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DEPARTMENT OF CHEMISTRY

(Dr. Bhimrao Ambedkar University)

Institute of Basic Science,
Khandari, Agra

Minutes of the Chemistry Department Academic Committee

The minutes of the meeting of the Academic Committee in Chemistry held on 14-05-2022 at 11.30 a.m. in the Department of Chemistry, Institute of Basic Science, Khandari, Agra. The following members attended the meeting in online and offline mode :

1- Prof. Ajay Taneja, Head, Dept. of Chem. I.B.S., Khandari, Agra (Convener)
2- Dr. Gautam Jaiswar, Associate Prof., Dept. of Chemistry, IBS
3- Dr. Devendra Kumar, Associate Prof., Dept. of Chemistry, IBS (in place of Assist. Prof.)
4- Dr. Susan Verghese, Head, Dept. of Chemistry, St. John's College, Agra.
5- Prof. Rohit Srivastava, Head, Dept. of Chemistry, D.E.I., Agra
6- Prof. P.M.S. Chauhan, C.D.R.I. Lucknow (Online)

1. The committee read and confirmed the minutes of the last meeting held on 08-01-2021and sub committee meeting held on 28-01-2022.
2. University B.Sc. Chemistry syllabus and ordiances was adopted as such. (Annexun-I)
3. Committee approved the syllabus of M.Sc. Chemistry framed as per (NEP) National Education Policy for 20 seats in the Department.
4. Committee also approved the syllabus of PGDR (Six month course) framed as per (NEP) National Education Policy.

After performing the above business Prof. Ajay Taneja gave vote of thanks to the members of the Committee.

(Dr. Susan Verghese) 14/05/22

(Prof. Rohit Srivastava) 14/5/2022

Online
(Prof. P.M.S. Chauhan) 14/5/22

(Prof. Ajay Taneja)

(Dr. Gautam Jaiswar)

(Dr. Devendra Kumar)

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Annexure –I

The committee also accepted course structure, syllabus and ordinance (Govt. order no. 401/70-3-2022 dated 09-02-2[illegible]2 National Education Policy-2020) framed by State Govern[illegible]ent / Unive[illegible]ty for B.Sc. programme and also decided that B.Sc. in the [illegible]biect of C[illegible]nistry shall be started from the session -2022-23 in the Dep[illegible]tmer[illegible] Chemistry, Institute of Basic Science, Khandari, Agra .

14/5/22
(Dr. Susan Verghese)

14/5/22
(Dr. Devendra Kumar)

14/5/22
(Prof. Ajay Taneja)

14.5.22
(Dr. Gautam Jaiswar)

Registrar
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AR (Academic)
21/5/22

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DR. BHIMRAO AMBEDKAR UNIVERSITY, AGRA

(Formerly Agra University, Agra)

Prof. B.P. Singh
HEAD

Department of Physics
Institute of Basic Sciences
Khandari, Agra-282002
Phone: 9837019242, 8394900007
E-Mail: drbps.ibs@gmail.com

22-04-2022

To,

1- **External Expert**: Prof. Sukhdev Rai,
Dayalbagh Educational Institute, Agra

2- **External Expert**: Dr. S.N. Dolia,
Physics Department, Rajasthan University, Jaipur.

3- **Local Expert Member**: Dr. Gaurang Mishra
Physics Department, Agra College, Agra

4- **Internal Expert**: Prof. Bindu Shekhar Sharma,
Physics Department, Institute of Basic Sciences, Khandari, Agra.

Dear Sir,

It gives me pleasure to inform you that you are an expert member of the Academic Committee of Physics Department, Institute of Basic Sciences, Dr. Bhimrao Ambedkar University, Khandari Campus, Agra. A meeting of the Academic Committee has been fixed on 29th April, 2022 at 03:00 PM in the Department of Physics, Institute of Basic Sciences, Khandari Campus, Agra.

You are requested to kindly attend the meeting of the Academic Committee as per program. You can also join the meeting online. The link for the meeting will be send you on the same day before on your e-mail and on your mobile no.

With best regards,

Yours faithfully,

BP Singh

Prof. B.P Singh

HOD & Convener

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PHYSICS DEPARTMENT

INSTITUTE OF BASIC SCIENCES

DR. B.R. AMBEDKAR UNIVERSITY,

KHANDARI CAMPUS, AGRA

AGENDA OF ACADEMIC COMMITTEE MEETING OF PHYSICS DEPARTMENT TO BE HELD ON 13-01-2021

The following items shall be considered:

1. Minutes of last meeting of the Academic Committee dated 12-01-2021 to be confirmed.

2. To revise the syllabus and ordinances of Pre-Ph.D. Course Work /PGDR (Physics) and M.Sc. (Physics) Course according to National Education Policy 2020 (NEP-2020).

3. Proposal for the beginning of Undergraduate course (B.Sc./I,II,III Year) in Physics with the collaboration of other faculty subjects.

4. Panel of Experts for thesis evaluation of following Ph.D. students
   1. Ms. Shalini Dubey.
   2. Rishi Kant Saxena

BP Singh

Prof. B.P Singh

HOD & Convener

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Dr. BHIMRAO AMBEDKAR UNIVERSITY, AGRA

Under Graduate Programmes
Ordinance 2021 under New Education Policy
for
(BA, B.Sc and B.Com)

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1. Applicability

These ordinances shall apply to all four-year, eight semesters, Under-Graduate (UG) Programmes leading to the award of B.A./ B.Sc./ B.Com. Degrees in the Dr. Bhimrao Ambedkar University, Agra from the session 2021-2022. The ordinances shall be read in conjunction with the directions issued by the University which are appended with these ordinances.

2. Definitions of Key Words

a) Academic Year: Two consecutive semesters, one odd and one even semester shall constitute one academic year.

b) Choice Based Credit System (CBCS): The CBCS provides choice for students to select from the prescribed courses (core, elective, value added, co-curricular, skill development intra-departmental and inter-departmental.

c) Course: Sometimes referred to, as 'papers' is a component of a programme. A course is designed to comprise lectures/ tutorials/laboratory work/field work/outreach activities/project work/vocational training/viva/seminars/term papers/assignments/presentations/self-study etc. or a combination of some of these.

d) Credit: A unit by which the weightage of course work is measured. It determines the number of hours of instructions required per week. One credit is equivalent to one hour of teaching (lecture/tutorial) or two hours of practical work/field work per week.

e) Semester Grade Point Average (SGPA): It is a measure of academic performance in a semester

f) Cumulative Grade Point Average (CGPA): It is a measure of overall cumulative academic performance of a student.

g) Letter Grade: It is an index of the performance of students in a said course. Grades are denoted by letters O, A+, A, B+, B, C, P, F and AB.

h) Grade Point: It is a numerical value allotted to marks obtained in a course.

i) Grade/Score Card: The grade cards will be given to all students at the end of any semester of a program and also on improvement of grades. It will display the course details (code, title, number of credits) grade points obtained in each course, and SGPA/CGPA.

j) Programme: An academic programme leading to award of a Certificate, Diploma, Degree or Degree with Research.

k) Faculty – Student own faculty will be the faculty from which he selects two major courses.

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l) Semester: Each semester will normally consist of academic work equivalent to 90 working days(15 weeks)including examination/evaluation. The odd semester will be from July/August to December and even semester from January to May/June in every academic year.

m). Transcript: The Transcript issued on successful completion of all semesters of a program will display the course details (code, title, number of credits) and grade points obtained in each course, and CGPA.

3. Types of Courses

a) Core (Major) Course:-Core (Major) course is a course which is compulsory for a student to study, if s/he has chosen that subject as Major.

b) Elective (Minor) Course:- Elective **(Minor)** course is a course which can be chosen from a pool of elective courses offered in the programme. It can be a major course of other subject.

c) Credited Value-Added Course: These courses add value through enhanced employability skills and have credits assigned to them and may be offered through Vocational and Co-curricular courses. These courses will be counted for calculation of SGPA/CGPA.

d) Non-credited Value-Added Course: These courses may be offered to add value through enhanced employability skills but do not have credits assigned to them. The performance in these courses shall not be counted for computation of 'SGPA' and 'CGPA'.

f) Vocational / Skill development Course: These courses will be offered by the Departments/Colleges in different Faculties as value added courses for enhancing employability. They will be of two types' Individual nature and progressive nature. There will be a capping on the maximum number of students in a particular course as specified by the department/colleges concerned.

g) Co-curricular Course: These courses will be offered by the Departments/Institutes in different Faculties of the University as value added courses for overall personality development in first six semesters. They will be fixed for each semester as prescribed in regulations /guidelines of University New education Policy (NEP). They will be qualifying in nature and their grades will not be added in CGPA.

h) Internship: All students of Under Graduate Programmes shall be required to undertake an Internship/Term-Paper during the summer vacation between fourth and fifth semester, carrying credits as specified by BOS.

i) Online courses / MOOCs: The student will have the freedom to choose a similar course of equal credits from MOOCs, SWAYAM portal of UGC/Ministry of education in place of a Course offered in the semester as specified by the Department. MOOC/SWAYAM courses may be opted depending upon the availability on the government approved portal. Online papers credit maximum of 20 % of the total credits required for that course could be earned in minor/elective papers from this mode and those credits have to be added by the University in their SGPA/ CGPA.

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j) Dissertation/ Major Project: All students of UG Programmes shall be required to prepare a Dissertation/Major Project in the eighth semester.

4. Minimum Eligibility Requirement and process of Admission

4.1 Minimum Eligibility Requirement: A certificate of successfully completing Class XII or equivalent from any Board recognised by the State or Centre Government shall constitute the minimum prerequisite requirement for admission to the under graduate degree programmes. The respective regulations may lay down additional or higher requirements.

4.2 Admission Process: The admission of Indian Nationals shall be based on entrance test or academic merit or a combination of the two and reservation/weightage in admissions shall be as per the UP-Government rules. However, Foreign Nationals applying for admission through authorised channels shall be eligible for direct admission with a maximum capping as per University norms.

5. Program Duration and Credit Requirements

a) The under graduate degree programmes shall be spread over eight semesters (4 academic years).

b) The maximum duration for completing the certificate in faculty is 4 years, diploma in faculty is 3 years after certificate, Bachelor of faculty is 3 years after diploma and Bachelor (research) in faculty is 2 years after Bachelor of faculty in under graduate degree programme. These will be consecutive academic years.

6. Course Structure

The course structure and course outlines of the under graduate degree programmes shall be as per the respective Regulations recommended by the respective Board of Studies and ratified by the competent authority.

7. Attendance Requirement

Students with less than 75% attendance shall not be eligible to appear in the End of Semester Examination. However, in exceptional cases, the Principal/ Vice chancellor may grant a relaxation in the minimum attendance requirement by not more than 15 % on the basis of genuine reason.

8. Examination(s) and Assessment /Evaluation:

8.1a In each semester from Vth to VIIIth Student have to do research project, In third year (Vth and VIth semester) it will be a minor project and in fourth year(VIIth and VIIIth) it will be a major project. This project should be from any of the two subjects taken for that semester. This project can be interdisciplinary or in the form of Industrial training /Internship/ or Survey. Research project will be done under supervision of one faculty member; the student can opt for another supervisor from either industry, company, technical institutes or research institutes.

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8.1 b. Student in the end of each semester will submit report/Dissertation which will be evaluated by external examiner (recommended by BOS) and supervisor with 75 marks. Continuous internal evaluation (CIA) of 25 marks in that semester will be done by supervisor. In V & VI semester it will be qualifying only. In VIIth and VIIIth semester it will be of 4 credits and will be used in calculation of CGPA. The Principal/ Head/ Director/ Dean shall convene and coordinate the process with practical examinations of that department.

8.2 In all credit courses (other than Internship/ survey /minor project report and Dissertation/ major Project), there shall be continuous internal assessment of the students and semester end examination as per the scheme of examination.

8.3 The semester end examination shall have a weightage of 75 marks. Questions for this examination shall be set by a panel of examiners approved by the Board of Studies and duly moderated by the Moderation Committee. The scheme of examination shall ensure that no student has to appear for examinations in more than two courses on any single day.

8.4 The continuous internal assessment shall have a weightage of 25 marks and shall be based on assignments, class test, quizzes etc. as specified by Board of studies of the subject concerned.

8.5 It shall be the duty of the Teacher teaching a particular course, to conduct internal assessment. In case more than one teacher is sharing the teaching work in a course, each teacher shall evaluate independently and a weighted average would be taken.

8.6 For the ease of computation, the assessment/evaluation of each course will be out of a maximum of 100 marks (25 for internal assessment and 75 for end of semester examination) irrespective of number of credits allotted to the course. The marks shall be converted to grades

8.7 Vocational Courses

8.7 a **Memorandum of Understanding**

1 Colleges are required to sign the MOUs at the local level.

2 Educational Institutions will contact nearby industries, I.T.I., Polytechnics, Engineering Colleges, Artisans, Registered Enterprises, Specialists for conducting vocational courses.

3 In order to connect with Government run Vocational Courses/Training/Internships, Educational Institutions will coordinate with the concerned departments.

4 The safety of a student in workplace should be considered while signing the MOU.

5 All possible efforts should be made to pay student honorarium, as per rules, to students during their training/internship.

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8.7 b. Time Table

Training/Internship could be done during holidays or after college hours. Alternatively, a day in a week may be fixed for this activity.

8.7 c Seat Allocation

Different Courses should be prepared by the college based on the number of enrolled students. The number of seats in each course must be decided in consultation with the skill partner.

8.7 d Examination

1 Theory examination (1 credit) will be conducted by the college, while the training/internship examination (2 credit) will be conducted by the skill partner or by the college wherever the facility exists.

2 Skill partner/College may evaluate the skills of the student either on the basis of the work done during the training/internship or on the basis of offline/online examination.

3 Colleges will upload the marks on the portal in time after obtaining theory and skill marks.

4 The details of the Vocational Course will be entered in the marksheet/degree issued by the university.

5 In addition to it, college and skill partner may issue a joint certificate to the student.

8.7 e Syllabus

1 Colleges will prepare the syllabus for each vocational course, which would be then duly approved by the Syllabus Committee, Academic Council and Executive Council as per existing rules.

2 Syllabus would be formulated with the help of college/skill partner/skill development council as per the guidelines given by UGC/NSQF.

3 In trades, for which syllabi made by UGC/NSQF/Skill Development Council/Government Department are available, priority should be given to adoption of such syllabi so that the support of the respective bodies may be obtained during the time of placement/internship.

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4 In different subjects, where the syllabus has been prepared by the Head of the Department/Teacher, the ratio of the General Theory to Skill/ Training/Internship/Lab will be 40:60, and for such courses the arrangements to sign MOU with the skill partners will be made by the college administration.

5 The theory component shall be of one credit (15 hours) and the skill component shall be of two credits (30 hours per credit). Thus the vocational course will be a 3credit course in which 15 hours of theory (1 credit) and 60 hours of training/internship/lab (2credits) will be there.

8.7 f Nature of the Syllabus

1 Syllabus can be of two types:

i. **Individual Nature-** A syllabus that would be completed in one semester.

ii. **Progressive Nature**–A syllabus the complexity/specialization would increase with each semester but will be complete in itself in each semester.

2 Students shall choose the course/syllabus as per their choice and convenience.

8.7 g Credit

A student will have to earn a minimum of three credits from vocational courses in each semester, which means six credits every year. Students may choose a vocational course with more than required credits and deposit them, but in a year six credits/in two years 12 credits will be used to obtain certificate/diploma/degree.

9.1 The formula adopted by the University for conversion of CGPA to equivalent percentage of marks is given below –

Percentage of Marks = (CGPA*10)

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9.2 The following percentage to Letter Grade / Grade Points conversion scheme will be followed

Percentage	Equivalent Letter Grade	Equivalent Grade Point
>= 95%	O	10
>= 85% and < 95%	A+	9
>=75% and < 85%	A	8
>= 65% and < 75%	B+	7
>= 55% and < 65%	B	6
>=45% and < 55%	C	5
>= 35% and < 45%	P	4
< 35%	F	0
NA	AB	0

9.3 Computation of Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA)

a) The SGPA is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student in a semester, i.e

SGPA (Si) = Σ(Ci x Gi) / ΣCi

where Ci is the number of credits of the ith course and Gi is the grade point scored by the student in the ith course.

b) The CGPA is also calculated in the same manner taking into account all the courses undergone by a student over all the semesters of a programme, i.e.

CGPA = Σ(Ci x Si) / Σ Ci

where Si is the SGPA of the ith semester and Ci is the total number of credits in that semester.

The SGPA and CGPA shall be given upto 2 decimal points without rounding off. For example, if the SGPA / CGPA is 5.2434, the final CGPA will be 5.24. Similarly, if the SGPA / CGPA is 5.2498 then also the final CGPA to be reflected in the transcript will be 5.24.

9.4 Grade Point Requirement / Minimum Standard

a) A student, in order to be eligible for the award (i) passed all the prescribed courses as laid down and completed the minimum credit requirement of the programme already defined in the ordinance; (ii) she/he has obtained a CGPA of 4.0 at the end of the programme.

b) The grade points – division mapping for UG programs will be as follows –

Grade Point Range	Division
>= 6.0 and above	First
>=4.5 and < 6.0	Second

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>=4.0 and <4.5	Third
<4.0	Fail

c) A student shall be deemed to have cleared a course only if (i) he/she has participated in the internal assessment and has secured an overall grade at least 'P' or higher **and** (ii) if she/he has secured a grade at least 'P' or higher in the end-semester examination (for courses having end-semester examination). A student obtaining Grade 'F' shall be considered fail and will be required to reappear in the examination.

d) If a student fails to clear a selected course then he/she shall be allowed to clear another similar credit course in lieu thereof or the same course.

e) In case a student earns extra credits by clearing courses in addition to the minimum prescribed for the programme, all the courses and their grades will reflect in the grade sheet. However, for the purposes of calculating the Cumulative Grade Point Average (CGPA) in the final semester, only his/her best grades will be taken into account such that the minimum credit requirements for the programme are fulfilled.

f) For awarding medals or for declaring the toppers in the course if the student gets the same CGPA, it should be resolved by considering the number of times a student has obtained higher SGPA but if it is not resolved even at this stage, the number of times a student has obtained higher grades in a paper like O, A+ etc should be taken into account in rank ordering of the students in a programme. However in case of further discrepancies the final decision lies at the discretion of the Head of the Department/ Controller of Examination/Examination Committee..

g) Transcript (Format) based on the above recommendations on letter grade, grade points and SGPA and CGPA may be used for each semester and a consolidated transcript indicating the performance of all semesters in the final semester transcript of the course.

9.5 Illustration of calculation of SGPA

Course	**Credit**	**Letter Grade**	**Grade Point**	**Credit Point (Credit x Grade)**
Course 1	4	A	8	4*8 = 32
Course 2	4	A+	9	4*9 = 36
Course 3	3	B	6	3*6 = 18
Course 4	2	C	5	2*5 = 10
Course 5	4	F	0	4*0 = 0
	Total (ΣCi) = 17			**Total (Σ(Ci x Gi)) = 96**

Thus SGPA = 96 / 17 = 5.64

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Illustration of calculation of CGPA

Semester 1	Semester 2	Semester 3	Semester 4
Credit: 17 SGPA: 5.64	Credit: 20 SGPA: 6.08	Credit: 22 SGPA: 4.9	Credit: 22 SGPA: 7.22

Thus, **CGPA** = (5.64*17 + 6.08*20 + 4.9*22 + 7.22*22) / 81 = **5.97**
Hence, **equivalent percentage** = (5.97*10) = **59.7**
And the **Division** will be **Second**

9.6 In co curricular courses a student has to score 40 (Forty) % marks for clearing it. Grades will be indicated in the grade sheet but they will not be counted for evaluating CGPA.

9.7 Examination, Promotion and Reappearing Rules:

a) A student obtaining grades 'P' to 'O' (grade point 4 or higher) in any course shall be considered PASS in that course.

b) For non-credit courses 'Satisfactory' (grades 'P' to 'O') or 'Unsatisfactory' (Grade 'F' or 'AB') shall be indicated instead of the letter grade and these will not be counted for the computation of SGPA/CGPA.

c) All students shall be promoted automatically from odd to even semesters but for promotion from even to odd semester i.e from current year to next year. It may be that s/he earns atleast 75% credits of all the credits of current year. S/He may be promoted in this manner till VIth Semester(IIIrd year). Further promotion (to VIIth sem) may not be allowed till s/he clears all the previous semester credits.

d) Those students who are NOT eligible for promotion shall have to reappear in the end semester examination of those courses in the semester(s)in which the student has failed along with those courses in which he/she wishes to improve, within the maximum stipulated time period allowed to complete the program. The grades of internal assessment shall carry forward in such cases.

e) Those students who are eligible for promotion and wish to improve their grades, may choose to reappear in the end of semester examination to improve their grades, within the maximum stipulated time period allowed to complete the program. The grades of internal assessment shall carry forward in such cases.

f) A Student may be allowed to re-register for a semester, within the maximum stipulated time period allowed to complete the program, provided he/she satisfies one of the following conditions. In such a case there shall be fresh assessment of internal evaluation:

(i) The student is declared fail.

(ii) The student did not appear in a semester examination or he/she was not granted permission to appear in the examination.

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(iii) The student had been detained by the University and subsequently has been permitted to take re-admission.

(iv) The student has own desire to abandon the performance of the semester and wishes to repeat.

i) Those students who reappear in any course/s in any semester or re-register for a semester shall have to pay the prescribed fee.

j) Cases of use of unfair means in the examination shall be dealt with as per the rules and regulations of the University.

k) Challenge evaluation shall be permitted as per rules/orders of the University.

09.8 Grade Card:

A grade card shall be issued to each student at the end of every semester.

9.9 Transcript:

A Transcript shall be issued to a student on successful completion of the programme on request as per rules.

9.10 Withholding of Grade Card/Transcript

The Grade Card/Transcript of a student shall be withheld if he/she has not paid his/her dues, or if there is a case of indiscipline pending against him/her.

10. Exit option and award of Under Graduate Degree

10.1 In case the student wishes to leave after completion of one year of any Under Graduate Degree Programme, he/she shall be eligible for award of a Certificate in faculty, provided the student fulfils the following conditions:

a) Has pursued the prescribed courses of study and has earned 46 credits as prescribed under the relevant regulations within four academic years without 'F' or 'AB' in any course.

b) Obtained a minimum CGPA of 4.0

c) Paid all the dues of the University.

d) No disciplinary proceedings are pending against him/her.

(e) Any other condition, as notified by the competent authority of the university.

10.2 In case the student wishes to leave after completion of two years of any Under Graduate Degree Programme, he/she shall be eligible for award of a Diploma in faculty , provided the student fulfils the following conditions:

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a) Has pursued the prescribed courses of study and has earned 92 credits as prescribed under the relevant regulations within six (three years after earning certificate) academic years without 'F' or 'AB' in any course.

b) Obtained a minimum CGPA of 4.0

c) Paid all the dues of the University.

d) No disciplinary proceedings are pending against him/her.

(e) Any other condition, as notified by the competent authority of the university.

10.3 In case the student wishes to leave after completion of three years of any Under Graduate Degree Programme, he/she shall be eligible for award of a Bachelor's Degree in faculty, provided the student fulfils the following conditions:

a) Has pursued the prescribed courses of study and has earned 132 credits as prescribed under the relevant regulations within ten (three years after diploma in faculty) academic years without 'F' or 'AB' in any course.

b) Obtained a minimum CGPA of 4.0

c) Paid all the dues of the University.

d) No disciplinary proceedings are pending against him/her.

(e) Any other condition, as notified by the competent authority of the university.

10.4 On completion of four years of any Under Graduate Degree Programme, he/she shall be eligible for award of a Bachelor's Degree with Research in faculty, provided the student fulfils the following conditions:

a) Has pursued the prescribed courses of study and has earned 184 credits as prescribed under the relevant regulations without 'F' or 'AB' in any course after Bachelor's degree.

b) Obtained a minimum CGPA of 4.0

c) Paid all the dues of the University.

d) No disciplinary proceedings are pending against him/her.

(e) Any other condition, as notified by the competent authority of the university.

10.5 Students holding a Certificate or Diploma can apply for lateral entry into the second / third year respectively of a Under Graduate Degree Programme through the laid down admission process for the purpose as notified by the university.

11.1 In programmes governed by professional councils such as AICTE, MCI, PCI, BCI and NCTE etc the norms decided by Board of Studies and other competent bodies in light of recommendations by the statuary councils shall apply.

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12. Interpretation clause

In case of any issue of interpretation arising during the course of implementation of these ordinances or in case of any unforeseen circumstance, decision of the Vice-Chancellor/Examination committee shall be final.

