KRISHNA KANTA HANDIQUI STATE OPEN UNIVERSITY
(KKHSOU)

PROGRAMME PROJECT REPORT
ON
BACHELOR OF SCIENCE (GENERAL) PROGRAMME
(B.Sc.-General)

Submitted to

UNIVERSITY GRANTS COMMISSION

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KRISHNA KANTA HANDIQUI STATE OPEN UNIVERSITY

(KKHSOU)

PROGRAMME PROJECT REPORT

BACHELOR OF SCIENCE (General)

1. Programme's Mission and Objectives:

The Bachelor of Science (B.Sc.) (General) Programme has been designed and proposed to be offered by the Hiranya Chandra Bhuyan School of Science and Technology, Krishna Kanta Handiqui State Open University (KKHSOU) with the mission to impart quality higher education in different areas of science giving equal emphasis on both theoretical and experimental aspects.
The duration of the B.Sc. (General) Programme will be 3-years, comprising of six semesters. Here, learners will be given opportunity to choose any three disciplines as per his or her interest from the four available disciplines on offer, viz., Physics, Chemistry, Mathematics and Computer Science.

The Programme has been prepared in accordance with the UGC-CBCS system and UGC (Open and Distance Learning Programmes and Online Programmes) Regulations, 2020. The syllabi of this programme have been prepared by an in-house Course Committee after a series of deliberations and discussions with academic experts in the respective fields from reputed Universities of the state. The quality of Curriculum and Syllabi of this programme have been so designed as to accommodate the recent developments in the fields of Higher Education in general and in the basic science subjects in particular.

The B.Sc. (General) Programme of KKHSOU is proposed to be offered with the following main objectives:

a) To provide an opportunity of higher education in science domain to the aspirants
b) To provide the basic theoretical, as well as, practical knowledge of different courses under the disciplines of Physics, Chemistry, Mathematics and Computer Science to the learners, to develop their levels of skill in their respective disciplines.
c) To enhance the professional competencies of the learners.

d) To provide current information in the field of science that emerges in domestic as well as global environment.

e) To provide opportunities to the learners for employability or promotion in their career.

f) To provide opportunities to the learners for further higher studies.

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2.Relevance of the Programme with KKHSOU's Mission and Goals:

As the goal of the Department of Higher Education, MHRD is to increase the Gross Enrolment Ratio (GER) in Higher Education to 50% by the year 2030, Open Universities of the nation have been playing a vital role in this regard. In Assam, KKHSOU is the one and only state Open University and it can contribute toward fulfillment of this goal.

The KKHSOU was established with the very purpose of promoting education that reaches the unreached through the Open and Distance Learning system and the Motto of the University is '*Education Beyond Barriers'* of age, academic background and geographical boundaries.

The proposed B.Sc. (General) Programme has been prepared in conformity with the Motto and objectives of KKHSOU, and aims to fulfill the mission and goals of the University, with regard to the following aims and objectives:

- To provide learning opportunity of higher education in the discipline of science to a large segment of the population, including working people, housewives and other adults who completed education at 10+2 level in science discipline or equivalent, but could not join or complete the B.Sc. degree in appropriate time owing to various reasons and still aspires to continue their studies to higher level.
- To contribute towards the improvement of the educational system in the State by providing alternative channel for higher studies in the discipline of science, that is complementary to the conventional system of education.
- To contribute towards economic growth and development of the country by preparing the learners with specific scientific skills and professional qualifications.
- To advance and disseminate learning and knowledge in the field of science through diversified means including the use of Information and Communication Technology.

3. Nature of Prospective Target Group of Learners:

KKHSOU specially strives to cater to the needs of the learners from far flung areas irrespective of age, sex and socio-economic background, so that they can have access to quality education.

The nature of the prospective target groups of learners of this Programme are as follows:

i. Persons who could not get access to science education at graduate level, in conventional system for various reasons, and particularly, those, hailing from remote and rural areas and living in other disadvantageous conditions.
ii. Working people with a desire for higher education in science stream and a need for professional development by capacity building through learning skills.
iii. Women learners and differently-abled persons who missed the opportunity to access science education at higher level.
iv. The learners who are desirous to obtain a degree without major subject in science stream.

4. Appropriateness of the Programme to be Conducted in ODL mode to Acquire Specific Skill and Competence:

The B.Sc. (General) Programme is basically a laboratory-based programme. Yet, it is possible to offer B.Sc. (General) programme in the Open and Distance learning (ODL) mode like in many other higher educational institutes such as, Indira Gandhi National Open University, Netaji Subhash Open University, Dr. B. R. Ambedkar Open University, Karnataka State Open University, etc.

The B.Sc. programme of KKHSOU would be offered through carefully designed SLMs, laboratory works, projects and assignments through ODL cum blended mode. It has been observed that there is a huge demand from learners to learn and gain a Bachelor's Degree in the domain of Science. The number of seats in conventional educational institutes is limited and hence a large number of learners do not get admission into such programmes. Offering B.Sc. in the ODL system is a viable solution to this problem. Also, the Department of Higher Education, MHRD has a goal of increasing the Gross Enrolment Ratio (GER) in Higher Education which can be achieved by offering the B.Sc. degree through ODL mode.

KKHSOU has already been successfully imparting education through ODL mode in various practical based programmes, which include laboratory-based practical works. In addition to these, KKHSOU has been also offering professional programmes, which include field-based practical works.

So, keeping the above points in view, and also the needs of the aspiring learners of the region, appropriateness of the B.Sc. (General) programme to be conducted in ODL mode is justified.

B.Sc. (General) Programme has been designed in such a way that KKHSOU can offer the programme through various modes of instructions, that the University has already adopted, so as to facilitate learners to participate actively in teaching-learning process.

5. Instructional Design:

5.1 Curriculum Design: The curriculum of B.Sc. (General) programme has been designed in such a way that it meets the standard of any other university, both conventional and ODL, offering the same programme. The curriculum is designed and developed by a Course Committee, comprising of in-house faculty members of concerned disciplines of the University in consultation with experienced subject experts from reputed Universities and Colleges of Assam. The syllabi of the programme have been developed in the light of the UGC Model Syllabi and in consultation with the syllabi of other Universities of the State, in addition to various other Open Universities of the country. English is proposed to be the medium of instruction for all the courses except MIL, which will be offered in Assamese medium.

5.2 Course Distribution: The semester-wise distribution of the different courses of the B.Sc. (General) programme is presented in Table-1.

Salient features of the Programme, shown in the Table-1.

1) A learner will have to opt from the following categories of courses:
    - Ability Enhancement Compulsory Courses (AECC)
    - Skill Enhancement Courses (SEC)
    - Discipline Specific Core (DSC) Courses
    - Discipline Specific Elective (DSE) Courses
2) Under the **Discipline Specific Core (DSC)** Courses, which are compulsory, a learner will have to choose **any three of the following disciplines** as per his/her interest.
    - Physics
    - Chemistry
    - Mathematics
    - Computer Science
3) **In Semester I,** two Ability Enhancement Compulsory Courses are on offer, from which a learner has to opt for any one**.**
4) **From Semester I to IV**, combination of three selected courses, i.e.one Discipline Specific Core Course from each of the three selected disciplines will be offered
5) **From Semester III onwards**, Skill Enhancement Courses shall be offered. Learners will be given freedom to opt for any one skill enhancement course in each semester from a list of available courses on offer from that particular semester.
6) **From Semester V onwards**, Discipline Specific Elective courses shall be offered. Learners will have to opt any one course in each semester, from **two** elective courses on offer from each discipline.

Table 1: Semester-wise Course Distribution of the proposed B.Sc. (General) Programme

Semester	Discipline Specific Core (DSC) Courses 6 credits each	Ability Enhancement Compulsory Courses (AECC) 2 credits each	Skill Enhancement Courses (SEC) 2 credits each	Discipline Specific Elective (DSE) Courses 6 credits each	Total Credit (Per Semester)
I	Three DSC courses, to be opted	AECC-1 Functional Language (English or MIL)			20
II	-do-	AECC-2 Environmental Studies			20
III	-do-		SEC 1		20
IV	-do-		SEC 2		20
V			SEC 3	Three DSE courses (one from each of the chosen disciplines)	20
VI			SEC 4	-do-	20
Total Credits					**120**

Details of course-distribution and syllabi of all the courses to be offered are given in Annexure 1-12.

5.3 Credit Distribution: Total credit of the B.Sc. (General) programme is 120 credits (6 semesters × 20 credits). Distribution of credits is shown in Table 2:

Table 2: Credit distribution of the B.Sc. (General) programme at KKHSOU

Semester	DSCC 6 credits each (4 Theory + 2 Lab)	AECC 2 credits each	SEC 2 credits each	DSEC 6 credits each	Total Credit (Per Semester)
I	Three DSC courses	AECC-1			20
II	-do-	AECC-2			20
III	-do-		SEC 1		20
IV	-do-		SEC 2		20
V			SEC 3	Three DSE courses	20
VI			SEC 4	-do-	20
Total Credits					120

5.4 Credit hours: The University follows the system of assigning 30 hours of study per credit of a course. Thus, following this norm, a 4-credit course constitutes a total of 120 hours of study. Out of the total credit hours, a minimum of 10 percent, i.e., minimum 12 hours of counseling per course, is offered to the learners at their respective study centres. And for practical/lab courses of 2 credits, a minimum of 60 hours of practical sessions have to be offered. In addition, the University is offering LMS support in four-quadrant approach for the learners.

5.5 Duration of the Programme: The B.Sc. (General) programme has six semesters and is of minimum 3 years. However, the maximum duration of the programme is 6 years as stated below:

- Minimum Duration : 3 years (6 semesters).
- Maximum Duration : 6 years.

In case, a learner is not able to qualify a course in the first attempt, he/she will have to qualify in that particular course within the next three attempts, subject to maximum duration of the study.

5.6 Faculty and Support Staff:

Currently, a total of 9 (nine) faculty members are associated with the School of Science and Technology of the University, comprising of 1 (one) Professor in the position of Director of the School, 1 (one) Associate Professor, 6 (six) Assistant Professors and 1 (one) Teaching Associate. For Ability Enhancement Compulsory Courses and Skill Enhancement Courses, faculties of other concerned disciplines of the University are also involved in the design and development of study materials of the B.Sc. (General) Programme.

6. Procedure for Admission, Curriculum Transaction and Evaluation:

6.1 Procedure for Admission:

i. Admission to the University is carried out through online mode, whereby a learner is required to fill-up and submit his/her application form through the online admission link provided in the University website www.kkhsou.in. In the online admission system, the learner has to register with his/her mobile number or email id, and has to verify the subjects of his/her choice available in the respective study centers.

ii. For admission to a particular programme, the course fee is to be paid through one of the various online modes of payment made available by the University.

iii. The learner after successful submission of the online admission form has to take a print-out of the form and submit the same to his/her respective study centre, on receipt of which the study centre provides the SLMs to the learner.

iv. Verification of online application form is carried out by the University.

v. In case of incomplete application, conditional admission may be given at the University's discretion, subject to fulfillment of other eligibility criteria.

vi. Every learner enrolled in the University is provided with a registration number and an identity card.

vii. If a learner is unable to complete the programme within the stipulated time period, he/she is required to register himself/herself as a fresh learner by paying the requisite fee.

6.1.1 Minimum Qualification:

Eligibility Criteria for the B.Sc. (General) Programme

10+2 in Science Stream or Three-year Diploma from Polytechnics in any branch.

6.1.2 Continuous Admission:

i. After completion of a particular semester, a learner is required to apply for next semester simply by paying the necessary fees within one month of the last examination day of the previous semester.

ii. Admission in subsequent semester does not depend on the results of the earlier semester. One may take admission in the next semester even without appearing in previous semester examination.

iii. Admission should be taken continuously without any break. A learner will be allowed to appear in all the examinations including back papers within the stipulated time of a programme.

iv. Learners are required to pay a late fine as laid by the University, if he or she applies for admission to the next semester after expiry of one month but within two months from the last day of examination of the previous semester. On special consideration, a learner may be allowed to take admission in the next semester even beyond the two months but before the issue of notification of the examination of that semester by the University on valid grounds and on payment of a fine as laid by the University.

v. A learner will, however, may be allowed to take admission even after that period without any fine, but he or she will be allowed to appear in examination of that semester in the next year only.

6.1.3 Fee Structure: The fee structure of the B.Sc. (General) Programme is presented in **Table-3**:

Table 3: Fee structure of the B.Sc. (General) Programme

Programme	Semester	Course Fees	Other fees	Total fees to be paid (in Rs)
B.Sc. (General)	I	4000	1000	5,000
	II	4000	1000	5,000
	III	4000	1000	5,000
	IV	4000	1000	5,000
	V	4000	1000	5,000
	VI	4000	1000	5,000
Total Programme Fees				**30,000**

NB: (1) **Course fees** include SLM, Counselling, Tutorial and Practical wherever applicable.

(2) **Other fees** include examination fees, Centre fees, Enrolment fees etc.

6.1.4 Financial Assistance: At present no financial assistance is provided for this course. However, University has general policy of fee waiver for certain categories of learners.

6.1.5 Refusal/Cancellation of Admission: Notwithstanding anything contained in the Prospectus/Information Brochure, the University reserves the right to refuse or cancel Admission of any Candidate.

6.2 Curriculum Transaction:

6.2.1 Activity Planner: An activity planner that guides the overall academic activities in the B.Sc. (General) Programme shall be made available prior to the admission schedule of the University. The office of the Centre for Internal Quality Assurance (CIQA) and the office of the Dean (Academic) will upload the Academic Plan and month wise Academic Calendar to enable the learners to plan their studies and activities accordingly.

6.2.2 Self-Learning Materials (SLM): The printed study material (written in self-instructional style) for both theory and practical components of the programmes will be supplied to the learners. The SLMs of the University have the following features:

i. ***Self-Explanatory and Self-contained:*** The content is presented in such a style so that the learners can go through the materials without much external support, for additional sources or even a teacher.

ii. ***Self-Directed:*** The SLMs are aimed at providing necessary guidance, hints and suggestions to its learners at each stage of learning. It is presented in the form of easy explanation, sequential development, illustrations, learning activities etc.

iii. ***Self-Motivating:*** In ODL system, the learners remain off the campus for most of their study time. Therefore, the SLMs of B.Sc. programme are designed in such a way that these arouse curiosity, raise problems, relate knowledge to familiar situations and make the entire learning meaningful for them.

iv. The SLMs includes 'Let Us Know (Additional Knowledge)', 'Illustrations', 'Check your Progress', 'Model Questions' etc. so that the learners become self-motivated and self-evaluating.

6.2.3 Multimedia Materials: Apart from the printed SLMs, the University provides, e-SLMs, audio-visual learning materials related to course content, which are uploaded in the YouTube channel of the University for better clarification and enhancement of understanding of the course material given to the learners.

6.2.4 Counselling Sessions: Counselling sessions on both theory and practical classes will be conducted at the approved Study centres for the B.Sc. Programme. of the University. Basically, counselling sessions are conducted on Sundays. In addition to this, the faculty members of the University offer weekly online-counselling sessions for theory part. Laboratory practical sessions are to be held at the approved study centres during Sundays, holidays and vacations.

6.2.5 LMS Support: All the courses for the proposed B.Sc. programme will follow the following 4-quadrant approach:

Quadrant 1 consists of e-Tutorial (Video).

Quadrant 2 consists of e-Content in the form of e-SLM, and links of Open Educational Resources (OER).

Quadrant 3 consists of Assessment in the form of MCQs, Fill in the blanks, True/False type questions etc.

Quadrant 4 consists of Discussion Forum for clarifying doubts/questions.

6.2.6 ICT Support: ICT-based support systems provided by the University are listed below:

- **Website:** There is a full-fledged official website www.kkhsou.in for the learners and general public. The necessary information is provided to the learners through the official website. The Website is also linked with the social-networking site like Facebook (KKHSOU FB Official Group) for interaction among the learners, faculty members and stakeholders. The website also includes a customized study centre-search facility based on district or programme. In addition, the Audio-Video tutorial programmes are made available online through YouTube.
- **Community Radio Service**: **Jnan Taranga** (90.0 MHz) of KKHSOU is the first Community Radio of the North Eastern part of the country. The Community Radio, being a platform for the community for taking up community issues, is also a platform to broadcast several educational programmes that includes debates, discussions, and talk shows.
- **Ekalavya**: With the help of Prasar Bharati, the University has launched a special educational programme namely ***Ekalavya.*** It is aired every Saturday from 8.00 PM to 8.30 PM through All India Radio, Guwahati and Dibrugarh.
- **e-SLM:** A digital repository by the name of e-SLM (http://eslm.kkhsou.in/) is available in the University website, where the study materials are uploaded for the benefit of the learners.
- **Open Access Journals Search Engine (OAJSE):** To provide easy access to various open access journal across the world, KKHSOU has developed the Open Access Journals Search Engine (OAJSE) which is available for the users from the URL www.kkhsou.in/library/oajse or http://oajse.kkhsou.in. OAJSE aims to cover journals in all subjects that are published in English language. There are now 4,500+ journals in the directory. All are searchable at article level.
- **KKHSOU Mobile App:** The University has developed a mobile application "KKHSOU" to help the learners to connect 24×7 with the University. It can be freely downloaded from Google Play Store (for Android user).
- **SMS and E-mail Alert Facility:** University has initiated an SMS and e-mail alert facility for learners regarding any news, events and learner-related information of the University.
- **E-mail services:** Learners can write emails regarding any queries related to academic or study material to the faculty members at respective Departmental email ids created for the purpose. For general information regarding KKHSOU, learners can write emails to any officials in University's general mail id: info@kkhsou.in. Queries raised through emails are readdressed by concerned official/faculty members of the University.
- **Official WhatsApp Group**: Year-wise and programme wise WhatsApp groups are created to keep in contact with the learners.

- **E-mentoring support**: The University has initiated the E-mentoring service through Whatsapp and Telegram groups to provide continuous support to the learners to improve their academic skills as well as self-development.

6.3 Evaluations: Evaluation process of the B.Sc. (General) programme will be as follows:

A) Evaluation of Theory Courses:

For theory courses, evaluation comprises three aspects:

- **Self-assessment exercises** (Check Your Progress) within each unit of study i.e., in the SLM (non-credit)
- **Continuous (Formative) evaluation,** which carries a weightage of 30% for each course (Assignments and MCQs, participation in extension activities, attendance in counselling classes, timely submission of assignment).
- **Term-End examination** which carries a weightage of 70% of the total for each course.

B) Evaluation of Practical Courses:

For practical courses, evaluation comprises of three aspects:

- Continuous (Formative) Evaluation of Laboratory work throughout one semester: 50% weightage for each practical component (Submission of laboratory copies / reports, attendance in laboratory/practical classes, timely submission of assignment)
- Term End Evaluation: 50% weightage for each practical/laboratory course (Experiment: 40%, Viva: 10%)

C) Evaluation of Project / Dissertation:

If a learner opts for project or dissertation, the evaluation will be carried out on the basis of submitted Project Report (50% weightage), presentation of the Project Report (25% weightage) and Viva-voce examination (25% weightage)

7. Requirement of the Laboratory Support and Library Resources

Laboratory Support: Practical is a very vital component of B.Sc. Programme and to facilitate learners with practical training, well equipped laboratory support is must. KKHSOU has selected various reputed educational institutes with adequate laboratory infrastructure, instruments, equipment, and computers etc. as its Study Centres for running B.Sc.(General) Programme. It is also planned to conduct the practical parts during the summer / winter vacation of the respective college (Study Centre) to conduct the practical part in a smooth and effective way to provide proper training to the learners.

Library Resources: Krishna Kanta Handiqui State Open University (KKHSOU) has its own Central Library with wide collection of books, journals, and magazines to support the needs of learners. Apart from the print resources, a good number of electronic resources comprising e-journals, online databases, gateway portal to e-journals are all made accessible to the patrons within the University campus. The library is fully computerized with Koha ILS (Integrated Library System) and also equipped with RFID (Radio-Frequency Identification) technology. Learners can also use the existing library of their respective study centre.

8. Cost Estimate of the Programme and the Provisions:

The University is fully committed to bear the cost of SLM preparation for the learners of B.Sc. (General) programme. The office of the Finance Officer of KKHSOU keeps all the records of finances regarding printing of SLMs, honorarium to be paid to the members of the Expert Committee, honorarium to be paid to Content Writers, Content Editors, Language Editors, Translators, Proof Readers and the expenditure related to organizing counselors' workshops, meeting of the co-coordinators of the study centres etc. Moreover, the office of the Finance Officer also maintains records of purchase of computers, online space, books, journals etc. The accounts are maintained as per the laid down procedures of government. In this regards, the cost of programme development, programme delivery, and programme maintenance, the latest indicative figures of cost as approved by the Finance Office of the University is presented below in respect of the B.Sc. (General) programme.

8.1. Programme Development Cost:

The office of the Finance Officer of KKHSOU has worked out the following details:

a. SLM Development Cost for Under Graduate Programme per Unit - Rs. 7,300/-

For 24 Courses with 14-16 units in one course total SLM development cost will be approximately Rs 25,00,000/-

b. Printing Cost per SLM- Rs. 50/-

c. Cost of audio-visual production per Unit: 4000/-

8.2 Programme Delivery Cost:

The SLMs prepared have to be delivered to various study centres located at the far-flung remote areas. On an average, the University delivers about 15 kgs of study materials per learner. The cost of delivery of 1 kg of such material is Rs.15. Accordingly, depending upon the number of learners, the cost for the B.Sc.(General) programme will be determined by the University. The office of the Finance Officer has calculated the delivery cost of SLM per learner at Rs. 230/-

8.3 Programme Maintenance Cost:

The University will keep financial provision for organizing stake holders' meetings, counseling workshops etc. as per the academic plan and academic calendar approved by the Academic Council of the University. The University will also bear the cost of organizing the meeting of Syllabus Revision Committee etc. and for supply of additional study materials, if required for improvement of the quality of the programme.

Moreover, the University will keep on investing in developing the IT infrastructure and science laboratory, so that the learners can benefit. The University will keep adequate financial provision for development, delivery, and maintenance of the programme presented as per the Programme Project Report.

9. Quality Assurance Mechanism and Expected Programme Outcomes

9.1 Quality Assurance Mechanism: With regard to the quality concerns of the course materials, the University is involved in the following activities:

i. The programme has been designed and developed, as mentioned in Curriculum Design under point 5.1, after a series of discussions and deliberations by a team of a few carefully chosen subject experts to ensure quality.

ii. Content writers for the development of SLMhave been carefully chosen from subject experts from reputed institutions as well as from the in-house faculties.

iii. Necessary content editing and language editing have also been carried out with utmost care by academics from reputed higher educational institutions. Their suggestions and feedbacks are to be included by the coordinator of the programme.

iv. It is also ensured by the University to distribute the SLMs to the learners at the time of admission.

v. Centre of the Internal Quality Assurance (CIQA)takes care of the following to enhance the quality of the various facets of the University:

   a. Counsellors' workshops
   b. Stakeholders' meetings
   c. Feedback Responses from the learners from various programmes
   d. Audit of SLM as well as Audio-Video Learning Materials

vi. In order to keep the programme updated, the programme will be revised and necessary changes will be incorporated for the benefit of the learners, based on the inputs received from the mechanism as mentioned above.

9.2 Expected Programme Outcome: The expected outcomes of the programme are as follows:

- The Programme will enable the learners to acquire knowledge of different courses in science stream.
- The programme will enable the learners of the target groups to fulfil their aspiration to become a graduate.
- The programme will encourage the learners to go for higher studies.
- The programme will enable the learners to acquire the entry level qualification of graduation to apply for various competitive examinations.
- And in a broader perspective, it will encourage them for expansion of science education in the society and to build scientific temperament

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10. Annexures

Syllabi of all courses of B.Sc. (General) Programme (discipline-wise with detail)

Annexure 1: Details of the Courses

Annexure 2: Detailed Syllabus of Physics

Annexure 3: Detailed Syllabus of Chemistry

Annexure 4: Detailed Syllabus of Mathematics

Annexure 5: Detailed Syllabus of Computer Science

Annexure 6: Detailed Syllabus of Functional Language (MIL-Assamese) (AECC)

Annexure 7: Detailed Syllabus of Functional Language (English) (AECC)

Annexure 8: Detailed Syllabus of Environmental Studies (AECC)

Annexure 9: Detailed Syllabus of Office Management (SEC)

Annexure 10: Detailed Syllabus of Entrepreneurship Development and Business Management (SEC)

Annexure 11: Detailed Syllabus of Basics of Tourism (SEC)

Annexure 12: Detailed Syllabus of Travel Geography (SEC)

N.B.: In addition to the syllabi of 4 (four) Skill Enhancement Courses (as per Annexure 9 to 12), there are 16 (sixteen) numbers of Skill Enhancement Courses proposed to be offered from the disciplines of Physics (4 Nos), Chemistry (4 Nos.) and Computer Science (8 Nos), the syllabi of which are provided along with the detailed syllabi of the respective disciplines.

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Annexure-1

Details of Courses

Bachelor of Science (General)

Discipline Specific Core (DSC) Courses:

Sl. No	Discipline	Nature of Course	Course Code	Title of Course	Credits
	Semester I				
1	Physics	DSC-1-1	BPHYS S1 01	Mechanics	4+2=6
2	Chemistry	DSC-2-1	BCHEM S1 01	Atomic Structure, Bonding, General Organic Chemistry & Aliphatic Hydrocarbons	4+2=6
3	Mathematics	DSC-3-1	BMATH S1 01	Differential Calculus	6
4	Computer Science	DSC-4-1	BCOMP S1 01	Problem Solving using Computers	4+2=6
	Semester II				
5	Physics	DSC-1-2	BPHYS S2 02	Electricity and Magnetism	4+2=6
6	Chemistry	DSC-2-2	BCHEM S2 02	Chemical Energetics, Equilibria and Functional Group Organic Chemistry-I	4+2=6
7	Mathematics	DSC-3-2	BMATH S2 02	Differential Equations	6
8	Computer Science	DSC-4-2	BCOMP S2 02	Database Management Systems	4+2=6
	Semester III				
9	Physics	DSC-1-3	BPHYS S3 03	Thermal Physics and Statistical Mechanics	4+2=6
10	Chemistry	DSC-2-3	BCHEM S3 03	Solutions, Phase Equilibrium, Conductance, Electrochemistry and Functional Group Organic Chemistry – II	4+2=6
11	Mathematics	DSC-3-3	BMATH S3 03	Algebra	6
12	Computer Science	DSC-4-3	BCOMP S3 03	Operating Systems	4+2=6
	Semester IV				
13	Physics	DSC-1-4	BPHYS S4 04	Waves and Optics	4+2=6
14	Chemistry	DSC-2-4	BCHEM S4 04	Coordination Chemistry, States of Matter & Chemical Kinetics	4+2=6
15	Mathematics	DSC-3-4	BMATH S4 04	Real Analysis	6
16	Computer Science	DSC-4-4	BCOMP S4 04	Computer System Architecture	4+2=6

Ability Enhancement Compulsory Courses (AECC):

Any one of the AECC courses needs to be selected for the first semester.

Sl. No	Course Code	Title of Course	Credits
	Semester I		
1	BS-AECC-1A	Functional Language-MIL (Assamese)	2
2	BS-AECC-1B	Functional Language (English)	2
	Semester II		
3	BS-AECC-2	Environmental Studies	2

Skill Enhancement Courses (SEC):

Only one of the SEC courses needs to be selected from the list of available courses for that particular semester.

Sl. No	Course Code	Title of Course	Credits
	Semester III		
1	BS-SEC-1A	Electrical Circuit Network Skills	2
2	BS-SEC-1B	Fundamentals of Green Chemistry	2
3	BS-SEC-1C	Office Automation Tools	2
4	BS-SEC-1D	MySQL (SQL/PL-SQL)	2
5	BS-SEC-1E	Office Management	2
	Semester IV		
6	BS-SEC-2A	Basic Instrumentation Skills	2
7	BS-SEC-2B	Pharmaceutical Chemistry	2
8	BS-SEC-2C	HTML Programming	2
9	BS-SEC-2D	XML Programming	2
10	BS-SEC-2E	Entrepreneurship Development and Small Business Management	2
	Semester V		
11	BS-SEC-3A	Renewable Energy and Energy Harvesting	2
12	BS-SEC-3B	Business Skills for Chemists	2
13	BS-SEC-3C	PHP Programming	2
14	BS-SEC-3D	Android Programming	2
15	BS-SEC-3E	Basics of Tourism	2
	Semester VI		
16	BS-SEC-4A	Physics Workshop Skill	2
17	BS-SEC-4B	Intellectual Property Rights	2
18	BS-SEC-4C	Programming in Scilab	2
19	BS-SEC-4D	Concept of Software Testing	2
20	BS-SEC-4E	Travel Geography	2

Discipline Specific Elective (DSE) Courses:

One has to opt for any one course of each of the chosen disciplines per semester.

Sl. No	Discipline	Course Code	Title of Course	Credits
	Semester V			
1	Physics	BPHYS S5 1A	Digital and Analog Circuits and Instrumentation	4+2=6
2		BPHYS S5 1B	Elements of Modern Physics	4+2=6
3	Chemistry	BCHEM S5 1A	Inorganic Materials of Industrial Importance	4+2=6
4		BCHEM S5 1B	Analytical Methods in Chemistry	4+2=6
5	Mathematics	BMATH S5 1A	Discrete Mathematics	6
6		BMATH S5 1B	Probability and Statistics	6
7	Computer Science	BCOMP S5 1A	Programming in JAVA	4+2=6
8		BCOMP S5 1B	Data Structures and Analysis of Algorithms	4+2=6
	Semester VI			
9	Physics	BPHYS S6 1A	Embedded System: Introduction To Microcontrollers	4+2=6
10		BPHYS S6 1B	Dissertation	6
11	Chemistry	BCHEM S6 1A	Industrial Chemicals and Environment	4+2=6
12		BCHEM S6 1B	Dissertation	6
13	Mathematics	BMATH S6 1A	Operations research	6
14		BMATH S6 1B	Analytical Geometry and Vector Calculus	6
15	Computer Science	BCOMP S6 1A	Computer Networks	4+2=6
16		BCOMP S6 1B	Project Work	6

Annexure 2

KRISHNA KANTA HANDIQUI STATE OPEN UNIVERSITY

N.H. 37, Khanapara, Guwahati-781022, Assam

B.Sc. General Programme with PHYSICS

CBCS Syllabus

for

B.Sc. in PHYSICS

without MAJOR in any discipline

2021

Detailed Syllabus of Physics

DISCIPLINE SPECIFIC CORE (DSC) COURSES
(All compulsory)

- Course 1: BPHYS S1 01: Mechanics (Theory + Lab) (Credit 4 + 2)
- Course 2: BPHYS S2 02: Electricity and Magnetism (Theory + Lab) (Credit 4 + 2)
- Course 3: BPHYS S3 03: Thermal Physics and Statistical Mechanics (Theory + Lab) (Credit 4+2)
- Course 4: BPHYS S4 04: Waves and Optics (Theory + Lab) (Credit 4+2)

Semester I

Course Code: BPHYS S1 01
Course Title: MECHANICS (THEORY)
Nature of the Course: DSC-1-1
Credit: 4
Marks: 100

Learning Objective of the course: At the completion of this course, a learner will be able to-

1. Understand the preliminary mathematical methods and homogeneous differential equations.
2. Understand the basic components of mechanics such as motion, force and torque, mass and moment of inertia, linear and angular momenta, kinetic energy and potential energy etc.
3. Explain the basic conservation laws and Kepler's laws by studying them in various mechanical systems including oscillations, gravitational systems etc.
4. Detailed analysis of simple harmonic oscillator.
5. Study elasticity including modulus of elasticity, Poisson's ratio, rigidity of modulus etc.
6. Know about the basic concept of relativity.

BLOCK I

UNIT 1: Mathematical Preliminaries

Classification of Physical Quantities; Geometrical and algebraic representation of vectors, Vector algebra, Scalar and Vector products, Derivatives of a vector with respect to a scalar.

UNIT 2: Differential Equations Part I

Few Examples of Differential Equations: Order and Degrees of Ordinary Differential Equation, Linear and Non-Linear Differential Equation; Solution to Differential Equation: Solution by Separation of Variable; Solution of First Order Homogeneous Differential Equation: Homogeneous Function, Solution by Variable Separation Method.

UNIT 3: Differential Equations Part II

Second Order Homogeneous Differential Equations with constant Co-efficient; Few Examples of Second Order Homogeneous Differential Equation.

UNIT 4: Laws of Motion

Frames of Reference; Newton's Laws of Motion: Some Important Quantities of Motion, First Law of Motion, Second Law of Motion, Third Law of Motion; Dynamics of a System Particles; Centre of Mass.

UNIT 5: Rotational Motion

Angular Velocity and Angular Momentum: Angular Velocity, Angular Momentum; Torque; Conservation of Angular Momentum; Moment of Inertia: Radius of Gyration, Kinetic Energy of Rotation, Theorems of Moment of Inertia, Relation Between Torque and Moment of Inertia, Relation Between Angular Momentum and Moment of Inertia, Moment of Inertia of Some Symmetrical Objects.

