SoP by Hybrid Mode

5 messages

pankaj biswas <pankaj.biswas@smvdu.ac.in> Mon, Jul 31, 2023 at 4:54 PM
To: Dinesh Pandya <dinesh.pandya@iitjammu.ac.in>, geeta.bhatt@bcas.du.ac.in, director@ncweb.du.ac.in, Department of Physics <dop@smvdu.ac.in>
Cc: "Office SoP (Physics)" <office.sop@smvdu.ac.in>, HoD Physics <hod.physics@smvdu.ac.in>

Dear All,

With reference to the 10th meeting of BoS of SoP which was held in the SoP conference room (in hybrid mode) today i.e. 31.07.2023 at 12:00 p.m. onwards, PFA the draft minutes along with annexures (in docx format) of the meeting.

The minutes have been prepared in accordance with the proposed ensuing Academic Council Meeting of SMVDU in near future. The worthy members of the Board are requested to give away their suggestions and/ or comments (if any) to the undersigned by 02.08.2023 (Wednesday) afternoon.

Minutes are being submitted to Board Members to accord their approval to notify the same.

With Best Regards,

Dr. Pankaj Biswas
Asst. Prof. SoP, SMVDU
(M): 9419113597

7 attachments

- **3 Annexure - II - Proposed detailed contents for 5 Yr Int B.Sc.-M.Sc. Programme-2020-21students and M.Sc. 2023-24 first year.docx**
  42K
- **4 Annexure-III - Proposed course structure and contents for (IIIrd and IVth Sem) 2 Yr Int B.Sc.-M.Sc. Physics Programme-2022-23 batch.docx**
  47K
- **6 Annexure-V - Pre Ph D Courses additional.docx**
  22K
- **5 Annexure-IV - Proposed Course structure and detailed contents of 5 Yr Int B.Sc.-M.Sc. Programme-2023-24_onwards.docx**
  53K
- **8. Budget Estimate FY 2023-24.PDF**
  29K
- **7 Annexure-VI - Regarding feedback of all stakeholders on Curriculum development.docx**
  33K
- **2 Annexure- I Minutes of 9th Meeting of BOS.pdf**
  6286K

pankaj biswas <pankaj.biswas@smvdu.ac.in> Mon, Jul 31, 2023 at 8:19 PM
To: Dinesh Pandya <dinesh.pandya@iitjammu.ac.in>, geeta.bhatt@bcas.du.ac.in, director@ncweb.du.ac.in, Department of Physics <dop@smvdu.ac.in>
Cc: "Office SoP (Physics)" <office.sop@smvdu.ac.in>, HoD Physics <hod.physics@smvdu.ac.in>

The DRAFT minutes of the 10th meeting of BoS of SoP is attached herewith for your kind perusal.

With regards,
[Quoted text hidden]
--
[Quoted text hidden]

- **Draft minutes of 10th Meeting of BOS of SoP.doc**
  152K

pankaj biswas <pankaj.biswas@smvdu.ac.in> Tue, Aug 1, 2023 at 9:55 AM
To: HoD Physics <hod.physics@smvdu.ac.in>

For your Ref.

---------- Forwarded message ---------
From: **kamni pathania** <kamni.pathania@smvdu.ac.in>
Date: Tue, Aug 1, 2023, 09:49
Subject: Re: [sop] Re: Draft Minutes of 10th meeting of BoS of SoP by Hybrid Mode
To: <pankaj.biswas@smvdu.ac.in>

Agenda item 10.12 names of the Ph.D. students Ms. Parul Sharma and Ms Pooja Khajuria along with the respective supervisor's name should be incorporated in the minutes.

Dr.KAMNI
Assistant Professor
School of Physics
Shri Mata vaishno Devi University
Katra-182320
Jammu- J&K, India.
www.smvdu.ac.in

[Quoted text hidden]

Dinesh Pandya <dinesh.pandya@iitjammu.ac.in> Tue, Aug 1, 2023 at 3:42 PM
To: pankaj biswas <pankaj.biswas@smvdu.ac.in>
Cc: geeta.bhatt@bcas.du.ac.in, director@ncweb.du.ac.in, Department of Physics <dop@smvdu.ac.in>, "Office SoP (Physics)" <office.sop@smvdu.ac.in>, HoD Physics <hod.physics@smvdu.ac.in>

I observed the need to make some changes in the resolutions and the changed texts are as below.
Agenda item 10.5
The Board resolved to approve the course structure and detailed contents only for the semesters I and II after due deliberations. This is only applicable to the batch of students to be admitted in AY 2023-24 to the Integrated B.Sc. - Physics-M.Sc. Physics programme under .....

Agenda item 10.6
The Board after detailed deliberations resolved to approve the three courses proposed for the pre-Ph.D. course work. Prof. Pandya proposed that the course coordinator/course instructures, particularly in case of course on characterization techniques, should give actual data based assignments to the students for better learning and to be able to do the basic analysis of data in a meaningful manner. This proposal was agreed to for implementation. Furthermore, based on the suggestion, it was agreed that for such multi-techniques based courses more than one instructor may be assigned based on their expertise of specific technique(s), thus enabling the students a better understanding of the technique(s) and data analysis.

MoM may be finalized with these inputs and sent for approval.

प्रोफेसर दिनेश पंड्या Professor Dinesh Pandya
आगंतुक प्रोफेसर भौतिकी Adjunct Professor Physics
आई. आई. टी. जम्मू I. I. T. Jammu
जगती, एन एच 44, जम्मू 181221, भारत Jagti, NH 44, Jammu 181221, India
दूरभाष: +91 9891165601 Phone: +91 9891165601

[Quoted text hidden]

pankaj biswas <pankaj.biswas@smvdu.ac.in> Wed, Aug 2, 2023 at 12:43 PM
To: HoD Physics <hod.physics@smvdu.ac.in>
Cc: "Office SoP (Physics)" <office.sop@smvdu.ac.in>

(10)

FYPP.

---------- Forwarded message ---------
From: **Dr.Geeta Bhatt** <geeta.bhatt@bcas.du.ac.in>
Date: Tue, Aug 1, 2023, 14:34
Subject: Re: Draft Minutes of 10th meeting of BoS of SoP by Hybrid Mode
To: pankaj biswas <pankaj.biswas@smvdu.ac.in>

I endorse the minutes.

With Warm Regards
Geeta Bhatt
Director
Non-Collegiate Women's Education Board (NCWEB)
Tutorial Building, II Floor, Guru Tegh Bahadur Road Building
University of Delhi, Delhi -110007
Former Member, Academic Council, University of Delhi (2015-17, 2017-119)
Senior Member, IEEE
Member, Advisory Committee, National Commission for Women
Institutional Website - https://ncweb.du.ac.in/ Homepage: https://drgeetabhattblog.wordpress.com/about/

[Quoted text hidden]

ANNEXURE – I

Shri Mata Vaishno Devi University
श्री माता वैष्णो देवी विश्वविद्यालय
Kakryal, Katra-182320 (J&K), India
School of Physics

SMVDU/SoP/22/352

Dated: 07/11/2022

Minutes of the 9th meeting of Board of Studies (BoS) of School of Physics (SoP) held on 31/10/2022 at 2.30 pm in hybrid mode

The 9th meeting of board of Studies (BoS) of School of Physics (SoP), SMVDU was held on 31/10/2022 at 2:30 pm in hybrid mode (External members attended the meeting through online mode). Agenda of this meeting (which was finalized after consultations held internally with all the faculty members of the school), and was then circulated to all the worthy members of the board as listed in the table below:

S. No.	Name of BoS Participants	Affiliation
1.	Dr. S.K. Wanchoo	Associate Professor & Head, SoP Chairman (Ex-Officio)
2.	Prof. D.K. Pandya	Visiting Professor, Department of Physics IIT Jammu (Former Professor of Physics, IIT Delhi) External Member Expert
3.	Prof. Saumitra Mukherjee	Professor School of Environmental Sciences, JNU, New Delhi External Member Expert
4.	Prof. Ashok K. Sharma	Professor, SoP
5.	Dr. YugalKhajuria	Associate Professor, SoP
6.	Dr. Jitendra Sharma	Assistant Professor, SoP
7.	Dr. Kamni	Assistant Professor, SoP
8.	Dr. Ram Prakash	Assistant Professor, SoP
9.	Dr. Pankaj Biswas	Assistant Professor, SoP Member Secretary, BoS of SoP
10.	Dr. Mudasir A. Mir	Assistant Professor, (contract) SoP
11.	Dr. Deepa Singh	Assistant Professor, (contract) SoP

At the outset, the chairman BoS on behalf of School of Physics placed on record deep sense of appreciation and gratitude to Prof. D.K. Pandya and Prof. Saumitra Mukherjee for providing constant

Minutes of the 9th meeting of Board of Studies, SoP, SMVDU in hybrid mode

guidance to the school which has greatly helped the school in shaping its academic programmes particularly the integrated program. He further stated that tenure of the current composition of BoS shall expire in the month of December. Thereafter the board shall once again be reconstituted by the Competent Authority.

Accordingly, based on the deliberations held during the meeting, the resolutions on individual agenda items are as follows:

Agenda Item No. 9.1:

To confirm the minutes of the 8th Meeting of BoS, SoP held in October, 2021 via circulation.

Resolution: *The minutes of 8th meeting of BoS stand confirmed.*

Agenda Item No. 9.2:

To consider and ratify the detailed course contents of the course on Elementary Statistical Mechanics Lab applicable to the batch admitted in 2020-21.

Resolution: *The Board deliberated on the agenda item and approved the same. The approved contents are appended as* ***Annexure-I****.*

Agenda Item No. 9.3:

To consider the proposal to replace the course tiled Basic Nuclear Physics Lab (PHP 3092) having L-T-P of 0-0-4) with new multidisciplinary course titled Energy Sources (PHL 3093 having L-T-P of 3-0-0) applicable to the batch admitted in 2020-21.

Resolution: The BoS accorded approval to the proposed change. *The approved contents are appended as* ***Annexure-II****.*

Agenda Item No. 9.4:

To consider and approve the detailed course structure and detailed contents for semesters I and II for the Integrated B.Sc. - M.Sc. (Physics) programme with multiple entry and multiple exit options as per NEP-2020 to be applicable for the batch admitted in 2022-23 and onwards.

Resolution: *The board deliberated on the agenda item and discussed the structure and contents of all the proposed courses and approved the same with some modifications. The finalized structure and contents are appended as* ***Annexure-III****. This is to be made applicable for Academic Year 2022-23. Prof Pandya suggested that it would be advisable that all the universities of the region should make efforts to arrive at a common structure of courses so as to allow easy mobility of students under multiple entry and exit scheme of NEP-2020. It was further resolved that School of Physics shall come up with complete five year structure and contents with learning objectives and outcomes listed for each course which shall then be placed before BoS at its next meeting.*

Agenda Item No. 9.5:

To consider and approve the modified course on Research Methodology for Pre-Ph.D. students at school level.

Resolution: *The Board considered the proposed changes and noted that same have been proposed by the course coordinator based on his experience after teaching the said course and unanimously resolved to approve the same. The finalized contents are appended as* ***Annexure-IV.***

Agenda Item No. 9.6:

To report the budgetary proposal submitted to Higher Education Department, J&K Government for implementation of NEP-2020 by the school.

Resolution: *The board ratified the action taken by the School in having submitted the said proposal to the J&K Government through University Administration.*

Agenda Item No. 9.7:

To report the invited lectures/ talks delivered by eminent experts in the school

Resolution: *The board noted the information and appreciated the efforts made by the School in having organized these activities since the previous BoS was held.*

Agenda Item No. 9.8:

To report the celebration of National Science Day by holding a Webinar on "Science is Fun" held at School of Physics SMVDU

Resolution: *The board noted the information and appreciated the efforts made by the School in having organized these activities under the banner of National Science Day-2022 jointly with IAPT-RC02.*

Agenda Item No. 9.9:

To report the bagging of meritorious positions by two B.Sc. (Hons.) Physics Sem-V students in NAEST 2022

Resolution: *The board noted the information and appreciated the efforts made by the School in general and students in particular for bringing laurels to the University.*

Agenda Item No. 9.10:

To report the successful defense of Ph.D. thesis by research students of the school since 6th, August -2021:

Resolution: *The board noted the information and expressed satisfaction at the same.*

The decisions taken by the BoS of SoP as listed hereinabove were finally recommended for discussion and approval in the next scheduled Academic Council meeting of the University.

Prof. A.K. Sharma
Professor
Member

Dr. Yugal Khajuria
Assoc. Professor
Member

Dr. Jitendra Sharma
Asstt. Professor
Member

Dr. Kamni
Asstt. Professor
Member

Dr. Ram Prakash
Asstt. Professor
Member

Dr. Pankaj Biswas
Asstt. Professor
Member

Dr. Deepa Singh
Asstt. Professor (Contract)

(See Pg 19 of 19)

Dr. Soumitra Mukherjee
Professor
Member Expert (External)

(See Pg 19 of 19)

Prof. D.K. Pandaya
Professor
Member Expert (External)

Dr. S.K. Wanchoo
Assoc. Professor & Head, SoP
Chairman

Submitted for your kind consideration and necessary action for approval of the same in the forthcoming Academic Council meeting.

Dr. Pankaj Biswas
Member Secretary BoS, SoP

Head, SoP: 07/11/2022

To

All members for the information.

Copy to:

1. Registrar, SMVDU for kind information
2. Dean (AA) for information.
3. PS to VC for kind information of the Hon'ble Vice Chancellor.
4. Concerned file.

VC

Annexure-I

Elementary Statistical Mechanics Lab (PHP-3062) 0-0-4

Choose & perform any 5 experiments from the list given below:

Sessions on the review of experimental data analysis, sources of error and their estimationin detail, writing of scientific laboratory reports including proper reporting of errors.

1. To determine Mechanical Equivalent of Heat, J, by Callender and Barne's constant flow method.
2. Measurement of Planck's constant using black body radiation.
3. To determine Stefan's Constant.
4. To determine the coefficient of thermal conductivity of Cu by Searle's Apparatus.
5. To determine the coefficient of thermal conductivity of a bad conductor by Lee andCharlton's disc method.
6. To determine the temperature co-efficient of resistance by Platinum resistancethermometer.
7. To study the variation of thermo emf across two junctions of a thermocouple withtemperature.