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YEAR WISE STUCTURE OF GRADUATE COURSES

		Subject I	Subject II	Subject III	Subject IV	Vocational	Co-Curricular	Industrial training/ Survey/ Research Project	(Minimum Credits) For the year	Cumulative (Minimum Credits) Required for Award of Certificate/ Diploma/ Degree
		Major	Major	Major	Minor Elective	Minor	Minor	Major		
		4/5/6 Credits	4/5/6 Credits	4/5/6 Credits	4/5/6 Credits	3 Credits		4 Credits		
Year	Sem.	Own Faculty	Own Faculty	Own/ Other Faculty	Other Subject/ Faculty	Vocational/ skDevelopment Course	Co-Curricular Course (Qualifying)	Inter/Intra Faculty related to main Subject		
1	I	Th-1(6) or Th-1(4)+ Pract-1(2)	Th-1(6) or Th-1(4)+ Pract-1(2)	Th-1(6) or Th-1(4)+ Pract-1(2)	1 (4/5/6)	1	1		46	(46) Certificate in Faculty
	II	Th-1(6) or Th-1(4)+ Pract-1(2)	Th-1(6) or Th-1(4)+ Pract-1(2)	Th-1(6) or Th-1(4)+ Pract-1(2)		1	1			
2	III	Th-1(6) or Th-1(4)+ Pract-1(2)	Th-1(6) or Th-1(4)+ Pract-1(2)	Th-1(6) or Th-1(4)+ Pract-1(2)	1 (4/5/6)	1	1		46	(92) Diploma in Faculty
	IV	Th-1(6) or Th-1(4) + Pract-1(2)	Th-1(6) or Th-1(4)+ Pract-1(2)	Th-1(6) or Th-1(4)+ Pract-1(2)		1	1			
3	V	Th-2(5) or Th-2(4)+ Pract-1(2)	Th-2(5) or Th-2(4)+ Pract-1(2)				1	I (Qualifying)	40	(132) Bachelor in Faculty
	VI	Th-2(5) or Th-2(4)+ Pract-1(2)	Th-2(5) or Th-2(4)+ Pract-1(2)				1	I (Qualifying)		
4	VII	Th-4(5)or Th-(4)+Pract-1(4)			1 (4/5/6)			1 (4) 1	52	(184) Bachelor (Research) in Faculty
	VIII	Th-4(5)or Th-4(4)+Pract-1(4)						1 (4) 1		

Note: Non-Credit Qualifying Courses; Th-Theory, Pract-Practical

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डॉ० भीमराव आंबेडकर विश्वविद्यालय, आगरा
(पूर्ववर्तीः आगरा विश्वविद्यालय, आगरा)

संख्या : शैक्षिक / 10 / 2021–22
दिनांक : 24 / 08 / 2021

अधिसूचना

एतत् द्वारा सूचित किया जाता है कि विद्यापरिषद की बैठक दिनांक 14.05.2021 एवं कार्यपरिषद की बैठक दिनांक 25.06.2021 के अनुपालन में सत्र 2021–22 से स्नातक स्तर पर विश्वविद्यालय से सम्बद्ध समस्त राजकीय / अनुदानित अशासकीय / स्ववित्तपोषित महाविद्यालयों में राष्ट्रीय शिक्षा नीति–2020 के अनुरूप तैयार न्यूनतम समान पाठ्यक्रम अनुमोदित एवं लागू कर दिया गया है। पाठ्यक्रमों के अनुमोदन के अनुक्रम में विश्वविद्यालय से सम्बद्ध समस्त महाविद्यालयों में प्रवेश राष्ट्रीय शिक्षा नीति–2020 के अन्तर्गत शासन द्वारा समय–समय पर दिये गये निर्देशों के आलोक में प्रारम्भ किया जायेगा। प्रवेश एवं पाठ्यक्रम में छात्र / छात्राओं द्वारा चुने जाने वाले विषयों की संरचना एवं पाठ्यक्रम संचालन हेतु दिशा–निर्देश फोर्स के टास्क द्वारा शासनादेश संख्या 1065 / सत्तर–3–2021–16 (26) / 2011 दिनांक 20.04.2021 एवं संख्या 1567 / सत्तर–3–2021–16 (26) / 2011 टी०सी० दिनांक 13.07.2021 के अनुपालन में तैयार कर लिये गये हैं। इस प्रकार सूच्य है कि सत्र 2021–22 में छात्र / छात्राएं स्नातक स्तर पर प्रवेश राष्ट्रीय शिक्षा नीति 2020 के अनुरूप लेंगे तथा महाविद्यालय छात्रों को पाठ्यक्रमों में प्रस्तावित विषय संरचना एवं संलग्न दिशा–निर्देश के अनुरूप अध्यापन करायेगें।

विश्वविद्यालय से सम्बद्ध समस्त राजकीय / अनुदानित अशासकीय / स्ववित्तपोषित महाविद्यालयों में सत्र 2021–22 में बीए०, बी०एस०सी एवं बी०कॉम के स्नातक प्रथम सेमेस्टर में प्रवेश संलग्न प्रवेश सम्बन्धी नियमावली तथा राष्ट्रीय शिक्षा नीति–2020 के अनुरूप जारी अन्य सम्बन्धित दिशा निर्देशों के अनुसार किये जायेंगे। भविष्य में जारी शासकीय निर्देशों के अनुक्रम में इस नियमावली व निर्देशों का संशोधित संस्करण या अलग से कोई अन्य अधिसूचना जारी की जा सकती है।

संलग्नक–यथोपरि।

कुलसचिव

संख्याःशैक्षिक / 846 / 2021 दिनांकः 24 / 08 / 2021

प्रतिलिपिः– निम्नलिखित को सूचनार्थ एवं आवश्यक कार्यवाही हेतु प्रेषित।

1. सहायक कुलसचिव, डॉ० भीमराव आंबेडकर विश्वविद्यालय, आगरा, मा० कुलपति जी के अवलोकनार्थ।
2. प्राचार्य, विश्वविद्यालय से सम्बद्ध समस्त राजकीय / अनुदानित अशासकीय / स्ववित्तपोषित महाविद्यालय।
3. प्रभारी वेब साइट को इस आशय से प्रेषित कि उक्त सूचना समस्त महाविद्यालयों के कॉलेज लॉगिन पर अपलोड कराना सुनिश्चित करें।
4. सहायक कुलसचिव प्रशासन / परीक्षा, डॉ० भीमराव आंबेडकर विश्वविद्यालय, आगरा।
5. सम्बन्धित पत्रावली में संरक्षित हेतु ।

कुलसचिव

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डॉ० भीमराव आंबेडकर विश्वविद्यालय, आगरा

राष्ट्रीय शिक्षा नीति–2020 को स्नातक स्तर पर सत्र 2021–22 से लागू करने सम्बन्धी दिशा निर्देश

उत्तर प्रदेश के समस्त राज्य/निजी विश्वविद्यालयों तथा महाविद्यालयों में राष्ट्रीय शिक्षा नीति–2020 की अनुशंसा के अनुरूप तैयार किये गये न्यूनतम समान पाठ्यक्रमों एवं स्नातक स्तर पर सी०बी०सी०एस० सेमेस्टर सिस्टम को शैक्षिक सत्र 2021–22 से लागू किये जाने के सम्बन्ध में उच्च शिक्षा अनुभाग–3, उत्तर प्रदेश शासन, लखनऊ के द्वारा जारी शासनादेश संख्या 1065/सत्तर–3–2021–16 (26)/2011 दिनांक 20.04.2021, संख्या 1567/सत्तर–3–2021–16(26)/2011 टी.सी. लखनऊ, दिनांक 13.07.2021; अपर मुख्य सचिव, उच्च विभाग, उत्तर प्रदेश शासन के पत्र दिनांक 25.06.2021 के द्वारा परिपत्र तथा इस सम्बन्ध में समय–समय पर शासकीय निर्देश जारी किये गये हैं।

डॉ० भीमराव आंबेडकर विश्वविद्यालय, आगरा के माननीय कुलपति जी द्वारा गठित टास्क फोर्स ने प्राप्त सभी शासनादेशों को अंगीकृत कर शैक्षिक सत्र 2021–22 के स्नातक प्रथम सेमेस्टर/ प्रथम वर्ष में प्रवेश–सम्बन्धी तथा अन्य सम्बंधित विषयगत बिन्दुओं के सन्दर्भ में प्रथम/मानक दिशा–निर्देश (गाइडलाइन) तैयार किये हैं। टास्क फोर्स द्वारा तैयार किये गये दिशा निर्देशों को लागू किया जाना प्रस्तावित है। इसी सम्बन्ध में यह भी सूच्य है कि सामयिक आवश्यकता तथा शासकीय निर्देशों के अनुसार भविष्य में इस गाइडलाइन का संशोधित प्रारूप अथवा किसी मामले में अलग से अधिसूचना जारी की जा सकती है।

1. क्षेत्रः

1.1 राष्ट्रीय शिक्षा नीति–2020 के अन्तर्गत की जा रही व्यवस्था चिकित्सा (Medicine and Dental etc.) एवं तकनीकी शिक्षा (बी.टेक, एम.सी.ए. आदि) के अतिरिक्त सभी संकायों के कार्यक्रमों पर लागू होगी।

1.2 यह व्यवस्था तीन विषय वाले पाठ्यक्रमों बी०ए०, बी०एस०सी० एवं बी०कॉम० के सत्र 2021–22 में प्रवेशित छात्रों पर लागू होगी। अन्य सभी पाठ्यक्रमों में शासन के निर्देशों के आने पर सत्र 2022–23 से लागू होगी।

1.3 विधि (बी.ए.एल.एल.बी., बी.एससी.एल.एल.बी., एल.एल.बी., एल.एल.एम. इत्यादि) शिक्षक शिक्षा (बी.एड., एम.एड., बी.पीएड., एम.पीएड., इत्यादि) के लिए व्यवस्था का निर्धारण उनकी नियामक संस्थाओं के एनईपी–2020 के अनुरूप नए पाठ्यक्रम व संरचना के आने पर किया जाएगा।

2. परिभाषाएंः

2.1 **<u>पाठ्यक्रम/कार्यक्रम (Programme)</u>**

विद्यार्थी द्वारा चुने गये अपने संकाय में एक वर्ष का सर्टिफिकेट, दो वर्ष का डिप्लोमा, तीन वर्ष की स्नातक डिग्री, चार वर्ष की स्नातक (शोध सहित) डिग्री,

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पाँच वर्ष की स्नातकोत्तर डिग्री, छः वर्ष की पी०जी०डी०आर० तथा शोध उपाधि यथा–बी०ए०, बी०एस०सी०, बी०कॉम, बी०एड०, बी०बी०ए०, बी०एल०ई०, एम०ए०, एम०एस०सी०, एम०कॉम, एल०एल०बी०, पी०एच०डी० इत्यादि।

2.2 **संकाय (Faculty)**

2.2.1 विद्यार्थी स्नातक स्तर पर जिस संकाय से दो मेजर विषयों का चुनाव करेगा वह संकाय विद्यार्थी का **"अपना संकाय"** (Own Faculty) कहलायेगा।

2.2.2 संकाय विषयों का समूह है यथा कला संकाय, विज्ञान संकाय, वाणिज्य संकाय इत्यादि।

2.2.3 विश्वविद्यालय में जो संकाय एवं प्रशासनिक व्यवस्था चल रही है वह यथावत् रहेगी।

2.2.4 विद्यार्थियों को बहुविषयकता उपलब्ध कराने के लिये संकायों में विषयों के वर्गीकरण एवं विषय कोडिंग की व्यवस्था शासनादेश संख्या 1267/सत्तर–3–2021–16 (26)/2011 दिनांक 15.06.2021 के अनुसार होगी यथा 1. विज्ञान संकाय, 2. वाणिज्य संकाय, 3. भाषा संकाय, 4. कला, मानविकी एवं सामाजिक विज्ञान संकाय, 5. ग्रामीण अध्ययन संकाय, 6. ललित कला एवं प्रदर्शन कला संकाय, 7. कृषि संकाय, 8. विधि संकाय, 9. शिक्षक शिक्षा संकाय, 10. प्रबन्धन संकाय, 11. वोकेशनल स्टडीज संकाय। भाषा संकाय, ग्रामीण अध्ययन संकाय एवं ललित कला एवं प्रदर्शन कला संकाय को बहुविषयकता के लिये अलग संकाय माना जायेगा किन्तु उन्हें डिग्री कला संकाय (B.A.) की मिलेगी।

2.3 **विषय (Subject)- यथा**

2.3.1 संस्कृत, हिन्दी, जन्तु विज्ञान, इतिहास आदि।

2.3.2 एक विषय एक ही संकाय में सूचीबद्ध होगा।

2.4 **कोर्स/पेपर/प्रश्नपत्र (Course/Paper)- यथा**

2.4.1 एक विषय के विभिन्न थ्योरी/प्रैक्टिकल के पेपर को कोर्स/पेपर/प्रश्नपत्र कहा जायेगा।

2.4.2 थ्योरी और प्रैक्टिकल के पेपर्स/प्रश्नपत्रों का कोड अलग–अलग होगा।

3. पाठ्यक्रम/कार्यक्रम लागू करने की समय–सारणीः

3.1 राष्ट्रीय शिक्षा नीति–2020 से सम्बन्धित उच्च शिक्षा परिषद द्वारा निर्देशित यह नए नियम सत्र 2021–22 में स्नातक स्तर में प्रवेशित विद्यार्थियों पर ही लागू होंगे। स्नातक/परास्नातक के समस्त पाठ्यक्रमों में सत्र 2020–21 तक प्रवेशित छात्रों पर उनके उपाधि प्राप्त करने तक यह नए नियम लागू नहीं होगें।

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3.2 तीन विषय वाले स्नातक पाठ्यक्रमों/कार्यक्रमों (बी.ए., बी.एससी., बी.कॉम.) में सी.बी.सी.एस. आधारित नवीन पाठ्यक्रम शैक्षणिक सत्र 2021–22 से लागू होगा।

3.3 स्नातक (शोध सहित) एवं स्नातकोत्तर पाठ्यक्रमों/कार्यक्रमों में सी.बी.सी.एस. आधारित नवीन पाठ्यक्रम शैक्षणिक सत्र 2022–23 से लागू होगा।

3.4 बी.ए., बी.एससी., बी.कॉम. एकल विषय स्नातक कार्यक्रमों में सी.बी.सी.एस. आधारित नवीन पाठ्यक्रम सत्र 2022–23 से लागू होगा।

3.5 पीएच.डी. कार्यक्रम में नवीन व्यवस्था सत्र 2022–23 से लागू होगी।

4. प्रवेश प्रकिया एवं विषय चयन की व्यवस्थाः

4.1 प्रवेश

4.1.1 विद्यार्थी स्नातक में प्रवेश के लिए विश्वविद्यालय की वेब साइट पर अपना रजिस्ट्रेशन कराएँगे तथा डब्ल्यू०आर०एन० नम्बर अंकित किये हुये रजिस्ट्रेशन के प्रपत्र को विश्वविद्यालय के संस्थान/विभाग/महाविद्यालयों में जमा कर मेरिट अथवा अन्य प्रवेश नियमों, सम्बंधित महाविद्यालय में उपलब्ध सीटों तथा संसाधनों के आधार पर प्रवेश ले सकेगें।

4.1.2 विद्यार्थी द्वारा चुनाव किये गये प्रथम दो विषयों के आधार पर प्रदान कि जाने वाली डिग्री यथा बी०ए०, बी०एस०सी० अथवा बी०कॉम में सीटों की उपलब्धता के आधार पर तथा विद्यार्थी के द्वारा आवश्यक अर्हता पूर्ण करने पर विद्यार्थी को विश्वविद्यालय अथवा महाविद्यालय द्वारा सम्बन्धित संकाय में प्रवेश दिया जायेगा।

4.1.3 प्रवेश हेतु अतिरिक्त अंकों की व्यवस्था विश्वविद्यालय की प्रवेश समिति की बैठक दिनांक 17.06.2021 में लिये गये निर्णय के अनुसार होगी।

4.2 मेजर विषयों का चुनाव

4.2.1 विद्यार्थी को स्नातक में प्रवेश के समय सर्वप्रथम विश्वविद्यालय/महाविद्यालय में एक संकाय (कला, विज्ञान, वाणिज्य आदि) का चुनाव करना होगा और तत्पश्चात् उसे उस संकाय के दो मुख्य (मेजर) विषयों का चुनाव करना होगा जिसका आवंटन महाविद्यालय में मेरिट, उपलब्ध सीट की संख्या व संसाधनों पर निर्भर करेगा। यह संकाय विद्यार्थी का अपना संकाय (Own Faculty) कहलायेगा, जिसमें वह तीन वर्ष (प्रथम से छठे सेमेस्टर तक) अथवा पॉच वर्ष (स्नातक व परास्नातक तक) अध्ययन कर सकेगा।

4.2.2 इसके उपरान्त विद्यार्थी एक और मुख्य विषय का चुनाव करेगा जो उसके अपने संकाय (Own Faculty) अथवा दूसरे संकाय (Other Faculty) से हो सकता है।

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4.2.3 इस तरह विद्यार्थी को कुल तीन मुख्य विषयों का अध्ययन करना होगा, जिसमें से दो मुख्य विषय उसके चुने हुए संकाय के होंगे तथा तीसरा मुख्य विषय वह अपने संकाय अथवा प्रवेशित महाविद्यालय में उपलब्ध दूसरे संकाय से ले सकता है।

4.3 मेजर विषयों को बदलने की सुविधा

4.3.1 विद्यार्थी विश्वविद्यालय/महाविद्यालय में उपलब्ध सीटों/शिक्षकों/संसाधनों/नियमों के आलोक में द्वितीय/तृतीय वर्ष में संकाय अथवा मुख्य विषय बदल सकता है अथवा उनके क्रम में परिवर्तन कर सकता है।

4.3.2 विद्यार्थी को विश्वविद्यालय/महाविद्यालयों में विषयों की उपलब्धता के आधार पर नियमानुसार विषय परिवर्तन की सुविधा होगी, परन्तु वह एक वर्ष के बाद ही विषय परिवर्तित कर सकता है, एक सेमेस्टर के बाद नहीं।

4.4 माइनर इलेक्टिव पेपर का चुनाव

4.4.1 तीन मुख्य विषयों के अतिरिक्त विद्यार्थी को एक माइनर इलेक्टिव पेपर का अध्ययन करना होगा। इस पेपर का चुनाव छात्र अपने संकाय के विषयों में से अथवा दूसरे संकायों के विषयों में से कर सकते है। इसके लिये उसे किसी पूर्व पात्रता (pre-requisite) की आवश्यकता नहीं होगी।

4.4.2 बहुविषयकता (Multidisplinarity) सुनिश्चित करने के लिये स्नातक स्तर पर माइनर इलैक्टिव पेपर सभी विद्यार्थियों को किसी भी चौथे विषय (उसके द्वारा लिये गये तीन मुख्य विषयों के अतिरिक्त) से लेना होगा।

4.4.3 तीसरे मुख्य (मेजर) विषय तथा माइनर इलेक्टिव पेपर का चयन छात्र को इस प्रकार करना होगा कि इसमें से कोई एक अनिवार्यतः अपने संकाय के अतिरिक्त महाविद्यालय में उपलब्ध किसी अन्य संकाय (Other Faculty) से हो।

4.4.4 स्नातक के विद्यार्थी को प्रथम एवं द्वितीय वर्ष में एक–एक माइनर पेपर का अध्ययन करना होगा।

4.4.5 कोई विद्यार्थी एक माइनर इलेक्टिव पेपर स्नातक प्रथम वर्ष के प्रथम अथवा द्वितीय सेमेस्टर में तथा दूसरा माइनर इलेक्टिव पेपर द्वितीय वर्ष के तृतीय अथवा चतुर्थ सेमेस्टर में ले सकता है। अर्थात विद्यार्थी अपनी सुविधा से सम अथवा विषम सेमेस्टर में उपलब्ध माइनर इलेक्टिव पेपर का चुनाव कर सकता है।

4.4.6 विश्वविद्यालय/महाविद्यालय द्वारा उपलब्ध सीटों के आधार पर माइनर/इलेक्टिव विषय आवंटित किया जायेगा।

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4.4.7 माइनर इलेक्टिव पेपर का चुनाव संस्थान/महाविद्यालय में संचालित विषयों के पेपर में से किया जायेगा। चुने हुए माइनर पेपर की कक्षायें फैकल्टी में संचालित उसी कोर्स की कक्षाओं के साथ ही होगी तथा उसकी परीक्षा भी उसी के साथ होगी।

4.5 रोजगारपरक/कौशल विकास के पाठ्यक्रम के लिए पेपर का चुनाव

4.5.1 **पाठ्यक्रम के प्रकार:** पाठ्यक्रम दो प्रकार के हो सकते हैं–

- Individual nature – एक सेमेस्टर में पूर्ण होने वाले पाठ्यक्रम
- Progressive nature – एक ही पाठ्यक्रम जिसकी विशेषज्ञता प्रत्येक सेमेस्टर के साथ बढती जायेगी, परन्तु किसी भी सेमेस्टर में छोड़ने पर वह पूर्ण हो सकेगा।

4.5.2 विद्यार्थी अपनी पसंद एवं सुविधानुसार पाठ्यक्रम का चुनाव कर सकेंगे।

4.5.3 विद्यार्थी द्वारा रोजगारपरक/कौशल विकास पाठ्यक्रम के चुनाव के समय महाविद्यालय में वह कार्यक्रम उपलब्ध न होने जैसी स्थिति में अपने प्रवेश के पश्च्यात (UGC, SWAYAM, MOOCs etc) पोर्टल पर उपलब्ध रोजगारपरक ऑनलाइन पाठ्यक्रम चुन सकते हैं । विद्यार्थी इस रोजगारपरक पाठ्यक्रम के सफलता पूर्वक पूर्ण करने के पश्चात् अर्जित किये गए क्रेडिट के सर्टिफिकेट को विश्वविद्यालय/महाविद्यालय में जमा कराएँगे जिससे वह उनके परीक्षा परिणाम में यथास्थान जोड़ा जा सके।

4.5.4 प्रत्येक विद्यार्थी को प्रथम दो वर्षो (चार सेमेस्टर्स) के प्रत्येक सेमेस्टर में 3 केडिट (3 x 4= 12 केडिट के कुल चार पाठ्यकम) का एक रोजगारपरक/कौशल विकास पाठ्यकम (Vocational/Skill Development Courses) पूर्ण करना होगा।

4.6 अनिवार्य सह पाठ्यक्रम (Co-curricular)

4.6.1 स्नातक स्तर के प्रत्येक विद्यार्थी को तीन वर्षो (छह सेमेस्टर्स) के प्रत्येक सेमेस्टर में एक सह–पाठ्यकम (Co-curricular) करना अनिवार्य होगा।

4.6.2 स्नातक स्तर पर अनिवार्य सह–पाठ्यकमों (Co-curricular) के अध्ययन–अध्यापन का कम सेमेस्टर के अनुसार निम्नवत् होगा:–

- **प्रथम सेमेस्टर:** भोजन, पोषण और स्वच्छता (Food, Nutrition and Hygiene)
- **द्वितीय सेमेस्टर:** प्राथमिक चिकित्सा और स्वास्थ्य (First Aid and Health)
- **तृतीय सेमेस्टर**-- मानव मूल्य और पर्यावरण अध्ययन (Human Values and Environmental Studies)

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- **चतुर्थ सेमेस्टरः** शारीरिक शिक्षा और योग (Physical Education and Yoga)
- **पंचम सेमेस्टरः** विश्लेषणात्मक योग्यता और डिजिटल जागरूक्ता (Analytic Ability and Digital Awareness)
- **षष्ठम सेमेस्टरः** संचार कौशल और व्यक्तित्व विकास (Communication Skills and Personality Development)

4.6.3 स्नातक स्तर के अनिवार्य सह–पाठ्यक्रमों (Co-curricular) के अध्ययन–अध्यापन के लिए शैक्षिक संसाधनों की व्यवस्था विश्वविद्यालय/महाविद्यालय द्वारा की जाएगी।

4.6.4 इन सभी सह–पाठ्क्रमों को 40 प्रतिशत अंकों के साथ विद्यार्थी को उत्तीर्ण करना होगा। विद्यार्थी की ग्रेड शीट पर इनके प्राप्ताकों पर आधारित ग्रेड तो अंकित होंगे, परन्तु उन्हें सी.जी.पी.ए. (C.G.P.A.) की गणना में सम्मिलित नहीं किया जायेगा।