UNIT 6: Momentum and Energy

Principle of Conservation of Momentum; Impulse; Work and Energy; Conservation of Energy; Motion of Rockets.

UNIT 7: Gravitation and Central Force Motion

Newton's Law of Gravitation: Escape Velocity, Satellites and Its Orbital Velocity; Motion of a Particle in a Central Force Field: Central Force, Equation of Motion, Some Particular Cases of Orbit.

BLOCK II

UNIT 8: Kepler's Laws and Related Topic

Kepler's Laws (statement only); Satellite in circular orbit and applications. Geosynchronous orbits. Basic idea of global positioning system (GPS). Weightlessness. Physiological effects on astronauts.

UNIT 9: Simple Harmonic Motion

Concept of Simple Harmonic Motion; Characteristics of SHM; Physical Examples: Spring-mass System, Simple Pendulum, A Bead on A Parabolic Wire, Compound Pendulum; Differential Equation of Motion; Kinetic and Potential Energy; Total Energy and their Time Averages.

UNIT 10: Oscillations and Waves

An Overview of Oscillations; Types of Oscillations: Free Oscillation, Damped Oscillation, Forced Oscillation; Wave motions; Characteristics of Wave Motion; Types of Waves; Mathematical Representations.

UNIT 11: Elasticity Part I:

Elasticity: Deforming Force and Restoring Force, Molecular Origin of Restoring Force, Stress and Strain; Hooke's Law; Stress Strain Diagram; Modulus of Elasticity: Young's Modulus, Rigidity Modulus, Bulk Modulus, Axial Modulus; Poisson's Ratio; Relation between Elastic Constants; Expression for Poisson's

Ratio in terms of Elastic Constants: Limiting values of Poisson's ratio; Twisting Torque on a Cylinder or Wire: Comparative torsional strength of a hollow and a solid cylinder of same mass.

UNIT 12: Elasticity Part II:

Determination of Rigidity Modulus by Static Torsion; Torsional Pendulum; Determination of Moment of Inertia and Rigidity modulus by torsional oscillation method.

UNIT 13: Introduction to Relativity

Relative Motion and Frame of Reference; Constancy of Speed of Light: Postulates of Special Theory of Relativity.

UNIT 14: Some relativistic phenomenon

Transformation Equations: Lorentz Transformation Equations in Three Spatial Dimensions; Length Contraction; Time Dilation; Relativistic Addition of Velocities; Simultaneity.

Reference Books:

1. Introduction to Mechanics, Mahendra K. Verma, Taylor & Francis
2. An Introduction to Mechanics of Materials, Vijay Gupta, Alpha Science Int. Ltd.
3. Mechanics, D. S. Mathur, S. Chand and Company Limited, 2000
4. Introduction to Special Relativity, R. Resnick, 2005, John Wiley and Sons.
5. An Introduction to Mechanics, D. Kleppner, R. J. Kolenkow, 1973, McGraw-Hill.
6. Mechanics, Berkeley Physics, vol.1, C. Kittel, W. Knight, et.al. 2007, Tata McGraw-Hill.
7. Theoretical Mechanics, M.R. Spiegel, 2006, Tata McGraw Hill.

Course Code: BPHYS S1 01
Course Title: MECHANICS (LAB)
Nature of the Course: DSC-1-1
Credits: 2
Marks: 50

List of Experiments:

1. Measurements of length (or diameter) using Vernier calipers, Screw Gauge and travelling microscope.
2. To determine the Height of a Building using a Sextant.
3. To determine the Moment of Inertia of a Flywheel.
4. To determine the Young's Modulus of a Wire by Optical Lever Method using Searle's apparatus.
5. To determine the Modulus of Rigidity of a Wire by Maxwell's needle.
6. To determine the Elastic Constants of a Wire by Searle's method.
7. To determine g by Bar Pendulum.
8. To study the Motion of a Spring and calculate (a) Spring Constant, (b) value of g.

Reference Books:

1. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House.
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers.
3. Engineering Practical Physics, S. Panigrahi and B. Mallick, 2015, Cengage Learning India Pvt. Ltd.
4. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.

Semester II

Course Code: BPHYS S2 02
Course Title: ELECTRICITY AND MAGNETISM (THEORY)
Nature of the Course: DSC-1-2
Credit: 4
Marks: 100

Learning Objective of the course: At the completion of this course, a learner will be able to-

1. Gain basic knowledge of electricity and magnetism.
2. Understand the electrical and magnetic properties of matter in brief.
3. Know the effect of electric field on magnetic field and the effect of magnetic field on current.
4. Describe about the electromagnetic induction including Faraday's and Lenz's laws and electromagnetic waves.
5. Understand the basic principle of the electrical circuit (AC).

BLOCK I:

UNIT 1: Vector Analysis

An Overview of Vector Algebra; Gradient; Divergence; Curl and Their Significance; Product Rules; Second Derivatives.

UNIT 2: Vector Integration

Concept of Vector Integration; Line, surface and volume integrals of Vector fields, Gauss-divergence theorem and Stoke's theorem of vectors (statement only).

UNIT 3: Electrostatics

Electrostatic Field; Electrostatic Flux; Gauss's law of Electrostatics.

UNIT 4: Applications of Gauss Theorem

Electric field due to point charge; Electric field due to line charge; Electric field due to Spherical shell and solid sphere; Electric field due to plane sheet of charge; Electric field due to charged conductor.

UNIT 5: Applications of Electric Diploe

Electric Potential as Line Integral of Electric Field; Potential Due to a Point Charge; Electric Dipole; Calculation of Electric Field from Potential; Capacitance of an Isolated Spherical Conductor; Parallel Plate, Spherical and Cylindrical Capacitors; Energy per Unit Volume in Electric Field.

UNIT 6: Electrostatics in Medium

Dielectric medium; Dielectric in Electric Field; Displacement Vector; Gauss's law in Dielectrics; Capacitors; Energy per unit volume in electrostatic field.

UNIT 7: Magnetism Part I

Magnetostatics: Biot-Savart's law and its applications, Straight Conductor, Circular Coil, Solenoid Carrying Current; Divergence and Curl of Magnetic Field.

BLOCK II:

UNIT 8: Magnetism Part II

Magnetic Properties of Materials: Magnetic Intensity, Magnetic Induction, Permeability, Magnetic Susceptibility; Brief Introduction of dia-, para- and ferro- Magnetic Materials.

UNIT 9: Magnetic Vector Potential

Concept of Magnetic Vector Potential; Ampere's circuital law.

UNIT 10: Electromagnetic Induction

Faraday's laws of Electromagnetic Induction**;** Lenz's law; Self and Mutual Inductance; Inductance of single coil; Mutual Inductance of two coils; Energy Stored in Magnetic Field.

UNIT 11: Maxwell`s Equations

Equation of Continuity of Current; Displacement Current; Introduction to Maxwell's Equations.

UNIT 12: Electromagnetic Wave

Poynting Vector; Energy density in electromagnetic field; Electromagnetic Wave Propagation through Vacuum and Isotropic Dielectric Medium; Transverse Nature of EM waves.

UNIT 13: Polarization of Electromagnetic Wave

An Overview of Polarization

UNIT 14: Electrical Circuits

AC Circuits: Kirchhoff‟s laws for AC circuits; Complex Reactance and Impedance; Series LCR Circuit:

Resonance, Power Dissipation, Quality Factor, Band Width; Parallel LCR Circuit.

Reference Books:

1. Electricity & Magnetism, D. Chattopadhaya, New Central Book Agency
2. Fundamental of Electricity & Magnetism, S. K. Chatterjee, PHI Learning Private Ltd.
3. Electricity, Magnetism & Electromagnetic Theory, S. Mahajan and Choudhury, 2012, Tata McGraw
4. Electricity and Magnetism, Edward M. Purcell, 1986 McGraw-Hill Education
5. Introduction to Electrodynamics, D. J. Griffiths, 3rd Edn. 1998, Benjamin Cummings.
6. Feynman Lectures Vol.2, R. P. Feynman, R. B. Leighton, M. Sands, 2008, Pearson Education
7. Elements of Electromagnetics, M. N. O. Sadiku, 2010, Oxford University Press.
8. Electricity and Magnetism, J. H. Fewkes and J. Yarwood. Vol. I, 1991, Oxford Univ. Press.
9. Electromagnetic Waves and Radiating System, E. C. Jordan, Keith G. Balmain, PHI

Course Code: BPHYS S2 02
Course Title: ELECTRICITY AND MAGNETISM (LAB)
Nature of the Course: DSC-1-2
Credits: 2
Marks: 50

List of Experiments:

1. To use a Multimeter for measuring (a) Resistances, (b) AC and DC Voltages,
(c) DC Current, and (d) checking electrical fuses.
2. To compare capacitances using De'Sauty's bridge.
3. Measurement of field strength B and its variation in a Solenoid (Determine dB/dx)
4. To study the Characteristics of a Series RC Circuit.
5. To study a series LCR circuit LCR circuit and determine its (a) Resonant frequency, (b) Quality factor
6. To study a parallel LCR circuit and determine its (a) Anti-resonant frequency and
(b) Quality factor Q
7. To determine a Low Resistance by Carey Foster's Bridge.
8. To verify the Thevenin's and Norton theorems.

Reference Books:

1. Advanced Practical Physics for students, B.L.Flint & H.T.Worsnop, 1971, Asia Publishing House.
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
3. A Text Book of Practical Physics, I.Prakash & Ramakrishna, 11th Ed.2011, Kitab Mahal
4. Engineering Practical Physics, S.Panigrahi & B.Mallick, 2015, Cengage Learning India Pvt. Ltd.

Semester III

Course Code: BPHYS S3 03
Course Title: THERMAL PHYSICS AND STATISTICAL MECHANICS (THEORY)
Nature of the Course: DSC-1-3
Credit: 4
Marks: 100

Learning Objective of the course: At the completion of this course, a learner will be able to-

1. Develop knowledge on the classical laws of thermodynamics and their application
2. Provide insight to the postulates of Statistical Mechanics and statistical interpretation of thermodynamics
3. Understand the laws of radiation and acquire knowledge for their applications in various disciplines in Physics, Chemistry, Biology, Earth and Atmospheric Sciences.
4. Develop application oriented knowledge on laws of statistical mechanics in selected problems
5. Use the concept of thermodynamics in real world experiences

BLOCK I:

UNIT 1: Laws of Thermodynamics
Introduction to Thermodynamic; Zeroth Law of Thermodynamics and Concept of Temperature. First law of Thermodynamics and internal energy; conversion of heat into work, Various Thermo Dynamical Processes,

UNIT 2: Applications of Thermodynamics
Applications of First Law of Thermodynamics; General Relation between C_P and C_V, Work done during Isothermal and Adiabatic Processes, Compressibility and Expansion Coefficient.

UNIT 3: Carnot's Cycle
Reversible and Irreversible processes; Second law of Thermodynamics; Carnot's cycle and theorem.

UNIT 4: Entropy
Concept of Entropy; Entropy changes in Reversible and Irreversible Processes, Entropy-temperature diagrams.

UNIT 5: Third law of Thermodynamics
Third law of thermodynamics, Unattainability of absolute zero.

UNIT 6: Thermodynamic Potentials
Internal Energy; Enthalpy; Helmholtz Free Energy, Gibbs Free Energy; Maxwell's Relations and Applications: Joule-Thompson Effect, Clausius-Clapeyron Equation, Expression for ($C_P - C_V$), C_P/C_V, T-dS Equations.

UNIT 7: Kinetic Theory of Gases

Derivation of Maxwell's law of distribution of velocities and its experimental verification, Mean free path (Zeroth Order),

BLOCK II:

UNIT 8: Transport Phenomena

Transport Phenomena in Ideal Gases: Viscosity, Conduction, Diffusion (for vertical case)

UNIT 9: Law of Equipartition of Energy

Applications to specific heat of gases; Mono-atomic gases; Diatomic gases.

UNIT 10: Theory of Radiation I

Blackbody Radiation; Spectral Distribution; Concept of Energy Density.

UNIT 11: Theory of Radiation II

Derivation of Planck's law; Deduction of Wien's distribution law; Rayleigh-Jeans Law; Stefan Boltzmann Law; Wien's Displacement law from Planck's law.

UNIT 12: Introduction Statistical Mechanics

Phase space; Macrostate and Microstate; Entropy and Thermodynamic probability.

UNIT 13: Maxwell-Boltzmann law

Distribution of velocity;

UNIT 14: Quantum Statistics

Fermi-Dirac distribution law; Electron gas; Bose-Einstein distribution law; Photon Gas; Comparison of three statistics.

Reference Books:

1. Thermal Physics and Statistical Mechanics, S K Roy, New Agency International Limited
2. Thermal and Statistical Physics, R. B. Singh, New Academic Science
3. Heat and Thermodynamics, M. W. Zemansky, Richard Dittman, 1981, McGraw-Hill.
4. A Treatise on Heat, Meghnad Saha, and B. N.Srivastava, 1958, Indian Press
5. Thermal Physics, S. Garg, R. Bansal and Ghosh, 2nd Edition, 1993, Tata McGraw-Hill
6. Modern Thermodynamics with Statistical Mechanics, Carl S. Helrich, 2009, Springer.
7. Thermodynamics, Kinetic Theory & Statistical Thermodynamics, Sears & Salinger. 1988, Narosa.
8. Concepts in Thermal Physics, S.J. Blundell and K.M. Blundell, 2nd Ed., 2012, Oxford University Press
9. Thermal Physics, A. Kumar and S.P. Taneja, 2014, R. Chand Publications.
10. Statistical Mechanics, R. K. Pathria, Butterworth Heinemann: 2nd Ed., 1996, Oxford University Press.

Course Code: BPHYS S3 03
Course Title: THERMAL PHYSICS AND STATISTICAL MECHANICS (LAB)
Nature of the Course: DSC-1-3
Credit: 2
Marks: 50

List of Experiments:

1. To determine Mechanical Equivalent of Heat, J, by Callender and Barne's constant flow method.
2. Measurement of Planck's constant using black body radiation.
3. To determine Stefan's Constant.
4. To determine the coefficient of thermal conductivity of a bad conductor by Lee and Charlton's disc method.
5. To determine the temperature co-efficient of resistance by Platinum resistance thermometer.
6. To study the variation of thermo emf across two junctions of a thermocouple with temperature.
7. To record and analyze the cooling temperature of a hot object as a function of time using a thermocouple and suitable data acquisition system.

Reference Books:

1. Advanced Practical Physics for students, B.L.Flint & H.T.Worsnop, 1971, Asia Publishing House.
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
3. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.
4. A Laboratory Manual of Physics for Undergraduate Classes, D.P. Khandelwal, 1985, Vani Publication.

Semester IV

Course Code: BPHY S4 04
Course Title: WAVES AND OPTICS (THEORY)
Nature of the Course: DSC-1-4
Credit: 4
Marks: 100

Learning Objective of the course: At the completion of this course, a learner will be able to-

1. Learn the basics of wave motion.
2. Know about the behavior of light due to its wave nature.
3. Identify and understand different phenomena due to the interaction of light with light and matter.
4. Analyze some of the fundamental laws and principles of light which is used in many important optical instruments.

BLOCK I:

UNIT 1: Superposition of Two Collinear Harmonic Oscillations
Linearity and Superposition Principle; Oscillations having equal frequencies; Oscillations having different frequencies (Beats).

UNIT 2: Superposition of Two Perpendicular Harmonic Oscillations
Graphical and Analytical Methods; Lissajous Figures with equal an unequal frequency and their uses.

UNIT 3: Waves Motion- General
Transverse waves on a string; Travelling and standing waves on a string; Normal Modes of a string; Group velocity, Phase velocity; Plane waves; Spherical waves, Wave intensity.

UNIT 4: Sound: Relation to SHM
Simple harmonic motion: forced vibrations and resonance

UNIT 5: Fourier's Theorem
Application to saw tooth wave and square wave – Intensity and loudness of sound; Decibels: Intensity levels, Musical notes, Musical scale.

UNIT 6: Acoustics of Buildings
Reverberation and time of reverberation - Absorption coefficient –
Sabine's formula - measurement of reverberation time - Acoustic aspects of halls and auditoria.

UNIT 7: Wave Optics
Electromagnetic nature of light; Definition and Properties of wave front; Huygens Principle.

BLOCK II:

UNIT 8: Introduction to Interference
Interference: Division of amplitude and division of wavefront; Young's Double Slit experiment.

UNIT 9: Interference of Light
Lloyd's Mirror and Fresnel's Biprism; Phase change on reflection: Stokes' treatment.

UNIT 10: Interference in Thin Films
Parallel and Wedge-Shaped Films. Fringes of equal inclination (Haidinger Fringes); Fringes of equal thickness (Fizeau Fringes). Newton's Rings: Measurement of Wavelength and Refractive Index.

UNIT 11: Michelson's Interferometer
Idea of form of fringes (no theory needed); Determination of wavelength; Wavelength Difference; Refractive index; Visibility of Fringes.

UNIT 12: Fraunhofer Diffraction
Concept of Diffraction; Single slit; Double Slit; Multiple slits; Diffraction grating.

UNIT 13: Fresnel Diffraction
Fresnel Assumption; Fresnel Half-Period Zones; Zone Plate; Fresnel Diffraction pattern of a straight edge; A slit and a wire using half-period zone analysis.

UNIT 14: Polarization
Transverse nature of light waves; Plane polarized light: Production and Analysis; Circular and Elliptical Polarization.

Reference Books:

1. Waves and Oscillations in Nature, A. Satya Narayan and S. K. Saha, CRC Press
2. Wave Optics, R. K. Verma, Discovery Publishing House
3. Waves: Berkeley Physics Course, vol. 3, Francis Crawford, 2007, Tata McGraw-Hill.
4. Optics, Ajoy Ghatak, 2008, Tata McGraw Hill.
5. Fundamentals of Optics, F. A. Jenkins and H.E. White, 1981, McGraw-Hill
6. Principles of Optics, Max Born and Emil Wolf, 7th Edn., 1999, Pergamon Press.
7. The Physics of Vibrations and Waves, H. J. Pain, 2013, John Wiley and Sons.
8. The Physics of Waves and Oscillations, N.K. Bajaj, 1998, Tata McGraw Hill.
9. Fundamental of Optics, A. Kumar, H. R. Gulati and D. R. Khanna, 2011, R. Chand Publications.

Course Code: BPHYS S4 04
Course Title: WAVES AND OPTICS (LAB)
Nature of the Course: DSC-1-4
Credits: 2
Marks: 50

List of Experiments:

1. To investigate the motion of coupled oscillators.
2. To determine the Frequency of an Electrically Maintained Tuning Fork by Melde's Experiment and to verify $\lambda 2$ – T Law.
3. To study Lissajous Figures
4. Familiarization with Schuster`s focussing; determination of angle of prism.
5. To determine the Coefficient of Viscosity of water by Capillary Flow Method (Poiseuille's method).
6. To determine the Refractive Index of the Material of a Prism using Sodium Light.
7. To determine Dispersive Power of the Material of a Prism using Mercury Light
8. To determine the value of Cauchy Constants.
9. To determine the Resolving Power of a Prism.
10. To determine wavelength of sodium light using Fresnel Biprism.
11. To determine wavelength of sodium light using Newton's Rings.
12. To determine the wavelength of Laser light using Diffraction of Single Slit.
13. To determine wavelength of (1) Sodium and (2) Spectral lines of the Mercury light using plane diffraction Grating
14. To determine the Resolving Power of a Plane Diffraction Grating.

Reference Books:

1. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House.
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers.
3. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.

DISCIPLINE SPECIFIC ELECTIVE (DSE) COURSES

- **Course 5: (Any one from the following)**

  BPHYS S5 1A: Digital and Analog Circuits and Instrumentation (Theory + Lab) (Credit 4 + 2)
  BPHYS S5 1B: Elements of Modern Physics (Theory + Lab (Credit 4 + 2)

- **Course 6: (Any one from the following)**

  BPHYS S6 1A: Embedded System: Introduction to Microcontrollers **(**Theory **+** Lab) (Credit 4 + 2)
  BPHYS S6 1B: Dissertation or Project work (Credit 6)

Semester V

Course Code: BPHYS S5 1A
Course Title: DIGITAL AND ANALOG CIRCUITS AND INSTRUMENTATION (THEORY)
Credit: 4
Marks: 100

Learning Objective of the course: At the completion of this course, a learner will be able to-

1. Know about digital circuits, Boolean algebra, logic gates and binary numbers systems.
2. Learn about semiconductor devices like PN junction, bipolar junction transistor and its application to different circuits.
3. Gain knowledge of operational amplifier, its applications and analysis.
4. Use and handle different instruments like power supply, Oscilloscope etc.

BLOCK I:

UNIT-1: Introduction to Number Systems
Number System; Categories of Number System: Decimal Number System, Binary Number System, Octal Number System, Hexadecimal Number System; Number System Conversion: Binary to Decimal Conversion, Decimal to Binary Conversion, Octal to Decimal Conversion, Decimal to Octal Conversion, Octal to Binary Conversion, Binary to Octal Conversion, Hexadecimal to Decimal Conversion, Decimal to Hexadecimal Conversion, Hexadecimal to Binary Conversion, Binary to Hexadecimal Conversion

UNIT-2 Boolean Algebra
Boolean Algebra; Properties of Boolean Algebra; De-Morgan's Theorem

UNIT-3 Logic Gates
Logic Gates: Truth Table, AND Gate, OR Gate, NOT Gate, NAND Gate, NOR Gate, XOR Gate, XNOR Gate; Conversion of Logic Gates

UNIT-4 Karnaugh Map
Fundamental Products; Minterms and Maxterms; Conversion of a Truth Table into an Equivalent Logic Circuit: By Sum of Products Method, Karnaugh Map Method.

UNIT-5 Arithmetic and Logic Circuits
Binary Addition; Binary Subtraction using 2's Complement Method; Half Adders; Full Adders; Subtractors, 4-bit binary Adder-Subtractor.

UNIT-6 Semiconductor Diodes
P and N type semiconductors. Barrier Formation in PN Junction Diode. Qualitative Idea of Current Flow Mechanism in Forward and Reverse Biased Diode. PN junction and its characteristics. Static and Dynamic Resistance.

UNIT-7 Special Diodes
Principle and structure of LED; Photodiode; Solar Cell.

BLOCK II:

UNIT-8 Transistors
Bipolar Junction transistors: n-p-n and p-n-p Transistors. Characteristics of CB, CE and CC Configurations. Active, Cutoff & Saturation regions Current gains α and β. Relations between α and β. Load Line analysis of Transistors. DC Load line & Q-point. Voltage Divider Bias Circuit for CE

UNIT-9 Amplifiers
Introduction to Amplifier, h-parameter Equivalent Circuit. Analysis of single-stage CE amplifier using hybrid Model. Input & output Impedance. Current, Voltage and Power gains. Class A, B & C Amplifiers.

UNIT-10 Operational Amplifiers
Characteristics of an Ideal and Practical Op-Amp (IC 741), Open-loop and closed-loop Gain. CMRR, concept of Virtual ground. Applications of Op-Amps: (1) Inverting and non-inverting Amplifiers, (2) Adder, (3) Subtractor, (4) Differentiator, (5) Integrator, (6) Zero crossing detector.

UNIT-11 Sinusoidal Oscillators
Barkhausen's Criterion for Self-sustained Oscillations. Determination of Frequency of RC Oscillator

UNIT-12 Instrumentations
Introduction to CRO: Block Diagram of CRO; Applications of CRO: (1) Study of Waveform, (2) Measurement of Voltage, Current, Frequency, and Phase Difference.

UNIT-13 Power Supply

Half-wave Rectifiers; Centre-tapped and Bridge Full-wave Rectifiers; Calculation of Ripple Factor and Rectification Efficiency; Basic idea about capacitor filter; Zener Diode; Voltage Regulation.

UNIT-14 Timer IC

IC 555: Block Diagram and Application; Astable Multivibrator; Monostable Multivibrator.

Reference Books:

1. Digital Principles and Applications, A. P. Malvino, D. P. Leach and Saha, 7th Ed., 2011, Tata McGraw
2. Fundamentals of Digital Circuits, Anand Kumar, 2nd Edn, 2009, PHI Learning Pvt. Ltd.
3. Digital Circuits and Systems, Venugopal, 2011, Tata McGraw Hill.
4. Digital Electronics, G. K. Kharate, 2010, Oxford University Press
5. Digital Electronics, S. K. Mandal, 2010, 1st Edition, McGraw Hill
6. Digital Systems: Principles & Applications, R. J. Tocci, N. S. Widmer, 2001, PHI Learning
7. Logic circuit design, Shimon P. Vingron, 2012, Springer.
8. Digital Electronics, Subrata Ghoshal, 2012, Cengage Learning.

Course Code: BPHYS S5 1A
Course Title: DIGITAL AND ANALOG CIRCUITS AND INSTRUMENTATION (LAB)
Credit: 2
Marks: 50

List of Experiments:

1. Realization of logic gates using NAND gates.
2. Minimization of logic circuits.
3. Realization of adder circuits using logic gates.
4. Design of astable multivibrator using timer IC.
5. Design of monostable multivibrator using timer IC.
6. Study of *I-V* characteristics of special diodes (Zener and LED).
7. Study of transistor characteristics in CE mode and design of CE amplifier.
8. Design of op-amp inverting and non-inverting amplifiers.
9. Design of op-amp differentiator and integrator.
10. Design and building of phase shift oscillator.

Reference Books:

1. Basic Electronics: A text lab manual, P.B. Zbar, A.P. Malvino, M.A. Miller, 1994, Mc-Graw Hill.
2. Electronics: Fundamentals and Applications, J.D. Ryder, 2004, Prentice Hall.
3. OP-Amps & Linear Integrated Circuit, R.A. Gayakwad, 4th Edn, 2000, Prentice Hall.
4. Electronic Principle, Albert Malvino, 2008, Tata Mc-Graw Hill.

Semester V

Course Code: BPHYS S5 1B
Course Title: ELEMENTS OF MODERN PHYSICS (THEORY)
Credit: 4
Marks: 100

Learning Objective of the course: At the completion of this course, a student will be able to-

1. Know the theoretical basis for the understanding of quantum Physics as the basis for dealing with microscopic phenomena.
2. Apply concepts of 20^{th} Century Modern Physics to deduce the structure of atoms.
3. Explain the wave-particle duality of the photon.
4. Analyze the structure of matter at its most fundamental.
5. Develop insight into the key principles and applications of Nuclear Physics

BLOCK I:

UNIT 1: Introduction to Quantum Mechanics:
Atomic Model; Rutherford model and its Problems: Instability of atoms, Observation of discrete atomic spectra.

UNIT 2: Bohr's Rule
Bohr's quantization rule; Atomic stability; Calculation of energy levels for hydrogen atoms and their spectra.

UNIT 3: Planck's Quantum Theory
Planck's constant and light as a collection of photons; Photoelectric effect and Compton scattering. De Broglie wavelength.

UNIT 4: Matter Waves
What is Matter waves and wave amplitude; Davisson-Germer experiment.

UNIT 5: Wave Particle Duality:
Position measurement: Gamma ray microscope thought experiment;

UNIT 6: Heisenberg Uncertainty Principle

Introduction to Heisenberg Uncertainty Principle; Estimating minimum energy of a confined particle using uncertainty principle; Energy-time uncertainty principle.

UNIT 7: Schrodinger Equation and Concept of Wave Function

Two-slit interference experiment with photons, atoms and particles; Linear Superposition Principle as a consequence; Schrodinger equation for non-relativistic particles; Momentum and Energy operators; Stationary States; Physical Interpretation of Wave Function, Probabilities and Normalization; Probability and probability current densities in one dimension.

BLOCK II:

UNIT 8: One Dimensional Box

Infinitely rigid box; Energy eigenvalues; Eigen functions; Normalization.

UNIT 9: Quantum Tunneling

Quantum dot; Quantum Mechanical Scattering; Tunneling in one dimension

UNIT 10: Step Potential

Step potential and across a rectangular potential barrier.

UNIT 11: Basic Nuclear Physics

Size and structure of atomic nucleus and its relation with atomic weight; Impossibility of an electron being in nucleus as a consequence of the uncertainty principle. Nature of nuclear force, NZ graph, semi-empirical mass formula and binding energy.

UNIT 12: Radioactivity

Stability of nucleus; Law of radioactive decay; Mean life and half-life; α decay; β decay - energy released, spectrum and Pauli's prediction of neutrino; γ-ray emission.

UNIT 13: Nuclear Fission:

Mass deficit, Relativity and Generation of Energy; Fission: Nature of Fragments and Emission of Neutrons.

UNIT 14: Nuclear Fusion

Fusion in Starts**;** Nuclear Reactor: Slow Neutrons Interacting with Uranium 235; Fusion and Thermonuclear Reactions.

Reference Books:

1. Concepts of Modern Physics, A. Beiser, Tata McGraw Hill
2. Modern Physics, G. Aruldas and P. Rajagopal, PHI Learning Private Ltd.
3. Concepts of Modern Physics, Arthur Beiser, 2002, McGraw-Hill.
4. Modern Physics**,** R. Murugeshan, Kiruthiga Sivaprasath S. Chand Publishing, 2016
5. Modern Physics, G. Kaur and G. R. Pickrell, 2014, McGraw Hill.
6. Introduction to Modern Physics, Rich Meyer, Kennard, Coop, 2002, Tata McGraw Hill
7. Introduction to Quantum Mechanics, David J. Griffith, 2005, Pearson Education.
8. Physics for Scientists and Engineers with Modern Physics, Jewett and Serway, 2010, Cengage Learning.

Course Code: BPHYS S5 1B
Course Title: ELEMENTS OF MODERN PHYSICS (LAB)
Credits: 2
Marks: 50

List of Experiments:

1. To determine value of Boltzmann constant using V-I characteristic of PN diode.
2. To determine work function of material of filament of directly heated vacuum diode.
3. To determine the ionization potential of mercury.
4. To determine value of Planck's constant using LEDs of at least 4 different colours.
5. To determine the wavelength of H-alpha emission line of Hydrogen atom.
6. To study the diffraction patterns of single and double slits using laser and measure its intensity variation using Photosensor and compare with incoherent source – Na.
7. Photo-electric effect: photo current versus intensity and wavelength of light; maximum energy of photo-electrons versus frequency of light.
8. To determine the value of e/m by (a) Magnetic focusing or (b) Bar magnet.

Reference Books:

1. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House.
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers.
3. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.

Semester VI

Course Code: BPHYS S6 1A
Course Title: EMBEDDED SYSTEM: INTRODUCTION TO MICROCONTROLLERS (THEORY)
Credit: 4
Marks: 100

Learning Objective of the course: At the completion of this course, a student will be able to-

1. Learn about microprocessor based system
2. Know about the 8051 I/O port programming, various addressing modes, Timer and counter programming, Serial port programming with and without interrupt and interfacing 8051 microcontroller to peripherals

BLOCK I:

Unit 1-Embedded system introduction:

Introduction to embedded systems and general purpose computer systems, architecture of embedded system, classifications, applications and purpose of embedded systems, challenges and design issues in embedded systems, operational and non-operational quality attributes of embedded systems, elemental description of embedded processors and microcontrollers.

Unit 2- Review of microprocessors-I:

Organization of Microprocessor based system, 8085μp pin diagram and architecture, concept of data bus and address bus, 8085 programming model, instruction classification, subroutines, stacks and its implementation, delay subroutines, hardware and software interrupts.

Unit 3- Review of Microprocessor -II:

Instruction classification, subroutines, stacks and its implementation, delay subroutines, hardware and software interrupts.

Unit 4- 8051 microcontroller-I:

Introduction and block diagram of 8051 microcontroller, architecture of 8051, overview of 8051 family, 8051 assembly language programming,

Unit 5- 8051 microcontroller-I:

Program Counter and ROM memory map, Data types and directives, Flag bits and Program Status Word (PSW) register, Jump, loop and call instructions.

Unit 6- 8051 I/O port programming:

Introduction of I/O port programming, pin out diagram of 8051 microcontroller, I/O port pins description and their functions, I/O port programming in 8051, (Using Assembly Language), I/O programming: Bit manipulation.

Unit 7- Programming of 8051-I:

8051addressing modes and accessing memory using various addressing modes, assembly language instructions using each addressing mode, arithmetic & logic instructions

Unit 8- Programming of 8051-II:

8051 programming in C- for time delay and I/O operations and manipulation, for arithmetic and logic operations, for ASCII and BCD conversions.

BLOCK II:

Unit 9- Timer and counter programming:

Programming 8051 timers, counter programming.

Unit 10- Serial port programming with and without interrupt:

Introduction to 8051 interrupts, programming timer interrupts, programming external hardware interrupts and serial communication interrupt, interrupt priority in the 8051.

Unit 11- Interfacing 8051 microcontroller to peripherals:

Parallel and serial ADC, DAC interfacing, LCD interfacing.

Unit 12- Programming Embedded Systems:
Structure of embedded program, infinite loop, compiling, linking and locating, downloading and debugging.

Unit 13- Embedded system design and development-I:
Embedded system development environment, File types generated after cross compilation, disassembler/ decompiler, simulator, emulator and debugging,

Unit 14- Embedded system design and development-II:
Embedded product development life-cycle, trends in embedded industry.

