Karnatak University, Dharwad

Agenda For
Science & Technology Faculty Meeting
held on 06.09.2022

VENUE : GOLDEN JUBILEE BLDG., K.U.DHARWAD.
TIME: 11.30 A. M.

KARNATAK UNIVERSITY, DHARWAD
ACADEMIC (S&T) SECTION
ಕರ್ನಾಟಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಧಾರವಾಡ
ವಿದ್ಯಾಮಂಡಳ (ಎಸ್&ಟಿ) ವಿಭಾಗ

website: kud.ac.in

Tele: 0836-2215224
e-mail: academic.st@kud.ac.in

Pavate Nagar,Dharwad-580003
ಪಾವಟೆ ನಗರ, ಧಾರವಾಡ – 580003

No. KU /Aca(S&T)/ JS-125/Sci.Fac.Meet/2022-23/931   Date: E 3 SEP 2022

ಸಭೆಯ ನೋಟಿಸ್

ವಿಷಯ: 2022–23ನೇ ಶೈಕ್ಷಣಿಕ ಸಾಲಿನ ವಿಜ್ಞಾನ ಹಾಗೂ ತಂತ್ರಜ್ಞಾನ ನಿಖಾಯದ ಸಭೆಯನ್ನು ಜರುಗಿಸುವ ಕುರಿತು.

ಉಲ್ಲೇಖ: ಮಾನ್ಯ ಕುಲಪತಿಗಳ ಆದೇಶ ದಿನಾಂಕ: 2|9|2022

ಮೇಲಿನ ವಿಷಯ ಹಾಗೂ ಉಲ್ಲೇಖಕ್ಕೆ ಸಂಬಂಧಿಸಿದಂತೆ, 2022–23ನೇ ಶೈಕ್ಷಣಿಕ ಸಾಲಿನ ವಿಜ್ಞಾನ ಹಾಗೂ ತಂತ್ರಜ್ಞಾನ ನಿಖಾಯದ ಅಭ್ಯಾಸಸೂಚಿ ಮಂಡಳಿಗಳು / ಅಡ್–ಹಾಕ್ ಸಮಿತಿ ಸಭೆಗಳು ಮಾಡಿರುವ ಶಿಫಾರಸ್ಸುಗಳನ್ನು ಪರಿಶೀಲಿಸುವ ಕುರಿತು ವಿಜ್ಞಾನ ಹಾಗೂ ತಂತ್ರಜ್ಞಾನ ನಿಖಾಯ ಸಭೆಯನ್ನು ದಿನಾಂಕ 06.09.2022 ರಂದು ಮುಂಜಾನೆ 11.30 ಗಂಟೆಗೆ ಕ.ವಿ.ವಿ.ಯ ಗೋಲ್ಡನ್ ಜ್ಯೂಬಲಿ ಸಭಾಭವನದಲ್ಲಿ ಕರೆಯಲಾಗಿದೆ. ಆದ್ದರಿಂದ ಸದರಿ ಸಭೆಗೆ ಹಾಜರಾಗಲು ತಿಳಿಸಲಾಗಿದೆ. ಸಭೆಯ ಕಾರ್ಯಸೂಚಿಯನ್ನು ಮಿಂಚಂಚೆ (E-mail) ಮುಖಾಂತರ ರವಾನಿಸಲಾಗುವುದು, ಪರ ಊರಿನ ಸದಸ್ಯರಿಗೆ ಕ.ವಿ.ವಿ. ನಿಯಮಗಳ ಪ್ರಕಾರ ದಿನಭತ್ಯ / ಪ್ರಯಾಣ ಭತ್ಯೆ ನೀಡಲಾಗುವುದು.

ಮುಂದುವರೆದು, ಕಲಂಗಳನ್ನೊಳಗೊಂಡ ಸಭೆಯ ಕಾರ್ಯಸೂಚಿ (Agenda) ಯನ್ನು ಪ್ರೊಜೆಕ್ಟರ್ ಮುಖಾಂತರ ಬಿತ್ತರಿಸಲಾಗುವುದು.

ಕುಲಸಚಿವರು

ಪ್ರತಿ ಸಾದರಪೂರ್ವಕವಾಗಿ:

1. ಡಾ. ಬಿ.ಬಸವನಗೌಡ, ಡೀನರು, ವಿಜ್ಞಾನ ಹಾಗೂ ತಂತ್ರಜ್ಞಾನ ನಿಖಾಯ, ಸ್ನಾತಕೋತ್ತರ ಗಣಿತಶಾಸ್ತ್ರ ಅಧ್ಯಯನ ವಿಭಾಗ, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.

2. ಎಲ್ಲ ವಿಜ್ಞಾನ ಹಾಗೂ ತಂತ್ರಜ್ಞಾನ ನಿಖಾಯದ ಸದಸ್ಯರುಗಳಿಗೆ ಕಾರ್ಯಸೂಚಿ (Agenda) ಮಿಂಚಂಚೆ (E-mail) ಮೂಲಕ ರವಾನಿಸಲಾಗಿದೆ.

3. ಡಾ. ಎಸ್.ಎಂ.ತುವಾರ, **ವಿಶೇಷ ಆಹ್ವಾನಿತರು**, ಸಹಪ್ರಾಧ್ಯಾಪಕರು, ಕರ್ನಾಟಕ ವಿಜ್ಞಾನ ಮಹಾವಿದ್ಯಾಲಯ, ಧಾರವಾಡ.

ಪ್ರತಿ ಮಾಹಿತಿಗಾಗಿ:

1. ಹಣಕಾಸು ಅಧಿಕಾರಿಗಳು, ಹಣಕಾಸು ವಿಭಾಗ, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ (ಪರ ಊರಿನ ಸದಸ್ಯರುಗಳಿಗೆ ಪ್ರವಾಸ / ದಿನ ಭತ್ಯೆ ಹಣಕಾಸಿನ ಸೌಲಭ್ಯ ಒದಗಿಸಲು ವಿನಂತಿಸಿದೆ) (ಪಟ್ಟಿ ಲಗತ್ತಿಸಿದೆ).

2. ಸ್ಥಾನಿಕ ಅಭಿಯಂತರರು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ (ಸದರ ಸಭೆಗೆ ದಿನಾಂಕ 06.08.2022 ರಂದು ಮೈಕ್ ಮುರ್ಚಿ ಇತ್ಯಾದಿ ಎಲ್ಲ ವ್ಯವಸ್ಥೆ ಮಾಡಲು ವಿನಂತಿಸಲಾಗಿದೆ).

3. ಸಹಾಯಕ ಕುಲಸಚಿವರು, ಸಾಮಾನ್ಯ ಆಡಳಿತ ವಿಭಾಗ, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ ಇವರ ಮಾಹಿತಿಗಾಗಿ ಹಾಗೂ ದಿನಾಂಕ 06.08.2022 ರಂದು ನಡೆಯುವ ಕಲಾ ನಿಖಾಯ ಸಭೆಗೆ ಆಗಮಿಸುವ ಸದಸ್ಯರಿಗೆ ಕೊಠಡಿ ಕಾಯ್ದಿರಿಸುವುದು.

4. ಅಧೀಕ್ಷಕರು, ಪಿ.ಜಿ. ಮಿಸಲೇನಿಯಸ್, ಹಣಕಾಸು ವಿಭಾಗ, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ ಇವರ ಮಾಹಿತಿಗಾಗಿ ಹಾಗೂ ಮುಂದಿನ ಸೂಕ್ತ ಕ್ರಮಕ್ಕಾಗಿ.

5. ಅಧೀಕ್ಷಕರು, ಪರೀಕ್ಷಾ (ಗೌಪ್ಯ) ವಿಭಾಗ, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.

6. ಕುಲಪತಿಗಳ ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.

7. ಕುಲಸಚಿವರ ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.

8. ಕುಲಸಚಿವರು (ಮೌಲ್ಯಮಾಪನ) ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.

Karnatak University, Dharwad

Science and Technology meeting convened on 06.09.2022 at 11.30 a.m. in Golden Jubilee Building, K.U.Dharwad.

Agenda

Sl. No.	Subject	Item No.	Encl. No.
1	Consideration of recommendation of BOS in Statistics (UG) regarding the syllabus of 3rd and 4th Semester of B.Sc in Statistics (Hons) and BA (Hons) with Applied Statistics (As Minor Subject) finalized as per NEP 2020 effect from academic year 2022-23.	1	1
2	Consideration of recommendation of BOS in Mathematics (UG) regarding the B. Sc. Mathematics Syllabus (III and IV Semester) as per NEP 2020 with effect from the academic year 2022-23.	2	2
3	Consideration of recommendation of BOS in Chemistry Syllabus for III & IV Semester B.Sc (Hon) course in Chemistry as per NEP 2020 with effect from the academic year 2022-23.	3	3
4	Consideration of recommendation of BOS in Geology III & IV semesters course of Geology along with Model Questions papers are mentioned herewith as per NEP 2020 with effect from the Academic year 2022-23.	4	4
5	Consideration of recommendation of BOS in UG Physics Syllabus (III and IV Semester) as per NEP 2020 with effect from the academic year 2022-23.	5	5
6	Consideration of recommendation of BOS in UG Electronics UG (B.Sc. Physics & Electronics) Programme as per NEP 2020 for the academic year 2022-23 and approved.	6	6
7	Consideration of recommendation of BOS in UG Botany semester 3 and 4 as per NEP 2020 with effect from the academic year 2022-23.	7	7
8	Consideration of recommendation of BOS in Zoology UG III and IV Semester Zoology course as per NEP-2020 for implementation from the academic year-2022-23.	8	8
9	Consideration of recommendation of BOS in Zoology PG approve the new theory question paper pattern for M.Sc. I-IV Semester Zoology examinations with effect from the academic year 2022-23 onwards.	9	9
10	Consideration of recommendation of BOS in Home Science III and IV semester syllabus of the U. G. Home Science course as per NEP-2020 w. e. f the academic year 2022-23 onwards.	10	10
11	Consideration of recommendation of BOS in Geography (UG) UG Second Year i.e Third and Fourth Semester in Geography has been prepared as per NEP-2020 w. e. f the academic year 2022-23 onwards.	11	11

Sl. No.	Subject	Item No.	Encl. No.
12	Consideration of recommendation of BOS in Pulp & Paper Science As per NEP -2020 w. e. f the academic year 2022-23 onwards.	12	12
13	Consideration of recommendation of BOS in Computer Science 3rd and 4th semesters syllabus for the academic year 2022-23of all UG courses (B.Sc, BCA & B.A) in Computer Science as per NEP w. e. f the academic year 2022-23 onwards.	13	13
14	Consideration of recommendation of Adhoc committee in Biotechnology syllabus of B.Sc. III & IV Semester (UG) in Biotechnology Course as per NEP-2020 w.e.f 2022-23 onwards.	14	14
15	Consideration of recommendation of Adhoc committee in Microbiology syllabus of B.Sc. III & IV Semester (UG) in Microbiology Course as per NEP-2020 w.e.f 2022-23 onwards.	15	15
16	Consideration of recommendation of Adhoc committee in Genetics (UG) syllabus of B.Sc. III & IV Semester (UG) in Genetics Course as per NEP-2020 w.e.f 2022-23 onwards.	16	16
17	Consideration of recommendation of Adhoc committee in Industrial Fish & Fisheries (UG) syllabus of B.Sc. III & IV Semester (UG) in Industrial Fish & Fisheries Course as per NEP-2020 w.e.f 2022-23 onwards.	17	17
18	Consideration of recommendation of Adhoc committee in BASLP syllabus (3rd and 4th semester) as per NEP 2020 with effect from the academic year 2022-23.	18	18
19	Consideration of recommendation of Adhoc committee in Biochemistry (UG) III and IV semester syllabus of the U. G. Biochemistry course as per NEP-2020 w. e. f the academic year 2022-23 onwards.	19	19
20	Consideration of recommendation of BOS / Adhoc committee in "**Apprenticeship/Internship Embedded Degree Program**" as per the UGC guidelines in Constituent and Affiliated Colleges of the University as per NEP-2020 w.e.f 2022-23 onwards.	20	20

Registrar
Karnatak University, Dharwad

ITEM FOR SCIENCE & TECHNOLOGY FACULTY

Consideration of recommendation of various BOS / Ad-hoc Committee (UG) coming under faculty of Science & Technology for preparing the Syllabi of III & IV Semester under NEP for the academic year 2022-23 are placed before faculty of Science & Technology.

Note:

The BOS / Ad-hoc Committee (UG) held different meeting is as under:

Statistics **BOS in Statistics (UG) Res. No. 01, dated 19.08.2022**
The syllabus of 3rd and 4th Semester B.Sc. in Statistics (Hons) and BA (Hons) with Applied Statistics (As Minor Subject) as per NEP– 2020 is prepared and finalized. The instruction no. 1 given in the circular No. KU/Aca(S&T)/SSL-423/BOS (UG/PG/2022-23/636, Dated: 03-08-2022 is taken into consideration while preparing the syllabus.

It is resolved to recommend to the University to approve the syllabus of 3rd and 4th Semester of B.Sc in Statistics (Hons) and BA (Hons) with Applied Statistics (As Minor Subject) finalized by UG BOS with effect from academic year 2022-23.

Mathematics **BOS in Mathematics (UG) Res. No. 02, dated 19.08.2022**
The matter was discussed and prepared the B. Sc. Mathematics Syllabus (III and IV Semester) according to the draft regulations Governing four years undergraduate programmes as per NEP-2020 of Karnatak University, Dharwad-2021-22. Further resolved to approve the draft copy of the B. Sc. Mathematics Syllabus (III and IV Semester) as per NEP 2020 with effect from the academic year 2022-23.

Chemistry **BOS in Chemistry (UG) Res. No. 02, dated 19.08.2022**

As per NEP guidelines, the Syllabus for III & IV Semester B.Sc (Hon) course in Chemistry was discussed at length and it was resolved to approve the same as given in Annexure – I.

Geology **BOS in Geology (UG) Res. No. 02, dated 19.08.2022**
It is resolved and approved syllabus as per definitions of CBCS and "SGPA/CGPA Regulations 2021" of NEP -2020 of the Karnatak University for III & IV semesters course of Geology along with Model Questions papers are mentioned herewith. (Copy of the Syllabus enclosed) with the effect from the Academic year 2022-23.

Physics **BOS in Physics (UG) Res. No. 02, dated 19.08.2022**
The matter was discussed and prepared the B. Sc. Physics Syllabus (III and IV Semester) according to the draft regulations Governing four years undergraduate programmes as per NEP-2020 of Karnatak University, Dharwad-2021-22. Further resolved to approve the draft copy of the B. Sc. Physics Syllabus (III and IV Semester) as per NEP 2020 with effect from the academic year 2022-23.

Electronics **BOS in Electronics (UG) Res. No. 02, dated 22.08.2022**
The Board of Studies prepared the III & IV Semester NEP-2020 Syllabus for UG (B.Sc. Physics & Electronics) Programme for the academic year 2022-23 and approved.

Botany   **BOS in Botany (UG) Res. No. 02, dated 23.08.2022**

The matter was discussed and prepared the B. Sc. Botany Syllabus (III and IV Semester) according to the draft regulations Governing four years undergraduate programmes as per NEP-2020 of Karnatak University, Dharwad-2021-22. Further resolved to approve the draft copy of the B. Sc. Botany Syllabus (III and IV Semester) as per NEP 2020 with effect from the academic year 2022-23.

Zoology   **BOS in Zoology (UG) Res. No. 01, dated 18.08.2022**

It is resolved to approve the draft syllabus for B.Sc. III and IV Semester Zoology course as per NEP-2020 for implementation from the academic year-2022-23.The prepared draft syllabus is sent to faculty and academic council meeting for approval and final implementation.

Zoology   **BOS in Zoology (PG) Res. No. 02, dated 20.08.2022**

It is resolved to approve the new theory question paper pattern for M.Sc. I-IV Semester Zoology examinations with effect from the academic year 2022-23 onwards

Home Science   **BOS in Home Science (UG) Res. No. 03, dated 20.08.2022**

The matter was discussed and it is resolved to approve the III and IV semester syllabus of the U. G. Home Science course as per NEP-2020 w. e. f the academic year 2022-23 onwards.

Geography   **BOS in Geography (UG) Res. No. 02, dated 20.08.2022**

Resolved the syllabus of UG Second Year i.e Third and Fourth Semester in Geography has been prepared under NEP-2020 for the year 2022-23.

Pulp & Paper Sci.   **BOS in Pulp & Paper Science (UG) Res. No. 02, dated 18.08.2022**

As per NEP guidelines the Syllabus for III & IV Semester B.Sc (Hon) course in Pulp & Paper Science was discussed at length and it was resolved to approve the same as given in Annexure – I.

Computer Science   **BOS in Computer Science (UG) Res. No. 01, dated 23.08.2022**

Discussed 3rd and 4th semesters syllabus for the academic year 2022-23of all UG courses (B.Sc, BCA & B.A) in Computer Science as per NEP.

Biotechnology   **BOS in Biotechnology (UG) Res. No. 02, dated 19.08.2022**

After the detailed discussions, as per National Education Policy-2020 prepared and finalized the syllabus of B.Sc. III & IV Semester (UG) in Biotechnology Course form 2022-23 onwards.

Microbiology   **BOS in Microbiology (UG) Res. No. 02, dated 20.08.2022**

After the detailed discussions, as per NEP-2020 prepared and finalize the syllabus of B.Sc. III & IV Semester (UG) in Microbiology Course form 2022-23 onwards.

Applied Genetics   **BOS in Applied Genetics (UG) Res. No. 02, dated 19.08.2022**

After the detailed discussions, as per NEP-2020 prepared and finalize the syllabus of B.Sc. III & IV Semester (UG) in Genetics Course from 2022-23 onwards.

Ind. Fish & Fisheries   **BOS in Ind. Fish & Fisheries (UG) Res. No. dated 18.08.2022**

1. Industrial Fish & Fisheries syllabus for 3rd semester B.Sc. were prepared and the title for the paper finalised as **DSCC "Capture Fisheries and Inland Fisheries" Code 033IFF011**
2. 3rd Semester Practical **DSCC "Industrial Fish and Fisheries" Code 033IFF012**
3. 3rd semester **OEC "Principles and Practice of Aquaculture" Code-003IFF051**
4. **4th semester** paper title finalised as **DSCC "Fisheries Technology and Extension" Code-034IFF011**
5. **4th semester** Practical **DSCC "Industrial Fish and Fisheries" Code-034IFF012**
6. 4th semester paper title was finalised a**s OEC "Mariculture and Fish Pathology" Code-004IFF051**

B.A.S.L.P.   **BOS in B.A.S.L.P. (UG) Res. No. 02, dated 19.08.2022**

The matter was discussed and prepared the BASLP syllabus (3rd and 4th semester) according to the draft regulations Governing four years undergraduate programmes as per NEP-2020 of Karnatak University, Dharwad-2021-22. Further resolved to approve the draft copy of the BASLP syllabus (3rd and 4th semester) as per NEP 2020 with effect from the academic year 2022-23.