References:

1. Advanced Practical Physics for students, B.L.Flint & H.T.Worsnop, 1971, AsiaPublishing House.
2. A Text Book of Practical Physics, InduPrakash and Ramakrishna, 11th Edition, 2011,KitabMahal, New Delhi.
3. A Laboratory Manual of Physics for Undergraduate Classes, D.P. Khandelwal, 1985,Vani Publication.
4. Practical Physics, G.L. Squires, 2015, 4th Edition, Cambridge University Press
5. An Advanced Course in Practical Physics:D. Chattopadhyay& P.C. Rakshit(New Central Book Agency)

Annexure-II

Energy Sources
(PHL 3093) (3-0-0)

Unit-I (12)
Types of sources

Introduction to Energy, conservation and various forms such as heat (thermal), light (radiant), mechanical, electrical, chemical, and nuclear energy. Conventional energy sources such as natural gas, oil, coal, or nuclear. Global scenario of energy sources. Renewable Energy Scenario. Energy resources and their utilization, national grid for the gas distribution, gas conservation, nuclear power programme, energy parameters, and rational use of energy, energy efficiency and conversion.

Unit-II (8)
Energy and Environment

Introduction to environmental aspects of electric energy generation- atmospheric pollution, hydrocarbons, particulates, thermal pollution, hydroelectric projects, nuclear power generation and environment, operational safety in nuclear plants and disposal of waste, impact of renewable energy generation on environment, cost of electricity production from various sources

Unit-III (8)
Solar Energy harvesting

Solar radiation and its measurement, solar thermal energy collectors, solar thermal energy conversion systems, solar photovoltaic system

Unit-IV (12)
Energy resources technology

Different types of energy source technologies- Wind energy, small hydropower energy, geothermal energy, ocean energy, biomass energy, fuel cells.

Note:- As a part of this course students shall be encouraged to do self studies on various topics of their interest based on but not limited to various energy models, field visits to various plants etc

Text book:

1. Renewable energy sources and technologies, Kothari, Singal & Ranjan, PHI, 2011.

Reference books:

1. Godfrey Boyle, "Renewable Energy, Power for a sustainable future", Oxford University Press, in association with The Open University, 2004.

17

Annexure-III

School of Physics, Shri Mata Vaishno Devi University

School of Physics [Credit breakup scheme as per NEP-2020 & draft NHEQF for Bachelors Degree Programme] Applicable for batch admitted in AY 2022-23 [First Year]

First Year			[10 credit exit bridge course of 2 months]*
Semester/ Type of course	I	II	Certificate [Level-5]
Major Course (Physics) (4 Credits)	Mechanics 3hrs (3credits) [PHL1023] Mechanics Lab 2hrs (1 credits) [PHP1022]	Electrodynamics & EM Waves 3hrs (3credits) [PHL1026] Electrodynamics & EM Waves Lab 2hrs (1 credit) [PHP1026]	
Minor Course (Physics) (4 Credits)	Thermal Physics 3hrs (3 credits) [PHL1024] Thermal Physics Lab 2hrs (1 credits) [PHP1024]	Physical Optics 3+1 (4 credits) [PHL1027] Physical Optics Lab 2 hrs (1 credits) [PHP1027]	–
Multidisciplinary (MD I & II) (3 Credits)	Basic Instrumentation Skills 3hrs (3 credits) [PHE1025] Choose one course from MD-I offered by other schools or MD I offered by School of Physics	Energy Sources 3hrs (3 credits) [PHE1028] Choose one course from MD-II offered by other schools or MD II offered by School of Physics	
Ability Enhancement course (AEC) (3 Credits)	Choose one course from the pool of courses from AEC – I : English Language (General), Communication Skills, Mathematical Ability [Inhouse / Swyam platform] (3 credits)	Choose one course from the pool of courses from AEC – II : English Language (General), Communication Skills, Mathematical Ability [Inhouse / Swyam platform] (3 credits)	–
Skill Enhancement course (SEC) (2 Credits)	Choose one from the pool of courses SEC – I. [Inhouse / Swyam platform] (2 Credits)	Choose one from the pool of courses SEC – II. [Inhouse / Swyam platform] (2 Credits)	
Value addition courses (VAC) (2+2 Credits)	Choose two from the pool of courses VAC-I & VAC-II [Inhouse / Swyam platform] (4 credits (2 courses of 2 credits each)	Choose two from the pool of courses VAC-III & VAC-IV [Inhouse / Swyam platform] (4 credits (2 courses of 2 credits each)	
Total credits	20	20	10
Exit options			Certificate (50

*Undergraduate Certificate (Field of study / discipline). (Programme duration: First year (first two semesters) of the undergraduate programme, followed by an exit 10-credit bridge course(s) lasting two months, including at least 6-credit job-specific internship/apprenticeship that would help the graduates acquire job-ready competencies required to enter the workforce. (10 credits)

(18)

Detailed Syllabi for Integrated B.Sc. Physics Semester I

Major (Part –A)

Mechanics
(PHL-1023)

(3-0-0)

Unit-I
Non-Inertial Systems and Fictitious Forces **12**

Unit vectors, Displacement, Velocity, Acceleration, Area and Volume elements in Cartesian and Plane Polar coordinates. Dynamics Using Polar Coordinates; Galilean Transformation: Uniformly Accelerating Systems: The Principle of Equivalence; Physics in a Rotating Coordinate System–Rate of Change of a Rotating Vector, Time Derivative of a Vector. Velocity and Acceleration, Fictitious Forces in a Rotating Coordinate System.

Unit-II
Collisions and Conservation Laws **10**

Concept Centre of Mass; Elastic Collision in Laboratory and Centre of MassCoordinates; Relationship between Displacement, Velocities, Kinetic energies and Angles in Laboratory and Centre ofMass Coordinates.

Unit-III
Central Force Motion **10**

Central Force Motion as a One-body Problem; Universal Features of Central Force Motion –Consequences of the Conservations of Angular Momentum and Energy. The Effective Potential. The Formal Solution for Central Force Motion; The Energy Equation and Energy Diagrams; Planetary Motion – Hyperbolic Orbits, Elliptic Orbits and Planetary Motion.

Unit-IV
Rigid Body Motion **9**

The Vector Nature of Angular Velocity andAngular Momentum;The Gyroscope:Examples of Rigid Body Motion:Conservation of Angular Momentum; Rigid Body Rotation – Angular Momentum and the Tensor of Inertia, Principal Axes, Rotational Kinetic Energy of a Rigid Body, Rotation about a Fixed Point.

Text Book:

1. An Introduction to Mechanics, 2nd Ed., D. Kleppner, R. Kolenkow, McGraw-Hill, 2014.

Reference Books:

1. Mechanics, Berkeley Physics, vol.1, C. Kittel, W. Knight, et al., Tata McGraw-Hill, 2007.
2. Mechanics, D.S. Mathur, S.Chand and Company Limited, 2000.

Major (Part –B)

Mechanics lab
(PHP-1022)

(0-0-2)

Choose a minimum of 5 experiments from the list given below:

1. To determine the Young's modulus of material of a metallic bar by bending of beam method.
2. To determine the coefficient of viscosity of highly viscous liquid by Stoke's method.
3. To find the surface tension of water by Jaeger's Method.
4. To determine the value of 'g' using bar pendulum.
5. To determine the Moment of Inertia of a Flywheel.
6. To determine the Elastic constants of a wire by Searle's method.
7. To find modulus of rigidity by Maxwell's needle.
8. To determine the moment of inertia of objects of regular shapes (rod, sheet, cylinder, sphere, spherical shell) and verify the parallel and perpendicular axes theorems.
9. To study oscillations of a bifilar pendulum.

Note - Emphasis shall be laid on the technological application of the concept and it's planning & methodology should be of the nature of study rather that obtaining the value of physical constant. A section on discussion of the results of study shall be included by the students in their report/ practical file. Objective learning goals and concept understood shall be defined for each experiment

Reference Books:

1. Advanced Practical Physics for Students, Worsnop and Flint, Methuen & Co. Ltd., 1957.
2. B. Sc. Practical Physics, C. L. Arora, S. Chand., 2001

20

Minor (Part –A)

Thermal Physics (PHL 1024) (3-0-0)

Unit-I
Thermodynamics-I 10

Thermodynamic system, Zeroth law of thermodynamics, concept of heat, thermodynamic equilibrium, work and their path-dependence, internal energy, First law of thermodynamics, specific heat of a gas, applications of first law of thermodynamics, work done during the isothermal and adiabatic process, reversible and irreversible process, heat engine, definition of efficiency, carnot's ideal heat engine.

Unit-II
Thermodynamics-II 10

Second Law of thermodynamics, carnot's theorem, steam engine, internal combustion engine, diesel engine, multi-cylinder engine, concept and physical significance of entropy, change in entropy, principle of increase of entropy, T-S diagram, thermodynamical scale of temperature. Third law of thermodynamics, zero point energy.

Unit-III
Thermodynamical relations 10

Thermodynamic variables, extensive and intensive variables, Maxwell thermodynamical relations and their applications, clausius-clapeyron's equations, thermodynamical potentials and significance, relation of thermodynamical potentials with their variables, relation between C_p, C_u and μ, adiabatic stretching of a wire, Joule-Kelvin coefficient, Phase transitions.

Unit-IV
Liquefaction of gases 10

Methods of Liquefaction of gases, method of freezing mixture, cooling by evaporation under reduced pressure, cooling by adiabatic expansion, Joule-Thomson expansion, regenerative cooling, liquefaction of air, principle of cascade cooling, liquefaction of various gases including helium I and II, production of low temperature, conversion of magnetic temperature into Kelvin temperature, measurement of very low temperature, superconductivity and Meissner effect.

Text Book:

1. Heat, thermodynamics & statistical physics, Lal and Subrahmanyam, S Chand, 2018.

Reference Books:

1. Thermal physics, Robert F. Sekerka, Elsevier, 2015.

Minor (Part –B)

Thermal Physics Lab
(PHP 1024) (0-0-2)

Choose a minimum of 5 experiments from the list given below:

1. To determine the thermal conductivity of a bad conductor by the Lee's disc method.
2. To determine the ratio of the specific heats of air by Kundt's tube method.
3. To determine the thermal conductivity of a good conductor by Searle's method.
4. To determine the value of Stefan's constant.
5. To determine the specific heat of a liquid by the method of Newton's law of cooling correction.
6. To find the latent heat of fusion of ice by the method of mixture.
7. To determine specific heat of bad conductor by method of mixture.
8. To find the thermal conductivity of rubber.
9. To study the heating efficiency of electrical kettle with varying voltages.
10. To measure the thermo emf of a given thermo couple.
11. To study the thermal behavior of an electric bulb (filament torch light bulb).
12. To study of variation of resistance with temperature - thermistor.
13. To verify Stefan's law using a torch bulb.
14. To determine the coefficient of thermal expansion of a metallic rod using an optical lever. mutual inductance between a pair of coils using a ballistic galvanometer.

Note: - Emphasis shall be laid on the technological application of the concept and it's planning & methodology should be of the nature of study rather that obtaining the value of physical constant. A section on discussion of the results of study shall be included by the students in their report practical file. Objective learning goals and concept understood shall be defined for each experiment

Reference Books:

1. Practical Physics by G L Squires Cambridge University Press, 2001.
2. An Advanced Course in Practical Physics by D. Chattopadhyay, P.C. Rakshit. New Central Book Agency, 1990.
3. B. Sc Practical Physics by C. L. Arora, S. Chand, 2001.

22

Multidisciplinary (MD-I)

Basic Instrumentation Skills (PHL 1025) (3-0-0)

Unit-I
Basics of Measurement (4)

Instruments accuracy, precision, sensitivity, resolution range etc. Errors in measurements and loading effects. Multimeter: Principles of measurement of dc voltage and dc current, ac voltage, ac current and resistance. Specifications of a multimeter and their significance.

Unit – II
Electronic multimeter (4)

Advantage over conventional multimeter for voltage measurement with respect to input impedance and sensitivity. Principles of voltage, measurement (block diagram only),Specifications of an electronic Voltmeter/ Multimeter and their significance.

Unit-III
Oscilloscope: (6)

Block diagram of basic CRO, CRT, electrostatic focusing and acceleration (Explanation only– no mathematical treatment), brief discussion on screen phosphor, visual persistence. Time base operation, synchronization. Front panel controls. Applications of CRO. Introduction to DSO.

Unit- IV
Signal and pulse Generators:

Block diagram, explanation and specifications of low frequency signal generator and pulse generator. Brief idea for testing, specifications. Distortion factor meter, wave analysis.

Basic Instrumentation Skills (Hands-on component)

Sessions on use of various measuring instruments for measurement of current, voltage, frequency, resistance, capacitance using instruments such as Voltmeter, Ammeter, Multimeter, CRO etc. Sessions on experimental data analysis and its application to specific experiments shall also be done in the lab.

Text Book:

1. Electronic Instrumentation, H.S. Kalsi, 3rd Ed. Tata McGraw Hill.

Reference Books:

2. Electronic Devices and circuits, S. Salivahanan & N. S.Kumar, 3rd Ed., 2012, Tata Mc-Graw Hill

Detailed Syllabi for Integrated B.Sc. Physics Semester II

Major (Part –A)

Electrodynamics & EM Waves (PHL-1026)

(3-0-0)

Unit I
Vector Analysis 4

Scalar and Vector Fields; Del Operator; Gradient, Divergence and Curl and their Physical Significance; Solenoidal Fields; Irrotational Fields;Line, Surface and Volume Integrals; The Fundamental Theorem for Gradients, Divergences and Curls; Spherical and Cylindrical Coordinates.

Unit II
Electrostatics 8

Gauss's Law in integral and differential forms and its applications; Line Integral of Electric Field, Conservative Nature of Electric field; Electric Field as the Negative Gradient of Potential; Poisson's and Laplace's equations; Boundary conditions satisfied by $\vec{E}$ at the interface between two media.

Unit III
Magnetostatics 9

Line, Surface and Volume Current Densities;Ampere's circuit law in Integral and Differential forms, Modified Ampere's Circuit Law, Displacement Current, Divergence and Curl of Magnetic Field, Magnetic Vector Potential, Boundary conditions satisfied by $\vec{B}$ at the interface between two media.

Unit IV
Time Varying Fields 8

The Continuity Equation; Poynting Theorem and its Differential Form; Newton's Third Law in Electrodynamics; Maxwell's Stress Tensor; Conservation of Momentum; Angular Momentum.

Unit IV
Electromagnetic Waves 12

The Wave Equation; Sinusoidal Waves; Boundary Conditions – Reflection and Transmission; Polarization; The Wave Equations for $\vec{E}$ and $\vec{B}$; Monochromatic Plane Waves; Energy and Momentum in Electromagnetic Waves; Propagation in Linear Media, Reflection and Transmission at Normal and Oblique Incidence, Derivation of Laws of Reflection and Refraction. Electromagnetic Waves in Conductors; Modified Wave Equations, Skin Depth and Characteristic Impedance.