Reference Books:

1. Embedded Systems: Architecture, Programming & Design, R.Kamal, 2008, Tata McGraw Hill
2. The 8051 Microcontroller and Embedded Systems Using Assembly and C, M.A. Mazidi, J.G. Mazidi, and R.D.
McKinlay, 2nd Ed., 2007, Pearson Education India.
3. Embedded Microcomputor System: Real time interfacing, J.W. Valvano, 2000, Brooks/Cole
4. Microcontrollers in practice, I. Susnea and M. Mitescu, 2005, Springer.
5. Embedded Systems: Design & applications, S.F. Barrett, 2008, Pearson Education India
6. Embedded Microcomputer systems: Real time interfacing, J.W. Valvano 2011, Cengage Learning Embedded
Systems: Architecture, Programming& Design, R.Kamal, 2008, Tata McGraw Hill
7. Embedded System, B.K. Rao, 2011, PHI Learning Pvt. Ltd.
8. Embedded Microcomputer systems: Real time interfacing, J.W. Valvano 2011, Cengage Learning.

Course Code: BPHYS S6 1A
Course Title: EMBEDDED SYSTEM: INTRODUCTION TO MICROCONTROLLERS (LAB)
Credits: 2
Marks: 50

List of experiments using 8051:

1. To find that the given numbers is prime or not.
2. To find the factorial of a number.
3. Write a program to make the two numbers equal by increasing the smallest number and decreasing the largest number.
4. Use one of the four ports of 8051 for O/P interfaced to eight LED's. Simulate binary counter (8 bit) on LED's.
5. Program to glow first four LED then next four using TIMER application.
6. Program to rotate the contents of the accumulator first right and then left.
7. Program to run a countdown from 9-0 in the seven segment LED display.
8. To interface seven segment LED display with 8051 microcontroller and display 'HELP' in the seven segment LED display.

Reference Books:

1. Embedded Systems: Architecture, Programming & Design, R. Kamal, 2008, Tata McGraw Hill
2. The 8051 Microcontroller and Embedded Systems Using Assembly and C, M.A.Mazidi, J.G. Mazidi, and R.D. McKinlay, 2nd Ed., 2007, Pearson Education India.
3. Embedded Microcomputor System: Real Time Interfacing, J.W. Valvano, 2000, Brooks/Cole
4. Embedded System, B.K. Rao, 2011, PHI Learning Pvt. Ltd.
5. Embedded Microcomputer systems: Real time interfacing, J.W.Valvano 2011, Cengage Learning

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Course Code: BPHYS S6 1B
Course Title: DISSERTATION
Credit: 6
Marks: 150

Objective of the Course: To write report in a scientific style and to solve scientific problems and to present information in a clear and effective manner.
Here, the learners will have to carry out project work (Laboratory experiments or Comprehensive Review work on a specified topic) either at their respective study centres or any other R&D laboratory or any other UGC recognized University department under guidance of a faculty member. The student may start their project work during the semester break between fifth and sixth semester.

The area of work will be decided by the supervisor.

On completion of the project work students have to submit the work in the form of a dissertation followed by oral presentation in the presence of faculty member of the enrolled study centre and an external expert.

The Project Work will consist of following aspects.

A. For Laboratory Experiment:
   1. Literature Review
   2. Objectives
   3. Experimental work
   4. Results and Discussions

B. For Comprehensive Review
   1. Objective
   2. Review
   3. References
   4. Future Prospects

Note: Learners will be encouraged to carry out both the laboratory experiment and comprehensive review individually. Submission of antiplagiarism certificate for the report/review may also be considered.

SKILL ENHANCEMENT COURSES

(Proposed to be offered from the Discipline of Physics)

SEC 1: Electrical Circuit Network Skills (Credit 2)
SEC 2: Basic Instrumentation Skills (Credit 2)
SEC 3: Renewable Energy and Energy Harvesting (Credit 2)
SEC 4: Physics Workshop Skill (Credit 2)

Semester III

Course Code: BS-SEC-1A
Course Title: ELECTRICAL CIRCUIT AND NETWORK SKILLS
Nature of the Course: SEC
Credit: 2
Marks: 50

Learning Objectives of the Course: After the completion of this course, a student will be able to-

1. Know the basic concept of electrical circuits.
2. Design and trouble shoot the electrical circuits, networks and appliances through hands on mode.

SECTION A: THEORY

UNIT 1: Basic Electricity Principles

Voltage, Current, Resistance, and Power. Ohm's law. Series, parallel, and series-parallel combinations. AC Electricity and DC Electricity. Familiarization with multimeter, voltmeter and ammeter.

UNIT 2: Understanding Electrical Circuits

Main electric circuit elements and their combination. Rules to analyze DC sourced electrical circuits. Current and voltage drop across the DC circuit elements. Single-phase and three-phase alternating current sources. Rules to analyze AC sourced electrical circuits. Real, imaginary and complex power components of AC source. Power factor. Saving energy and money.

UNIT 3: Electrical Drawing and Symbols

Drawing symbols. Blueprints. Reading Schematics. Ladder diagrams. Electrical Schematics. Power circuits. Control circuits. Reading of circuit schematics. Tracking the connections of elements and identify current flow and voltage drop.

UNIT 4: Generators and Transformers

DC Power sources. AC/DC generators. Inductance, capacitance, and impedance. Operation of transformers.

UNIT 5: Electric Motors

Single-phase, three-phase and DC motors: Basic design; Interfacing DC or AC sources to control heaters and motors; Speed and power of ac motor.

UNIT 6: Solid-State Devices

Resistors, inductors and capacitors. Diode and rectifiers; Components in Series and in shunt; Response of inductors and capacitors with DC or AC sources

UNIT 7: Electrical Protection

Relays. Fuses and disconnect switches. Circuit breakers. Overload devices. Ground-fault protection. Grounding and isolating. Phase reversal. Surge protection. Interfacing DC or AC sources to control elements

UNIT 8: Electrical Wiring

Different types of conductors and cables; Basics of wiring: Star and delta connection; Voltage drop and losses across cables and conductors; Instruments to measure current, voltage, power in DC and AC circuits. Insulation. Solid and stranded cable. Conduit. Cable trays. Splices: wirenuts, crimps, terminal blocks, split bolts, and solder. Preparation of extension board.

SECTION B: PRACTICAL

List of Experiments:

1. Series and Parallel combinations: Verification of Kirchoff‟s law.
2. To verify network theorems: (I) Thevenin (II) Norton (III) Superposition theorem (IV) Maximum power transfer theorem
3. To study frequency response curve of a Series LCR circuit.
4. To verify (1) Faraday‟s law and (2) Lenz‟s law.
5. Programming with Pspice/NG spice.
6. Demonstration of AC and DC generator.

Reference Books:

1. A text book in Electrical Technology - B L Theraja - S Chand & Co.
2. A text book of Electrical Technology - A K Theraja
3. Performance and design of AC machines - M G Say ELBS Edn.

Semester IV

Course Code: BS-SEC-2A
Course Title: BASIC INSTRUMENTATION SKILLS
Nature of the Course: SEC
Credit: 2
Marks: 50

SECTION A: THEORY

Unit 1: Basic of Measurement

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

Unit 2: Electronic Voltmeter

Advantage over conventional multimeter for voltage measurement with respect to input impedance and sensitivity. Principles of voltage, measurement (block diagram only). Specifications of an electronic Voltmeter/ Multimeter and their significance. AC millivoltmeter: Type of AC millivoltmeters: Amplifier-rectifier, and rectifier-amplifier. Block diagram ac millivoltmeter**,** specifications and their significance.

Unit 3: Cathode Ray Oscilloscope

Block diagram of basic CRO. Construction of CRT, Electron gun, electrostatic focusing and acceleration (Explanation only– no mathematical treatment), brief discussion on screen phosphor, visual persistence and chemical composition. Time base operation, synchronization. Front panel controls. Specifications of a CRO and their significance; Use of CRO for the measurement of voltage (dc and ac) frequency, time period. Special features of dual trace, introduction to digital oscilloscope, probes. Digital storage; Oscilloscope: Block diagram and principle of working.

Unit 4: Signal Generators and Analysis Instruments

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

Unit 5: Impedance Bridges and Q-Meters

Block diagram of bridge; Working principles of basic (balancing type) RLC bridge; Specifications of RLC bridge; Block diagram and working principles of a Q- Meter; Digital LCR bridges.

Unit 6: Digital Instruments

Principle and working of digital meters; Comparison of analog and digital instruments; Characteristics of a digital meter; Working principles of digital voltmeter. Digital Multimeter: Block diagram and working of a digital multimeter; Working principle of time interval, frequency

and period measurement using universal counter/ frequency counter, time- base stability, accuracy and resolution.

SECTION B: PRACTICAL

Laboratory Exercises:

1. To observe the loading effect of a multimeter while measuring voltage across a low resistance and high resistance.
2. To observe the limitations of a multimeter for measuring high frequency voltage and currents.
3. To measure Q of a coil and its dependence on frequency, using a Q- meter.
4. Measurement of voltage, frequency, time period and phase angle using CRO.
5. Measurement of R, L and C using a LCR bridge/ universal bridge.

Reference Books:

1. Electronic Measurements and Instrumentation, K. Lal Kishore, Pearson India
2. Electrical and Electronics Measurements and Instrumentation, Prithwiraj Purkait, Budhaditya Biswas, Santanu Das, Chiranjib Koley, McGraw Hill India.
3. A text book in Electrical Technology - B L Theraja - S Chand and Co.
4. Performance and design of AC machines - M G Say ELBS Edn.
5. Digital Circuits and systems, Venugopal, 2011, Tata McGraw Hill.
6. Logic circuit design, Shimon P. Vingron, 2012, Springer.
7. Digital Electronics, Subrata Ghoshal, 2012, Cengage Learning.
8. Electronic Devices and circuits, S. Salivahanan & N. S.Kumar, 3rd Ed., 2012, Tata Mc-Graw Hill
9. Electronic circuits: Handbook of design and applications, U.Tietze, Ch.Schenk, 2008, Springer

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Semester V

Course Code: BS-SEC-3A
Course Title: RENEWABLE ENERGY AND ENERGY HARVESTING
Nature of the Course: SEC
Credit: 2
Marks: 50

Learning Objectives of the Course: After the completion of this course, a student will be able to-

1. Know various types of renewable energy sources
2. Learn the uses and limitations of different renewable energy source

SECTION A: THEORY

UNIT 1: Fossil Fuels and Alternate Sources of energy
Fossil fuels and nuclear energy: their limitation, Need of renewable energy; Non-conventional energy sources. An overview of developments in Offshore Wind Energy, Tidal Energy, Wave energy systems, Ocean Thermal Energy Conversion; Solar Energy, Biomass, Biochemical Conversion, Biogas generation, Geothermal energy tidal energy, Hydroelectricity.

UNIT 2: Solar Energy
Concept of Solar energy, storage of solar energy, solar pond, Non convective solar pond, applications of solar pond and solar energy, solar water heater, flat plate collector, solar distillation, solar cooker, solar green houses, solar cell, absorption air conditioning. Need and characteristics of photovoltaic (PV) systems, PV models and equivalent circuits, and sun tracking systems.

UNIT 3: Wind Energy harvesting
Fundamentals of Wind energy, Wind Turbines and different electrical machines in wind turbines, Power electronic interfaces, and grid interconnection topologies.

UNIT 4: Ocean Energy
Ocean Energy Potential against Wind and Solar, Wave Characteristics and Statistics, Wave Energy Devices.

UNIT 5: Tide Energy
Tide characteristics and Statistics; Tide Energy Technologies; Ocean Thermal Energy; Osmotic Power; Ocean Bio-mass.

UNIT 6: Geothermal Energy
Geothermal Resources, Geothermal Technologies.

UNIT 7: Hydro Energy
Hydropower resources, hydropower technologies, environmental impact of hydro power sources.

UNIT 8: Piezoelectric Energy Harvesting

Introduction to Piezoelectric Energy harvesting; Physics and characteristics of piezoelectric effect; Materials and mathematical description of piezoelectricity; Piezoelectric parameters and modeling; Piezoelectric energy harvesting applications; Human power.

SECTION B: PRACTICAL

Demonstration and Experiments:

1. Demonstration of Training modules on Solar energy, wind energy etc.
2. Conversion of vibration to voltage using piezoelectric materials
3. Conversion of thermal energy into voltage using thermoelectric modules.

Reference Books:

1. Non-conventional energy sources, B.H. Khan, McGraw Hill
2. Solar energy, Suhas P Sukhative, Tata McGraw - Hill Publishing Company Ltd.
3. Renewable Energy, Power for a sustainable future, Godfrey Boyle, 3rd Edn., 2012, Oxford University Press.
4. Renewable Energy, 3rd Edition,
5. Solar Energy: Resource Assesment Handbook, P Jayakumar, 2009

Semester VI

Course Code: BS-SEC-4A
Course Title: PHYSICS WORKSHOP SKILL
Nature of the Course: SEC
Credit: 2
Marks: 50

Learning Objectives of the Course: After the completion of this course, a student will be able to-

1. Use various mechanical and electrical tools through hands on work.
2. Enhance the mechanical, electrical and electronic skill.

SECTION A: THEORY

UNIT 1: Introduction

Measuring units; Conversion to SI and CGS; Familiarization with meter scale; Vernier caliper; Screw gauge and their utility; Measure the dimension of a solid block, volume of cylindrical beaker/glass, diameter of a thin wire, thickness of metal sheet, etc. Use of Sextant to measure height of buildings, mountains, etc.

UNIT 2: Mechanical Skill
Concept of workshop practice; Overview of manufacturing methods: casting, foundry, machining, forming and welding. Types of welding joints and welding defects. Common materials used for manufacturing like steel, copper, iron, metal sheets, composites and alloy, wood. Concept of machine processing,

UNIT 3: Cutting and Drilling Skill
Introduction to common machine tools like lathe, shaper, drilling, milling and surface machines. Cutting tools, lubricating oils. Cutting of a metal sheet using blade. Smoothening of cutting edge of sheet using file. Drilling of holes of different diameter in metal sheet and wooden block. Use of bench vice and tools for fitting. Make funnel using metal sheet.

UNIT 4: Electrical and Electronic Skill
Use of Multimeter; Soldering of electrical circuits having discrete components (R, L, C, diode) and ICs on PCB. Operation of oscilloscope. Making regulated power supply. Timer circuit, Electronic switch using transistor and relay

UNIT 5: Introduction to Prime Movers
Mechanism, gear system, wheel, Fixing of gears with motor axel. Lever mechanism, Lifting of heavy weight using lever; Braking systems, pulleys, working principle of power generation systems. Demonstration of pulley experiment

SECTION B: PRACTICAL

Demonstration and Experiments:

1. Demonstration and practice of using different cutting and drilling tools.
2. Demonstration and practice of using electronic measurement tools

Reference Books:

1. A text book in Electrical Technology - B L Theraja – S. Chand and Company.
2. Performance and design of AC machines – M.G. Say, ELBS Edn.
3. Mechanical workshop practice, K.C. John, 2010, PHI Learning Pvt. Ltd.
4. Workshop Processes, Practices and Materials, Bruce J Black 2005, 3rd Edn., Editor Newnes [ISBN: 0750660732]
5. New Engineering Technology, Lawrence Smyth/Liam Hennessy, The Educational Company of Ireland [ISBN: 0861674480]

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Annexure - 3

KRISHNA KANTA HANDIQUI STATE OPEN UNIVERSITY

N.H. 37, Khanapara, Guwahati-781022, Assam

B.Sc. General Programme with CHEMISTRY

CBCS Syllabus

for

B.Sc. in CHEMISTRY

without MAJOR in any discipline

2021

Detailed Syllabus of Chemistry

DISCIPLINE SPECIFIC CORE COURSE
(All compulsory)

- Course BCHEM S1 01: Atomic Structure, Bonding, General Organic Chemistry and Aliphatic Hydrocarbons (Theory + Lab) (Credit 4 + 2)
- Course BCHEM S2 02: Chemical Energetics, Equilibria and Functional Group Organic Chemistry-I (Theory + Lab) (Credit 4 + 2)
- Course BCHEM S3 03: Solutions, Phase Equilibrium, Conductance, Electrochemistry and Functional Group Organic Chemistry-II (Theory + Lab) (Credit 4+2)
- Course BCHEM S4 04: Coordination Chemistry, States of Matter & Chemical Kinetics (Theory + Lab) (Credit 4+2)

Semester I

Course Code: BCHEM S1 01(Th)
Course Title: Atomic Structure, Bonding, General Organic Chemistry and Aliphatic Hydrocarbons (Theory)
Credits: 4
Marks: 100

BLOCK 1: GENERAL / INORGANIC CHEMISTRY

Section A: Atomic Structure

Unit 1: Bohr's Theory

A brief review of earlier Atomic Models. Bohr's Atomic Model. Analysis of Bohr's theory and its limitations.

Unit 2: Nature of Matter and Radiation

Dual Behavior of matter and radiation, de-Broglie's Relation. Heisenberg Uncertainty Principle. Hydrogen atom spectra. Need for a New Approach to Atomic Structure.

Unit 3: Quantum Mechanics

Concept of Quantum Mechanics. Time-independent Schrödinger Equation and meaning of various terms in it. Significance of ψ and ψ^2.

Unit 4: Hydrogen Atom

Schrödinger Equation for Hydrogen Atom. Radial and angular parts of the hydogenic wave functions (atomic orbitals) and their variations for 1*s*, 2*s*, 2*p*, 3*s*, 3*p* and 3*d* orbitals (Only graphical representation). Radial and angular nodes and their significance. Radial distribution functions and the concept of the most probable distance with special reference to 1s and 2s atomic orbitals.

Unit 5: Quantum Numbers

Significance of quantum numbers, orbital angular momentum and quantum numbers m_l and m_s. Shapes of s, p and d atomic orbitals, nodal planes. Discovery of spin, spin quantum number (s) and magnetic spin quantum number (m_s).

Unit 6: Electronic Configuration of Multi-Electron Atoms

Rules for filling electrons in various orbitals (Aufbau Principle), Electronic configurations of the atoms. Stability of half-filled and completely filled orbitals, concept of exchange energy. Relative energies of atomic orbitals, Anomalous electronic configurations.

Section B: Chemical Bonding and Molecular Structure

Unit 7: Ionic Bonding

General characteristics of ionic bonding. Energy considerations in ionic bonding, lattice energy and solvation energy and their importance in the context of stability and solubility of ionic compounds. Statement of Born-Landé equation for calculation of lattice energy, Born-Haber cycle and its applications, polarizing power and polarizability. Fajan's rules, ionic character in covalent compounds, bond moment, dipole moment and percentage ionic character.

Unit 8: Covalent Bonding

VB Approach: Shapes of some inorganic molecules and ions on the basis of VSEPR and hybridization with suitable examples of linear, trigonal planar, square planar, tetrahedral, trigonal bipyramidal and octahedral arrangements. Concept of resonance and resonating structures in various inorganic and organic compounds.

Unit 9: MO Approach

Rules for the LCAO method, bonding and antibonding MOs and their characteristics for s-s, s-p and p-p combinations of atomic orbitals, non-bonding combination of orbitals, MO treatment of homonuclear diatomic molecules of 1st and 2nd periods (including idea of s-p mixing) and heteronuclear diatomic molecules such as CO, NO and NO^+. Comparison of VB and MO approaches.

BLOCK 2: ORGANIC CHEMISTRY

Section A: Fundamentals of Organic Chemistry

Unit 10: Physical Effects, Electronic Displacements

Inductive Effect, Electromeric Effect, Resonance and Hyperconjugation. Cleavage of Bonds: Homolysis and Heterolysis.

Unit 11: Structure, Shape and Reactivity of Organic Molecules

Cleavage of Bonds, Bond Heterolysis, Bond Homolysis; Types of Reagents, Nucleophiles, Electrophiles;

Reactive Intermediates: Carbocations, Carbanions, Carbenes, Nitrenes, Free Radicals.

Unit 12: Strengths of Organic Acids and Bases

Comparative study with emphasis on factors affecting *p*K values. Aromaticity: Benzenoids and Hückel's rule.

Unit 13: Stereochemistry: Conformation vs. configuration

Conformation with respect to ethane, butane and cyclohexane. Interconversion of Wedge Formula, Newmann, Sawhorse and Fischer representations. Concept of chirality (up to two carbon atoms).

Unit 14: Stereochemistry: Geometrical isomerism

Geometrical and Optical isomerism; Enantiomerism, Diastereomerism and Meso Compounds. Threo and erythro; D and L; Cis-trans nomenclature; CIP Rules: R/S (for upto 2 chiral carbon atoms) and E/Z Nomenclature (for upto two C=C systems)

Section B: Aliphatic Hydrocarbons

Unit 15: Alkanes (Up to 5 Carbons)

Preparation: Catalytic hydrogenation, Wurtz reaction, Kolbe's synthesis, from Grignard reagent.

Reactions: Free radical Substitution: Halogenation.

Unit 16: Alkenes (Up to 5 Carbons)

Preparation: Elimination reactions: Dehydration of alkenes and dehydrohalogenation of alkyl halides (Saytzeff's rule).

Reactions: cis-addition (alk. $KMnO_4$) and trans-addition (bromine), Addition of HX (Markownikoff's and anti Markownikoff's addition), Hydration, Ozonolysis.

Unit 17: Alkynes (Up to 5 Carbons)

Preparation: Acetylene from CaC_2 and conversion into higher alkynes; by dehalogenation of tetra halides and dehydrohalogenation of vicinal-dihalides.

Reactions: Formation of metal acetylides, addition of bromine and alkaline $KMnO_4$, ozonolysis and oxidation with hot alk. $KMnO_4$.

Reference Books:

- Lee, J.D. *Concise Inorganic Chemistry* ELBS, 1991.
- Cotton, F.A., Wilkinson, G. & Gaus, P.L. *Basic Inorganic Chemistry*, 3rd ed., Wiley.
- Douglas, B.E., McDaniel, D.H. & Alexander, J.J. *Concepts and Models in Inorganic Chemistry*, John Wiley & Sons.
- Huheey, J.E., Keiter, E.A., Keiter, R.L. & Medhi, O.K. *Inorganic Chemistry: Principles of Structure and Reactivity*, Pearson Education India, 2006.
- Bruice, Paula Yurkanis, *Organic Chemistry*, Pearson
- Finar, I.L. *Organic Chemistry* (Vol. I & II), E.L.B.S.
- Morrison, R.T., Boyd, R.N. and Bhattacharjee, S. K. *Organic Chemistry*, Pearson, 2010.
- Bahl, A. & Bahl, B.S. *Advanced Organic Chemistry,* S. Chand, 2010.
- Subrata Sengupta, *Basic Stereochemistry of Organic Molecules,* Oxford University Press
- Sykes, P. A Guide Book to Mechanism in Organic Chemistry, Orient Longman.
- Eliel, E.L. Stereochemistry of Carbon Compounds, Tata McGraw Hill.

Course Code/No.: BCHEM S1 01(Lab)
Course Title: Atomic Structure, Bonding, General Organic Chemistry and Aliphatic Hydrocarbons (Lab)
Credits: 2
Marks: 50

Section A: Inorganic Chemistry - Volumetric Analysis

1. Estimation of sodium carbonate and sodium hydrogen carbonate present in a mixture.
2. Estimation of oxalic acid by titrating it with $KMnO_4$.
3. Estimation of water of crystallization in Mohr's salt by titrating with $KMnO_4$.
4. Estimation of Fe (II) ions by titrating it with $K_2Cr_2O_7$ using internal indicator.
5. Estimation of Cu (II) ions iodometrically using $Na_2S_2O_3$.

Section B: Organic Chemistry

1. Detection of extra elements (N, S, Cl, Br, I) in organic compounds (containing upto two extra elements)
2. Separation of mixtures by Chromatography: Measure the R_f value in each case (combination of two compounds to be given)

(a) Identify and separate the components of a given mixture of 2 amino acids (glycine, aspartic acid, glutamic acid, tyrosine or any other amino acid) by paper chromatography

(b) Identify and separate the sugars present in the given mixture by paper chromatography.

Reference Books:

- Svehla, G. *Vogel's Qualitative Inorganic Analysis*, Pearson Education, 2012.
- Mendham, J. *Vogel's Quantitative Chemical Analysis*, Pearson, 2009.
- Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G., *Textbook of Practical Organic Chemistry*, Prentice-Hall, 5th edition, 1996.
- Practical Organic Chemistry, O. P. Agarwal

Semester II

Course Code/No.: BCHEM S2 02(Th)
Course Title: Chemical Energetics, Equilibria and Functional Group Organic Chemistry-I (Theory)
Credits: 4
Marks: 100

BLOCK 1: PHYSICAL CHEMISTRY

Section A: Chemical Energetics

Unit 1: Review of Thermodynamic

Thermodynamics and its importance, the laws of thermodynamics

Unit 2: Thermochemistry

Important principles and definitions of thermochemistry. Concept of standard state and standard enthalpies of formations, integral and differential enthalpies of solution and dilution. Calculation of bond energy, bond dissociation energy and resonance energy from thermochemical data. Variation of enthalpy of a reaction with temperature– Kirchhoff's equation.

Unit 3: Third Law of Thermodynamic

Statement of the Third Law of thermodynamics. Calculation of absolute entropies of substances.

Section B: Chemical and Ionic Equilibria

Unit 4: Chemical Equilibrium-I

Free energy change in a chemical reaction. Thermodynamic derivation of the law of chemical equilibrium.

Unit 5: Chemical Equilibrium-II

Distinction between ΔG and ΔG^o, Le Chatelier's principle. Relationships between Kp, Kc and Kx for reactions involving ideal gases.

Unit 6: Ionic Equilibrium I

Strong, moderate and weak electrolytes, degree of ionization, factors affecting degree of ionization, ionization constant and ionic product of water. Ionization of weak acids and bases, pH scale, common ion effect.

Unit 7: Ionic Equilibrium II

Salt hydrolysis-calculation of hydrolysis constant, degree of hydrolysis and pH for different salts. Buffer solutions. Solubility and solubility product of sparingly soluble salts – applications of solubility product principle.

BLOCK 2: ORGANIC CHEMISTRY

Section A: Aromatic Hydrocarbons

Unit 8: An introduction to Aromatic Hydrocarbons

Nomenclature and structure of Benzene (review), Physical Properties, Isolation of Benzene

Unit 9: Preparation of Aromatic Hydrocarbon (Case Benzene)

Preparation of benzene from phenol, by decarboxylation, from acetylene, from benzene sulphonic acid.

Unit 10: Reaction of Aromatic Hydrocarbon (Case Benzene)

Electrophilic substitution: nitration, halogenation and sulphonation. Friedel-Craft's reaction (alkylation and acylation) (up to 4 carbons on benzene).

Side chain oxidation of alkyl benzenes (up to 4 carbons on benzene).

Section B: Alkyl and Aryl halides

Unit 11: Alkyl Halides (Up to 5 Carbons)

Types of Nucleophilic Substitution (S_N1, S_N2 and S_Ni) reactions.

Preparation: from alkenes and alcohols.

Reactions: hydrolysis, nitrite & nitro formation, nitrile & isonitrile formation. Williamson's ether synthesis: Elimination vs substitution.

Unit 12: Aryl Halides

Preparation of Aryl halides (Chloro, bromo and iodo-benzene case): from phenol, Sandmeyer & Gattermann reactions.

Reactions (Chlorobenzene): Aromatic nucleophilic substitution (replacement by –OH group) and effect of nitro substituent. Benzyne Mechanism: KNH_2/NH_3 (or $NaNH_2/NH_3$). Reactivity and Relative strength of C-Halogen bond in alkyl, allyl, benzyl, vinyl and aryl halides.

Section C: Functional Groups

Unit 13: Alcohols

Preparation: Preparation of 1°, 2° and 3° alcohols: using Grignard reagent, Ester hydrolysis, Reduction of aldehydes, ketones, carboxylic acid and esters.

Reactions: With sodium, HX (Lucas test), esterification, oxidation (with PCC, alk. $KMnO_4$, acidic dichromate, conc. HNO_3).

Diols: (Up to 6 Carbons) oxidation of diols. Pinacol-Pinacolone rearrangement.

Unit 14: Phenols

Preparation of Phenol: Cumene hydroperoxide method, from diazonium salts.

Reactions: Electrophilic substitution: Nitration, halogenation and sulphonation. Reimer- Tiemann Reaction, Schotten – Baumann Reaction.

Unit 15: Ethers (aliphatic and aromatic)

Cleavage of ethers with HI

Unit 16: Aliphatic Aldehydes and Ketones

Preparation: Preparation of formaldehyde, acetaldehyde and acetone

Reactions: – Reaction with HCN, ROH, $NaHSO_3$ and NH_2-derivatives. Iodoform test. Aldol Condensation, Cannizzaro's Reaction, Wittig Reaction, Benzoin Condensation. Clemensen Reduction and Wolff Kishner Reduction. Meerwein-Pondorff Verley Reduction.

Unit 17: Aromatic Aldehydes and Ketones

Structure and Properties of Aryl aldehydes and ketones

Preparation of Benzaldehyde

Reference Books:

1. I. L. Finar: Organic Chemistry (Vol. I & II), E. L. B. S.
2. R. T. Morrison & R. N. Boyd: Organic Chemistry, Prentice Hall.
3. Arun Bahl and B. S. Bahl: Advanced Organic Chemistry, S. Chand.
4. G. M. Barrow: Physical Chemistry Tata McGraw-Hill (2007).
5. G. W. Castellan: Physical Chemistry 4th Edn. Narosa (2004).
6. Peter Atkins, Julio de Paula, James Keeler, Atkins' Physical Chemistry: International 11th Edition Paperback, Oxford University Press, 2018
7. R. H. Petrucci: General Chemistry 5th Ed. Macmillan Publishing Co.: New York (1985).
8. Ball, D. W. Physical Chemistry Thomson Press, India (2007).
9. Castellan, G. W. Physical Chemistry 4th Ed. Narosa (2004)

Course Code/No.: BCHEM S2 02 (Lab)
Course Title: Chemical Energetics, Equilibria and Functional Group Organic Chemistry-I (Lab)
Credits: 2
Marks: 50

Section A: Physical Chemistry

Thermochemistry

1. Determination of heat capacity of calorimeter for different volumes.
2. Determination of enthalpy of neutralization of hydrochloric acid with sodium hydroxide.
3. Determination of enthalpy of ionization of acetic acid.
4. Determination of integral enthalpy of solution of salts (KNO_3, NH_4Cl).
5. Determination of enthalpy of hydration of copper sulphate.
6. Study of the solubility of benzoic acid in water and determination of ΔH.

Ionic Equilibria

1. Measurement of pH of different solutions like aerated drinks, fruit juices, shampoos and soaps (use dilute solutions of soaps and shampoos to prevent damage to the glass electrode) using pH-meter.
2. Preparation of buffer solutions:
    i. Sodium acetate-acetic acid or,
    ii. Ammonium chloride-ammonium hydroxide

Measurement of the pH of buffer solutions and comparison of the values with theoretical values

Section B: Organic Chemistry

1. Purification of organic compounds by crystallization (from water and alcohol) and distillation.
2. Criteria of Purity: Determination of melting and boiling points.
3. Preparations: Mechanism of various reactions involved to be discussed. Recrystallisation, determination of melting point and calculation of quantitative yields to be done.
    (a) Bromination of Phenol/Aniline
    (b) Benzoylation of amines/phenols
    (c) Oxime and 2, 4-dinitrophenylhydrazone of aldehyde/ketone

Reference Book:

1. A. I. Vogel: Textbook of Practical Organic Chemistry, Prentice-Hall
2. B. D. Khosla, Senior Practical Physical Chemistry, R. Chand & Co.

Semester III

Course Code/No.: BCHEM S3 03 (Th)
Course Title: Solutions, Phase Equilibrium, Conductance, Electrochemistry and Functional Group Organic Chemistry-II (Th)
Credits: 4
Marks: 100

BLOCK 1: PHYSICAL CHEMISTRY

Unit 1: Solutions-I

Thermodynamics of ideal solutions: Ideal solutions and Raoult's law, deviations from Raoult's law – non-ideal solutions. Vapour pressure-composition and temperature composition curves of ideal and non-ideal solutions. Distillation of solutions. Azeotropes.

Unit 2: Solutions-II

Partial miscibility of liquids: Critical solution temperature; effect of impurity on partial miscibility of liquids. Immiscibility of liquids- Principle of steam distillation. Nernst distribution law and its applications, solvent extraction.

Unit 3: Phase Equilibrium-I

Phases, components and degrees of freedom of a system, criteria of phase equilibrium. Gibbs Phase Rule and its thermodynamic deviation.

Unit 4: Phase Equilibrium-II

Phase diagrams of one-component systems (water and sulphur) and two component systems involving eutectics, congruent and incongruent melting points (lead –silver, $FeCl_3$-H_2O and Na-K only)

Unit 5: Conductance-I

Conductivity, equivalent and molar conductivity and their variation with dilution for weak and strong electrolytes. Kohlrausch's law of independent migration of ions.

Unit 6: Conductance-II

Transference number and its experimental determination using Hittorf and Moving boundary methods. Ionic mobility. Applications of conductance measurements: determination of degree of ionization of weak electrolyte, solubility and solubility products of sparingly soluble salts, ionic product of water, hydrolysis constant of a salt. Conductometric titrations (only acid- base).