Bio-chemistry   **BOS in Bio-chemistry (UG) Res. No. 03, dated 22.08.2022**

The matter was discussed and it is resolved to approve the III and IV semester syllabus of the U. G. Biochemistry course as per NEP-2020 w. e. f the academic year 2022-23 onwards.

all subjects   **BOS in all subjects (UG) Res. No. dated 18 to 22.08.2022**

"**Apprenticeship/Internship Embedded Degree Program**" as per the UGC guidelines in Constituent and Affiliated Colleges of the University.

Hence, the recommendation of BOS / Ad-hoc committees are placed before the SCIENCE & TECHNOLOGY faculty for consideration.

KARNATAK UNIVERSITY, DHARWAD

04 - Year B.Sc. (Hons.) Program

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SYLLABUS

Subject: STATISTICS

[Effective from 2022-23]

DISCIPLINE SPECIFIC CORE COURSE (DSCC) FOR SEM III & IV

OPEN ELECTIVE COURSE (OEC) FOR SEM III & IV

AS PER N E P – 2020

Karnatak University, Dharwad
Four Years Under Graduate Program in STATISTICS for B.Sc. (Hons.)
Effective from 2022-23

Sem	Type of Course	Theory/ Practical	Instruction hour per week	Total hours of Syllabus / Sem	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks	Credits
III	DSCC 3	Theory 033STA011	04hrs	56	02 hrs	40	60	100	04
		Practical 033STA012	04 hrs	52	03 hrs	25	25	50	02
	OEC-3 003STA051	Theory	03 hrs	42	02 hrs	40	60	100	03
IV	DSCC 4	Theory 034STA011	04 hrs	56	02 hrs	40	60	100	04
		Practical 034STA012	04 hrs	52	03 hrs	25	25	50	02
	OEC- 4 004STA051	Theory	03 hrs	42	02 hrs	40	60	100	03
	Details of the other Semesters will be given later								

B.Sc. Semester – III

Subject: STATISTICS
Discipline Specific Course (DSC)

The course STATISTICS in III semester has two papers (Theory Paper –I for 04 credits & Practical Paper -II for 2 credits) for 06 credits: Both the papers are compulsory. Details of the courses are as under.

Course No.-3 (Theory): 033STA011

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
Course-03	DSCC	Theory	04	04	56 hrs	2hrs	40	60	100

Course No.3 (Theory): Title of the Course (Theory) **: 033STA011: Calculus and Probability Distributions**

Course Outcome (CO):

After completion of course (Theory), students will be able to:

CO 1   Judge continuity of a function, find integrations and solve problems of differentiability.

CO 2   Solve problems of various analytical environments using different distributions and their properties.

CO 3   Find sampling distributions of functions of random variables and explore their applications.

Syllabus- Course 3 (Theory): 033STA011: Title- Calculus and Probability Distributions	Total Hrs: 56
Unit-I : Calculus of one and more variables	**15 hrs**
Review of calculus of one variable: continuity, differentiability, mean value theorem and Taylor series expansion. Functions of several variables: Continuity, directional derivatives, differentials of functions of several variables, the gradient vector. The mean value theorem, a sufficient condition for the existence of the differential, partial derivatives of higher order and Taylor's formula. Applications of partial differentiation, Jacobians. Riemann integrals, integration by parts, mean value theorem. Multiple integrals and evaluation of multiple integrals by repeated integration, Mean-value theorem for multiple integrals. Sequences and Series of real numbers. convergence of sequences and series, tests for convergence of series. (Only results and applications)	
Unit-II Distribution of Random Variables (Two-dimensional)	**12 hrs**
Two dimensional random variables: Joint distribution, Marginal distribution and Conditional distributions of random variables, conditional expectation, covariance, correlation and moments. Distribution of functions of random variables using m.g.f. and distribution function. Transformation of variable technique (one and two variables). Chebyshev's inequality- proof and its use in approximating probabilities; Statements of Weak Law of Large Numbers; Convergence in law and Central Limit theorems – De-Moivre. (Some simple examples)	

Unit-III Probability Distributions-II	16 hrs
Discrete distributions: Rectangular, Geometric, Negative Binomial, Hypergeometric, Multinomial- definition through probability mass function, mean, variance, moments, p.g.f., m.g.f., other properties and applications. Continuous distributions: Uniform, Gamma, Exponential, Beta (type 1 and type 2), Cauchy, Weibull– definition through probability density function, mean, variance, moments, m.g.f., other properties and applications. Bivariate normal distribution- definition through probability density function, marginal and conditional distribution.	
Unit-IV Sampling Distributions and Simulation	13 hrs
Definitions of random sample, parameter and statistic, sampling distribution of sample mean, standard error of sample mean, sampling distribution of sample variance, standard error of sample variance. Exact sampling distributions: Chi square distribution- mean, variance, moments, mode, additive property. Student's and Fisher's t-distribution- mean, variance, moments and limiting form of t distribution. Snedecor's F-distribution: mean, variance and mode. Distribution of 1/F. Relationship between t, F and $\chi2$ distributions. Introduction to simulation. Generation of random observations from Uniform, Exponential, Normal, Binomial, Poisson distributions using inverse-method and R-codes.	

Books recommended.

1. Andre I Khuri (2003). Advanced Calculus with Applications in Statistics, Second Edition, John Wiley & Sons.
2. Ghorpade, S. R. and Limaye, B. V. (2006). A Course in Calculus and Real Analysis, Springer
3. Gupta S.C. and V.K. Kapoor (2020), Fundamental of Mathematical Statistics, Sultan Chand and Co. 12th Edition.
4. Hogg, R. V. McKean J. W. and Craig, A. T. (2012), Introduction to Mathematical Statistics, Pearson 7th Edition.
5. Hogg, R.V., Tanis, E.A. and Rao J.M. (2009), Probability and Statistical Inference,10th Edition, Pearson Education, New Delhi.
6. Jay Kerns, G. (2010). Introduction to Probability and Statistics using R. 1st Edition, Springer.
7. Rohatgi, V.K. and A.K. Md. Ehsanes Saleh. (2002). An Introduction to Probability Theory and Mathematical Statistics, New York, John Wiley.
8. Ross, S. M. (2014). Introduction to Probability Models. 11th Edition, Elsevier science.
9. Ross, S. M. (2012). Simulation. Academic Press.
10. Shanthi Narayana (2000), Integral Calculus, S. Chand & Co. Ltd.
11. Shanti Narayana (2000). Differential Calculus, S. Chand & Co. Ltd.
12. Verzani, J. (2002). Simple R - Using R for Introductory Statistics.

B.Sc. Semester – III

Subject: STATISTICS
Discipline Specific Course (DSC)

Course No.-03 (Practical): 033STA012

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
Course-03	DSCC	Practical	02	04	52 hrs	3hrs	25	25	50

Course No.03 (Practical): Title of the Course (Practical): **033STA012: Practicals (based on Calculus and Probability Distributions)**

Course Outcome (CO):

After completion of course (Practical), students will be able to gain:

CO 1   Practical knowledge of handling various types of R-functions for calculus and probability distributions.

CO 2   Practical knowledge of carrying out numerical analysis.

CO 3   The knowledge of simulating random observations from various probability distributions using R.

List of the Experiments for 52 hrs / Semesters

Note: The first practical assignment is on R-programming. Practical assignments 2 to 10 have to be first solved manually (using scientific calculators) and executed using R-programming.

1. Demonstration of R functions for calculus, distribution of random variables, probability distributions, sampling distributions, simulation.

2. Numerical differentiation and integration.

3. Bivariate Probability Distributions - Marginal and Conditional distributions,

4. Bivariate Probability Distributions - Conditional Mean, Conditional Variance, Correlation.

5. Applications of Chebyshev's inequality (For standard distributions such as Normal, Exponential, Gamma).

6. Applications of discrete probability distributions - Negative – Binomial, Geometric, Hyper geometric and discrete uniform, multinomial distributions.

7. Applications of continuous probability distributions - Exponential, Gamma, Cauchy, Weibull distributions.

8. Fitting of discrete and continuous distributions.

9. Generating random sample from discrete distributions.

10. Generating random sample from continuous distributions.

General instructions:

Computation of all the practicals manually and using Excel

Scheme of Practical Examination (distribution of marks): 25 marks for Semester end examination

Students have to attempt 3 practical questions out of four practical questions given, each carrying 7 marks.

1. **7 Marks**

2. **7 Marks**

3. **7 Marks**

4. **Viva 2 Marks**

5. **Journal 2 Marks**

     Total 25 marks

Note: Same Scheme may be used for IA(Formative Assessment) examination

Books recommended.

1. Andre I Khuri (2003). Advanced Calculus with Applications in Statistics, Second Edition, John Wiley & Sons.

2. Ghorpade, S. R. and Limaye, B. V. (2006). A Course in Calculus and Real Analysis, Springer

3. Gupta S.C. and V.K. Kapoor (2020), Fundamental of Mathematical Statistics, Sultan Chand and Co. 12th Edition.

4. Hogg, R. V. McKean J. W. and Craig, A. T. (2012), Introduction to Mathematical Statistics, Pearson 7th Edition.

5. Hogg, R.V., Tanis, E.A. and Rao J.M. (2009), Probability and Statistical Inference,10th Edition, Pearson Education, New Delhi.

6. Jay Kerns, G. (2010). Introduction to Probability and Statistics using R. 1st Edition, Springer.

7. Rohatgi, V.K. and A.K. Md. Ehsanes Saleh. (2002). An Introduction to Probability Theory and Mathematical Statistics, New York, John Wiley.

8. Ross, S. M. (2012). Simulation. Academic Press.

9. Verzani, J. (2002). Simple R - Using R for Introductory Statistics.

B.Sc. Semester – III

Subject: STATISTICS
Open Elective Course (OEC-3): 003STA051
(OEC for other students)

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
OEC-3	OEC	Theory	03	03	42 hrs	2hrs	40	60	100

OEC-3: **003STA051:** Title of the Course: **POPULATION STUDIES**

After completion of course, students will be able to:

CO 1 : Study the concepts of Vital Statistics, sources of data, different measures of Fertility, Mortality and migration.

CO 2 : Understand the Growth rates- GRR and NRR and their interpretations.

Syllabus- OEC: 003STA051: Title- POPULATION STUDIES	Total Hrs: 42
Unit-I Introduction and Sources of Population Data	**14 hrs**
History, definition, nature and scope of population Studies. Sources of population data – salient features of Census, Civil Registration System, National Sample Surveys, Demographic Surveys, relative merits and demerits of these sources. Coverage and content errors. Use of balancing equations, Chandrasekar-Deming formula to check completeness of vital registration data, use of Whipple's, Myer's and UN indices.	
Unit-II Fertility, Mortality	**14 hrs**
Basic concepts and terms used in the study of fertility. Measures of fertility- Crude Birth Rate (CBR), General Fertility Rate (GFR), Age Specific Fertility Rate (ASFR), Total Fertility Rate (TFR), Birth order statistics, Child Women ratio. Measures of reproduction- Gross Reproduction Rate (GRR)and Net Reproduction rate(NRR). Measurement of population growth rate- simple growth rate and compound growth. Basic concepts and terms used in the study of mortality. Measures of mortality- Crude Death Rate (CDR), Age Specific Death Rate (ASDR), Direct and Indirect Standardized Death rates, Infant Mortality Rate (IMR), Under-five mortality Rate, Neo-natal mortality rate, Post-natal mortality rate; Maternal Mortality Rate (MMR).	
Unit-III Life tables and Population change	**14 hrs**
Life tables: Components of a life table, force of mortality and expectation of life table, types of life tables. Construction of life tables using Reed-Merrell's method, Greville's method. Uses of life tables. Basic concepts and definition of population change, migration. Types of migration- internal and international, factors affecting migration. Rates and ratios of Migration- Indirect measures of net-internal migration, national growth rate method, residual method, push-pull factors Population estimates and projections.	

Books recommended.

1. Barclay, G, W(1968). Techniques of Population Analysis, John Wiley and Sons, Incs. New York/London.
2. Keyfitz, H (1968). Introduction to the Mathematics of Population. Addison-Wesley Publishing Co.
3. Pathak, K.B and Ram, F (1991).Techniques of Demographic Analysis, Himalaya Publishing House.
4. Ramakumar. R (1986). Technical Demography, Wiley Eastern Ltd.
5. Srinivasan. K (1998). Basic Demographic Techniques and Applications, Sage Publication, New Delhi.
6. Wunsch G.J. & M.G. Tarmota(1978). Introduction to Demographic Analysis, Plenum Press, N.Y.

Details of Formative assessment (IA) for DSCC theory/OEC: 40% weight age for total marks

Type of Assessment	Weight age	Duration	Commencement
Written test-1	10%	1 hr	8th Week
Written test-2	10%	1 hr	12th Week
Seminar	10%	10 minutes	--
Case study / Assignment / Field work / Project work/ Activity	10%	------	--
Total	40% of the maximum marks allotted for the paper		

Faculty of Science
04 - Year UG Honors programme:2021-22

GENERAL PATTERN OF THEORY QUESTION PAPER FOR DSCC/ OEC
(60 marks for semester end Examination with 2 hrs duration)

Part-A
1. Question number 1-06 carries 2 marks each. Answer any 05 questions   : 10marks

Part-B

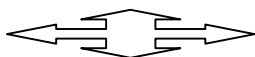2. Question number 07- 11 carries 05Marks each. Answer any 04 questions   : 20 marks

Part-C

3. Question number 12-15 carries 10 Marks each. Answer any 03 questions   : 30 marks

    (Minimum 1 question from each unit and 10 marks question may have sub
    questions for 7+3 or 6+4 or 5+5 if necessary)

Total: 60 Marks

Note: Proportionate weight age shall be given to each unit based on number of hours prescribed.

B.Sc. Semester – IV

Subject: STATISTICS
Discipline Specific Course (DSC)

The course STATISTICS in IV semester has two papers (Theory Paper –I for 04 credits & Practical paper-II for 2 credits) for 06 credits: Both the papers are compulsory. Details of the courses are as under.

Course No.-4 (Theory): 034STA011

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
Course-04	DSCC	Theory	04	04	56 hrs	2hrs	40	60	100

Course No.4 (Theory): **034STA011:** Title of the Course (Theory)**: STATISTICAL INFERENCE-I**

Course Outcome (CO):

After completion of course (Theory), students will be able to:

CO 1   Carryout statistical analysis by identifying families of distributions and the use of order statistics.

CO 2   To find estimators using different methods of estimation and compare estimators.

CO 3   To carryout statistical inference using different tests of hypotheses under different scenarios.

Syllabus- Course 4 (Theory): 034STA011: Title- STATISTICAL INFERENCE-I	Total Hrs: 56
Unit-I Point Estimation-I	**16 hrs**
Families of distributions- location and scale families. Single parameter exponential family. Concept of order statistics, Distribution of maximum and minimum order statistics (with proof) and rth order statistic (without proof). Concepts of estimator and estimate. Criteria for estimators: Unbiasedness, Consistency. Invariance property of consistent estimators. Efficiency and relative efficiency. Mean squared error as a criterion for comparing estimators. Sufficient statistics. Statement of Neyman-Factorization theorem.	
Unit-II : Point Estimation-II	**12 hrs**
Fisher information function. Statement of Cramer–Rao inequality and its applications. Minimum Variance Unbiased Estimator and Minimum Variance Bound Estimator. Maximum likelihood and method of moment estimation; Properties of MLE and moment estimators and examples. Method of Scoring, Rao-Blackwell theorem and examples.	

Unit-III Testing of Hypotheses	18 hrs
Statistical hypotheses - null and alternative, Simple and composite hypotheses. Type-I and Type-II errors, test functions. Randomized and non-randomized tests. Size, level of significance, Power function, power of tests. Critical region, p- value and its interpretation. Most Powerful (MP) and UMP test. Statement of Neyman-Pearson Lemma and its applications. Likelihood ratio tests. Large and small samples tests of significance. Tests for single mean, equality of two means, single variance and equality of two variances for normal populations. Tests for proportions.	
Unit-IV Interval Estimation	**10 hrs**
Confidence interval, confidence coefficient, shortest confidence interval. Methods of constructing confidence intervals using pivotal quantities. Construction of confidence intervals for mean, difference of two means, variance and ratio of variances, proportions, difference of two proportions and correlation coefficient.	

Books recommended.

1. Gupta S.C. and V.K. Kapoor (2020), Fundamental of Mathematical Statistics, Sultan Chand and Co. 12th Edition.

2. Hogg, R. V. McKean J. W. and Craig, A. T. (2012), Introduction to Mathematical Statistics, Pearson 7th Edition.

3. Hogg, R.V., Tanis, E.A. and Rao J.M. (2009), Probability and Statistical Inference, 10th Edition, Pearson Education, New Delhi.

4. Kale, B.K. (1999). A First Course on Parametric Inference, New Delhi, Narosa Publishing House.

5. Kendall, M.G., et. al., (1996).An Introduction to the Theory of Statistics, Universal Book Stall.

6. Rohatgi, V.K. and A.K. Md. Ehsanes Saleh. (2002). An Introduction to Probability Theory and Mathematical Statistics, New York, John Wiley.

7. Ross, S.M. (2014), Introduction to Probability and Statistics for Engineers and Scientists, 5th Edition, Academic Press.

B.Sc. Semester – IV

Subject: STATISTICS
Discipline Specific Course (DSC)

Course No.-4 (Practical) : 034STA012

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
Course-04	DSCC	Practical	02	04	52 hrs	3hrs	25	25	50

Course No.4 (Practical): **034STA012:** Title of the Course (Practical): **Practicals (Based On Statistical Inference-I)**

Course Outcome (CO):

After completion of course (Practical), students will be able to gain :

CO 1 Practical knowledge of computing the estimates and test statistics using R.

CO 2 Practical knowledge of carrying out statistical inference with different tests of hypotheses.

CO 3 Practical knowledge on carrying out MP and UMP tests using R.

List of the Experiments for 52 hrs / Semesters

Note: The first practical assignment is on R-programming and R packages. Practical assignments 2 to 10 have to be first solved manually (using scientific calculators) and executed using R-programming.