4.7 शोध परियोजना :

4.7.1 स्नातक/स्नातकोत्तर/पी०जी०डी०आर० स्तर पर विद्यार्थी को पांचवें से ग्यारहवें सेमेस्टर तक प्रत्येक समेस्टर में एक शोध परियोजना करनी होगी। विद्यार्थी को तीसरे वर्ष मे लघु शोध परियोजना तथा चतुर्थ व पंचम वर्ष में वृहद शोध परियोजना करनी होगी। पी०जी०डी०आर० मे शोध परियोजना का स्वरूप विश्वविद्यालय अपने प्री पीएच.डी. कोर्स वर्क के अनुसार बाद में निर्धारित करेगा।

4.7.2 विद्यार्थी द्वारा चुने गए तीसरे वर्ष के दो मुख्य विषयों में से किसी एक विषय एवं चतुर्थ, पंचम, षष्ठम वर्ष के मुख्य विषय से संबन्धित शोध परियोजना करनी होगी। यह शोध परियोजना इंटरडिस्प्लनरी भी हो सकती है। यह शोध परियोजना इंडस्ट्रियल ट्रेनिंग/इंटर्नशिप/सर्वे वर्क इत्यादि के रूप में भी हो सकती है।

4.7.3 शोध परियोजना एक शिक्षक सुपरवाइजर के निर्देशन में की जाएगी। एक अन्य को–सुपरवाइजर किसी उद्योग, कंपनी, तकनीकी संस्थान शोध संस्थान से लिया जा सकता है। विद्यार्थी वर्ष के अंत में दोनों सेमेस्टर में की गई शोध परियोजना का संयुक्त प्रबंध (Report/Dissertation) जमा करेगा, जिसका मूल्यांकन वर्ष के अंत में सुपरवाइजर एवं विश्वविद्यालय द्वारा नामित बाहय परीक्षक द्वारा संयुक्त रूप से 100 अंक में से किया जाएगा।

4.7.4 स्नातक स्तर एवं पी०जी०डी०आर० के विद्यार्थी की ग्रेड शीट पर शोध परियोजना के प्राप्तांको पर आधारित ग्रेड तो अंकित होंगे परन्तु उन्हें सी०जी०पी०ए० की गणना मे शामिल नहीं किया जायेगा।

4.7.5 स्नातक (शोध सहित) एवं स्नातकोतर के विद्यार्थी को प्रत्येक सेमेस्टर में चार क्रेडिट की शोध परियोजना करनी होगी। शोध परियोजना के प्राप्तांको पर आधारित ग्रेड अंकित होंगे तथा उन्हें सी०जी०पी०ए० की गणना में भी सम्मिलित किया जायेगा।

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5. कौशल–विकास/रोजगारपरक (Skill Development/Vocational) पाठ्यकमों के संचालन किये जाने सम्बन्धी दिशा निर्देशः

रोजगारपरक पाठ्यकमों को उच्च शिक्षण संस्थानों में छात्र एवं छात्राओं को अध्ययन हेतु उपलब्ध कराये जाने हेतु शासनादेश संख्या –1969/सत्तर–3–2021 दिनांक 18.08.2021 के अनुपालन में निम्न व्यवस्था लागू होगीः–

5.1 पाठ्यक्रम

5.1.1 विश्वविद्यालय/महाविद्यालय रोजगार परक विषयों/पेपर के पाठ्यक्रम तैयार करेंगे, जिन्हें विश्वविद्यालय की पाठ्यक्रम समिति, विद्धुत परिषद एवं कार्यपरिषद इत्यादि से नियमानुसार अनुमोदित कराया जायेगा।

5.1.2 पाठ्यक्रम स्किल पार्टनर/स्किल डेवलपमेन्ट कॉउसिंल आदि के सहयोग से यू०जी०सी०/एन०एस०क्यू०एफ० (NSQF: National Skill Qualification Framework) आदि की गाइडलाइन्स के अनुसार बनाया जायेगा।

5.1.3 जिन ट्रेड में यू०जी०सी०/ एन०एस०क्यू०एफ०/स्किल डवलपमेंट काउसिंल/शासकीय विभाग के पाठ्यक्रम उपलब्ध हैं, उनमें उन पाठ्यक्रमों को वरीयता दी जानी उचित होगी ताकि छात्रों के प्लेसमेंट/इर्न्टनशिप में उनका सहयोग प्राप्त हो सके।

5.1.4 विभिन्न विषयों में विभागाध्यक्ष/शिक्षक द्वारा तैयार पाठ्यक्रमों में सामान्य/थ्योरी एवं स्किल/ट्रेनिंग/इनर्टरनशिप/लैब का अनुपात 40:60 होगा तथा ऐसे पाठ्यक्रमों के लिये स्किल पार्टनर के साथ एम०ओ०यू० की व्यवस्था विश्वविद्यालय/कॉलेज प्रशासन करेगा।

5.1.5 समान्य/थ्योरी पाठ्यक्रम का एक क्रेडिट–15 घंटो का तथा स्किल का एक क्रेडिट–30 घंटो का होगा अर्थात 3 क्रेडिट के पाठ्यक्रम में 15 घंटे की थ्योरी (1 क्रेडिट) तथा 60 घंटे की ट्रेनिंग/इर्न्टरनशिप/लैब (2 क्रेडिट) होगी।

5.3 सीट निर्धारण

कॉलेज में अध्ययन करने वाले विद्यार्थियों की संख्या के आधार पर विभिन्न विभागों द्वारा विभिन्न पाठ्यक्रम तैयार किये जायेगें तथा स्किल पार्टनर से वार्ता कर सीटों का निर्धारण किया जायेगा।

5.4 समझौता ज्ञापन (MoU)

5.4.1 उच्च शिक्षा विभाग द्वारा राज्य स्तर पर सूक्ष्म लघु एवं मध्यम उद्यम (MSME) विभाग के साथ किये गये समझौता ज्ञापन (MoU) के सम्बन्ध में निर्गत शासनादेश संख्या–602/ सत्तर–3–2021–08 (35)/2020 दिनांक 22.02.2021 के क्रम में विश्वविद्यालय एवं कॉलेज द्वारा स्थानीय स्तर पर समझौता ज्ञापन (MoU) किये जाने अपेक्षित हैं।

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5.4.2 संचालित किये जाने वाले रोजगार परक पाठ्यक्रमों के लये शिक्षण संस्थान निकटस्थ उद्योग, आई०टी०आई०, पॉलीटैक्निक, इंजीनियरिंग कॉलेज, शिल्पकार, पंजीकृत उद्यमों, विशेषज्ञ व्यक्तियों आदि से समन्वय करेंगे।

5.4.3 सरकार द्वारा चलाये जा रहे रोजगार परक पाठ्यक्रमों/ प्रशिक्षण/ इर्न्टरनशिप के लिये विश्वविद्यालयी शिक्षण संस्थान/महाविद्यालय सम्बन्धित विभागों से समन्वय करगें।

5.4.4 MoU करते वक्त विद्यार्थी की कार्यस्थल पर सुरक्षा के लिये विशेष ध्यान रखा जाये।

5.4.5 MoU में विद्यार्थी को ट्रेनिंग/इर्न्टरनशिप के दौरान नियमानुसार मानदेय के लिये यथा सम्भव प्रयास किया जाना चाहिए।

6. कक्षाओं हेतु समय–सारणीः

6.1 सभी महाविद्यालय/शिक्षण संस्थान प्रवेश प्रारम्भ होने से पूर्व अपनी समय–सारणी (Time Table) इस प्रकार तैयार कर लें जिससे छात्र प्रवेश के समय अन्य संकाय के उन विषयों का चुनाव कर सकें जिनकी कक्षाएं अलग समय पर संचालित होती हैं तथा उनकी कक्षाओं के समय में ओवरलैपिंग न हो।

6.2 सभी शिक्षण संस्थान समय सारिणी (Time Table) ऐसे तैयार करें कि छात्रों को अन्य संकाय के विषयों को चुनने के अधिकतम विकल्प उपलब्ध हों।

6.3 कॉलेज समय–सारणी में रोजगारपरक पाठ्यक्रमों की थ्योरी को अथवा शिक्षण कार्य को यथा संम्भव आरम्भ (प्रातः) अथवा अंत (सायं) में रखा जा सकता है, ताकि सभी विषयों के विद्यार्थी सुगमता से इसका लाभ उठा सकते हैं। इसके अतिरिक्त प्रशिक्षण, इर्न्टरनशिप आदि को अवकाश के समय अथवा कॉलेज समय–सारणी के पश्चात् करायी जा सकती है अथवा इसके लिये सप्ताह में एक दिन निर्धारित किया जा सकता है।

7. किसी भी पाठ्यक्रम में प्रवेश, निकास एवं पुनः प्रवेश की प्रकियाः

7.1 विद्यार्थी को एक वर्ष (दो सेमेस्टर) पूर्ण करने पर सर्टिफिकेट के साथ निकास तथा दो वर्ष (चार सेमेस्टर) पूर्ण करने पर डिप्लोमा के साथ निकास की सुविधा उपलब्ध होगी। विद्यार्थी को निर्गत सर्टिफिकेट अथवा डिप्लोमा पर उसके द्वारा प्रशिक्षण प्राप्त रोजगार–परक (Vocational) प्रशिक्षण–पाठ्यक्रम का स्पष्ट उल्लेख किया जायेगा।

7.2 विद्यार्थी को तीन वर्ष (छः सेमेस्टर) पूर्ण करने पर ही डिग्री प्राप्त होगी।

7.3 विद्यार्थी निकास के बाद अगले स्तर पर विश्वविद्यालय द्वारा निर्धारित नियमानुसार पुनः प्रवेश ले सकेगा।

7.4 पूर्व पात्रता (Pre-requisite) के आधार पर विद्यार्थी को द्वितीय/तृतीय वर्ष में विषय परिवर्तन की सशर्त सुविधा उपलब्ध होगी।

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8. डिग्री का संकाय एंव पूण करने की अवधि/पाठ्यकम की उत्तीर्णता एवं आगामी सेमेस्टर में प्रवेशः

8.1 विद्यार्थी के लिए Certificate in Faculty का Course Module अर्थात प्रथम एवं द्वितीय सेमेस्टर को सफलतापूर्वक पूर्ण करने की अधिकतम अवधि 04 वर्ष निर्धारित है। उक्त अवधि में विद्यार्थियों को यह Course Module आवश्यक केडिट (प्रथम एवं द्वितीय सेमेस्टर में सम्मिलित रूप से न्यूनतम 46 क्रेडिट) के साथ पूर्ण करना आवश्यक होगा, उसके पश्चात् विद्यार्थी अगले Course Module अर्थात Diploma in Faculty में प्रवेश हेतु योग्यता धारित कर सकेगा।

8.2 विद्यार्थी के लिए Diploma in Faculty का Course Module अर्थात तृतीय एवं चतुर्थ सेमेस्टर को सफलतापूर्वक पूर्ण करने की अधिकतम अवधि 03 वर्ष (Certificate in Faculty पूर्ण करने के उपरान्त 03 वर्ष) निर्धारित है। इस अवधि में विद्यार्थी को यह Course Module आवश्यक केडिट (तृतीय और चतुर्थ सेमेस्टर में सम्मिलित रूप से 46 क्रेडिट) के साथ पूर्ण करना आवश्यक होगा। इसके पश्चात् ही विद्यार्थी अगले–अगले Course Module अर्थात Bachelor in Faculty में प्रवेश हेतु योग्यता धारित कर सकेगा।

8.3 विद्यार्थी के लिए Bachelor in Faculty का Course Module अर्थात पांचवें एवं छठवें सेमेस्टर को सफलतापूर्वक पूर्ण करने की अधिकतम अवधि 03 वर्ष (Diploma in Faculty पूर्ण करने के उपरान्त 03 वर्ष) निर्धारित है। इस अवधि में विद्यार्थी को यह Course Module आवश्यक केडिट (पांचवे एवं छठवे सेमेस्टर में सम्मिलित रूप से 40 क्रेडिट) के साथ पूर्ण करना आवश्यक होगा, इसके पश्चात् ही विद्यार्थी अगले Course Module अर्थात Bachelor (Research) in Faculty में प्रवेश हेतु योग्यता धारित कर सकेगा।

8.4 किसी पाठ्यकम संरचना (Course Module) के लिये निर्धारित केडिट प्राप्त करने में असफल छात्र के लिये पृथक रूप से पुनः परीक्षा अथवा बैक पेपर परीक्षा आयोजित नहीं की जायेगी। सेमेस्टर प्रणाली की पारम्परिक और प्रचलित व्यवस्था के कम में उसे सम अथवा विषम सेमेस्टर की नियमानुसार आयोजित परीक्षा के साथ निर्धारित परीक्षा शुल्क जमा करते हुए पुनः परीक्षा देनी होगी।

9. क्रेडिट एवं क्रेडिट निर्धारणः

9.1 **केडिट के आधार पर शिक्षण कार्यः** थ्योरी के एक केडिट के पेपर में एक घंटा प्रति सप्ताह का शिक्षण कार्य होगा, अर्थात एक सेमेस्टर के 15 सप्ताह में 15 घंटे का शिक्षण कराना होगा।

9.2 प्रैक्टिकल/इंटर्नशिप/फील्ड वर्क आदि के एक केडिट के पेपर में दो घंटे प्रति सप्ताह का शिक्षण कार्य होगा, अर्थात एक सेमेस्टर के 15 सप्ताह में 30 घंटे का प्रैक्टिकल/इंटर्नशिप/फील्ड वर्क आदि कराना होगा। शिक्षक के कार्यभार की गणना में थ्योरी के एक घंटे का कार्यभार प्रैक्टिकल/इंटर्नशिप/फील्ड वर्क आदि के दो घंटे के कार्यभार के बराबर होगा।

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9.3 **केडिट्स का राज्य स्तर पर संरक्षण:**— केडिट संबंधित समस्त कार्य राज्य स्तरीय ABACUS-UP शासनादेश संख्या–1816/सत्तर–3–2021 दिनांक 09.08.2021 के माध्यम से किए जाएंगे, जिसके दिशा–निर्देश शासन द्वारा जारी दिशा–निर्देशों के अनुरूप अलग से जारी किए जाएगें।

9.4 **वर्षवार/मोड्यूलवार पाठ्यकयमों के नाम:**— विद्यार्थी न्यूनतम 46 केडिट अर्जित करने पर एक वर्षीय सर्टिफिकेट; न्यूनतम 92 केडिट अर्जित करने पर दो वर्षीय डिप्लोमा तथा न्यूनतम 132 केडिट अर्जित करने पर तीन वर्षीय स्नातक डिग्री ले सकता है। इसके आगे विद्यार्थी न्यूनतम 184 केडिट अर्जित करने पर चार वर्षीय स्नातक डिग्री; न्यूनतम 232 केडिट अर्जित करने पर स्नातकोत्तर डिग्री तथा न्यूनतम 248 केडिट अर्जित करने पर पी.जी.डी.आर. ले सकता है।

9.5 **केडिट अर्जन तथा उपयोग के पश्चात् रि–केडिट की सुविधा:**— एक बार केडिट का उपयोग करने के पश्चात् विद्यार्थी उनके केडिट का उपयोग नहीं कर सकेगा। उदाहरण के लिए यदि कोई छात्र एक वर्ष के बाद 46 केडिट का प्रयोग कर सर्टिफिकेट प्राप्त करता है तो उसके केडिट खर्च माने जाएंगे। यदि वह कुछ वर्षो बाद डिप्लोमा लेना चाहता है तो वह या तो अपना मूल सर्टिफिकेट विद्यालय में जमा (Surrender) कर 46 केडिट खाते में रि–केडिट करेगा अथवा नए 46 केडिट पुनः जमा करेगा, जिसके आधार पर वह द्वितीय वर्ष (वास्तविक तृतीय वर्ष) में 92 (46+46) केडिट अर्जित कर डिप्लोमा ले सकता है। इसी तरह की व्यवस्था आगामी वर्षो के लिये भी होगी। यदि विद्यार्थी लगातार अध्ययन करता है तथा सर्टिफिकेट/डिप्लोमा नहीं लेता है तो वह 132 केडिट के आधार पर डिग्री ले सकता है।

9.6 **योग्य विद्यार्थी (Fast Learner) को सुविधा:**— यदि कोई योग्य विद्यार्थी (Fast Learner) कम समय में डिग्री के लिए आवश्यक केडिट प्राप्त कर लेगा तो न्यूनतम केडिट प्राप्त करने पर उसे अंतराल की सुविधा होगी; परन्तु डिग्री तीन वर्ष बाद ही मिलेगी। अंतराल के दौरान वह किसी भी कार्य को करने के लिए स्वतंत्र होगा।

9.7 **संकाय अथवा विषय बदलने पर डिप्लोमा नहीं:**— द्वितीय वर्ष में संकाय अथवा विषय परिवर्तन की स्थिति में अर्जित केडिट सर्टिफिकेट की श्रेणी में आएंगे न कि डिप्लोमा की, क्योंकि डिप्लोमा प्राप्त करने के लिए उसे उसी विषय के आवश्यक केडिट प्राप्त करने होंगे।

9.8 **छात्र को उसके अपने संकाय में डिग्री:**— तीन वर्षो में विद्यार्थी जिस संकाय में न्यूनतम 60 प्रतिशत केडिट प्राप्त करेगा उसी संकाय में उसे डिग्री दी जाएगी और विश्वविद्यालय में नियमानुसार स्नातकोत्तर में प्रवेश की सुविधा होगी।

9.9 **बैचलर ऑफ लिबरल एजूकेशन (B.L.Ed.):**— यदि विद्यार्थी तीन वर्ष में किसी एक संकाय में तीन मुख्य विषयों के कुल केडिट का न्यूनतम 60 प्रतिशत, यथा–112 का 60 प्रतिशत अर्थात 67 केडिट प्राप्त नहीं कर पाता है तो उसे **बैचलर आफ लिबरल एजूकेशन (B.L.Ed.)** की डिग्री दी जाएगी तथा वह

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उन विषयों में स्नातकोत्तर कर सकेगा जिनमें स्नातक स्तर पर किसी विषय की पूर्व पात्रता (Pre-Requisite) की आवश्यकता नहीं होगी। समान्यतः इस श्रेणी में कला संकाय के ऐसे विषय आएंगे जिनमें प्रयोगात्मक कार्य अनिवार्य नहीं है।

9.10 **परीक्षा में अनुत्तीर्ण होने पर रि- केडिट वाले विद्यार्थियों को लाभः–** यदि कोई योग्य विद्यार्थी सर्टिफिकेट/डिप्लोमा लेकर अपने केडिट पुनः जमा (Re-Credit) कर लेता है और वह आगामी परीक्षा में अनुत्तीर्ण हो जाता है तो वह रि–केडिट किए गए केडिट का उपयोग कर पुनः सर्टिफिकेट/डिप्लोमा प्राप्त कर सकता है।

9.11 **रोजगारपरक पाठ्यक्रमों में क्रेडिट :–** रोजगार परक पाठ्यक्रम से प्रत्येक सेमेस्टर में विद्यार्थी को न्यूनतम 3 क्रेडिट अर्थात् प्रति वर्ष 6 क्रेडिट अर्जित करने होंगे। विद्यार्थी आवश्यकता से अधिक क्रेडिट वाले रोजगार परक पाठ्यक्रम का चुनाव कर सकते है तथा उन्हें जमा कर सकते हैं, परन्तु एक वर्ष में 6 क्रेडिट/दो वर्ष में 12 क्रेडिट का उपयोग सर्टीफिकेट/डिप्लोमा/डिग्री प्राप्त करने में किया जायेगा।

10. उपस्थिति व क्रेडिट निर्धारणः

10.1 केडिट वैलिडेशन के लिए परीक्षा देना आवश्यक होगा। परीक्षा के बिना केडिट अपूर्ण होंगे।

10.2 परीक्षा देने के लिए पूर्व नियमानुसार 75 प्रतिशत उपस्थिति अनिवार्य होगी।

10.3 छात्र कक्षा में उपस्थिति के आधार पर परीक्षा के लिए अर्हता प्राप्त करता है, परन्तु किसी कारण से नहीं दे पाता, तो वह आगामी समय में परीक्षा दे सकता है।

11. राष्ट्रीय शिक्षा नीति–2020 के सन्दर्भ में विद्यार्थी को प्राप्त होने वाली अन्य सुविधाएँः

11.1 **ऑनलाइन कोर्स के केडिट को जोड़ने की व्यवस्थाः–** विद्यार्थी मान्यता प्राप्त संस्थानों (UGC, SWAYAM, MOOCs portals) से 20 प्रतिशत तक या यू0जी0सी0/शिक्षा मंत्रालय, भारत सरकार द्वारा अनुमन्य सीमा तक केडिट ऑनलाइन कोर्स के माध्यम से प्राप्त कर सकेंगे तथा उसके अनुपालन में कोर्स/विषय छोड़ सकेंगे। विश्वविद्यालय व्यवस्था के दृष्टिगत ऑनलाइन पेपर चयनित किये जाने की यह सुविधा माइनर/इलेक्टिव पेपर्स के लिए छूट पर ही लागू होगी। यू0जी0सी0 के नियमों के अनुसार ऑनलाइन कोर्स के केडिट सभी विश्वविद्यालयों/महाविद्यालयों को जोड़ने होंगे।

11.2 **विशेष विषय को अन्य शिक्षण संस्थानों से पढ़ने की सुविधाः–** विद्यार्थी की आवश्यकता के अनुसार निकट के अन्य शिक्षण संस्थान से किसी विशेष विषय के अध्ययन की सुविधा विश्वविद्यालय द्वारा अनुमन्य की जा सकती है। इस सुविधा का लाभ विद्यार्थियों को प्रदान करने के लिए सम्बन्धित महाविद्यालय

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पारम्परिक रूप से अनुबन्ध हस्ताक्षरित करते हुए उसकी एक प्रति सूचनार्थ विश्वविद्यालय को भेजेंगे।

11.3 एन०सी०सी० एक लघु–वैकल्पिक विषय (गाईनर इलेक्टिव)

11.3.1 लघु–वैकल्पिक (Minor Elective) पेपर के रूप में एन०सी०सी० को भी सम्मिलित किया गया है। यह पेपर 12 क्रेडिट का होगा तथा प्रथम एवं द्वितीय वर्षों (प्रथम से लेकर चुतर्थ सेमेस्टर तक) में पढ़ाया जायेगा। (शासनादेश सं०–1815/सत्तर–3–2021–16(26)/2011 दिनांक 09.08.2021)

11.3.2 लघु–वैकल्पिक पेपर एन०सी०सी० का पाठ्यक्रम न्यूनतम समान पाठ्यक्रम योजना के अन्तर्गत शीघ्र ही राज्य सरकार के द्वारा निर्धारित कर दिया जायेगा। तद्नुसार विश्वविद्यालय की अध्ययन समिति (BoS) एवं अन्य सक्षम समितियों के समक्ष रखकर अनुमोदन प्राप्त करने की प्रकिया पूर्ण करायी जायेगी।

11.3.3 एन०सी०सी० लघु–वैकल्पिक पेपर प्रारम्भ में केवल एन०सी०सी० कैडेटों के लिये उपलब्ध होगा, परन्तु कालांतर में संसाधन आवश्यकताओं को पूर्ण कर सभी छात्रों के लिये उपलब्ध कराया जायेगा तथा तद्नुसार पाठ्यक्रम में आवश्यक संशोधन भी किया जायेगा।

12. परीक्षा व्यवस्थाः

12.1 सभी विषयों के प्रश्नपत्र 100 अंकों के होगें, जिनको क्रेडिट एवं फार्मूला के अनुसार परसेन्टाइल एवं ग्रेड में सॉफ्टवेयर द्वारा परिवर्तित कर दिया जायेगा।

12.2 सभी विषयों की परीक्षा 100 में से 25 अंकों के लिये सतत् आन्तरिक मूल्यांकन (Continuous Internal Evalution: CIE) एवं 75 अंको के लिये वाह्य मूल्याकंन के आधार पर ही सम्पन्न की जायेगी।

12.3 25 अंकों का आन्तरिक मूल्यांकन पाठ्यक्रमों में वर्णित व्यवस्था के अनुसार होगा।

12.4 महाविद्यालय केन्द्रीकृत व्यवस्था या अन्य सुचितापूर्ण व्यवस्था के अनुरूप सतत आन्तरिक मूल्यांकन करायेंगे तथा असाइनमेंट, क्लास टेस्ट की उत्तरपुस्तिकाओं व अन्य रिपोर्टो को परीक्षा परिणाम घोषित होने के कम से कम एक वर्ष आगे तक सुरक्षित रखा जायेगा।