Unit 7: Electrochemistry-I

Reversible and Irreversible Cells; Concept of EMF of a Cell, Experimental Measurement of EMF; Nernst Equation and its Importance

Unit 8: Electrochemistry-II

Types of electrodes. Standard electrode potential. Electrochemical series. Thermodynamics of a reversible cell, calculation of thermodynamic properties: ΔG, ΔH and ΔS from EMF data.

Unit 9: Electrochemistry-III

Calculation of equilibrium constant from EMF data. Concentration cells with transference and without transference. Liquid junction potential and salt bridge.

pH determination using hydrogen electrode and quinhydrone electrode.

BLOCK 2: ORGANIC CHEMISTRY

Unit 10: Carboxylic Acid (Aliphatic and Aromatic)

Preparation: Acidic and Alkaline hydrolysis of esters. Reactions: Hell – Vohlard - Zelinsky Reaction.

Unit 11: Carboxylic Acid Derivatives (Aliphatic) (upto 5 carbons)

Preparation: Acid chlorides, anhydrides, Esters and Amides from acids and their interconversion.

Reactions: Comparative study of nucleophilicity of acyl derivatives. Reformatsky Reaction, Perkin Condensation.

Unit 12: Amines (Aliphatic and Aromatic) (Up to 5 Carbons)

Preparation: from alkyl halides, Gabriel's Phthalimide synthesis, Hofmann Bromamide reaction.

Reactions: Hofmann vs. Saytzeff elimination, Carbylamine test, Hinsberg test, with HNO_2, Schotten – Baumann Reaction. Electrophilic substitution (case aniline): nitration, bromination, sulphonation.

Unit 13: Diazonium Salts

Preparation from Aromatic Amines; Reactions of Diazonium Salts, Conversion to Benzene, Phenol, Dyes.

Unit 14: Amino Acids and Peptides

Structure and Physical Properties Amino Acids, Zwitter Ion, Isoelectric Point and Electrophoresis (+optical activity in brief): Synthesis of 2-Amino Acids: Gabriel's Phthalimide Synthesis, Strecker Synthesis; Structure of Peptides; Synthesis of Peptides, Synthesis by N-protection, *t*-Butyloxycarbonyl (Boc) Group, Phthaloyl Group, Synthesis by C-Activating Groups; Merrifield Solid-Phase Synthesis; Lab Detection of Amino Acids, Complexation with Cu^{2+}, Ninhydrin Test.

Unit 14: Structure of Peptides and Proteins

Overview of Primary, Secondary, Tertiary and Quaternary Structures of Proteins; Determination of Primary Structure of Peptides and Proteins, Partial Hydrolysis, End Group Analysis, N-terminal Identification by, Degradation (i) Sanger Method (ii) Edman degradation, C-terminal Identification (with Carboxypeptidase Enzyme).

Unit 15: Carbohydrates-I (Monosaccharaides)

Monosaccharides: Classification of Carbohydrates; General Properties; Structure of Glucose and Fructose; Configuration of Monosaccharides, Absolute Configuration of Glucose and Fructose, Mutarotation; Ascending and Descending of Chains in Monosaccharides.

Unit 16: Carbohydrates-II (Disaccharides)

Disaccharrides and Polysaccharrides: Structure of Disaccharrides, Sucrose, Cellobiose, Maltose, Lactose; Structure of Polysaccharrides, Starch, Cellulose, (Excluding their Structure Elucidation).

Reference Books:

1. G. M. Barrow: Physical Chemistry Tata McGraw-Hill (2007).
2. G. W. Castellan: Physical Chemistry 4th Ed. Narosa (2004).
3. J. C. Kotz, P. M. Treichel, J. R. Townsend, General Chemistry
4. R. H. Petrucci, General Chemistry, 5th Ed., Macmillan Publishing Co.: New York (1985).
5. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
6. Finar, I. L. Organic Chemistry (Volume 2), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
7. Nelson, D. L. & Cox, M. M. Lehninger's Principles of Biochemistry 7th Ed., W. H. Freeman.

Course Code/No.: BCHEM S3 03 (Lab)
Course Title: Solutions, Phase Equilibrium, Conductance, Electrochemistry and Functional Group Organic Chemistry-II (Lab)
Credits: 2
Marks: 50

Section A: Physical Chemistry

Distribution

Study of the equilibrium of one of the following reactions by the distribution method:

$I_2(aq) + I^-(aq) \rightleftharpoons I_3^-(aq)$

$Cu^{2+}(aq) + xNH_2(aq) \rightleftharpoons [Cu(NH_3)_x]^{2+}$

Phase Equilibria

1. Construction of the phase diagram of a binary system (simple eutectic) using cooling curves.
2. Determination of the critical solution temperature and composition of the phenol water system and study of the effect of impurities on it.
3. Study of the variation of mutual solubility temperature with concentration for the phenol water system and determination of the critical solubility temperature.

Conductance

1. Determination of cell constant
2. Perform the following conducto-metric titrations:
   - Strong acid vs. strong base or,
   - Weak acid vs. strong base

Potentiometry

Perform the following potentiometric titrations:

i. Strong acid vs. strong base

ii. Weak acid vs. strong base

iii. Potassium dichromate vs. Mohr's salt

Section B: Organic Chemistry

Part I

Systematic Qualitative Organic Analysis of Organic Compounds possessing mono-functional groups (-COOH, phenolic, aldehydic, ketonic, amide, nitro, amines) and preparation of one derivative.

Part II

1. Separation of amino acids by paper chromatography
2. Determination of the concentration of glycine solution by formylation method.
3. Titration curve of glycine
4. Action of salivary amylase on starch
5. Effect of temperature on the action of salivary amylase on starch.
6. Differentiation between a reducing and a nonreducing sugar.

Reference Books:

1. A. I. Vogel: Textbook of Practical Organic Chemistry, Prentice Hall
2. B. D. Khosla: Senior Practical Physical Chemistry, R. Chand & Co.
3. Ahluwalia, V. K. & Aggarwal, R. Comprehensive Practical Organic Chemistry, Universities Press.

Semester IV

Course Code/No.: BCHEM S4 04 (Th)
Course Title: Coordination Chemistry, States of Matter & Chemical Kinetics (Th)
Credits: 4
Marks: 100

BLOCK 1: INORGANIC CHEMISTRY

Unit 1: Transition Series Elements-I

General group trends with special reference to electronic configuration, variable valency, colour, magnetic and catalytic properties.

Unit 2: Transition Series Elements-II

Ability to form complexes and stability of various oxidation states (Latimer diagrams) for Mn, Fe and Cu

Unit 3: Inner-Transition Elements (Lanthanoids and Actinoids)

Electronic configurations, oxidation states, colour, magnetic properties, lanthanide contraction, separation of lanthanides (ion exchange method only).

Unit 4: Coordination Chemistry-I

Valence Bond Theory (VBT): Inner and outer orbital complexes of Cr, Fe, Co, Ni and Cu (coordination numbers 4 and 6). IUPAC (2005) system of nomenclature

Unit 5: Coordination Chemistry –II

Structural and stereoisomerism in complexes with coordination numbers 4 and 6. Drawbacks of VBT.

Unit 6: Crystal Field Theory-I

Crystal field effect, octahedral symmetry. Crystal field stabilization energy (CFSE), Crystal field effects for weak and strong fields. Tetrahedral symmetry. Factors affecting the magnitude of D.

Unit 7: Crystal Field Theory-II

Spectrochemical series. Comparison of CFSE for Oh and Td complexes, Tetragonal distortion of octahedral geometry.

Jahn-Teller distortion, Square planar coordination.

BLOCK 2: PHYSICAL CHEMISTRY

Unit 8: Kinetic Theory of Gases

Postulates of Kinetic Theory of Gases and derivation of the kinetic gas equation.

Unit 9: Real Gases

Deviation of real gases from ideal behaviour, compressibility factor, causes of deviation. van der Waals equation of state for real gases. Boyle temperature (derivation not required). Critical phenomena, critical constants and their calculation from van der Waals equation. Andrews isotherms of CO2. Maxwell Boltzmann distribution laws of molecular velocities and molecular energies (graphic representation – derivation not required) and their importance. Temperature dependence of these distributions. Most probable, average and root mean square velocities (no derivation). Collision number and mean free path of molecules. Viscosity of gases, effect of temperature/pressure on coefficient of viscosity (qualitative treatment only).

Unit 10: Liquids

Surface tension and its determination using stalagmometer. Viscosity of a liquid and determination of coefficient of viscosity using Ostwald viscometer. Effect of temperature on surface tension and coefficient of viscosity of a liquid (qualitative treatment only)

Unit 11: Solids – I

Forms of solids. Symmetry elements, unit cells, crystal systems, Bravais lattice types and identification of lattice planes. Laws of Crystallography - Law of constancy of interfacial angles, Law of rational indices. Miller indices.

Unit 12: Solids –II

Bragg's law. Structures of NaCl (qualitative treatment only). Defects in crystals. Glasses and liquid crystals.

Unit 13: Chemical Kinetics – I

The concept of reaction rates. Effect of temperature, pressure, catalyst and other factors on reaction rates. Order and molecularity of a reaction. Derivation of integrated rate equations for zero, first and second order reactions.

Unit 14: Chemical Kinetics – II

Half–life of a reaction. General methods for determination of order of a reaction. Concept of activation energy and its calculation from Arrhenius equation.

Theories of Reaction Rates: Collision theory and Activated Complex theory of bimolecular

reactions. Comparison of the two theories (qualitative treatment only).

Reference Books:

- Barrow, G.M. *Physical Chemistry* Tata McGraw-Hill (2007).
- Castellan, G.W. *Physical Chemistry* 4th Ed. Narosa (2004).
- Kotz, J.C., Treichel, P.M. & Townsend, J.R. *General Chemistry* Cengage Learning India Pvt. Ltd., New Delhi (2009).
- Cotton, F.A. & Wilkinson, G. *Basic Inorganic Chemistry,* Wiley.
- Shriver, D.F. & Atkins, P.W. *Inorganic Chemistry*, Oxford University Press.
- Wulfsberg, G. *Inorganic Chemistry,* Viva Books Pvt. Ltd.
- Rodgers, G.E. *Inorganic & Solid State Chemistry,* Cengage Learning India Ltd., 2008.

Course Code/No.: BCHEM S4 04(Lab)
Course Title: Coordination Chemistry, States of Matter & Chemical Kinetics (Lab)
Credit: 2
Marks: 50

Section A: *Inorganic Chemistry*

Semi-micro qualitative analysis using H_2S of mixtures- not more than four ionic species (two anions and two cations and excluding insoluble salts) out of the following:

Cations: Pb^{2+}, Ag^{2+}, Bi^{3+}, Cu^{2+}, Cd^{2+}, Sn^{2+}, Fe^{3+}, Al^{3+}, Co^{2+}, Cr^{3+}, Ni^{2+}, Mn^{2+}, Zn^{2+}, Ba^{2+}, Sr^{2+}, Ca^{2+}, Mg^{2+}, NH_4^+.

Anions: CO_3^{2-}, NO_2^-, NO_3^-, SO_4^{2-}, Cl^-, Br^-, I^-, BO_3^{3-}, PO_4^{3-}.

Spot tests should be done whenever possible.

1. Estimate the amount of nickel present in a given solution as bis(dimethylglyoximato) nickel(II) or aluminium as oximate in a given solution gravimetrically.
2. Draw calibration curve (absorbance at λ_{max} vs. concentration) for various concentrations of a given coloured compound ($KMnO_4$/ $CuSO_4$) and estimate the concentration of the same in a given solution.
3. Determine the composition of the Fe^{3+}-salicylic acid complex solution by Job's method.
4. Estimation of (i) Mg^{2+} or (ii) Zn^{2+} by complexometric titrations using EDTA.
5. Estimation of total hardness of a given sample of water by complexometric titration.
6. Determination of concentration of Na^+ and K^+ using Flame Photometry.

Section B: Physical Chemistry

I. Surface tension measurement (*use of organic solvents excluded*)

a. Determination of the surface tension of a liquid or a dilute solution using a stalagmometer.

b. Study of the variation of surface tension of a detergent solution with concentration.

II. Viscosity measurement (*use of organic solvents excluded*)

a. Determination of the relative and absolute viscosity of a liquid or dilute solution using an Ostwald's viscometer.

b. Study of the variation of viscosity of an aqueous solution with concentration of solute.

III. Chemical Kinetics

Study the kinetics of the following reactions.

1. Initial rate method: Iodide-persulphate reaction
2. Integrated rate method:
   a. Acid hydrolysis of methyl acetate with hydrochloric acid.
   b. Saponification of ethyl acetate.
   c. Compare the strengths of HCl and H_2SO_4 by studying kinetics of hydrolysis of methyl acetate

Reference Books:

- Svehla, G. *Vogel's Qualitative Inorganic Analysis*, Pearson Education, 2012.
- Mendham, J. *Vogel's Quantitative Chemical Analysis*, Pearson, 2009.
- Khosla, B. D.; Garg, V. C. & Gulati, A. *Senior Practical Physical Chemistry,* R. Chand & Co.: New Delhi (2011).

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DISCIPLINE SPECIFIC ELECTIVES

SEMESTER V

To choose any one from the following courses

Course BCHEM S5 1A: Inorganic Materials of Industrial Importance (Th + Lab) (Credit 4 + 2)

Course BCHEM S5 1B: Analytical Methods in Chemistry (Th + Lab) (Credit 4 + 2)

Course Code: BCHEM S5 1A (Th)

Course Title: Inorganic Materials of Industrial Importance (Th)

Credits: 4

Marks:100

Unit 1: Review of *s*- and *p*-Block Elements

Periodicity in *s*- and *p*-block elements with respect to electronic configuration, atomic and ionic size, ionization enthalpy, electronegativity (Pauling, Mulliken, and Alfred-Rochow scales). Allotropy in C, S, and P.

Oxidation states with reference to elements in unusual and rare oxidation states like carbides and nitrides), inert pair effect, diagonal relationship and anomalous behaviour of first member of each group.

Unit 2: Silicate Industries-1

Glass: Glassy state and its properties, classification (silicate and non-silicate glasses). Manufacture and processing of glass. Composition and properties of the following types of glasses: Soda lime glass, lead glass, armoured glass, safety glass, borosilicate glass, fluorosilicate, coloured glass, photosensitive glass.

Unit 3: Silicate Industries-2

Ceramics: Important clays and feldspar, ceramic, their types and manufacture. High technology ceramics and their applications, superconducting and semiconducting oxides, fullerenes carbon nanotubes and carbon fibre.

Unit 4: Silicate Industries-3

Cements: Classification of cement, ingredients and their role, Manufacture of cement and the setting process, quick setting cements.

Unit 5: Fertilizers

Different types of fertilizers. Manufacture of the following fertilizers: Urea, ammonium nitrate, calcium ammonium nitrate, ammonium phosphates; polyphosphate, superphosphate, compound and mixed fertilizers, potassium chloride, potassium sulphate.

Unit 6: Basic Concept of Surface Coatings

Objectives of coatings surfaces, preliminary treatment of surface, classification of surface coatings.

Unit 7: Paints and Pigments

Paints and pigments-formulation, composition and related properties.

Oil paint, Vehicle, modified oils, Pigments, toners and lakes pigments, Fillers, Thinners, Enamels, emulsifying agents.

Unit 8: Special Categories of Paints

Heat retardant, Fire retardant, Eco-friendly paint, Plastic paint, Dyes, Wax polishing, Water and Oil paints, additives, Metallic coatings (electrolytic and electroless), metal spraying and anodizing.

Unit 9: Batteries

Primary and secondary batteries, battery components and their role, Characteristics of Battery.

Unit 10: Types of Batteries

Pb acid, Li-Battery, Solid state electrolyte battery. Fuel cells, Solar cell and polymer cell.

Unit 11: Concept of Alloys

Classification of alloys, ferrous and non-ferrous alloys, Specific properties of elements in alloys.

Unit 12: Steel

Manufacture of Steel (removal of silicon decarbonization, demanganization, desulphurization dephosphorisation) and surface treatment (argon treatment, heat treatment, nitriding, carburizing). Composition and properties of different types of steels.

Unit 13: Catalysis

General principles and properties of catalysts, homogenous catalysis (catalytic steps and examples) and heterogenous catalysis (catalytic steps and examples) and their industrial applications, Deactivation or regeneration of catalysts.

Phase transfer catalysts, application of zeolites as catalysts.

Unit 14: Chemical explosives

Origin of explosive properties in organic compounds, preparation and explosive properties of lead azide, PETN, cyclonite (RDX). Introduction to rocket propellants.

Reference Books:

- E. Stocchi: *Industrial Chemistry*, Vol-I, Ellis Horwood Ltd. UK.
- R. M. Felder, R. W. Rousseau: *Elementary Principles of Chemical Processes*, Wiley Publishers, New Delhi.
- W. D. Kingery, H. K. Bowen, D. R. Uhlmann: *Introduction to Ceramics,* Wiley Publishers, New Delhi.
- J. A. Kent: Riegel's *Handbook of Industrial Chemistry*, CBS Publishers, New Delhi.
- P. C. Jain & M. Jain: *Engineering Chemistry,* Dhanpat Rai & Sons, Delhi.
- R. Gopalan, D. Venkappayya, S. Nagarajan: *Engineering Chemistry,* Vikas Publications, New Delhi.
- B. K. Sharma: *Engineering Chemistry*, Goel Publishing House, Meerut

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Course Code: BCHEM S5 1A (Lab)

Course Title: Inorganic Materials of Industrial Importance (Lab)

Credits: 2

Marks: 50

Experiments

1. Determination of free acidity in ammonium sulphate fertilizer.
2. Estimation of calcium in calcium ammonium nitrate fertilizer.
3. Estimation of phosphoric acid in superphosphate fertilizer.
4. Electroless metallic coatings on ceramic and plastic material.
5. Determination of composition of dolomite (by complexometric titration).
6. Analysis of (Cu, Ni); (Cu, Zn) in alloy or synthetic samples.
7. Analysis of Cement.
8. Preparation of pigment (zinc oxide).

Reference Books:

- E. Stocchi: *Industrial Chemistry*, Vol-I, Ellis Horwood Ltd. UK.
- R. M. Felder, R. W. Rousseau: *Elementary Principles of Chemical Processes*, Wiley Publishers, New Delhi.
- W. D. Kingery, H. K. Bowen, D. R. Uhlmann: *Introduction to Ceramics,* Wiley Publishers, New Delhi.
- J. A. Kent: Riegel's *Handbook of Industrial Chemistry*, CBS Publishers, New Delhi.
- P. C. Jain, M. Jain: *Engineering Chemistry,* Dhanpat Rai & Sons, Delhi.
- R. Gopalan, D. Venkappayya, S. Nagarajan: *Engineering Chemistry,* Vikas Publications, New Delhi.
- Sharma, B.K. & Gaur, H. *Industrial Chemistry,* Goel Publishing House, Meerut (1996).

Course Code: BCHEM S5 1B (Th)

Course Title: Analytical Methods in Chemistry (Th)

Credits: 4

Marks: 100

Unit 1: **Qualitative and quantitative aspects of analysis**

Sampling, evaluation of analytical data, errors, accuracy and precision, methods of their expression, normal law of distribution if indeterminate errors, statistical test of data; F, Q and t test, rejection of data, and confidence intervals.

Unit 2: **Optical methods of analysis**

Origin of spectra, interaction of radiation with matter, fundamental laws of spectroscopy and selection rules, validity of Beer-Lambert's law.

Unit 3: **UV-Visible Spectrometry**

Basic principles of instrumentation (choice of source, monochromator and detector) for single and double beam instrument;

Unit 4: **Basic principles of quantitative analysis**

Estimation of metal ions from aqueous solution, geometrical isomers, keto-enol tautomers. Determination of composition of metal complexes using Job's method of continuous variation and mole ratio method.

Unit 5: Infrared Spectrometry

Basic principles of instrumentation (choice of source, monochromator & detector) for single and double beam instrument; sampling techniques, structural illustration through interpretation of data, Effect and importance of isotope substitution.

Unit 6: **Flame Atomic Absorption and Emission Spectrometry**

Basic principles of instrumentation (choice of source, monochromator, detector, choice of flame and Burner designs. Techniques of atomization and sample introduction; Method of background correction, sources of chemical interferences and their method of removal. Techniques for the quantitative estimation of trace level of metal ions from water samples.

Unit 7: **Thermal methods of analysis**

Theory of thermogravimetry (TG), basic principle of instrumentation. Techniques for quantitative estimation of Ca and Mg from their mixture.

Unit 8: **Electroanalytical methods**

Classification of electroanalytical methods, basic principle of pH metric, potentiometric and conductometric titrations. Techniques used for the determination of equivalence points. Techniques used for the determination of pK_a values.

Unit 9: **Separation techniques**

Solvent extraction: Classification, principle and efficiency of the technique. Mechanism of extraction: extraction by solvation and chelation.

Unit 10: **Technique of extraction**

Batch, continuous and counter current extractions.

Unit 11: **Qualitative and quantitative aspects of solvent extraction**

Extraction of metal ions from aqueous solution, extraction of organic species from the aqueous and nonaqueous media.

Unit 12: Chromatography

Classification, principle and efficiency of the technique. Mechanism of separation: adsorption, partition & ion exchange.

Unit 13: **Development of chromatograms**

Frontal, elution and displacement methods.

Unit 14: **Qualitative and quantitative aspects of chromatographic methods of analysis**

IC, GLC, GPC, TLC and HPLC

Unit 15: **Stereoisomeric separation and analysis**

Measurement of optical rotation, calculation of Enantiomeric excess (ee)/ diastereomeric excess (de) ratios and determination of enantiomeric composition using NMR, Chiral solvents and chiral shift reagents. Chiral chromatographic techniques using chiral columns (GC and HPLC).

Reference Books:

- Jeffery, G.H., Bassett, J., Mendham, J. & Denney, R.C. *Vogel's Textbook of Quantitative Chemical Analysis*, John Wiley & Sons, 1989.
- Willard, H.H., Merritt, L.L., Dean, J. & Settoe, F.A. *Instrumental Methods of Analysis*, 7th Ed. Wadsworth Publishing Company Ltd., Belmont, California, USA, 1988.
- Christian, G.D; *Analytical Chemistry*, 6th Ed. John Wiley & Sons, New York, 2004.
- Khopkar, S.M. *Basic Concepts of Analytical Chemistry*. New Age, International Publisher, 2009.
- Skoog, D.A. Holler F.J. & Nieman, T.A. *Principles of Instrumental Analysis*, Cengage Learning India Ed.

Course Code: BCHEM S5 1B (Lab)

Course Title: Analytical Methods in Chemistry (Lab)

Credits: 2

Marks: 50

Experiments:

1. Paper chromatographic separation of Fe^{3+}, Al^{3+}, and Cr^{3+}, Pb^{2+}, Hg_2^{2+}, and Ag^{+}
2. Separation and identification of the monosaccharides present in the given mixture (glucose & fructose) by paper chromatography. Reporting the R_f values.
3. Separate a mixture of Sudan yellow and Sudan Red by TLC technique and identify them on the basis of their R_f values.
4. Chromatographic separation of the active ingredients of plants, flowers and juices by TLC
5. Determine the pH of the given aerated drinks fruit juices, shampoos and soaps.

6. Determination of Na, Ca, Li in cola drinks and fruit juices using flame photometric techniques.
7. Analysis of Soil: Determination of pH of soil, Total soluble salt, Estimation of calcium, magnesium, phosphate, nitrate in soil
8. Separation of metal ions from their binary mixture.
9. Separation of amino acids from organic acids by ion exchange chromatography.
10. Determination of pK_a values of indicator using spectrophotometry.
11. Structural characterization of compounds by infrared spectroscopy.
12. Determination of dissolved oxygen in water.
13. Determination of chemical oxygen demand (COD).
14. Determination of Biological oxygen demand (BOD).

References Books:

- Jeffery, G.H., Bassett, J., Mendham, J. & Denney, R.C. *Vogel's Textbook of Quantitative Chemical Analysis*, John Wiley & Sons, 1989.
- Willard, H.H., Merritt, L.L., Dean, J. & Settoe, F.A. *Instrumental Methods of Analysis*, 7th Ed. Wadsworth Publishing Company Ltd., Belmont, California, USA, 1988.
- Christian, Gary D; Analytical Chemistry, 6th Ed. John Wiley & Sons, New York, 2004.
- Khopkar, S.M. Basic Concepts of Analytical Chemistry. New Age, International Publisher, 2009.
- Skoog, D.A. Holler F.J. & Nieman, T.A. *Principles of Instrumental Analysis*, Cengage Learning India Ed.
- Mikes, O. *Laboratory Hand Book of Chromatographic & Allied Methods*, Elles Harwood Series on Analytical Chemistry, John Wiley & Sons, 1979.

Semester VI

To choose any one from the following courses

Course BCHEM S6 1A: Industrial Chemicals and Environment (Th + Lab) (Credit 4 + 2)

Course BCHEM S6 1B: Dissertation (Credit 6)

Course Code: BCHEM S6 1A (Th)

Course Title: Industrial Chemicals and Environment (Th)

Credits: 4

Marks: 100

BLOCK 1: INDUSTRIAL CHEMICALS

Unit 1: Industrial Gases

Large scale production, uses, storage and hazards in handling of the following gases: oxygen, nitrogen, argon, neon, helium, hydrogen, acetylene, carbon monoxide, chlorine, fluorine, sulphur dioxide and phosgene.

Unit 2: Inorganic Chemicals

Manufacture, application, analysis and hazards in handling the following chemicals: hydrochloric acid, nitric acid, sulphuric acid, caustic soda, common salt, borax, bleaching powder, sodium thiosulphate, hydrogen peroxide, potash alum, chrome alum, potassium dichromate and potassium permanganate.

Unit 3: General Principles of Metallurgy

Chief modes of occurrence of metals based on standard electrode potentials. Ellingham diagrams for reduction of metal oxides using carbon as reducing agent.

Unit 4: Hydrometallurgy

Methods of purification of metals (Al, Pb, Ti, Fe, Cu, Ni, Zn): electrolytic, oxidative refining, Kroll process, Parting process, van Arkel-de Boer process and Mond's process.

Unit 5: Preparation of metals

Preparation of ferrous and nonferrous and ultrapure metals for semiconductor

technology.

BLOCK 2: Environment and its Segments

Unit 6: Basics of Environment

Ecosystems. Biogeochemical cycles of carbon, nitrogen and sulphur.

Unit 7: Air Pollution

Major regions of atmosphere. Chemical and photochemical reactions in atmosphere. Air pollutants: types, sources, particle size and chemical nature; Photochemical smog: its constituents and photochemistry. Environmental effects of ozone, Major sources of air pollution.

Unit 8: Pollution by some gases

Pollution by SO_2, CO_2, CO, NO_x, H_2S and other foul-smelling gases. Methods of estimation of CO, NO_x, SO_x and control procedures.

Unit 9: Effects of air pollution

Effects of air pollution on living organisms and vegetation. Greenhouse effect and Global warming, Ozone depletion by oxides of nitrogen, chlorofluorocarbons and Halogens, removal of sulphur from coal. Control of particulates.

Unit 10: Water Pollution

Hydrological cycle, water resources, aquatic ecosystems, Sources and nature of water pollutants, Techniques for measuring water pollution, Impacts of water pollution on hydrological and ecosystems.

Unit 11: Water purification methods

Effluent treatment plants (primary, secondary and tertiary treatment). Industrial effluents from the following industries and their treatment: electroplating, textile, tannery, dairy, petroleum and petrochemicals, agro, fertilizer, etc. Sludge disposal.

Unit 12: Waste Management

Industrial waste management, incineration of waste. Water treatment and purification (reverse osmosis, electro dialysis, ion exchange). Water quality parameters for waste water, industrial water and domestic water.

Unit 13: Energy & Environment

Sources of energy: Coal, petrol and natural gas. Nuclear Fusion / Fission, Solar energy, Hydrogen, geothermal, Tidal and Hydel, etc.

Nuclear Pollution: Disposal of nuclear waste, nuclear disaster and its management.

Unit 14: Biocatalysis

Introduction to biocatalysis - Importance in "Green Chemistry" and Chemical Industry.

Reference Books:

- E. Stocchi: *Industrial Chemistry*, Vol-I, Ellis Horwood Ltd. UK.
- R.M. Felder, R.W. Rousseau: *Elementary Principles of Chemical Processes*, Wiley Publishers, New Delhi.
- J. A. Kent: *Riegel's Handbook of Industrial Chemistry, CBS Publishers, New Delhi.*
- *S. S. Dara: A Textbook of Engineering Chemistry*, S. Chand & Company Ltd. New Delhi.
- K. De, *Environmental Chemistry*: New Age International Pvt., Ltd, New Delhi.
- S. M. Khopkar, *Environmental Pollution Analysis*: Wiley Eastern Ltd, New Delhi.
- S.E. Manahan, *Environmental Chemistry*, CRC Press (2005).
- G.T. Miller, *Environmental Science* 11th edition. Brooks/ Cole (2006).
- A. Mishra, *Environmental Studies*. Selective and Scientific Books, New Delhi (2005).

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Course Code: BCHEM S6 1A (Lab)

Course Title: Industrial Chemicals and Environment (Lab)

Credits: 2

Marks:50

Experiments:

1. Determination of dissolved oxygen in water.
2. Determination of Chemical Oxygen Demand (COD)
3. Determination of Biological Oxygen Demand (BOD)
4. Percentage of available chlorine in bleaching powder.
5. Measurement of chloride, sulphate and salinity of water samples by simple titration method ($AgNO_3$ and potassium chromate).
6. Estimation of total alkalinity of water samples (CO_3^{2-}, HCO_3^-) using double titration method.
7. Measurement of dissolved CO_2.
8. Study of some of the common bio-indicators of pollution.

9. Estimation of SPM in air samples.
10. Preparation of borax/ boric acid.

Reference Books:

- E. Stocchi: *Industrial Chemistry*, Vol-I, Ellis Horwood Ltd. UK.
- R.M. Felder, R.W. Rousseau: *Elementary Principles of Chemical Processes*, Wiley Publishers, New Delhi.
- J. A. Kent: Riegel's *Handbook of Industrial Chemistry*, CBS Publishers, New Delhi.
- S. S. Dara: *A Textbook of Engineering Chemistry*, S. Chand & Company Ltd. New Delhi.
- K. De, *Environmental Chemistry*: New Age International Pvt. Ltd, New Delhi.
- S. M. Khopkar, *Environmental Pollution Analysis*: Wiley Eastern Ltd, New Delhi.

Course Code: BCHEM S6 1B

Course Title: DISSERTATION

Credit: 06

Marks: 150

Objective of the Course: To write report in a scientific style and to solve scientific problems and to present information in a clear and effective manner.

Here, the learners will have to carry out project work (Laboratory experiments or Comprehensive Review work on a specified topic) either at their respective study centres or any other R&D laboratory or any other UGC recognized University Department under the supervision and guidance of a faculty member. The student may start their project work during the semester break between fifth and sixth semester.

The area of work will be decided by the supervisor.

On completion of the project work students have to submit the work in the form of a dissertation followed by oral presentation in the presence of faculty member of the enrolled study centre and an external expert.

The Project Work will consist of following aspects.

A. For Laboratory Experiment:
    1. Literature Review
    2. Objectives
    3. Experimental work
    4. Results and Discussions
    5. Conclusion
    6. Bibliography
B. For Comprehensive Review
    1. Objective
    2. Review
    3. References
    4. Future Prospects

Note: Learners will be encouraged to carry out both the laboratory experiment and comprehensive review individually. Submission of antiplagiarism certificate for the report/review may also be considered.

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SKILL ENHANCEMENT COURSES

(Proposed to be offered from the Discipline of Chemistry)

SEC 1: Fundamentals of Green Chemistry
SEC 2: Pharmaceutical Chemistry
SEC 3: Business Skills for Chemists
SEC 4: Intellectual Property Rights

Semester III

Course Code: BS-SEC-1B (Th)
Course Title: Fundamentals of Green Chemistry
Credit: 02
Marks: 50

SECTION A: THEORY

Unit 1: Introduction to Green Chemistry

Definition of Green Chemistry. Need for Green Chemistry. Goals of Green Chemistry. Limitations/ Obstacles in the pursuit of the goals of Green Chemistry

Unit 2: Principles of Green Chemistry

Twelve principles of Green Chemistry with examples

Unit 3: Atom Economy and Reduction of Toxicity

Concept of atom economy, calculation of atom economy of the rearrangement, addition, substitution and elimination reactions.

Reducing toxicity. risk = (function) hazard × exposure; waste or pollution prevention hierarchy.

Unit 4: Green Solvents

Supercritical fluids, water as a solvent for organic reactions, ionic liquids, fluorous biphasic solvent, PEG, solventless processes, immobilized solvents and how to compare greenness of solvents.

Unit 5: Alternative sources of energy and Selection of starting materials

Use of microwaves and ultrasonic energy.

Selection of starting materials; avoidance of unnecessary derivatization – careful use of blocking/protecting groups.

Unit 6: Catalysis and Green Chemistry

Comparison of heterogeneous and homogeneous catalysis, biocatalysis, asymmetric catalysis and photocatalysis.