Text Book:

1. Introduction to Electrodynamics, D. J. Griffiths, 3rd Ed. Pearson.

Reference Books:

1. Schaum's Outline of Electromagnetics, J. A. Edminister, 4thEd.TataMcGraw Hill
2. Electricity and Magnetism, Edward M. Purcell, 1986, McGraw-Hill Education.

24

Major (Part –B)

Electrodynamics & EM Waves
(PHP-1026) (0-0-2)

Choose & perform any 5 experiments from the list given below:

1. To measure field strength B and its variation in a Solenoid (determinedB/dx).
2. To find Capacity of a Capacitor by Electrical vibrator.
3. To find the Impedance of series LCR circuit.
4. To find low resistance by Carey Foster Bridge (Calibrating Bridgewire).
5. To determine the temperature coefficient of the material of a coil using a Carey-Foster's bridge.
6. Find Horizontal component of Earth's magnetic field by usingvibration and deflection magnetometer.
7. To find Self-inductance by Anderson's bridge.
8. To measure the self-inductance of two coils, mutual inductance between these coils and the coefficient of coupling by Anderson's bridge method.
9. To calibrate a ballistic galvanometer.
10. To determine the mutual inductance between a pair of coils using a ballistic galvanometer.

Note: - Emphasis shall be laid on the technological application of the concept and it's planning & methodology should be of the nature of study rather that obtaining the value of physical constant. A section on discussion of the results of study shall be included by the students in their report practical file. Objective learning goals and concept understood shall be defined for each experiment.

Reference Books:

1. Advanced Practical Physics for Students, Worsnop and Flint, Methuen & Co. Ltd., 1957.
2. B. Sc. Practical Physics, C. L. Arora, S. Chand., 2001

25

Minor (Part –A)

Physical Optics
(PHL-1027) (3-0-0)

Unit –I
Interference (10)

Interference of light, conditions for interference, Young's double slit experiment, division of wavefront - Fresnel's biprism & mirror and Lloyd's Mirror. Interference by division of amplitude – plane parallel film, wedge shaped film, Newton's Ring. Interferometer - Michelson and Fabry-Perot.

Unit –II
Diffraction (10)

Introduction to diffraction. Fresnel's and Fraunhofer's class of diffraction. diffraction by a rectangular aperture, circular aperture, single slit, n slits, diffracting grating and single edge. Resolving Power of Optical Instruments - Rayleigh's criterion and resolving power of telescope, microscope & grating.

Unit –III
Polarization (10)

Introduction to polarization of light, circular and elliptical polarized light, production of plane polarized light, production and detection of circular and elliptically polarized light, applications of polarization, Optical Rotation - Fresnel's explanation of optical rotation and Half Shade & Biquartz polarimeters.

Unit –IV
Lasers (10)

Introduction and evaluation of lasers, laser principles, process absorption & emission, Characteristics and uses of Lasers. Laser operation- population inversion & derivation of threshold, gain medium (active medium),. Conditions for Laser action and Einstein's coefficients. Three and four level laser systems (qualitative discussion). Types of laser including their working

Text Book:

1. Introduction to optics, Nkoma & Jain, "Mkuki Na Nyota, 2019.

Reference Book:

1. A text book of optics, N Subrahmanyam et. al. S. Chand, 2004
2. Lasers & optical instrumentation, Nagabhushana & Sathyanarayana, I K International, 2010.

26

Minor (Part –B)

Physical Optics Lab
(PHP-1027)

(0-0-2)

Choose a minimum of 5 experiments from the list given below:

1. To determine refractive index of a transparent liquid using a travelling microscope.
2. To determine the refractive index of the material of a convex lens by measuring its focal length and radii of curvature.
3. To determine refractive index of a liquid with the help of a convex lens and a plane mirror.
4. To determine of the focal length and power of a convex lens by u-v method.
5. To find refractive index of water by using hollow prism.
6. To find wave length of Sodium light using Newton's Rings.
7. To find the radius of curvature of plano-convex lens using Newton's rings experiment, given λ=5893A°.
8. To determine the refractive index of a liquid by using Newton's rings apparatus.
9. To find wave length by using Diffraction Grating.
10. To determine the wavelength of monochromatic light by Fresnel's biprism.

Note: - Emphasis shall be laid on the technological application of the concept and it's planning & methodology should be of the nature of study rather that obtaining the value of physical constant. A section on discussion of the results of study shall be included by the students in their report/ practical file. Objective learning goals and concept understood shall be defined for each experiment.

Reference Books:

1. Practical Physics by G L Squires Cambridge University Press, 2001.
2. Practical Physics by R K Shukla, New Age International (P) Limited, Publishers, 2007.
3. B.Sc Practical Physics by Harnam Singh, S. Chand, 2000.
4. An Advanced Course in Practical Physics by D. Chattopadhyay, P.C. Rakshit, New Central Book Agency, 1990.
5. A Text Book of Practical Physics, S.K. Ghosh, New Central Book Agency, 2015.
6. B. Sc Practical Physics by C. L. Arora, S. Chand, 2001.

Multidisciplinary (MD-II)

Energy Sources
(PHL 1028) (3-0-0)

Unit-I (12)
Types of sources

Introduction to Energy, conservation and various forms such as heat (thermal), light (radiant), mechanical, electrical, chemical, and nuclear energy. Conventional energy sources such as natural gas, oil, coal, or nuclear. Global scenario of energy sources. Renewable Energy Scenario. Energy resources and their utilization, national grid for the gas distribution, gas conservation, nuclear power programme, energy parameters, and rational use of energy, energy efficiency and conversion.

Unit-II (8)
Energy and Environment

Introduction to environmental aspects of electric energy generation- atmospheric pollution, hydrocarbons, particulates, thermal pollution, hydroelectric projects, nuclear power generation and environment, operational safety in nuclear plants and disposal of waste, impact of renewable energy generation on environment, cost of electricity production from various sources

Unit-III (8)
Solar Energy harvesting

Solar radiation and its measurement, solar thermal energy collectors, solar thermal energy conversion systems, solar photovoltaic system

Unit-IV (12)
Energy resources technology

Different types of energy source technologies- Wind energy, small hydropower energy, geothermal energy, ocean energy, biomass energy, fuel cells.

Note:- As a part of this course students shall be encouraged to do self studies on various topics of their interest based on but not limited to various energy models, field visits to various plants etc

Text book:

1. Renewable energy sources and technologies, Kothari, Singal & Ranjan, PHI, 2011

Reference book:

1. Godfrey Boyle, "Renewable Energy, Power for a sustainable future", Oxford University Press, in association with The Open University, 2004.

Annexure-IV

Course Title: RESEARCH METHODOLOGY **4-0-0**
Course Code: PHL 9142 **Credits: 4**

UNIT 1: Foundations of Research
Philosophy of Science - Subjective thinking versus Objective thinking, Materialism versus idealism, causality, etc.; Logical Reasoning - Inductive logic, Deductive logic, Syllogistic logic; Historical perspective – Mechanical and Scientific materialism, Empiricism and Evolution, Positivism **12**

UNIT 2: Techniques of Scientific Measurement
What scientists actually do; Falsifiability and Reproducibility; Proposing a hypothesis; Elements of scientific measurement; The central limit theorem and its applications; **8**

UNIT 3: Hypothesis Testing
Issues in hypothesis testing; Null hypothesis; Statistical methods in hypothesis testing; Z-test and T-test; The Chi-square test **10**

UNIT 4: Graphing and Error Analysis
Curve fitting, Least Square Fit to a straight line and a polynomial, Simple Scientific graphing and data analysis using Origin, Error bars and confidence interval; Measurement of a proportion; Box and Whisker plot; Propagation of Errors **12**

UNIT 5: Communicating Research Results:
Search engines and database; Research proposal, Report, Thesis; Presentation in Seminar and conference; Journal abbreviations, Bibliography standards, Indices of quality assessment of publications. **8**

References:

1. Research Methodology for Natural Sciences, Soumitro Banerjee, IISc Press, 2022.
2. Research Methodology: The Aims, Practices and Ethics of Science, P. Pruzan, Springer, 2016.
3. Data Reduction and Error Analysis for the Physical Sciences 3rd Ed. by Philip R Bevington& D Keith Robinson, McGraw – Hill (2003)
4. OriginLab Tutorials, Access link: https://www.originlab.com/doc/Tutorials

29

HoD Physics <hod.physics@smvdu.ac.in>

Draft minutes of 9th BoS of School of Physics

3 messages

HoD Physics <hod.physics@smvdu.ac.in> Fri, Nov 4, 2022 at 3:14 PM
Cc: pankaj biswas <pankaj.biswas@smvdu.ac.in>, "Office SoP (Physics)" <office.sop@smvdu.ac.in>
Bcc: Department of Physics <dop@smvdu.ac.in>, Dinesh Pandya <dinesh.pandya@iitjammu.ac.in>, saumitra mukherjee <saumitramukherjee3@gmail.com>

Sir/ Madam,

Kindly find attached draft minutes of the 9th meeting of BoS held in hybrid mode on 31/10/2022 at 2.30 pm in the conference room of the School. External expert members joined through online mode. You are requested to go through the same and favour us with your valuable comments latest by 7/11/2022 (11:00 am) so as to enable us to finalize and issue the same as the session shall be commencing from 07.11.2022.

Regards

Head, SoP

5 attachments

- **2 Annexure-I - Statistical Mechanics Lab Syllabus.docx**
  16K
- **1 Draft Minutes of 9th meeting BoS_SoP.docx**
  77K
- **3 Annexure-II Energy Sources.docx**
  14K
- **5 Annexure-IV - Research Methodology course modifoed contents.docx**
  17K
- **4 Annexure-III First Struture and Contents as per NEP.docx**
  48K

saumitra mukherjee <saumitramukherjee3@gmail.com> Fri, Nov 4, 2022 at 6:47 PM
To: HoD Physics <hod.physics@smvdu.ac.in>

Dear Head SOP
I agree with the draft minutes of the meeting.
Regards
Saumitra Mukherjee
Professor Saumitra Mukherjee PhD (B.H.U.), PGDEE Commonwealth Fellow(UK),Earth Sciences Fellow(India), Excellence in Groundwater Science Award of INC-IAH-2016 New Code of Education Award 2022
Former Dean,School of Environmental Sciences
Professor of Geology Remote sensing and Space Sciences
Jawaharlal Nehru University
New Delhi-110067
India
Website:http://www.jnu.ac.in/Faculty/smukherjee/cv.pdf
Phone:9313908512
[Quoted text hidden]

Dinesh Pandya <dinesh.pandya@iitjammu.ac.in> Mon, Nov 7, 2022 at 11:37 AM
To: HoD Physics <hod.physics@smvdu.ac.in>

In general I agree with the draft minutes. I have following submission for incorporation in MoM.
1. Text book (preferably one) should be written separately. Others could be under "Reference books".
2. Name of the E&M course should be Electrodynamics and EM Waves.
3. For the experiments planned, the emphasis should be on the technological application of the concept and it's planning & methodology should be of the nature of study rather that obtaining the value of physical constant. A section on discussion of the results of study should be included by the students in their report. Objectives, learning goals and concepts understood should be defined for each experiment.

[Quoted text hidden]

Annexure-II
School of Physics

Detailed course contents for VII & VIII semesters of Int. B.Sc. (Hons.) Physics-M.Sc. (Physics) applicable for batches admitted in AYs 2020-21 & 2021-22 and students to be admitted to PG level (M.Sc. Physics) in AYs 2023-24 & 2024-25 as lateral entrants (Course structure as approved in 7th BoS of SoP held on 05.10.2020)

	Fourth Year (M.Sc. - Ist year)	
Semester/ Type of Course	**VII**	**VIII**
Major Course (Physics)	Classical Mechanics **4-0-0 (4 credits) [PHL 6021]** Mathematical Physics **4-0-0 (4 credits) [PHL 6033]** Quantum Mechanics-I **4-0-0(4 credits) [PHL 6041]** Physics of Semiconductor Devices **4-0-0(4 credits) [PHL 6054]**	Electrodynamics and Plasma Physics **4-0-0 (4 credits) [PHL 6075]** Digital Systems **4-0-0 (4 credits) [PHL 6055]** Quantum Mechanics-II **4-0-0 (4 credits) [PHL 6042]** Computational Physics **3-0-2 (4 credits) [PHL 6113]**
Laboratory Component	Physics Laboratory-I **0-0-12 (6 credits) [PHP 6123]**	Physics Laboratory-II **0-0-12** (6 **credits) [PHP 6124]**
Total credits	**22**	**22**

Detailed Syllabi for M.Sc. (Physics) Semesters-I & II applicable for 2020-21, 2021-22 students

Semester - VII

Classical Mechanics
(PHL 6021) (4-0-0)

Unit I: **[12]**

Newton's laws, Mechanics of systems of particles, conservation laws, dynamical systems: conservative versus dissipative systems, Phase space dynamics, stability analysis, degrees of freedom, constraints, and generalized coordinates, velocities, momenta and forces.

Unit-II **[15]**

Hamilton's variational principle, the Lagrangian and the Euler-Lagrange equations, the Hamiltonian, Cyclic Coordinates and Canonical Momenta, Applications of the Lagrangian and Hamiltonian formalisms to systems with one and two degrees of freedom, Principle of least action, Canonical transformations, Poisson brackets, the Hamilton-Jacobi theory, symmetry, invariance and Noether's theorem.

Unit-III **[9]**

Central force problem, Kepler's problem, bound and scattering motions, Scattering in a central potential, Rutherford formula, and the Scattering cross section. Two body Collisions–scattering in laboratory and Centre of mass frames.