12.5 सभी विषयों की लिखित परीक्षा होगी एवं अनिवार्य को–करीकुलर विषय की परीक्षा बहुविकल्पीय आधार पर होगी।

12.6 **रोजगारपरक पाठ्यक्रमों की परीक्षा**

12.6.1 रोजगारपरक पाठ्यक्रमों की थ्योरी/सामान्य भाग की परीक्षा (1 क्रेडिट) विश्वविद्यालयी संस्थानों/ महाविद्यालय द्वारा करायी जायेगी

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तथा ट्रेनिंग/इन्टर्नशिप (2 क्रेडिट) की परीक्षा स्किल पार्टनर द्वारा करायी जायेगी।

12.6.2 स्किल पार्टनर विद्यार्थी के द्वारा ट्रेनिंग/इन्टर्नशिप के दौरान किये गये कार्य तथा ऑनलाइन/ऑफलाइन परीक्षा के आधार पर उसके स्किल का आंकलन कर सकते हैं।

12.6.3 Theory and Skill के अंक प्राप्त होने के पश्चात् समयान्तर्गत महाविद्यालय द्वारा ABACUS-UP पोर्टल पर अंक अपलोड किये जायेंगे।

12.6.4 विश्वविद्यालय द्वारा प्राप्त अंकतालिका/डिग्री में उक्त रोजगार परक विषय का विवरण अंकित किया जायेगा।

12.6.5 इसके अतिरिक्त, विश्वविद्यालय/महाविद्यालय एवं स्किल पार्टनर संयुक्त रूप से विद्यार्थी को अलग से भी सर्टीफिकेट जारी कर सकते हैं।

13. उपरोक्त शासनादेश के निर्देशानुकम में उक्त संरचना मूल और अनुप्रयुक्त विज्ञान, कला, सामाजिक विज्ञान, मानविकी विज्ञान, वाणिज्य, भारतीय एवं विदेशी भाषाएँ तथा कृषि संकायों पर लागू होगी। तदनुक्रम में निम्न बिन्दुओं पर भी प्रमुखता से ध्यान अपेक्षित है:

13.1 स्नातक पाठ्यकम के प्रथम वर्ष के लिए 46 संचित केडिट के सापेक्ष तीन प्रमुख विषय, एक सहायक (माइनर) विषय, दो सह–पाठ्यकम एवं दो व्यवसायिक पाठ्यकम होंगे। जिसे उत्तीर्ण करने पर Certificate in Faculty प्रदान किया जायेगा।

13.2 द्वितीय वर्ष तक 92 केडिट संचित के सापेक्ष द्वितीय वर्ष में तीन प्रमुख विषय, एक सहायक (माइनर) विषय, दो सह–पाठ्यकम तथा दो व्यवसायिक पाठ्यकम होंगे, जिसे उत्तीर्ण करने पर Diploma in Faculty प्रदान किया जायेगा।

13.3 तृतीय वर्ष तक 132 संचित केडिट के सापेक्ष इस वर्ष में दो प्रमुख विषय, दो सह–पाठ्यकम तथा दो माइनर रिसर्च प्रोजेक्ट होंगे, जिसे उत्तीर्ण करने पर Bachelor in Faculty की उपाधि प्रदान की जायेगी।

13.4 चौथे वर्ष तक 184 संचित केडिट के सापेक्ष इस वर्ष में एक प्रमुख विषय, एक माइनर विषय तथा दो प्रमुख वृहद शोध परियोजनायें सम्मिलित होंगीं। जिसे उत्तीर्ण करने पर शोध सहित स्नातक Bachelor (Research) in Faculty की उपाधि प्रदान की जायेगी।

13.5 पांचवे वर्ष तक 232 संचित केडिट के सापेक्ष इस वर्ष में एक प्रमुख विषय एवं दो प्रमुख अनुसंधान परियोजनाएँ सम्मिलित होगीं, जिसे उत्तीर्ण करने के उपरान्त स्नातकोत्तर Master in Faculty उपाधि प्रदान की जायेगी।

13.6 छठें वर्ष तक 248 संचित केडिट के सापेक्ष इस वर्ष में एक प्रमुख विषय, एक अनुसंधान पद्धति एवं एक प्रमुख अनुसंधान परियोजना सम्मिलित होंगी, जिसे

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उत्तीर्ण करने के उपरान्त स्नातकोत्तर डिप्लोमा (शोध) (P.G.D.R. – Post Graduate Diploma in Research) प्रदान किया जा सकता है।

13.7 प्राथमिकता के आधार पर सातवें और आठवें वर्ष में (अन्यथा की स्थिति मे उसके आगे के वर्षो में) शोध–प्रबन्ध (Research Thesis) जमा करना होगा, जिसके मूल्यांकन के उपरान्त सफल घोषित किये जाने की संस्तुति के आधार पर पी–एच.डी. की उपाधि प्रदान की जायेगी।

13.8 यूनिफार्म केडिट एवं ग्रेडिंग सिस्टम का निर्धारण शासकीय निर्देशों के अनुरूप प्रचलित व्यवस्था के मानकानुरूप किया जायेगा।

13.9 प्रवेश, निकास एवं पुनः प्रवेश व्यवस्था के सम्बन्ध में गाइडलाइन विश्वविद्यालय द्वारा ही जारी की जायेगी; महाविद्यालय अपने स्तर से इस सम्बन्ध में निर्णय नहीं लेंगे।

13.10 स्नातक पाठ्यक्रमों के प्रथम दो वर्षो में कौशल–विकास से सम्बन्धित पाठ्यक्रम का अध्ययन अनिवार्य होगा। उच्च शिक्षा विभाग द्वारा सूक्ष्म लघु एवं मध्यम उद्योग विभाग के साथ एम०ओ०यू० हस्ताक्षर किया गया है, जिसके आलोक में विश्वविद्यालय / महाविद्यालयों को समन्वय स्थापित करना होगा।

संलग्नकः 1. स्नातक व स्नातकोत्तर कार्यक्रमों की वर्षवार संरचना।
2. रोजगारपरक पाठ्यक्रमों को बनाने हेतु संरचना प्रारूप।

Manoj Kr. Srivastava 18.08.2021
(प्रो० मनोज कुमार श्रीवास्तव)
निदेशक, समाज विज्ञान संस्थान, आगरा।

18/8/21
(प्रो० अजय तनेजा)
निदेशक, आई०क्यू०ए०सी०

18.08.202
(प्रो० वी०के० सारस्वत)
निदेशक, आई०ई०टी०

21/12/21

Vijay K. Singh 18/8/21
(डॉ० वी०के० सिंह)
ऐसो० प्रो०, जन्तु विज्ञान
आगरा कॉलेज, आगरा

Sanjay Jain 18.08.21
(डॉ० संजय जैन)
ऐसो० प्रो०, सांख्यिकी विभाग,
सेन्ट जोन्स कॉलेज, आगरा

(कुलसचिव) 18/8/21

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संलग्नक—1

स्नातक व स्नातकोत्तर कार्यक्रमों की वर्षवार संरचना

		Subject I	Subject II	Subject III	Subject IV	Vocational	Co-Curricular	Industrial Training/ Survey/ Research Project	(Minimum Credits) For the year	(Cummulative Minimum Credits) Required for Award of Certificate/ Diploma/ Degree
		Major	Major	Major	Minor Elective	Minor	Minor	Major		
		4/5/6 Credits	4/5/6 Credits	4/5/6 Credits	4/5/6 Credits	3 Credits		4 Credits		
Year	Sem	Own Faculty	Own Faculty	Own/ Other Faculty	Other Subject/ Faculty	Vocational/ Skill Development Course	Co-Curricular course (Qualifying)	Interdisciplinary Faculty related to main Subject		
1	I	Th-1(6) or Th-1(4)+ Pract-1(2)	Th-1(6) or Th-1(4)+ Pract-1(2)	Th-1(6) or Th-1(4)+ Pract-1(2)	1 (4/5/6)	1	1		46	(46) Certificate in Faculty
	II	Th-1(6) or Th-1(4)+ Pract-1(2)	Th-1(6) or Th-1(4)+ Pract-1(2)	Th-1(6) or Th-1(4)+ Pract-1(2)		1	1			
2	III	Th-1(6) or Th-1(4)+ Pract-1(2)	Th-1(6) or Th-1(4)+ Pract-1(2)	Th-1(6) or Th-1(4)+ Pract-1(2)	1 (4/5/6)	1	1		46	(92) Diploma in Faculty
	IV	Th-1(6) or Th-1(4)+ Pract-1(2)	Th-1(6) or Th-1(4)+ Pract-1(2)	Th-1(6) or Th-1(4)+ Pract-1(2)		1	1			
3	V	Th-2(5) or Th-2(4)+ Pract-1(2)	Th-2(5) or Th-2(4)+ Pract-1(2)				1	1 (Qualifying)	40	(132) Bachelor in Faculty
	VI	Th-2(5) or Th-2(4)+ Pract-1(2)	Th-2(5) or Th-2(4)+ Pract-1(2)				1	1 (Qualifying)		
4	VII	Th-4(5) or Th-4(4)+ Pract-1(4)			1 (4/5/6)			1 (4)	52	(184) Bachelor (Research) in Faculty
	VIII	Th-4(5) or Th-4(4)+ Pract-1(4)						1 (4)		
5	IX	Th-4(5) or Th-4(4)+ Pract-1(4)						1 (4)	48	(232) Master in Faculty
	X	Th-4(5) or Th-4(4)+ Pract-1(4)						1 (4)		
6	XI	2 (6)	1 Research [illegible]					1 (Qualifying)	16	(248) PGDR in Subject
6,7,8	XII-XVI							Ph D Thesis		Ph D in Subject

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संलग्नक–2

Format for syllabus development of Skill development course

Title of course-	
Nodal Department of HEI to run course	
Broad Area/Sector-	
Sub Sector-	
Nature of course - Independent / Progressive	
Name of suggestive Sector Skill Council	
Aliened NSQF level	
Expected fees of the course –Free/Paid	
Stipend to student expected from industry	
Number of Seats-……	
Course Code-……	Credits- 03 (1 Theory, 2 Practical)
Max Marks…100…… Minimum Marks……	
Name of proposed skill Partner (Please specify, Name of industry, company etc for Practical /training/ internship/OJT	
Job prospects-Expected Fields of Occupation where student will be able to get job after completing this course in (Please specify name/type of industry, company etc.)	

Syllabus

Unit	Topics	General/ Skill component	Theory/ Practical/ OJT/ Internship/ Training	No of theory hours (Total-15 Hours=1 credit)	No of skill Hours (Total-60 Hours=2 credits)
I					
II					
III					
IV					
V					
VI					

Suggested Readings:

Suggested Digital platforms/ web links for reading-

Suggested OJT/ Internship/ Training/ Skill partner

Suggested Continuous Evaluation Methods:

Course Pre-requisites:

- No pre-requisite required, open to all
- To study this course, a student must have the subject …….. in class/12th/ certificate/diploma
- If progressive, to study this course a student must have passed previous courses of this series.

Suggested equivalent online courses:

Any remarks/ suggestions:

Notes:

- Number of units in Theory/Practical may vary as per need
- Total credits/semester-3 (it can be more credits, but students will get only 3credit/ semester or 6credits/ year
- Credits for Theory =01 (Teaching Hours = 15)
- Credits for Internship/OJT/Training/Practical = 02 (Training Hours = 60)

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DEPARTMENT OF HIGHER EDUCATION
U.P. GOVERNMENT, LUCKNOW

National Education Policy-2020
Common Minimum Syllabus for all U.P. State Universities and Colleges
For first three years of Higher Education (UG)

PROPOSED STRUCTURE OF
UG PHYSICS SYLLABUS

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Name	Designation	Affiliation
Steering Committee		
Mrs. Monika S. Garg, (I.A.S.) Chairperson Steering Committee	Additional Chief Secretary	Dept. of Higher Education U.P., Lucknow
Prof. Poonam Tandan	Professor, Dept. of Physics	Lucknow University, U.P.
Prof. Hare Krishna	Professor, Dept. of Statistics	CCS University Meerut, U.P.
Dr. Dinesh C. Sharma	Associate Professor, Dept. of Zoology	K.M. Govt. Girls P.G. College Badalpur, G.B. Nagar, U.P.
Supervisory Committee-Science Faculty		
Dr. Vijay Kumar Singh	Associate Professor, Dept. of Zoology	Agra College, Agra
Dr. Santosh Singh	Dean, Dept. of Agriculture	Mahatma Gandhi Kashi Vidhyapeeth, Varanasi
Dr. Baby Tabussam	Associate Professor, Dept. of Zoology	Govt. Raza P.G. College Rampur, U.P.
Dr. Sanjay Jain	Associate Professor, Dept. of Statistics	St. John's College, Agra

Syllabus Developed by:

S.No.	Name	Designation	Department	College/University
1.	Dr. Gaurang Misra	Associate Professor	Physics	Agra College, Agra
2.	Dr. Naresh Kumar Chaudhary	Associate Professor	Physics & Electronics	Dr. R. M. L. A. University, Faizabad
3.	Dr. Vikram Singh	Assistant Professor	Physics	St. John's College, Agra

SEMESTER-WISE TITLES OF THE PAPERS IN UG PHYSICS COURSE

YEAR	SEME-STER	COURSE CODE	PAPER TITLE	THEORY / PRACTICAL	CREDIT
CERTIFICATE -IN BASIC PHYSICS & SEMICONDUCTOR DEVICES					
FIRST YEAR	I	B010101T	Mathematical Physics & Newtonian Mechanics	Theory	4
		B010102P	Mechanical Properties of Matter	Practical	2
	II	B010201T	Thermal Physics & Semiconductor Devices	Theory	4
		B010202P	Thermal Properties of Matter & Electronic Circuits	Practical	2
DIPLOMA - IN APPLIED PHYSICS WITH ELECTRONICS					
SECOND YEAR	III	B010301T	Electromagnetic Theory & Modern Optics	Theory	4
		B010302P	Demonstrative Aspects of Electricity & Magnetism	Practical	2
	IV	B010401T	Perspectives of Modern Physics & Basic Electronics	Theory	4
		B010402P	Basic Electronics Instrumentation	Practical	2
DEGREE -IN BACHELOR OF SCIENCE					
THIRD YEAR	V	B010501T	Classical & Statistical Mechanics	Theory	4
		B010502T	Quantum Mechanics & Spectroscopy	Theory	4
		B010503P	Demonstrative Aspects of Optics & Lasers	Practical	2
	VI	B010601T	Solid State & Nuclear Physics	Theory	4
		B010602T	Analog & Digital Principles & Applications	Theory	4
		B010603P	Analog & Digital Circuits	Practical	2

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SUBJECT PREREQUISITES

To study this subject, a student must have had the subjects **Physics & Mathematics** in class 12th.

PROGRAMME OUTCOMES (POs)

The practical value of science for productivity, for raising the standard of living of the people is surely recognized. Science as a power, which provides tools for effective action for the benefit of mankind or for conquering the forces of Nature or for developing resources, is surely highlighted everywhere. Besides the utilitarian aspect, the value of Science, lies in the fun called intellectual enjoyment. Science teaches the value of rational thought as well as importance of freedom of thought.

Our teaching so far has been aimed more at formal knowledge and understanding instead of training and application oriented. Presently, the emphasis is more on training, application and to some extent on appreciation, the fostering in the pupils of independent thinking and creativity. Surely, teaching has to be more objective based. The process of application based training, whether we call it a thrill or ability, is to be emphasized as much as the content.

Physics is a basic science; it attempts to explain the natural phenomenon in as simple a manner as possible. It is an intellectual activity aimed at interpreting the Multiverse. The starting point of all physics lies in experience. Experiment, whether done outside or in the laboratory, is an important ingredient of learning physics and hence the present programme integrates six experimental physics papers focusing on various aspects of modern technology based equipments. With all the limitations imposed (even the list of experiments as given in the syllabus) if the spirit of discovery by investigation is kept in mind, much of the thrill can be experienced.

1. The main aim of this programme is to help cultivate the love for Nature and its manifestations, to transmit the methods of science (the contents are only the means) to observe things around, to generalize, to do intelligent guessing, to formulate a theory & model, and at the same time, to hold an element of doubt and thereby to hope to modify it in terms of future experience and thus to practice a pragmatic outlook.
2. The programme intends to nurture the proficiency in functional areas of Physics, which is in line with the international standards, aimed at realizing the goals towards skilled India.
3. Keeping the application oriented training in mind; this programme aims to give students the competence in the methods and techniques of theoretical, experimental and computational aspects of Physics so as to achieve an overall understanding of the subject for holistic development. This will cultivate in specific application oriented training leading to their goals of employment.
4. The Bachelor's Project (Industrial Training / Survey / Dissertation) is intended to give an essence of research work for excellence in explicit areas. It integrates with specific job requirements / opportunities and provides a foundation for Bachelor (Research) Programmes.

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PROGRAMME SPECIFIC OUTCOMES (PSOs)	
CERTIFICATE IN BASIC PHYSICS & SEMICONDUCTOR DEVICES	
FIRST YEAR	This programme aims to give students the competence in the methods and techniques of calculations using Newtonian Mechanics and Thermodynamics. At the end of the course the students are expected to have hands on experience in modeling, implementation and calculation of physical quantities of relevance. An introduction to the field of Circuit Fundamentals and Basic Electronics which deals with the physics and technology of semiconductor devices is practically useful and gives the students an insight in handling electrical and electronic instruments. Experimental physics has the most striking impact on the industry wherever the instruments are used. The industries of electronics, telecommunication and instrumentation will specially recognize this course.
DIPLOMA IN APPLIED PHYSICS WITH ELECTRONICS	
SECOND YEAR	This programme aims to introduce the students with Electromagnetic Theory, Modern Optics and Relativistic Mechanics. Electromagnetic Wave Propagation serves as a basis for all communication systems and deals with the physics and technology of semiconductor optoelectronic devices. A deeper insight in Electronics is provided to address the important components in consumer Optoelectronics, IT and Communication devices, and in industrial instrumentation. The need of Optical instruments and Lasers is surely highlighted everywhere and at the end of the course the students are expected to get acquaint with applications of Lasers in technology. Companies and R&D Laboratories working on Electromagnetic properties, Laser Applications, Optoelectronics and Communication Systems are expected to value this course.
DEGREE IN BACHELOR OF SCIENCE	
THIRD YEAR	This programme contains very important aspects of modern day course curriculum, namely, Classical, Quantum and Statistical computational tools required in the calculation of physical quantities of relevance in interacting many body problems in physics. It introduces the branches of Solid State Physics and Nuclear Physics that are going to be of utmost importance at both undergraduate and graduate level. Proficiency in this area will attract demand in research and industrial establishments engaged in activities involving applications of these fields. This course amalgamates the comprehensive knowledge of Analog & Digital Principles and Applications. It presents an integrated approach to analog electronic circuitry and digital electronics. Present course will attract immense recognition in R&D sectors and in the entire cutting edge technology based industry.

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SEMESTER-WISE PAPER TITLES WITH DETAILS					
YEAR	**SEME-STER**	**PAPER**	**PAPER TITLE**	**PREREQUISITE For Paper**	**ELECTIVE For Major Subjects**
CERTIFICATE IN BASIC PHYSICS & SEMICONDUCTOR DEVICES					
FIRST YEAR	**SEMESTER I**	Theory Paper-1	Mathematical Physics & Newtonian Mechanics	Physics in 12th / Mathematics in 12th	YES Open to all
		Practical Paper	Mechanical Properties of Matter	Opted / Passed Sem I, Th Paper-1	YES Bota./Chem./Comp. Sc./ Math./Stat./Zool.
	SEMESTER II	Theory Paper-1	Thermal Physics & Semiconductor Devices	Physics in 12th / Chemistry in 12th	YES Open to all
		Practical Paper	Thermal Properties of Matter & Electronic Circuits	Opted / Passed Sem II, Th Paper-1	YES Bota./Chem./Comp. Sc./ Math./Stat./Zool.
DIPLOMA IN APPLIED PHYSICS WITH ELECTRONICS					
SECOND YEAR	**SEMESTER III**	Theory Paper-1	Electromagnetic Theory & Modern Optics	Passed Sem I, Th Paper-1	YES Open to all
		Practical Paper	Demonstrative Aspects of Electricity & Magnetism	Opted / Passed Sem III, Th Paper-1	YES Bota./Chem./Comp. Sc./ Math./Stat./Zool.
	SEMESTER IV	Theory Paper-1	Perspectives of Modern Physics & Basic Electronics	Passed Sem I, Th Paper-1	YES Open to all
		Practical Paper	Basic Electronics Instrumentation	Opted / Passed Sem IV, Th Paper-1	YES Bota./Chem./Comp. Sc./ Math./Stat./Zool.
DEGREE IN BACHELOR OF SCIENCE					
THIRD YEAR	**SEMESTER V**	Theory Paper-1	Classical & Statistical Mechanics	Passed Sem I, Th Paper-1	YES Chem./Comp. Sc./Math./Stat.
		Theory Paper-2	Quantum Mechanics & Spectroscopy	Passed Sem IV, Th Paper-1	YES Chem./Comp. Sc./Math./Stat.
		Practical Paper	Demonstrative Aspects of Optics & Lasers	Passed Sem III, Th Paper-1	YES Chem./Comp. Sc./Math./Stat.
	SEMESTER VI	Theory Paper-1	Solid State & Nuclear Physics	Passed Sem V, Th Paper-2	YES Chem./Comp. Sc./Math./Stat.
		Theory Paper-2	Analog & Digital Principles & Applications	Passed Sem IV, Th Paper-1	YES Open to all
		Practical Paper	Analog & Digital Circuits	Opted / Passed Sem VI, Th Paper-2	YES Chem./Comp. Sc./Math./Stat.

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FIRST YEAR

DETAILED SYLLABUS FOR

CERTIFICATE

IN

BASIC PHYSICS & SEMICONDUCTOR DEVICES

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YEAR	SEME-STER	PAPER	PAPER TITLE	UNIT TITLE (Periods Per Semester)
CERTIFICATE IN BASIC PHYSICS & SEMICONDUCTOR DEVICES				
FIRST YEAR	**SEMESTER I**	Theory Paper-1	**Mathematical Physics & Newtonian Mechanics** Part A: Basic Mathematical Physics Part B: Newtonian Mechanics & Wave Motion	**Part A** I: Vector Algebra (7) II: Vector Calculus (8) III: Coordinate Systems (8) IV: Introduction to Tensors (7) **Part B** V: Dynamics of a System of Particles (8) VI: Dynamics of a Rigid Body (8) VII: Motion of Planets & Satellites (7) VIII: Wave Motion (7)
		Practical Paper	**Mechanical Properties of Matter**	Lab Experiment List Online Virtual Lab Experiment List/Link
	SEMESTER II	Theory Paper-1	**Thermal Physics & Semiconductor Devices** Part A: Thermodynamics & Kinetic Theory of Gases Part B: Circuit Fundamentals & Semiconductor Devices	**Part A** I: 0^{th} & 1^{st} Law of Thermodynamics (8) II: 2^{nd} & 3^{rd} Law of Thermodynamics (8) III: Kinetic Theory of Gases (7) IV: Theory of Radiation (7) **Part B** V: DC & AC Circuits (7) VI: Semiconductors & Diodes (8) VII: Transistors (8) VIII: Electronic Instrumentation (7)
		Practical Paper	**Thermal Properties of Matter & Electronic Circuits**	Lab Experiment List Online Virtual Lab Experiment List/Link

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Programme/Class: **Certificate**	Year: **First**	Semester: **First**
Subject: **Physics**		
Course Code: **B010101T**	Course Title: **Mathematical Physics & Newtonian Mechanics**	

Course Outcomes (COs)

1. Recognize the difference between scalars, vectors, pseudo-scalars and pseudo-vectors.
2. Understand the physical interpretation of gradient, divergence and curl.
3. Comprehend the difference and connection between Cartesian, spherical and cylindrical coordinate systems.
4. Know the meaning of 4-vectors, Kronecker delta and Epsilon (Levi Civita) tensors.
5. Study the origin of pseudo forces in rotating frame.
6. Study the response of the classical systems to external forces and their elastic deformation.
7. Understand the dynamics of planetary motion and the working of Global Positioning System (GPS).
8. Comprehend the different features of Simple Harmonic Motion (SHM) and wave propagation.