Unit 7: Examples of Green Synthesis/Reactions and some real-world cases (Part-I)

- Surfactants for carbon dioxide – replacing smog producing and ozone depleting solvents with CO_2 for precision cleaning and dry cleaning of garments.
- Designing of Environmentally safe marine antifoulant.
- Rightfit pigment: synthetic azopigments to replace toxic organic and inorganic pigments.

Unit 8: Examples of Green Synthesis/ Reactions and some real-world cases (Part-II)

- An efficient, green synthesis of a compostable and widely applicable plastic (poly lactic acid) made from corn.
- Healthier fats and oil by Green Chemistry: Enzymatic interesterification for production of no Trans-Fats and Oils
- Development of Fully Recyclable Carpet: Cradle to Cradle Carpeting

Reference Books:

- K. Ahluwalia & M. R. Kidwai: New Trends in Green Chemistry, Anamalaya Publishers (2005).
- P. T. Anastas & J. K. Warner: Oxford Green Theory and Practical, University Press (1998).
- S. Matlack: Introduction to Green Chemistry, Marcel Dekker (2001).
- M. C. Cann & M. E. Connely: Real-World cases in Green Chemistry, American Chemical Society, Washington (2000).
- M. A. Ryan & M. Tinnesand, Introduction to Green Chemistry, American Chemical Society, Washington (2002).

SECTION B: PRACTICAL

1. **Safer Starting Materials**

   The Vitamin C clock reaction using Vitamin C tablets, tincture of iodine, hydrogen peroxide and liquid laundry starch – study of effect of concentration on clock reaction.

2. **Using Renewable Resources**

   Preparation of biodiesel from vegetable oil.

3. **Avoiding Waste**

   Principle of atom economy.

   Use of molecular model kit to stimulate the reaction to investigate how the atom economy can illustrate Green Chemistry.

   Preparation of acetanilide from aniline using acetic acid in presence of zinc dust.

4. Green Reactions

Solvent free, microwave assisted one pot synthesis of phthalocyanine complex of copper (II).

Photoreduction of benzophenone to benzopinacol in the presence of sunlight.

Reference Books:

- Anastas, P. T & Warner, J. C. Green Chemistry: Theory and Practice, Oxford University Press (1998).
- Kirchoff, M. & Ryan, M. A. Greener approaches to undergraduate chemistry experiment. American Chemical Society, Washington DC (2002).
- Ryan, M. A. Introduction to Green Chemistry, Tinnesand; (Ed), American Chemical Society, Washington DC (2002).
- Sharma, R. K.; Sidhwani, I. T. & Chaudhari, M. K. I. K. Green Chemistry Experiment: A monograph International Publishing House Pvt Ltd. New Delhi. Bangalore CISBN 978-93-81141-55-7 (2013). 56
- Cann, M. C. & Connelly, M. E. Real world cases in Green Chemistry, American Chemical Society (2008).
- Pavia, D. L. Lamponan, G. H. & Kriz, G. S. W B Introduction to organic laboratory.

Semester IV

Course Code: BS-SEC-2B (Th)
Course Title: Pharmaceutical Chemistry
Credit: 02
Marks:50

SECTION A: THEORY

Unit 1: Introduction to the Concept of Drugs and Pharmaceuticals

Drug discovery, design and development; Basic retrosynthetic approach

Unit 2: Synthesis of Analgesics, Antipyretic and Anti-inflammatory Drugs

Synthesis of analgesics, antipyretic and anti-inflammatory drugs (aspirin, paracetamol, ibuprofen)

Unit 3: Synthesis of Antibiotics, Antibacterial

Synthesis of antibiotics (chloramphenicol) and antibacterial drugs

Unit 4: Synthesis of Antifungal and Antiviral

Synthesis of antiviral (acyclovir) and antifungal (sulphonamides, sulphanethoxazol, sulphacetamide, trimethoprim)

Unit 5: Synthesis of Some Other Drugs

Synthesis of drugs effecting central nervous system (phenobarbital, diazepam), cardiovascular (glyceryl trinitrate), antilaprosy (dapsone), HIV-AIDS related drugs (AZT- Zidovudine).

Unit 6: Fermentation

Concept of aerobic and anaerobic fermentation, production of ethanol and citric acid

Unit 7: Production of Antibiotics

Production of antibiotics like penicillin, cephalosporin, chloromycetin and streptomycin

Unit 8: Production of Amino Acids and Vitamins

Production of lysine, glutamic acid, vitamin B2, vitamin B12 and vitamin C.

Reference Books:

- G.L. Patrick: Introduction to Medicinal Chemistry, Oxford University Press, UK.
- Hakishan, V.K. Kapoor: Medicinal and Pharmaceutical Chemistry, Vallabh Prakashan, Pitampura, New Delhi.
- William O. Foye, Thomas L., Lemke, David A. William: Principles of Medicinal Chemistry, B.I. Waverly Pvt. Ltd. New Delhi.

SECTION B: PRACTICAL

Part 1: Experiment

1. Preparation of Aspirin and its analysis.
2. Preparation of magnesium bisilicate (antacid)

Part 2: Field Study

A field report to be prepared by the learner on some locally used traditional herbal medicines

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Semester V

Course Code: BS-SEC-3B (Th)
Course Title: Business Skills for Chemists
Credit: 02
Marks:50

Unit 1: Chemistry in Industry

Current challenges and opportunities for the chemistry-using industries, role of chemistry in India and global economies.

Unit 2: Business Basics

Key business concepts - Business plans, market need, project management and routes to market.

Unit 3: Basics of Management

Management Functions and skills, principles of motivation, forms of business organization including partnerships and companies.

Unit 4: Preparation of Cash Book

Meaning; Importance; Preparation.

Unit 5: Basics of Financial Statements

Introduction to Financial Statements

Unit 6: Financial Management Skills

An overview of financial management, working capital management, and cost accounting with cases, managerial finance functions.

Unit 7: Skills of Marketing, Advertising and Personal Selling

Understanding basics of marketing and marketing mix strategies with cases.

Advertising: Concept; Importance; Advertising Media.

Personal Selling: Concept; Importance; Strategies.

Unit 8: Human Resource Management (HRM) Skills

Managerial HRM functions viz. recruitment, training and development and compensation.

Unit 9: Intellectual Property

Concept of intellectual property, patents.

Reference Book:

- Philip Kotler, Keven Lane Keller Marketing Management 15th Ed., Pearson Education; Fifteenth edition (10 August 2017).
- D. Chasndra Bose. Principles of Management and Administration. PHI. 2nd Edition. 2013.

Semester VI

Course Code: BS-SEC-4B (Th)
Course Title: Intellectual Property Rights
Credit: 02
Marks:50

Unit 1: Introduction to Intellectual Property

Historical Perspective, Different Types of IP, Importance of protecting IP.

Unit 2: Copyrights and Trade Marks

Copyright: How to obtain, Differences from Patents.

Trade Marks: How to obtain, Different types of marks – Collective marks, certification marks, service marks, Trade names, etc., Differences from Designs.

Unit 3: Patents

Historical Perspective, Basic and associated right, WIPO, PCT system, Traditional Knowledge, Patents and Healthcare – balancing promoting innovation with public health, Software patents and their importance for India.

Unit 5: Geographical Indications, Industrial Designs and Trade Secrets

Geographical Indications: Definition, rules for registration, prevention of illegal exploitation, importance to India.

Industrial Designs: Definition, how to obtain, features, international design registration.

Trade Secrets: Introduction and Historical Perspectives, Scope of Protection, Risks involved and legal aspects of Trade Secret Protection.

Unit 6: Word Trade Organization (WTO)

- General Agreement on Tariffs & Trade (GATT), Trade Related Intellectual Property Rights (TRIPS) agreement
- General Agreement on Trade related Services (GATS)
- Madrid Protocol
- Berne Convention
- Budapest Treaty

Unit 7: Paris Convention

WIPO and TRIPS, IPR and Plant Breeders Rights, IPR and Biodiversity

Unit 8: IP Infringement issue and enforcement

Role of Judiciary, Role of law enforcement agencies – Police, Customs etc.

Unit 9: Economic Value of Intellectual Property

Intangible assets and their valuation

Unit 10: Intellectual Property in the Indian Context

Various laws in India Licensing and technology transfer

Reference Books:

- N.K. Acharya: *Textbook on intellectual property rights*, Asia Law House (2001).
- Manjula Guru & M.B. Rao, *Understanding Trips: Managing Knowledge in Developing Countries*, Sage Publications (2003).
- P. Ganguli, Intellectual Property Rights: *Unleashing the Knowledge Economy,* Tata McGraw-Hill (2001).
- Arthur Raphael Miller, Micheal H. Davis; *Intellectual Property: Patents, Trademarks and Copyright in a Nutshell,* West Group Publishers (2000).
- Jayashree Watal, *Intellectual property rights in the WTO and developing countries,* Oxford University Press, Oxford.

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Annexure 4

Detailed Syllabus of Mathematics

DISCIPLINE SPECIFIC CORE COURSE – MATHEMATICS
(All compulsory)

- Course 01: Differential Calculus (Credit 6)
- Course 02: Differential Equations (Credit 6)
- Course 03: Algebra (Credit 6)
- Course 04: Real Analysis (Credit 6)

Semester I

Course Code: BMATH S1 01 (Th)
Course Title: DIFFERENTIAL CALCULUS
Nature of the Course: DSC-3-1
Credit: 06
Marks: 100

BLOCK I

UNIT-1: **Function**: Definition, Domain and range, Classification of a function.

UNIT -2: **Limit of a function**: Concept of limit of a function, properties.

UNIT- 3: **Continuity of a function**: Definition and examples, properties

UNIT -4: **Differentiability of a function**: Definition and Examples, properties

UNIT-5: **Derivative of a function:** Derivative of various standard function, Derivative of sum and difference of functions, Derivative of product of functions, Quotient rule,

UNIT- 6: **Derivative of some special function**: Derivative of trigonometric functions, Derivative of exponential and logarithmic function. Logarithmic Differentiation, Derivative of hyperbolic function.

UNIT- 7: **Indeterminate forms**: Definition, L Hospital's Rules, Forms $\frac{0}{0}, \frac{\infty}{\infty}, 0.\infty,$

$\infty - \infty, 0^0, 1^\infty, \infty^0$

BLOCK II

UNIT-8: **Successive differentiation**: Leibnitz's theorem for the nth derivative of the product of two functions, problems.

UNIT-9: **Application of derivatives**: Increasing and Decreasing of a function, Derivatives as rate measurer, Maximum and minimum of a function, Curvature, tangent and normal.

UNIT-10: **Mean Value theorem**: Rolle's theorem, Lagrange's mean value theorem, Cauchy's mean value theorem,

UNIT-11: **Function of several variables**: Partial Derivatives, homogeneous function, Euler's theorem on homogeneous function.

UNIT-12: **Extreme value of a function of several variables:** Maximum and minimum of a function of two variables, Definition, Examples, Application.

UNIT -13: **Jacobians**: Definition, its properties.

UNIT- 14: **Lagrange method of undetermined multipliers:** Statement, Application

Reference Books:

1. Differential Calculus; H. S. Dhami, New Age International(P) Limited Publishers.
2. Basics of Differential Calculus; Sudhir Gupta: Anmol publication Pt. Ltd.
3. Differential Calculus; Hari Kishan: Atlantic Publishers Distributors (P) Ltd.
4. Differential Calculus; Shanti Narayan: S. Chand Limited.
5. Differential Calculus; S. Rao Berkeley: University of California Press.
6. Text Book of Differential Calculus for B.A., B.Sc., B.Com., I.A.S., P.C.S.; A.K. Sharma: Discovery Publishing House.

Semester II

Course Code: BMATH S2 02 (Th)
Course Title: DIFFERENTIAL EQUATION
Nature of the Course: DSC-3-2
Credit: 06
Marks: 100

BLOCK I

UNIT-1: **Differential Equation: Fundamental concepts:** Definition and Examples, Order and degree of ordinary differential equation, Linear and non-linear differential equation, Formation of a differential equation.

UNIT-2: **Differential equation of first order and first degree:** Solution of differential equation, Differential equation of first order and first degree; solution by variable separable methods; homogeneous equations

UNIT -3: **Exact Differential Equation of First Order and First Degree:** Exact differential Equation; Equations reducible to Exact Equations.

UNIT-4: Linear differential equation of first order: linear differential equations, Bernoulli's equation, exact differential equations.

UNIT-5: **First order and higher degree differential equation:** First order higher degree equations solvable for x, y and Clairaut's form.

UNIT-6: **Ordinary Simultaneous differential equations:** Simultaneous differential equations with constant coefficients

UNIT-7: **Simultaneous differential equations of the form $\frac{dx}{P} = \frac{dy}{Q} = \frac{dz}{R}$:**Introduction, Rule I, II, III &IV for solving $\frac{dx}{P} = \frac{dy}{Q} = \frac{dz}{R}$

BLOCK II

UNIT-8: **Linear differential equation of higher order:** Linear differential equation of higher order with constant coefficients, Method of variation of parameters.

UNIT-9: **Homogeneous linear differential equations:** Cauchy -Euler equations

UNIT-10: **Total differential Equation:** Introduction, Necessary and sufficient conditions for integrability of differential equation $Pdx + Qdy + Rdz = 0$,The conditions for the equation $Pdx + Qdy + Rdz = 0$ to be exact.

UNIT -11: **Partial differential equation**: Order and degree of partial differential equation, Formation of Partial differential equation,

UNIT-12: **Linear partial differential equation**: Solution of first order and first-degree partial differential equation, Lagrange's method.

UNIT-13: **Non-linear partial differential equation of order-I**: Standard form -I, II, III IV &V

UNIT-14: **Non-linear partial differential equation of order-II**: Charpit's Method

Reference Books:

1. Ordinary and partial differential equation, M.D. Raisinghania, S. Chand & company Ltd.
2. Advanced differential Equations, Sharma, A. K. Sharma Discovery Publishing House.
3. Higher Engineering Mathematics, B.V. Ramana, Tata McGraw Hill Education Private Ltd.

Semester III

Course Code: BMATH S3 03 (Th)
Course Title: ALGEBRA
Nature of the Course: DSC-3-3
Credit: 06
Marks: 100

BLOCK I

UNIT-1: Theory of equation-I: Polynomial equations, Relation between roots and coefficients and related problems, Symmetric functions of roots

UNIT -2: Theory of equation-II: Cardon's method of solution of cubic equation, Descartes' rule of sign, Cardan's Solution of the Standard cubic.

UNIT -3: Inequalities: Definition, properties, Inequalities involving arithmetic, geometric and harmonic means, Weirstrass inequalities and examples.

UNIT- 4: Determinant: Definition and examples, properties (without proof), problems on determinants (using properties).

UNIT-5: Matrices-I: Definition of Matrix and Examples, Types of matrices, Transpose of a matrix, symmetric and skew-symmetric matrix, algebra of matrices: Addition of matrices, scalar multiplication, subtraction of matrices, multiplication of matrices: Adjoint and inverse of a matrix and its existence.

UNIT- 6: Matrices-II: Canonical forms, Rank and nullity

UNIT- 7: Rank and Elementary Operations: Definition of rank of a matrix, Properties Elementary operations, Inverse Using Elementary operations.

BLOCK II

UNIT -8: System of Linear Equations -I: Solution of a system of linear equations by matrix method, Solution of a system of linear equations by Cramer's rule

Unit -9: System of linear equations-II: Gaussian Elimination Method

UNIT -10: Eigen Values and Eigen Vectors: Characteristic equation of a matrix, Characteristic matrix, Definition, properties of eigenvalues and eigenvectors, Cayley Hamilton.

UNIT-11: De Moivre's theorem and its application: The Complex Number Plane; De Moivre's Theorem; Determination of Roots using DeMoivre's Theorem

UNIT-12: Expansion of Trigonometric function: Expansion for cosine and sine.

UNIT-13: **Relation & Functions**: Relations and Types of relations, equivalence relation, function and types of function.

UNIT -14: **Binary Operation**: Definition, Types of binary operation

Reference Books:

1.Trigonometry, for B. A/B.Sc. Classes (1st Edition), N.P. Bali: Laxmi Publication (P) Ltd.
2. Trigonometry; (1st Edition), Hari Kishan: Atlantic Publishers.
3. Linear Algebra: Schum Solved Problems Series; Seymour Lipschitz: Tata McGraw Hill.
4. Higher Algebra (Classical):S. K. Mapa
5. A Text Book of Higher Algebra. Ray, H.S. Sharma
6. Trigonometry: A.R. Vasishta, S.K. Sharma

Semester IV

Course Code: BMATH S4 04 (Th)
Course Title: REAL ANALYSIS
Nature of the Course: DSC-3-4
Credit: 06
Marks: 100

BLOCK I

UNIT -1: Sets: Definition, finite and Infinite sets, Countable and uncountable sets, Real line, Intervals

UNIT -2: Countability of Sets: Denumerable sets, Countable and Uncountable set

UNIT-3: **Real number system-I:** Rational numbers**,** Real and complex numbers, Geometric representation of Real numbers, Order completeness of real numbers.

Unit-4: Order completeness of real numbers: The set of real numbers as a complete ordered field, Completeness axioms, Archimedean property of real numbers

UNIT-5: **Real number system-II:** Bounded and Unbounded subsets of real numbers, least upper bound or Supremum, Greatest lower bound or Infimum, Some properties of Supremum and Infimum, Existence of Suprema and Infima of bounded sets

UNIT-6: Limit point of a set: Open and Closed sets: Neighborhood of a point, properties of neighborhood, Interior point of a set, limit point of a set, open sets, closed sets

UNIT-7: Real Sequences-I: Definition, Range of a sequence, Finite and Infinite Sequences, Bounded and unbounded sequence, Convergent sequence, Divergent sequence, Oscillatory sequence, Monotonic sequence, Limit of a Sequence, Basic Theorems of Convergence of Monotonic Sequences.

BLOCK II

UNIT-8: Real Sequences-II: Cauchy's Sequence, Cauchy's general principle of Convergence, Supremum of a sequence, Infimum of a sequence, Limit superior and limit inferior of Sequence

UNIT-9: **Infinite Series-I**: Introduction, Convergent, divergent and oscillatory series, Cauchy's general principle of convergence of series,

UNIT-10: **Infinite Series-II**: Comparison tests for series of positive terms, The p-test for the series of the type $\sum(\frac{1}{n^p})$. D'Alembert's ratio test, Raabe's Test, Logarithmic Test, Cauchy's root test

UNIT-11: **Power Series**: Introduction, Convergence of power series, Interval of convergence, Radius of convergence, working rule for finding radius of convergence and interval of convergence.

Unit-12: Sequence of Functions: Sequence of real valued functions, Pointwise convergence of a sequence of functions, Uniform convergence of functions, Uniform bounded functions of sequence, Cauchy's criterion for uniform convergence

Unit-13: Tests for Uniform convergence of sequence of functions: Mn Test,

Unit-14: Series of real valued function: Introduction, Pointwise convergence of a series of functions, Uniform convergence of series of functions, Cauchy's criterion for uniform convergence of a series of functions, weierstrass's M-test.

Reference Books:

1. Elements of Real Analysis, Shanti Narayan.M.D. Raisinghania, S. Chand & Company Pvt.LtD
2. Real Analysis, Sunil K. Mittal, Sudhir K.Pundir, Pragati Prakashan.
3. Principles of Real Analysis, S.C. Malik: New Age International(P) Limited
4.Real Analysis, Dipak Chatterjee: Prentice Hall of India Prívate Limited

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Semester V

Course Code: BMATH S5 1A (Th)
Course Title: DISCRETE MATHEMATICS
Nature of the Course: DSE-3-1A
Credit: 06
Marks: 100

BLOCK I

Unit 1: Introduction to Mathematical Logic

Statements, logical connectives, truth tables.

Unit 2: Tautology & Contradiction

Tautologies, Contradictions, logical equivalence, Application to everyday reasoning

Unit 3: Counting principles

The pigeonhole principle, Counting principle

Unit 4: Permutation and Combination

Definitions of permutation and combination, simple example of permutation and combination

UNIT-5: **Group: Definitions** and Examples of groups, Properties of groups

UNIT- 6: **Subgroups:** Definition, Examples, Properties, cyclic groups,

UNIT- 7: **Group of permutation**: Definition of permutation, different kinds of permutation, permutation group.

BLOCK II

UNIT -8: **Cosets**: Definition, properties of cosets, Lagrange's Theorem on the order of a subgroup of a finite group.

UNIT- 9: **Normal subgroups &Quotient groups**: Definition and Examples, properties.

UNIT - 10: **Homomorphism of groups**: Definition and Examples, Properties of Homomorphism

UNIT- 11: Ring: Definitions and Examples of Rings, Properties of Ring

UNIT- 12: **Integral domain & Field:** Integral domains, Field and their properties.

UNIT- 13: **Vector Space**: Definition and Examples, Subspace, Properties, Linear dependence and Independence, Basis and Dimension.

UNIT- 14: **Boolean Algebra:** Definition, Basic Boolean algebra Laws, Boolean expression

Reference Books:

1. Higher Algebra (Abstract and Linear) (1994), S.K. Mapa: Ashok Prakashan.
2. A Course in Abstract Algebra: V.K. Khanna, S.K. Bhambri: Vikas Publishing House Pvt. Ltd.
3. Modern Algebra: Surajeet Singh, Qazi Zameeruddin Vikas Publishing House Pvt. Ltd.
4.Contemporary Algebra (1977), B.K. Tamuli: New Book Stall, Guwahati- 781 001.
5. Discrete Mathematics, J.K. Sharma: Macmillian Publishing India Ltd.

Course Code: BMATH S5 1B (Th)
Course Title: PROBABILITY AND STATISTICS
Nature of the Course: DSE-3-1B
Credit: 06
Marks: 100

BLOCK I

UNIT- 1: **Measures of Central tendency**: Introduction, Arithmetic mean (A.M.), Properties of arithmetic mean, Median, Mode, Geometric mean (G.M.), Harmonic mean (H.M.).

UNIT-2: **Measures of Dispersion**: Range, Quartile deviation, Mean deviation, Standard deviation, co-efficient of variation.

UNIT- 3: **Moments, Skewness & Kurtosis**: Moments, Moments –raw and central, Relation between raw and central moments, Skewness, Measures of skewness, kurtosis, Measures of kurtosis

UNIT-4: **Probability**: Basic terminology: Random experiment, sample space, events, Classical definition of probability, Axiomatic approach to probability. Some theorems on probability.

UNIT-5: **Conditional probability**: Multiplication theorem of probability, independent events, Multiplication theorem of probability for independent events, Extension of multiplication theorem of probability, Law of Total probability, Bayes theorem.

UNIT- 6: **Random variables and probability distribution:** Definition (discrete and continuous type)

UNIT -7: Theoretical Distribution-I: Standard Distributions: Discrete type Bernoulli, Binomial, Poisson distributions (definition, properties and applications).

UNIT- 8: **Theoretical Distribution-II**: Continuous type, Normal (definition, properties and application), related problems.

BLOCK II

Unit-9: Correlation: Definition, Correlation coefficient, Types of Correlation, Scatter diagram, Karl Pearson coefficient of correlation, properties, Spearman's rank correlation coefficient

Unit-10: Regression: Definition, Simple linear regression, Formation of regression lines, Correlation vs regression, Regression coefficients

Unit-11: Sampling: Definition, Basics of sampling distribution

Unit-12: Basics of Testing of Hypothesis: Test of a hypothesis, Null and alternative hypothesis, Simple and composite hypothesis, Test statistic, critical value(s) and critical region test statistic, Type I and Type II errors, Level of significance

Unit-13: Large Sample Tests: Central limit theorem and its uses in testing of hypothesis, critical or significant values, testing for proportions, testing for means and standard deviations

Unit-14: Small Sample Tests: Test for single mean, t-test for difference of means, paired t-test for difference of means, t-test for significance of an observed sample correlation coefficient-distribution-test for equality of population variances

Unit-15: Test based on Chi-square(χ^2) :Chi-square test of goodness of fit, Chi-square test for independence of attributes, Chi-square test for population variance

Reference Books:

1.An introduction to commercial Mathematics and statistics - Dr. Ajanta Mazumder, Dr. Runjan Phookun.

S. Chand and Company Lt. R New Delhi.

2. Business Statistics - Dr. Nityananda Barman, Assam Book Depot.

3. Elementary statistics, H.C. Saxena, S. Chand & Company Ltd., 2002.

4. Basic Statistics, B.L. Agarwal, New Age International Publishers, 2009

5.Biostatistics, P.N. Arora and Dr. P.K. Maihan, Himalaya Publishing House, 2010.

6. Fundamental of Statistics volume -1, A.M. Gun, M.K. Gupta, V.K. Kapoor, Sultan chand & Sons, 2009.

Semester VI

Course Code: BMATH S6 1A (Th)
Course Title: OPERATIONS RESEARCH
Nature of the Course: DSE-3-2A
Credit: 06
Marks: 100

BLOCK I

UNIT 1: Introduction to operations research I

Origin and Development of Operations Research (OR), Nature and Features of Operations Research, Scientific Method in OR, Application of OR, Opportunities and Shortcomings in OR

UNIT 2: Introduction to operations research II

Modelling in OR, Classification of Models, Advantages and Limitations of Models, General solution methods to OR models.

UNIT 3: Linear programming problem (LPP)

Linear programming problem (LPP), General form of Linear programming problem (LPP), Some important definitions, Basic assumption of LPP, Application of LPP, Limitations of LPP, Mathematical formulation of a LPP

UNIT 4: Graphical method of solution for LPP

Some basic definition, Graphical methods to solve LPP, Some special cases, Limitations of graphical method

UNIT 5: Simplex Method

Standard Form of Linear Programming Problem (LPP), General LPP, Canonical and Standard Forms of LPP, Solution of LPP, Fundamental Theorem of LPP, the Simplex Algorithm, Big-M Method, Two-Phase Method

BLOCK II

UNIT 6: Duality in Linear programming problem

Importance of Duality Concepts, Formulation of Dual Problem, Economic Interpretation of Duality, Sensitivity Analysis

UNIT 7: Transportation Problem

Formulation of Transportation Problem (TP), Basic Theorems on TP, Initial Basic Feasible Solution: North-West Corner Method, Matrix-Minima Method, Vogel Approximation Method, Optimality Test, Algorithm of MODI Method

UNIT 8: Assignment problem

Formulation of an Assignment Problem, Assignment Problem as a Special Case of Transportation Problem, Solution of an Assignment Problem, The Hungarian Method of Solution of an Assignment Problem, The Travelling Salesman Problem (Shortest Cyclic Route Model)

UNIT 9: Game theory

Competitive Situations, Characteristics of Competitive Games, Two-Person Game, Two-Person Zero-Sum Game, Pay-off Matrix, Strategy, Maximin and Minimax Principle, Saddle Point, Value of a Game, and Symmetric Game, Dominance Property

Unit 10: Project Scheduling and PERT, CPM

Project, Project planning, Project Scheduling Network and its basic components, Procedure relationship, CPM, PERT, Basic difference between PERT and CPM

Reference Books:

1.Linear Programming and Game Theory (2008) by DC Sanyal, K. Das (U N Dhur & Sons Private Ltd. Kolkata 700073)
2.Operations Research: Prem Kuman Gupta, D. S. Hira :S. Chand &Company Ltd.
3.Operations Research: Kanti Swarup, P. K. Gupta, Man Mohan (Sultan Chand and Sons)
4.Panneerselvam: Operations Research (2006), Prentice Hall of India Private Limited, New Delhi.

Course Code: BMATH S6 1B (Th)
Course Title: ANALYTICAL GEOMETRY AND VECTOR CALCULUS
Nature of the Course: DSE-3-2B
Credit: 06
Marks: 100

BLOCK I

UNIT-1: Introduction of straight lines: Slope of a line, Various standard forms of equation of straight lines.

UNIT -2: Transformation of coordinate axes: Translation and rotation, Related theories and problems.

UNIT-3: **Pair of straight lines**: Pair of straight lines though origin, Angle and Bisectors of the angle between the lines given by homogenous equation of 2nd degree, Condition for the general equation of second degree to represent a pair of straight lines, Pair of intersecting straight lines, Pair of parallel straight lines.

UNIT-4: **Circle**: Second degree equation of a circle, Equation of a circle when end points of its diameter is given, tangent and normal

UNIT-5: **Conic sections**: Parabola and its standard equation, Ellipse and its standard equation, hyperbola and its standard equation, Conjugate Hyperbola, Conjugate Diameter for Ellipse and Hyperbola.

UNIT-6: **Introduction of co-ordinate in three dimensions**: Coordinate axes, Direction cosine of a line, direction ratio of a line

UNIT -7: The Plane: Equation of a plane, Various forms of the equation of a plane

UNIT 8: The straight line: The straight line, The shortest distance (S.D) between two lines

BLOCK II

UNIT- 9: **Sphere**: Definition and General equation of Sphere.

UNIT -10: Cone: Definition and General equation of Cone.

UNIT -11: **Cylinder**: Definition and General equation of Cylinder.

UNIT-12: Introduction to Vectors: Classification of vectors, Algebra of vectors: Addition of vectors, subtraction of vectors, Multiplication vectors by scalars.

UNIT-13: **Product of vectors-I**: Scalar or dot product and cross or vector product of two vectors, Properties and problems.

UNIT -14: Product of vectors-II: Geometrical meaning of scalar triple product, product of four vectors.

UNIT -15: Vector Calculus: Scalar and Vector point function, Vector differential operator (del), Gradient, divergence and Curl and their Identities, Laplacian operator.

Reference Books:

1.Analytical Geometry of Two & Three Dimensions & Vector Analysis. Khan New Central Book Agency (P) Limited.

2.Coordinate Geometry of Two dimensions. Hari Kishan: Atlantic Publishers & Distributors.

3.Vector Algebra and Calculus. Hari Kishan: Atlantic Publishers & Distributors (P) Ltd.

4.A Textbook of Vector Calculus. Shanti Narayan

5.Vector Analysis. Pandey: Discovery Publishing House.

6.Coordinate Geometry (2D). A.K. Sharma: Discovery Publishing House.

7.Textbook of Vector Calculus. A.K. Sharma: Discovery Publishing House.

8.Analytical Geometry of Three Dimensions (Coordinate of Solid Geometry). A.R. Vasishta, D.C. Agrawal.

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Annexure - 5

KRISHNA KANTA HANDIQUI STATE OPEN UNIVERSITY
N.H. 37, Khanapara, Guwahati-781022, Assam

B.Sc. General Programme with COMPUTER SCIENCE

CBCS Syllabus

For

B.Sc. in
COMPUTER SCIENCE
without MAJOR in any discipline

2021

Detailed Syllabus of Computer Science

DISCIPLINE SPECIFIC CORE COURSE (All compulsory)

Credit: 06 each

- Course **BCOMP S1 01**: Problem Solving using Computers + Lab (4 + 2 Lab)
- Course **BCOMP S2 02**: Database Management Systems + Lab (4 + 2 Lab)
- Course **BCOMP S3 03**: Operating Systems + Lab(4 + 2 Lab)
- Course **BCOMP S4 04**: Computer System Architecture + Lab (4 + 2 Lab)

*(4+ 2 Lab) means 4 credits are allocated for Theory and 2 credits are allocated for Laboratory/Practicals

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Semester I

Course Code: BCOMP S1 01 (Th)
Course Title: Problem Solving using Computers
Nature of the Course: DSC
Credit: 04
Marks: 100

UNIT 1: Computer Fundamentals: Introduction to Computers: Characteristics of Computers, Uses of computers, Types and generations of Computers.

UNIT 2: Basic Computer Organization: Units of a computer – ALU, Control Unit, Memory unit, Input and Output unit; Memory hierarchy, Registers, I/Odevices.

UNIT 3: Planning the Computer Program: Concept of problem solving, Problem definition, Program design, Debugging, Types of errors inprogramming,Documentation

UNIT 4: Techniques of Problem Solving : Flowcharting, decision table, algorithms, Structured programming concepts, Programming methodologies viz. top-down and bottom-up programming, Procedural and Object oriented programming.

UNIT 5: Installation of Python : Python Installation, Working with Google Colab, Anaconda-Installation, Working with Jupyter Notebook, Spyder

UNIT 6: Introduction to Python : Python Interpreter, Using Python as calculator, Python shell, Indentation. Atoms, Identifiers and keywords, Literals, Strings

UNIT 7: Operators : Arithmetic operator, Relational operator, Logical or Boolean operator, Assignment operator, Bit wise operator, Identity and Membership operator.

UNIT 8: Python Programs: Input and Output Statements, Control statements, Conditional Statements-if...else, Nested if statements, Ternary Operators.

UNIT 9: Loop Control Statements: Looping- while Loop, for Loop, Loop Control, break, continue andpass.

UNIT 10: Structures: Structures, Numbers, Strings, Lists, Tuples, Dictionary, Date & Time, Modules

UNIT 11: Functions : Defining Functions, Python Built-in Functions, Python User-defined Functions, Exit function,defaultarguments.