Unit-IV **[12]**

Elements of rigid-body dynamics: moment of inertia tensor, Euler forces, Euler angles, symmetric top, Periodic motion; Small Oscillations: Normal modes analysis, and Normal modes of a harmonic chain

Unit-V **[12]**

Inertial frames, Postulates of special relativity. Lorentz transformations relativistic velocity addition formula, Relativistic kinematics–Four- vector notation. Velocity-energy-momentum-force four-vectors for a particle. Relativistic invariance of physical laws, relativistic mass-energy equivalence

Suggested Books:

1. Classical Mechanics: H Goldstein.
2. Classical Dynamics of Particles and Systems: Stephen Thornton
3. Classical Mechanics by J C Upadhyay

Mathematical Physics
(PHL-6033) (4-0-0)

Unit-I **[12]**

Linear Algebra: Special type of matrices: Orthogonal, Hermitian, anti-Hermitian and Unitary matrices, Matrices in Classical and Quantum mechanics: Rotation, Pauli spin and Dirac matrices, Similar matrices, Orthogonal, Unitary and Similarity transformations, Determination of eigenvalues and eigen vectors of matrices and their properties, Cayley Hamilton theorem, Condition for diagonalizability, Diagonalization of matrices

Unit-II **[10]**

Tensors: Tensor and their ranks, contravariant and covariant tensors, symmetric and asymmetric tensors, Scalars or invariants, The Kronecker delta, Algebraic operations of tensors – sum and difference of tensors, direct product of tensors, Contraction, Extension of the rank, quotient law

Unit-III **[14]**

Complex Analysis: Elements of complex analysis, analytic functions, Analyticity and Cauchy-Reimann Conditions, Cauchy's integral theorem and formula, Taylor, Laurent and Maclaurine series expansion, zeros and singular points, poles, residues and residue theorem, Cauchy's residue theorem, contour integration, Jordan's Lemma, evaluation of definite integrals.

Unit-IV **[12]**
Special Functions

Beta and Gamma functions and their properties and inter relationships. Bessel's equation and its solutions, Bessel's functions of first and second kind, Spherical Bessel and Neumann functions, Recurrence formulae, Orthogonality of Bessel functions, Laguerre's differential equation, Rodrigues' formula, Generating Function, Orthogonal properties

Unit-V **[12]**

Fourier and Laplace Transforms: Fourier Transform (F.T.), Fourier integral, Inverse F.T., Properties of F.T., Fourier Convolution Theorem, Parseval relation, Multiple convolutions, Transform of a product, Momentum space, Discrete F.T., Fast F.T., Simple problems, Laplace Transforms (L.T.), Elementary functions, Dirac delta function, Properties of L.T., Transforms of derivatives, Derivative of a transform, Integration of transforms, Laplace convolution theorem, Inverse L.T., Simple problems

Suggested Books:

1. Mathematical Methods for Physicists: George B. Arfken and Hans-Jurgen Weber.
2. Mathematical Physics: Dass and Verma, S. Chand. Publishing (8e).

Quantum Mechanics-I
(PHL-6041) (4-0-0)

Unit-I **[10]**

Wave-function in coordinate and momentum representations, Schrödinger equation (time-dependent and time-independent), Expectation Values, current density, equation of continuity, Ehrenfest's theorem.

Unit-II **[15]**

Particle in three dimensional box, harmonic oscillator, Potential Step, Potential Well, Rigid rotator and Hydrogen atom.

Unit-III **[12]**

Fundamental postulates of wave mechanics, Commutators, Hermitian operators, properties of eigen functions and eigen values of Hermitian operators, Dirac notation for state vectors (Bra and ket notations), matrix representation of wave function and operator, energy spectrum of one dimensional harmonic oscillator using matrix mechanics.

Unit-IV **[13]**

Definition of generalized orbital angular momentum, Angular momentum algebra: operators for J_+, J_- and J_z, Commutation relation of angular momentum operator. Spectrum of eigen values of J^2 and J_z, operators for angular momentum L in spherical polar co-ordinates, Eigen values and eigen functions of L^2 and L_z. Spin angular momentum, Eigen values and eigen functions of S^2 and S_z. Spin orbit coupling, fine structure.

Unit-V **[10]**

Matrix representation of J^2, J_z, J_+, J_-, J_x, J_y for j=1/2 and 1. Pauli's spin matrices and their properties, Addition of two angular momenta; coupled and uncoupled representation, Clebsch Gordon coefficients, Spectrum of eigen values of total angular momentum. Calculations of C. G. coefficients when (i) $j_1 = ½$, $j_2 = ½$ (ii) $j_1 = ½$, $j_2 = 1$.

Suggested Books:

1. Introduction of Quantum Mechanics: D.J. Griffiths.
2. Quantum Mechanics, Ghatak & Loknathan, 1st Edition, MacMillan India
3. Quantum Mechanics, L. I. Schiff, 3rd Edition, McGraw-Hill (1968).

Physics of Semiconductor Devices
(PHL-6054) (4-0-0)

Unit-I

[13]

Physics and Properties of Semiconductors: Crystal Structure, Energy Bands and Energy Gap, Carrier Concentration at Thermal Equilibrium, Carrier-Transport Phenomena, Phonon, Optical, and Thermal Properties, Heterojunctions and Nanostructures, Basic Equations and Examples

Unit-II

[10]

Semiconductor Device Building Blocks: p-n Junctions, Depletion Region, Current-Voltage Characteristics, Junction Breakdown, Transient Behavior and Noise, Terminal Functions, Heterojunctions, Metal-Semiconductor Contacts, Metal-Insulator-Semiconductor Capacitors

Unit-III

[13]

Transistors: Bipolar Transistors- Structures and Characteristics, Heterojunction Bipolar Transistors, MOSFETs- Structures and Characteristics, Introduction to JFETs, MESFETs, and MODFETs.

Unit-IV

[12]

Negative-Resistance and Power Devices: Tunnel Diode and its characteristics, IMPATT, TRAPATT, BARITT Diodes and their Static and Dynamic Characteristics

Unit-V

[12]

Photonic Devices: Radiative Transitions and Optical Absorption, Light-Emitting Diodes, Various Light-Emitting Diodes, Semiconductor Lasers, Photodetectors, Solar Cells, Silicon and Compound-Semiconductor Solar Cells, Third-Generation Solar Cells, Optical Concentration

Suggested Books:

1. Physics of Semiconductor Devices, S.M. Sze, Wiley, 2006.
2. Semiconductor Devices: Physics and Technology, S.M. Sze, Wiley, 2001.
3. Physics of Semiconductor Devices, M. Shur, Prentice Hall, 1990.
4. Semiconductor Physics and Devices: Donald A. Neamen (4e) McGraw-Hill 2012.

35

Physics Laboratory - I

(PHP-6123) (0-0-12)

Choose a minimum of 6 experiments from the list given below. The course coordinators can suggest additional experiments as per the requirements.

I. General Experiments

1. Determination of Semiconductor Bandgap
2. Magnetic Susceptibility of Solids
3. Magnetic Susceptibility of Liquids
4. Hall Effect
5. Curie Temperature
6. Dielectric constant
7. High Field Magnetic Hysteresis

II. Electronics Experiments

1. Zener Voltage Regulator
2. LM317 Voltage and Current Regulation
3. Transistor Characteristics and Operating Point
4. Op-amp Characteristics
5. Op-amp Frequency Response
6. Op-amp Configurations – Inverting and Non-inverting
7. Op-amp Integrator& Differentiator
8. Op-amp – Wein-bridge Oscillator
9. Op-amp – Comparator
10. Op-amp – Multivibrator
11. Op-amp – First order Active Filters

Semester - VIII

Electrodynamics and Plasma Physics (PHL 6075) (4-0-0)

Unit-I: **[15]**

Faraday's Law of Electromagnetic Induction, Induced Electric Field, Inductance, Energy in Magnetic Fields, Maxwell's Equation, Magnetic Charge, Maxwell's Equations in Matter, Boundary Conditions, Continuity Equation, Poynting Theorem, Newton's Third Law in Electrodynamics, Maxwell's Stress Tensor, Conservation of Momentum, Angular Momentum.

Unit-II: **[12]**

Wave Equation in One Dimension, Boundary Conditions: Reflection and Transmission, Polarization, Wave Equation for E and B, Monochromatic Plane Waves, Energy and Momentum in electromagnetic Waves.

Unit-III: **[10]**

Scalar and Vector Potentials, Gauge Transformations, Coulomb Gauge and Lorentz Gauge, Retarded Potential, Lienard-Weichert Potentials, Fields of a Moving Point Charge.

Unit-IV: **[10]**

Electric Dipole Radiation, Magnetic Dipole Radiation, Radiation from an Arbitrary Source, Power Radiated by a Point Charge, Radiation Reaction, Physical Basis of Radiation Reaction.

Unit V: **[13]**

Occurrence of Plasmas in Nature, Definition of Plasma, Concept of Temperature, Debye Shielding, Plasma Parameters, Criteria for Plasmas, Applications of Plasma Physics.

Suggested Books:

1. D.J. Griffiths- Introduction to Electrodynamics (4e)
2. F.F. Chen- Introduction to Plasma Physics

Digital Systems
(PHL-6055) (4-0-0)

Unit-I

[12]

Combinational Logic Simplification and Analysis: The Karnaugh Map (K-Map), K-Map SOP Minimization, K-Map POS Minimization, Boolean Expressions with VHDL, Pulse Waveform Operation, Combinational Logic with VHDL, Ripple Carry and Look-Ahead Carry Adders

UNIT-II

[12]

Sequential Logic Systems: Shift Register Operations, Type of Shift Registers, Shift Register counters, Shift registers applications, Asynchronous Counters, Synchronous Counters, Up/Down Synchronous Counters, Design of Synchronous Counters , Cascaded Counters , Counter Decoding. Counter Applications

UNIT-III

[12]

Signal Conversion and Processing: Analog-to-Digital Conversion, Methods of Analog-to-Digital Conversion, Methods of Digital-to-Analog Conversion, Digital Signal Processing, Digital Signal Processor (DSP)

Unit-IV

[12]

Semiconductor Memory: The Random-Access Memory (RAM), The Read-Only Memory (ROM), Programmable ROMs, The Flash Memory, Memory Expansion, Special Types of Memories. Magnetic and Optical Storage 670

Unit-V

[12]

Microprocessor Basics: 8085 Microprocessor – Block diagram, addressing modes, 8085 instruction set, simple assembly language programs involving looping, counting and delays.

Suggested Books:

1. Digital Fundamentals by Thomas L. Floyd, 10e (2011), Pearson Ed.
2. Microprocessor Architecture, Programming and Applications with 8085, Ramesh S. Gaonkar, 6e (2013), Penram International Publisher

Quantum Mechanics-II
(PHL-6042) (4-0-0)

Unit-I: **[15]**

Time independent non-degenerate perturbation theory upto second order. Applications to normal He atom, perturbed harmonic oscillator. Time independent degenerate perturbation theory upto first order, Application of degenerate perturbation theory to stark effect. Time dependent perturbation theory, calculation of 1^{st} order transition amplitude, transition probability, and derivation of Fermi Golden rule.

Unit-II: **[9]**

Variational method, its application to ground state of He atom, W.K.B-approximation, classical turning points, connection formulae, Application to WKB to bound state problem.

Unit-III: **[12]**

Semi Classical theory of radiations, Expression for transition probability for absorption and induced emission using electric dipole approximation. Selection rules, Identical particles, Pauli's exclusion principle, spin-statistics connection. Elementary theory of scattering: phase shifts, partial waves, Born approximation.

Unit-IV: **[12]**

Relativistic quantum mechanics: Klein-Gordon Equation, Klein-Gordon equation in electromagnetic field, solution of Klein-Gordon equation for a particle with coulomb potential V_0 (hydrogen atom problem), Derivation of Dirac equation, γ-, -matrices.

Unit-V: **[12]**

Dirac equation with central potential and hydrogen atom problem, existence of electron spin for a Dirac particle. Covariant form of Dirac Equation, -matrices and their properties, $_5$-matrix and properties, Covariance of Dirac Equation, Zitterbewegung and negative energy solutions

Suggested Books:

1. Introduction of Quantum Mechanics: D.J. Griffiths.
2. Quantum Mechanics, Ghatak & Loknathan, 1^{st} Edition, MacMillan India
3. Introduction to Quantum Mechanics: C.J. Joachain and B.H. Bransden.

89

Computational Physics
(PHL-6113) (3-0-2)

UNIT-I **[10]**

Basic Programming concepts, Controlling programs with 'if' and 'while', Lists and Arrays, For loops, User Defined functions, Graphics and visualization, Accuracy and Speed

UNIT-II **[12]**

Integrals: The trapezoidal rule, Simpson's rule, Romberg integration, Higher-order integration methods, Gaussian quadrature, Integrals over infinite ranges, Derivatives: Forward and Backward differences, Central differences, Second derivatives, Interpolation

UNIT-III

[12]

Simultaneous linear equations- Gaussian elimination, Back substitution, Pivoting, Calculating the inverse of a matrix, Eigenvalues and eigenvectors, Non-linear equations- Binary search, Newton's method, Secant method

UNIT-IV **[11]**

Ordinary differential equations with one variable- Euler's method, Runge-Kutta method, Fourth-order Runge-Kutta method, Differential equations with more than one variable, Second-order differential equations

Suggested Books:

1. Computational Physics: Problem Solving with Python, Landau & Paez, WILEY-VCH (3e) 2015
2. Computational Physics: Mark Newman (1e) CreateSpace Independent Publishing Platform 2013
3. Essential Python for the Physicist: Giovanni Moruzzi (1e) Springer, 2020

Computational Physics Lab component

Choose a minimum of 6 experiments from the list given below.

1. Data handling: find standard deviation, mean, variance, moments etc. of at least 25 entries.
2. Choose a set of 10 values and find the least squared fitted curve.
3. To find the roots of quadratic equations.
4. Perform numerical integration on 1-D function using Simpson rules.
5. Perform numerical integration on 1-D function using Trapezoid rule.
6. To generate random numbers between (i) 1 and 0, (ii) 1 and 100.
7. To find the value of π using Monte Carlo simulation.
8. To find the solution of differential equation using Runge-Kutta method.
9. To find the solution of differential equation using Euler's method.
10. To find the value of y for given value of x using Newton's interpolation method.
11. To evaluate sum of finite series and the area under a curve.
12. To find the product of two matrices
13. To study the motion of spherical body falling in viscous medium using Euler method.
14. To study the motion of one dimensional harmonic oscillator without and with damping effects.
15. To obtain the energy eigenvalues of a quantum oscillator using Runge-Kutta method.
16. To study the motion of charged particles in uniform electric field, uniform magnetic field and combined uniform EM field.
17. To study the phenomenon of nuclear radioactive decay.
18. To study the EM oscillation in a LCR circuit using Runge-Kutta method.

Suggested Book(s):

1. Computational Physics: Problem Solving with Python, Landau & Paez, WILEY-VCH (3e) 2015
2. Data Reduction and Error analysis for Physical Sciences: Bevington & Robinson, (McGraw Hill, Noida, India) 2003.
3. Computational Physics: Mark Newman (1e) Create Space Independent Publishing Platform 2013
4. Essential Python for the Physicist: Giovanni Moruzzi (1e) Springer, 2020

Physics Laboratory - II
(PHP-6124) (0-0-12)

Choose a minimum of 6 experiments from the list given below. The course coordinators can suggest additional experiments as per the requirements.