Credits: **4**	Core Compulsory / Elective
Max. Marks: **25+75**	Min. Passing Marks:

Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: **4-0-0**

Unit	Topics	No. of Lectures
	PART A **Basic Mathematical Physics**	
I	***Introduction to Indian ancient Physics and contribution of Indian Physicists, in context with the holistic development of modern science and technology, should be included under Continuous Internal Evaluation (CIE).*** **Vector Algebra** Coordinate rotation, reflection and inversion as the basis for defining scalars, vectors, pseudo-scalars and pseudo-vectors (include physical examples). Component form in 2D and 3D. Geometrical and physical interpretation of addition, subtraction, dot product, wedge product, cross product and triple product of vectors. Position, separation and displacement vectors.	7
II	**Vector Calculus** Geometrical and physical interpretation of vector differentiation, Gradient, Divergence and Curl and their significance. Vector integration, Line, Surface (flux) and Volume integrals of vector fields. Gradient theorem, Gauss-divergence theorem, Stoke-curl theorem, Greens theorem and Helmholtz theorem (statement only). Introduction to Dirac delta function.	8
III	**Coordinate Systems** 2D & 3D Cartesian, Spherical and Cylindrical coordinate systems, basis vectors, transformation equations. Expressions for displacement vector, arc length, area element, volume element, gradient, divergence and curl in different coordinate systems. Components of velocity and acceleration in different coordinate systems. Examples of non-inertial coordinate system and pseudo-acceleration.	8

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IV	**Introduction to Tensors** Principle of invariance of physical laws w.r.t. different coordinate systems as the basis for defining tensors. Coordinate transformations for general spaces of nD, contravariant, covariant & mixed tensors and their ranks, 4-vectors. Index notation and summation convention. Symmetric and skew-symmetric tensors. Invariant tensors, Kronecker delta and Epsilon (Levi Civita) tensors. Examples of tensors in physics.	7
PART B **Newtonian Mechanics & Wave Motion**		
V	**Dynamics of a System of Particles** Review of historical development of mechanics up to Newton. Background, statement and critical analysis of Newton's axioms of motion. Dynamics of a system of particles, centre of mass motion, and conservation laws & their deductions. Rotating frames of reference, general derivation of origin of pseudo forces (Euler, Coriolis & centrifugal) in rotating frame, and effects of Coriolis force.	8
VI	**Dynamics of a Rigid Body** Angular momentum, Torque, Rotational energy and the inertia tensor. Rotational inertia for simple bodies (ring, disk, rod, solid and hollow sphere, solid and hollow cylinder, rectangular lamina). The combined translational and rotational motion of a rigid body on horizontal and inclined planes. Elasticity, relations between elastic constants, bending of beam and torsion of cylinder.	8
VII	**Motion of Planets & Satellites** Two particle central force problem, reduced mass, relative and centre of mass motion. Newton's law of gravitation, gravitational field and gravitational potential. Kepler's laws of planetary motion and their deductions. Motions of geo-synchronous & geo-stationary satellites and basic idea of Global Positioning System (GPS).	7
VIII	**Wave Motion** Differential equation of simple harmonic motion and its solution, use of complex notation, damped and forced oscillations, Quality factor. Composition of simple harmonic motion, Lissajous figures. Differential equation of wave motion. Plane progressive waves in fluid media, reflection of waves and phase change, pressure and energy distribution. Principle of superposition of waves, stationary waves, phase and group velocity.	7

Suggested Readings

PART A

1. Murray Spiegel, Seymour Lipschutz, Dennis Spellman, "Schaum's Outline Series: Vector Analysis", McGraw Hill, 2017, 2e
2. A.W. Joshi, "Matrices and Tensors in Physics", New Age International Private Limited, 1995, 3e

PART B

1. Charles Kittel, Walter D. Knight, Malvin A. Ruderman, Carl A. Helmholz, Burton J. Moyer, "Mechanics (In SI Units): Berkeley Physics Course Vol 1", McGraw Hill, 2017, 2e
2. Richard P. Feynman, Robert B. Leighton, Matthew Sands, "The Feynman Lectures on Physics - Vol. 1", Pearson Education Limited, 2012
3. Hugh D. Young and Roger A. Freedman, "Sears & Zemansky's University Physics with Modern Physics", Pearson Education Limited, 2017, 14e
4. D.S. Mathur, P.S. Hemne, "Mechanics", S. Chand Publishing, 1981, 3e

Books published in Hindi & Other Reference / Text Books may be suggested / added to this list by individual Universities.

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Suggestive Digital Platforms / Web Links
1. MIT Open Learning - Massachusetts Institute of Technology, https://openlearning.mit.edu/ 2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd 3. Uttar Pradesh Higher Education Digital Library, http://heecontent.upsdc.gov.in/SearchContent.aspx 4. Swayam Prabha - DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current_he/8
Course Prerequisites
Physics in 12th / Mathematics in 12th
This course can be opted as an Elective by the students of following subjects
Open to all
Suggested Continuous Internal Evaluation (CIE) Methods
20 marks for Test / Quiz / Assignment / Seminar 05 marks for Class Interaction
Suggested Equivalent Online Courses
1. Swayam - Government of India, https://swayam.gov.in/explorer?category=Physics 2. National Programme on Technology Enhanced Learning (NPTEL), https://nptel.ac.in/course.html 3. Coursera, https://www.coursera.org/browse/physical-science-and-engineering/physics-and-astronomy 4. edX, https://www.edx.org/course/subject/physics 5. MIT Open Course Ware - Massachusetts Institute of Technology, https://ocw.mit.edu/courses/physics/
Further Suggestions
• Other Digital Platforms / Web Links and Equivalent Online Courses may be suggested / added to the respective lists by individual Universities. • **In End-Semester University Examinations, equal weightage should be given to Part A (units I to IV) and Part B (units V to VIII) while framing the questions.**

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Programme/Class: **Certificate**	Year: **First**	Semester: **First**
Subject: **Physics**		
Course Code: **B010102P**	Course Title: **Mechanical Properties of Matter**	

Course Outcomes (COs)

Experimental physics has the most striking impact on the industry wherever the instruments are used to study and determine the mechanical properties. Measurement precision and perfection is achieved through Lab Experiments. Online Virtual Lab Experiments give an insight in simulation techniques and provide a basis for modeling.

Credits: **2**	Core Compulsory / Elective
Max. Marks: **25+75**	Min. Passing Marks:

Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: **0-0-4**

Unit	Topics	No. of Lectures
	Lab Experiment List	60
	1. Moment of inertia of a flywheel 2. Moment of inertia of an irregular body by inertia table 3. Modulus of rigidity by statistical method (Barton's apparatus) 4. Modulus of rigidity by dynamical method (sphere / disc / Maxwell's needle) 5. Young's modulus by bending of beam 6. Young's modulus and Poisson's ratio by Searle's method 7. Poisson's ratio of rubber by rubber tubing 8. Surface tension of water by capillary rise method 9. Surface tension of water by Jaeger's method 10. Coefficient of viscosity of water by Poiseuille's method 11. Acceleration due to gravity by bar pendulum 12. Frequency of AC mains by Sonometer 13. Height of a building by Sextant 14. Study the wave form of an electrically maintained tuning fork / alternating current source with the help of cathode ray oscilloscope.	
	Online Virtual Lab Experiment List / Link	
	Virtual Labs at Amrita Vishwa Vidyapeetham https://vlab.amrita.edu/?sub=1&brch=74 1. Torque and angular acceleration of a fly wheel 2. Torsional oscillations in different liquids 3. Moment of inertia of flywheel 4. Newton's second law of motion 5. Ballistic pendulum 6. Collision balls 7. Projectile motion 8. Elastic and inelastic collision	

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Suggested Readings
1. B.L. Worsnop, H.T. Flint, "Advanced Practical Physics for Students", Methuen & Co., Ltd., London, 1962, 9e 2. S. Panigrahi, B. Mallick, "Engineering Practical Physics", Cengage Learning India Pvt. Ltd., 2015, 1e 3. R.K. Agrawal, G. Jain, R. Sharma, "Practical Physics", Krishna Prakashan Media (Pvt.) Ltd., Meerut, 2019 4. S.L. Gupta, V. Kumar, "Practical Physics", Pragati Prakashan, Meerut, 2014, 2e ***Books published in Hindi & Other Reference / Text Books may be suggested / added to this list by individual Universities.***
Suggestive Digital Platforms / Web Links
1. Virtual Labs at Amrita Vishwa Vidyapeetham, https://vlab.amrita.edu/?sub=1&brch=74 2. Digital Platforms /Web Links of other virtual labs may be suggested / added to this lists by individual Universities.
Course Prerequisites
Opted / Passed Semester I, Theory Paper-1 (B010101T)
This course can be opted as an Elective by the students of following subjects
Botany / Chemistry / Computer Science / Mathematics / Statistics / Zoology
Suggested Continuous Internal Evaluation (CIE) Methods
15 marks for Record File (depending upon the no. of experiments performed out of the total assigned experiments) 05 marks for Viva Voce 05 marks for Class Interaction
Suggested Equivalent Online Courses
Further Suggestions
• The institution may add / modify / change the experiments of the same standard in the subject. • The institution may suggest a minimum number of experiments (say 6) to be performed by each student per semester from the Lab Experiment List. • The institution may suggest a minimum number of experiments (say 3) to be performed by each student per semester from the Online Virtual Lab Experiment List / Link.

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Programme/Class: **Certificate**	Year: **First**	Semester: **Second**
Subject: **Physics**		
Course Code: **B010201T**	Course Title: **Thermal Physics & Semiconductor Devices**	

Course Outcomes (COs)

1. Recognize the difference between reversible and irreversible processes.
2. Understand the physical significance of thermodynamical potentials.
3. Comprehend the kinetic model of gases w.r.t. various gas laws.
4. Study the implementations and limitations of fundamental radiation laws.
5. Utility of AC bridges.
6. Recognize the basic components of electronic devices.
7. Design simple electronic circuits.
8. Understand the applications of various electronic instruments.

Credits: **4**	Core Compulsory / Elective
Max. Marks: **25+75**	Min. Passing Marks:

Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: **4-0-0**

Unit	Topics	No. of Lectures
	PART A **Thermodynamics & Kinetic Theory of Gases**	
I	**0^{th} & 1^{st} Law of Thermodynamics** State functions and terminology of thermodynamics. Zeroth law and temperature. First law, internal energy, heat and work done. Work done in various thermodynamical processes. Enthalpy, relation between C_P and C_V. Carnot's engine, efficiency and Carnot's theorem. Efficiency of internal combustion engines (Otto and diesel).	8
II	**2^{nd} & 3^{rd} Law of Thermodynamics** Different statements of second law, Clausius inequality, entropy and its physical significance. Entropy changes in various thermodynamical processes. Third law of thermodynamics and unattainability of absolute zero. Thermodynamical potentials, Maxwell's relations, conditions for feasibility of a process and equilibrium of a system. Clausius- Clapeyron equation, Joule-Thompson effect.	8
III	**Kinetic Theory of Gases** Kinetic model and deduction of gas laws. Derivation of Maxwell's law of distribution of velocities and its experimental verification. Degrees of freedom, law of equipartition of energy (no derivation) and its application to specific heat of gases (mono, di and poly atomic).	7
IV	**Theory of Radiation** Blackbody radiation, spectral distribution, concept of energy density and pressure of radiation. Derivation of Planck's law, deduction of Wien's distribution law, Rayleigh-Jeans law, Stefan-Boltzmann law and Wien's displacement law from Planck's law.	7

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PART B Circuit Fundamentals & Semiconductor Devices		
V	**DC & AC Circuits** Growth and decay of currents in RL circuit. Charging and discharging of capacitor in RC, LC and RCL circuits. Network Analysis - Superposition, Reciprocity, Thevenin's and Norton's theorems. AC Bridges - measurement of inductance (Maxwell's, Owen's and Anderson's bridges) and measurement of capacitance (Schering's, Wein's and de Sauty's bridges).	7
VI	**Semiconductors & Diodes** P and N type semiconductors, qualitative idea of Fermi level. Formation of depletion layer in PN junction diode, field & potential at the depletion layer. Qualitative idea of current flow mechanism in forward & reverse biased diode. Diode fabrication. PN junction diode and its characteristics, static and dynamic resistance. Principle, structure, characteristics and applications of Zener, Tunnel, Light Emitting, Point Contact and Photo diodes. Half and Full wave rectifiers, calculation of ripple factor, rectification efficiency and voltage regulation. Basic idea about filter circuits and voltage regulated power supply.	8
VII	**Transistors** Bipolar Junction PNP and NPN transistors. Study of CB, CE & CC configurations w.r.t. active, cutoff & saturation regions; characteristics; current, voltage & power gains; transistor currents & relations between them. Idea of base width modulation, base spreading resistance & transition time. DC Load Line analysis and Q-point stabilisation. Voltage Divider Bias circuit for CE amplifier. Qualitative discussion of RC coupled amplifier (frequency response not included).	8
VIII	**Electronic Instrumentation** Multimeter: Principles of measurement of dc voltage, dc current, ac voltage, ac current and resistance. Specifications of a multimeter and their significance. Cathode Ray Oscilloscope: Block diagram of basic CRO. Construction of CRT, electron gun, electrostatic focusing and acceleration (no mathematical treatment). Front panel controls, special features of dual trace CRO, specifications of a CRO and their significance. Applications of CRO to study the waveform and measurement of voltage, current, frequency & phase difference.	7

Suggested Readings

PART A

1. M.W. Zemansky, R. Dittman, "Heat and Thermodynamics", McGraw Hill, 1997, 7e
2. F.W. Sears, G.L. Salinger, "Thermodynamics, Kinetic theory & Statistical thermodynamics", Narosa Publishing House, 1998
3. Enrico Fermi, "Thermodynamics", Dover Publications, 1956
4. S. Garg, R. Bansal, C. Ghosh, "Thermal Physics", McGraw Hill, 2012, 2e
5. Meghnad Saha, B.N. Srivastava, "A Treatise on Heat", Indian Press, 1973, 5e

PART B

1. R.L. Boylestad, L. Nashelsky, "Electronic Devices and Circuit Theory", Prentice-Hall of India Pvt. Ltd., 2015, 11e
2. J. Millman, C.C. Halkias, Satyabrata Jit, "Electronic Devices and Circuits", McGraw Hill, 2015, 4e
3. B.G. Streetman, S.K. Banerjee, "Solid State Electronic Devices", Pearson Education India, 2015, 7e
4. J.D. Ryder, "Electronic Fundamentals and Applications", Prentice-Hall of India Private Limited, 1975, 5e
5. A. Sudhakar, S.S. Palli, "Circuits and Networks: Analysis and Synthesis", McGraw Hill, 2015, 5e
6. S.L. Gupta, V. Kumar, "Hand Book of Electronics", Pragati Prakashan, Meerut, 2016, 43e

Books published in Hindi & Other Reference / Text Books may be suggested / added to this list by individual Universities.

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Suggestive Digital Platforms / Web Links
1. MIT Open Learning - Massachusetts Institute of Technology, https://openlearning.mit.edu/ 2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd 3. Uttar Pradesh Higher Education Digital Library, http://heecontent.upsdc.gov.in/SearchContent.aspx 4. Swayam Prabha - DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current_he/8
Course Prerequisites
Physics in 12th / Chemistry in 12th
This course can be opted as an Elective by the students of following subjects
Open to all
Suggested Continuous Internal Evaluation (CIE) Methods
20 marks for Test / Quiz / Assignment / Seminar 05 marks for Class Interaction
Suggested Equivalent Online Courses
1. Swayam - Government of India, https://swayam.gov.in/explorer?category=Physics 2. National Programme on Technology Enhanced Learning (NPTEL), https://nptel.ac.in/course.html 3. Coursera, https://www.coursera.org/browse/physical-science-and-engineering/physics-and-astronomy 4. edX, https://www.edx.org/course/subject/physics 5. MIT Open Course Ware - Massachusetts Institute of Technology, https://ocw.mit.edu/courses/physics/
Further Suggestions
• Other Digital Platforms / Web Links and Equivalent Online Courses may be suggested / added to the respective lists by individual Universities. • **In End-Semester University Examinations, equal weightage should be given to Part A (units I to IV) and Part B (units V to VIII) while framing the questions.**

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Programme/Class: **Certificate**	Year: **First**	Semester: **Second**
Subject: **Physics**		
Course Code: **B010202P**	Course Title: **Thermal Properties of Matter & Electronic Circuits**	

Course Outcomes (COs)

Experimental physics has the most striking impact on the industry wherever the instruments are used to study and determine the thermal and electronic properties. Measurement precision and perfection is achieved through Lab Experiments. Online Virtual Lab Experiments give an insight in simulation techniques and provide a basis for modeling.

Credits: **2**	Core Compulsory / Elective
Max. Marks: **25+75**	Min. Passing Marks:

Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: **0-0-4**

Unit	Topics	No. of Lectures
	Lab Experiment List	60
	1. Mechanical Equivalent of Heat by Callender and Barne's method 2. Coefficient of thermal conductivity of copper by Searle's apparatus 3. Coefficient of thermal conductivity of rubber 4. Coefficient of thermal conductivity of a bad conductor by Lee and Charlton's disc method 5. Value of Stefan's constant 6. Verification of Stefan's law 7. Variation of thermo-emf across two junctions of a thermocouple with temperature 8. Temperature coefficient of resistance by Platinum resistance thermometer 9. Charging and discharging in RC and RCL circuits 10. A.C. Bridges: Various experiments based on measurement of L and C 11. Resonance in series and parallel RCL circuit 12. Characteristics of PN Junction, Zener, Tunnel, Light Emitting and Photo diode 13. Characteristics of a transistor (PNP and NPN) in CE, CB and CC configurations 14. Half wave & full wave rectifiers and Filter circuits 15. Unregulated and Regulated power supply 16. Various measurements with Cathode Ray Oscilloscope (CRO)	
	Online Virtual Lab Experiment List / Link	
	Thermal Properties of Matter: Virtual Labs at Amrita Vishwa Vidyapeetham https://vlab.amrita.edu/?sub=1&brch=194 1. Heat transfer by radiation 2. Heat transfer by conduction 3. Heat transfer by natural convection 4. The study of phase change 5. Black body radiation: Determination of Stefan's constant 6. Newton's law of cooling 7. Lee's disc apparatus 8. Thermo-couple: Seebeck effects	

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Semiconductor Devices:
Virtual Labs an initiative of MHRD Govt. of India
http://vlabs.iitkgp.ac.in/be/#

9. Familiarisation with resistor
10. Familiarisation with capacitor
11. Familiarisation with inductor
12. Ohm's Law
13. RC Differentiator and integrator
14. VI characteristics of a diode
15. Half & Full wave rectification
16. Capacitative rectification
17. Zener Diode voltage regulator
18. BJT common emitter characteristics
19. BJT common base characteristics
20. Studies on BJT CE amplifier

Suggested Readings

1. B.L. Worsnop, H.T. Flint, "Advanced Practical Physics for Students", Methuen & Co., Ltd., London, 1962, 9e
2. S. Panigrahi, B. Mallick, "Engineering Practical Physics", Cengage Learning India Pvt. Ltd., 2015, 1e
3. R.L. Boylestad, L. Nashelsky, "Electronic Devices and Circuit Theory", Prentice-Hall of India Pvt. Ltd., 2015, 11e
4. A. Sudhakar, S.S. Palli, "Circuits and Networks: Analysis and Synthesis", McGraw Hill, 2015, 5e

Books published in Hindi & Other Reference / Text Books may be suggested / added to this list by individual Universities.

Suggestive Digital Platforms / Web Links

1. Virtual Labs at Amrita Vishwa Vidyapeetham, https://vlab.amrita.edu/?sub=1&brch=194
2. Virtual Labs an initiative of MHRD Govt. of India, http://vlabs.iitkgp.ac.in/be/#
3. Digital Platforms /Web Links of other virtual labs may be suggested / added to this lists by individual Universities.

Course Prerequisites

Opted / Passed Semester II, Theory Paper-1 (B010201T)

This course can be opted as an Elective by the students of following subjects

Botany / Chemistry / Computer Science / Mathematics / Statistics / Zoology

Suggested Continuous Internal Evaluation (CIE) Methods

15 marks for Record File (depending upon the no. of experiments performed out of the total assigned experiments)
05 marks for Viva Voce
05 marks for Class Interaction

Suggested Equivalent Online Courses

Further Suggestions

- The institution may add / modify / change the experiments of the same standard in the subject.
- The institution may suggest a minimum number of experiments (say 6) to be performed by each student per semester from the Lab Experiment List.
- The institution may suggest a minimum number of experiments (say 3) to be performed by each student per semester from the Online Virtual Lab Experiment List / Link.

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SECOND YEAR

DETAILED SYLLABUS FOR

DIPLOMA

IN

ADVANCED PHYSICS WITH ELECTRONICS

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YEAR	SEME-STER	PAPER	PAPER TITLE	UNIT TITLE (Periods Per Semester)
DIPLOMA IN APPLIED PHYSICS WITH ELECTRONICS				
SECOND YEAR	**SEMESTER III**	Theory Paper-1	**Electromagnetic Theory & Modern Optics** Part A: Electromagnetic Theory Part B: Physical Optics & Lasers	**Part A** I: Electrostatics (8) II: Magnetostatics (8) III: Time Varying Electromagnetic Fields (7) IV: Electromagnetic Waves (7) **Part B** V: Interference (8) VI: Diffraction (8) VII: Polarisation (7) VII: Lasers (7)
		Practical Paper	**Demonstrative Aspects of Electricity & Magnetism**	Lab Experiment List Online Virtual Lab Experiment List/Link
	SEMESTER IV	Theory Paper-1	**Perspectives of Modern Physics & Basic Electronics** Part A: Perspectives of Modern Physics Part B: Basic Electronics & Introduction to Fiber Optics	**Part A** I: Relativity-Experimental Background (7) II: Relativity-Relativistic Kinematics (8) III: Inadequacies of Classical Mechanics (8) IV: Introduction to Quantum Mechanics (7) **Part B** V: Transistor Biasing (7) VI: Amplifiers (7) VII: Feedback & Oscillator Circuits (8) VIII: Introduction to Fiber Optics (8)
		Practical Paper	**Basic Electronics Instrumentation**	Lab Experiment List Online Virtual Lab Experiment List/Link

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Programme/Class: **Diploma**	Year: **Second**	Semester: **Third**
Subject: **Physics**		
Course Code: **B010301T**	Course Title: **Electromagnetic Theory & Modern Optics**	

Course Outcomes (COs)

1. Better understanding of electrical and magnetic phenomenon in daily life.
2. To troubleshoot simple problems related to electrical devices.
3. Comprehend the powerful applications of ballistic galvanometer.
4. Study the fundamental physics behind reflection and refraction of light (electromagnetic waves).
5. Study the working and applications of Michelson and Fabry-Perot interferometers.
6. Recognize the difference between Fresnel's and Fraunhofer's class of diffraction.
7. Comprehend the use of polarimeters.
8. Study the characteristics and uses of lasers.