UNIT 12: Classes and Objects : Definition of Classes and Objects, Python Inheritance, Different types of Inheritance with examples

UNIT 13: Advanced Python: Regular Expressions- RegEx Functions, Metacharacters; Event Driven Programming, Python Module – Asyncio

UNIT 14: GUI Programming: GUI Programming, Creating a GUI application using Tkinter, Working with Widgets, Making Your Applications Interactive: Events and Event Handlers

Reference Books:

1. P. K. Sinha & Priti Sinha , "Computer Fundamentals", BPB Publications,2007.
2. Dr. Anita Goel, Computer Fundamentals, Pearson Education,2010.
3. T. Budd, Exploring Python, TMH, 1st Ed, 2011
4. Python Tutorial/Documentation www.python.or2010
5. Allen Downey, Jeffrey Elkner, Chris Meyers , How to think like a computer scientist: learning with Python , Freely availableonline.2012
6. http://docs.python.org/3/tutorial/index.html
7. http://interactivepython.org/courselib/static/pythonds
8. http://www.ibiblio.org/g2swap/byteofpython/read/

Course Code: BCOMP S1 01 (Lab)
Course Title: Software Lab using Python (LAB)
Nature of the Course: DSC
Credit: 02
Marks: 50

List of Programs:

Section: A (Simple programs)

1. WAP to display the first n terms of Fibonacci series.
2. WAP to find factorial of the givennumber.
3. WAP to find sum of the following series forn terms: 1 – 2/2!+3/3! ----------n/n!
4. WAP to calculate the sum and product of two compatiblematrices.
5. Write a menu driven program to convert the given temperature from Fahrenheit to Celsius and vice versa depending upon user'schoice.
6. WAP to calculate total marks, percentage and grade of a student. Marks obtained in each of the three subjects are to be input by the user. Assign grades according to the following criteria:

Grade A: Percentage >=80Grade B: Percentage>=70 and <80
Grade C: Percentage>=60 and <70 Grade D: Percentage>=40 and <60 Grade E: Percentage<40

7. Write a menu-driven program, using user-defined functions to find the area of rectangle, square, circle and triangle by accepting suitable input parameters from user.

Section: B (Visual Python):
All the programs should be written using user defined functions, wherever possible.

1. Write a menu-driven program to create mathematical 3Dobjects
   i. curve
   ii. sphere
   iii. cone
   iv. arrow
   v. ring
   vi. cylinder.

2. WAP to read n integers and display them as ahistogram.
3. WAP to display sine, cosine, polynomial and exponentialcurves.
4. WAP to plot a graph of people with pulse rate p vs. height h. The values of p and h are to be entered by theuser.
5. WAP to calculate the mass m in a chemical reaction. The mass m (in gms) disintegrates according to the formula m=60/(t+2), where t is the time in hours. Sketch a graph for t vs. m, wheret>=0.
6. A population of 1000 bacteria is introduced into a nutrient medium. The population p grows asfollows:P(t) = (15000(1+t))/(15+ *e)*where the time t is measured in hours. WAP to determine the size of the population at given time t and plot a graph for P vs t for the specified time interval.
7. Input initial velocity and acceleration, and plot the following graphs depicting equations ofmotion:
   i. velocity wrt time(v=u+at)
   ii. distance wrt time (s=u*t+0.5*a*t*t)
   iii. distance wrt velocity (s=(v*v-u*u)/2*a)

Semester II

Course Code: BCOMP S2 02 (Th)
Course Title: Database Management Systems
Nature of the Course: DSC
Credit: 04
Marks: 100

UNIT 1: Introduction to Database Management Systems: Traditional File approach, Characteristics of database approach, data models: Conceptual model, Logical model, Physical model

UNIT 2: DBMS Architecture: Data independence, Database Architecture, The Three levels of Architecture, Database Administrator, The Database Management System, Types of DBMS, Merits and demerits of DBMS.

UNIT 3: Entity Relationship and Enhanced ER Modeling: Entity Set, Attribute, Relationship and relationship Set, Mapping cardinalities, participation constraints,Entity Relationship Diagram (ERD), Extended Features of ERD

UNIT 4: Database Schema: Schema Definition, constraints, and object modeling

UNIT 5: Relational Data Model: Basic concepts, Relational constraints- Integrity and domain constraints, Relational Data Model; Terms: Relation, Tuple, Attribute, Cardinality, Degree, Domain;

UNIT 6: Keys: Super Key, Candidate Key, Primary Key, Foreign Key

UNIT 7: Relational Algebra: Relational algebra, Operations: Select, Project, Union, Difference, Intersection, Cartesian Product, Natural Join.

UNIT 8: Database Design: ER and EER to relational mapping, Database Design Guidelines, Anomalies in Database

UNIT 9: Functional Dependencies: Functional dependencies, Types of functional dependencies: Trivial FD, Full Functional Dependency, Partial Dependency, Transitive Dependency, Multi-Valued Dependency.

UNIT 10: Normalization: Normalization, First Normal form (1NF), Second Normal form (2NF), Third Normal form (3NF), Boyce-Codd Normal form (BCNF)

UNIT 11: SQL commands: DDL: Structured Query Language (SQL), Characteristics of SQL, Advantages of SQL, SQL Data types, Types of SQL commands, DDL, DML, Create table, alter table, drop table

UNIT 12: SQL commands: DML Part I: Select, update, delete, insert statements; Condition specification using Boolean and comparison operators (and, or, not,=,<>,>,<,>=,<=); Arithmetic operators and aggregate functions(Count, sum, avg, Min, Max).

UNIT 13: SQL commands: DML Part II: Multiple table queries (join on different and same tables); Nested select statements.

UNIT 14: SQL commands: DML Part III: Set manipulation using (any, in, contains, all, not in, not contains, exists, not exists, union, intersect, minus, etc.); Categorization using group by……..having; Arranging using order by clauses.

Books Recommended:

1. R. Elmasri, S.B. Navathe, Fundamentals of Database Systems 6th Edition, Pearson Education,2010.
2. R. Ramakrishanan, J. Gehrke, Database Management Systems, 3rd Edition, McGraw-Hill, 2002
3. A. Silberschatz, H.F. Korth, S. Sudarshan, Database System Concepts, 6th Edition, McGraw-Hill, 2010.
4. R.Elmasri,S.B.NavatheDatabaseSystemsModels,Languages,Designandapplication Programming,6th Edition, Pearson Education, 2013.

Course Code: BCOMP S2 02 (Lab)
Course Title: Database Management Systems (LAB)
Nature of the Course: DSC
Credit: 02
Marks: 50

Note: MyAccess/MySQL may be used.

The following concepts must be introduced to the students:

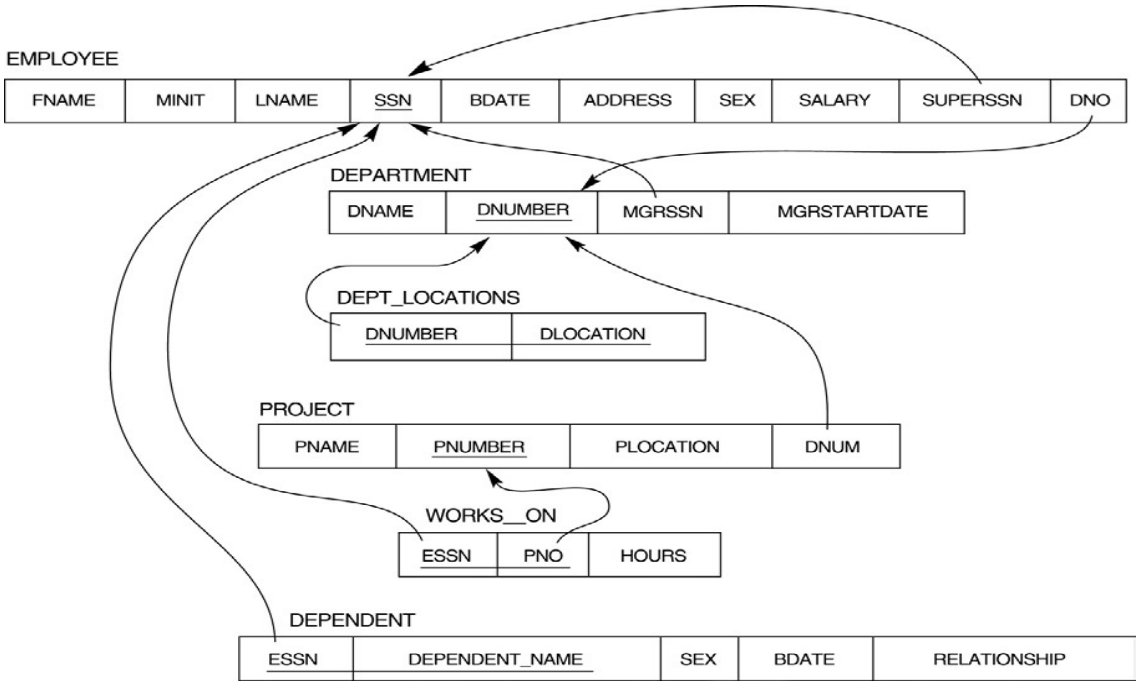
DDL Commands

- Create table, alter table, droptable

DML Commands

- Select , update, delete, insertstatements
- Condition specification using Boolean and comparison operators (and,or, not,=,<>, >,<,>=,<=)
- Arithmetic operators and aggregate functions(Count, sum, avg, Min,Max)
- Multiple table queries (join on different and sametables)
- Nested selectstatements
- Set manipulation using (any, in, contains, all, not in, not contains, exists, not exists, union, intersect, minus,etc.)
- Categorization usinggroup by ..... having
- Arranging using orderby

Relational Database Schema - COMPANY



Questions to be performed on above schema

A. Create tables with relevant foreign keyconstraints

B. Populate the tables withdata

C. Perform the following queries on the database:

1. Display all the details of all employees working in thecompany.
2. Display ssn, lname, fname, address of employees who work in department no7.
3. Retrieve the birthdate and address of the employee whose name is 'Franklin T. Wong'
4. Retrieve the name and salary of everyemployee
5. Retrieve all distinct salaryvalues
6. Retrieve all employee names whose address is in‘Bellaire’
7. Retrieve all employees who were born during the1950s
8. Retrieve all employees in department 5 whose salary is between 50,000and 60,000(inclusive)
9. Retrieve the names of all employees who do not havesupervisors
10. Retrieve SSN and department name for allemployees

11. Retrieve the name and address of all employees who work for the 'Research' department

12. For every project located in 'Stafford', list the project number, the controlling department number, and the department manager's last name, address, andbirthdate.

13. For each employee, retrieve the employee's name, and the name of his or her immediatesupervisor.

14. Retrieve all combinations of Employee Name and DepartmentName

15. Make a list of all project numbers for projects that involve an employee whose last name is 'Narayan' either as a worker or as a manager of the department that controls theproject.

16. Increase the salary of all employees working on the 'ProductX' project by 15%. Retrieve employee name and increased salary of theseemployees.

17. Retrieve a list of employees and the project name each works in, ordered by the employee's department, and within each department ordered alphabetically by employee firstname.

18. Select the names of employees whose salary does not match with salary of any employee in department10.

19. Retrieve the name of each employee who has a dependent with the same first name and same sex as theemployee.

20. Retrieve the employee numbers of all employees who work on project located in Bellaire, Houston, orStafford.

21. Find the sum of the salaries of all employees, the maximum salary, the minimum salary, and the average salary. Display with properheadings

22. Find the sum of the salaries and number of employees of all employees of the 'Marketing' department, as well as the maximum salary, the minimum salary, and the average salary in thisdepartment.

23. Select the names of employees whose salary is greater than the average salary of all employees in department10.

24. For each department, retrieve the department number, the number of employees in the department, and their averagesalary.

25. For each project, retrieve the project number, the project name, and the number of employees who work on thatproject.

26. Change the location and controlling department number for all projects having more than 5 employees to 'Bellaire' and 6respectively.

27. For each department having more than 10 employees, retrieve the department no, no of employees drawing more than 40,000 assalary.

28. Insert a record in Project table which violates referential integrity constraint with respect to

Department number. Now remove the violation by making necessary insertion in the Departmenttable.

29. Delete all dependents of employee whose ssn is‘123456789’.

30. Delete an employee from Employee table with ssn = ‘12345’(make sure that this employee has some dependents, is working on some project, is a manager of some department and is supervising some employees). Check and display the cascading effect on Dependent and Work on table. In Department table MGRSSN should be set to default value and in Employee table SUPERSSN should be set toNULL

31. Perform a query using alter command to drop/add field and a constraint inEmployee table.

Semester III

Course Code: BCOMP S3 03 (Th)
Course Title: Operating Systems
Nature of the Course: DSC
Credit: 04
Marks: 100

UNIT 1: Introduction to OS: System Software, Resource Abstraction,OSstrategies, Definition of OS, Objectives and Functions of OS.

UNIT 2: Types of operating systems: Types of operating systems, Multiprogramming, Batch, Time Sharing, Single user and Multiuser, Process Control & RealTimeSystems.

UNIT 3: Process Management : Concept of process, Process life cycle, Process Control Block (PCB), Creation and termination of Process, Concept of Threads, Uses of Thread, Design Issues of Thread, Thread Management

UNIT 4: Inter-process Communication: Inter-process Communication, Message passing model, shared memory model

UNIT 5: Process synchronization and Co-ordination: Concept of race conditions, critical-sections, mutual exclusion, Solution to critical section problem, disabling interrupt, Peterson’s solution, Sleep & Wake up, The Producer Consumer Problem

UNIT 6: Scheduling: Scheduling Mechanisms, Strategy selection, non-pre-emptive and pre-emptive strategies. Scheduling algorithms: first come first serve (FCFS), shortest job first (SJF)

UNIT 7: Memory Management: Mapping address space to memory space, memory allocation strategies, fixed partition, variable partition.

UNIT 8: Paging: Paging,Basic Concepts of Paging, Page Tables, Address Translation in Paging, Page replacement, Virtualmemory

UNIT 9: Introduction to Shell: Shell and various type of shell, various editors present inLinux, Different modes of operation in *vi*editor

UNIT 10:Shell Scripting: Shell script, Writing and executing the shellscript, Shell variable (user defined and systemvariables)

UNIT 11:System Calls: System calls, Different types of System call, Examples Using systemcalls, Pipes andFilters

UNIT 12:Decision and Control Statements: Decision making in Shell Scripts (If else, switch), Loops inshell

UNIT 13:Functions: Functions, definition, Examples using functions

UNIT 14:Utility programs: Utility programs (cut, paste, join, tr ,uniqutilities), Pattern matching utility(grep)

Books Recommended:

1. A Silberschatz, P.B. Galvin, G. Gagne, Operating Systems Concepts, 8thEdition, John Wiley Publications2008.
2. A.S. Tanenbaum, Modern Operating Systems, 3rdEdition, Pearson Education 2007
3. G. Nutt, Operating Systems: A Modern Perspective, 2ndEdition Pearson Education1997.
4. W.Stallings,OperatingSystems,Internals&DesignPrinciples,5thEdition, Prentice Hall of India. 2008.
5. M. Milenkovic, Operating Systems- Concepts and design, Tata McGraw Hill1992.

Course Code: BCOMP S3 03 (Lab)
Course Title: Operating Systems (LAB)
Nature of the Course: DSC
Credit: 02
Marks: 50

Software Lab based on Operating Systems

Note: Following exercises can be performed using Linux or Unix

1. Usage of following commands: ls, pwd, tty, cat, who, whoami, rm, mkdir, rmdir, touch, cd.
2. Usage of following commands: cal, cat(append), cat(concatenate), mv, cp, man, date.
3. Usage of following commands: chmod, grep, tput (clear, highlight), bc.
4. Write a shell script to check if the number entered at the command line is prime ornot.
5. Write a shell script to modify "cal" command to display calendars of the specified months.

6. Write a shell script to modify “cal” command to display calendars of the specified range ofmonths.
7. Write a shell script to accept a login name. If not a valid login name display message – “Entered login name isinvalid”.
8. Write a shell script to display date in the mm/dd/yy format.
9. Write a shell script to display on the screen sorted output of “who” command along with the total number of users.
10. Write a shell script to display the multiplication table of any number.
11. Write a shell script to compare two files and if found equal asks the user to delete the duplicate file.
12. Write a shell script to find the sum of digits of a given number.
13. Write a shell script to merge the contents of three files, sort the contents and then display them page bypage.
14. Write a shell script to find the LCD (least common divisor) of two numbers.
15. Write a shell script to perform the tasks of basic calculator.
16. Write a shell script to find the power of a given number.
17. Write a shell script to find the factorial of a given number.
18. Write a shell script to check whether the number is Armstrong ornot.
19. Write a shell script to check whether the file have all the permissions or not.
20. Program to show the pyramid of special character“*”.

Semester IV

Course Code: BCOMP S4 04 (Th)
Course Title: Computer System Architecture
Nature of the Course: DSC
Credit: 04
Marks: 100

UNIT 1: Introduction to Number systems: Number System; Categories of Number System: Decimal, Binary, Octal and Hexadecimal Number System; Number System Conversion: Binary to Decimal Conversion, Decimal to Binary Conversion, Octal to Decimal Conversion, Decimal to Octal Conversion, Octal to Binary Conversion, Binary to Octal Conversion, Hexadecimal to Decimal Conversion, Decimal to Hexadecimal Conversion, Hexadecimal to Binary Conversion, Binary to Hexadecimal Conversion

UNIT 2: Complements of Numbers: (r–1)’s Complement, r’s Complement, 1’s Complement, 2’s Complement.

UNIT 3: Data Representation: Fixed and floating point representation, character representation

UNIT 4: Binary Arithmetic: Binary addition, subtraction, magnitudecomparison.

UNIT 5: Logic Gates: Basic gates: AND Gate, OR Gate and NOT Gate, Truth Table, NAND Gate, NOR Gate, XOR Gate, XNOR Gate; Universal Logic Gates, Conversion of Logic Gates into Universal Logic gates

UNIT 6: Boolean Algebra: Boolean Algebra; Properties of Boolean Algebra; De-Morgan's Theorem.

UNIT 7: Simplification of Boolean Function: Boolean Expression; Canonical Form and Standard Form: Minterms and Maxterms, SOP, POS, Conversion of SOP to Sum of Minterm, Conversion of POS to Product of Maxterm; Simplification of Boolean Expression: Algebraic Method, Karnaugh Map

UNIT 8: Combinational Circuits I: Combinational Circuit; Half-Adder and Full-Adder; Half-Subtractor and Full-Subtractor

UNIT 9: Combinational Circuits II: Decoders, Encoders, Multiplexers, and Memory(ROM).

UNIT 10: Sequential Circuits: Flip-flops and sequential circuits, Synchronous and Asynchronous Sequential Circuit; Flip-Flop: RS Flip-Flop, D Flip-Flop, JK and Master slave flip flop.

UNIT 11: Basic Computer Organization and Design: Computer registers, bus system, instruction set, timing and control, instruction cycle, memory reference, input-output and interrupt.

UNIT 12: Central Processing Unit: Register organization, arithmetic and logical micro-operations, stack organization, microprogrammedcontrol.

UNIT 13: Programming the Basic Computer: Instruction formats, addressing modes, instruction codes, machine language, assembly language, inputoutputprogramming.

UNIT 14: Input-output Organization: Peripheral devices, I/O interface, Modes of data transfer, directmemoryaccess.

Books Recommended:

1. M. Mano, Computer System Architecture, Pearson Education1992.
2. A. J. Dos Reis, Assembly Language and Computer Architecture using C++ and JAVA, Course Technology,2004
3. W. Stallings, Computer Organization and Architecture Designing for Performance, 8thEdition, Prentice Hall of India,2009
4. Digital Design, M.M. Mano, Pearson Education Asia,1979

Course Code: BCOMP S4 04 (Lab)
Course Title: Computer System Architecture (LAB)
Nature of the Course: DSC
Credit: 02
Marks: 50

Memory 4096 words 16 bits per word	Instruction format 0 3 4 15 Opcode Address

Basic Computer Instructions

Memory Reference	Register Reference	Input-Output

1. Create a machine based on the following architecture:
Register Set

IR	DR	AC	AR	PC	FGI	FGO	S	I	E
0 15	0 15	0 15	011	011	1 Bit	1 Bit	1Bit	1 bit	1 Bit

Symbol	Hex		Symbol	Hex	Symbol	Hex
AND	0xxx		CLA	E800	INP	F80 0
ADD	2xxx		CLE	E400	OUT	F40 0
ISZ	Cxxx		INC	E020		
AND_I	1xxx		SPA	E010		
ADD_I	3xxx		SNA	E008		
LDA_I	5xxx	Indirect	SZA	E004		
STA_I	7xxx	Addressing	SZE	E002		
BUN_I	9xxx		HLT	E001		
BSA_I	Bxxx					
ISZ_I	Dxxx					

Refer to Chapter-5 of Morris Mano for description of instructions.

ii) Create the micro operations and associate with instructions as given in the chapter (except interrupts). Design the register set, memory and the instruction set. Use this machine for the assignments of thissection.

iii) Create a Fetch routine of the instructioncycle.

iv) Simulate the machine to determine the contents of AC, E, PC, AR and IR registers in hexadecimal after the execution of each of following register referenceinstructions:

a. CLA	e. CIR	i. SNA
b. CLE	f. CIL	j. SZA
c. CMA	g. INC	k. SZE
d. CME	h. SPA	l. HLT

Initialize the contents of AC to $(A937)_{16}$, that of PC to $(022)_{16}$ and E to 1.

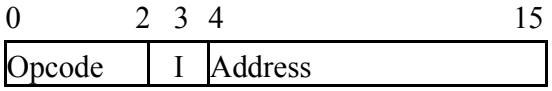
5. Simulate the machine for the following memory-reference instructions with I= 0 and address part = 082. The instruction to be stored at address 022 in RAM. Initialize the memory word at address 082 with the operand B8F2 and AC with A937. Determine the contents of AC, DR, PC, AR and IR in hexadecimal after theexecution.

a. ADD	f.BSA
b. AND	g.ISZ
c. LDA	
d. STA	
e. BUN	

6. Simulate the machine for the memory-reference instructions referred in above question with I= 1 and address part = 082. The instruction to be stored at address 026 in RAM. Initialize the memory word at address 082 with the value 298. Initialize the memory word at address 298 with operand B8F2 and AC with A937. Determine the contents of AC, DR, PC, AR and IRin hexadecimal after theexecution.

7. Modify the machine created in Practical 1 according to the following instructionformat:

Instruction format



a. The instruction format contains a 3-bit opcode, a 1-bit addressing mode and a 12-bit address. There are only two addressing modes, I = 0 (direct addressing) and I = 1 (indirectaddressing).

b. Create a new register I of 1bit.

c. Create two new microinstructions as follows:

i. Check the opcode of instruction to determine type of instruction (Memory Reference/Register Reference/Input-Output) and then jumpaccordingly.
ii. Check the I bit to determine the addressing mode and then jumpaccordingly.

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DISCIPLINE SPECIFIC ELECTIVES – COMPUTER SCIENCE

Credit: 06 each

Learners need to choose one option from the discipline specific electives offered in that particular semester

Course for 5th Semester (Any one from the following)
- Course **BCOMP S5 1A** :Programming in JAVA (4 + 2 Lab)
- Course **BCOMP S5 1B** :Data Structures and Analysis of Algorithms (4 + 2 Lab)

Course for 6th semester (Any one from the following)
- Course **BCOMP S6 1A** :Computer Networks (4+2 Lab)
- Course **BCOMP S61B** :Project Work(6 credit)

*(4 + 2 Lab) means 4 credits are allocated for Theory and 2 credits are allocated for Laboratory/Practicals

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Semester V

Course Code: BCOMP S5 1A (Th)
Course Title: Programming in JAVA
Nature of the Course: DSE
Credit: 04
Marks: 100

UNIT 1: Introduction to Java: Introduction to Java, Features of Java, JDK Environment

UNIT 2: Object Oriented Programming Concepts: Overview of Programming, Paradigm, Classes, Abstraction, Encapsulation, Inheritance, Polymorphism, Difference between C++ and JAVA.

UNIT 3: Java Programming Fundamentals: Structure of java program, Data types, Variables, Operators, Keywords, Naming Convention

UNIT 4: Decision and Control Statements: Decision Making (if, switch),Looping(for, while),Type Casting.

UNIT 5: Classes and Objects: Definition of Classes and Objects,Creating Classes and objects, Memory allocation for objects.

UNIT 6: Constructor: Constructor, Types of constructors in Java, copy constructor.

UNIT 7: Inheritance and Polymorphism: Inheritance basics, Multilevel Inheritance, Polymorphism, Implementation of Inheritance, Implementation of Polymorphism

UNIT 8: Method Overloading and Overriding: Method Overloading, Method Overriding, Nested and Inner classes

UNIT 9: Arrays: Arrays, Creating an array, Initializing Arrays, System Array copy(), Multi-Dimensional Arrays

UNIT 10: Strings: Strings: string arrays, String class Methods, String Buffer methods.

UNIT 11: Interface and Packages: Modifiers and Access Control, Abstract classes and methods, Interfaces, Packages Concept, Creating user defined packages

UNIT 12: Exception Handling: Exception types, Using try catch and multiple catch, Nested try, throw, throws and finally, Creating User defined Exceptions.

UNIT 13: File Handling: Byte Stream, Character Stream, File IO Basics, File Operations, Creating file, Reading file, Writing File

UNIT 14: Applet Programming: Introduction, Types Applet, Applet Life cycle, Creating Applet, Applet tag

Books Recommended:

1. Ivan Bayross, Web Enabled Commercial Application Development Using Html, Dhtml,javascript, Perl Cgi , BPB Publications, 2009.
2. Cay Horstmann, BIG Java, Wiley Publication , 3rd Edition., 2009
3. Herbert Schildt , Java 7, The Complete Reference, , 8th Edition, 2009.
4. E Balagurusamy , Programming with JAVA, TMH, 2007

Course Code: BCOMP S5 1A (Lab)
Course Title: Programming in JAVA (LAB)
Nature of the Course: DSE
Credit: 02
Marks: 50

Software Lab based on Java

1. WAP to find the largest of n naturalnumbers.
2. WAP to find whether a given number is prime ornot.
3. WAP to print the sum and product of digits of an Integer and reverse theInteger.
4. Write a menu driven program for following:
    a. Display a Fibonacciseries
    b. Compute Factorial of anumber
    c. WAP to check whether a given number is odd oreven.
    d. WAP to check whether a given string is palindrome ornot.
5. Write a program to create an array of 10 integers. Accept values from the user in that array. Input another number from the user and find out how many numbers are equal to the number passed, how many are greater and how many are less than the numberpassed.
6. Write a program that will prompt the user for a list of 5 prices. Compute the average of the prices and find out all the prices that are higher than the calculatedaverage.
7. Write a program in java to input N numbers in an array and print out the Armstrong numbers from theset.
8. Write java program for the following matrixoperations:
    a. Addition of twomatrices
    b. Summation of twomatrices
    c. Transpose of amatrix
    d. Input the elements of matrices fromuser.
9. Write a java program that computes the area of a circle, rectangle and a Cylinder using functionoverloading.
10. Write a Java for the implementation of Multiple inheritance using interfaces to calculate the area of a rectangle andtriangle.
11. Write a java program to create a frame window in an Applet. Display your name, address and qualification in the framewindow.
12. Write a java program to draw a line between two coordinates in awindow.
13. Write a java program to display the following graphics in an appletwindow.
    a. Rectangles
    b. Circles
    c. Ellipses
    d. Arcs
    e. Polygons
14. Write a program that reads two integer numbers for the variables a and b. If any other character except number (0-9) is entered then the error is caught by NumberFormatException object. After that ex.getMessage() prints the information about the error occurringcauses.
15. Write a program for the following stringoperations:

a. Compare twostrings
b. Concatenate twostrings
c. Compute length of astring

16. Create a class called Fraction that can be used to represent the ratio of two integers. Include appropriate constructors and methods. If the denominator becomes zero, throw and handle an exception.

Course Code: BCOMP S5 1B (Th)
Course Title: Data Structures and Analysis of Algorithms
Nature of the Course: DSE
Credit: 04
Marks: 100

Block 1: Data Structures

UNIT 1: Introduction to Data Structure: Basic concept of data, Data type, Abstract Data Type, Types of Data Structure, Dynamic Memory Allocation.

UNIT 2: Arrays: Single and Multi-dimensional Arrays (2-D arrays), Memory representation, Address translation functions, Applications of array, Random accessing of array element, Sparse Matrices, Array Traversal, Search, Problems associated with Insertion and Deletion, Sorting, Reversing, Merging.

UNIT 3: LinkedLists: Singly Linked List, Important terms associated with Linked list, Representation of Singly linked list using Static and Dynamic Memory Allocation, Circular linked list, Doubly linked list, Applications of Linked List.

UNIT 4: Operation on Linked List: Insertion of node in a singly linked list (at Start, at End, at a Given Position), deletion of node in a linked list (at Start, at End, at a Given Position), searching and traversal of elements and their comparative studies with implementations using array structure, Reversing a singly lined list.

UNIT 5: Stacks: Definition of Stack, LIFO,Implementing stack using array and linked list, Prefix, Infix and Postfix expressions, Utility and conversion of these expressions from one to another; Applications of stack.

UNIT 6: Queues: Definitions of Queue, FIFO, Array and Linked representation of Queue, De-queue, Priority Queues, application of queue.

UNIT 7: Recursion: Rules for Recursive Function, Recursion versus Iteration, Developing Recursive Definition of Simple Problems and their implementation; Advantages and Limitations of Recursion;

UNIT 8: Trees: Introduction to Tree as a data structure; Binary Trees, Binary Search Tree, (Creation, and Traversals of Binary Search Trees algorithms, in-order, preorder, post-order.

Block 2: Analysis of Algorithms

UNIT 9: Design and Analysis of Algorithms: Introduction, Basic Design and Analysis techniques of Algorithms, Correctness of Algorithm.

UNIT 10: Algorithm Design Techniques: Iterative techniques, Divide and Conquer, Dynamic Programming,GreedyAlgorithms.

UNIT 11: Elementary Sorting Techniques- Bubble Sort, Insertion Sort, Merge Sort

UNIT 12: Advanced Sorting Techniques- Heap Sort, Quick Sort, Sorting in Linear Time-Bucket Sort, Radix Sort and Count Sort

UNIT 13: Searching Techniques: Linear and Binary search.

UNIT 14: C**omplexity Analysis**: Medians & Order Statistics.

Recommended Books:

1. T.H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein-Introduction to Algorithms, PHI, 3rd Edition2009.
2. Sarabasse & A.V. Gelder Computer Algorithm–Introduction to Design and Analysis,Publisher–Pearson 3rd Edition1999.
3. Adam Drozdek, "Data Structures and algorithm in C++", Third Edition, Cengage Learning,2012.
4. SartajSahni, Data Structures, "Algorithms and applications in C++", Second Edition, Universities Press,2011.
5. Aaron M. Tenenbaum, Moshe J. Augenstein, YedidyahLangsam, "Data Structures Using C and C++:, Second edition, PHI,2009.
6. Robert L. Kruse, "Data Structures and Program Design in C++",Pearson.
7. D.S Malik, Data Structure using C++,Second edition, Cengage Learning,2010.

Course Code: BCOMP S5 1B (Lab)
Course Title: Data Structures and Analysis of Algorithms (LAB)
Nature of the Course: DSE
Credit: 02
Marks: 50

Software Lab based on Analysis of Algorithms:

1. Implement Insertion Sort (The program should report the number ofcomparisons)
2. Implement Merge Sort(The program should report the number ofcomparisons)
3. Implement Heap Sort (The program should report the number ofcomparisons)

4. Implement Randomized Quick sort (The program should report the number of comparisons)
5. Implement RadixSort.
6. Implement SearchingTechniques
7. Implementation of Recursivefunction.
8. Array and Linked list implementation of Stack andQueue.
9. Implementation of Single, Double and circular LinkedList
10. Creation and traversal of Binary SearchTree.

Semester VI

Course Code: BCOMP S6 1A (Th)
Course Title: Computer Networks
Nature of the Course: DSE
Credit: 04
Marks: 100

UNIT 1: Basic concepts of Computer Networks: Types of Signal: Analog, Digital, Computer Networks Definition, Goals, Structure; Broadcast and Point-To-Point Networks; Block representation of Data Communication System, Bandwidth, SNR, Network Protocols and Standards, Components of data communication, standards and organizations, Network Classification;

UNIT 2: Types of Data Communication: Data Communication, Parallel and Serial Communication, Modes of Communication: Simplex, Half Duplex, Full Duplex; Asynchronous and Synchronous Communication

UNIT 3: Networking Switching Techniques: Circuit, Packet and Message Switching.

UNIT 4: Network Devices : Gateway, Bridge, Hub, Switch, Network Interface Card (NIC), Network Adapters, Ethernet: Basic Features, Types of Ethernet.

UNIT 5: Network Topologies: Definitions, Types of Network Topologies, Advantages and Disadvantages; Layered network architecture;

UNIT 6: Network Models: Network Reference Models, Overview of OSI reference model; overview of TCP/IPprotocolsuite.

UNIT 7: Physical Layer: Cabling, Network Interface Card, Transmission Media Devices- Repeater, Hub, Bridge, Switch,Router,Gateway.

UNIT 8: Data Link Layer : Framing techniques; Error Control; Flow Control Protocols; Shared media protocols - CSMA/CDandCSMA/CA.