General Experiments:

1. Thickness of Mesh wire using a He-Ne Laser
2. Pitch of the Screw using a He-Ne Laser
3. Wavelength of the He-Ne Laser using meter scale.
4. Fraunhoffer diffraction through circular apertures.
5. Measurement of numerical aperture of an optical fibre
6. Michelson Interferometer
7. Zeeman setup
8. Frank-Hertz Experiment
9. Electron spin Resonance

Digital Electronics Experiments

1. Combinational Logic Circuits based on Logic Gates
2. Combinational Logic Circuits – Boolean algebra
3. Binary Addition – Half Adder & Full Adder
4. Decoders – 2 bit binary, 2 bit Decoder and 7447 decoder
5. Flip-flops
6. Counters & Registers
7. Decade Counting Unit
8. Microprocessor – Simple programs

Annexure-III

School of Physics

Course Structure and course contents as per NEP-2020 & NCrF for Five Year Integrated B.Sc.-M.Sc. (Physics) Programme (3rd and 4th Semesters) to be made applicable for batch admitted in AY 2022-23

	First Year* (Certificate Course in Basic Physics)		Certificate	Second Year (Diploma in Applied Physics)		Diploma
Semester/ Type of Course	**I**	**II**		**III**	**IV**	
Major Course (Physics) **(4 credits)**	Mechanics **3-0-0 (3 credits) [PHL 1023]** Mechanics Lab **0-0-2 (1 credit) [PHP 1023]**	Electrodynamics and EM Waves **3-0-0 (3 credits) [PHL 1026]** Electrodynamics and EM Waves Lab **0-0-2 (1 credit) [PHP 1026]**		Analog Electronics **3-0-0 (3 credits) [PHL 2051]** Analog Electronics Lab **0-0-2(1 credit) [PHP 2051]** Mathematical Methods -I **3-1-0 (4 credits) [PHL 2033]**	Digital Fundamentals **3-0-0 (3 credits) [PHL 2052]** Digital Fundamentals Lab **0-0-2 (1 credit) [PHP 2052]** Mathematical Methods -II **3-1-0 (4 credits) [PHL 2036]**	
Minor Course **(4 credits)**	Thermal Physics **3-0-0 (3 credits) [PHL 1024]** Thermal Physics Lab **0-0-2 (1 credit) [PHP 1024]**	Physical Optics **3-0-0 (3 credits) [PHL 1027]** Physical Optics Lab **2 hrs (1 credit) [PHP 1027]**		Waves and Oscillations **3-0-0 (3 credits) {PHL 2013]** Waves and Oscillations Lab **0-0-2 (1 credit) {PHP 2013]**	Measurements and Analysis **2-0-0 (2 credits) {PHL 2125]** Measurements and Analysis Lab **0-0-4 (2 credits) {PHP 2125]**	
Multidisciplinary (MD) **(3 credits)**	Basic Instrumentation Skills **3-0-0 (3 credits) [PHE 1025]** Choose one course from MD-I offered by other schools or MD-I offered by School of Physics	Energy Sources **3-0-0 (3 credits) [PHE 1028]** Choose one course from MD-II offered by other schools or MD-II offered by School of Physics		Elements of Thermodynamics **3-0-0 (3 credits) [PHE 2024]** is the MD-III offered to other schools. Physics students to choose one course from MD-III offered by other schools	Fundamentals of Modern Physics **3-0-0 (3 credits) [PHE 2046]** is the MD-IV offered to other schools. Physics students to choose one course from MD-IV offered by other schools	
Ability Enhancement Course (AEC) **(3 credits)**	Choose one course from the pool of courses from AEC-I: English Language (General), Communication Skills, Mathematical	Choose one course from the pool of courses from AEC-II: English Language (General), Communication Skills, Mathematical Ability [In house/		Choose one course from the pool of courses from AEC-III: English Language (General), Communication Skills, Mathematical Ability [In house/ Swayam platform] **(3 credits)**	Choose one course from the pool of courses from AEC-IV: English Language (General), Communication Skills, Mathematical Ability [In house/ Swayam platform] **(3 credits)**	

	Ability [In house/ Swayam platform] (**3 credits**)	Swayam platform] (**3 credits**)				
Skill Enhancement Course (SEC) (**2 credits**)	Choose one course from the pool of courses from SEC-I [In house/ Swayam platform] (**2 credits**)	Choose one course from the pool of courses from SEC-II [In house/ Swayam platform] (**2 credits**)		Choose one course from the pool of courses from SEC-III [In house/ Swayam platform/ Industry based] (**2 credits**)	Choose one course from the pool of courses from SEC-IV [In house/ Swayam platform/ Industry based] (**2 credits**)	
Value Addition Courses (VAC) (**2 + 2 credits**)	Choose two courses from the pool of courses from VAC-I & VAC-II [In house/ Swayam platform] (**4 credits: 2 courses of 2 credits each**)	Choose two courses from the pool of courses from VAC-III & VAC-IV [In house/ Swayam platform] (**4 credits: 2 courses of 2 credits each**)				
Skill Development/ Training/ Laboratory Skills/ Project/ Dissertation			**[An exit 4 credit skill enhancement course]**			**[An exit 4 credit skill enhancement course]**
Total credits	**20**	**20**	**4**	**20**	**20**	**4**
Exit Options			**Certificate [44 credits]**			**Diploma [84 credits]**

** The course structure and detailed course contents for Semesters I and II for the batch of students admitted in AY 2022-23 has already been approved in 9th BoS*

Five Year Integrated B.Sc.-M.Sc. (Physics) Programme as per NEP-2020 (3rd and 4th Semesters) to be applicable for batch admitted in AY 2022-23

Detailed Course Contents for Major, Minor and Multidisciplinary Courses_

Semester – III

Major Course - III

Analog Electronics (PHL 2051) (3-0-0)

UNIT-I
Circuit Theory **[10]**

Voltage and Current sources, Conversion of current source to voltage source and vice versa, Series-Parallel Circuits, Voltage Dividers and Current Dividers, Kirchhoff's Laws, Node-Voltage Analysis, Mesh-Current Analysis, Superposition Theorem, Thevenin's Theorem and Norton's Theorem, Thevenin-Norton Conversions.

UNIT-II
PN-Junction Diode and Applications **[10]**

Diode operation, V-I characteristics, Half-Wave Rectifiers, Full-Wave Rectifiers, Power Supply Filters and Regulators, Diode Limiters and Clampers, Zener Diode and its Applications

UNIT-III
Bipolar Junction Transistors **[12]**

Basic BJT Operation, BJT Characteristics and Parameters, BJT Operating Regions, The DC operating point, Voltage divider bias, Other Bias Methods, BJT Amplifier operation, Single stage RC coupled CE-amplifier, Frequency response curve (qualitative)

UNIT-IV
Operational Amplifiers and Oscillators **[13]**

Operational Amplifier, Op-Amp Input modes and Parameters, Bias current and offset voltage, Basic Op-Amp Circuits- Comparator, Summing Amplifiers, Integrator and Differentiators, Concept of feedbacks in Op-Amps, Oscillators, Barkhausen criterion, RC oscillators (Wein-bridge & Phase-shift), The 555 timer as an oscillator.

Reference Books:

1. Electronic Devices, Thomas L. Floyd (9e) (Textbook).
2. Grob's Basic Electronics: Mitchel E. Schultz (11e).

Major Course Lab - III

Analog Electronics Lab
(PHP 2051) (0-0-2)

Every student must perform at least 5 experiments as listed below, however additional experiments can be identified by the course coordinator to complete this requirement.

1. To verify Kirchhoff's Laws (KCL/ KVL).
2. To verify Thevenin's theorem
3. To verify Norton's theorem.
4. To study PN junction diode characteristics (forward & reverse).
5. To draw V-I characteristics of Zener diode and to study it as a voltage regulator.
6. To find the Ripple factor of Half wave rectifier with different filters.
7. To find the Ripple factor of Full wave rectifier with different filters.
8. To draw characteristics of common base NPN/ PNP transistor.
9. To draw characteristics of common emitter NPN/ PNP transistor.
10. To draw the JFET characteristics.

Major Course – IV

Mathematical Methods-I
(PHL 2033) (3-1-0)

UNIT-I
Elements of Probability Theory **[10]**

Probability: Definitions, Simple Properties, Random Variables, Binomial Distribution, Poisson Distribution, Gauss' Normal Distribution

UNIT-II
Vector Analysis **[15]**

Review of Basics Properties of vectors, Vector in 3-D Spaces, Differential Vector Operators (gradient, divergence and curl), Properties of Differential Vector Operators, Vector Integrations- Line, surface and volume integrals, Green's theorem (in a plane), Stoke's theorem, Gauss's divergence theorem

UNIT-III
Coordinate Systems

Unit vectors, displacement vector, area elements and volume elements in Cartesian Coordinates, Plane Polar Coordinates, Spherical Polar Coordinates and Circular Cylindrical Coordinates. **[10]**

UNIT-IV
First Order Differential Equations (ODE)

First Order Equations- Separable equations, Exact differentials, Equations homogeneous in x and y, Linear first order ODE, ODEs with constant coefficients **[10]**

Reference Books:

1. Mathematical Methods for Physicists: Arfken, Weber and Harris (7e) (Textbook).
2. Mathematical Physics: Dass and Verma, S. Chand (8e) 2018

Minor Course – III

Waves and Oscillations
(PHL 2013) (3-0-0)

UNIT-I
Simple Harmonic Motion **[15]**

Differential equation of simple harmonic oscillator, its solution and characteristics, energy in simple harmonic motion, linearity and superposition principle, rotating vector representation of simple harmonic oscillation, motion of simple and compound pendulum (Bar and Kater's pendulum), loaded spring. Superposition of N collinear harmonic oscillations with (1) equal phase differences and (2), equal frequency differences, Beats Superposition of two perpendicular harmonic oscillations: Graphical and Analytical Methods. Lissajous Figures with equal and unequal frequencies, effect of variation of phase.

Unit-II
Damped and Forced Oscillations **[12]**

Damped Oscillations: Equation of motion, dead beat motion, critically damped system, lightly damped system: relaxation time, logarithmic decrement, quality factor
Forced Oscillations: Equation of motion, complete solution, steady state solution, resonance, sharpness of resonance, power dissipation, quality factor.

Unit-IV
Coupled Oscillations **[8]**

Coupled oscillators, normal coordinates and normal modes, energy relation and energy transfer, di-atomic molecules, representation of a general solution as a linear sum of normal modes, normal modes of N coupled oscillators.

Unit-VI
Wave Motion **[8]**

One dimensional plane wave, classical wave equation, standing wave on a stretched string (both ends fixed), normal modes. Travelling wave solution.

Suggested Readings:

1. Vibrations and Waves by A. P. French. (CBS Pub. and Dist., 1987) (Textbook).
2. The Physics of Waves and Oscillations by N.K. Bajaj (Tata McGraw-Hill, 1988).
3. Fundamentals of Waves and Oscillations By K. Uno Ingard (Cambridge University Press, 1988).

Minor Course Lab – III

Waves and Oscillations Lab
(PHP 2013) (0-0-2)

Every student must perform at least 5 experiments as listed below, however additional experiments can be identified by the course coordinator to complete this requirement.

1. Various experiments using bar pendulum.
2. Understand the applications of CRO by measuring voltage and time period of a periodic waveform using CRO. And study the superposition of two perpendicular simple harmonic oscillations using CRO (Lissajous figures)
3. To determine the current amplitude and phase response of a driven series LCR circuit with driving frequency and resistance. Draw resonance curves and find quality factor for low and high damping.
4. Experiments with spring and mass system
   a) To calculate g, spring constant and mass of a spring using static and dynamic methods.
   b) To calculate spring constant of series and parallel combination of two springs.
5. To determine the current amplitude and phase response of a driven series LCR circuit with driving frequency and resistance. Draw resonance curves and find quality factor for low and high damping.
6. To determine the value of acceleration due to gravity using Kater's pendulum for both the cases (a) $T_1 \approx T_2$ and (b) $T_1 \neq T_2$ and discuss the relative merits of both cases by estimation of error in the two cases.
7. Frequency of tuning fork using Sonometer.

Suggested Readings:

1. Advanced Practical Physics for students, B. L. Flint and H. T. Worsnop, 1971, Asia Publishing House.
2. Engineering Practical Physics, S. Panigrahi and B. Mallick, 2015, Cengage Learning India Pvt. Ltd.
3. Practical Physics, G. L. Squires, 2015, 4/e, Cambridge University Press.
4. A Text Book of Practical Physics, Vol I and II, Prakash and Ramakrishna, 11/e, 2011, Kitab Mahal.
5. An Introduction to Error Analysis: The study of uncertainties in Physical Measurements, J. R. Taylor, 1997, University Science Books List of experiments

Multidisciplinary (MD-III)

Elements of Thermodynamics
(PHP 2024) (3-0-0)

UNIT-I
Zeroth Law of Thermodynamics **[10]**

Macroscopic and Microscopic point of view, Thermal equilibrium and Zeroth law, Concept of Temperature, Thermometers and Measurement of Temperature, Ideal-Gas Temperature, Platinum Resistance Thermometry.Rankine and Fahrenheit Temperature Scales.

UNIT-II
First Law of Thermodynamics **[12]**

Work and Heat, Adiabatic Work, Internal-Energy Function, Mathematical Formulation of First Law, Concept of Heat, Differential Form of the First Law, Equation of State of a Gas, Internal Energy of a Real Gas.

UNIT-III
Second Law of |Thermodynamics **[12]**

Conversion of Work into Heat and Vice-Versa, The Diesel Engine, The Steam Engine, Heat Engine, Kelvin-Planck Statement of the Second Law, Equivalence of Kelvin-Planck and Clausius Statements, Entropy and Disorder, Entropy of Ideal Gas, TS diagram, Entropy and Reversibility, Entropy and Irreversibility.

UNIT-IV
Third Law of Thermodynamics **[11]**

Third Law of Thermodynamics, Carnot Cycle, Examples of Carnot Cycles, Carnot Refrigerator, Carnot's Theorem, The Thermodynamic Temperature Scale, Absolute Zero and Carnot Efficiency, Equality of Ideal-Cas and Thermodynamic Temperature.