1. Demonstration of R-functions for estimation and testing of hypotheses.
2. Point estimation of parameters and obtaining estimate of standard errors and mean square error.
3. Computing maximum likelihood estimates.
4. Computing moment estimates.
5. Interval estimation: Construction of confidence interval (large and small samples)
6. Evaluation of Probabilities of Type – I and Type – II errors and power of tests.
7. Small sample tests: Tests for mean, equality of means under normality when variance is (i) known (ii) unknown, P-values.
8. Small sample tests: single proportion and equality of two proportions, variance and equality of two variances under normality.P-values for the above tests.
9. Large sample tests: Tests for mean, equality of means when variance is (i) known (ii) unknown, under normality, variance and equality of two variances under normality. P-values for the above tests.
10. MP and UMP tests for parameters of binomial, Poisson distributions, normal and Exponential(scale parameter only) distributions and power curve.

General instructions:

Computation of all the practicals manually and using R

Scheme of Practical Examination (distribution of marks): 25 marks for Semester end examination

Students have to attempt 3 practical questions out of four practical questions given, each carrying 7 marks.

1. **7 Marks**
2. **7 Marks**
3. **7 Marks**
4. **Viva 2 Marks**
5. **Journal 2 Marks**

    Total 25 marks

Note: Same Scheme may be used for IA(Formative Assessment) examination

Books recommended.

1. Gupta S.C. and V.K. Kapoor (2020), Fundamental of Mathematical Statistics, Sultan Chand and Co. 12th Edition.
2. Hogg, R.V., Tanis, E.A. and Rao J.M. (2009), Probability and Statistical Inference, 10th Edition, Pearson Education, New Delhi.
3. Ross, S.M. (2014), Introduction to Probability and Statistics for Engineers and Scientists, 5th Edition, Academic Press.
4. R for beginners by Emmanuel Paradis (freely available at **https://cran.r-project.org/doc/contrib/Paradisrdebuts_en.pdf**)

B.Sc. Semester – IV

Subject: STATISTICS
Open Elective Course (OEC-4): 004STA051
(OEC for other students)

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
OEC-4	OEC	Theory	03	03	42 hrs	2hrs	40	60	100

OEC-4: **004STA051:** Title of the Course: **Basics of Operations Research**

Course Outcomes (CO):

Students will be able to

CO1- Generate mathematical models of business environment.

CO2-Analyze the business situations.

CO3-Use different solution procedures through OR models.

Syllabus- OEC: 004STA051: Title- Basics of Operations Research	Total Hrs: 42
Unit-I Introduction to Operations Research(OR) and LPP	**14 hrs**
Origin and growth of OR, importance of OR in managerial decision making, scope and applications of OR, models and modelling in OR. Linear programming problems(LPP): Formulation of the problem, feasible & infeasible, basic feasible solution, optimal, unbounded and multiple optimal solutions of LPP, solution by graphical method. Slack, Surplus and Artificial variables. Duality in LPP, Importance of Duality Concepts, Formulation of Dual Problem, Economic Interpretation of Duality.	
Unit-II Allocation Problems	**14 hrs**
Transportation problems: Formulation, methods of finding initial solution (North West Corner Rule, Least Cost Method and Vogel's Approximation Method), unbalanced transportation problems, maximization transportation problem. Assignment problems: Formulation, methods of solution, Hungarian method, multiple optimal solutions, unbalanced problems, maximization problems.	
Unit-III Decision theory	**14 hrs**
Game theory: Basic concepts. Two – Person Zero Sum Game. Pure and Mixed Strategies. Maximin– Minimax principle, Games with and without saddle points. Principle of dominance. Concepts of decision making, decision making environments, Decision making under uncertainty - Decision making under risk, decision tree analysis. Case discussion. Concepts of network analysis, project network models, Critical Path Method, PERT.	

Books recommended.

1. Hillier, F S, et al. Introduction to Operations Research (9/e). Tata McGraw Hill, 2011.

2. Ravindran, A and Don T Phillips. Operations Research: Principles and Practice. John Wiley & Sons, 1987.

3. Sharma, J K. Operations Research: Theory and Applications (5/e). New Delhi: Laxmi Publications, 2013.

4. Taha, Hamdy A. Operations Research: An Introduction (9/e). Prentice Hall, 2010.

5. Vohra, N D. Quantitative Techniques for Management. Tata McGraw Hill Education, 2015.

6. KantiSwarup, Gupta, P.K. and Man Mohan: Operations Research, Sultan Chand & Sons, New Delhi.

7. Kapoor, V.K: Operations Research, Sultan Chand & Sons, New Delhi.

8. Kapoor, V.K.: Operations Research Problems & Solutions, Sultan Chand & Sons, New Delhi.

Details of Formative assessment (IA) for DSCC theory/OEC: 40% weight age for total marks

Type of Assessment	Weight age	Duration	Commencement
Written test-1	10%	1 hr	8th Week
Written test-2	10%	1 hr	12th Week
Seminar	10%	10 minutes	--
Case study / Assignment / Field work / Project work/ Activity	10%	------	--
Total	40% of the maximum marks allotted for the paper		

Faculty of Science
04 - Year UG Honors programme:2021-22

GENERAL PATTERN OF THEORY QUESTION PAPER FOR DSCC/ OEC
(60 marks for semester end Examination with 2 hrs duration)

Part-A
1. Question number 1-06 carries 2 marks each. Answer any 05 questions   : 10marks

Part-B

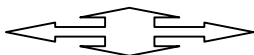**2.** Question number 07- 11 carries 05Marks each. Answer any 04 questions   : 20 marks

Part-C

3. Question number 12-15 carries 10 Marks each. Answer any 03 questions   : 30 marks

   (Minimum 1 question from each unit and 10 marks question may have sub
      questions for 7+3 or 6+4 or 5+5 if necessary)

Total: 60 Marks

Note: Proportionate weight age shall be given to each unit based on number of hours prescribed.

KARNATAK UNIVERSITY, DHARWAD

04 - Year B.A. (Hons.) Program

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SYLLABUS

Subject: APPLIED STATISTICS

[Effective from 2022-23]

DISCIPLINE SPECIFIC CORE COURSE (DSCC) FOR SEM III & IV

OPEN ELECTIVE COURSE (OEC) FOR SEM III & IV

AS PER N E P – 2020

Karnatak University, Dharwad
Four Years Under Graduate Program for B.A. (Hons.)
Effective from 2021-22
APPLIED STATISTICS (As Minor subject)

Sem	Type of Course	Theory/ Practical	Instruction hour per week	Total hours of Syllabus / Sem	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks	Credits
III	DSCC3 -P-I **013AST011**	Theory	03 hrs	42	02 hrs	40	60	100	03
	DSCC3-P-II **013AST012**	Theory	03 hrs	42	02 hrs	40	60	100	03
	OEC-3 **003AST051**	Theory	03 hrs	42	02 hrs	40	60	100	03
IV	DSCC4-P-I **014AST011**	Theory	03 hrs	42	02 hrs	40	60	100	03
	DSCC4-P-II **014AST012**	Theory	03 hrs	42	02 hrs	40	60	100	03
	OEC-4 **004AST051**	Theory	03 hrs	42	02 hrs	40	60	100	03
	Details of the other Semesters will be given later								

B.A. Semester – III

Subject: APPLIED STATISTICS
Discipline Specific Course (DSC)

The course APPLIED STATISTICS in III semester has two papers (Paper I & II) for 06 credits: Each paper has 03 credits. Both the papers are compulsory. Details of the courses are as under.

Course No.-5 (Paper No. I): 013AST011

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
Course-05	DSCC	Theory	03	03	42 hrs	2hrs	40	60	100

Course No.5 (Paper-I): Title of the Course (Paper-I): **013AST011: EXACT SAMPLING DISTRIBUTIONS AND STATISTICAL INFERENCE**

Course Outcome (CO):

After completion of this course, students will be able to:

CO 1 : Apply different methods of estimations to real life data sets

CO 2 : Understand basic concepts involved in Tests of Significance and Testing of Hypothesis

CO 3 : Formulate null and alternative hypotheses and apply small, large sample and parametric tests in real life problems

CO 4 : Perform large sample and small sample tests of hypotheses

CO 5 : Apply Chi-square, t and F tests in real life problems

Syllabus- Course 5: 013AST011 : Title- EXACT SAMPLING DISTRIBUTIONS AND STATISTICAL INFERENCE	Total Hrs: 42
UNIT-I Sampling distribution and Estimation	**20 hrs**
Definition of basic concepts: population, sample, parameter and statistic. Definition of a Random Sample, Sampling distribution of a Statistic along with examples, Definition of standard error, Standard error of mean, standard deviation, proportion, difference of means and difference of proportions. Uses of standard error and simple problems. Definition of the terms – Estimate, Estimation, Point estimation and interval estimation. Meaning of confidence interval, confidence limits and confidence co-efficient with examples. Construction of 95% and 99% confidence intervals - mean, difference of means, proportion and difference of proportions for large samples only and their numerical problems on the construction of 95% and 99% confidence limits.	

UNIT-II Testing of Hypothesis	10 hrs
Explanation of terms – Statistical hypothesis, Null hypothesis, Alternative hypothesis, Level of significance, critical region, size of the test, power of the test with examples. Definition of type–I and type–II errors. Large sample tests- Test of significance of population mean, test of significance of equality of means of two populations, test of significance of population proportion and test of significance of equality proportion of two populations.	
Unit-III Chi-Square, *t* - test and F-test Distributions	**12 hrs**
Introduction to Chi-square distribution, definition of Chi-square variate. Properties of Chi-square distribution. Applications of Chi-square distribution. Chi-square test of goodness of fit. Problems on Chi-square test of Goodness of fit and independence of attributes. Definition, assumption and properties of t-test. t-test for testing population mean, equality of sample means and paired t-test. Applications of t-test. Simple problems. Definition, assumption and properties of F-statistic. F-test for equality of variances and its applications. Numerical problems.	

Books recommended.

1. Ramchandran, K.M. and Tsokos C. P. (2009). Mathematical Statistics with Applications, Academic Press.

2. Gupta S. P. (2021). Statistical Methods, Sultan Chand and Sons, New Delhi, 46th edition.

3. Mukhopadhyaya, P. (2011). Applied Statistics, Books and Allied Ltd.

4. Gupta, S C. and V. K. Kapoor. (2018). Fundamentals of Mathematical Statistics, Sultan Chand, New Delhi, 11th Edition.

5. Gani S. G.(2003). Sankhyshastra and Ganakayantra, Udaya Ravi Publications, Bijapur.

Subject: APPLIED STATISTICS
Discipline Specific Course (DSC)

Course No.-6 (Paper No. II): 013AST012

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
Course-06	DSCC	Theory	03	03	42 hrs	2hrs	40	60	100

Course No.6 (Paper-II): Title of the Course (Paper-II) **: 013AST012 : SAMPLING TECHNIQUES**

Course Outcome (CO):

After successful completion of this course, students will be able to:

CO 1 : Know the concept of Population, Sample, Sampling unit, sampling design, sampling frame, sampling scheme, need for samping.

CO 2 : Apply different sampling methods for designing and selecting a sample from a population.

CO 3 : Design good questionnaire relevant to a survey for a specific investigation.

CO 4 : Explain sampling and non-sampling errors.

Syllabus-Course 6: 013AST012: Title- SAMPLING TECHNIQUES	Total Hrs: 42
Unit-I Basic Concepts of Sampling	**08 hrs**
Meaning of population, population size, finite population, infinite population, sample, sample size, sampling, sampling technique, sampling unit, sampling frame, census and sample survey, advantages of sampling. Examples of sampling. Types of errors in sample survey-Sampling errors and non-sampling errors, non response errors, response errors and tabulation errors. Advantages of sampling over complete census. Limitation of sampling. Planning of sample survey and its execution.	
Unit-II Simple Random Sampling	**14 hrs**
Introduction and definition of Simple Random Sampling (SRS), Notations and formulae for estimating population mean, total and variance. Methods of obtaining simple random sample-Lottery method and Random numbers table method. Merits and demerits of Simple Random Sampling. Simple problems on simple random sampling method.	

Unit-III Stratified Random and Systematic Random Sampling Techniques	20 hrs
Need for stratification, stratifying factors, improvement of method over SRS, Definition of strata, stratification, and stratified random sampling. Notations and formulae for estimating population mean, total and variance. Methods of allocation and sample size in different strata-Equal allocation, Proportional allocation and Optimal allocation. Determination of Bowley's formulae for proportional allocation and Neyman's formula for optimal allocation. Advantages and disadvantages of stratified random sampling method. Simple problems on stratified random sampling method, Proportional and Optimal allocation. Definition of systematic random sampling. Explanation of methods of obtaining systematic random samples. Examples of systematic random sample. Formulae for estimating population mean, total and variance. Applications of systematic random sampling method. Merits and demerits of systematic random sampling method. Simple problems on systematic random sampling method.	

Books recommended.

1. Parimal Mukhopadhyay (2008). Theory and methods of Survey Sampling, PHI publications.

2. Gupta S. P. (2021). Statistical Methods, Sultan Chand and Sons, New Delhi, 46th edition.

3. Gupta S. C. and V. K. Kapoor (2018). Fundamentals of Applied Statistics, Sultan Chand, New Delhi

4. Gani S. G.(2003). Sankhyshastra and Ganakayantra. Udaya Ravi Publications, Bijapur.

B.A. Semester – III
Subject: APPLIED STATISTICS

Title of the Course: OEC-3: 003AST051: DATA ANALYSIS WITH SPSS

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
OEC	OEC-3	Theory	03	03	42 hrs	2hrs	40	60	100

Course No.OEC-3: Title of the Course (OEC-3) **: 003AST051: DATA ANALYSIS WITH SPSS**

Course Outcome (CO):

After the completion of this course, students will be able to:

CO 1 : Use SPSS software for cleaning and presentation of data.

CO 2 : Present the data in the form of diagrams and graphs.

CO 3 : Analyze univariate, bivariate and multivariate data.

Syllabus-Course OEC-3 : 003AST051: Title- DATA ANALYSIS WITH SPSS	Total Hrs: 42
Unit-I Introduction	**18 hrs**
Need of SPSS, preparation of coding sheet of the questionnaire, defining the type of variable and data, constructing the database – defining variable name, type of variable, width of variable name, labeling, assigning the numeric value to the characteristic, declare measurement of scale of data. **Data Editing in SPSS**: Enter the data based on type of data case wise for different variables, defining the grouping of variable for repeated measures. Replacing the missing value, transforming the data into same variable and different variable, use of commands –Compute variables using different operators and functions and saving of the data.	
Unit-II Tabulation and Graphical representation	**12 hrs**
Formation of frequency distribution, representation of frequency distribution by graphs, construction cross table, P-P plots and Q-Q Plots.	
Unit-III Univariate, Bivariate and multivariate Data analysis	**12 hrs**
Calculation of Measures of central tendency, Dispersion, Karl-Pearson's correlation, Regression, fitting different curves, testing of hypothesis- t-test for single mean, difference of means for independent samples, paired sample and one-way ANOVA.	

Note: Various techniques studied in the paper has to be demonstrated using SPSS software.

Books recommended.

1. Robert V. Hogg, Joseph W. McKean and Allen T. Craig (2007). Introduction to Mathematical Statistics, Pearson Education, Asia.

2. Irwin Miller and Marylees Miller, John E. Freunds (2006). Mathematical Statistics with Applications, 7th Ed., Pearson Education, Asia.

3. Sheldon Ross (2007). Introduction to Probability Models, 9th Ed., Academic Press, Indian Reprint.

4. Gardener, M (2012). Beginning R: The Statistical Programming Language, Wiley Publications.

5. Cunningham, B.J (2012). Using SPSS: An Interactive Hands-on approach.

Details of Formative assessment (IA) for DSCC/OEC/SEC: 40% weightage for total marks

Type of Assessment	Weightage	Duration	Commencement
Written test-1	10%	1 hr	8th Week
Written test-2	10%	1 hr	12th Week
Seminar	10%	10 minutes	--
Case study / Assignment / Field work / Project work/ Activity	10%	------	--
Total	40% of the maximum marks allotted for the paper		

Faculty of Social Science
04 - Year UG Honors programme:2021-22

GENERAL PATTERN OF THEORY QUESTION PAPER FOR DSCC/ OEC
(60 marks for semester end Examination with 2 hrs duration)

Part-A
4. Question number 1-06 carries 2 marks each. Answer any 05 questions : 10marks

Part-B
5. Question number 07- 11 carries 05Marks each. Answer any 04 questions : 20 marks
Part-C

6. Question number 12-15 carries 10 Marks each. Answer any 03 questions : 30 marks
   (Minimum 1 question from each unit and 10 marks question may have sub questions for 7+3 or 6+4 or 5+5 if necessary)

Total: 60 Marks

Note: Proportionate weightage shall be given to each unit based on number of hours prescribed.

B.A. Semester – IV
Subject: APPLIED STATISTICS
Discipline Specific Course (DSC)

The course STATISTICS in IV semester has two papers (Paper I & II) for 06 credits: Each paper has 03 credits. Both the papers are compulsory. Details of the courses are as under.

Course No.-7 (Paper No. I): 014AST011

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
Course-07	DSCC	Theory	03	03	42 hrs	2hrs	40	60	100

Course No.7 (Paper-I): Title of the Course (Paper-I): **014AST011: Title of Paper: ANALYSIS OF VARIANCE AND DESIGN OF EXPERIMENTS**

Course Outcome (CO):
After the successful completion of the course, the students will be able to:
- **CO 1 :** Develop strategic plans for experimentation in scientific research projects.
- **CO 2 :** Apply the principles of Design of Experiment to generate experimental designs.
- **CO 3 :** Develop problem solving skills for the application of Design of experiments to Agriculture and controlled laboratory experiments.

Syllabus-Course 7: 014AST011: Title- ANALYSIS OF VARIANCE AND DESIGN OF EXPERIMENTS	Total Hrs: 42
Unit-I Analysis of Variance: One-Way and Two-way Classification	**18 hrs**
Definition of analysis of variance and its basic assumptions. Meaning of assignable and chance variations. ANOVA for one-way classified data-definition, linear mathematical model, assumptions, statement of hypothesis, splitting up of total sum of squares into various component sum of squares, degrees of freedom and ANOVA table. Simple numerical problems one-way classified data. Analysis of variance for two-way classification – definition, linear mathematical model, assumptions, statement of hypothesis, splitting up of total sum of squares into various component sum of squares. Degrees of freedom and ANOVA table. Simple numerical problems on two way classified data.	
Unit-II Design of Experiments: Completely Randomized Design	**12 hrs**
Definition of terms - Experiment, treatment, experimental unit, experimental material, yield, block, precision, experimental error, uniformity trials, and efficiency. Basic principles of design of experiments – Replication, Randomization and Local control. Completely Randomized Design (CRD) -definition, layout, linear mathematical model, assumptions, hypothesis, splitting up of sum of squares into various component sum of squares, degrees of freedom and ANOVA table. Merits, demerits and applications of CRD. Simple numerical problems.	