UNIT 9: Network Layer : Virtual Circuits and Datagram approach, IP addressing methods – Subnetting; Routing Algorithms (adaptiveandnon-adaptive)

UNIT 10: Transport Layer: Transport services, Transport Layer protocol of TCPandUDP.

UNIT 11: Session Layer : Interhost communication; Services- Dialog control, Token management,

Synchronization; Protocols- Remote Procedure Call (RPC), NETBIOS.

UNIT 12: Presentation Layer : Services - Data conversion, Translation, Encryption, Compression; Protocols - FTP, Telnet.

UNIT 13: Application Layer : Application layer protocols and services – Domain name system,

HTTP, WWW, Telnet,FTP,SMTP.

UNIT 14: Network Security : Common Terms, Firewalls, VirtualPrivateNetworks.

Books Recommended:

1. B.A. Forouzan, Data Communication and Networking, 4th Edition, Tata McGraw Hill, 2007.
2. D.E. Comer, Internetworking with TCP/IP, Vol. I, Prentice Hall of India,1998.
3. W. Stalling, Data & Computer Communication, 8th edition, Prentice Hall of India, 2006.
4. Bertsekas, R. Gallager, Data Networks, 2nd edition, Prentice Hall of India,1992.

Course Code: BCOMP S6 1A (Lab)
Course Title: Computer Networks (LAB)
Nature of the Course: DSE
Credit: 02
Marks: 50

Software Lab based on ComputerNetworks:

Implement the concepts of Computer Networks suchas:

1. Simulate ChecksumAlgorithm.
2. Simulate CRCAlgorithm
3. Simulate Stop & WaitProtocol.
4. Simulate Go-Back-NProtocol.
5. Simulate Selective RepeatProtocol.

and so on.

Course Code: BCOMP S6 1B
Course Title: Project Work
Nature of the Course: DSE
Credit: 06
Marks: 150

Proposed KKHSOU Guidelines:

- This option is to be offered only in 6th Semester.
- The students will be allowed to work on any project based on the concepts studied in core/elective or skill based elective courses.
- Project will have to be done individually.
- Each learner is to choose a supervisor for their project work.

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SKILL ENHANCEMENT COURSES (SEC) – COMPUTER SCIENCE

Credit: 02 each
(Proposed to be offered from the Discipline of Computer Science)

Course for 3rd Semester

- Course **BS-SEC-1C :**Office Automation Tools
- Course **BS-SEC-1D :**MySQL (SQL/PL-SQL)

Course for 4th Semester

- Course **BS-SEC-2C :**HTML Programming
- Course **BS-SEC-2D :**XML Programming

Course for 5th Semester

- Course **BS-SEC-3C :**PHP Programming
- Course **BS-SEC-3D :**Android Programming

Course for 6th semester

- Course **BS-SEC-4C :**Programming in SCILAB
- Course **BS-SEC-4D :**Concept of Software Testing

Semester III

Course Code: BS-SEC-1C
Course Title: Office Automation Tools
Nature of the Course: SEC
Credit: 2
Marks: 50

SECTION A: THEORY

UNIT 1: Introduction to Open office/MS office/Libre office: Introduction, Features of Open office/MS office/Libre office

UNIT 2: Word Processing (Part I): Opening, Closing, Saving a word document, Formatting Text, Paragraph.

UNIT 3: Word Processing (Part 1I): Page Formatting.

UNIT 4: Word Processing (Part III): Lists, Tables.

UNIT 5: Spreadsheets (Part I): Worksheets, Formatting data, creating charts and graphs.

UNIT 6: Spreadsheets (Part II): Formulas and Functions, Macros -creating recording, viewing, saving; Pivot Table.

UNIT 7: Presentation Tools (Part I): Adding and formatting text, pictures, and graphic objects;

UNIT 8: Presentation Tools (Part II): Including charts in presentations, Importing work sheets, objects, formatting slides, notes, hand-outs, slide shows, using transitions, animations.

Books Recommended:

1. Sushila Madan, Introduction to Essential tools, JBA, 2009.
2. Anita Goel, Computer Fundamentals, Pearson,2012

SECTION B: PRACTICAL

Computer Lab Based on Office Automation:

Practical List for WORD:

1. Create a **telephone directory**.

- The heading should be 16-point Arial Font inbold
- The rest of the document should use 10-point fontsize
- Other headings should use 10-point Courier NewFont.
- The footer should show the page number as well as the date lastupdated.

2. Design a time-table form for yourcollege.

- The first line should mention the name of the college in 16-point Arial Font and should bebold.
- The second line should give the course name/teacher's name and the department in 14- pointArial.
- Leave a gap of 12-points.
- The rest of the document should use 10-point Times New Romanfont.
- The footer should contain your specifications as the designer and date ofcreation.

3. Create the following one pagedocuments.

(a) Compose a note inviting friends to a get-together at your house, including a list of things to bring withthem.

(b) Design a certificate in landscape orientation with a border around thedocument.

4. Create the following document: A newsletter with a headline and 2 columns in portrait orientation, including at least one image surrounded bytext.

5. Convert following text to a table, using comma as delimiter
Type the following as shown (do notbold).

Color, Style, Item
Blue, A980, Van
Red, X023, Car
Green, YL724, Truck

Name, Age, Sex
Bob, 23, M
Linda, 46, F
Tom, 29, M

6. Prepare a grocery list having four columns (Serial number, the name of the product, quantity and price) for the month of April,06.

- Font specifications for Title (Grocery List): 14-point Arial font in bold and italics.
- The headings of the columns should be in 12-point andbold.
- The rest of the document should be in 10-point Times NewRoman.
- Leave a gap of 12-points after thetitle.

7. XYZ Publications plans to release a new book designed as per your syllabus. Design the first page of the book as per the givenspecifications.

(a) The title of the book should appear in bold using 20-point Arialfont.
(b) The name of the author and his qualifications should be in the center of the page in 16-point Arialfont.
(c) At the bottom of the document should be the name of the publisher and address in 16-point Times NewRoman.
(d) The details of the offices of the publisher (only location) should appear in thefooter.

8. Create the following one pagedocuments.
   a) Design a Garage Salesign.
   b) Make a sign outlining your rules for your bedroom at home, using a numbered list.

9. Enter the following data into a table given on the nextpage.

Salesperson	**Dolls**	**Trucks**	**Puzzles**
Amit	1327	1423	1193
Shivi	1421	3863	2934
Om	5214	3247	5467
Ananya	2190	1278	1928
Anupama	1201	2528	1203
Maharshi	4098	3079	2067

Add a column Region (values: S, N, N, S, S, S) between the Salesperson and Dolls columns to the given table Sort your table data by Region and within Region by Salesperson in ascending order:

Practical List for EXCEL

Q1. Create a student worksheet containing roll numbers, names and total marks. Open a document in Word and insert the excel worksheetusing:-

i) Copy/Paste
ii) Embedding
iii) Linking

Q2. The term wise marks for APS class of 20 students are stored in 3 separate sheets named term1, term2 and term3. Create 4^{th} worksheet that contains student names and their total and average marks for the entire year. Give proper headings using headers. Make the column headings bold and italic. The 4^{th} worksheet should contain college name as the first line. Make it bold, italic and centerit.

Q3. Using a simple pendulum, plot 1-T and $1\text{-}T^2$ graph.

I	t1	t2	t3	Mean(t)	T=t/20	T^2
70						
80						
90						
100						

Q4. Consider the following employeeworksheet:-

Full Name (First Last)	Grade 1/2/3	Basic Salary	HRA	PF	Gross	Net	(VA) Vehicle Allowance

HRA is calculated as follows:

Grade	HRA %(of Basic)
1	40%
2	35%
3	30%

Gross = Basic + HRA + VA

Net = Gross –PF

PF is 8% for all Grades

VA is 15000, 10000 and 7000 for Grades 1, 2 and 3.

i) Find max, min and average salary of employees in respectiveGrade

ii) Count no. of people whereVA>HRA

iii) Find out most frequently occurringgrade.

iv) Extract records where employee name starts with “A” hasHRA>10000

v) Print Grade wise report of all employees with subtotals of net salary and also grand totals. Use subtotal command.

vi) Extract records where Grade is 1 or 2 and salary is between 10000 and 20000 both inclusive.

Q5. In a meeting of a marketing department of an organization it has been decided that price of selling an item is fixed at Rs40. It was resolved to increases the sell of more of more items and getting the profit of Rs40,000/.Use Goal Seek of find out how many items you will have to sell to meet your profitfigure.

Q6.To study the variation in volume with pressure for a sample of an air at constant temperature by plotting a graph for P – V and P-I/V. Sample observationsare:-

Pressure(P)	Volume (V)	I/V	PV	P/V
75	20			
78.9	19			
83.3	18			

88.2	17			

Q7. Plot the chart for marks obtained by the students (out of 5) vs. frequency (total number of students in class is 50).

Q8. Create the following worksheet(s) containing an year wise sale figure of five salesmen in Rs.

Salesman	2002	2003	2004	2005
MOHAN	10000	12000	20000	50000
MITRA	15000	18000	50000	60000
SHIKHA	20000	22000	70000	70000
ROHIT	30000	30000	100000	80000
MANGLA	40000	45000	125000	90000

Apply the following Mathematical & Statistical functions:

i) Calculate the commission for each salesman under the condition:-
   a) If total sales is greater than Rs. 3, 00,000/-, then commission is 10% of total sale made by thesalesman.
   b) Otherwise, 4% of totalsale.

ii) Calculate the maximum sale made by eachsalesman.
iii) Calculate the maximum sale made in eachyear.
iv) Calculate the minimum sale made by eachsalesman.
v) Calculate the minimum sale made in eachyear.
vi) Count the no. of salespersons.
vii) Calculate the cube of sales made by Mohan in the year2002.
viii) Find the difference in sales by salesman Mitra between the year 2002 and 2003. Find the absolute value ofdifference.
ix) Also calculate the Mode, Stddev, Variance, Median for the sale made by each salesman.
ix) Calculate the year wise Correlation coefficient between the sales man Mohan and Mitra yearwise.

Q9. The following table gives an year wise sale figure of five salesmen inRs.

Salesman	2000	2001	2002	2003
S1	10000	12000	20000	50000
S2	15000	18000	50000	60000
S3	20000	22000	70000	70000
S4	30000	30000	100000	80000
S5	40000	45000	125000	90000

v) Calculate total sale yearwise.
vi) Calculate the net sales made by eachsalesman
vii) Calculate the commission for each salesman under the condition:-
   c) If total sales is greater than Rs. 4, 00,000/-, then commission is 5% of total

sale made by thesalesman.

d) Otherwise, 2% of totalsale.

viii) Calculate the maximum sale made by eachsalesman.

ix) Calculate the maximum sale made in eachyear.

x) Draw a bar graph representing the sale made by eachsalesman.

xi) Draw a pie graph representing the sale made by salesmen in year2001.

Q10. Consider the following worksheet for APS 1st year students:-

S.No.	Name	PH	CH	BY	MT	CS	Total Marks	%	Grade
1									
2									

Grade is calculated as follows:-

If%>=90 Grade A

If %>=80 &<90 Grade B

If %>=70 &<80 Grade C

If % >=60 &<70 GradeD

Otherwise students will be declared fail.

i) Calculate Grade using iffunction

ii) Sort the data according to totalmarks

iii) Apply filter to display the marks of the students having more than 65%marks.

iv) Draw a pie chart showing % marks scored in each subject by the topper of theclass.

v) Draw the doughnut chart of the data as in(iv)

vi) Enter the S.No. of a student and find out the Grade of the student usingVLOOKUP.

vii) Extract all records where name

a) Begins with"A"

b) Contains"A"

c) Ends with"A"

Practical List for Power Point:

1. Create five Power point slides. Each slide should support different format. In these slides explain areas of applications of IT. Make slide transition time as 10seconds.
2. Create five Power Point slides to give advantages/disadvantages of computer, application of computers and logical structure ofcomputer.
3. Create five Power Point slides detailing the process of internal assessment. It should be a self-running demo.

Course Code: BS-SEC-1D
Course Title: MySQL (SQL/PL-SQL)
Nature of the Course: SEC
Credit: 2
Marks: 50

SECTION A: THEORY

UNIT 1: SQL and SQL * Plus: SQL Commands and Data types, Operators and Expressions, Introduction to SQL * Plus.

UNIT 2 : Installation of MySQL : Installation of MySQL (both Linux and Windows)

UNIT 3: Working with MySQL : Working with MySQL in Windows and Linux platform with examples.

UNIT 4: Managing Tables and Data: Creating and Altering Tables (Including constraints), Data Manipulation Command like Insert, update, delete; SELECT statement with WHERE, GROUP BY and HAVING, ORDER BY, DISTINCT, Special operator like IN, ANY, ALL BETWEEN, EXISTS,LIKE, Join, Builtinfunctions.

UNIT 5: Database Objects: View, Synonyms, Index

UNIT 6: Transaction Control Statements: Commit, Rollback, Savepoint

UNIT 7: Introduction to PL/SQL : SQL v/s PL/SQL, PL/SQL Block Structure

UNIT 8: Language construct of PL/SQL: Variables, Basic and Composite Data type Conditions loopingetc.) % TYPE and %ROWTYPE, Using Cursor(Implicit, Explicit)

Books Recommended:

1. Baron Schwartz , High Performance MySQL, O'Reilly,2012.
2. Vikram Vaswani , The Complete Reference MySQL , McGraw Hill Educations, 2004.

SECTION B: PRACTICAL

Software Lab Based on MySQL (SQL/PL-SQL):

[SQL COMMANDS]

1) SQL* formatting commands

2) To create a table, alter and drop table.

3) To perform select, update, insert and delete operation in atable.

4) To make use of different clauses viz where, group by, having, order by, union and intersection

5) To study differentconstraints.

[SQL FUNCTION]

6) To use oracle function viz aggregate, numeric, conversion, stringfunction.

7) To understand use and working with joins.

8) To make use of transaction control statement viz rollback, commit and savepoint.

9) To make views of atable.

10) To make indexes of atable.

[PL/SQL]

11) To understand working withPL/SQL

12) To implement Cursor on atable.

13) To implement trigger on atable

Semester IV

Course Code: BS-SEC-2C
Course Title: HTML Programming
Nature of the Course: SEC
Credit: 2
Marks: 50

SECTION A: THEORY

UNIT 1:HTML Basics: Web page, Home page, Web Client, Web Server, Search Engines, HTML tags : The Head, theBody, Colors; Tag Attributes;

UNIT 2: Hyperlinks: Introduction, Relative Links, AbsoluteLinks, LinkAttributes, Using the ID Attribute to Link Within aDocument.

UNIT 3:Working with Images: Putting an Image on aPage, Using Images asLinks, Putting an Image in theBackground.

UNIT 4: Working with Tables: Creating aTable, TableHeaders, Captions, Spanning MultipleColumns, StylingTable.

UNIT 5:HTML List: HTML Lists, ordered,unordered and definition list

UNIT 6: Frames: Use ofFrame, Frameset tags with examples.

UNIT 7: **Forms:** Basic Input and Attributes, Other kinds ofInputs, Styling forms withCSS.

UNIT 8: Dynamic HTML: Dynamic HTML, Document Object Model, Features of DHTML, Cascading StyleSheet Positioning, JavaScript Assisted Style Sheet, The ID attribute, DHTML Events.

Book Recommended:

1. Ben Henick,. HTML & CSS: The Good Parts: Better Ways to Build Websites That Work." O'Reilly Media, Inc.", 2010.
2. Jon Duckett,. HTML & CSS: design and build websites. Vol. 15. Indianapolis, IN: Wiley, 2011.

SECTION B: PRACTICAL

Software Lab Based on HTML:

Q1. Create an HTML document with the following formattingoptions:

I. Bold
II. Italics
III. Underline
IV. Headings (Using H1 to H6 headingstyles)
V. Font (Type, Size andColor)
VI. Background (Colored background/Image inbackground)
VII. Paragraph
VIII. Line Break
IX. HorizontalRule
X. Pretag

Q2. Create an HTML document which consistsof:

I. OrderedList
II. UnorderedList
III. NestedList
IV. Image

XYZ Ltd's Update

1. Introduction
2. Company Financial Update
    - First Quarter
    - Second Quarter
    - Third Quarter
    - Fourth Quarter
3. Advertising Update
    - Result of Newspaper Campaign
    - Additions to staff
    - New Thoughts on Television
4. Human Resources Update

A. Saftey Considerations
    1. Body substance isolation
    2. Sense safty
    3. Initial size-up
B. Intitial Patient Assessment
    1. General Impression
    2. Unresponsiveness
        i. Alert to person, place and time
        ii. Verbal response to audible stimuli
        iii. Pain evokes verbal or physical response
        iv. Unresponsive to all stimuli
C. Patient Critical Needs
    1. Airway
    2. Breathing
        i. Use oxygen if indicated
        ii. Consider use of assisting with bag value mask
    3. Circulation
    4. Bleeding

Q3. Create an HTML document which implements Internal linking as well asExternal linking.

Q4. Create a table using HTML which consists of columns for Roll No., Student's name and grade.

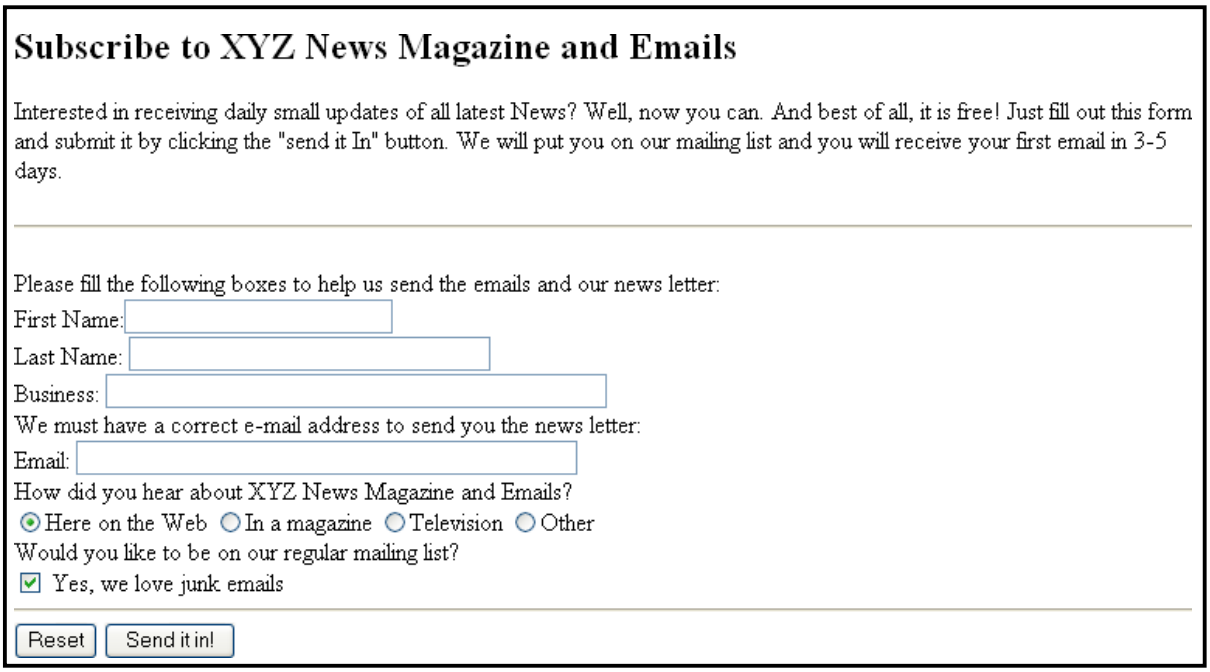
Result		
Roll No.	Name	Grade

Q5. Create a Table with the followingview:

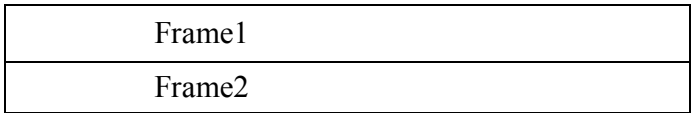
			Place an image here	

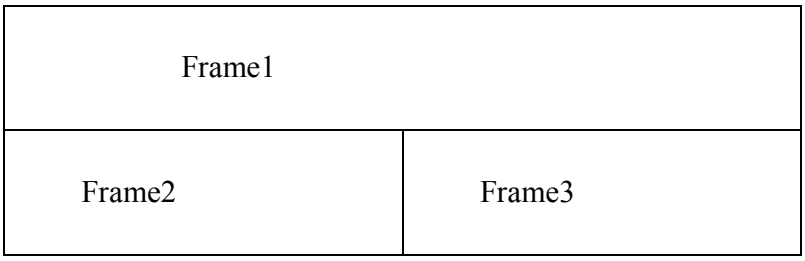
Q6. Create a form using HTML which has the following types ofcontrols:

I. TextBox
II. Option/radiobuttons
III. Check boxes
IV. Reset and Submitbuttons



Q7. Create HTML documents (having multiple frames) in the following threeformats:





Course Code: BS-SEC-2D
Course Title: XML Programming
Nature of the Course: SEC
Credit: 2
Marks: 50

SECTION A: THEORY

UNIT 1: Introduction to XML : Understanding Mark-up Languages, Introduction to XML, Goals, XML applications.

UNIT 2: XML Tools : XML viewers, Text editors, Web Browsers: Firefox, Chrome, Error in XML document.

UNIT3: XML Basics I : XML Structure and Syntax, Document Classes and Rules.

UNIT4: XML Basic II : XML Elements, XML Attributes, comments, character entities.

UNIT5: Working with DTD : DTD, Validating XML documents with DTD

UNIT 6: Advanced XML Concepts : Scripting XML, XML as Data, LinkingwithXML.

UNIT7: XML with Style I : Concept of XSL, Difference between CSS and XSL, Creating a XSL file

UNIT8: XML with Style II : Use of XSLT, Syntax,<template>,<value-of>,<for-each>,<sort>,<if>,<choose>,<key>,<message>,<apply-template>,<import>

Books Recommended

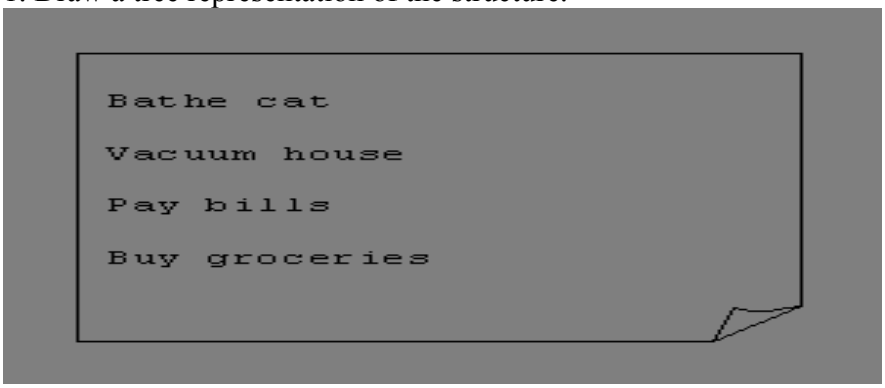
1. William J. Pardi , XML in action web technology, Microsoft Press,1999
2. Michael J. Young ,Step by Step XML , Microsoft Press,2002

SECTION B: PRACTICAL

Software Lab Based on XML:

Exercise #1 – Information Structure
In this exercise, student will practice identifying the structure of an information object.
For the sample document provided below:
Label the information structures you see, including containing structures.

1. Draw a tree representation of the structure.



Exercise #2-Deconstructing an XML Document

In this exercise, student will practice identifying the explicit structure within an XML document. In a sense, this is the reverse of what you did in Exercise #1. For the sample XML markupbelow, create a document-like representation (or a simple drawing) for the content contained within the XMLtags:

<book>

<coverInfo>

<title>The XML Handbook</title>

<author>Charles F. Goldfarb</author>

<author>Paul Prescod</author>

<edition>Second</edition>

<description>The definitive XML resource: applications, products, and technologies. Revised and expanded—over 600 new pages.

</description>

</coverInfo>

</book>

Exercise #3 – Creating XML Markup

In this exercise, create some XML markup based on the tree representation from Exercise #1 above, and the content from the original sample document.

Exercise #4 – Well-Formedness
This exercise checks your understanding of the constraints for well-formedness. Are the following document instances well-formed? Explain any NO answers.

<list><title>The first list</title><item>An item</list>

<item>An item</item><item>Another item</item>

<para>Bathing a cat is a <emph>relatively</emph> easy task as long as the cat is willing.</para>

<bibl><title>How to Bathe a Cat<author></title>Merlin Bauer<author></bibl>

Exercise #5-Well Formedness
This exercise is a bit more challenging than the previous example. Here is a fragment of an XML document instance. Identify all the places where it fails to match the constraints for well-formedness.

<PROCEDURE><TITLE How to Bathe a Cat</TITLE>

<OVERVIEW>

This procedure tells you how to bathe a cat. <WARNING></OVERVIEW>Cats don't like to take baths. You could get hurt doing this. Be sure to obtain all the required protective gear before you start. </WARNING><EQUIPEMENT><ITEM>Hockey Mask <ITEM>Padded Full-bodyKevlar Armor</ITEM><ITEM>Tub full of warm water</ITEM><ITEM>Towels </ITEM><ITEM>First Aid kit</ITEM><ITEM>Cat Shampoo</ITEM> <EQUIPMENT><INSTRUCTIONS><STEP> Locate the cat, who by now is hiding under the bed.</STEP><STEP>Place the cat in the tub of water.</STEP><ITEM>Using the First Aid kit, repair the damage to your head and arms.</STEP><STEP>Place the cat back in the tub and hold it down.</STEP><STEP>Wash it really fast, then make an effort to dry it with the towels.</STEP><STEP>Decide not to do this again. </STEP></INSTRUCTIONS>

Note: Cover more exercises based on XML Programming theory concepts.

Semester V

Course Code: BS-SEC-3C
Course Title: PHP Programming
Nature of the Course: SEC
Credit: 2
Marks: 50

SECTION A: THEORY

UNIT 1: Introduction to PHP : PHP introduction, inventions and versions, important tools and software requirements (like Web Server, Database, Editors etc.), PHP with other technologies, scope of PHP, Basic Syntax, PHP variables and constants, Types of data in PHP, Expressions, scopes of a variable (local, global)

UNIT 2: Installation of PHP : Installing Web Server with PHP & Database server (both for Linux, Windows), Configuration of Server etc.

UNIT 3: Operators in PHP : Arithmetic, Assignment, Relational, Logical operators, Bitwise, ternary and MOD operator, PHP operator Precedence and Associativity.

UNIT 4: PHP Form Handling : Capturing Form Data, GET and POST form methods, dealing with multi value fields, Redirecting a form after submission.

UNIT 5: Conditional Events : PHP IF Else conditional statements (Nested IF and Else), Switch case.

UNIT 6: Working with Loops : Concept of loop, while, For and Do While Loop, Goto, Break, Continue and exit.

UNIT 7: Working with Functions : Function, Need of Function, declaration and calling of a function, PHP Function with arguments, Default Arguments in Function, Function argument with call by value, call by reference, Scope of Function Global and Local.

UNIT 8: Working with Strings: Creating and accessing String, Searching & Replacing String, Formatting, joining and splitting String, String Related Library functions, Use and advantage of regular expression over inbuilt function, Use of preg_match(), preg_replace(), preg_split() functions in regular expression.

UNIT 9: Working with Arrays : Anatomy of an Array, different types of arrays, creating index based and Associative array, accessing array, Looping with Index based array, working with associative array using each () and foreach (), Some useful Library function.

UNIT 10: Connecting with Database: Overview of MySQL: creating database, creating tables, insert/delete/update/select operations; connecting PHP with mysql with various operations.

Books Recommended

1. Rasmus Lerdorf, et al. Programming Php. " O'Reilly Media, Inc.", 2002.
2. Steven Holzner, PHP: the complete reference. Tata McGraw-Hill Education, 2007.

SECTION B: PRACTICAL

Software Lab Based on PHP:

1. Create a PHP page using functions for comparing three integers and print the largest number.
2. Write a function to calculate the factorial of a number (non-negative integer). The function accept the number as anargument.
3. WAP to check whether the given number is prime ornot.
4. Create a PHP page which accepts string from user. After submission that page displays the reverse of providedstring.
5. Write a PHP function that checks if a string is all lowercase.
6. Write a PHP script that checks whether a passed string is palindrome or not? (A palindrome is word, phrase, or sequence that reads the same backward as forward, e.g., madam or nurses run)
7. WAP to sort anarray.
8. Write a PHP script that removes the whitespaces from astring.

   Sample string : 'The quick " " brownfox'

   Expected Output :Thequick""brownfox
9. Write a PHP script that finds out the sum of first n oddnumbers.
10. Create a login page having user name and password. On clicking submit, a welcome message should be displayed if the user is already registered (i.e.name is present in the database) otherwise error message should bedisplayed.
11. Write a PHP script that checks if a string contains anotherstring.
12. Create a simple 'birthday countdown' script, the script will count the number of days between current day and birthday.
13. Create a script to construct the following pattern, using nested forloop.
    *
    * *
    * * *
    * * * *
    * * * * *
14. Write a simple PHP program to check that emails arevalid.
15. WAP to print first n evennumbers.
16. $color = array('white', 'green','red")
    Write a PHP script which will display the colors in the following way :
    Output :
    white, green, red,

- green
- red
- white

17. Using switch case and dropdown list display a “Hello” message depending on the language selected in drop downlist.
18. Write a PHP program to print Fibonacci series usingrecursion.
19. Write a PHP script to replace the first 'the' of the following string with'That'.

    Sample :'the quick brown fox jumps over the lazy dog.'

    Expected Result : That quick brown fox jumps over the lazy dog.

Course Code: BS-SEC-3D
Course Title: Android Programming
Nature of the Course: SEC
Credit: 2
Marks: 50

SECTION A: THEORY

UNIT 1: Overview of object-oriented programming using Java : OOPs Concepts: Inheritance, Polymorphism, Interfaces, Abstract class, Threads, Overloading and Overriding, Java Virtual Machine.

UNIT 2: Introduction to Android : History of Android, Introduction to Android Operating Systems, Android Development Tools, Android Architecture, Kotlin programming language.

UNIT 3: Development Tools : Installing and using Android Studio, Working with Emulator, Android Virtual Device (AVD), Android SDK manager, Android App Project Package Structure, Creating a android project – Hello Word, run on emulator, Deploy it on USB-connected Android device.

UNIT 4: User Interface Architecture : Application context, intents, fragments, Activity life cycle, multiple screen sizes.

UNIT 5: User Interface Design : Android Widgets: Form widgets, Text Fields, Layouts, Button control, toggle buttons, Spinners (Combo boxes), Images, Menu, and Dialog etc.

UNIT 6: Working with Layout and Views : Introduction of various layout: linear, relative, tabular etc, Android different views and view groups.

UNIT7: Android Animation : Android Animations, Create XML File to Define Animation, Load and Start the Animation, Different Types of Android Animations

UNIT 8: Working with Database and Application Server : Understanding of SQLite database, connecting with the database, working remote server (e.g. retrieving data from server, login system etc).

B**ook Recommended:**

1. James C Sheusi,. Android Application development for Java programmers. Cengage Learning, 2013.

Online Reading / Supporting Material:

1. http://www.developer.android.com
2. http://developer.android.com/about/versions/index.html
3. http://developer.android.com/training/basics/firstapp/index.html
4. http://docs.oracle.com/javase/tutorial/index.htm (Available in the form of free downloadable ebooks also).
5. http://developer.android.com/guide/components/activities.html
6. http://developer.android.com/guide/components/fundamentals.html
7. http://developer.android.com/guide/components/intents-filters.html.
8. http://developer.android.com/training/multiscreen/screensizes.html
9. http://developer.android.com/guide/topics/ui/controls.html
10. http://developer.android.com/guide/topics/ui/declaring-layout.html
11. http://developer.android.com/training/basics/data-storage/databases.html

SECTION B: PRACTICAL

Software Lab Based on Android Programming:

1. Create “Hello World” application. That will display “Hello World” in the middle of the screen in the emulator. Also display “Hello World” in the middle of the screen in the AndroidPhone.
2. Create an application with login module. (Check username andpassword).
3. Create spinner with strings taken from resource folder (res >> value folder) and on changing the spinner value, Image willchange.
4. Create a menu with 5 options and and selected option should appear in textbox.
5. Create a list of all courses in your college and on selecting a particular course teacher-in-charge of that course should appear at the bottom of thescreen.
6. Create an application with three option buttons, on selecting a button colour of the screen willchange.
7. Create and Login application as above. On successful login, pop up themessage.
8. Create an application to Create, Insert, update, Delete and retrieve operation on the database.

Semester VI

Course Code: BS-SEC-4C
Course Title: Programming in SCILAB
Nature of the Course: SEC
Credit: 2
Marks: 50

SECTION A: THEORY

UNIT 1: Installation of SCILAB: Installation of SCILAB (both Windows & Linux)

UNIT 2: Introduction to SCILAB : Introduction to SCILAB, SCILAB Environment, Workspace, Working Directory

UNIT 3: SCILAB Programming : Expressions, Basic syntax, Mathematical Operators, Predefined constants, Handling .sci files, Variables and assignment statement, Arrays.