Reference Books:

1. Heat and Thermodynamics: Zemansky and Dittman 7(e) (Textbook).
2. Heat, Thermodynamics and Statistical Physics: Lal and Subrahmanyam, S. Chand, 2018

Semester -IV

Major Course – V

Digital Fundamentals
(PHL 2052) (3-0-0)

UNIT-I
Number Systems and Logic Gates **[12]**

Number systems and their conversions: Decimal, binary and hexadecimal, binary arithmetic, binary coded decimal, Logic Gates – NOT, AND, OR, NAND, NOR, EX-OR and EX-NOR, Universal property of NAND and NOR gates.

UNIT-II
Boolean Algebra and Logic Simplification **[12]**

Boolean operations and expressions, Laws of Boolean algebra, DeMorgan's Theorems, Boolean analysis of logic circuits, Logic simplification using Boolean algebra, Standard forms of Boolean expressions, Boolean expressions and truth tables.

UNIT-III
Combinational Logic **[11]**

Basic combinational logic circuits, Combinational logic using NAND and NOR gates, Half and Full adders, Parallel binary adders, comparators, decoders, encoders, multiplexers, de-multiplexers, parity generators/ checkers.

Unit-IV
Sequential logic **[8]**

Latches, Flip-Flops- Operating characteristics and applications, one-shots, Astable multivibrators

Reference Books:

1. Digital Fundamentals: Floyd 11(e), Pearson (Textbook).
2. Modern Digital Electronics: R.P. Jain, 4e (2009), TMH.

Major Course Lab- V

Digital Fundamentals Lab
(PHL 2052) (0-0-2)

Every student must perform at least 5 experiments as listed below, however additional experiments can be identified by the course coordinator to complete this requirement.

1. To study performance of a NOT circuit.
2. To verify De Morgan's theorem and some relationships in Boolean algebra.
3. To design OR & AND logic with diode and resistor.
4. To realize basic logic gates with any type of universal gate NAND/NOR.
5. To form different combinational problems by construction of Truth Table and implement it using basic logic gates.
6. To design half adder circuit and to verify its truth table.
7. To design full adder circuit and to verify its truth table.
8. To design half subtractor, full subtractor, adder-subtractor using full adder.
9. To construct i) RS ii) D, and JK FF circuits using NAND gates.

Suggested Books:

1. Digital Fundamentals: Floyd 11(e), Pearson.
2. Modern Digital Electronics: R.P. Jain, 4e (2009), TMH Advanced Practical Physics for Students by Worsnop and Flint.
3. Basic Electronics-A text Lab Manual, Zbar&Malvino, (Tata McGraw-Hill, 1999).

Major Course – VI

Mathematical Methods-II
(PHL 2034) (3-1-0)

UNIT-I
Linear Differential Equations of Second Order **[12]**

Second order linear and no-linear differential equations with constant coefficients, Non-homogeneous and Homogeneous differential equations, Methods to find the complementary function and particular integral.

UNIT-II
Double and Triple Integrals **[12]**

Evaluation of double integration in Cartesian and Polar coordinates, Applications of double integrals in finding area, centre of gravity, mass and volume, Triple integration in Cartesian and Polar coordinates, Applications of triple integrals in calculating volume, area, centre of gravity, mass and moment of inertia

UNIT-III
Fourier Series **[10]**

Periodic functions, Fourier Series, Dirichlet's condition, Useful integrals, Determination of Fourier Coefficients, Fourier series for discontinuous functions, Even and Odd functions, Half-range series, Half period series, Parseval's formula, complex form of fourier series

UNIT-IV
Special Functions **[11]**

Legendre's and Hermite functions- Equation, Polynomials, General solution, Generating function, Orthogonality, Recurrence formulae for each

Reference Books:

1. Mathematical Methods for Physicists: Arfken, Weber and Harris (7e) (Textbook)
2. Mathematical Physics: Dass and Verma, S. Chand (8e) 2018

Minor Course – IV

Measurements and Analysis (2-0-0)
(PHL 2125)

UNIT-I
Some Laboratory Instruments and Methods **[10]**

Metre rule, Micrometer screw gauge, Measurement of length, Measuring frequency, Negative feedback amplifier, Servo systems, Natural limits of measurements

UNIT-II
Experimental Techniques and Logic **[12]**

Rayleigh refractometer, Measurement of resistivity, Measurement of 'g', Measurement of frequency and time, The Global positioning system, Sequence of measurements, Drift, Systematic variations, Relative methods, Null methods, Repetition of measurements

UNIT-III
Uncertainty in Measurements **[11]**

Measuring errors, Systematic and random errors, Set of measurements, Distribution of measurements, Estimation of σ and σ_m, Propagation of errors

UNIT-IV
Data Handling **[12]**

Parent and Sample Distributions, Mean and Standard Deviation of Distributions, The Gaussion distribution, The integral function, The treatment of functions, Method of least squares for fitting a straight line

Suggested Books:

1. Practical Physics: G. L. Squires (4e) Cambridge Universiry Press, 2001 (Textbook).
2. Data Reduction and Error Analysis for Physical Sciences: Bevington and Robinson (3e) McGraw Hill, 2003

Minor Course Lab – IV

Measurements and Analysis Lab (0-0-4)
(PHP 2125)

Course Outcomes:

After completing this course, the students will be able to

- Use various instruments for measurements of physical quantities.
- Use propagation of errors to estimate uncertainty in the outcome of an experiment and perform the statistical analysis of the random errors in the observations.

Choose any 5 experiments from the list given below:

1. To observe the loading effect of a multimeter while measuring voltage across a low resistance and high resistance.
2. To observe the limitations of a multimeter for measuring high frequency voltage and currents.

3. To measure Q of a coil and its dependence on frequency, using a Q- meter.
4. Measurement of voltage, frequency, time period and phase angle using CRO.
5. Measurement of time period, frequency, average period using universal counter/ frequency counter.
6. Measurement of rise, fall and delay times using a CRO.
7. Measurement of distortion of a RF signal generator using distortion factor meter.
8. Measurement of R, L and C using a LCR bridge/ universal bridge.

Suggested Readings:

1. A text book in Electrical Technology - B L Theraja - S Chand and Co.
2. Performance and design of AC machines - M G Say ELBS Edn.
3. Digital Circuits and systems, Venugopal, 2011, Tata McGraw Hill.
4. Digital Electronics, Subrata Ghoshal, 2012, Cengage Learning.
5. Electronic Devices and circuits, S. Salivahanan & N. S.Kumar, 3rd Ed., 2012, Tata Mc-Graw Hill

Multidisciplinary (MD – IV)

Fundamentals of Modern Physics
(PHL 2046) (3-0-0)

UNIT – I
Relativity **[10]**

Special Relativity-Postulates – Time dilation – Doppler effect – Length contraction – Twin Paradox – Relativistic momentum – Mass and energy – Energy and momentum – General relativity

UNIT – II
Matter and Radiations **[12]**

EM waves – Blackbody radiation – Photoelectric effect – X-rays – Diffraction of X-rays– Compton effect – de Broglie waves – Phase and group velocities – Electron diffraction – Uncertainty principle.

UNIT-III
Atomic structure **[10]**

Electron orbits – Atomic spectra – Bohr atom – Energy levels and spectra – Absorption spectra – Finite nuclear mass correction, Sommerfeld model – Bohr's quantization rule, Bohr's correspondence principle, Vector atom model, L-S and j-j coupling.

UNIT-IV
Quantum mechanics **[11]**

Wave equation – Schrödinger equation – Operators – Postulates of quantum mechanics – Particle in a box – Finite potential well – Introduction to quantum tunneling – Harmonic oscillator.

Suggested Books:

1. Concepts of Modern Physics, Arthur Beiser, Tata McGraw Hill, (2002), 6th Edition (Textbook).
2. Introduction to Modern Physics, H. S. Mani and G. K. Metha, Affiliated East-West Press, (1988).
3. Fundamentals of Physics, David Halliday, Robert Resnick and Jearl Walker, John Wiley & Sons, (2004), 7th Edition.

Annexure-IV

School of Physics

Credit breakup as per NEP-2020 &NCrF for Five Year Integrated B.Sc.-M.Sc. (Physics) Programme (upto 2nd Sem.) and detailed contents with CO-PO applicable for batch to be admitted in AY 2023-24

	First Year (Certificate Course in Basic Physics)		Certificate
Semester/ Type of Course	**I**	**II**	
Major Course (Physics) **(4 credits)**	Mechanics **3-0-0 (3 credits) [PHL 1023]** Mechanics Lab **0-0-2 (1 credit) [PHP 1023]**	Electromagnetism **3-0-0 (3 credits) [PHL 1029]** Electromagnetism Lab **0-0-2 (1 credit) [PHP 1029]**	
Minor Course (Physics or Any Discipline) **(4 credits)**	Thermal Physics **3-0-0 (3 credits) [PHL 1024]** Thermal Physics Lab **0-0-2 (1 credit) [PHP 1024]**	Physical Optics **3-0-0 (3 credits) [PHL 1027]** Physical Optics Lab **0-0-2 (1 credit) [PHP 1027]**	
Multidisciplinary (MD) **(3 credits)**	**Basic Instrumentation Skills 1-0-4 (3 credits) [PHE 1025]** is the MD-I offered to other schools. Physics students to choose one course from MD-I offered by other schools	**Energy Sources** **3-0-0 (3 credits) [PHE 1028]** is the MD-II offered to other schools. Physics students to choose one course from MD-II offered by other schools	
Ability Enhancement Course (AEC) **(3 credits)**	Choose one course from the pool of courses from AEC-I: English Language (General), Communication Skills, Mathematical Ability [Inhouse/ Swayam platform] **(3 credits)**	Choose one course from the pool of courses from AEC-II: English Language (General), Communication Skills, Mathematical Ability [Inhouse/ Swayam platform] **(3 credits)**	
Skill Enhancement Course (SEC) **(2 credits)**	Choose one course from the pool of courses from SEC-I [Inhouse/ Swayam platform/ Industry based] **(2 credits)**	Choose one course from the pool of courses from SEC-II [Inhouse/ Swayam platform/ Industry based] **(2 credits)**	
Value Addition Courses (VAC) **(2 + 2 credits)**	Choose two courses from the pool of courses from VAC-I & VAC-II [Inhouse/ Swayam platform] **(4 credits: 2 courses of 2 credits each)**	Choose two courses from the pool of courses from VAC-III & VAC-IV [Inhouse/ Swayam platform] **(4 credits: 2 courses of 2 credits each)**	
Skill Development/ Training/ Laboratory Skills/ Project/ Dissertation			**[An exit 4 credit skill enhancement course]**
Total credits	**20**	**20**	**4**
Exit Options			**Certificate [44 credits]**

School of Physics
Proposed Credit breakup as per NEP-2020 &NCrF for
Five Year Integrated B.Sc.-M.Sc. (Physics) Programme (upto 2nd Sem.) and detailed contents with CO-PO applicable for batch to be admitted in AY 2023-24

Semester - I

Major-1 (Part –A)

Mechanics
(PHL-1023) (3-0-0)

Learning Objectives

This course aims to review the concepts of mechanics learnt at school in a more advanced perspective and progressively builds up new concepts. The students will be able to apply the learnt concepts to many real world problems.

Course Outcomes:

After completing this course, the students will be able to

- *Understand the difference between Inertial and Non-inertial frames of references.*
- *Learn the Galilean invariance of Newton's laws of motion.*
- *Express different types of collisions and related physical quantities in laboratory and centre of mass coordinates*
- *Apply central force motion to describe the motion of planets and satellite in elliptical orbits.*
- *Understand translational and rotational dynamics of the rigid bodies.*

Unit-I
Non-Inertial Systems and Fictitious Forces **[12]**

Unit vectors, Displacement, Velocity, Acceleration, Area and Volume elements in Cartesian and Plane Polar coordinates, Dynamics Using Polar Coordinates; Galilean Transformation; Uniformly Accelerating Systems; The Principle of Equivalence; Physics in a Rotating Coordinate System–Rate of Change of a Rotating Vector, Time Derivative of a Vector, Velocity and Acceleration, Fictitious Forces in a Rotating Coordinate System.

Unit-II
Collisions and Conservation Laws **[10]**

Concept Centre of Mass; Elastic Collision in Laboratory and Centre of Mass Coordinates; Relationship between Displacement, Velocities, Kinetic energies and Angles in Laboratory and Centre of Mass Coordinates.

Unit-III
Central Force Motion **[10]**

Central Force Motion as a One-body Problem; Universal Features of Central Force Motion –Consequences of the Conservations of Angular Momentum and Energy, The Effective Potential, The Formal Solution for Central Force Motion; The Energy Equation and Energy Diagrams; Planetary Motion – Hyperbolic Orbits, Elliptic Orbits and Planetary Motion.

Unit-IV
Rigid Body Motion **[9]**

The Vector Nature of Angular Velocity and Angular Momentum; The Gyroscope; Examples of Rigid Body Motion; Conservation of Angular Momentum; Rigid Body Rotation – Angular Momentum and the Tensor of Inertia, Principal Axes, Rotational Kinetic Energy of a Rigid Body, Rotation about a Fixed Point.

Suggested Books:

1. An Introduction to Mechanics, 2nd Ed., D. Kleppner, R. Kolenkow, McGraw-Hill, 2014 (Textbook).
2. Mechanics, Berkeley Physics, vol.1, C. Kittel, W. Knight, et al., Tata McGraw-Hill, 2007.
3. Mechanics, D.S. Mathur, S.Chand and Company Limited, 2000.

Major-1 (Part –B)

Mechanics lab (PHP-1023) (0-0-2)

Course Outcomes:

After completing this course, the students will be able to

- *Use various instruments for measurements and perform experiments related to rotational dynamics, elastic properties, fluid dynamics, acceleration due to gravity, collisions, etc.*
- *Learn to estimate the error for every experiment performed and report the result of experiment along with the uncertainty in the result up to correct significant figures.*

Choose a minimum of 5 experiments from the list given below:

1. To determine the Young's modulus of material of a metallic bar by bending of beam method.
2. To determine the coefficient of viscosity of highly viscous liquid by Stoke's method.
3. To find the surface tension of water by Jaeger's Method.
4. To determine the value of 'g' using bar pendulum.
5. To determine the Moment of Inertia of a Flywheel.
6. To determine the Elastic constants of a wire by Searle's method.
7. To find modulus of rigidity by Maxwell's needle.
8. To determine the moment of inertia of objects of regular shapes (rod, sheet, cylinder, sphere, spherical shell) and verify the parallel and perpendicular axes theorems.
9. To study oscillations of a bifilar pendulum.