Unit-III Randomized Block Design	12 hrs
Introduction and definition of Randomized Block Design (RBD), layout, linear mathematical model, assumptions, statistical hypothesis, splitting up of total sum of squares into various component sum of squares, degree of freedom, and ANOVA table. Merits and demerits of RBD. Applications of RBD. Comparison between CRD and RBD. Simple problems.	

Books recommended.

1. Das, M.N. and Giri, N.C. (1986). Design and Analysis of Experiments, II Edition Wiley Eastern Ltd., New Delhi

2. Goon, A.M., Gupta, M.K. and Dasgupta, B. (1998). Fundamentals of Statistics, Vol. II, The world Press Pvt. Ltd. Kolkatta.

3. Gupta S. P. (2021). Statistical Methods, Sultan Chand and Sons, New Delhi, 46th edition.

4. Gupta S. C. and V. K. Kapoor (2018). Fundamentals of Applied Statistics, Sultan Chand, New Delhi.

5. Mukhopadhaya, P. (2011). Applied Statistics, Books and Allied Ltd.

6. Gani S. G.(2003). Sankhyshastra and Ganakayantra. Udaya Ravi Publications, Bijapur.

B.A. Semester – IV
Subject: APPLIED STATISTICS
Discipline Specific Course (DSC)

Course No.-8 (Paper No. II): 014AST012

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
Course-08	DSCC	Theory	03	03	42 hrs	2hrs	40	60	100

Course No.8(Paper-II):Title of the Course(Paper-II): **014AST012: REGRESSION ANALYSIS AND ECONOMETRICS**

Course Outcome (CO):

After completion of the course, students will be able to:

CO 1 : Provide a wider and deeper exposure to the econometric techniques and their application to the discipline of Economics.

CO 2 : Gain an understanding of how to solve problems using econometrics that are common to economic modeling.

CO 3 : Develop ability to accurately translate complex economic problems into models and so as to solve them by applying econometric techniques.

Syllabus-Course 8: 014AST012: Title- REGRESSION ANALYSIS AND ECONOMETRICS	Total Hrs: 42
Unit-I: Introduction to Econometrics and Simple Regression Analysis	**18 hrs**
Econometrics – definitions – scope – methodology – types. Quantification of hypothetical linear relationship using appropriate data. Two variable regression model, assumptions, method of least squares properties. An optimality property of OLS: Gauss-Markov theorem, R-square, maximum likelihood method, testing of hypotheses using point and interval estimates, forecasting solving problems using SPSS.	
Unit-II : Multiple Regression Analysis	**12 hrs**
Nonlinear relationships – transformation of variables – functional forms – three variable regression model – applications using SPSS. General linear model (matrix approach) – specification – OLS estimators –The properties of the estimated regression coefficients, hypothesis testing and the construction of confidence intervals of the regression model, problems and application using SPSS.	

Unit-III: Problems in regression analysis	12 hrs
Violation of classical assumptions – multicollinearity – autocorrelation – heteroscedasticity – problems – causes – consequences – remedial measures – model specification and diagnostic testing.	

Books recommended.

1. Damodar N. Gujarathi (2009). Basic Econometrics, New Delhi: Tata McGraw Hill

2. Companies Johnston, J. (1972). Econometric Methods, 2nd Edition, McGraw Hill International.

3. Koutsoyiannis, A. (2004). Theory of Econometrics, 2nd Edition, , Palgrave Macmillan Limited

4. Maddala, G.S. and Lahiri, K. (2009). Introduction to Econometrics, 4th Edition, John Wiley & Sons

5. G.M.K. Madanani (1980). Introduction to Econometrics, second edition, Oxford & IBH Publishing company, New Delhi.

6. Gupta, S.C. and Kapoor, V. K. (2020). Fundamentals of Applied Statistics, Sultan Chand & Sons, New Delhi.

B.A. Semester – IV

Subject: APPLIED STATISTICS

Title of the Course: OEC-4: 004AST051: Quantitative Analysis Techniques

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
OEC	OEC-4	Theory	03	03	42 hrs	2hrs	40	60	100

Course No.OEC-4: Title of the Course (OEC-4) **: 004AST051: Quantitative Analysis Techniques**

Course Outcome (CO):

After the completion of this course, students will be able to:

CO 1 : Carryout correlation and regression analysis

CO 2 : Formulate and solve linear programming problems

CO 3 : Formulate and solve transportation and assignment problems

Syllabus-Course OEC-4 : 004AST051: Title- Quantitative Analysis Techniques	Total Hrs: 42
Unit-I Correlation and regression analysis	**18 hrs**
Correlation- Definition, Types - Simple, multiple, partial. Causation - Spurious, positive, negative, perfect and no correlation, explanation with examples. Importance of correlation analysis. Measurement of correlation- scatter diagram, Karl Pearson's coefficient of correlation, Properties of coefficient of correlation, interpretation. Spearman's coefficient of rank correlation – with and without ties, interpretation. Coefficient of determination and its interpretation. **Regression**-Definition, regression lines/equations of X on Y and Y on X. Properties of regression coefficients and regression lines/equations. Principle of least squares and fitting of linear, quadratic and exponential curves. Uses of regression analysis. Comparison between correlation and regression.	
Unit-II Linear programming problem (LPP)	**12 hrs**
Definition and scope of Operations Research (OR). Modeling and solution. Linear Programming Problem (L.P.P): Definition, Standard forms. Formulation of LPP. Basic Solutions, degenerate and non-degenerate solutions. Graphical method of solving LPP. Criteria for unbounded, Multiple and infeasible solutions.	
Unit-III Transportation problem and Assignment Problem	**12 hrs**
Transportation problem: Mathematical formulation. Existence of feasible solution. Finding initial basic feasible solution: North West Corner Rule, matrix minima method and Vogel's method. Unbalanced transportation problem. **Assignment Problem:** Mathematical Formulation and Hungarian algorithm. Unbalanced assignment problem.	

Books recommended.

References

1. Goon, A.M., Gupta, M.K. and Dasgupta, B. (2002). Fundamentals of Statistics, Vol. I, 8th Ed., The World Press, Kolkata.
2. Ross, S.M. (2014). Introduction to Probability and Statistics for Engineers and Scientists, 5th Edition, AcademicPress.
3. KanthiSwaroop, Manmohan and P. K. Gupta (2013). Operation Research, Sultan Chand New Delhi.
4. Mustafi, C.K.(2006). Operations Research Methods and Practice, 3/e.NewAge Publication.
5. Narag. A.S.(1970). Linear Programming and Decision Making. Sultan Chand and Co.
6. Sharma, J K.(2013). Operations Research: Theory and Applications (5/e). New Delhi: Laxmi Publications.

Details of Formative assessment (IA) for DSCC/OEC/SEC: 40% weight age for total marks

Type of Assessment	Weight age	Duration	Commencement
Written test-1	10%	1 hr	8th Week
Written test-2	10%	1 hr	12th Week
Seminar	10%	10 minutes	--
Case study / Assignment / Field work / Project work/ Activity	10%	------	--
Total	40% of the maximum marks allotted for the paper		

Faculty of Social Science
04 - Year UG Honors programme:2021-22

GENERAL PATTERN OF THEORY QUESTION PAPER FOR DSCC/ OEC
(60 marks for semester end Examination with 2 hrs duration)

Part-A

7. Question number 1-06 carries 2 marks each. Answer any 05 questions   : 10marks

Part-B

8. Question number 07- 11 carries 05Marks each. Answer any 04 questions   : 20 marks
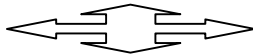
Part-C

9. Question number 12-15 carries 10 Marks each. Answer any 03 questions   : 30 marks

    (Minimum 1 question from each unit and 10 marks question may have sub
       questions for 7+3 or 6+4 or 5+5 if necessary)

Total: 60 Marks

Note: Proportionate weightage shall be given to each unit based on number of hours prescribed.

KARNATAKUNIVERSITY, DHARWAD

04-YearB.Sc.(Hons.)Program

***SYLLABUS

Subject:Mathematics[Effectivefrom2022-

23]

DISCIPLINESPECIFICCORECOURSE (DSCC)FOR SEMIII &IV AND

OPENELECTIVE COURSE (OEC) FOR SEM III & IV.

ASPER NEP-2020

KarnatakUniversity,Dharwad
FourYearsUnderGraduatePrograminMathematicsforB.Sc.(Hons.)Effective from2022-23

Sem	TypeofCourse	Theory/Practical	Instructionhourperweek	TotalhoursofSyllabus/Sem	DurationofExam	FormativeAssessmentMarks	Summative Assessment Marks	Total Marks	Credits
III	DSCC	Theory	04hrs	56	02hrs	40	60	100	04
		Practical	04hrs	52	03hrs	25	25	50	02
	OEC-3	Theory	03hrs	42	02hrs	40	60	100	03
IV	DSCC	Theory	04hrs	56	02hrs	40	60	100	04
		Practical	04hrs	52	03hrs	25	25	50	02
	OEC-4	Theory	03hrs	42	02hrs	40	60	100	03

B.Sc.Semester–III

**Subject:
MathematicsDisciplineSpecificCou
rse(DSC)**

ThecourseMathematicsinIII semesterhastwopapers(TheoryPaper–033MAT011 for04credits&PracticalPaper-033MAT012for2credits)for06credits:Boththepapersarecompulsory.Detailsofthecoursesareasunder.

Course No.: 5

CourseCode(Theory): 033MAT011

CourseCode	TypeofCourse	Theory/ Practical	Credits	Instructionhour perweek	Total No. ofLectures/Hours /Semester	Duration ofExam	Formative Assessmen tMarks	Summative Assessmentt Marks	Total Marks
033MAT011	DSCC	Theory	04	04	56hrs	2hrs	40	60	100

TitleoftheCourse(Theory):**DSCC-5 :OrdinaryDifferentialEquationsandRealAnalysis–I(033MAT011)**

CourseOutcome(CO):

Aftercompletionofthe course(Theory),studentswillbeableto:

CO1: Solvefirst-ordernon-lineardifferentialequationsandlineardifferentialequations.

CO2: To model problems in nature using Ordinary Differential Equations.

CO3: Formulate differential equations for various mathematical models
CO 4: Apply these techniques to solve and analyze various mathematical models.
CO 5: Understandthefundamental properties of the real numbers that lead todefine sequenceandseries

intheformaldevelopmentofrealanalysis.

CO 6: Learnthe concept ofConvergenceandDivergenceofasequence.

CO 7: Able to handle and understand limits and their use in sequences, series, differentiation, and

integration.

CO 8: Apply the ratio, root, alternating series, and limit comparison tests for convergence andabsolute

convergenceofaninfiniteseries.

Syllabus-Course(Theory): DSCC-5	TotalHrs:56
Title-033MAT011:OrdinaryDifferentialEquationsandRealAnalysis–I	

Unit-I	14hrs
OrdinaryDifferentialEquations: Recapitulation of Differential Equations of the first order and first degree, Exact Differentialequations, Necessary and sufficientcondition for the equations to be exact, Reducibleto theexact differential equations. Differential equations of the first order and higher degree: Equationssolvable for p, x, y.Clairaut's equation and singular solution.Orthogonal trajectories ofCartesianandpolarcurves.	

Unit-II	14hrs
Linear differential equations: Linear differential equations of the n^{th}order with constant coefficients. ParticularIntegrals when the RHS is of the form e^{ax}, sin(ax+b), cos(ax+b), x^n, e^{ax} V and x V (with proofs),where V is a function of x. Cauchy – Euler equations, Legendre differential equations, Methodof variation of parameters.Simultaneous differential equations with two and more than twovariables.Conditionfor integrabilityoftotaldifferentialequationsPdx+Qdy+Rdz =0.	

Unit-III	14hrs
Sequences: Sequences of real numbers,Bounded sequences. Limit of a sequence.convergent, divergent, and oscillatory sequences.Monotonic sequences. Algebra of convergentsequences. Limit points of a sequence. Bolzano Weierstrass theorem for sequence.Limit superiorand limit inferior of sequences. Cauchy's first and second theorem on limits of a sequence.Cauchy's generalprincipleforconvergenceofasequence.Subsequenceandtheirproperties.	

Unit-IV	14hrs
Infinite Series: Definition of convergent, divergent,and oscillatoryseries. Series ofnon-negativeterms,Cauchy'sgeneralprincipleofconvergence.Geometricseries,P-series(Harmonic series). Comparison tests for positive term series. D'Alembert's ratio test, Raabe'stest.Cauchy'sRoottestandCauchy'sintegraltest.Alternatingseries.Leibnitz'stheorem. Absolute convergence and conditional convergence of a series.Summation of series: Binomial,exponential,andlogarithmic.	

Booksrecommended:

1. M. D. Raisinghania,OrdinaryDifferentialEquations&PartialDifferential Equations,S.Chand&Company,NewDelhi.
2. J.SinhaRoyandSPadhy:AcourseofOrdinaryandPartialDifferentialEquation,KalyaniPublishers,NewDelhi.
3. D.Murray,IntroductoryCourseinDifferentialEquations,Orient Longman (India)
4. W. T.Reid,OrdinaryDifferentialEquations,JohnWiley, NewDelhi.
5. M.LKhannaandL.S.Varhiney,RealAnalysis by, JaiPrakashNath&Co.Meerut.
6. M. L.Khanna,DifferentialEquations,JaiPrakashNath&Co.Meerut
7. S.L.Ross,DifferentialEquations,3rdEd.,JohnWileyandSons,1984.

8. R.G.BartleandD.R.Sherbert,IntroductiontoRealAnalysis,3rdEd.,JohnWileyandSons(Asia)Pvt.Ltd.,Singapore,2015.
9. GeraldG.Bilodeau,PaulR.Thie,G.E.Keough,AnIntroductiontoAnalysis,2ndEd.,Jones&Bartlett,2010.
10. K.A.Ross,ElementaryAnalysis:TheTheoryofCalculus, (2nd edition),Springer,2013
11. S.K.Berberian,A First CourseinRealAnalysis,SpringerVerlag,NewYork,1994.
12. T.Apostol,MathematicalAnalysis,NarosaPublishingHouse.
13. E. Kreyzig,AdvancedEngineeringMathematics,JohnWiley,NewDelhi.

B.Sc. Semester–III

CourseCode	TypeofCourse	Theory/Practical	Credits	Instructionhour perweek	Total No. ofLectures/Hours /Semester	Duration ofExam	FormativeAssessmentMarks	Summative AssessmentMarks	Total Marks
033MAT012	DSCC	Practical	02	04	52hrs	3hrs	25	25	50

TitleoftheCourse(Practical):**PracticalsonDSCC-6: OrdinaryDifferentialEquationsandReal**

Analysis–I (033MAT012)

CourseOutcome(CO):

Aftercompletionofthe course(Practical),studentswillbeableto:

This course will enablethestudents togainhands-onexperienceof

CO 1: Freeand Open Source software (FOSS)tools or computer programming.

CO 2: Solvingexact differentialequations

CO 3: Plotting orthogonaltrajectories

CO 4: Finding complementaryfunctionsandparticularintegraloflinearandhomogeneous differentialequations.

CO 5: Acquireknowledgeofapplicationsofrealanalysisanddifferentialequations.

CO 6: Verificationofconvergence/divergenceofdifferenttypesofseries

ListoftheExperimentsfor52hrs/Semesters

Introduction to the software and commands related to the topic.

1. Fundamentals ofOrdinarydifferential equationsandRealanalysisusingFOSS.
2. Verificationofexactnessofadifferentialequation
3. PlotorthogonaltrajectoriesforCartesianandpolarcurves
4. Solutionsofdifferentialequationsthataresolvableforx,y,p.
5. TofindthesingularsolutionbyusingClairaut'sform.
6. Finding the Complementary Function and Particular Integral of linear and Homogeneous differential equations with constant coefficients and plot the solutions.

7. Finding the Particular Integral of differential equations upto second order and plot the solutions.
8. Solutions to the Total and Simultaneous differential equations and plot the solutions.
9. Test the convergence of sequences
10. Verification of exponential, logarithm, and binomial series.
11. Verification of geometric series, p-series, Cauchy's Integral test, root test, and D Alembert's Test
12. Examples on a series of positive terms.
13. Examples on alternating series using Leibnitz's theorem.
14. Finding the convergence of series using Cauchy's criterion for partial sums.

Pedagogy

General instructions: Suggested Software: Maxima/Scilab/Maple/MatLab/Mathematica/Phython/R.

Scheme of Practical Examination (distribution of marks):25 marks for Semester end examination

   1. Programme writing and problem-solving:10 Marks

   2. Programme Execution:5 Marks

   3. Viva:5 Marks

   4. Journal:5 Marks

       Total 25 marks

Note: Same Scheme may be used for IA (Formative Assessment) examination

Books recommended:
1. Scilab by example: M. Affouf 2012, ISBN:978-1479203444
2. Scilab (A free software to MatLab): H. Ramchandran, A.S. Nair. 2011 S. Chand and Company
3. Scilab for very beginners. -www.scilab-enterprises.com
4. M. Kanagasabapathy, Introduction to Maxima for Scientific Computers, BPB Publishers.
5. Kalyanarao Takale, Computational Mathematics using Maxima Software, Nirali Publishers.
6. Vaisak Vena, Maxima, The Computer Algebra System, Notion Press.
7. M. D. Raisinghania, Ordinary Differential Equations & Partial Differential Equations, S. Chand & Company, New Delhi.
8. J. Sinha Roy and S Padhy: A course of Ordinary and Partial Differential Equation, Kalyani Publishers, New Delhi.
9. D. Murray, Introductory Course in Differential Equations, Orient Longman (India)
10. W. T. Reid, Ordinary Differential Equations, John Wiley, New Delhi.
11. M.L Khanna and L.S. Varhiney, Real Analysis, Jai Prakash Nath & Co. Meerut.
12. M. L. Khanna, Differential Equations, Jai Prakash Nath & Co. Meerut.

B.Sc.Semester–III

Subject: Mathematics

OpenElectiveCourse(OEC-3)
(OECforotherstudents)

Course Code(OEC):): 003MAT051

CourseC ode	TypeofC ourse	Theory/ Practical	Credits	Instruction hour perweek	Total No. ofLectures/Ho urs /Semester	Duration ofExam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
003MAT051	OEC	Theory	03	03	42hrs	2hrs	40	60	100

OEC-3 (OECforotherstudents): 003MAT051

TitleoftheCourse:**Quantitative Mathematics**

CourseOutcome(CO):

Aftercompletionofthe course,studentswillbeableto:
   CO1: Understandnumbersystemandfundamentaloperations
   CO2: Understand theconcept oflinearquadraticandsimultaneous equationsand
        theirapplicationsinreal-lifeproblems.
CO3: Understandandsolvetheproblemsbasedon Age.
   CO4: SolveSpeedandDistancerelatedproblems.