UNIT 4: Graph Plots : Basic plotting, built in functions, generating waveforms, Sound replay, load and save.

UNIT 5: Working with Matrices : Matrices and Some Simple Matrix Operations, Sub-Matrices, Matrix operations (functions like inv(), spec(), zeros(), ones(), eye(), rand().

UNIT 6: Procedures and Functions : Arguments and return values, Built in functions, Complex numbers, Polynomials, Vectors, Handling these data structures using built in functions.

UNIT 7: Control Statements : Conditional statements: If, Else, Else-if, Repetition statements: while, for loop.

UNIT 8: Manipulating Text : Writing to a text file, reading from a text file, Randomizing and sorting a list, searching list.

Recommended Books:

1. M. Affouf, SCILAB by Example, CreateSpace Independent Publishing Platform, 2012
2. H. Ramchandran, A.S. Nair, SCILAB ,S.Chand,2011

SECTION B: PRACTICAL

Software Lab Based on SCILAB:

1. Write a program to assign the following expressions to a variable A and then to print out the value ofA.
   a. (3+4)/(5+6)
   b $2\pi^2$
   c. $\sqrt{2}$
   d. $(0.0000123 + 5.67\times10^{-3}) \times 0.4567\times10^{-4}$

2. Celsius temperatures can be converted to Fahrenheit by multiplying by 9, dividing by 5, and adding 32. Assign a variable called C the value 37, and implement this formula to assign a variable F the Fahrenheit equivalent of 37Celsius.
3. Set up a vector called N with five elements having the values: 1, 2, 3, 4, 5. Using N, create assignment statements for a vector X which will result in X having thesevalues:
   a. 2, 4, 6, 8, 10
   b. 1/2, 1, 3/2, 2, 5/2
   c. 1, 1/2, 1/3, 1/4, 1/5
   d. 1, 1/4, 1/9, 1/16, 1/25
4. A supermarket conveyor belt holds an array of groceries. The price of each product (in pounds) is [0.6, 1.2 ,0.5, 1.3] ; while the numbers of each product are [3, 2 ,1 ,5]. Use MATLAB to calculate the totalbill.
5. The *sortrows(x)*function will sort a vector or matrix X into increasing row order. Use this function to sort a list of names into alphabeticalorder.
6. The "identity" matrix is a square matrix that has ones on the diagonal and zeros elsewhere. You can generate one with the eye() function in MATLAB. Use MATLAB to find a matrix B, such that when multiplied by matrix A=[1 2; -1 0] the identity matrix I=[1 0; 0 1] is generated. That isA*B=I.
7. Create an array of N numbers. Now find a single MATLAB statement that picks out from that array the 1,4,9,16,…,√Nth entries, i.e. those numbers which have indices that are square numbers.
8. Draw a graph that joins the points (0,1), (4,3), (2,0) and(5,-2).
9. The seeds on a sunflower are distributed according to the formula below. Plot a small circle at each of the first 1000 co-ordinates:

$$r_n = \sqrt{n}$$

$$\theta_n = \frac{137.51}{180}\pi n$$

10. Calculate 10 approximate points from the function y=2x by using theformulae:
    i. $x_n = n$
    ii. $y_n = 2n + \text{rand} - 0.5$

    Fit a line of best fit to these points using the function polyfit() with degree=1, and generate co-ordinates from the line of best fit using polyval(). Use the on-line help to find out how to use these functions. Plot the raw data and the line of best fit.
11. Calculate and replay 1 second of a sinewave at 500Hz with a sampling rate of

11025Hz. Save the sound to a file called "ex35.wav". Plot the first 100samples.

12. Calculate and replay a 2 second chirp. That is, a sinusoid that steadily increases in frequency with time, from say 250Hz at the start to 1000Hz at theend.
13. Build a square wave by adding together 10 odd harmonics: 1f, 3f, 5f, etc. The amplitude of the nth harmonic should be 1/n. Display a graph of one cycle of the result superimposed on the individualharmonics.
14. Write a function called FtoC (ftoc.m) to convert Fahrenheit temperatures into Celsius. Make sure the program has a title comment and a help page. Test from the command windowwith:
    i. FtoC(96)
    ii. lookforFahrenheit
    iii. helpFtoC
15. Write a program to input 2 strings from the user and to print out (i) the concatenation of the two strings with a space between them, (ii) a line of asterisks the same length as the concatenated strings, and (iii) the reversed concatenation. Forexample:
    i. Enter string 1:Mark
    ii. Enter string 2:Huckvale
    iii. Mark Huckvale
    iv. **********
    v. elavkcuHkraM

Course Code: BS-SEC-4D
Course Title: Concepts of Software Testing
Nature of the Course: SEC
Credit: 2
Marks: 50

SECTION A: THEORY

UNIT 1: Introduction to Software Testing : Concept of software testing, psychology and economics of software testing, principles of software testing, error, fault, failure, incident, error and fault taxonomies, test cases, limitations of testing

UNIT 2: Strategic Approach to Software Testing : Strategic Approach to Software Testing, Test Strategies for Conventional Software

UNIT 3: Software Testing Terminologies : Validation Testing, System Testing, Basic Terminologies

UNIT 4: Software Lifecycle Model : System Development Phases, Software Life Cycle Model, Software Development Models: Classical and Iterative Waterfall Model, V ShapedSoftware Lifecycle Model

UNIT 5: Functional Testing I : Functional Testing, Boundary Value Analysis

UNIT 6: Functional Testing II : Equivalence Class Testing, Decision Table Based Testing

UNIT 7: Structural Testing I : Structural Testing, Basis Path Testing: Program Graph, DD Path graph, Cyclomatic Complexity, Graph Matrices

UNIT 8: Structural Testing II : Control Flow Testing: Statement Coverage, Branch Coverage, Condition Coverage, Path Coverage

Books Recommended:

1. Roger S. Pressman, Software Engineering: A Practitioner's Approach, Seventh Edition, Mc Graw HillEducation.2009.
2. Yogesh Singh, Software Testing, Cambridge UniversityPress,2011.

SECTION B: PRACTICAL

Computer Lab Based on Software Testing:

1. Write a program that take three inputs (a, b & c) that represent the sides of a triangle, and the output is one of the below four:
    a. Not a triangle
    b. Scalene triangle
    c. Isosceles triangle
    d. Equilateral triangle

    1.1 Generate test cases using Boundary Value Analysis, Equivalence Class Partitioning and Decision TableTesting.

    1.2 Generate test cases using Basis path testing.

    1.3 Run code coverage tool.

2. Write a program that determines the nature of roots of a quadratic equation. Output should be one of thefollowing:-
    - Not a quadraticequation.
    - Complexroots
    - Realroots
    - Singleroots

    I. Generate test cases using Boundary Value Analysis, Equivalence Class Partitioning and Decision TableTesting.
    II. Generate test cases using Basis path testing.

III. Run code coverage tool

3. Write a program that checks whether the number is even or odd. Run code coverage tool and find the amount of code beingcovered.
4. Write a program that dynamically allocates memory to10 integers using malloc() or calloc() and

- do not free memory leading to memory leaks. Verify the same using Valgrind.
- Now, free memory using free() at the end of the program to avoid memory leaks. Verify the same using Valgrind.

5. Use LoadUI load testing tool to test the web applicationperformance.

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Final MIL (Assamese) syllabus for
B.Sc. General Programme at KKHSOU

পাঠ্যবিষয়ৰ শিৰোনাম : ব্যৱহাৰিক অসমীয়া (Functional Assamese)

মুঠ অধ্যায় : ১৪

মুঠ নম্বৰ : ৫০

ক্ৰেডিট : ২

Course Code: BS-AECC 1A

এই পাঠ্যবিষয় বিশ্ববিদ্যালয়ে আগবঢ়াব বিচৰা বিজ্ঞানৰ স্নাতক পাঠ্যক্ৰমৰ বৈকল্পিক পাঠ্যবিষয় (আধুনিক ভাৰতীয় ভাষাৰ অন্তৰ্গত) হিচাপে থাকিব। এই পাঠ্যবিষয়ৰ জৰিয়তে অসমীয়া ভাষাৰ ব্যৱহাৰিক প্ৰয়োগৰ দিশ কিছুমানৰ লগত শিক্ষাৰ্থীসকলক পৰিচয় কৰাই দিবলৈ বিচৰা হৈছে। পাঠ্যবিষয়ৰ আৰম্ভণিতে অসমীয়া ব্যাকৰণৰ কেইটিমান দিশৰ লগতো শিক্ষাৰ্থীসকলক পৰিচয় কৰাই দিবলৈ বিচৰা হৈছে। ইয়াৰ মূল কাৰণ হ'ল তেখেতসকলে যাতে সঠিকভাৱে অসমীয়া ভাষাৰ কালিকা অনুধাৱন কৰিবলৈ সক্ষম হয় । বিজ্ঞানৰ শিক্ষাৰ্থী হিচাপে শিক্ষাৰ্থীসকলক অসমীয়া ভাষাত বিজ্ঞান শিক্ষা আৰু চৰ্চা কেনেদৰে হৈ আহিছে সেই বিষয়েও সামগ্ৰিক ধাৰণা প্ৰদান কৰিবলৈ বিচৰা হৈছে।

অধ্যায় ১ : অসমীয়া ভাষাৰ ব্যাকৰণৰ কেইটামান বিশেষ দিশ

আখৰ, ধ্বনি আৰু বৰ্ণ; আখৰ, বৰ্ণ আৰু ধ্বনিৰ সম্পৰ্ক; অসমীয়া ধ্বনি, উপধ্বনি আৰু তাৰ শ্ৰেণীবিভাজন, বিশিষ্ট ধ্বনি বা বৰ্ণ : বিশিষ্ট স্বৰধ্বনি, বিশিষ্ট ব্যঞ্জনধ্বনি; চন্দ্ৰবিন্দুৰ ব্যৱহাৰ; ণত্ববিধি আৰু ষত্ববিধি, যতি চিহ্ন

বিভক্তি আৰু প্ৰত্যয়; অসমীয়া ভাষাৰ বিভক্তিৰ শ্ৰেণী বিভাগ : শব্দ বিভক্তি বা কাৰক বিভক্তি, পুৰুষবাচক সম্বন্ধবাচক বিভক্তি, ক্ৰিয়া বিভক্তি; অসমীয়া ভাষাৰ প্ৰত্যয়ৰ শ্ৰেণী বিভাগ : কৃৎ প্ৰত্যয় আৰু তদ্ধিৎ প্ৰত্যয়, নিৰ্দিষ্টতাবাচক প্ৰত্যয়

অধ্যায় ২ : অসমীয়া ভাষাৰ বাক্যৰীতি, পদ, সন্ধি, সমাস, বচন আৰু লিংগ

বাক্যৰীতিৰ সংজ্ঞা ; বাক্যৰ শ্ৰেণী বিভাজন; উদ্দেশ্য আৰু বিধেয়; বাক্য; উক্তি;

পদ; পদৰ শ্ৰেণী বিভাজন : সব্যয় আৰু অব্যয়; বিশেষ্য; বিশেষণ; সৰ্বনাম; ক্ৰিয়া; বাক্যত পদৰ ক্ৰম সন্ধি; সমাস; বচন; লিংগ

অধ্যায় ৩ : জতুৱা ঠাঁচ আৰু খণ্ডবাক্য,শব্দৰ ভুল প্ৰয়োগ, সমোচ্চাৰিত শব্দ, সমাৰ্থক শব্দ, বিপৰীত শব্দ, বাক-সংহতি

জতুৱা ঠাঁচ আৰু খণ্ডবাক্যৰ সংজ্ঞা, অসমীয়া জতুৱা ঠাঁচ আৰু খণ্ডবাক্যৰ প্ৰয়োগ আৰু অৰ্থ

শব্দৰ ভুল প্ৰয়োগ; সমোচ্চাৰিত শব্দ; সমাৰ্থক শব্দ; বিপৰীত শব্দ; বাক-সংহতি

অধ্যায় ৪ : সাম্প্রতিক দৈনন্দিন জীৱনত ব্যৱহৃত অসমীয়া ভাষা

দৈনন্দিন জীৱনত ব্যৱহৃত অসমীয়া ভাষা – শব্দৰ ভুল প্ৰয়োগ; এফ এম তথা ভিন ভিন দৃশ্য-শ্ৰাব্য মাধ্যমৰ অসমীয়া ভাষা; নিৰ্দিষ্টতাবাচক প্ৰত্যয়; কাৰক আদিৰ পৰিহাৰ

অধ্যায় ৫ : সংবাদ লিখন আৰু বিজ্ঞাপন লিখনৰ প্ৰাথমিক ধাৰণা

সংবাদৰ সংজ্ঞা, ধাৰণা, অৰ্থ আৰু ইতিহাস; সংবাদৰ শ্ৰেণীবিভাজন; লিখন পদ্ধতি; বিভিন্ন প্ৰকাৰৰ সংবাদ;

বিজ্ঞাপনৰ সংজ্ঞা; অৰ্থ আৰু ইতিহাস; বিজ্ঞাপনৰ লক্ষ্য আৰু উদ্দেশ্য; বিজ্ঞাপনৰ সমল; বিজ্ঞাপন লিখাৰ কাৰিকৰী কৌশল; ইয়াৰ লগত জড়িত বিবিধ পৰিভাষা;

সংবাদ লিখন আৰু বিজ্ঞাপন লিখনৰ সৌন্দৰ্যবোধ আৰু সামাজিক দায়বদ্ধতা

অধ্যায় ৬ : প্ৰবন্ধ লিখন, সমীক্ষা লিখন আৰু পৰিভাষাৰ প্ৰাথমিক ধাৰণা

প্ৰবন্ধৰ সংজ্ঞা, অৰ্থ আৰু ইতিহাস, লিখন পদ্ধতি – গুৰুত্ব দিবলগীয়া কিছু দিশ

সমীক্ষাৰ সংজ্ঞা, অৰ্থ আৰু ইতিহাস, লিখন পদ্ধতি, বিভিন্ন প্ৰকাৰৰ সমীক্ষা; পৰিভাষাৰ সাধাৰণ পৰিচয়

অধ্যায় ৭ : চিঠি, আৱেদন পত্ৰ, কাৰ্যালয়ৰ টোকা প্ৰস্তুত আৰু সভাৰ কাৰ্যক্ৰমণিকা লিখন

চিঠিৰ বিভাগ আৰু লিখন পদ্ধতি, আৱেদন পত্ৰৰ ভাগসমূহ, লিখন পদ্ধতি, কাৰ্যালয়ৰ টোকা প্ৰস্তুতিৰ পদ্ধতি, সভাৰ কাৰ্যক্ৰমণিকা লিখন

অধ্যায় ৮ : কম্পিউটাৰত ব্যৱহৃত অসমীয়া ভাষা আৰু ইণ্টাৰনেটত অসমীয়া ভাষা

কম্পিউটাৰত অসমীয়া ভাষা – অসমীয়া ফণ্ট, অসমীয়া কী-বৰ্ড, অসমীয়া বিবিধ চফটৱেৰ

ইণ্টাৰনেটৰ সংজ্ঞা, ইতিহাস; ইণ্টাৰনেটত অসমীয়া ভাষা – ই-মেইল আৰু ব্লগত ব্যৱহৃত অসমীয়া ভাষা, ৱেব জাৰ্নেল, বিভিন্ন সামাজিক মাধ্যমত অসমীয়া ভাষা, ইণ্টাৰনেটৰ অসমীয়া অভিধান তথা পুথিভঁৰাল

অধ্যায় ৯ : অসমীয়া ভাষাত বিজ্ঞান শিক্ষা আৰু চৰ্চা

অসমীয়া ভাষাত বিজ্ঞান শিক্ষা আৰু চৰ্চাৰ সামাগ্ৰিক ইতিহাস (ব্যৱহাৰিক সাহিত্যৰ পৰা বৰ্তমানলৈকে), বিজ্ঞান জনপ্ৰিয়কৰণ বিষয়ক ৰচনা; জনপ্ৰিয় বিজ্ঞান সাহিত্য, সাহিত্যৰ বিভাগ হিচাপে বিজ্ঞান বিষয়ক লিখনি

Annexure - 7

Functional Language (English)

Course Name: Functional English
Course Code: BS-AECC-1B
Total Marks: 50
Total Credit 2

Unit 1: Importance of Functional English
What is Functional English?, English Communication in the Global Contexts, Skills for better Communication in English

Unit 2: Communication
Defining Communication, Significance of Communication, Effective Communication, Process of Communication, Communication Network, Communication Media or Methods, Barriers to Communication, Types and Channels of Communication

Unit 3: Communication Skills
Why Communication Skills required?, Essentials of Oral Communication, Written Communication, Spoken Communication, Non-Verbal Communication, Essentials of Written Communication, Skills Involved in Oral Communication, Non-verbal Communication, Reading and Writing Skill, The Process of Speech, Listening and Speaking Skills, Phrasal Verbs, Turn-Taking, The Language of Conversation, Conversation as a speech event

Unit 4: Grammar in Context
Grammaticality and Appropriateness, Eliciting Information, Question patterns in Context, Some verb forms in contexts, Modals in Conversation, Uses of Will and Would, Uses of May, Might, and Must, Uses of Other Modals, Uses of Shall, should, Shouldn't, Miscellaneous uses of Modals.

Unit 5: Informal/Formal Speech and Public speaking
Features of Informal Speech, Ellipsis, Discourse Markers in informal Speech, Features of Formal Speech, Techniques of Informative Speech, Techniques of Persuasive Speech, Public Speaking on Special Occasions

Unit 6: Telephone Skills and Interview Skills
Giving Instructions, Handling Calls, Making Requests, Request to Do Things, Understanding Telephone Communication, Media Interviews, Job Interviews, The art of Interviewing

Unit 7: Essay and Story Writing

Introduction to Essay Writing, The Structure of the Essay, Sample of Essays, Introduction to Story Writing, The Technique of Story Writing, Sample of Stories

Unit 8: Précis Writing, Report Writing and Writing Comprehension

Précis Writing, How to Write a Précis?, Report Writing, How to Write a Report?, What is Comprehension?, Descriptive Comprehension and Objective Comprehension

Unit 9: Note Making/Note Taking & Correspondences

Note making and Note taking, Format of Note making, scanning a Piece of Text, Skimming a Piece of Text, Samples of Note making, Letter Writing, How to Write a Letter, Format of a Business Letter, How to Write a Memo, Examples, Notices, Types of Notices, How to Write a Notice, Press Release, How to Write a Press Release, Format of a Press Release

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Annexure 8

Detailed Syllabus of Ability Enhancement Course (AECC) on Environmental Studies

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Semester II

Course Code: BS-AECC-2
Course Title: Environmental Studies
Nature of the Course: AECC
Credit: 02

Total Marks: 100

Course Learning Objectives:

1. Help the undergraduate students to obtain in-depth knowledge on natural processes and resources that sustain life and govern economy.
2. Understand the consequences of human activities on the environment, global economy, and quality of human life.
3. Develop critical thinking for shaping strategies (scientific, social, economic, administrative, and legal) for environmental protection, conservation of biodiversity, environmental equity, and sustainable development.

Unit 1: Introduction to environmental studies

- Multidisciplinary nature of environmental studies; components of environment –atmosphere, hydrosphere, lithosphere and biosphere.
- Scope and importance; Concept of sustainability and sustainable development.

Unit 2: Ecosystems

- What is an ecosystem? Structure and function of ecosystem; Energy flow in an ecosystem: food chain, food web and ecological succession. Case studies of the following ecosystems:
  a) Forest ecosystem
  b) Grassland ecosystem
  c) Desert ecosystem
  d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Unit 3: Natural Resources: Renewable and Non-renewable Resources

- Land Resources and land use change; Land degradation, soil erosion and desertification.
- Deforestation: Causes and impacts due to mining, dam building on environment, forests, biodiversity and tribal populations.
- Water: Use and over-exploitation of surface and ground water, floods, droughts, conflicts over water (international & inter-state).
- Heating of earth and circulation of air; air mass formation and precipitation.
- Energy resources: Renewable and non-renewable energy sources, use of alternate energy sources, growing energy needs, case studies.

Unit 4: Biodiversity and Conservation

- Levels of biological diversity :genetic, species and ecosystem diversity; Biogeography zones of India; Biodiversity patterns and global biodiversity hot spots
- India as a mega-biodiversity nation; Endangered and endemic species of India
- Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasions; Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.
- Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational value.

Unit 5: Environmental Pollution

Environmental pollution: types, causes, effects and controls; Air, water, soil, chemical and noise pollution

- Nuclear hazards and human health risks
- Solid waste management: Control measures of urban and industrial waste.
- Pollution case studies.

Unit 6: Environmental Policies & Practices

Climate change, global warming, ozone layer depletion, acid rain and impacts on human communities and agriculture.

- Environment Laws : Environment Protection Act; Air (Prevention & Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act; International agreements; Montreal and Kyoto

protocols and conservation on Biological Diversity (CBD). The Chemical Weapons Convention (CWC).

- Nature reserves, tribal population and rights, and human, wildlife conflicts in Indian context

Unit 7: Human Communities and the Environment

- Human population and growth: Impacts on environment, human health and welfares.
- Carbon foot-print.
- Resettlement and rehabilitation of project affected persons; case studies.
- Disaster management: floods, earthquakes, cyclones and landslides.
- Environmental movements: Chipko, Silent valley, Bishnios of Rajasthan.
- Environmental ethics: Role of Indian and other religions and cultures in environmental conservation.
- Environmental communication and public awareness, case studies (e.g., CNG vehicles in Delhi).

Unit 8: Field work

- Visit to an area to document environmental assets; river/forest/flora/fauna, etc.
- Visit to a local polluted site – Urban/Rural/Industrial/Agricultural.
- Study of common plants, insects, birds and basic principles of identification.
- Study of simple ecosystems-pond, river, Delhi Ridge, etc.

Suggested Readings:

1. Carson, R. *2002. Silent Spring.* Houghton Mifflin Harcourt.
2. Gadgil, M., & Guha, R.1993. This *Fissured Land:* An Ecological History of India. Univ. of California Press.
3. Gleeson,B. and Low, N. (eds.) 1999. Global Ethics and Environment, London, Routledge.
4. Gleick, P.H. 1993. Water in *Crisis*. Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute, Oxford Univ. Press.
5. Groom, Martha J. Gary K. Meffe, and Carl Ronald carroll. *Principles of Conservation Biology*. Sunderland: Sinauer Associates, 2006.
6. Grumbine, R. Edward, and Pandit, M.K. 2013. Threats from India's Himalaya dams. Science, 339: 36-37.

7. McCully, P.1996. *Rivers no more: the environmental effects of dams*(pp. 29-64). Zed Books.
8. McNeil, John R. 2000. Something New Under the Sun: An Environmental

Annexure 9: Detailed Syllabus of Office Management (SEC)

Semester III

Course Code: BS-SEC-1E
Course Title: Office Management
Nature of the Course: SEC
Credit: 02
Marks: 50

Unit 1:Introduction to Office Management: Meaning and importance of office, Nature and functions of Office, Relationship of office with other departments, Functions-basic and auxiliary, Position and role of an office manager.

Unit 2: Office Administration: Administrative office management, objectives of administrative office management, functions of administrative office manager, scientific office management

Unit 3:Office Layout and Environment: Office Layout and Working Condition, Location of office, Office building, Office layout-nature, principles, types. Open and private offices, Office Environment - lighting, ventilation, Temperature and interior decoration etc.

Unit 4:Workflow in Office: Concept of work-flow and flow charts, Difficulties in work flow.

Unit 5:Office Organization: Principles, Types - line, line and staff and services Organization, Office charts and manuals.

Unit 6:Office Communication: Basic Principles, Internal Communication and External communication. Handling Inward and Outward communication; Mail Organization of the mailing section, Arrangements with post offices, Inward Mail routine, dealing with correspondence, Outward mail routine, Mechanizing mail service.

Unit 7: Filing System: Filing - meaning and importance, Classification of papers for filing, Methods of filing: horizontal and vertical.

Unit 8: Office automation: Uses and abuses of Labour-saving appliances, various types of commonly used appliances.

Annexure 10: Detailed Syllabus of Entrepreneurship Management and Small Business Management

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Semester IV

Course Code: BS-SEC-2E
Course Title: Entrepreneurship Management and Small Business Management
Nature of the Course: SEC
Credit: 02
Marks: 50

UNIT 1 : Introduction to Entrepreneur

Meaning of Entrepreneur, Characteristics of an Entrepreneur, Emergence of Entrepreneurial Class, Theories of Entrepreneurship, Economic Theory, Sociological Theory, Dynamic Entrepreneurship Innovation Theory, Leibenstein's X- efficiency theory, Theory of profit, Role of Entrepreneurs in Economic Growth, Entrepreneurship Development Programme- Meaning and Importance, Meaning of Entrepreneurial Development Programme (EDP), Importance of EDP, Course Contents and Curriculum of Entrepreneurship Development Programmes, Role of Entrepreneurship Development Programmes in Context of North-East Region, Institutions providing Entrepreneurship Development Programmes in India

UNIT 2 : Promotion of a Venture

Meaning of Promotion of a Venture, Sources of Business Ideas, Steps in Identification of Business Opportunities, External Environmental Analysis- Meaning and Importance, Economic Factors, Social Factors, Technological Factors, Competitive Factors, Establishment of a New Business Unit- Legal Requirements, Venture Capital- Meaning and Importance, Function of Venture Capitalists, Venture Capital Instruments, Sources of Venture Capital, Documentation for Obtaining Venture Capital

UNIT 3 : Size of Business Unit

Standards to Measure the Size of Business Units, Factors Determining the Size of Business Unit, Optimum Size of a Firm, Principles of Location of

Business Unit, Factors Influencing Location of Business Unit, Plant Location in the North- East Region– the Present and Future Status

UNIT 4 : Small Enterprise

Definition of small enterprise, Characteristics of small enterprise, Relationship between small and large scale units, Objectives and scope of small enterprise, Role of small enterprises in economic development, Problems of small scale units

UNIT 5 : Ownership Structures

Concept of Proprietorship, Features of Proprietorship, Advantages and Disadvantages of Proprietorship, Concept of Partnership, Features of Partnership, Advantages and Disadvantages of Partnership, Concept of Company, Features of Company, Distinction between a Private Company and a Public Company, Advantages and Disadvantages of a Company, Concept of cooperative, Features of Co-operatives, Advantages and Disadvantages of Co-operatives, Selection of an appropriate form of Ownership Structure, Ownership Pattern in Small Scale Industries in India

UNIT 6 : Industrial Sickness

Meaning of Industrial Sickness, Warning Signals of Industrial Sickness, Causes of Industrial Sickness, External causes of Industrial Sickness, Internal causes of Industrial Sickness, Factors responsible for sickness of small business, Consequences of Industrial Sickness, Corrective Measures

UNIT 7 : Tax Benefits to Small Scale Industries

Need for tax benefits, Tax Exemption, Rehabilitation Allowance, Investment Allowance, Tax Concession to small scale industries in rural areas, Tax concession to small scale industries in backward areas, MODVAT and Small Scale industries

UNIT 8 : Financing of an Enterprise

Meaning of Financial Planning, Sources of Finance, Sources of short term finance, Capital Structure, Theories of Capital Structure, Factors determining Capital Structure, Term loan– Meaning and its Significance, Capitalisation,

Over-Capitalisation, Under-Capitalisation, Export Finance, Exim Bank Finance, Forfeiting, Concept of other development financial institution

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Annexure 11

Detailed Syllabus of Basics of Tourism

Semester V

Course Code: BS-SEC-3E
Course Title: BASICS OF TOURISM
Nature of the Course: SEC
Credit: 2
Marks: 50

UNIT 1: Introduction to Tourism

Definition of Tourism: Tourist, Visitor, Traveller, Excursionist; Categories of Tourism: Inbound Tourism, Outbound Tourism; Concept of Travel and Tourism: Transport and Travel Interrelationship.

Elements of Tourism: Major Elements; Accommodation; Accessibility; Attraction; Amenity; Activity; Role of Elements in Tourism Growth.

Motivators in Tourism: Travel Motivations: Purpose of Travel, Impact of Travel Motivation in Tourism, Typologies of Travel Motivation; Concept of Tourist Flows; Factors Influencing Tourism Pattern.

Concept of Tourist Data; Tourist In-Flow; Tourist Out-Flow.

UNIT 2: Types of Tourism and Travel Planning and Destination Management

Various Types of Tourism: Eco Tourism, Adventure Tourism, Leisure Tourism, Holiday Tourism, Event Tourism, Religious Tourism; Tourism Activities; Upcoming Tourism.

Travel Planning and Destination Management: Travel Planning: Benefits of Planned Travel, Precautionary Measures for Travel, Travel Do's and Don'ts; Managing Travel Destinations.

UNIT 3: Tourism and Travel Organizations

Concept of Organization; Government Organizations: ATDC, Indian Tourist Development Corporation, Department of Tourism in Assam, WTO; Non-Government and Private Organizations: IATA, ICAO.

United Federation of Travel Agent Association (UFTAA); Pacific Association of Travel Agent (PATA): Role and Activities; Travel Agent Association of India (TAAI); Travel Agent Federation of India (TAFI); International Civil Aviation Organization (ICAO); Indian Association of Tour Operator (IATO); Association of Domestic Tour Operator of India (ADTOI).

Unit 4: Travel Houses and Activities: Travel Houses and Activities**:** Concepts of Travel Houses; Types of Travel Houses: Travel Agency, Tour Operator, Travel Consultancy, Transport Agencies; Immigration Services: Visa Facilitation Centre, Immigration Consultancy; Foreign Exchange Service: Foreign Money Changer, Forex Consultant.

Unit 5: Travel Destinations and World Heritage Sites in India and Wonders of the World

Major Travel Destinations in Assam; Major Travel Destinations in North East India; Major Indian Travel Destinations.

UNESCO World Heritage Sites: Heritage Sites in North India, Heritage Sites in Easter India, Heritage Sites in Central India, Heritage Sites in Western India, Heritage Sites in South India.

Types of Wonders: Ancient Wonders, Modern Wonders, Natural Wonders; Major Wonders of Tourist Attraction.

Unit 6: Conservation and Promotions of Tourism

Promotion of Tourism; Promotional activities; Employment generation in Tourism; Sustainable Tourism; Tourism events and fairs; Private area development.

Unit 7: Elements Affecting Tourism Growth in India

Elements Affecting Tourism; Natural Elements: Global Warming, Natural Calamity; Man Made Threats; Types of Affects: Natural, Social, Political, Economic; Possible Remedies and Scope for Improvement.

Unit 8: Careers in Tourism

Career in Travel: Direct Employment, Employment in the Allied Industries, Scope for Career Building; Entrepreneurship in Tourism.

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Annexure 12

Detailed Syllabus of Travel Geography

Semester VI

Course Code: BS-SEC-4E
Course Title: TRAVEL GEOGRAPHY
Nature of the Course: SEC
Credit: 2
Marks: 50

Unit 1: Travel Geography of India with special to North Eastern State

States; Geographical Information; Climate Condition; Major Cities; Major Connectivity, Festivals, Natural/Historical/Archaeological Information; Important Tourist Attractions.

North Eastern States; Geographical Information; Climate Condition; Major Cities; Major Connectivity, Festivals, Natural/Historical/Archaeological Information; Important Tourist Attractions.

Indian Map and Destination Study**:** Map Drawing; Location Identifier: Latitude-Longitude-Boundary; Other Information

Unit 2: Asian Travel Geography

Countries; Geographical Information; Climate Condition; Major Cities; Major Connectivity: Major Airport HUBs; Important Tourist Attractions.
(Currencies-Time Zone and Best Time to Visit-Other Information-Major Language).

Asian Map and Destination Study**:** Map Drawing; Location Identifier: Latitude-Longitude-Boundary; Other Information

Unit 3: Travel Geography of Europe

European Countries; Geographical Information; Climate Condition; Major Cities; Major Connectivity: Major Airport HUBs; Important Tourist Attractions; EU and Schengen Area. (Currencies- Time Zone and Best Time to Visit- Mostly Visiting European Countries).

Europe Map and Destination Study**:** Map Drawing; Location Identifier: Latitude-Longitude-Boundary; Other Information.

Unit 4: Travel Geography of Africa

African Countries; Geographical Information; Climate Condition; Major Cities; Major Connectivity: Major Airport HUBs; Important Tourist Attractions;

Africa Map and Destination Study**:** Map Drawing; Location Identifier: Latitude-Longitude-Boundary; Other Information

Unit 5: Travel Geography of North America and South America

North American Countries; Geographical Information; Climate Condition; Major Cities; Connectivity and Currency; Major Airport HUBs; Important Tourist Attractions.

South American Countries; Geographical Information; Climate Condition; Major Cities; Connectivity and Currency; Major Airport HUBs; Important Tourist Attractions.

American Map and Destination Study: Map Drawing; Location Identifier: Latitude-Longitude-Boundary; Other Information

Unit 6: Travel Geography of Oceania

Oceania Countries; Geographical Information; Climate Condition; Major Cities; Connectivity and Currency; Major Airport HUBs; Important Tourist Attractions; Major Island in Oceania

Oceania Map and Destination Study: Map Drawing; Location Identifier: Latitude-Longitude-Boundary; Other Information

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