Suggested Books:

1. Advanced Practical Physics for Students, Worsnop and Flint, Methuen & Co. Ltd., 1957.
2. B. Sc. Practical Physics, C. L. Arora, S. Chand., 2001

Minor-1 (Part –A)

Thermal Physics
(PHL 1024) (3-0-0)

Learning Objectives

This course aims to review the concepts of Thermal Physics learnt at school in a more advanced perspective and progressively builds up new concepts. The students will be able to apply the learnt concepts to many real world problems.

Course Outcomes:

After completing this course, the students will be able to

- *Gain the knowledge of the basic concepts of thermodynamics, the zeroth, first, second and third law of thermodynamics*
- *Understand the concept of entropy and the associated real-life phenomena*
- *Explain Maxwells' thermodynamic relations and their applications*
- *Understand thermodynamical potentials and their significance*
- *Describe various methods of liquefaction of gases*

Unit-I
Thermodynamics-I **[10]**

Thermodynamic system, Zeroth law of thermodynamics, concept of heat, thermodynamic equilibrium, work and their path-dependence, internal energy, First law of thermodynamics, specific heat of a gas, applications of first law of thermodynamics, work done during the isothermal and adiabatic process, reversible and irreversible process, heat engine, definition of efficiency, carnot's ideal heat engine.

Unit-II
Thermodynamics-II **[10]**

Second Law of thermodynamics, carnot's theorem, steam engine, internal combustion engine, diesel engine, multi-cylinder engine, concept and physical significance of entropy, change in entropy, principle of increase of entropy, T-S diagram, thermodynamical scale of temperature. Third law of thermodynamics, zero point energy.

Unit-III
Thermodynamical relations **[10]**

Thermodynamic variables, extensive and intensive variables, Maxwell thermodynamical relations and their applications, clausius-clapeyron's equations, thermodynamical potentials and significance, relation of thermodynamical potentials with their variables, relation between C_p, C_v and μ, adiabatic stretching of a wire, Joule-Kelvin coefficient, Phase transitions.

Unit-IV
Liquefaction of gases **[10]**

Methods of Liquefaction of gases, method of freezing mixture, cooling by evaporation under reduced pressure, cooling by adiabatic expansion, Joule-Thomson expansion, regenerative cooling, liquefaction of air, principle of cascade cooling, liquefaction of various gases including helium I and II, production of low temperature, conversion of magnetic temperature into Kelvin temperature, measurement of very low temperature, superconductivity and Meissner effect.

Suggested Books:

1. Heat, thermodynamics & statistical physics, Lal and Subrahmanyam, S Chand, 2018 (Textbook).
2. Thermal physics, Robert F. Sekerka, Elsevier, 2015.

Minor-1 (Part –B)

Thermal Physics Lab
(PHP 1024) (0-0-2)

Course Outcomes:

After completing this course, the students will be able to

- *Use various instruments for thermal measurements and perform experiments related to thermometry, heat transfer, thermal expansion, thermocouple etc.*
- *Learn to estimate the error for every experiment performed and report the result of experiment along with the uncertainty in the result up to correct significant figures.*

Choose a minimum of 5 experiments from the list given below:

1. To determine the thermal conductivity of a bad conductor by the Lee's disc method.
2. To determine the ratio of the specific heats of air by Kundt's tube method.
3. To determine the thermal conductivity of a good conductor by Searle's method.
4. To determine the value of Stefan's constant.
5. To determine the specific heat of a liquid by the method of Newton's law of cooling correction.
6. To find the latent heat of fusion of ice by the method of mixture.
7. To determine specific heat of bad conductor by method of mixture.
8. To find the thermal conductivity of rubber.
9. To study the heating efficiency of electrical kettle with varying voltages.
10. To measure the thermo emf of a given thermo couple.
11. To study the thermal behavior of an electric bulb (filament/torch light bulb).
12. To study of variation of resistance with temperature - thermistor.
13. To verify Stefan's law using a torch bulb.
14. To determine the coefficient of thermal expansion of a metallic rod using an optical lever, mutual inductance between a pair of coils using a ballistic galvanometer.

Suggested Books:

1. Practical Physics by G L Squires Cambridge University Press, 2001.
2. An Advanced Course in Practical Physics by D. Chattopadhyay, P.C. Rakshit, New Central Book Agency, 1990.
3. B. Sc Practical Physics by C. L. Arora, S. Chand, 2001.

Basic Instrumentation Skills
(PHE 1025) (1-0-4)

Learning Objectives:

This course aims at enabling the students to be familiar with various electrical measuring instruments through theoretical understanding and hands-on practice sessions

Course Outcomes:

After completing this course, the students will be able to

- *Measure uncertainties in measurements from experiments and identify them either as systematic or random errors*
- *Understand the measuring principles of ac/dc voltages and currents*
- *Gain knowledge of the working principle of electronic devices such as signal generators, multimeter and CRO and their use in generating and measuring ac/dc signals*
- *In laboratory course, the students are expected to perform experiments based on the concepts developed in the theory classes*

Unit-I
Errors in Experiments **[8]**

Accuracy and precision, Significant figures, Types of error- systematic errors, and random errors, source of errors in measuring instruments, Uncertainties types, propagation of uncertainties

Unit-II
Measurement Principles **[10]**

Principles of measurement of dc voltage and dc current, ac voltage, ac current and resistance

Unit-III
Analysis Instruments: **[12]**

Multimeter, Specifications of a multimeter, Multimeter accuracy and resolution, Low frequency signal generator- block diagram and specifications, Cathode ray oscilloscope (CRO)- block diagram, Vertical and horizontal deflection systems, Use of CRO in voltage, time period and frequency measurements.

Suggested Books:

1. H. Cooper: Modern electronic instrumentation and measurement techniques, Pearson Education, 2005 (Textbook).
2. P. Holman: Experimental Methods for Engineers 7th Edition. McGraw Hill, 2000
3. H. S. Kalsi: Electronic Instrumentation, Tata McGraw Hill, 2006

Laboratory Component:

Choose a minimum of 8 experiments from the list given below:

1. To calibrate galvanometer into an ammeter/ a voltmeter of given range.
2. To design a multirange ammeter/ voltmeter.
3. To convert an ammeter into voltmeter.
4. To observe the loading effect of a multimeter while measuring voltage across a low and a high resistance.
5. To observe the limitations of a multimeter for measuring high frequency voltage and currents.
6. To monitor waveform and to measure Amplitude, Frequency and Period of an AC signal.

7. To measure Amplitude, Frequency and Period of a Signal with both DC and AC components.
8. To measure Frequency Ratio using Lissajous Figures in a CRO.
9. To measure Phase Difference using CRO by studying relationship between Lissajous Figures and Voltage-Time.
10. To measure rise, fall and delay times using a CRO.
11. To study the use of Dual slope oscilloscope.

Suggested Books:

1. H. Cooper: Modern electronic instrumentation and measurement techniques, Pearson Education, 2005
2. H. S. Kalsi: Electronic Instrumentation, Tata McGraw Hill, 2006.

Semester II

Major-2 (Part –A)

Electromagnetism
(PHL 1029) (3-0-0)

Learning Objectives

This course aims at familiarizing the students with the fundamental concepts and laws in electricity and magnetism using standard mathematical tools and applying the knowledge of gained in this field to explain natural physical processes and related technological advances.

Course Outcomes:

After completing this course, the students will be able to

- *Use an understanding of calculus along with physical principles to effectively solve problems encountered in everyday life.*
- *Gain knowledge on the concepts of electrostatics, electric potential, energy density and their applications.*
- *Understand concepts of Magnetostatics, magnetic flux density, scalar and vector potential and its applications.*
- *Explore the dielectric and magnetic properties of matter.*
- *Understand the relation between electric and magnetic fields.*

Unit I
Electrostatics **[15]**

Electric field and Coulomb's Law, Continuous Charge Distribution, Field Lines, Flux, Gauss's Law, Divergence of E, Applications of Gauss law, Curl of E, Electric Potential, Poisson's equation and Laplace's equation, The potential of a Localized Charge Distribution, Work done to move a charge, Energy of a point charge and that of a continuous charge distribution, Multipole expansion

Unit II
Electric Fields in Matter **[10]**

Polarization of Dielectrics, Polarization vector P, The field of a polarized object, Bound charges and their physical interpretation, The field inside a dielectric, The electric displacement, Gauss's law in presence of dielectrics, Boundary conditions for E, Susceptibility, Permittivity and Dielectric Constant

Unit III
Magnetostatics **[10]**

Lorentz Force Law, Lline current, Surface current and Volume current densities, Equation of continuity, Biot-Savart's law, Div B, Curl B, Applications of Ampere's Law, Magnetic vector potential A, Boundary conditions for B, Multipole Expansion

Unit IV
Magnetic Fields in Matter **[10]**

Magnetization- Dia-, Para- and Ferro- magnets, The field of magnetized object, Bound currents and their physical interpretation, The magnetic field inside the matter, Auxiliary magnetic field H, Ampere's law in magnetic materials, Boundary conditions for H, Magnetic susceptibility and Permeability

Suggested Books:

1. Introduction to Electrodynamics, D. J. Griffiths, Pearson (Textbook).
2. Schaum's Outline of Electromagnetics, 4th Ed., J. A. Edminister, TMH

64

Electromagnetism Lab
(PHP 1029) (0-0-2)

Course Outcomes:

After completing this course, the students will be able to

- *Use various instruments for measurements and perform experiments related to electricity and magnetism.*
- *Learn to estimate the error for every experiment performed and report the result of experiment along with the uncertainty in the result up to correct significant figures.*

Choose any 5 experiments from the list given below:

1. To determine e/m ratio by Millikan's Oil-drop method.
2. To verify Biot-Savart's law.
3. To measure field strength B and its variation in a Solenoid (determine dB/dx).
4. To find Capacity of a Capacitor by Electrical vibrator.
5. Find Horizontal component of Earth's magnetic field by using vibration and deflection magnetometer.
6. To find Self-inductance by Anderson's bridge.
7. To calibrate a ballistic galvanometer.
8. To determine the mutual inductance between a pair of coils using a ballistic galvanometer.

Suggested Books:

1. Practical Physics by G L Squires ,Cambridge University Press.
2. Advanced Practical Physics for Students by Worsnop and Flint.
3. B. Sc Practical Physics by C. L. Arora.

Minor-2 (Part –A)

Physical Optics
(PHL-1027) (3-0-0)

Learning Objectives

This course aims at providing the students an understanding of wave nature of light to describe different optical phenomenon like interference, diffraction, polarization and stimulated emission observed in everyday life

Course Outcomes:

After completing this course, the students will be able to

- *Understand the phenomenon of interference using division of wavefront and division of amplitude techniques*
- *Gain the knowledge of Fresnel's and Fraunhofer's diffraction observed in slits, straight edge, circular aperture, rectangular aperture and diffraction grating.*
- *Determine the resolving power of telescopes, microscopes and gratings.*
- *Gain an insight into the phenomenon of polarization and by singly and doubly refracting crystals*
- *Understand the Lasers principles, characteristics, uses and types..*

Unit –I
Interference **[12]**

Interference of light, conditions for interference, Young's double slit experiment, division of wavefront - Fresnel's biprism & mirror and Lloyd's Mirror. Interference by division of amplitude – plane parallel film, wedge shaped film, Newton's Ring. Interferometer - Michelson and Fabry-Perot.

Unit –II
Diffraction **[12]**

Introduction to diffraction. Fresnel's and Fraunhofer's class of diffraction. diffraction by a rectangular aperture, circular aperture, single slit, n slits, diffracting grating and single edge. Resolving Power of Optical Instruments - Rayleigh's criterion and resolving power of telescope, microscope & grating.

Unit –III
Polarization **[10]**

Introduction to polarization of light, circular and elliptical polarized light, production of plane polarized light, production and detection of circular and elliptically polarized light, applications of polarization, Optical Rotation - Fresnel's explanation of optical rotation and Half Shade & Biquartz polarimeters.

Unit –IV
Lasers **[11]**

Introduction and evaluation of lasers, laser principles, process absorption & emission, Characteristics and uses of Lasers. Laser operation- population inversion & derivation of threshold, gain medium (active medium),. Conditions for Laser action and Einstein's coefficients. Three and four level laser systems (qualitative discussion). Types of laser including their working

66

Suggested Books:

1. A text book of optics, N Subrahmanyam et. al. S. Chand, 2004 (Textbook).

2. Introduction to optics, Nkoma & Jain, "Mkuki Na Nyota, 2019.
3. Lasers & optical instrumentation, Nagabhushana & Sathyanarayana, I K International, 2010.

Minor-2 (Part –B)

Physical Optics Lab (PHP-1027) (0-0-2)

Course Outcomes:

After completing this course, the students will be able to

- *Use various instruments for measurements and perform experiments related to geometrical optics, interference, diffraction and polarization.*
- *Learn to estimate the error for every experiment performed and report the result of experiment along with the uncertainty in the result up to correct significant figures.*

Choose a minimum of 5 experiments from the list given below:

1. To determine refractive index of a transparent liquid using a travelling microscope.
2. To determine the refractive index of the material of a convex lens by measuring its focal length and radii of curvature.
3. To determine refractive index of a liquid with the help of a convex lens and a plane mirror.
4. To determine of the focal length and power of a convex lens by u-v method.
5. To find refractive index of water by using hollow prism.
6. To find wave length of Sodium light using Newton's Rings.
7. To find the radius of curvature of plano-convex lens using Newton's rings experiment, given λ=5893A°.
8. To determine the refractive index of a liquid by using Newton's rings apparatus.
9. To find wave length by using Diffraction Grating.
10. To determine the wavelength of monochromatic light by Fresnel's biprism.

Suggested Books:

1. Practical Physics by G L Squires Cambridge University Press, 2001.
2. A Text Book of Practical Physics, S.K. Ghosh, New Central Book Agency, 2015.
3. B. Sc Practical Physics by C. L. Arora, S. Chand, 2001.

Energy Sources
(PHL 1028) (3-0-0)

Learning Objectives

This course aims at providing a review of the most important renewable energy resources and the technologies for harnessing these resources within the framework of a broad range of primitive to contemporary world energy systems.

Course Outcomes:

After completing this course, the students will be able to

- *Describe sources and uses of energy.*
- *Differentiate between and provide examples of renewable and non-renewable sources of energy.*
- *Explain general ways to save energy at a personal, community and global level.*
- *Describe some general characteristics of solar power, hydropower and wind power.*
- *List out the benefits and disadvantages to using renewable resources.*

Unit-I **[12]**
Types of sources

Introduction to Energy, conservation and various forms such as heat (thermal), light (radiant), mechanical, electrical, chemical, and nuclear energy. Conventional energy sources such as natural gas, oil, coal, or nuclear. Global scenario of energy sources. Renewable Energy Scenario. Energy resources and their utilization, national grid for the gas distribution, gas conservation, nuclear power programme, energy parameters, and rational use of energy, energy efficiency and conversion.