Syllabus-003MAT051: Title-Quantitative Mathematics	TotalHrs:42
Unit-I	**14hrs**
Number System: Numbers, Operations on Numbers, Tests on Divisibility, HCF, and LCM of numbers. Decimal Fractions, Simplification, Square roots, and Cube roots - Problems thereon. Surds and Indices. Illustrations thereon.	
Unit-II	**14hrs**
Theory of equations Linear equations, quadratic equations, simultaneous equations in two variables, simple application problems - Problems on Ages, Problems on conditional Age calculations, Present &Past age calculations.	
Unit-III	**14hrs**
QuantitativeAptitude Percentage, Average, Average Speed-problems.Time and distance, problems based on trains, problems onwork and time, work and wages, clock and calendar.	

Booksrecommended:

1. R.S.Aggarwal,Quantitative Aptitude, S. Chand and Company Limited,New Delhi-110055.

2. AbhijitGuha, Quantitative Aptitude,5thEdition,Mc.Grawhillpublications.2014.

3. R. V. Praveen,Quantitative Aptitude and Reasoning,PHIpublishers.

4. R. S. Aggarwal,ObjectiveArithmetic,S.Chand&CompanyLtd.

5. QaziZameerddin,VijayK. Khanna,S. K. Bhambri,Business Mathematics-II Edition, S. Chand & Company Ltd.

6. S.K.SharmaandGurmeetKaur, BusinessMathematics,S.Chand&Sons.

7. HazarikaPadmalochan,ATextBookofBusinessmathematicsforB.Com. andBBACourse, S. Chand & Company Ltd.

8. J. K. Thukrol,BusinessMathematics,abcibook:2020,FirstEdition, The world book depot, India

9. N. G. Das and J.K.Das, Business Mathematics and Statics, McGraw Hill Education,2017.

DetailsofFormativeassessment(IA)forDSCCtheory/OEC:40%weightagefortotalmarks

TypeofAssessment	Weightage	Duration	Commencement
Writtentest-1	10%	1hr	8th Week
Writtentest-2	10%	1hr	12th Week
Seminar	10%	10minutes	--
Casestudy/Assignment / Fieldwork/ Projectwork/Activity	10%	------	--
Total	40%ofthemaximumm arksallottedforthe paper		

FacultyofScience

04-YearUGHonorsprogramme:2022-23

GENERALPATTERNOFTHEORYQUESTIONPAPERFORDSCC/OEC

(60marksforsemesterendExaminationwith2hrsduration)

Part-A

1. Questionnumber1-6carries2markseach.Answerany5questions   :10marks

Part-B

2. Questionnumber7-11carries5 markseach.Answerany4questions   :20marks

Part-C

3. Questionnumber12-15carries10 markseach.Answerany3questions

:30marks(Min

imum1questionfromeachunitand10marksquestionmayhavesub
questionsfor7+3or6+4or5+5ifnecessary)

Total:60Marks

Format for Model question paper Unit wise

033MAT011:OrdinaryDifferentialEquationsandRealAnalysis–I

Question Number	Number of questions to be set in Unit	Number of questions to be answered	Marks for each question	Max marks for the question
1	Unit-I ------2 Unit-II ------1 Unit-III------1 Unit-IV------2 Total: 6	5	2	10
2	Unit-I ------1 Unit-II------2 Unit-III------1 Unit-IV------1 Total: 5	4	5	20
3	Unit-I ------1 Unit-II------1 Unit-III------1 Unit-IV------1 Total: 4	3	10	30

003MAT051 Quantitative Mathematics

Question Number	Number of questions to be set in Unit	Number of questions to be answered	Marks for each question	Max marks for the question
1	Unit-I ------2 Unit-II ------2 Unit-III------2 Total: 6	5	2	10
2	Unit-I ------1 Unit-II------2 Unit-III------2 Total: 5	4	5	20
3	Unit-I ------2 Unit-II------1 Unit-III------1 Total: 4	3	10	30
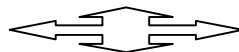
B.Sc. Semester–IV

Subject: Mathematics Discipline Specific Course (DSCC)

The course Mathematics in IV semester has two papers (Theory Paper for 04 credits & Practical paper for 2 credits) for 06 credits: Both papers are compulsory. Details of the courses are as under.

Course No.: 7

CourseCode(Theory): 034MAT011

CourseCode	TypeofCourse	Theory/ Practical	Credits	Instructionhour perweek	Total No. ofLectures/Hours /Semester	Duration ofExam	FormativeAssessmentMarks	Summative Assessmentt Marks	Total Marks
034MAT011	DSCC	Theory	04	04	56hrs	2hrs	40	60	100

Title of the Course (Theory):: **DSCC-7: Partial Differential Equations and Integral Transforms(034MAT011)**

Course Outcome(CO):

After completion of the course (Theory), students will be able to:

CO1: Solve the Partial Differential Equations of the first order and second order.

CO2: Formulate, classify and transform partial differential equations into canonical form.

CO3: Solve linear and non-linear partial differential equations using various methods; and apply

these methods to solving some physical problems.

CO4: Able to take more courses on wave equation, heat equation, and Laplace equation.

CO5: Solve PDE by Laplace Transforms and Fourier Transforms.

Syllabus-(Theory): DSCC-7	TotalHrs:56
Title-034MAT011: Partial DifferentialEquations and Integral Transforms	
Unit-I	**14hrs**
Basic concepts–Formation of partial differential equations by elimination of arbitrary constants and functions, Solution of partial differential equations –Solution by Direct integration, Lagrange's linear equations of the form $Pp + Qq = R$, Standard types of first order non-linear partial differential equations. The integrals of the non-linear equation by Charpit's method	

Unit-II	14hrs
Homogeneous linear partial differential equations with constant coefficients. Partial differential equations of the second order. Classification of second-order partial differential equations, canonical forms. Classification of second-order linear equations as hyperbolic, parabolic, and elliptic. Solutions of the Heat equation, Laplace equation, and Wave equation (usingseparationofvariables).	
Unit-III	14hrs
Laplace Transforms Definition**,** Basic Properties. Laplace transforms of some standard functions. Laplace transform of Periodic functions. Laplace transform of derivative and integral of a function. Heaviside function. Dirac-delta function. Convolution theorem. InverseLaplace transforms and its properties. Solution of differential equations by using Laplacetransforms	
Unit-IV	14hrs
Fourier Series and Transforms: Periodic functions. Fourier Coefficients. Fourierseries of functions with period $2\pi$and period 2L. Fourier series of even and odd functions. Halfrange Cosine and Sine series. Fourier Transforms - Finite Fourier Cosine and Sine transform.Transformsofderivates**.**ApplicationsofFourierTransforms**.**	

Booksrecommended:

1. D. A. Murray, Introductory Coursein Differential Equations, Orientand Longman
2. H.T.H.Piaggio, Elementary Treatiseon Differential Equations and their Applications,CBS Publisher & Distributors, Delhi,1985.
3. G.F.Simmons, Differential Equations, TataMcGraw Hill.
4. S.L.Ross, Differential Equations, 3rd Ed.,JohnWiley and Sons,India,2004.
5. M. D. Raisinghania, Ordinary Differential Equations & Partial Differential Equations, S.Chand& Company, New Delhi.
6. K. SankaraRao, Introductionto Partial Differential Equations, PHI,Third Edition, 2015.
7. I.N.Sneddean, Elements of Partial differential equations, McGraw-Hill International Editions,1986.
8. Murray R. Spiegal(Schaum'sSeries), LaplaceTransforms, McGraw-Hill International Editions.
9. Goel and Gupta, LaplaceTransform, PragatiPrakashan, Meerut, India.
10. Sudhir KumarPundir, Integral Transform Methods in Science & Engineering, CBS Engineering Series, 2017, New Delhi.
11. Murray R.Spiegal(Schaum'sSeries), Fourier Transforms,McGraw-Hill International Editions.
12. Earl David Rainville and Philip Edward Bedient-A short course in Differential Equations,Prentice Hall College Div;6thEdition.
13. SathyaPrakash, Mathematical Physics, S. ChandandSons, New Delhi.

B.Sc.Semester–IV

Subject: MathematicsDisciplineSpecificCourse(DSCC)

Course No.: 8
CourseCode (Practical): 034MAT012

CourseCode	TypeofCourse	Theory/Practical	Credits	Instructionhour perweek	Total No. ofLectures/Hours /Semester	DurationofExam	Formative AssessmentMarks	Summative Assessment Marks	Total Marks
034MAT012	DSCC	Practical	02	04	52hrs	3hrs	25	25	50

TitleoftheCourse(Practical):**Practicalson DSCC-8: Partial Differential Equations and Integral Transforms(034MAT012)**

CourseOutcome(CO):

Aftercompletionofthe course(Practical),studentswillbeableto:

CO1: Learn Free and Open Source software(FOSS) tools or computer programming.

CO2: Solve problemson Partial Differential Equations and Integral Forms.

CO3: To find Laplace transformof various functions.

CO 4: To find the Fourier Transform of periodic functions

CO 5: To solve partial differential equations by using Integral transforms.

ListoftheExperimentsfor52hrs/Semesters

1 Solutions of Linear Partial differential equationsof   type1 to type4 and Lagrange's method.
2 Solutions of the partial differential equation using Charpit's method.
3 Solutions of Second-order homogenous partial differential equation with constant coefficients.
4 Solutions to thepartial differential equations using the separation of variables method (Heat/ Wave/ Laplace).
5 Finding the Laplace transforms of some standard and periodic functions.
6 Finding the inverse Laplace transform of simple functions
7 Verification of Convolution Theorem.
8 To solve ordinary linear differential equations using Laplace transforms.
9 To solve the Integral equation using Laplace transform.
10 To find full range Fourier series ofsome simple functions with period 2π and 2L
11 To find Half range sine and cosine series of some simple functions and ploting them.
12 To find Cosine Fourier transforms.
13 To find Sine Fouriertransforms.

Generalinstructions:SuggestedSoftwares:Maxima/Scilab/Maple/MatLab/Mathematica/Phython/R.

Scheme of Practical Examination (distribution of marks): 25 marks for Semester end examination

1. **Programme writing and problem solving: 10 Marks**

2. **Programme Execution: 5 Marks**

3. **Viva: 5 Marks**

4. **Journal: 5 Marks**

   Total 25 marks

Note: Same Scheme may be used for IA (Formative Assessment) examination

Books recommended.

1. Scilab by example: M. Affouf 2012, ISBN: 978-1479203444.
2. Scilab (A free software to Matlab): H. Ramchandran, A.S. Nair. 2011 S. Chand and Company.
3. Scilab for very beginners. -www.scilab-enterprises.com
4. M. Kanagasabapathy, Introduction to Maxima for Scientific Computers, BPB Publishers.
5. Kalyanarao Takale, Computational Mathematics using Maxima Software, Nirali Publishers.
6. Vaisak Vena, Maxima, The Computer Algebra System, Notion Press.
7. P.N.de Souza. R.J. Fateman, J.Moses and C. Yapp, The Maxima Book.
8. M. D. Raisinghania, Ordinary Differential Equations & Partial Differential Equations, S.Chand & Company, New Delhi.
9. I.N.Sneddean, Elements of Partial differential equations, McGraw-Hill International Editions,1986.
10. Murray R.Spiegal(Schaum'sSeries), LaplaceTransforms, McGraw-Hill International Editions.
11. Murray R.Spiegal(Schaum'sSeries), Fourier Transforms, McGraw-Hill International Editions.

B.Sc.Semester –IV

Subject: MathematicsOpenElectiveCourse(OEC-4)

(OECforotherstudents)

Course Code(OEC): 004MAT051

CourseCode	TypeofCourse	Theory/ Practical	Credits	Instructionhour perweek	Total No. ofLectures/Hours /Semester	Duration ofExam	FormativeAssessmentMarks	Summative Assessment Marks	Total Marks
004MAT051	OEC	Theory	03	03	42hrs	2hrs	40	60	100

OEC-4(forotherstudents): 004MAT051:

TitleoftheCourse:**Mathematical Finance**

CourseOutcome(CO):

Aftercompletionofthe course,studentswillbeableto:

CO1: Understandhowto computeprofitandloss,discount,andBanker'sdiscount.

CO2: Understand the concept of Linear equations and inequalities and their use in the

Solvingthe Linear Programming Problems.

CO3: Formulation of Transportation Problem and its application in the routing problem

Integratethe conceptinbusinessconceptwiththe functioningofglobaltrade.

CO4: Understandcommercialarithmetic.

CO5: Applydecision-supporttoolstobusinessdecision-making.

CO6: Applyknowledgeofbusinessconceptsandfunctionsinanintegratedmanner.

Syllabus-OEC Title-004MAT051: Mathematical Finance	TotalHrs:42
Unit-I	**14hrs**
Commercial Arithmetic Bill of exchange, Bill of the discounting procedure.Basic formula related to profit, loss, discount and brokerage, Successive discount,True discount, Banker's discount.	
Unit-II	**14hrs**
LinearProgramming Linear equations and inequalities- Rectangular coordinates, straight line, parallel and intersecting lines, and linear inequalities. Introduction to linear programming, Mathematical formulation of LPP, Solution of an LPP by graphical method, special cases in the graphical method.	
Unit-III	**14hrs**
Transportationproblem Introduction, Formulation of Transportation problem, Initial basic feasible solution, Steps in solving a transportation problem, optimality check, special cases in Transportation problem. The Traveling salesman Problem (RoutingProblem).	

Booksrecommended:
1. R. S. Aggarwal, Objective Arithmetic, S.Chand& Company Ltd.
2. A. Mizrahi and M. Sullivan, Mathematics for Business and Social Sciences and Application approach, JohnWiley and Sons, India.
3. QaziZameeruddin, Vijay K. Khanna, S. K. Bhambri, Business Mathematics- II Edition, Vikas Publishing House.
4. S.Kalavathy,OperationResearch, Fourth edition,Vikas publication house Pvt. Ltd.
5. Sreenivasa Reddy M, Operations Research, 2nd edition, Sanguine Technical publishers Bangalore.
6. S.D.Sharma, OperationResearch,KedarNath Ram Nath, Meerut.

DetailsofFormativeassessment(IA)forDSCCtheory/OEC:40%weightagefortotalmarks

TypeofAssessment	Weightage	Duration	Commencement
Writtentest-1	10%	1hr	8thWeek
Writtentest-2	10%	1hr	12thWeek
Seminar	10%	10minutes	--
Casestudy/Assignment/Field work/Projectwork/Activity	10%	------	--
Total	40%ofthemaximummarks allottedforthepaper		

FacultyofScience

04-YearUGHonorsprogramme:2022-23

GENERALPATTERNOFTHEORYQUESTIONPAPERFORDSCC/OEC

(60marksforsemesterendExaminationwith2hrsduration)

Part-A

1. Questionnumber1-6carries2markseach.Answerany5questions   :10marks

Part-B

2. Questionnumber7-11carries5Markseach.Answerany4questions   :20marks

Part-C

3. Questionnumber12-15carries10Markseach.Answerany3questions

:30mark

s(Minimum1questionfromeachunitand10marksquestionmayhavesub
questionsfor7+3or6+4or5+5ifnecessary)

Total:60Marks

Format for Model question paper Unit wise

DSCCTheory: 034MAT011: Partial Differential Equations and   Integral Transforms

Question Numbers	Number of questions to be set in Unit	Number of questions to be answered	Marks for each question	Max marks for the question
1	Unit-I: ------ 2 Unit-II ------ 1 Unit: III-------1 Unit: IV-------2 Total: 6	5	2	10
2	Unit-I ------1 Unit-II ------1 Unit-III -----2 Unit-IV ------1 Total: 5	4	5	20
3	Unit-I ------1 Unit-II ------1 Unit-III------1 Unit-IV------1 Total: 4	3	10	30

OEC4:004MAT051: Mathematical Finance

Question Number	Number of questions to be set in Unit	Number of questions to be answered	Marks for each question	Max marks for the question
1	Unit-I ------2 Unit-II ------2 Unit-III------2 Total: 6	5	2	10
2	Unit-I ------2 Unit-II ------1 Unit-III------2 Total : 5	4	5	20
3	Unit-I ------1 Unit-II ------2 Unit-III------1 Total: 4	3	10	30
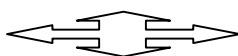
KARNATAK UNIVERSITY, DHARWAD

Four - Year B.Sc. (Hons.) Program

SYLLABUS FOR SEM I & II

Course: CHEMISTRY

SEMESTER - I

DISCIPLINE SPECIFIC CORE COURSES(DSCC)

DSCC – 1 : Chemistry (Theory) - I (Code:031CHE011) DSCC – 2 : Chemistry (Practical) - II (Code:031CHE012)OEC- 1 : Chemistry in daily life (Code: 001CHE051)

SEMESTER - II

DSCC – 3 : Chemistry (Theory) - III (Code:032CHE011) DSCC- 4 : Chemistry (Practical) - IV (Code:032CHE012) OEC- 2 : Molecules of life (Code:002CHE051)

Effective from 2021-22

AS PER N E P – 2020

Karnatak University, Dharwad

Sem	Type of Course	Course Code	Instruction hour per week (hrs)	Total hours of Syllabus / Sem	Duration of Exam (hrs)	Formative Assessment Marks	Summative Assessment Marks	Total Marks	Credits
I	DSCC -1 Chemistry (Theory) - I	031CHE011	04	56	02	40	60	100	04
	DSCC -2 Chemistry (Practical) - II	031CHE012	04	52	03	25	25	50	02
	OEC- 1 Chemistry in daily life	001CHE051	03	42	02	40	60	100	03
	SEC-I : Soil analysis	031CHE061	03	30	02	25	25	50	02
II	DSCC -3 Chemistry (Theory) - III	032CHE011	04	56	02	40	60	100	04
	DSCC -4 Chemistry (Practical) - IV	032CHE012	04	52	03	25	25	50	02
	OEC- 2 Molecules of life	002CHE051	03	42	02	40	60	100	03

Programme Specific Outcome (PSO):

On completion of the 03/ 04 years Degree in Chemistry students will be able to:

PO 1 Demonstrate, solve and an understanding of major concepts in all the disciplines of chemistry.

PO 2 Provide students with broad and balanced knowledge and understanding of key chemical concepts.