Credits: **4**	Core Compulsory / Elective
Max. Marks: **25+75**	Min. Passing Marks:

Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: **4-0-0**

Unit	Topics	No. of Lectures
	PART A **Electromagnetic Theory**	
I	**Electrostatics** Electric charge & charge densities, electric force between two charges. General expression for Electric field in terms of volume charge density (divergence & curl of Electric field), general expression for Electric potential in terms of volume charge density and Gauss law (applications included). Study of electric dipole. Electric fields in matter, polarization, auxiliary field **D** (Electric displacement), electric susceptibility and permittivity.	8
II	**Magnetostatics** Electric current & current densities, magnetic force between two current elements. General expression for Magnetic field in terms of volume current density (divergence and curl of Magnetic field), General expression for Magnetic potential in terms of volume current density and Ampere's circuital law (applications included). Study of magnetic dipole (Gilbert & Ampere model). Magnetic fields in matter, magnetisation, auxiliary field **H**, magnetic susceptibility and permeability.	8
III	**Time Varying Electromagnetic Fields** Faraday's laws of electromagnetic induction and Lenz's law. Displacement current, equation of continuity and Maxwell-Ampere's circuital law. Self and mutual induction (applications included). Derivation and physical significance of Maxwell's equations. Theory and working of moving coil ballistic galvanometer (applications included).	7
IV	**Electromagnetic Waves** Electromagnetic energy density and Poynting vector. Plane electromagnetic waves in linear infinite dielectrics, homogeneous & inhomogeneous plane waves and dispersive & non-dispersive media. Reflection and refraction of homogeneous plane electromagnetic waves, law of reflection, Snell's law, Fresnel's formulae (only for normal incidence & optical frequencies) and Stoke's law.	7

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PART B Physical Optics & Lasers		
V	**Interference** Conditions for interference and spatial & temporal coherence. Division of Wavefront - Fresnel's Biprism and Lloyd's Mirror. Division of Amplitude - Parallel thin film, wedge shaped film and Newton's Ring experiment. Interferometer - Michelson and Fabry-Perot.	8
VI	**Diffraction** Distinction between interference and diffraction. Fresnel's and Fraunhofer's class of diffraction. Fresnel's Half Period Zones and Zone plate. Fraunhofer diffraction at a single slit, n slits and Diffracting Grating. Resolving Power of Optical Instruments - Rayleigh's criterion and resolving power of telescope, microscope & grating.	8
VII	**Polarisation** Polarisation by dichronic crystals, birefringence, Nicol prism, retardation plates and Babinet's compensator. Analysis of polarized light. Optical Rotation - Fresnel's explanation of optical rotation and Half Shade & Biquartz polarimeters.	7
VIII	**Lasers** Characteristics and uses of Lasers. Quantitative analysis of Spatial and Temporal coherence. Conditions for Laser action and Einstein's coefficients. Three and four level laser systems (qualitative discussion).	7

Suggested Readings

PART A

1. D.J. Griffiths, "Introduction to Electrodynamics", Prentice-Hall of India Private Limited, 2002, 3e
2. E.M. Purcell, "Electricity and Magnetism (In SI Units): Berkeley Physics Course Vol 2", McGraw Hill, 2017, 2e
3. Richard P. Feynman, Robert B. Leighton, Matthew Sands, "The Feynman Lectures on Physics - Vol. 2", Pearson Education Limited, 2012
4. D.C. Tayal, "Electricity and Magnetism", Himalaya Publishing House Pvt. Ltd., 2019, 4e

PART B

1. Francis A. Jenkins, Harvey E. White, "Fundamentals of Optics", McGraw Hill, 2017, 4e
2. Samuel Tolansky, "An Introduction to Interferometry", John Wiley & Sons Inc., 1973, 2e
3. A. Ghatak, "Optics", McGraw Hill, 2017, 6e

Books published in Hindi & Other Reference / Text Books may be suggested / added to this list by individual Universities.

Suggestive Digital Platforms / Web Links

1. MIT Open Learning - Massachusetts Institute of Technology, https://openlearning.mit.edu/
2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd
3. Uttar Pradesh Higher Education Digital Library, http://heecontent.upsdc.gov.in/SearchContent.aspx
4. Swayam Prabha - DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current_he/8

Course Prerequisites

Passed Semester I, Theory Paper-1 (B010101T)

This course can be opted as an Elective by the students of following subjects

Open to all

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Suggested Continuous Internal Evaluation (CIE) Methods
20 marks for Test / Quiz / Assignment / Seminar 05 marks for Class Interaction
Suggested Equivalent Online Courses
1. Swayam - Government of India, https://swayam.gov.in/explorer?category=Physics 2. National Programme on Technology Enhanced Learning (NPTEL), https://nptel.ac.in/course.html 3. Coursera, https://www.coursera.org/browse/physical-science-and-engineering/physics-and-astronomy 4. edX, https://www.edx.org/course/subject/physics 5. MIT Open Course Ware - Massachusetts Institute of Technology, https://ocw.mit.edu/courses/physics/
Further Suggestions
• Other Digital Platforms / Web Links and Equivalent Online Courses may be suggested / added to the respective lists by individual Universities. • **In End-Semester University Examinations, equal weightage should be given to Part A (units I to IV) and Part B (units V to VIII) while framing the questions.**

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Programme/Class: **Diploma**	Year: **Second**	Semester: **Third**
Subject: **Physics**		
Course Code: **B010302P**	Course Title: **Demonstrative Aspects of Electricity & Magnetism**	

Course Outcomes (COs)

Experimental physics has the most striking impact on the industry wherever the instruments are used to study and determine the electric and magnetic properties. Measurement precision and perfection is achieved through Lab Experiments. Online Virtual Lab Experiments give an insight in simulation techniques and provide a basis for modeling.

Credits: **2**	Core Compulsory / Elective
Max. Marks: **25+75**	Min. Passing Marks:

Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: **0-0-4**

Unit	Topics	No. of Lectures
	Lab Experiment List 1. Variation of magnetic field along the axis of single coil 2. Variation of magnetic field along the axis of Helmholtz coil 3. Ballistic Galvanometer: Ballistic constant, current sensitivity and voltage sensitivity 4. Ballistic Galvanometer: High resistance by Leakage method 5. Ballistic Galvanometer: Low resistance by Kelvin's double bridge method 6. Ballistic Galvanometer: Self inductance of a coil by Rayleigh's method 7. Ballistic Galvanometer: Comparison of capacitances 8. Carey Foster Bridge: Resistance per unit length and low resistance 9. Deflection and Vibration Magnetometer: Magnetic moment of a magnet and horizontal component of earth's magnetic field 10. Earth Inductor: Horizontal component of earth's magnetic field	60
	Online Virtual Lab Experiment List / Link Virtual Labs at Amrita Vishwa Vidyapeetham https://vlab.amrita.edu/?sub=1&brch=192 1. Tangent galvanometer 2. Magnetic field along the axis of a circular coil carrying current 3. Deflection magnetometer 4. Van de Graaff generator 5. Barkhausen effect 6. Temperature coefficient of resistance 7. Anderson's bridge 8. Quincke's method	

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Suggested Readings
1. B.L. Worsnop, H.T. Flint, "Advanced Practical Physics for Students", Methuen & Co., Ltd., London, 1962, 9e 2. S. Panigrahi, B. Mallick, "Engineering Practical Physics", Cengage Learning India Pvt. Ltd., 2015, 1e 3. R.K. Agrawal, G. Jain, R. Sharma, "Practical Physics", Krishna Prakashan Media (Pvt.) Ltd., Meerut, 2019 4. S.L. Gupta, V. Kumar, "Practical Physics", Pragati Prakashan, Meerut, 2014, 2e ***Books published in Hindi & Other Reference / Text Books may be suggested / added to this list by individual Universities.***
Suggestive Digital Platforms / Web Links
1. Virtual Labs at Amrita Vishwa Vidyapeetham, https://vlab.amrita.edu/?sub=1&brch=192 2. Digital Platforms /Web Links of other virtual labs may be suggested / added to this lists by individual Universities.
Course Prerequisites
Opted / Passed Semester III, Theory Paper-1 (B010301T)
This course can be opted as an Elective by the students of following subjects
Botany / Chemistry / Computer Science / Mathematics / Statistics / Zoology
Suggested Continuous Internal Evaluation (CIE) Methods
15 marks for Record File (depending upon the no. of experiments performed out of the total assigned experiments) 05 marks for Viva Voce 05 marks for Class Interaction
Suggested Equivalent Online Courses
Further Suggestions
• The institution may add / modify / change the experiments of the same standard in the subject. • The institution may suggest a minimum number of experiments (say 6) to be performed by each student per semester from the Lab Experiment List. • The institution may suggest a minimum number of experiments (say 3) to be performed by each student per semester from the Online Virtual Lab Experiment List / Link.

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Programme/Class: **Diploma**	Year: **Second**	Semester: **Fourth**
Subject: **Physics**		
Course Code: **B010401T**	Course Title: **Perspectives of Modern Physics & Basic Electronics**	

Course Outcomes (COs)

1. Recognize the difference between the structure of space & time in Newtonian & Relativistic mechanics.
2. Understand the physical significance of consequences of Lorentz transformation equations.
3. Comprehend the wave-particle duality.
4. Develop an understanding of the foundational aspects of Quantum Mechanics.
5. Study the comparison between various biasing techniques.
6. Study the classification of amplifiers.
7. Comprehend the use of feedback and oscillators.
8. Comprehend the theory and working of optical fibers along with its applications.

Credits: **4**	Core Compulsory / Elective
Max. Marks: **25+75**	Min. Passing Marks:

Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: **4-0-0**

Unit	Topics	No. of Lectures
	PART A **Perspectives of Modern Physics**	
I	**Relativity-Experimental Background** Structure of space & time in Newtonian mechanics and inertial & non-inertial frames. Galilean transformations. Newtonian relativity. Galilean transformation and Electromagnetism. Attempts to locate the Absolute Frame: Michelson-Morley experiment and significance of the null result. Einstein's postulates of special theory of relativity.	7
II	**Relativity-Relativistic Kinematics** Structure of space & time in Relativistic mechanics and derivation of Lorentz transformation equations (4-vector formulation included). Consequences of Lorentz Transformation Equations (derivations & examples included): Transformation of Simultaneity (Relativity of simultaneity); Transformation of Length (Length contraction); Transformation of Time (Time dilation); Transformation of Velocity (Relativistic velocity addition); Transformation of Acceleration; Transformation of Mass (Variation of mass with velocity). Relation between Energy & Mass (Einstein's mass & energy relation) and Energy & Momentum.	8
III	**Inadequacies of Classical Mechanics** Particle Properties of Waves: Spectrum of Black Body radiation, Photoelectric effect, Compton effect and their explanations based on Max Planck's Quantum hypothesis. Wave Properties of Particles: Louis de Broglie's hypothesis of matter waves and their experimental verification by Davisson-Germer's experiment and Thomson's experiment.	8
IV	**Introduction to Quantum Mechanics** Matter Waves: Mathematical representation, Wavelength, Concept of Wave group, Group (particle) velocity, Phase (wave) velocity and relation between Group & Phase velocities. Wave Function: Functional form, Normalisation of wave function, Orthogonal & Orthonormal wave functions and Probabilistic interpretation of wave function based on Born Rule.	7

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PART B Basic Electronics & Introduction to Fiber Optics		
V	**Transistor Biasing** Faithful amplification & need for biasing. Stability Factors and its calculation for transistor biasing circuits for CE configuration: Fixed Bias (Base Resistor Method), Emitter Bias (Fixed Bias with Emitter Resistor), Collector to Base Bias (Base Bias with Collector Feedback) &, Voltage Divider Bias. Discussion of Emitter-Follower configuration.	7
VI	**Amplifiers** Classification of amplifiers based on Mode of operation (Class A, B, AB, C & D), Stages (single & multi stage, cascade & cascode connections), Coupling methods (RC, Transformer, Direct & LC couplings), Nature of amplification (Voltage & Power amplification) and Frequency capabilities (AF, IF, RF & VF). Theory & working of RC coupled voltage amplifier (Uses of various resistors & capacitors, and Frequency response) and Transformer coupled power amplifier (calculation of Power, Effect of temperature, Use of heat sink & Power dissipation). Calculation of Amplifier Efficiency (power efficiency) for Class A Series-Fed, Class A Transformer Coupled, Class B Series-Fed and Class B Transformer Coupled amplifiers.	7
VII	**Feedback & Oscillator Circuits** Feedback Circuits: Effects of positive and negative feedback. Voltage Series, Voltage Shunt, Current Series and Current Shunt feedback connection types and their uses for specific amplifiers. Estimation of Input Impedance, Output Impedance, Gain, Stability, Distortion, Noise and Band Width for Voltage Series negative feedback and their comparison between different negative feedback connection types. Oscillator Circuits: Use of positive feedback for oscillator operation. Barkhausen criterion for self-sustained oscillations. Feedback factor and frequency of oscillation for RC Phase Shift oscillator and Wein Bridge oscillator. Qualitative discussion of Reactive Network feedback oscillators (Tuned oscillator circuits): Hartley & Colpitt oscillators.	8
VIII	**Introduction to Fiber Optics** Basics of Fiber Optics, step index fiber, graded index fiber, light propagation through an optical fiber, acceptance angle & numerical aperture, qualitative discussion of fiber losses and applications of optical fibers.	8

Suggested Readings

PART A

1. A. Beiser, Shobhit Mahajan, "Concepts of Modern Physics: Special Indian Edition", McGraw Hill, 2009, 6e
2. John R. Taylor, Chris D. Zafiratos, Michael A.Dubson, "Modern Physics for Scientists and Engineers", Prentice-Hall of India Private Limited, 2003, 2e
3. R.A. Serway, C.J. Moses, and C.A. Moyer, "Modern Physics", Cengage Learning India Pvt. Ltd, 2004, 3e
4. R. Resnick, "Introduction to Special Relativity", Wiley India Private Limited, 2007
5. R. Murugeshan, Kiruthiga Sivaprasath, "Modern Physics", S. Chand Publishing, 2019, 18e

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PART B

1. R.L. Boylestad, L. Nashelsky, "Electronic Devices and Circuit Theory", Prentice-Hall of India Pvt. Ltd., 2015, 11e
2. J. Millman, C.C. Halkias, Satyabrata Jit, "Electronic Devices and Circuits", McGraw Hill, 2015, 4e
3. B.G. Streetman, S.K. Banerjee, "Solid State Electronic Devices", Pearson Education India, 2015, 7e
4. J.D. Ryder, "Electronic Fundamentals and Applications", Prentice-Hall of India Private Limited, 1975, 5e
5. John M. Senior, "Optical Fiber Communications: Principles and Practice", Pearson Education Limited, 2010, 3e
6. John Wilson, John Hawkes, "Optoelectronics: Principles and Practice", Pearson Education Limited, 2018, 3e
7. S.L. Gupta, V. Kumar, "Hand Book of Electronics", Pragati Prakashan, Meerut, 2016, 43e

Books published in Hindi & Other Reference / Text Books may be suggested / added to this list by individual Universities.

Suggestive Digital Platforms / Web Links

1. MIT Open Learning - Massachusetts Institute of Technology, https://openlearning.mit.edu/
2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd
3. Uttar Pradesh Higher Education Digital Library, http://heecontent.upsdc.gov.in/SearchContent.aspx
4. Swayam Prabha - DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current_he/8

Course Prerequisites

Passed Semester I, Theory Paper-1 (B010101T)

This course can be opted as an Elective by the students of following subjects

Open to all

Suggested Continuous Internal Evaluation (CIE) Methods

20 marks for Test / Quiz / Assignment / Seminar
05 marks for Class Interaction

Suggested Equivalent Online Courses

1. Swayam - Government of India, https://swayam.gov.in/explorer?category=Physics
2. National Programme on Technology Enhanced Learning (NPTEL), https://nptel.ac.in/course.html
3. Coursera, https://www.coursera.org/browse/physical-science-and-engineering/physics-and-astronomy
4. edX, https://www.edx.org/course/subject/physics
5. MIT Open Course Ware - Massachusetts Institute of Technology, https://ocw.mit.edu/courses/physics/

Further Suggestions

- Other Digital Platforms / Web Links and Equivalent Online Courses may be suggested / added to the respective lists by individual Universities.
- **In End-Semester University Examinations, equal weightage should be given to Part A (units I to IV) and Part B (units V to VIII) while framing the questions.**

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Programme/Class: **Diploma**	Year: **Second**	Semester: **Fourth**
Subject: **Physics**		
Course Code: **B010402P**	Course Title: **Basic Electronics Instrumentation**	

Course Outcomes (COs)

Basic Electronics instrumentation has the most striking impact on the industry wherever the components / instruments are used to study and determine the electronic properties. Measurement precision and perfection is achieved through Lab Experiments. Online Virtual Lab Experiments give an insight in simulation techniques and provide a basis for modeling.

Credits: **2**	Core Compulsory / Elective
Max. Marks: **25+75**	Min. Passing Marks:

Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: **0-0-4**

Unit	Topics	No. of Lectures
	Lab Experiment List	60
	1. Transistor Bias Stability 2. Comparative Study of CE, CB and CC amplifier 3. Clippers and Clampers 4. Study of Emitter Follower 5. Frequency response of single stage RC coupled amplifier 6. Frequency response of single stage Transformer coupled amplifier 7. Effect of negative feedback on frequency response of RC coupled amplifier 8. Study of Schmitt Trigger 9. Study of Hartley oscillator 10. Study of Wein Bridge oscillator	
	Online Virtual Lab Experiment List / Link	
	Virtual Labs an initiative of MHRD Govt. of India http://vlabs.iitkgp.ac.in/psac/# 1. Diode as Clippers 2. Diode as Clampers 3. BJT as switch and Load Lines Virtual Labs an initiative of MHRD Govt. of India http://vlabs.iitkgp.ac.in/be/# 4. RC frequency response Virtual Labs at Amrita Vishwa Vidyapeetham https://vlab.amrita.edu/index.php?sub=1&brch=201 5. Hartley oscillator 6. Colpitt oscillator	

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	Virtual Labs at Amrita Vishwa Vidyapeetham http://vlab.amrita.edu/index.php?sub=59&brch=269 7. Fiber Optic Analog and Digital Link 8. Fiber Optic Bi-directional Communication 9. Wavelength Division Multiplexing 10. Measurement of Bending Losses in Optical Fiber 11. Measurement of Numerical Aperture 12. Study of LED and Detector Characteristics	

Suggested Readings

1. R.L. Boylestad, L. Nashelsky, "Electronic Devices and Circuit Theory", Prentice-Hall of India Pvt. Ltd., 2015, 11e
2. J. Millman, C.C. Halkias, Satyabrata Jit, "Electronic Devices and Circuits", McGraw Hill, 2015, 4e
3. B.G. Streetman, S.K. Banerjee, "Solid State Electronic Devices", Pearson Education India, 2015, 7e
4. J.D. Ryder, "Electronic Fundamentals and Applications", Prentice-Hall of India Private Limited, 1975, 5e
5. John M. Senior, "Optical Fiber Communications: Principles and Practice", Pearson Education Limited, 2010, 3e
6. John Wilson, John Hawkes, "Optoelectronics: Principles and Practice", Pearson Education Limited, 2018, 3e
7. S.L. Gupta, V. Kumar, "Hand Book of Electronics", Pragati Prakashan, Meerut, 2016, 43e

Books published in Hindi & Other Reference / Text Books may be suggested / added to this list by individual Universities.

Suggestive Digital Platforms / Web Links

1. Virtual Labs an initiative of MHRD Govt. of India, http://vlabs.iitkgp.ac.in/psac/#
2. Virtual Labs an initiative of MHRD Govt. of India, http://vlabs.iitkgp.ac.in/be/#
3. Virtual Labs at Amrita Vishwa Vidyapeetham, https://vlab.amrita.edu/index.php?sub=1&brch=201
4. Virtual Labs at Amrita Vishwa Vidyapeetham, http://vlab.amrita.edu/index.php?sub=59&brch=269
5. Digital Platforms /Web Links of other virtual labs may be suggested / added to this lists by individual Universities.

Course Prerequisites

Opted / Passed Semester IV, Theory Paper-1 (B010401T)

This course can be opted as an Elective by the students of following subjects

Botany / Chemistry / Computer Science / Mathematics / Statistics / Zoology

Suggested Continuous Internal Evaluation (CIE) Methods

15 marks for Record File (depending upon the no. of experiments performed out of the total assigned experiments)
05 marks for Viva Voce
05 marks for Class Interaction

Suggested Equivalent Online Courses

Further Suggestions

- The institution may add / modify / change the experiments of the same standard in the subject.
- The institution may suggest a minimum number of experiments (say 6) to be performed by each student per semester from the Lab Experiment List.
- The institution may suggest a minimum number of experiments (say 3) to be performed by each student per semester from the Online Virtual Lab Experiment List / Link.

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THIRD YEAR

DETAILED SYLLABUS FOR

DEGREE

IN

BACHELOR OF SCIENCE

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YEAR	SEME-STER	PAPER	PAPER TITLE	UNIT TITLE (Periods Per Semester)
DEGREE IN BACHELOR OF SCIENCE				
THIRD YEAR	**SEMESTER V**	Theory Paper-1	**Classical & Statistical Mechanics** Part A: Introduction to Classical Mechanics Part B: Introduction to Statistical Mechanics	**Part A** I: Constrained Motion (6) II: Lagrangian Formalism (9) III: Hamiltonian Formalism (8) IV: Central Force (7) **Part B** V: Macrostate & Microstate (6) VI: Concept of Ensemble (6) VII: Distribution Laws (10) VIII: Applications of Statistical Distribution Laws (8)
		Theory Paper-2	**Quantum Mechanics & Spectroscopy** Part A: Introduction to Quantum Mechanics Part B: Introduction to Spectroscopy	**Part A** I: Operator Formalism (5) II: Eigen & Expectation Values (6) III: Uncertainty Principle & Schrodinger Equation (7) IV: Applications of Schrodinger Equation (12) **Part B** V: Vector Atomic Model (10) VI: Spectra of Alkali & Alkaline Elements (6) VII: X-Rays & X-Ray Spectra (7) VIII: Molecular Spectra (7)
		Practical Paper	**Demonstrative Aspects of Optics & Lasers**	Lab Experiment List Online Virtual Lab Experiment List/Link
	SEMESTER VI	Theory Paper-1	**Solid State & Nuclear Physics** Part A: Introduction to Solid State Physics Part B: Introduction to Nuclear Physics	**Part A** I: Crystal Structure (7) II: Crystal Diffraction (7) III: Crystal Bindings (7) IV: Lattice Vibrations (9) **Part B** V: Nuclear Forces & Radioactive Decays (9) VI: Nuclear Models & Nuclear Reactions (9) VII: Accelerators & Detectors (6) VIII: Elementary Particles (6)
		Theory Paper-2	**Analog & Digital Principles & Applications** Part A: Analog Electronic Circuits Part B: Digital Electronics	**Part A** I: Semiconductor Junction (9) II: Transistor Modeling (8) III: Field Effect Transistors (8) IV: Other Devices (5) **Part B** V: Number System (6) VI: Binary Arithmetic (5) VII: Logic Gates (9) VIII: Combinational & Sequential Circuits (10)
		Practical Paper	**Analog & Digital Circuits**	Lab Experiment List Online Virtual Lab Experiment List/Link

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Programme/Class: **Degree**	Year: **Third**	Semester: **Fifth**
Subject: **Physics**		
Course Code: **B010501T**	Course Title: **Classical & Statistical Mechanics**	

Course Outcomes (COs)

1. Understand the concepts of generalized coordinates and D'Alembert's principle.
2. Understand the Lagrangian dynamics and the importance of cyclic coordinates.
3. Comprehend the difference between Lagrangian and Hamiltonian dynamics.
4. Study the important features of central force and its application in Kepler's problem.
5. Recognize the difference between macrostate and microstate.
6. Comprehend the concept of ensembles.
7. Understand the classical and quantum statistical distribution laws.
8. Study the applications of statistical distribution laws.

Credits: **4**	Core Compulsory / Elective
Max. Marks: **25+75**	Min. Passing Marks:

Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: **4-0-0**

Unit	Topics	No. of Lectures
	PART A **Introduction to Classical Mechanics**	
I	**Constrained Motion** Constraints - Definition, Classification and Examples. Degrees of Freedom and Configuration space. Constrained system, Forces of constraint and Constrained motion. Generalised coordinates, Transformation equations and Generalised notations & relations. Principle of Virtual work and D'Alembert's principle.	6
II	**Lagrangian Formalism** Lagrangian for conservative & non-conservative systems, Lagrange's equation of motion (no derivation), Comparison of Newtonian & Lagrangian formulations, Cyclic coordinates, and Conservation laws (with proofs and properties of kinetic energy function included). Simple examples based on Lagrangian formulation.	9
III	**Hamiltonian Formalism** Phase space, Hamiltonian for conservative & non-conservative systems, Physical significance of Hamiltonian, Hamilton's equation of motion (no derivation), Comparison of Lagrangian & Hamiltonian formulations, Cyclic coordinates, and Construction of Hamiltonian from Lagrangian. Simple examples based on Hamiltonian formulation.	8
IV	**Central Force** Definition and properties (with prove) of central force. Equation of motion and differential equation of orbit. Bound & unbound orbits, stable & non-stable orbits, closed & open orbits and Bertrand's theorem. Motion under inverse square law of force and derivation of Kepler's laws. Laplace-Runge-Lenz vector (Runge-Lenz vector) and its applications.	7

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PART B Introduction to Statistical Mechanics		
V	**Macrostate & Microstate** Macrostate, Microstate, Number of accessible microstates and Postulate of equal a priori. Phase space, Phase trajectory, Volume element in phase space, Quantisation of phase space and number of accessible microstates for free particle in 1D, free particle in 3D & harmonic oscillator in 1D.	6
VI	**Concept of Ensemble** Problem with time average, concept of ensemble, postulate of ensemble average and Liouville's theorem (proof included). Micro Canonical, Canonical & Grand Canonical ensembles. Thermodynamic Probability, Postulate of Equilibrium and Boltzmann Entropy relation.	6
VII	**Distribution Laws** Statistical Distribution Laws: Expressions for number of accessible microstates, probability & number of particles in ith state at equilibrium for Maxwell-Boltzmann, Bose-Einstein & Fermi-Dirac statistics. Comparison of statistical distribution laws and their physical significance. Canonical Distribution Law: Boltzmann's Canonical Distribution Law, Boltzmann's Partition Function, Proof of Equipartition Theorem (Law of Equipartition of energy) and relation between Partition function and Thermodynamic potentials.	10
VIII	**Applications of Statistical Distribution Laws** Application of Bose-Einstein Distribution Law: Photons in a black body cavity and derivation of Planck's Distribution Law. Application of Fermi-Dirac Distribution Law: Free electrons in a metal, Definition of Fermi energy, Determination of Fermi energy at absolute zero, Kinetic energy of Fermi gas at absolute zero and concept of Density of States (Density of Orbitals).	8

Suggested Readings

PART A

1. Herbert Goldstein, Charles P. Poole, John L. Safko, "Classical Mechanics", Pearson Education, India, 2011, 3e
2. N.C. Rana, P.S. Joag, "Classical Mechanics", McGraw Hill, 2017
3. R.G. Takwale, P.S. Puranik, "Introduction to Classical Mechanics", McGraw Hill, 2017

PART B

1. F. Reif, "Statistical Physics (In SI Units): Berkeley Physics Course Vol 5", McGraw Hill, 2017, 1e
2. B.B. Laud, "Fundamentals of Statistical Mechanics", New Age International Private Limited, 2020, 2e
3. B.K. Agarwal, M. Eisner, "Statistical Mechanics", New Age International Private Limited, 2007, 2e

Books published in Hindi & Other Reference / Text Books may be suggested / added to this list by individual Universities.