Unit-II **[8]**
Energy and Environment

Introduction to environmental aspects of electric energy generation- atmospheric pollution, hydrocarbons, particulates, thermal pollution, hydroelectric projects, nuclear power generation and environment, operational safety in nuclear plants and disposal of waste, impact of renewable energy generation on environment, cost of electricity production from various sources

Unit-III **[8]**
Solar Energy harvesting

Solar radiation and its measurement, solar thermal energy collectors, solar thermal energy conversion systems, solar photovoltaic system

Unit-IV **[12]**
Energy resources technology

Different types of energy source technologies- Wind energy, small hydropower energy, geothermal energy, ocean energy, biomass energy, fuel cells.

Note: *As a part of this course students shall be encouraged to do self-studies on various topics of their interest based on but not limited to various energy models, field visits to various plants etc.*

Suggested Books:

1. Renewable energy sources and technologies, Kothari, Singal & Ranjan, PHI, 2011 (Textbook).
2. Godfrey Boyle, "Renewable Energy, Power for a sustainable future", Oxford University Press, in association with The Open University, 2004.

Annexure-V

Additional Pre-Ph.D. Courses

Nanomaterials: Properties and Applications (PHL 9193) (4-0-0)

UNIT I: **[12]**
Nanomaterials - An introduction

Size and surface effects, Types of nanomaterials - Clusters, Semiconductor nanoparticles, Effective mass approximation, Plasmonic materials, Nanomagnetic materials, Magnetic oxide materials

UNIT-II **[14]**
Optical properties of nanomaterials

Adjustment of the Index of Refraction, Optical properties related to quantum confinement, Quantum dots and other lumophores, Special luminescent nanocomposites, Electroluminescence, Photochromic and Electrochromic materials

UNIT-III **[12]**
Magnetic Properties of nanomaterials

Superparamagnetic materials, Susceptibility and related phenomena in Superparamagnets, Applications of Superparamagnetic materials, Exchange coupled magnetic nanoparticles

UNIT IV **[10]**
Mechanical properties of nanomaterials

Bulk metallic and ceramic materials, Influence of porosity, Influence of grain size, Superplasticity, Filled polymer composites.

UNIT-V **[12]**
Energy efficient devices

Photovoltaic cells, Fuel cell, Hybrid energy cells, Automobiles, Sports and toys, Textiles, Cosmetics, Medical field, Agriculture and food, Domestic appliances, Space and Defense

Suggested Readings:

1. Nanomaterials - An Introduction to Synthesis, Properties, and Applications: Dieter Vollath (2e) WILEY-VCH, 2013
2. Nanotechnology: Principles and Practices: Sulabha K. Kulkarni (3e) Springer, 2015

Synthesis of Nanomaterials: Methods & Technology (PHL-9194) (4-0-0)

UNIT-I
Physical Methods-I **[12]**

Introduction, Factors affecting synthesis of nanoparticles, Mechanical Methods-Ball Milling, Melt Mixing, Physical Vapour Deposition, Ionized Cluster Beam Deposition, Laser Vapourization (Ablation), Laser Pyrolysis

UNIT-II
Physical Methods-II **[14]**

Sputter Deposition DC Sputtering, RF Sputtering, Magnetron Sputtering, ECR Plasma Deposition, Chemical Vapour Deposition (CVD), Electric Arc Deposition, Ion Beam Techniques (Ion Implantation), Molecular Beam Epitaxy (MBE)

UNIT-III
Chemical Methods-I **[12]**

Colloids and Colloids in Solutions, Nucleation and Growth of Nanoparticles, Synthesis of Metal Nanoparticles by Colloidal Route, Synthesis of Semiconductor Nanoparticles by Colloidal Route

UNIT-IV
Chemical Methods-II **[12]**

Langmuir-Blodgett (LB) Method, Microemulsions, Sol-Gel Method, Combustion Synthesis, Hydrothermal Synthesis, Sonochemical Synthesis, Microwave Synthesis

UNIT-V
Self Assembly **[10]**

Mechanism of Self Assembly, Some Examples of Self Assembly, Self Assembly of Nanoparticles Using Organic Molecules, Self Assembly in Biological Systems, Self Assembly in Inorganic Materials

Suggested Readings:

1. Nanotechnology: Principles and Practices: Sulabha K. Kulkarni (3e) Springer, 2015
2. A Textbook of Nanoscience and Nanotechnology: T. Pradeep, Tata McGraw Hill Education, 2012

20

Material Characterization Techniques and Applications (PHL-9195) (4-0-0)

Unit-I
X-Ray Diffractometry **[12]**

X-ray Diffractometer- general features, X-ray optics- Bragg–Brentano geometry, Detectors- proportional counters, Counting efficiency, Energy resolution, Energy-dispersive diffractometry, Position-sensitive diffractometry, Debye-Scherrer powder method

Unit-II
X-Ray Diffraction Analysis **[15]**

Phase Identification- Basic principles, Identification of single phase samples, Identification of phases in mixtures, Computerized search match, Determination of crystal structure, Preliminary treatment of data, Indexing patterns of cubic and non-cubic crystals, Determination of the number of atoms in a unit cell, Determination of atom positions, Simple examples of structure determination

Unit-III
IR Spectroscopy **[12]**

Introduction, Molecular formulas and their role, Infrared absorption process, use of infrared spectrum, various modes of stretching and bending, Infrared spectrometer (dispersive and FT spectrometer), preparation of sample, Analysis of spectra with examples (various functional groups)

UNIT-IV
UV-Vis Spectroscopy **[10]**

Introduction, Beer-Lambert law, Spectrophotometers- Optical system, Light sources for UV-Vis spectroscopy, Diffuse reflectance spectroscopy and its analysis- Kubelka-Munk function, Tauc-plot, Optical band gap and Urbach energy calculation.

UNIT-V
Luminescence Technique **[11]**

Introduction, Classification of Luminescence, Basic Mechanisms of Photoluminescence-Excitation and Emission Spectra, Features of Rare Earth (RE) Ions with Respect to Luminescence, Excitation by Energy Transfer, Rare Earths Energy Levels and Transitions, Energy Transfer

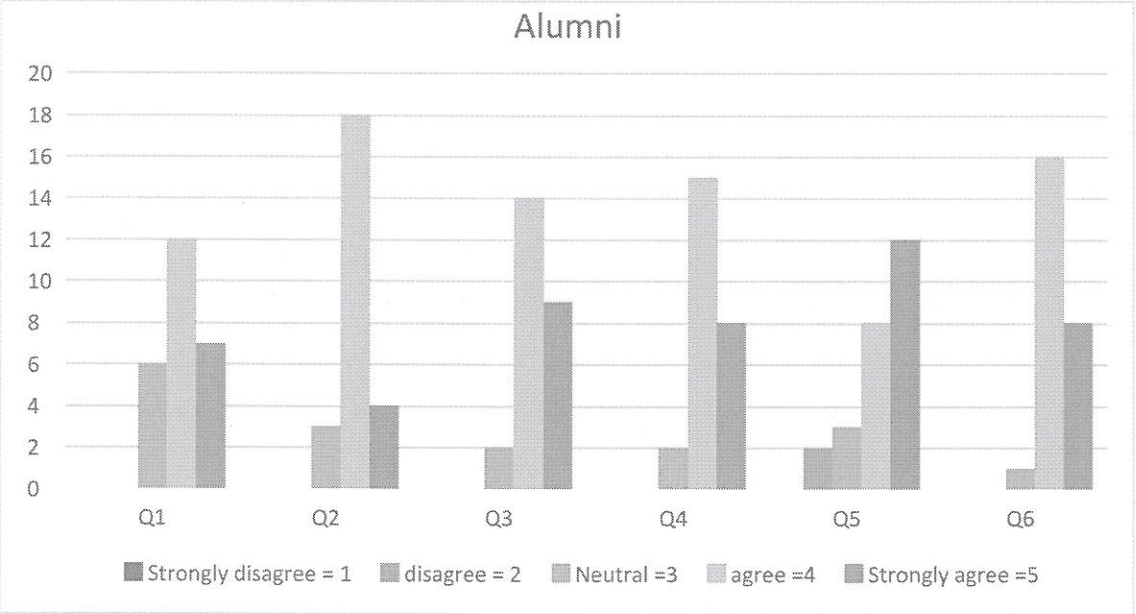
Suggested Readings:

1. Elements of X-Ray Diffraction, B.D. Cullity (3e) Pearson, 2014
2. Introduction to Spectroscopy, Pavia (3e) Thomson Learning, 2001
3. UV-VIS Spectroscopy and Its Applications, Heinz-Helmut Perkampus (1e) Springer-Verlag
4. Phosphate Phosphors for Solid-State Lighting, Shinde & Dhoble (1e) Springer, 2012

ANNEXURE-VI

Regarding feedback of all stakeholders on Curriculum development.

Alumni Feedback on Curriculum

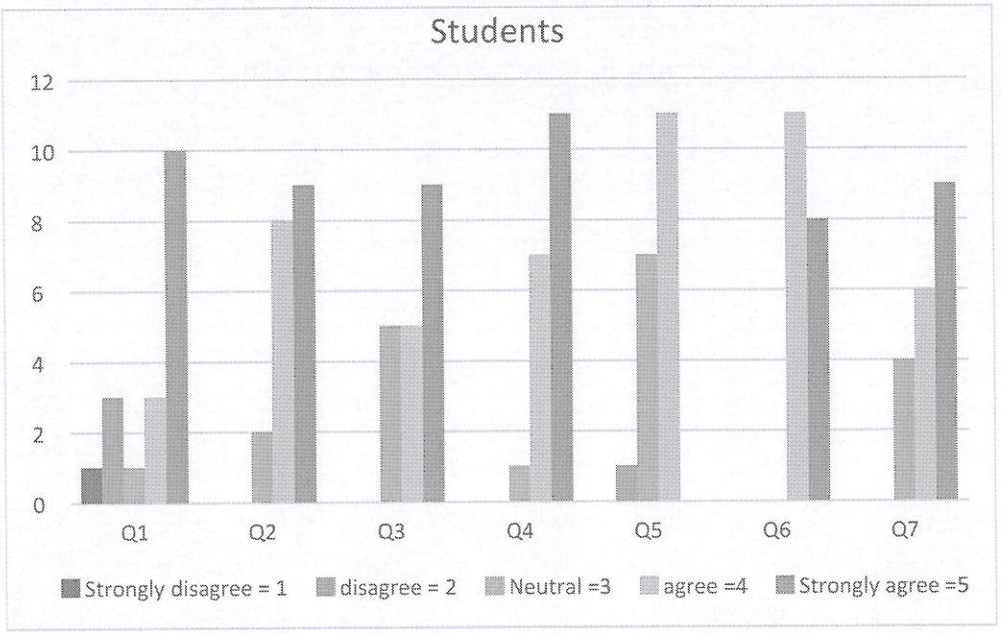


1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, and 5 = strongly agree.

S.No.	Question	1	2	3	4	5
1.	The current syllabus is adequately updated from the one followed during your course of study.					
2.	The curriculum has the ability to find solutions to real-life/practical problems in industry and academia.					
3.	The curriculum has reasonable practical and laboratory skills.					
4.	The curriculum has relevance to societal needs and has components with respect to professional ethics and Human values.					
5.	The curriculum is updated according to recent trends and developments.					
6.	The course curriculum fulfilled your expectations.					

72

Students Feedback on Curriculum



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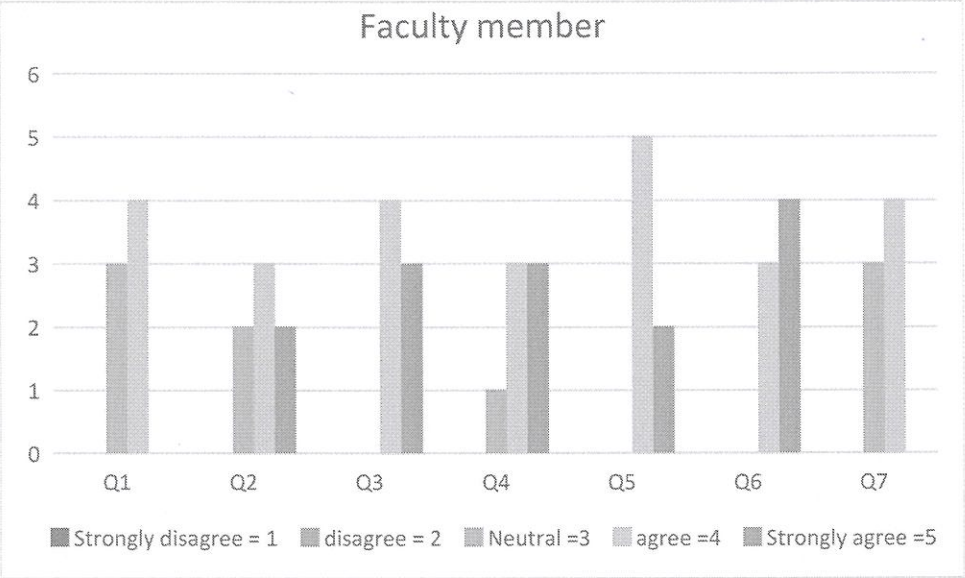
S. No.	Question	1	2	3	4	5
1.	The current syllabus is adequately updated from the one followed during your course of study.					
2.	The curriculum has the ability to find solutions to real-life/practical problems in industry and academia.					
3.	The curriculum has reasonable practical and laboratory skills.					
4.	The curriculum has relevance to societal needs and has components with respect to professional ethics and Human values.					
5.	The curriculum is updated according to recent trends and developments.					
6.	The course curriculum fulfilled your expectations.					

Teacher Feedback on Curriculum



1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, and 5 = strongly agree.

S. No.	Question	1	2	3	4	5
1.	Syllabus is need based with respect to the recent advancements.					
2.	Objectives and Outcomes of the syllabi are well defined and clear to teachers and students.					
3.	The books prescribed/listed as reference materials are relevant and updated.					
4.	The curriculum has good balance between theory and Lab.					
5.	The course content of the subjects improved student's knowledge and perspective.					
6.	The syllabus is sufficient for the preparation of other National level competitive Examinations.					
7.	Curriculum equipped you with the necessary technical skills and hands-on experience required by the industry and academia.					

74