PO 3 Understand practical skills so that they can understand and assess risks and work safely and competently in the laboratory.

PO 4 To apply standard methodology to the solutions of problems in chemistry.

PO 5 Provide students with knowledge and skill towards employment or higher education in chemistry or multi-disciplinary areas involving chemistry.

PO 6 Provide students with the ability to plan and carry out experiments independently and assessthe significance of outcomes.

PO 7 Develop in students the ability to adapt and apply methodology to the solution of unfamiliar types of problems.

PO 8 Employ critical thinking and the scientific knowledge to design, carry out, record and analyze the results of chemical reactions.

PO 9 To prepare students effectively for professional employment or research degrees in chemical sciences.

PO 10 To cater to the demands of chemical industries of well-trained graduates.

PO 11 To build confidence in the candidate to be able to work on his own in industry and institutionof higher education.

PO 12 To develop an independent and responsible work ethics.

B.Sc. Semester – I

Course Outcome (CO):

After completion of course (Theory), students will be able to:

CO1 : Describe the dual nature of radiation and matter; dual behavior of matter and radiation, de Broglie's equations, Heisenberg uncertainty principle and their related problems. Quantum mechanics. Derivation of Schrodinger's wave equation. Orbital s ha pe s of *s, p, d and f* atomic orbitals, nodal planes. Electronic configurations of the atoms.

CO2: Define periodicity, explain the cause of periodicity in properties, classify the elements into four categories according to their electronic configuration. Define atomic radii, ionisation energy, electron affinity and electronegativity, discuss the factors affecting atomic radii, describe the relationship of atomic radii with ionization energy and electron affinity, describe the periodicity in atomic radii, ionization energy, electron affinity and electronegativity.

CO3: Explain bond properties, electron displacement effects (inductive effect, electrometric effect, resonance effect and Hyper conjugation effect). steric effect and their applications in explaining acidic strength of carboxylic acids, basicity of amines. Understand basic concept of organic reaction mechanism, types of organic reactions, structure, stability and reactivity of reactive intermediates.

CO4: Describe important characteristics of configurational and conformational isomers. Practice and write conformational isomers of ethane, butane and cyclohexane. Understand the various concepts of geometrical isomerism and optical isomerism. Describe CIP rules to assign E,Z notations and R& S notations. Explain D and L configuration and *threo* and *erythro* nomenclature. Explain racemic mixture and racemisation, resolution of racemic mixture through mechanical separation, formation of diastereomers, and biochemical methods, biological significance of chirality.

CO5: Explain the existence of different states of matter in terms of balance between intermolecular forces and thermal energy of the particles. Explain the laws governing behavior of ideal gases and real gases. Understand cooling effect of gas on adiabatic expansion. Describe the conditions required for liquefaction of gases. Realize that there is continuity in gaseous and liquid state. Explain properties of liquids in terms of intermolecular attractions.

CO6: Understand principles of titrimetric analysis. Understand principles of different type's titrations. Titration curves for all types of acids – base titrations. Gain knowledge about balancing redox equations, titration curves, theory of redox indicators and applications.

CO7: Understand titration curves, indicators for precipitation titrations involving silver nitrate-Volhard's and Mohr's methods and their differences. Indicators for EDTA titrations - theory of metal ion indicators. Determination of hardness of water.

Syllabus- DSCC-1 : Chemistry (Theory) I (Code: 031CHE011)	Total Hrs: 56
Unit-I : ATOMIC STRUCTURE & PERIODICITY OF ELEMENTS	**14 hrs**
Atomic Structure: Review of Rutherford's atomic model, Bohr's theory, Hydrogen atomic spectra. Derivation of radius and energy of an electron in hydrogen atom, limitations of Bohr's theory, dual behavior of matter and radiation, de Broglie's equations, Heisenberg Uncertainty principle and their related problems. Quantum mechanics. Derivation of Schrodinger's wave equation for hydrogen atom and meanings of various terms in it. Significance of ψ and ψ^2. Radial and angular wave functions (atomic orbitals) and their distribution curves 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. Quantum numbers and their significance. Orbital sh a pe s of *s*, *p, d and f* atomic orbitals, nodal planes. Rules for filling electrons in various orbitals, Electronic configurations of the atoms (atomic number up to 54). Concept of exchange energy. Anomalous electronic configurations. IUPAC nomenclature of elements with atomic number greater than hundred. **(10 Lectures)** **Periodicity of elements:** Brief account on the following properties of elements with reference to s and p-block and trends in groups and periods. Effective nuclear charge, screening effect, Slater's rules, atomic and ionic radii, ionization enthalpy, electron gain enthalpy, electronegativity, Pauling/ Allred-Rochow scales**.** Numerical problems are to be solved wherever applicable. **(04 Lectures)**	
Unit-II FUNDAMENTALS OF ORGANIC CHEMISTRY & STEREOCHEMISTRY	**14 hrs**
Fundamentals of Organic Chemistry: Review of hybridization, *sigma* and *pi* bonds. IUPAC Nomenclature of poly functional organic compounds, comparative study of bond lengths, bond angles, bond energies and dihedral angles, bond polarity, dipole moment and illustration with examples of organic compounds, delocalization, electron displacement effects and their applications: inductive effect, electrometric effect, resonance effect, hyperconjugation, and steric effect. **Organic reaction Mechanism**: Definition, classification of organic reactions: substitution, addition, elimination, rearrangement, oxidation and reduction reactions with suitable examples. Use of curved arrows, types of bond fission, electrophiles,	

nucleophiles, nucleophilicity, nucleofugacity and basicity.

Reactive intermediates: Energy profile diagrams, structure, formation and stability and reactions of carbocations, carbanions, free radicals and carbenes. **(7 Lectures)**

Stereochemistry:

Stereoisomersim: Definition of stereoisomerism, conformational isomers and configurational isomers (distinction between conformation and configuration). Newman, Sawhorse and Fischer projection formulae and their interconversions.

Geometrical isomerism: Definition, reason for geometrical isomerism, E and Z notation -CIP rules and examples, determination of configuration of geometric isomers by dipole moment method and anhydride formation method, *syn* and *anti* isomers in compounds containing C=N.

Optical isomerism: Chirality/asymmetry, enantiomerism, diastereomerism and meso compounds. R and S notations (compounds with two asymmetric centers), D and L configurations and *threo* and *erythro* nomenclature, racemic mixture and racemization, Resolution: Definition, Resolution of racemic mixture by: i) Mechanical separation ii) Formation of diastereomers iii) Biochemical methods. Biological significance of chirality. Problems are to be solved wherever applicable. **(7 Lectures)**

Unit-III GASES & LIQUIDS	**14 hrs**

Gaseous state: Review of kinetic theory of gases, van der Waals equation of state Boyle temperature.

Molecular velocity: Maxwell's Boltzmann distribution law of molecular velocities (most probable, average and root mean square velocities). Relation between RMS, average and most probable velocity and average kinetic energies (derivation not required), law of equipartition of energy.

Collision frequency, collision diameter, Collision cross-section, collision number and mean free path and coefficient of viscosity, calculation of σ and η , variation of viscosity with temperature and pressure.

Critical phenomena: Andrews isotherms of CO_2, critical constants and their determination Relation between critical constants and van der Waals equation (Derivation), continuity of states, law of corresponding states. Numerical problems are to be solved wherever applicable. **(7 Lectures)**

Liquid state: Molecular forces and general properties of liquids**.**

Surface tension: surface tension, surface energy, effect of temperature on surface tension, shapes of liquid drops and soap bubbles, capillary action, determination of surface tension by capillary rise method, drop weight and drop number methods using

stalagmometer. Effect of temperature on surface tension. Parachor, Additive and constitutive properties: atomic and structural parachor. Elucidation of structure of benzene and benzoquinone.

Viscosity: Definition, viscosity coefficient, fluidity, molecular viscosity, relative viscosity and absolute viscosity, determination of coefficient of viscosity using Ostwald viscometer. Effect of temperature, size, weight, shape of molecules and intermolecular forces.

Refractive index: Definition, Specific and molar refraction. Determination of refractive index using Abbe's refractometer. Additive and constitutive properties: Elucidation of structure of molecules. Numerical problems are to be solved wherever applicable.   **(7 Lectures)**

Unit-IV ANALYTICAL CHEMISTRY	14 hrs

Introduction to Analytical Chemistry and its interdisciplinary nature. Concept of sampling. Accuracy, precision, selectivity and sensitivity. Method validation. Types and sources of errors in analytical measurements. Presentation of experimental data and results from the point of view of significant figures.

Titrimetric analysis: Principle, classification, normality, molarity, molality, mole fraction, ppm, ppb etc. Standard solutions, preparation and dilution of reagents/solutions using $N_1V_1 = N_2V_2$, preparation of ppm level solutions from source materials (salts).

Acid-base titrimetry: Theory, titration curves for all types of acids – base titrations.

Redox titrimetry: Theory, balancing redox equations, titration curves, theory of redox indicators and applications.

Precipitation titrimetry: Theory, titration curves, indicators for precipitation titrations involving silver nitrate- Volhard's and Mohr's methods and their differences.

Complexometric titrimetry: Theory, titration methods employing EDTA (direct, back, displacement and indirect determinations). Indicators for EDTA titrations - theory of metal ion indicators. Determination of hardness of water.

Numerical problems are to be solved wherever applicable.   (**14 Lectures)**

Recommended Books/References

Inorganic Chemistry

1. Lee, J.D. Concise Inorganic Chemistry ELBS, 1991.

2. Cotton, F.A., Wilkinson, G. & Gaus, P.L. Basic Inorganic Chemistry, 3rd Ed., Wiley.

3. Douglas, B.E., McDaniel, D.H. & Alexander, J. J. Concepts and Models in Inorganic Chemistry, John Wiley & Sons.

4. Huheey, J. E., Keiter, E.A., Keiter, R.L. & Medhi, O. K. Inorganic Chemistry: Principles of Structure and Reactivity, Pearson Education India, 2006.

5. Shriver, D.F. & Atkins, P.W. Inorganic Chemistry, Oxford University Press.

6. Wulfsberg, G. Inorganic Chemistry, Viva Books Pvt. Ltd.

7. Rodgers, G. E. Inorganic & Solid State Chemistry, Cengage Learning India Ltd., 2008.

8. Mark Weller and Fraser Armstrong, 5th Edition, Oxford University Press (2011-2012) Adam, D.M.

   Inorganic Solids: An introduction to concepts in solid-state structural chemistry. John Wiley & Sons, 1974.

9. G.L. Miessler & Donald A. Tarr: Inorganic Chemistry, Pearson Publication.

10. Mahan, B.H. University Chemistry 3rd Ed. Narosa (1998).

11. Petrucci, R.H. General Chemistry 5th Ed. Macmillan Publishing Co., New York (1985).

Organic Chemistry

1. Organic Chemistry-P. Y. Bruice, 7th Edition, Pearson Education Pvt. Ltd., New Delhi (2013).

2. Heterocyclic Chemistry- R. K. Bansal, 3rd Edition, New- Age International, New Delhi, 2004.

3. McMurry, J.E. Fundamentals of Organic Chemistry, 7th Ed. Cengage Learning India Edition, 2013.

4. Sykes, P. A Guidebook to Mechanism in Organic Chemistry, Orient Longman, New Delhi (1988).

5. Stereochemistry-Conformation and Mechanism-P. S. Kalsi, Wiley-Eastern Ltd, New Delhi.

6. Morrison, R.T. & Boyd, R.N. Organic Chemistry, Pearson, 2010.

7. Bahl, A. & Bahl, B.S. Advanced Organic Chemistry, S. Chand, 2010.

8. Graham Solomons, T. W., Fryhle, C. B. & Snyder, S.A. Organic Chemistry, John Wiley & Sons (2014).

9. Organic Chemistry Volume-I, II- I. L. Finar, 6th Edition, ELBS London (2004).

10. Organic Chemistry-F. A. Carey, 4th Edition, McGraw Hill (2000).

11. Modern Organic Chemistry - R.O.C. Norman and D.J. Waddington, ELBS, 1983.

12. Understanding Organic reaction mechanisms - A. Jacobs, Cambridge Univ. Press, 1998.

13. Organic Chemistry - L. Ferguson, Von Nostrand, 1985.

14. Organic Chemistry - M. K. Jain, Nagin & Co., 1987.

15. Organic Chemistry- Mehta and Mehta, 2005.

Physical Chemistry

1. Barrow, G.M. Physical Chemistry, Tata McGraw-Hill, 2007.
2. Castellan, G.W. Physical Chemistry, 4th Ed. Narosa, 2004.
3. Kotz, J.C., Treichel, P.M. & Townsend, J.R. General Chemistry Cengage Learning India Pvt. Ltd., New Delhi, 2009.
4. P.W. Atkins: Physical Chemistry, 2002.
5. W.J. Moore: Physical Chemistry, 1972.
6. Text Book of Physical Chemistry - P. L. Soni, S. Chand & Co., 1993.
7. Text Book of Physical Chemistry - S. Glasstone, Mackmillan India Ltd., 1982.
8. Principles of Physical Chemistry - B. R. Puri, L. R. Sharma and M. S. Patania, S. L. N. Chand & Co.1987.
9. Physical Chemistry - Alberty R. A. and Silbey, R. J. John Wiley and sons, 1992.
10. Physical Chemistry - G. M. Barrow, McGraw Hill, 1986.
11. Physical Chemistry (3rd Edition) - Gilbert W. Castilian, Narosa Publishing House, 1985.
12. Chemical Kinetics by K. J. Laidler, Tata McGraw Hill Publishing Co., New Delhi.
13. Kinetics and Reaction Mechanisms by Frost and Pearson, Wiley, New York, 1981.

Analytical Chemistry

1. Jeffery, G.H., Bassett, J., Mendham, J. & Denney, R.C. Vogel's Textbook of Quantitative Chemical Analysis, John Wiley & Sons, 1989.
2. Willard, H. H., Merritt, L.L., Dean, J.   & Settle, F.A. Instrumental Methods of Analysis, 7th Ed.
   Wadsworth Publishing Company Ltd., Belmont, California, USA, 1988.
3. Christian, G.D; Analytical Chemistry, VI Ed. John Wiley & Sons, New York, 2004.
4. Harris, D. C. Exploring Chemical Analysis, Ed. New York, W.H. Freeman, 2001.
5. Skoog, D. A. Holler F.J. & Nieman, T.A. Principles of Instrumental Analysis, Cengage Learning India Ed, 2017.
6. Ditts, R.V. Analytical Chemistry; Methods of Separation, van Nostrand, 1974.

DSCC-2 : Chemistry II (Practical) (Code: 032CHE012)

Course Outcome (CO):

After completion of course (Practical), students will be able to:

CO1: Understand and practice the calibration of glasswares (burette, pipette, volumetric flask).

CO2: Basic concepts involved in titrimetric analysis, primary standard substances, preparation of standard solutions.

CO3: Explain the principles of acid-base, redox and iodometric titrations.

CO4: Work out the stoichiometric relations based on the reactions involved in the titrimetric analysis.

CO5: Based on principles of titrimetric analysis student can perform

CO6: Describe the significance of organic quantitative analysis.

CO7: Determine the amount of phenol, aniline, amide, ester and formaldehyde in a given solution by performing blank titration and main titrations.

CO8: Determine aspirin in the tablet by hydrolysis method.

Syllabus- DSCC-2 : Chemistry II (Practical) (Code: 032CHE012)	Total Hrs: 52
Inorganic chemistry experiments Explaination of calibration of glasswares (burette, pipette, volumetric flask), primary and secondary standard solutions, normality, molarity, molality & equivalent mass. (Students should write in the journal regarding the above). 1. Determination of sodium carbonate and sodium bicarbonate in a mixture. 2. Determination of carbonate and hydroxide present together in a mixture. 3. Determination of Mohr's salt and oxalic acid separately using standardized $KMnO_4$ solution. 4. Determination of ferrous and ferric ions in a solution using standard solution of $K_2Cr_2O_7$ by internal indicator method (diphenylamine or N-phenylanthranilic acid). 5. Determination of magnesium using standard EDTA solution (Standardize EDTA solution using standard zinc sulphate solution). 6. Determination of iodine using sodium thiosulphate (Standardize sodium thiosulphate solution using standard potassium dichromate solution). Note : Standard solution is to be prepared by the students for both in regular and in practical examination **Distribution of marks** 1. **Accuracy:**　　　　　12 (6+6)Marks 2. **Technique and presentation :**　02Marks	

3. **Reactions and Calculations:** **03 Marks** 4. **Viva:** **05 Marks** 5. **Journal:** **03 Marks** **Total** **25 marks** **Deduction of marks for accuracy :** : ±0.4 CC – 6 marks, $\pm$ 0.6 CC- 04 marks, ±0.8 CC- 02 marks, ±1.0 CC - 01 marks. Above ±1.0 CC - 00 marks	
Organic chemistry experiments 7. Determination of phenol by bromination method 8. Determination of aniline by bromination method. 9. Determination of acetamide by hydrolysis method. 10. Determination of ethyl benzoate by hydrolysis method. 11. Determination of aspirin in the tablet by hydrolysis method. 12. Determination of formaldehyde by sodium sulphite method.	
Distribution of marks 1. **Accuracy:** **12 (6+6) Marks** 2. **Technique and presentation :** **02Marks** 3. **Reactions and Calculations:** **03 Marks** 4. **Viva:** **05 Marks** 5. **Journal:** **03 Marks** **Total** **25 marks** **Deduction of marks for accuracy :** : ±0.4 CC – 6 marks, $\pm$ 0.6 CC- 04 marks, ±0.8 CC- 02 marks, ±1.0 CC - 01 marks. Above ±1.0 CC - 00 marks	
General instructions: In the practical examination, in a batch of ten students, five students each will be performing inorganic and organic experiments. Selection of experiments may be done by the students based on lots. Viva questions may be asked on any of the experiments prescribed in the practical syllabus**.** *Manual is not allowed in the examination.*	

Books recommended:

1. Vogel's Qualitative and quantitative Inorganic Analysis, G.Svehla, 7th Ed, Longman (2001).

2. Advanced Practical Chemistry, Pragathi, Publications, Jagadamba Singh,

3. Advanced Practical Inorganic Chemistry, Gurdeep Raj, Goel Publishing House, Meerut

B.Sc. Semester – I

Course Outcome (CO):

After completion of course, students will be able to:

CO1: Understand the chemical constituents in various day to day materials used by a common man like Tooth paste, Cosmetics, Soaps and detergents and Biomolecules .

CO2: Understand the chemical constituents and applications in Food additives, adulterants and contaminants, Artificial food colorants.

CO3: Understand the scientific reasons in various aspects and chemotherapy and its applications.