Suggestive Digital Platforms / Web Links

1. MIT Open Learning - Massachusetts Institute of Technology, https://openlearning.mit.edu/
2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd
3. Uttar Pradesh Higher Education Digital Library, http://heecontent.upsdc.gov.in/SearchContent.aspx
4. Swayam Prabha - DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current_he/8

Course Prerequisites

Passed Semester I, Theory Paper-1 (B010101T)

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This course can be opted as an Elective by the students of following subjects
Chemistry / Computer Science / Mathematics / Statistics
Suggested Continuous Internal Evaluation (CIE) Methods
20 marks for Test / Quiz / Assignment / Seminar 05 marks for Class Interaction
Suggested Equivalent Online Courses
1. Swayam - Government of India, https://swayam.gov.in/explorer?category=Physics 2. National Programme on Technology Enhanced Learning (NPTEL), https://nptel.ac.in/course.html 3. Coursera, https://www.coursera.org/browse/physical-science-and-engineering/physics-and-astronomy 4. edX, https://www.edx.org/course/subject/physics 5. MIT Open Course Ware - Massachusetts Institute of Technology, https://ocw.mit.edu/courses/physics/
Further Suggestions
• Other Digital Platforms / Web Links and Equivalent Online Courses may be suggested / added to the respective lists by individual Universities. • **In End-Semester University Examinations, equal weightage should be given to Part A (units I to IV) and Part B (units V to VIII) while framing the questions.**

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Programme/Class: **Degree**	Year: **Third**	Semester: **Fifth**
Subject: **Physics**		
Course Code: **B010502T**	Course Title: **Quantum Mechanics & Spectroscopy**	

Course Outcomes (COs)

1. Understand the significance of operator formalism in Quantum mechanics.
2. Study the eigen and expectation value methods.
3. Understand the basis and interpretation of Uncertainty principle.
4. Develop the technique of solving Schrodinger equation for 1D and 3D problems.
5. Comprehend the success of Vector atomic model in the theory of Atomic spectra.
6. Study the different aspects of spectra of Group I & II elements.
7. Study the production and applications of X-rays.
8. Develop an understanding of the fundamental aspects of Molecular spectra.

Credits: **4**	Core Compulsory / Elective
Max. Marks: **25+75**	Min. Passing Marks:

Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: **4-0-0**

Unit	Topics	No. of Lectures
	PART A **Introduction to Quantum Mechanics**	
I	**Operator Formalism** Operators: Review of matrix algebra, definition of an operator, special operators, operator algebra and operators corresponding to various physical-dynamical variables. Commutators: Definition, commutator algebra and commutation relations among position, linear momentum & angular momentum and energy & time. Simple problems based on commutation relations.	5
II	**Eigen & Expectation Values** Eigen & Expectation Values: Eigen equation for an operator, eigen state (value) and eigen functions. Linear superposition of eigen functions and Non-degenerate & Degenerate eigen states. Expectation value pertaining to an operator and its physical interpretation. Hermitian Operators: Definition, properties and applications. Prove of the hermitian nature of various physical-dynamical operators.	6
III	**Uncertainty Principle & Schrodinger Equation** Uncertainty Principle: Commutativity & simultaneity (theorems with proofs). Non commutativity of operators as the basis for uncertainty principle and derivation of general form of uncertainty principle through Schwarz inequality. Uncertainty principle for various conjugate pairs of physical-dynamical parameters and its applications. Schrodinger Equation: Derivation of time independent & time dependent forms, Schrodinger equation as an eigen equation, Deviation & interpretation of equation of continuity in Schrodinger representation, and Equation of motion of an operator in Schrodinger representation.	7

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IV	**Applications of Schrodinger Equation** Application to 1D Problems: Infinite Square well potential (Particle in 1D box), Finite Square well potential, Potential step, Rectangular potential barrier and 1D Harmonic oscillator. Application to 3D Problems: Infinite Square well potential (Particle in a 3D box) and the Hydrogen atom (radial distribution function and radial probability included). (Direct solutions of Hermite, Associated Legendre and Associated Laguerre differential equations to be substituted).	12
	PART B **Introduction to Spectroscopy**	
V	**Vector Atomic Model** Inadequacies of Bohr and Bohr-Sommerfeld atomic models w.r.t. spectrum of Hydrogen atom (fine structure of H-alpha line). Modification due to finite mass of nucleus and Deuteron spectrum. Vector atomic model (Stern-Gerlach experiment included) and physical & geometrical interpretations of various quantum numbers for single & many valence electron systems. LS & jj couplings, spectroscopic notation for energy states, selection rules for transition of electrons and intensity rules for spectral lines. Fine structure of H-alpha line on the basis of vector atomic model.	10
VI	**Spectra of Alkali & Alkaline Elements** Spectra of alkali elements: Screening constants for s, p, d & f orbitals; sharp, principle, diffuse & fundamental series; doublet structure of spectra and fine structure of Sodium D line. Spectra of alkaline elements: Singlet and triplet structure of spectra.	6
VII	**X-Rays & X-Ray Spectra** Nature & production, Continuous X-ray spectrum & Duane-Hunt's law, Characteristic X-ray spectrum & Mosley's law, Fine structure of Characteristic X-ray spectrum, and X-ray absorption spectrum.	7
VIII	**Molecular Spectra** Discrete set of energies of a molecule, electronic, vibrational and rotational energies. Quantisation of vibrational energies, transition rules and pure vibrational spectra. Quantisation of rotational energies, transition rules, pure rotational spectra and determination of inter nuclear distance. Rotational-Vibrational spectra; transition rules; fundamental band & hot band; O, P, Q, R, S branches.	7

Suggested Readings

PART A

1. D.J. Griffiths, "Introduction to Quantum Mechanics", Pearson Education, India, 2004, 2e
2. E. Wichmann, "Quantum Physics (In SI Units): Berkeley Physics Course Vol 4", McGraw Hill, 2017
3. Richard P. Feynman, Robert B. Leighton, Matthew Sands, "The Feynman Lectures on Physics - Vol. 3", Pearson Education Limited, 2012
4. R Murugeshan, Kiruthiga Sivaprasath, "Modern Physics", S. Chand Publishing, 2019, 18e

PART B

1. H.E. White, "Introduction to Atomic Spectra", McGraw Hill, 1934
2. C.N. Banwell, E.M. McCash, "Fundamentals of Molecular Spectroscopy", McGraw Hill, 2017, 4e
3. R Murugeshan, Kiruthiga Sivaprasath, "Modern Physics", S. Chand Publishing, 2019, 18e
4. S.L. Gupta, V. Kumar, R.C. Sharma, "Elements of Spectroscopy", Pragati Prakashan, Meerut, 2015, 27e

Books published in Hindi & Other Reference / Text Books may be suggested / added to this list by individual Universities.

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Suggestive Digital Platforms / Web Links
1. MIT Open Learning - Massachusetts Institute of Technology, https://openlearning.mit.edu/ 2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd 3. Uttar Pradesh Higher Education Digital Library, http://heecontent.upsdc.gov.in/SearchContent.aspx 4. Swayam Prabha - DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current_he/8
Course Prerequisites
Passed Semester IV, Theory Paper-1 (B010401T)
This course can be opted as an Elective by the students of following subjects
Chemistry / Computer Science / Mathematics / Statistics
Suggested Continuous Internal Evaluation (CIE) Methods
20 marks for Test / Quiz / Assignment / Seminar 05 marks for Class Interaction
Suggested Equivalent Online Courses
1. Swayam - Government of India, https://swayam.gov.in/explorer?category=Physics 2. National Programme on Technology Enhanced Learning (NPTEL), https://nptel.ac.in/course.html 3. Coursera, https://www.coursera.org/browse/physical-science-and-engineering/physics-and-astronomy 4. edX, https://www.edx.org/course/subject/physics 5. MIT Open Course Ware - Massachusetts Institute of Technology, https://ocw.mit.edu/courses/physics/
Further Suggestions
• Other Digital Platforms / Web Links and Equivalent Online Courses may be suggested / added to the respective lists by individual Universities. • **In End-Semester University Examinations, equal weightage should be given to Part A (units I to IV) and Part B (units V to VIII) while framing the questions.**

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Programme/Class: **Degree**	Year: **Third**	Semester: **Fifth**
Subject: **Physics**		
Course Code: **B010503P**	Course Title: **Demonstrative Aspects of Optics & Lasers**	

Course Outcomes (COs)

Experimental physics has the most striking impact on the industry wherever the instruments are used to study and determine the optical properties. Measurement precision and perfection is achieved through Lab Experiments. Online Virtual Lab Experiments give an insight in simulation techniques and provide a basis for modeling.

Credits: **2**	Core Compulsory / Elective
Max. Marks: **25+75**	Min. Passing Marks:

Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: **0-0-4**

Unit	Topics	No. of Lectures
	Lab Experiment List	60
	1. Fresnel Biprism: Wavelength of sodium light 2. Fresnel Biprism: Thickness of mica sheet) 3. Newton's Rings: Wavelength of sodium light 4. Newton's Rings: Refractive index of liquid 5. Plane Diffraction Grating: Resolving power 6. Plane Diffraction Grating: Spectrum of mercury light 7. Spectrometer: Refractive index of the material of a prism using sodium light 8. Spectrometer: Dispersive power of the material of a prism using mercury light 9. Polarimeter: Specific rotation of sugar solution 10. Wavelength of Laser light using diffraction by single slit	
	Online Virtual Lab Experiment List / Link	
	Virtual Labs at Amrita Vishwa Vidyapeetham https://vlab.amrita.edu/?sub=1&brch=189 1. Michelson's Interferometer 2. Michelson's Interferometer: Wavelength of laser beam 3. Newton's Rings: Wavelength of light 4. Newton's Rings: Refractive index of liquid 5. Brewster's angle determination 6. Laser beam divergence and spot size Virtual Labs at Amrita Vishwa Vidyapeetham https://vlab.amrita.edu/index.php?sub=1&brch=281 7. Spectrometer: Refractive index of the material of a prism 8. Spectrometer: Dispersive power of a prism 9. Spectrometer: Determination of Cauchy's constants 10. Diffraction Grating	

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Suggested Readings
1. B.L. Worsnop, H.T. Flint, "Advanced Practical Physics for Students", Methuen & Co., Ltd., London, 1962, 9e 2. S. Panigrahi, B. Mallick, "Engineering Practical Physics", Cengage Learning India Pvt. Ltd., 2015, 1e 3. R.K. Agrawal, G. Jain, R. Sharma, "Practical Physics", Krishna Prakashan Media (Pvt.) Ltd., Meerut, 2019 4. S.L. Gupta, V. Kumar, "Practical Physics", Pragati Prakashan, Meerut, 2014, 2e ***Books published in Hindi & Other Reference / Text Books may be suggested / added to this list by individual Universities.***
Suggestive Digital Platforms / Web Links
1. Virtual Labs at Amrita Vishwa Vidyapeetham, https://vlab.amrita.edu/?sub=1&brch=189 2. Virtual Labs at Amrita Vishwa Vidyapeetham, https://vlab.amrita.edu/index.php?sub=1&brch=281 3. Digital Platforms /Web Links of other virtual labs may be suggested / added to this lists by individual Universities.
Course Prerequisites
Passed Semester III, Theory Paper-1 (B010301T)
This course can be opted as an Elective by the students of following subjects
Chemistry / Computer Science / Mathematics / Statistics
Suggested Continuous Internal Evaluation (CIE) Methods
15 marks for Record File (depending upon the no. of experiments performed out of the total assigned experiments) 05 marks for Viva Voce 05 marks for Class Interaction
Suggested Equivalent Online Courses
Further Suggestions
• The institution may add / modify / change the experiments of the same standard in the subject. • The institution may suggest a minimum number of experiments (say 6) to be performed by each student per semester from the Lab Experiment List. • The institution may suggest a minimum number of experiments (say 3) to be performed by each student per semester from the Online Virtual Lab Experiment List / Link.

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Programme/Class: **Degree**	Year: **Third**	Semester: **Sixth**
Subject: **Physics**		
Course Code: **B010601T**	Course Title: **Solid State & Nuclear Physics**	

Course Outcomes (COs)

1. Understand the crystal geometry w.r.t. symmetry operations.
2. Comprehend the power of X-ray diffraction and the concept of reciprocal lattice.
3. Study various properties based on crystal bindings.
4. Recognize the importance of Free Electron & Band theories in understanding the crystal properties.
5. Study the salient features of nuclear forces & radioactive decays.
6. Understand the importance of nuclear models & nuclear reactions.
7. Comprehend the working and applications of nuclear accelerators and detectors.
8. Understand the classification and properties of basic building blocks of nature.

Credits: **4**	Core Compulsory / Elective
Max. Marks: **25+75**	Min. Passing Marks:

Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: **4-0-0**

Unit	Topics	No. of Lectures
	PART A **Introduction to Solid State Physics**	
I	**Crystal Structure** Lattice, Basis & Crystal structure. Lattice translation vectors, Primitive & non-primitive cells. Symmetry operations, Point group & Space group. 2D & 3D Bravais lattice. Parameters of cubic lattices. Lattice planes and Miller indices. Simple crystal structures - HCP & FCC, Diamond, Cubic Zinc Sulphide, Sodium Chloride, Cesium Chloride and Glasses.	7
II	**Crystal Diffraction** X-ray diffraction and Bragg's law. Experimental diffraction methods - Laue, Rotating crystal and Powder methods. Derivation of scattered wave amplitude. Reciprocal lattice, Reciprocal lattice vectors and relation between Direct & Reciprocal lattice. Diffraction conditions, Ewald's method and Brillouin zones. Reciprocal lattice to SC, BCC & FCC lattices. Atomic Form factor and Crystal Structure factor.	7
III	**Crystal Bindings** Classification of Crystals on the Basis of Bonding - Ionic, Covalent, Metallic, van der Waals (Molecular) and Hydrogen bonded. Crystals of inert gases, Attractive interaction (van der Waals-London) & Repulsive interaction, Equilibrium lattice constant, Cohesive energy and Compressibility & Bulk modulus. Ionic crystals, Cohesive energy, Madelung energy and evaluation of Madelung constant.	7

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IV	**Lattice Vibrations** Lattice Vibrations: Lattice vibrations for linear mono & di atomic chains, Dispersion relations and Acoustical & Optical branches (qualitative treatment). Qualitative description of Phonons in solids. Lattice heat capacity, Dulong-Petit's law and Einstein's theory of lattice heat capacity. Free Electron Theory: Fermi energy, Density of states, Heat capacity of conduction electrons, Paramagnetic susceptibility of conduction electrons and Hall effect in metals. Band Theory: Origin of band theory, Qualitative idea of Bloch theorem, Kronig-Penney model, Effectice mass of an electron & Concept of Holes & Classification of solids on the basis of band theory.	9
	PART B **Introduction to Nuclear Physics**	
V	**Nuclear Forces & Radioactive Decays** General Properties of Nucleus: Mass, binding energy, radii, density, angular momentum, magnetic dipole moment vector and electric quadrupole moment tensor. Nuclear Forces: General characteristic of nuclear force and Deuteron ground state properties. Radioactive Decays: Nuclear stability, basic ideas about beta minus decay, beta plus decay, alpha decay, gamma decay & electron capture, fundamental laws of radioactive disintegration and radioactive series.	9
VI	**Nuclear Models & Nuclear Reactions** Nuclear Models: Liquid drop model and Bethe-Weizsacker mass formula. Single particle shell model (the level scheme in the context of reproduction of magic numbers included). Nuclear Reactions: Bethe's notation, types of nuclear reaction, Conservation laws, Cross-section of nuclear reaction, Theory of nuclear fission (qualitative), Nuclear reactors and Nuclear fusion.	9
VII	**Accelerators & Detectors** Accelerators: Theory, working and applications of Van de Graaff accelerator, Cyclotron and Synchrotron. Detectors: Theory, working and applications of GM counter, Semiconductor detector, Scintillation counter and Wilson cloud chamber.	6
VIII	**Elementary Particles** Fundamental interactions & their mediating quanta. Concept of antiparticles. Classification of elementary particles based on intrinsic-spin, mass, interaction & lifetime. Families of Leptons, Mesons, Baryons & Baryon Resonances. Conservation laws for mass-energy, linear momentum, angular momentum, electric charge, baryonic charge, leptonic charge, isospin & strangeness. Concept of Quark model.	6

Suggested Readings

PART A

1. Charles Kittel, "Introduction to Solid State Physics", Wiley India Private Limited, 2012, 8e
2. A.J. Dekker, "Solid State Physics", Macmillan India Limited, 1993
3. R.K. Puri, V.K. Babbar, "Solid State Physics", S. Chand Publishing, 2015

PART B

1. Kenneth S. Krane, "Introductory Nuclear Physics", Wiley India Private Limited, 2008
2. Bernard L. Cohen, "Concepts of Nuclear Physics", McGraw Hill, 2017
3. S.N. Ghoshal, "Nuclear Physics", S. Chand Publishing, 2019

Books published in Hindi & Other Reference / Text Books may be suggested / added to this list by individual Universities.

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Suggestive Digital Platforms / Web Links
1. MIT Open Learning - Massachusetts Institute of Technology, https://openlearning.mit.edu/ 2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd 3. Uttar Pradesh Higher Education Digital Library, http://heecontent.upsdc.gov.in/SearchContent.aspx 4. Swayam Prabha - DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current_he/8
Course Prerequisites
Passed Semester V, Theory Paper-2 (B010502T)
This course can be opted as an Elective by the students of following subjects
Chemistry / Computer Science / Mathematics / Statistics
Suggested Continuous Internal Evaluation (CIE) Methods
20 marks for Test / Quiz / Assignment / Seminar 05 marks for Class Interaction
Suggested Equivalent Online Courses
1. Swayam - Government of India, https://swayam.gov.in/explorer?category=Physics 2. National Programme on Technology Enhanced Learning (NPTEL), https://nptel.ac.in/course.html 3. Coursera, https://www.coursera.org/browse/physical-science-and-engineering/physics-and-astronomy 4. edX, https://www.edx.org/course/subject/physics 5. MIT Open Course Ware - Massachusetts Institute of Technology, https://ocw.mit.edu/courses/physics/
Further Suggestions
• Other Digital Platforms / Web Links and Equivalent Online Courses may be suggested / added to the respective lists by individual Universities. • **In End-Semester University Examinations, equal weightage should be given to Part A (units I to IV) and Part B (units V to VIII) while framing the questions.**

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Programme/Class: **Degree**	Year: **Third**	Semester: **Sixth**
Subject: **Physics**		
Course Code: **B010602T**	Course Title: **Analog & Digital Principles & Applications**	

Course Outcomes (COs)

1. Study the drift and diffusion of charge carriers in a semiconductor.
2. Understand the Two-Port model of a transistor.
3. Study the working, properties and uses of FETs.
4. Comprehend the design and operations of SCRs and UJTs.
5. Understand various number systems and binary codes.
6. Familiarize with binary arithmetic.
7. Study the working and properties of various logic gates.
8. Comprehend the design of combinational and sequential circuits.

Credits: **4**	Core Compulsory / Elective
Max. Marks: **25+75**	Min. Passing Marks:

Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: **4-0-0**

Unit	Topics	No. of Lectures
	PART A **Analog Electronic Circuits**	
I	**Semiconductor Junction** Expressions for Fermi energy, Electron density in conduction band, Hole density in valence band, Drift of charge carriers (mobility & conductivity), Diffusion of charge carries and Life time of charge carries in a semiconductor. Work function in metals and semiconductors. Expressions for Barrier potential, Barrier width and Junction capacitance (diffusion & transition) for depletion layer in a PN junction. Expressions for Current (diode equation) and Dynamic resistance for PN junction.	9
II	**Transistor Modeling** Transistor as Two-Port Network. Notation for dc & ac components of voltage & current. Quantitative discussion of Z, Y & h parameters and their equivalent two-generator model circuits. h-parameters for CB, CE & CC configurations. Analysis of transistor amplifier using the hybrid equivalent model and estimation of Input Impedance, Output Impedance and Gain (current, voltage & power).	8
III	**Field Effect Transistors** JFET: Construction (N channel & P channel); Configuration (CS, CD & CG); Operation in different regions (Ohmic or Linear, Saturated or Active or Pinch off & Break down); Important Terms (Shorted Gate Drain Current, Pinch Off Voltage & Gate Source Cut-Off Voltage); Expression for Drain Current (Shockley equation); Characteristics (Drain & Transfer); Parameters (Drain Resistance, Mutual Conductance or Transconductance & Amplification Factor); Biasing w.r.t. CS configuration (Self Bias & Voltage Divider Bias); Amplifiers (CS & CD or Source Follower); Comparison (N & P channels and BJTs & JFETs). MOSFET: Construction and Working of DE-MOSFET (N channel & P channel) and E-MOSFET (N channel & P channel); Characteristics (Drain & Transfer) of DE-MOSFET and E-MOSFET; Comparison of JFFET and MOSFET.	8

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IV	**Other Devices** SCR: Construction; Equivalent Circuits (Two Diodes, Two Transistors & One Diode-One Transistor); Working (Off state & On state); Characteristics; Applications (Static switch, Phase control system & Battery charger). UJT: Construction; Equivalent Circuit; Working (Cutoff, Negative Resistance & Saturation regions); Characteristics (Peak & Valley points); Applications (Trigger circuits, Relaxation oscillators & Sawtooth generators).	5
	PART B **Digital Electronics**	
V	**Number System** Number Systems: Binary, Octal, Decimal & Hexadecimal number systems and their inter conversion. Binary Codes: BCD, Excess-3 (XS3), Parity, Gray, ASCII & EBCDIC Codes and their advantages & disadvantages. Data representation.	6
VI	**Binary Arithmetic** Binary Addition, Decimal Subtraction using 9's & 10's complement, Binary Subtraction using 1's & 2's compliment, Multiplication and Division.	5
VII	**Logic Gates** Truth Table, Symbolic Representation and Properties of OR, AND, NOT, NOR, NAND, EX-OR & EX-NOR Gates. Implementation of OR, AND & NOT gates (realization using diodes & transistor). De Morgan's theorems. NOR & NAND gates as Universal Gates. Application of EX-OR & EX-NOR gates as pairty checker. Boolean Algebra. Karnaugh Map.	9
VIII	**Combinational & Sequential Circuits** Combinational Circuits: Half Adder, Full Adder, Parallel Adder, Half Substractor, Full Substractor. Data Processing Circuits: Multiplexer, Demultiplexer, Decoders & Encoders. Sequential Circuits: SR, JK & D Flip-Flops, Shift Register (transfer operation of Flip-Flops), and Asynchronous & Synchronous counters.	10

Suggested Readings

PART A

1. R.L. Boylestad, L. Nashelsky, "Electronic Devices and Circuit Theory", Prentice-Hall of India Pvt. Ltd., 2015, 11e
2. J. Millman, C.C. Halkias, Satyabrata Jit, "Electronic Devices and Circuits", McGraw Hill, 2015, 4e
3. B.G. Streetman, S.K. Banerjee, "Solid State Electronic Devices", Pearson Education India, 2015, 7e
4. J.D. Ryder, "Electronic Fundamentals and Applications", Prentice-Hall of India Private Limited, 1975, 5e
5. S.L. Gupta, V. Kumar, "Hand Book of Electronics", Pragati Prakashan, Meerut, 2016, 43e

PART B

1. D. Leach, A. Malvino, Goutam Saha, "Digital Principles and Applications", McGraw Hill, 2010, 7e
2. William H. Gothmann, "Digital Electronics: An Introduction to Theory and Practice", Prentice-Hall of India Private Limited, 1982, 2e
3. R.P. Jain, "Modern Digital Electronics", McGraw Hill, 2009, 4e

Books published in Hindi & Other Reference / Text Books may be suggested / added to this list by individual Universities.

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Suggestive Digital Platforms / Web Links
1. MIT Open Learning - Massachusetts Institute of Technology, https://openlearning.mit.edu/ 2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd 3. Uttar Pradesh Higher Education Digital Library, http://heecontent.upsdc.gov.in/SearchContent.aspx 4. Swayam Prabha - DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current_he/8
Course Prerequisites
Passed Semester IV, Theory Paper-1 (B010401T)
This course can be opted as an Elective by the students of following subjects
Open to all
Suggested Continuous Internal Evaluation (CIE) Methods
20 marks for Test / Quiz / Assignment / Seminar 05 marks for Class Interaction
Suggested Equivalent Online Courses
1. Swayam - Government of India, https://swayam.gov.in/explorer?category=Physics 2. National Programme on Technology Enhanced Learning (NPTEL), https://nptel.ac.in/course.html 3. Coursera, https://www.coursera.org/browse/physical-science-and-engineering/physics-and-astronomy 4. edX, https://www.edx.org/course/subject/physics 5. MIT Open Course Ware - Massachusetts Institute of Technology, https://ocw.mit.edu/courses/physics/
Further Suggestions
• Other Digital Platforms / Web Links and Equivalent Online Courses may be suggested / added to the respective lists by individual Universities. • **In End-Semester University Examinations, equal weightage should be given to Part A (units I to IV) and Part B (units V to VIII) while framing the questions.**

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Programme/Class: **Degree**	Year: **Third**	Semester: **Sixth**
Subject: **Physics**		
Course Code: **B010603P**	Course Title: **Analog & Digital Circuits**	

Course Outcomes (COs)

Analog & digital circuits have the most striking impact on the industry wherever the electronics instruments are used to study and determine the electronic properties. Measurement precision and perfection is achieved through Lab Experiments. Online Virtual Lab Experiments give an insight in simulation techniques and provide a basis for modeling.

Credits: **2**	Core Compulsory / Elective
Max. Marks: **25+75**	Min. Passing Marks:

Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: **0-0-4**

Unit	Topics	No. of Lectures
	Lab Experiment List	60
	1. Energy band gap of semiconductor by reverse saturation current method 2. Energy band gap of semiconductor by four probe method 3. Hybrid parameters of transistor 4. Characteristics of FET, MOSFET, SCR, UJT 5. FET Conventional Amplifier 6. FET as VVR and VCA 7. Study and Verification of AND gate using TTL IC 7408 8. Study and Verification of OR gate using TTL IC 7432 9. Study and Verification of NAND gate and use as Universal gate using TTL IC 7400 10. Study and Verification of NOR gate and use as Universal gate using TTL IC 7402 11. Study and Verification of NOT gate using TTL IC 7404 12. Study and Verification of Ex-OR gate using TTL IC 7486	
	Online Virtual Lab Experiment List / Link	
	Virtual Labs an initiative of MHRD Govt. of India http://vlabs.iitkgp.ac.in/ssd/# 1. ID-VD characteristics of Junction Field Effect Transistor (JFET) 2. Silicon Controlled Rectifier (SCR) characteristics 3. Unijunction Transistor (UJT) and relaxation oscillator	

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Virtual Labs an initiative of MHRD Govt. of India
https://de-iitr.vlabs.ac.in/List%20of%20experiments.html

4. Verification and interpretation of truth table for AND, OR, NOT, NAND, NOR, Ex-OR, Ex-NOR gates
5. Construction of half and full adder using XOR and NAND gates and verification of its operation
6. To study and verify half and full subtractor
7. Realization of logic functions with the help of Universal Gates (NAND, NOR)
8. Construction of a NOR gate latch and verification of its operation
9. Verify the truth table of RS, JK, T and D Flip Flops using NAND and NOR gates
10. Design and Verify the 4-Bit Serial In - Parallel Out Shift Registers
11. Implementation and verification of decoder or demultiplexer and encoder using logic gates
12. Implementation of 4x1 multiplexer and 1x4 demultiplexer using logic gates
13. Design and verify the 4-Bit Synchronous or Asynchronous Counter using JK Flip Flop
14. Verify Binary to Gray and Gray to Binary conversion using NAND gates only
15. Verify the truth table of 1-Bit and 2-Bit comparator using logic gates

Suggested Readings

1. R.L. Boylestad, L. Nashelsky, "Electronic Devices and Circuit Theory", Prentice-Hall of India Pvt. Ltd., 2015, 11e
2. J. Millman, C.C. Halkias, Satyabrata Jit, "Electronic Devices and Circuits", McGraw Hill, 2015, 4e
3. B.G. Streetman, S.K. Banerjee, "Solid State Electronic Devices", Pearson Education India, 2015, 7e
4. J.D. Ryder, "Electronic Fundamentals and Applications", Prentice-Hall of India Private Limited, 1975, 5e
5. S.L. Gupta, V. Kumar, "Hand Book of Electronics", Pragati Prakashan, Meerut, 2016, 43e
6. D. Leach, A. Malvino, Goutam Saha, "Digital Principles and Applications", McGraw Hill, 2010, 7e
7. William H. Gothmann, "Digital Electronics: An Introduction to Theory and Practice", Prentice-Hall of India Private Limited, 1982, 2e
8. R.P. Jain, "Modern Digital Electronics", McGraw Hill, 2009, 4e

Books published in Hindi & Other Reference / Text Books may be suggested / added to this list by individual Universities.

Suggestive Digital Platforms / Web Links

1. Virtual Labs an initiative of MHRD Govt. of India, http://vlabs.iitkgp.ac.in/ssd/#
2. Virtual Labs an initiative of MHRD Govt. of India, https://de-iitr.vlabs.ac.in/List%20of%20experiments.html
3. Digital Platforms /Web Links of other virtual labs may be suggested / added to this lists by individual Universities.

Course Prerequisites

Opted / Passed Semester VI, Theory Paper-2 (B010602T)

This course can be opted as an Elective by the students of following subjects

Chemistry / Computer Science / Mathematics / Statistics

Suggested Continuous Internal Evaluation (CIE) Methods

15 marks for Record File (depending upon the no. of experiments performed out of the total assigned experiments)
05 marks for Viva Voce
05 marks for Class Interaction

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Suggested Equivalent Online Courses
Further Suggestions
• The institution may add / modify / change the experiments of the same standard in the subject. • The institution may suggest a minimum number of experiments (say 6) to be performed by each student per semester from the Lab Experiment List. • The institution may suggest a minimum number of experiments (say 3) to be performed by each student per semester from the Online Virtual Lab Experiment List / Link.

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APPENDIX-V

BOARD OF STUDIES /ACADEMIC COMMITTEE OF PHYSICS DEPARTMENT

INSTITUTE OF BASIC SCIENCES
DR. BHIMRAO AMBEDKAR UNIVERSITY,
KHANDARI CAMPUS, AGRA

Recommendation of Panel of Examiners for Thesis evaluation of :-

Candidate Name : SHALINI DUBEY
Thesis Title : SIMULATION STUDY OF DIFFERENT DEFECTS IN SOLAR CELLS
Research Centre : PHYSICS DEPARTMENT, IBS, KHANDARI, AGRA

S.No.	Name	Mobile No E-Mail	Address/University/Department	Teaching Experince	Remark
1.	Prof. B.P. Singh	9837019242 drbps.ibs@gmail.com	Department of Physics, Dr. Bhimrao Ambedkar University Agra-282002 **U.P.**	25 yrs	**Supervisor & Examiner**
2.	Prof. Sudhish Kumar	9460931280 skmlsu@gmail.com	Department of Physics, M.L.S. University, Udaipur-313001 **RAJASTHAN**	25 yrs	**Any Two Examiners one examiner outside the STATE**
3.	Prof. S.N. Dolia	94143 70172 sndolia64@gmail.com	Department of Physics, University of Rajasthan Jaipur **RAJASTHAN**	28 yrs	
4.	Prof. Mohd. Zulfequar	9811222035 mzulfequar@jmi.ac.in	Department of Physics, Jamia Milia Islamia, New Delhi-110025 **NEW DELHI**	28 yrs	
5.	Prof. Neeraj Mishra	9451407587 profneerajmisra@gmail.com	Department of Physics, University of Lucknow Lucknow-226007 **LUCKNOW**	28 yrs	
6.	Prof. S.K. Sharma	9460931280 skmlsu@gmail.com	Department of Physics, J.N.V. University, Jodhpur-342011 **RAJASTHAN**	31 yrs	
7.	Prof. Jai Shanker (Rtd.)	94120290294 drbps.dbrau@gmail.com	Department of Physics, Dr. Bhimrao Ambedkar University Agra-282002 **U.P.**	35 yrs	

(Prof. S.N. Dolia)
(External Expert)

(Prof. Sukhdev Roy)
(External Expert)

(Dr. Gaurang Mishra)
(Local Expert)

(Prof. B.S. Sharma)
(Internal Expert)

(Prof. B.P. Singh)
Convener & Head of the Department

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APPENDIX-VII

BOARD OF STUDIES /ACADEMIC COMMITTEE OF PHYSICS DEPARTMENT

INSTITUTE OF BASIC SCIENCES
DR. BHIMRAO AMBEDKAR UNIVERSITY,
KHANDARI CAMPUS, AGRA

Recommendation of Panel of Examiners for Thesis evaluation of :-

Candidate Name : RISHIKANT SAXENA
Thesis Title :AN ANALYTICAL STUDY OF MEAN NORMALIZED MULTIPLICITY IN HADRON-NUCLEUS COLLISIONS
Research Centre : PHYSICS DEPARTMENT, BSA COLLEGE, MATHURA

S.No.	Name	Mobile No E-Mail	Address/University/Department	Teaching Experince	Remark
1.	Dr. K. Y. Singh	9412446831	Department of Physics, BSA College, Mathura **U.P.**	23 yrs	**Supervisor & Examiner**
2.	Prof. Dinesh Kumar Gupta	8770400983	Department of Physics, Jiwaji University, Gwalior **M.P.**	27 yrs	**Any Two Examiners one examiner outside the STATE**
3.	Prof. Ajay Kumar Rai	9904003860	Department of Applied Physics, Sardar Vallabhbhai National Institute of Technology, Surat **GUJRAT**	26 yrs	
4.	Prof. T. Prasad	9415447668	Department of Physics, BHU, Varanasi **U.P.**	25 yrs	
5.	Prof. Neeraj Kumar Gaur	7554907651	Department of Physics, Barkatulla University, Bhopal **M.P.**	25 yrs	
6.	Prof. B. P. Singh	8791970542	Department of Physics, Aligarh Muslim University, Aligarh **U.P.**	28 yrs	
7.	Prof. Munish Kumar	82182 81241	Department of Physics, G.B. Pant University Of Agriculture And Technology, Pant Nagar **Uttarakhand 263153**	28 yrs	

(Prof. S.N. Dolia)
(External Expert)

(Prof. Sukhdev Roy)
(External Expert)

(Dr. Gaurang Mishra)
(Local Expert)

(Prof. K.Y. Singh)
Supervisor

(Prof. B.S. Sharma)
(Internal Expert)

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(Prof. B.P. Singh)
Convener & Head of the Department

डा0 भीमराव आंबेडकर विश्वविद्यालय,आगरा

(पूर्ववर्तीः आगरा विश्वविद्यालय, आगरा)

विद्या परिषद् की बैठक दिनांक 04.06.2022 का कार्यवृत्त

विद्या परिषद् की बैठक दिनांक 04.06.2022 को पूर्वाह्न 1:00 बजे Zoom Platform पर आहूत हुई, जिसमें निम्नलिखित सदस्य उपस्थित हुये :–

प्रो0 विनय कुमार पाठक (अध्यक्ष) – कुलपति

2. प्रो0 अजय तनेजा, प्रति कुलपति
3. प्रो0 संजीव कुमार
4. प्रो0 यू0सी0 शर्मा
5. डा0 कुलदीप कुमार
6. प्रो0 अचला गक्खर
7. प्रो0 वी0के0 सारस्वत
8. प्रो0 संजय चौधरी
9. डा0 जैसवार गौतम लाल बिहारी
10. डा0 आर0के0 अग्निहोत्री
11. डा0 अमिता शर्मा
12. प्रो0 दीपमाला श्रीवास्तव
13. डा0 एन0के0 सिंह
14. डा0 निशा अग्रबाल
15. डा0 राजीव वर्मा
16. डा0 विवेक
17. प्रो0 मनोज कुमार श्रीवास्तव
18. प्रो0 मनोज कुमार उपाध्याय
19. डा0 भूपेन्द्र स्वरूप शर्मा
20. डा0 के0पी0 सिंह
21. प्रो0 यू0एन0 शुक्ला
22. प्रो0 अनिल कुमार वर्मा
23. प्रो0 मनुप्रताप सिंह
24. प्रो0 बिन्दुशेखर शर्मा
25. प्रो0 वी0पी0 सिंह
26. डा0 बी0डी0 शुक्ला
27. प्रो0 मोहम्मद अरशद
28. प्रो0 पी0के0 सिंह
29. प्रो0 प्रदीप श्रीधर
30. प्रो0 शरद उपाध्याय
31. प्रो0 सुगम आनन्द
32. प्रो0 विनीता सिंह
33. डा0 रनवीर सिंह
34. डा0 प्रीति जौहरी
35. डा0 विवेक द्विवेदी
36. डा0 सुकेश कुमार
37. डा0 राधा अग्रबाल
38. डा0 शैलेन्द्र प्रताप सिंह
39. डा0 निर्मला यादव
40. प्रो0 यू0सी0 शर्मा

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निर्णयः–विद्या परिषद् द्वारा बेसिक विज्ञान संस्थान, खन्दारी आगरा के अर्न्तगत **Department of Mathematics** की एकेडेमिक कमेटी की बैठक दिनांक 29.04.2022 की संस्तुतियों को अनुमोदन प्रदान किया गया।

25. विद्या परिषद् द्वारा इन्स्टीट्यूट ऑफ टूरिज्म एण्ड होटल मैनेजमैंट, खन्दारी, आगरा की एकेडेमिक कमेटी की बैठक दिनांक 19.05.2022 की संस्तुतियों के अनुमोदन पर विचार। **(परिशिष्ट-25)**

निर्णयः–विद्या परिषद् द्वारा उक्त संस्तुतियों को यथावत् अनुमोदन प्रदान किया गया।

26. विद्या परिषद् द्वारा पं0 दीन दयाल उपाध्याय ग्राम्य विकास संस्थान, पालीवाल पार्क, आगरा की एकेडेमिक कमेटी की बैठक दिनांक 28.04.2022 की संस्तुतियों के अनुमोदन पर विचार। **(परिशिष्ट-26)**

निर्णयः–विद्या परिषद् द्वारा उक्त संस्तुतियों को यथावत् अनुमोदन प्रदान किया गया।

27. विद्या परिषद् द्वारा **Department of Pharmacy** खन्दारी, आगरा की एकेडेमिक कमेटी की बैठक दिनांक 07.03.2022 एवं 23.05.2022 की संस्तुतियों को अनुमोदन पर विचार। **(परिशिष्ट-27)**

निर्णयः–विद्या परिषद् द्वारा उक्त संस्तुतियों को यथावत् अनुमोदन प्रदान किया गया।

28. विद्या परिषद् द्वारा **Department of Computer Science,** आई0ई0टी0 खन्दारी, आगरा की एकेडेमिक कमेटी की बैठक दिनांक 29.04.2022 की संस्तुतियों को अनुमोदन पर विचार। **(परिशिष्ट-28)**

निर्णयः–विद्या परिषद् द्वारा उक्त संस्तुतियों को यथावत् अनुमोदन प्रदान किया गया।

29. विद्या परिषद् द्वारा **Department of Physics** खन्दारी, आगरा की एकेडेमिक कमेटी की बैठक दिनांक 29.04.2022 की संस्तुतियों को अनुमोदन पर विचार। **(परिशिष्ट-29)**

निर्णयः–विद्या परिषद् द्वारा उक्त संस्तुतियों को यथावत् अनुमोदन प्रदान किया गया।

30. विद्या परिषद् द्वारा **Department of Physical Education** छलेसर, आगरा की एकेडेमिक कमेटी की बैठक दिनांक 29.04.2022 की संस्तुतियों को अनुमोदन पर विचार। **(परिशिष्ट-30)**

निर्णयः–विद्या परिषद् द्वारा उक्त संस्तुतियों को यथावत् अनुमोदन प्रदान किया गया।

31. (i) विद्या परिषद् द्वारा इतिहास के विभागाध्यक्ष प्रो0 सुगम आनन्द के पत्र दिनांक 09.05.2022 के अनुमोदन पर विचार, जिसके द्वारा नई शिक्षा नीति-2020 के निर्देशानुसार परास्नातक पाठ्यक्रमों की संरचना प्रस्तुत की गयी है।

(ii) इतिहास विभाग की एकेडेमिक कमेटी की दिनांक 31.05.2022 की संस्तुतियों के अनुमोदन पर विचार। **(परिशिष्ट-31)**

निर्णयः–विद्या परिषद् द्वारा उक्त संस्तुतियों को सम्यक् गहन विचार विमर्शोपरान्त यथावत् अनुमोदन प्रदान किया गया।

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32. विद्या परिषद् द्वारा **Department of Library & Information Science,** पालीवाल पार्क, आगरा की एकेडेमिक कमेटी की बैठक दिनांक 29.04.2022 की संस्तुतियों के अनुमोदन पर विचार। **(परिशिष्ट-32)**

निर्णयः- विद्या परिषद् द्वारा उक्त संस्तुतियों को यथावत् अनुमोदन प्रदान किया गया।

33. विद्या परिषद् द्वारा स्कूल ऑफ लाइफ साइंस संस्थान, खन्दारी, आगरा में परास्नातक स्तर पर नई शिक्षा नीति-2020 के अन्तर्गत तैयार किये गये पाठ्यक्रमों एवं सम्बन्धित अध्यादेशों हेतु आहूत की गई निम्न एकेडेमिक कमेटी की संस्तुतियों के अनुमोदन पर विचार। **(संलग्नक-33)**

(i) **Department of Environmental Studies** दिनांक 02.06.2022।
(ii) **Department of Zoology** दिनांक 02.06.2022।
(iii) **Department of Microbiology** दिनांक 02.06.2022।
(iv) **Department of Biotechnology** दिनांक 03.06.2022।
(v) **Department of Botany** दिनांक 03.06.2022।
(vi) **Department of Biochemistry** दिनांक 03.06.2022।

निर्णयः–विद्या परिषद् द्वारा उक्त समस्त एकेडेमिक कमेटी की संस्तुतियों को यथावत् अनुमोदन प्रदान किया गया।

अध्यक्ष की अनुमति से अन्य मद

1. विद्या परिषद् द्वारा प्रति कुलपति प्रो0 अजय तनेजा के Teaching Assistantship to Research Students Registered in RW Department विषयक पत्र दिनांक 01.06.2022 पर विचार। **(परिशिष्ट-1)**

निर्णयः– विद्या परिषद् द्वारा प्रति कुलपति प्रो0 अजय तनेजा के उक्त प्रस्ताव को अनुमोदन प्रदान किया गया।

अन्त में कुलसचिव द्वारा धन्यवाद के साथ बैठक समाप्ति की घोषणा की गई।

कुलसचिव

कुलपति

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डा0 भीमराव आंबेड़कर विश्वविद्यालय, आगरा
(पूर्ववर्तीः आगरा विश्वविद्यालय, आगरा)

कार्य परिषद् की बैठक दिनांक 05-06-2022 का कार्यवृत्त

कार्य परिषद् की बैठक वृहस्पति भवन, पालीवाल पार्क, आगरा पर दिनांक 05.06.2022 को दोपहर 03:00 बजे आहूत हुई, जिसमें निम्नलिखित सदस्य उपस्थित हुयेः-

प्रो0 विनय कुमार पाठक, कुलपति - अध्यक्ष

2. प्रो0 अजय तनेजा-प्रति कुलपति
3. प्रो0 अचला गक्खर
4. प्रो0 अनिल कुमार वर्मा
5. डा0 रनवीर सिंह
6. डा0 प्रीति जौहरी
7. डा0 निर्मला यादव
8. डा0 लता चन्डोला
9. डा0 अमिता शर्मा
10. प्रो0 प्रदीप श्रीधर
11. डा0 शैलेन्द्र प्रताप सिंह
12. डा0 बी0डी0 शुक्ला
13. डा0 रोशन लाल
14. डा0 नीलम यादव
15. डा0 जगदीश प्रसाद शर्मा

श्री संजीव कुमार सिंह, कुलसचिव - सचिव

बैठक में श्री अजय कृष्ण यादव, परीक्षा नियत्रंक विशेष आमंत्रित सदस्य के रूप उपस्थित रहे।

सर्वप्रथम सचिव द्वारा बैठक के सदस्यों का स्वागत किया गया, तत्पश्चात् अध्यक्ष की अनुमति से सचिव द्वारा बैठक की कार्यवाही प्रारम्भ की गई।

1. कार्य परिषद् की बैठक दिनांक 15.03.2022 के कार्यवृत्त की सम्पुष्टि पर विचार। **(परिशिष्ट-1)**

   निर्णयः- कार्य परिषद् द्वारा पूर्व बैठक दिनांक 15.03.2022 के कार्यवृत्त को सम्पुष्टि प्रदान की गई।

2. कार्य परिषद् द्वारा विद्या परिषद् की बैठक दिनांक 04.06.2022 की संस्तुतियों के अनुमोदन पर विचार। **(परिशिष्ट-2)**

   निर्णयः-कार्य परिषद् द्वारा विद्या परिषद् की बैठक दिनांक 04.06.2022 की संस्तुतियों के अनुमोदन प्रदान किय गया।

3. कार्य परिषद् द्वारा वित्त समिति की बैठक दिनांक 03.06.2022 की संस्तुतियों के अनुमोदन पर विचार। **(परिशिष्ट-3)**

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गया कि जिन महाविद्यालयों द्वारा स्थायी सम्बद्धता की सभी शर्तो को पूरा कर लिया हो और वर्तमान में भी अवस्थापना सम्बन्धी मानक को पूर्ण करते हों, सम्बन्धी शपथ पत्र के आधार पर 08 जनपदों के कुल 201 महाविद्यालयों के ऐसे पाठ्यक्रमों को, जिनकी समयावधि पूर्ण हो रही थी, को स्थायी सम्बद्धता प्रदान की गयी है। माननीय कार्य परिषद् द्वारा ऐसे पाठ्यक्रमों को स्थायी सम्बद्धता प्रदान किये जाने को अनुमोदन प्रदान किया गया। इन सभी महाविद्यालयों का Data base तैयार कर लिया जाय जिसमें अनुमोदित प्राचार्य, अनुमोदित शिक्षकों की सूची एवं महाविद्यालय की अवस्थापना (infrastructure) सम्बन्धी सूचनाएँ दर्शाते हुए महाविद्यालय के डाटाबेस को ऑन लाईन कराये जाने का निर्देश प्रदान किया गया ।

8. कार्य परिषद् द्वारा शासन के पोर्टल http://henoc.upsdc.gov.in के माध्यम से प्रस्तावित नवीन 13 महाविद्यालय, एवम् पूर्व से संचालित 14 महाविद्यालयों में नवीन पाठ्यक्रमों में सम्बद्धता प्रदान किये जाने को अनुमोदन प्रदान किया गया।(परिशिष्ट-5)

9. कार्य परिषद् द्वारा विश्वविद्यालय के आवासीय संस्थानों में स्नातक/परास्नातक स्तर पर जो नये पाठ्यक्रम प्रारम्भ किये जा रहे है, उन पाठ्यक्रमों में सृजित हुए पदों को भी अनुमोदन प्रदान किया गया। (जैसा कि वित्त समिति द्वारा शुल्क इत्यादि सहित अनुमोदित है)

अन्त में कुलसचिव द्वारा धन्यवाद के साथ बैठक के समापन की घोषणा की गई।

कुलसचिव

कुलपति

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