CO4: Understand the basic constituents and applications in polymers, surface coatings, fertilizers, insecticides and pesticides, chemical explosives etc.

Syllabus- **OEC- 1 : Chemistry in daily life (Code: 001CHE051)**	**Total Hrs: 42**
Unit-I	**14 hrs**
Household chemicals: Common chemicals used at home. **Tooth paste** – Contents of toothpaste, chemical name, ingredients, flavor and its role. **Cosmetics** – Contents and uses of Face powder, snow, lipsticks and perfumes. Toxic household chemicals and their effects (antifreeze, bleach, drain cleaners, carpet cleaners, ammonia, air fresheners). **Soaps and detergents**- Types of soaps, synthetic detergents (neutral, anionic and cationic), cleansing action of detergents. Advantages and disadvantages of detergents over soaps. **Biomolecules:** Composition and uses of Carbohydrates, proteins, oils and fats minerals and vitamins. Functions of enzymes and hormones in the human body.	
Unit-II	**14 hrs**
Food additives, adulterants and contaminants: Definition types and applications - Food preservatives like benzoates, propionates, sorbates, disulphites. Artificial sweeteners: Aspartame, saccharin, dulcin, sucralose and sodium cyclamate. Flavours: Vanillin, alkyl esters (fruit flavours) and monosodium glutamate. **Artificial food colorants:** Coal tar dyes and non-permitted colours and metallic salts. Analysis of pesticide residues in food. **Science behind** emotions, sunscreen, rust formation, rainbow, motion sickness, salt harvesting, crystallization of sugar and kidney stones.	

Chemotherapy: Drugs and their classification. Therapeutic action of different classes of the drugs *viz.* analgesics, antibiotics, antacids, antihistamines, antimicrobials, contraceptives, antipyretics, antiseptics and neurologically active drugs.	
Unit-III	**14 hrs**
Polymers: Examples of synthetic polymers and their uses (LDPE, HDPE, PVC, Polypropylene, nylon, teflon, polysiloxanes, polyphosphazenes and polybutadiene). **Surface Coatings:** Classification and brief introduction to surface coatings. Paints and pigments - formulation, composition and related properties. Fillers, Thinners, Enamels, emulsifying agents. Special paints (Heat retardant, Fire retardant, Eco-friendly paint, Plastic paint), Dyes, Wax polishing, Water and Oil paints, Metallic coatings (electrolytic and electroless), metal spraying and anodizing. **Fertilizers:** Composition of fertilizers, uses of Urea, ammonium nitrate, calcium ammonium nitrate, ammonium phosphates, superphosphate of lime. **Insecticides, weedicides and pesticides**: Examples, content and uses. **Chemical explosives:** Origin of explosive properties in organic compounds, preparation and explosive properties of lead azide, PETN, cyclonite (RDX). Introduction to rocket propellants.	

Recommended Books/References

1. Hawley's Condensed Chemical Dictionary by Richard J. Lewis. Call Number: REF 540.3 H31.
2. Van Nostrand's Encyclopedia of Chemistry by Glenn D. Considine, Call Number: REF 540.3 V33C2005.
3. Macmillan Encyclopedia of Chemistry by Joseph J. Lagowski.
4. NCERT 12th Standard Book and references therein.
5. Chemistry in Daily Life: Third Edition Paperback – 1 January 2012 by Singh K.

Details of Formative assessment (IA) for DSCC theory/OEC: 40% weight age for total marks

Type of Assessment	Weight age	Duration	Commencement
Written test-1	10%	1 hr	8th Week
Written test-2	10%	1 hr	12th Week
Seminar	10%	10 minutes	--
Case study / Assignment / Field work / Project work/ Activity	10%	------	--
Total	40% of the maximum marks allotted for the paper		

GENERAL PATTERN OF THEORY QUESTION PAPER FOR DSCC/ OEC

(60 marks for semester end Examination with 2 hrs duration)

Part-A

1. Question number 1-06 carries 2 marks each. Answer any 05 questions   : 10marks

Part-B

2. Question number 07- 11 carries 05Marks each. Answer any 04 questions   : 20 marks

Part-C

3. Question number 12-15 carries 10 Marks each. Answer any 03 questions   : 30 marks

   (Minimum 1 question from each unit and 10 marks question may have sub questions for 7+3 or 6+4 or 5+5 if necessary)

Total: 60 Marks

Note: Proportionate weight age shall be given to each unit based on number of hours prescribed.

Subject: Chemistry

SKILL ENHANCEMENT COURSE (SEC)-I

SEC-I : Soil Analysis: (031CHE061)

Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Mode of Examination	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
SEC-I	Practical	02	03hrs	30	Practical	2hr	25	25	50

Course Outcome (CO)

After completion of Skill Enhancement course, students will be able to:

CO1: Acquire skills for Laboratory management and routine analysis of Soil.

CO2: Improve working ability in analytical laboratory.

CO3: Helpful for obtaining jobs in various fields.

CO4: The student can start his own business /laboratory or can associate with any kind of laboratory or associated jobs with confidence.

List of the Experiments for 30 hrs / Semesters (Theory and Practical= 3Hours/Week)
1.   Introduction: Soil, Physical properties of Soil,
2.   Chemical Properties of soil: chemistry of clays, ionic   exchange, acidity,   alkalinity, pH, salinity, reactions in liming and acidification.
3.   Soil organic matter, C: N relationships, nitrogen-transformation, soil organisms, sulfur transformation.
4.   Fertility of soil. Soil deficiency with respect to macro and micro nutrient components.
5.   Brief study of micronutrient & macronutrient sources & importance

Practical

  6. Visit to soil testing laboratory & report writing. Visit to farmers fields for collection of different types of soil samples.
  7. Determination of pH of different types of soil samples
  8. Determination of electrical conductivity of different types of soil samples
  9. Determination of alkalinity and salinity of the soil samples.
 10. Determination of total organic matter in the soil Samples.
 11. Determination of Ca (II) ions from soil samples.
 12. Determination of Mg(II) ions from soil samples.
 13. Determination of Fe (II) and Fe (III) ions from soil sample.
 14. Determination of Na from soil samples by flame photometry.
 15. Determination of K from soil samples by flame photometry.

General instructions:

In the practical examination, in a batch of ten students, minimum three sets of experiments may be given. Selection of experiment may be done by the students based on lots. Viva questions may be asked on any of the experiments prescribed in the practical syllabus. *Manual is not allowed in the examination*

Scheme of Practical Examination (distribution of marks)For

internal and Semester end examination

1. **Three questions on the theory may be given.**
   Student has to answer any two questions: 06 Marks
2. **Accuracy in the practical :**   **08 Marks**
3. Reactions and Calculations: 03 Marks
4. **Viva:**   **05 Marks**
5. Journal: 03 Marks
   Total   **25 marks**

Deduction of marks for accuracy: : ±0.2 CC -08 marks, ± 0.4 CC- 06 marks, ±0.6 CC- 04 marks, ±0.8CC- 02 marks, ±0.9 CC or above - 01 marks.

Recommended Books/References

1. Laboratory manual for Environmental Chemistry: Sunita Hooda and Sumanjeet Kaur by S. Chand &Company 1999.

2. Soils and soil fertility, Troch, F.R. And Thompson, L.M. Oxford Press.

3. Fundamentals of soil science, Foth, H.D. Wiley Books.

4. Soil Science and Management, Plaster, Edward J., Delmar Publishers.

5. Principles of Soil Chemistry (2Wed.) Marcel Dekker Inc., New York.

6. Handbook of Agricultural Sciences, S.S. Singh, P. Gupta, A. K. Gupta, Kalyani Publication.

7. Introduction to soil laboratory manual - J. J. Harsett Stipes.

8. Introduction to soil science laboratory manual, Palmer and troch – Iowa State.

B.Sc. Semester – II

DSCC-3 : Chemistry (Theory) III (Code: 032CHE011)

Course Outcome (CO):

After completion of course (Theory), students will be able to:

CO1: Explain ionic bond, Born Lande equation ,Born Haber cycle and Fajan's rules. State VSEPR theory, hybridisation and shapes of various molecules. Understand the concept of resonance and write resonating structures of NO_3^-, CO_3^{2-} and SO_4^{2-}.

CO2: Explain MO Theory and draw the MO diagrams for homonuclear diatomic molecules and ions of 1st and 2nd periods and heteronuclear diatomic molecules such as CO, NO and NO^+. Compare MO and VB theory.

CO3: Learn preparation and reactions of alkanes, alkenes and alkynes. Clear the concept learning mechanism of Free radical mechanism of halogenations of alkanes. Understand the mechanisms of addition reactions of alkenes and alkynes.

CO4: Learn the concept of polymerization, ozonolysis in alkenes and alkynes. Learn acidity of alkynes, formation of metal acetylides and their applications. Explain cycloalkanes and their relative stability. Explain conformational analysis of cyclohexane with Karplus energy diagram. Axial and equatorial bonds. Relative stability of mono substituted cycloalkanes.

CO5: Expected to learn symmetry elements, unit cells, crystal systems. Learn Bravais lattice, types and identification of lattice planes. Explain laws of crystallography - law of constancy of interfacial angles, law of rational indices.

CO6: Miller indices. X–Ray diffraction by crystals, Bragg's law. Structures of NaCl, KCl and CsCl (qualitative treatment only). Explain defects in crystals. Learn the applications of liquid crystals. Learn the concept of reaction rates. Effect of temperature, pressure, catalyst and other factors on reaction rates.

CO7: Understand the concept of order and molecularity of a reaction and their applications. Define half–life of a reaction. Explain methods for determination of order of a reaction by half life period and differential equation method. Understand the concept of activation energy and its calculation from Arrhenius equation. Explain theories of reaction rates: Collision theory and activated complex theory of bimolecular reactions.

CO8: Learn principles of gravimetric analysis. Learn the precipitation, mechanism of precipitation, factors influencing precipitation, co-precipitation and post-precipitation. Learn structure, specificity, conditions and applications of organic reagents. Advantages of organic reagents over inorganic reagents.

CO9: Learn about quality of surface water, ground water. Impurities in water, standards of water quality (color, pH, hardness, TDS, sulphate, fluoride, chloride) for potable, domestic, industrial and agricultural purpose. Learn Water treatment technologies – house hold water treatment, municipal water treatment, industrial treatment (primary and secondary treatment of industrial effluent), softening of water, and disinfection of water. Determinations of DO, BOD and COD, and their significance.

Syllabus- DSCC-3 : Chemistry (Theory) III (Code: 032CHE011)	Total Hrs: 56
Unit-I: CHEMICAL BONDING & MOLECULAR STRUCTURE	**14 hrs**
Ionic Bonding*: General characteristics of ionic compounds. Energy considerations in ionic bonding, lattice energy and solvation energy and their importance in the context of stability and solubility of ionic compounds. Born-Landé equation and calculation of lattice energy. Born-Haber cycle and its applications. **Polarizing power and polarizability**: Fajan's rules, ionic character in covalent compounds and percentage of ionic character. **Covalent bonding:** General characteristics of covalent compounds. 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 of NO_3^-, CO_3^{2-} and SO_4^{2-}. **Molecular Orbital Theory:** LCAO method, bonding and antibonding MOs and their characteristics for *s-s*, *s-p* and *p-p* combinations of atomic orbitals, nonbonding combination of orbitals, MO treatment of homonuclear diatomic molecules and ions of 1st and 2nd periods and heteronuclear diatomic molecules such as CO, NO and NO^+. Comparison of VB and MO approaches. Numerical problems are to be solved wherever applicable.	
Unit-II : ALIPHATIC HYDROCARBONS	**14 hrs**
Alkanes: Methods of preparation by catalytic hydrogenation, Wurtz reaction, Kolbe's synthesis and from Grignard reagent. Free radical mechanism of halogenations, relative reactivity and selectivity of halogenation. Conformational analysis of ethane and butane. **Alkenes**: Methods of preparation by dehydration of alcohols and dehydrohalogenation of alkyl halides. Mechanism of E1, E2, E1cb reactions. Saytzeff and Hofmann eliminations. *cis* Alkenes by partial catalytic hydrogenation and *trans*	

alkenes b y Birch reduction. Reactions: Addition of HX (Markownikov's and anti-Markownikov's addition) Stereospecificity of halogen addition, regioselectivity and relative rates of addition reaction. Hydrogenation, hydration, hydroxylation and epoxidation of alkenes. Oxidative cleavage of alkenes with $KMnO_4$. Ozonolysis, mechanism of ozonolysis in propene and polymerization.

Alkadienes: Classification, mechanism of addition of halogen and hydrogen halides in 1,3-diene, kinetically and thermodynamically controlled addition of HBr to 1,3-butadiene, polymerization and Diels-Alder reaction.

Alkynes: Preparation: Acetylene from CaC_2 and conversion into higher alkynes by dehalogenation of tetra halides and dehydrohalogenation of vicinal-dihalides. Reactions: Acidity of 1-alkynes and formation of metal acetylides, addition of bromine and alkaline $KMnO_4$, ozonolysis and oxidation with hot alk. $KMnO_4$. **(11 Lectures)**

Cycloalkanes: Types of cycloalkanes and their relative stability. Baeyer strain theory and theory of strainless rings. Conformational analysis of cyclohexane with Karplus energy diagram. Axial and equatorial bonds. Relative stability of mono substituted cyclohexanes. **(3 Lectures)**

Unit-III : SOLIDS & CHEMICAL KINETICS	14 hrs

Solids: Types 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. X-Ray diffraction by crystals, Bragg's law. Structures of NaCl, KCl and CsCl. Defects in crystals.

Liquid Crystals: Explanation, classification with examples- Smetic, nematic, cholesteric, disc shaped and polymeric. Structures of nematic and cholesteric phases-molecular arrangements in nematic and cholesteric liquid crystals. Applications of liquid crystals in LCDs and thermal sensing. Numerical problems are to be solved wherever applicable. **(7 Lectures)**

Chemical Kinetics: Review of reaction rates, order and molecularity.

Factors affecting rates of reaction: concentration pressure, temperature, catalyst, etc. Examples for different orders of reactions. Derivation of integrated rate equations for zero and second order reactions (both for equal and unequal concentrations of reactants). Half–life of a reaction (numerical problems). Methods for determination

of order of a reaction by half life period and differential equation method. Effect of temperature on reaction rates, temperature coefficient, 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). Numerical problems are to be solved wherever required. **(7 Lectures)**	
Unit-IV ANALYTICAL CHEMISTRY	**14 hrs**
Gravimetric Analysis: Stages in gravimetric analysis, requisites of precipitation, theories of precipitation, factors influencing precipitation, co-precipitation and post-precipitation. Structure, specificity, conditions and applications of organic reagents such as salcylaldoxime, oxine, dimethyl glyoxime, cupron and cupferron in inorganic analysis. Advantages of organic reagents over inorganic reagents. **(6 Lectures)** **Water analysis:** Water availability, requirement of water. Quality of surface water and ground water. Impurities in water. Standards of water quality for potable, domestic, industrial and agricultural purpose (color, pH, alkalinity, hardness, TDS, sulphate, fluoride, chloride etc.) **Water treatment technologies**: House hold water treatment, municipal water treatment and industrial treatment (primary and secondary treatment of industrial effluent). Softening of water. Disinfection of water. Definition and determinations of DO, BOD and COD, and their significance. Numerical problems are to be solved wherever required. **(8 Lectures)**	

Recommended Books/References

Inorganic Chemistry

1. Lee, J.D. Concise Inorganic Chemistry ELBS, 1991.

2. Cotton, F.A., Wilkinson, G. & Gaus, P.L. Basic Inorganic Chemistry, 3rd Ed., Wiley.

3. Douglas, B.E., McDaniel, D.H. & Alexander, J. J. Concepts and Models in Inorganic Chemistry, John Wiley & Sons.

4. Huheey, J. E., Keiter, E.A., Keiter, R.L. & Medhi, O. K. Inorganic Chemistry: Principles of Structure and Reactivity, Pearson Education India, 2006.

5. Shriver, D.F. & Atkins, P.W. Inorganic Chemistry, Oxford University Press.

6. Wulfsberg, G. Inorganic Chemistry, Viva Books Pvt. Ltd.

7. Rodgers, G. E. Inorganic & Solid State Chemistry, Cengage Learning India Ltd., 2008.
8. Mark Weller and Fraser Armstrong, 5 Edition, Oxford University Press (2011-2012) Adam, D.M.

   Inorganic Solids: An introduction to concepts in solid-state structural chemistry. John Wiley & Sons, 1974.

9. G.L. Miessler & Donald A. Tarr: Inorganic Chemistry, Pearson Publication.

10. Mahan, B.H. University Chemistry 3rd Ed. Narosa (1998).

11. Petrucci, R.H. General Chemistry 5th Ed. Macmillan Publishing Co., New York (1985).

Organic Chemistry

1. Organic Chemistry-P. Y. Bruice, 7th Edition, Pearson Education Pvt. Ltd., New Delhi (2013).

2. Heterocyclic Chemistry- R. K. Bansal, 3rd Edition, New- Age International, New Delhi, 2004.

3. McMurry, J.E. Fundamentals of Organic Chemistry, 7th Ed. Cengage Learning India Edition, 2013.

4. Sykes, P. A Guidebook to Mechanism in Organic Chemistry, Orient Longman, New Delhi (1988).

5. Stereochemistry-Conformation and Mechanism-P. S. Kalsi, Wiley-Eastern Ltd, New Delhi.

6. Morrison, R.T. & Boyd, R.N. Organic Chemistry, Pearson, 2010.

7. Bahl, A. & Bahl, B.S. Advanced Organic Chemistry, S. Chand, 2010.

8. Graham Solomons, T. W., Fryhle, C. B. & Snyder, S.A. Organic Chemistry, John Wiley & Sons (2014).

9. Organic Chemistry Volume-I, II- I. L. Finar, 6th Edition, ELBS London (2004).

10. Organic Chemistry-F. A. Carey, 4th Edition, McGraw Hill (2000).

11. Modern Organic Chemistry - R.O.C. Norman and D.J. Waddington, ELBS, 1983.

12. Understanding Organic reaction mechanisms - A. Jacobs, Cambridge Univ. Press, 1998.

13. Organic Chemistry - L. Ferguson, Von Nostrand, 1985.

14. Organic Chemistry - M. K. Jain, Nagin & Co., 1987.

15. Organic Chemistry- Mehta and Mehta, 2005.

Physical Chemistry

1. Barrow, G.M. Physical Chemistry, Tata McGraw-Hill, 2007.

2. Castellan, G.W. Physical Chemistry, 4th Ed. Narosa, 2004.

3. Kotz, J.C., Treichel, P.M. & Townsend, J.R. General Chemistry Cengage Learning India Pvt. Ltd.,New Delhi, 2009.

4. P.W. Atkins: Physical Chemistry, 2002.

5. W.J. Moore: Physical Chemistry, 1972.

6. Text Book of Physical Chemistry - P. L. Soni, S. Chand & Co., 1993.

7. Text Book of Physical Chemistry - S. Glasstone, Mackmillan India Ltd., 1982.

8. Principles of Physical Chemistry - B. R. Puri, L. R. Sharma and M. S. Patania, S. L. N. Chand & Co.1987.

9. Physical Chemistry - Alberty R. A. and Silbey, R. J. John Wiley and sons, 1992.

10. Physical Chemistry - G. M. Barrow, McGraw Hill, 1986.

11. Physical Chemistry (3rd Edition) - Gilbert W. Castilian, Narosa Publishing House, 1985.

12. Chemical Kinetics by K. J. Laidler, Tata McGraw Hill Publishing Co., New Delhi.

13. Kinetics and Reaction Mechanisms by Frost and Pearson, Wiley, New York, 1981.

Analytical Chemistry

1. Jeffery, G.H., Bassett, J., Mendham, J. & Denney, R.C. Vogel's Textbook of Quantitative ChemicalAnalysis, John Wiley & Sons, 1989.

2. Willard, H. H., Merritt, L.L., Dean, J. & Settle, F.A. Instrumental Methods of Analysis, 7th Ed.Wadsworth Publishing Company Ltd., Belmont, California, USA, 1988.

3. Christian, G.D; Analytical Chemistry, VI Ed. John Wiley & Sons, New York, 2004.

4. Harris, D. C. Exploring Chemical Analysis, Ed. New York, W.H. Freeman, 2001.

5. Skoog, D. A. Holler F.J. & Nieman, T.A. Principles of Instrumental Analysis, Cengage LearningIndia Ed, 2017.

6. Ditts, R.V. Analytical Chemistry; Methods of Separation, van Nostrand, 1974.

Course Outcome (CO)

After completion of course (Practical), students will be able to:

CO1: Learn regarding errors, types of errors, accuracy, precision, significant figures and standard deviation. To determine the total alkalinity in antacids, Vitamin C in lemon juice/formulations. To determine free alkali present in different soaps/detergents. Learn analysis of DO in waste water sample.

CO2: To determine Chemical Oxygen Demand (COD) in waste water sample.

CO3: To determine temporary, permanent and total hardness of water by collecting different samples of water.

CO4: Enable to understand the applications of experiments like methods of determination of viscosity, surface tension, refractive index.

Syllabus- **DSCC-4 : Chemistry IV (Practical) (Code: 032CHE012)**	**Total Hrs: 52**
Analytical chemistry experiments Explanation regarding errors, types of errors, accuracy, precision, significant figures and standard deviation (students should write in the journal regarding the above). 1. Determination of total alkalinity in antacids in terms of calcium carbonate (two different samples). 2. Determination of Vitamin C in fruit juice / formulations by iodate method (two different samples). 3. Determination of alkali present in soaps / detergents (two different samples). 4. Determination of DO in water sample, pond water and river water and compare the DOs (two different samples). 5. Determination of Chemical Oxygen Demand (COD) in waste water sample. 6. Determination of temporary, permanent and total hardness of water using standard EDTA solution 7. Determination of Ni (II) using DMG by gravimetric method.	

Distribution of marks
 	
  1. **Accuracy:**   **6+6 Marks**
  2. **Technique and presentation :** **02Marks**
  3. **Reactions and Calculations:**   **03 Marks**
  4.   **Viva:**   **05 Marks**
  5.   **Journal:**   **03 Marks**
      Total   **25 marks**
 	
Deduction of marks for accuracy : : ±0.4 CC – 6 marks, ± 0.6 CC- 04 marks, ±0.8 CC- 02 marks, ±1.0 CC - 01 marks. Above ±1.0 CC - 00 marks	

Physical chemistry experiments

1. Determination of surface tension and parachor of $-CH_2$ in alcohol series.
2. Determination of surface tension for different concentrations of soap solutions (Sodium laurate) and calculation of Critical Miceller Concentration(CMC) graphically.
3. Determination of the viscosity of liquids (ethyl acetate & ethyl alcohol / toluene, & chlorobenzene or any other two non hazardous liquids) using Ostwald's viscometer.
4. Study of the variation of viscosity for different concentration of sucrose solution and calculation of radius of sucrose by graphical method.
5. Determination of specific and molar refraction by Abbes refractometer (ethyl acetate, methyl acetate, ethylene chloride)
6. Determination of the composition of liquid mixture by Abbes refractometry (toluene & alcohol, water & sucrose solution).

Dstribution of marks

1. **Accuracy:** **12 Marks**
2. **Graphs and Calculations:** **05 Marks**
3. **Viva:** **05 Marks**
4. **Journal:** **03 Marks**

Total 25 marks

Deduction of marks for accuracy: Error up to 5% - 12 marks, 6 - 10% 09 marks, 11-15% 6 marks, 16 or above 3 marks.

General instructions:

In the practical examination, in a batch of ten students, five students each will be performing analytical and physical experiments. Selection of experiments may be done by the students based on lots. Viva questions may be asked on any of the experiments prescribed in the practical syllabus. *Manual is not allowed in the examination.*

Books recommended:

1 Vogel's Qualitative and quantitative Inorganic Analysis, G.Svehla, 7th Ed, Longman (2001).

Advanced Practical Chemistry, Pragathi, Publications, Jagadamba Singh,

Advanced Practical Inorganic Chemistry, Gurdeep Raj, Goel Publishing House, Meerut

OEC-2: **Molecules of Life** (Code: 002CHE051)

Course Outcome (CO)

After completion of course, students will be able to:

CO1: Acquire knowledge about different types of sugars and their chemical structures. Identify different types of amino acids and determine the structure of peptides.

CO2: Explain the actions of enzymes in our body and interpret enzyme inhibition. Predict action of drugs. Depict the biological importance of oils and fats. Importance of lipids in the metabolism. Differentiate RNA and DNA and their replication. Explain production of energy in our body.

Syllabus- OEC-2: **Molecules of Life** (Code: 002CHE051)	Total Hrs: 42
Unit-I	**14 hrs**
Carbohydrates: Sugars, non sugars, reducing and non-reducing sugars. Occurrence and general properties of glucose and fructose. Open chain and Haworth ring structures of glucose and fructose. Epimers, mutarotation and anomers. Disaccaharides: Occurance of disaacharides (Sucrose, Maltose and Lactose). Glycosidic linkage in disaccharides. Ring structures of sucrose, maltose and lactose. Polysaccharides: Starch – monomer units, glycosidic linkage, components-difference in their structure (explanation only) and solubility in water. Cellulose and glycogen– monosaccharide, glycosidic linkage, structure (explanation only). Biological importance of carbohydrates. **(8 Lecturers)** **Amino Acids, Peptides and Proteins :**α- amino acids , general formula, zwitter ion form of α- amino acid, general formula. Isoelectric point and its importance. Classification of amino acids as essential and non-essential- examples. Configuration of optically active α-amino acids (found in proteins). Peptide bond. Proteins: classification based molecular shape –fibrous and globular, examples. Structure of protein – qualitative idea about primary, secondary, tertiary, and quaternary structures (diagrams not required). Denaturation of protein. **(6 lectures)**	
Unit-II	**14 hrs**
Enzymes and correlation with drug action: Mechanism of enzyme action, factors affecting enzyme action, Co-enzymes and cofactors and their role in biological reactions, Specificity of enzyme action (including stereospecificity), Enzyme inhibitors and their importance, phenomenon of inhibition (Competitive and Noncompetitive inhibition including allosteric inhibition). **(6 lectures)**	

Drug action- Receptor theory. Structure–activity relationships of drug molecules, binding role of –OH group, -NH$_2$ group, double bond and aromatic ring.　**(3 lectures)** **Oils and fats** Biological Importance of oils and fats. Fatty acids (saturated, unsaturated fatty acids, formation of triglycerides and general formula of triglycerides. Chemical nature of oils and fats-saponification, acid hydrolysis, rancidity and its prevention methods, refining of oils, hydrogenation of oils, drying of oils. Iodine value. Introduction to lipids, classification. Biological importance of triglycerides, phospholipids, glycolipids, and steroids (cholesterol). **(5 lecturers)**	
Unit-III	**14 hrs**
Nucleic Acids : Components of nucleic acids: Adenine, guanine, thymine and cytosine (Structure only), other components of nucleic acids, Nucleosides and nucleotides (nomenclature), Structure of polynucleotides; Structure of DNA (Watson-Crick model) and RNA (types of RNA), Genetic Code, Biological roles of DNA and RNA: Replication, Transcription and Translation.　**(8 lectures)** **Vitamins and Hormones:** Classification and biological significance, source and structure of Vitamin A, B1 (thiamine), B2 (riboflavin), B6 (pyridoxine), α-tocopherol, K1 (phylloquinone), C (ascorbic acid). Deficiency diseases of vitamins. **Hormones:** definition, classification with examples, functions and deficiency diseases of hormones.　**(6 lectures)**	

Recommended Books/References

1. Morrison, R. T. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
2. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
3. Finar, I. L. Organic Chemistry (Volume 2), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
4. Nelson, D. L. & Cox, M. M. Lehninger's Principles of Biochemistry 7th Ed.,
5. W. H. Freeman. Berg, J.M., Tymoczko, J.L. & Stryer, L. Biochemistry, 2002.

Details of Formative assessment (IA) for DSCC theory/OEC: 40% weight age for total marks

Type of Assessment	Weight age	Duration	Commencement
Written test-1	10%	1 hr	8th Week
Written test-2	10%	1 hr	12th Week
Seminar	10%	10 minutes	--
Case study / Assignment / Field work / Project work/ Activity	10%	------	--
Total	40% of the maximum marks allotted for the paper		

GENERAL PATTERN OF THEORY QUESTION PAPER FOR DSCC/ OEC

(60 marks for semester end Examination with 2 hrs duration)

Part-A

1. Question number 1-06 carries 2 marks each. Answer any 05 questions   : 10marks

Part-B

2. Question number 07- 11 carries 05Marks each. Answer any 04 questions   : 20 marks
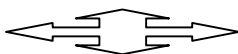
Part-C

3. Question number 12-15 carries 10 Marks each. Answer any 03 questions   : 30 marks

   (Minimum 1 question from each unit and 10 marks question may have sub
    questions for 7+3 or 6+4 or 5+5 if necessary)

Total: 60 Marks

Note: Proportionate weight age shall be given to each unit based on number of hours prescribed.

KARNATAK UNIVERSITY, DHARWAD

Four - Year B.Sc. (Hons.) Program

SYLLABUS FOR SEM III & IV

Course: CHEMISTRY

SEMESTER - III:

DISCIPLINE SPECIFIC CORE COURSE(DSCC)

DSCC – 5 : Chemistry (Theory) - I (Code:033CHE011) DSCC – 6 : Chemistry (Practical) - II (Code:033CHE012)OEC- 3 : Chemistry in daily life (Code: 003CHE051)

SEMESTER - IV:

DSCC – 7 : Chemistry (Theory) - III (Code:034CHE011) DSCC - 8 : Chemistry (Practical) - IV (Code:034CHE012)OEC- 4 : Molecules of life (Code:004CHE051)

Effective from 2022-23

AS PER N E P – 2020

Sem	Type of Course	Course Code	Instruction hour per week (hrs)	Total hours of Syllabus / Sem	Duration of Exam (hrs)	Formative Assessment Marks	Summative Assessment Marks	Total Marks	Credits
III	DSCC -5 Chemistry (Theory) - V	033CHE011	04	56	02	40	60	100	04
	DSCC -6 Chemistry (Practical) - VI	033CHE012	04	52	03	25	25	50	02
	OEC- 3 Industrial & Environmental Chemistry	003CHE051	03	42	02	40	60	100	03
IV	DSCC -7 Chemistry (Theory) - VII	034CHE011	04	56	02	40	60	100	04
	DSCC -8 Chemistry (Practical) - VIII	034CHE012	04	52	03	25	25	50	02
	OEC- 4 Analytical Chemistry	004CHE051	03	42	02	40	60	100	03
Details of the other Semesters will be given later									

Programme Specific Outcome (PSO):

After the completion of 03/ 04 years Degree in Chemistry , students will be able to:

PO 13 : Demonstrate, solve and an understanding of major concepts in all the disciplines of chemistry.

PO 14 : Provide students with broad and balanced knowledge and understanding of key chemical concepts.

PO 15 : Understand practical skills so that they can understand and assess risks and work safely and competently in the laboratory.

PO 16 : Apply standard methodology to the solutions of problems in chemistry.

PO 17 : Provide students with knowledge and skill towards employment or higher education in chemistry or multi-disciplinary areas involving chemistry.

PO 18 : Provide students with the ability to plan and carry out experiments independently and assessthe significance of outcomes.

PO 19 : Develop in students the ability to adapt and apply methodology to the solution of unfamiliartypes of problems.

PO 20 : Employ critical thinking and the scientific knowledge to design, carry out, record and analyze the results of chemical reactions.

PO 21 : To prepare students effectively for professional employment or research degrees in chemical sciences.

PO 22 : To cater to the demands of chemical industries of well-trained graduates.

PO 23 : To build confidence in the candidate to be able to work on his own in industry and institution of higher education.

PO 24 : To develop an independent and responsible work ethics.

B.Sc. Semester – III

DSCC-5 : Chemistry (Theory) V (Code: 033CHE011)

Course Outcomes (CO):

After completion of course, Chemistry (Theory) - V students will be able to:

CO1: Explain free electron theory, physical properties of metals, distinguish between conductors, insulators, extrinsic and intrinsic semi conductors, Appreciate the importance of Hydrogen bond, applications of hydrogen bonding, van der Waals forces and factors affecting the strength and magnitude of van der Waals forces.

CO2 : Explain anomalous properties of lithium, diagonal relationship among elements preparation, uses, structure and bonding in diborane, borazine, boron nitride, carboranes, classification of silicates and their structures, oxides and oxyacids of nitrogen, oxoacids of phosphorus, sulphur and chlorine, inter halogen compounds and xenon compounds.

CO3: Understand preparation, general mechanism and named reactions of benzene and alkyl benzenes.

CO4: Describe theory of orientation, explanation on the basis of stability of sigma complex using electron withdrawing and electron donating groups.

CO5: Understand relative synthesis, mechanisms and reactivities of halogen in alkyl halides, vinyl halides, allyl halides, aryl halides and aryl-alkyl halides.

CO6: Know different methods of synthesis of primary, secondary and tertiary their reactions and mechanisms.

CO7:. Understand different thermodynamic processes, first law of thermodynamics, work done, significance of enthalpy, Joule-Thomson effect and applications Kirchhoff's equation

CO8: Derive Nernst distribution law and under different molecular states.

CO9: Acquaint with the industrial applications of Nernst distribution law.

CO10: Learn the law of chemical equllibrium, Le-Chatelier's principle, relations between Kp, Kc and Kx, ionic equilibria, hydrolysis, pH, common ion effect, solubility and solubility product.

CO11: Understand the principles and processes of metallurgy, extraction of d and f block elements and powder metallurgy.

CO12: Aware of alloys, purpose of making, composition and significance of alloys.

Syllabus	Total
DSCC-5: Chemistry (Theory) - V (Code: 033CHE011)	**Hrs: 56**

UNIT-I : CHEMICAL BONDING & CHEMISTRY OF s- & p- BLOCK ELEMENTS	**14 hrs**
Metallic Bond: Explanation of physical properties of metals (conductivity, lustre, malleability, ductility and cohesive force) based on free electron theory. Band theory of metals to explain conductors, insulators, extrinsic and intrinsic semi conductors. **Hydrogen bond:** Definition, properties and types of hydrogen bond. Consequences of hydrogen bonding. **van der Waals forces**: Definition and types of van der Waals forces. Factors affecting the strength and magnitude of van der Waals forces. **(4 Lectures)** **Chemistry of s- and p- block elements**: General characteristics, anomalous properties of lithium. Diagonal relationship of Li with Mg, and Be with Al. Preparation, uses, structure and bonding in diborane, borazine, boron nitride and carboranes. Silicates-Classification and structures. Preparation, properties and structure of oxides and oxyacids of nitrogen. Preparation and bonding in oxoacids of phosphorus, sulphur and chlorine. Inter halogen compounds (preparation and bonding in ClF_3, BrF_5 and IF_7), Xenon compounds- XeF_2, XeF_4, XeF_6, $XeOF_4$ and XeO_3 (preparation and bonding). **(10 Lectures)**	
UNIT-II AROMATIC HYDROCARBONS , ALKYL HALIDES, ARYL HALIDES & ALCOHOLS	**14 hrs**
Aromatic Hydrocarbons Preparation of benzene and alkyl benzenes (Aromatization, cyclic polymerization of ethyne, hydrodealkylation, Wurtz-Fittig reaction). General mechanism for electrophilic aromatic substitution, examples of halogenation, nitration, sulphonation and Friedel-Craft alkylation and acylation reaction. Limitations of Friedel Craft's alkylation. Theory of orientation, explanation on the basis of stability of sigma complex using electron withdrawing and electron donating groups (explain with the energy profile diagram). Oxidation of side chain (Benzene with alkyl groups $-CH_3$, $-CH_2CH_2CH_3$ and 1,4-dimethyl benzene) **(5 Lectures)** **Alkyl and Aryl halides:** Alkyl Halides**:** Relative reactivities of halogen in alkyl halides, vinyl halides, allyl halides, aryl halides and aralkyl halides. Nucleophilic substitution reactions : S_N^1 and S_N^2 reactions and their mechanisms, stereochemistry and comparison. S_N^1 reaction and mechanism. Aryl-halides: Synthesis of aryl halide from phenols, Sandmeyer's reaction, Gattermann reaction, Raschig-Hooker process and Balz-Schiemann reaction. Aromatic Nucleophilic Substitution reactions : S_NAr, S_N^1 and *via* Benzyne intermediate along with mechanisms. Effect of nitro substitution on aromatic nucleophilic substitution reactions. **(5 Lectures)** **Alcohols:** Synthesis of primary, secondary and tertiary alcohols using Grignard reagent, ester hydrolysis. Reduction of aldehydes and ketones, carboxylic acids and	

esters.Reactions of alcohols with halo acids, esterification reaction and oxidation of alcohols with PCC, $KMnO_4$, Conc. HNO_3 and dichromate salt and Oppenauer oxidation.

Diols: Oxidation of diols, Mechanism of Pinacol-Pinacolone rearrangement.

(4 **Lectures**)

UNIT-III: THERMODYNAMICS I, DISTRIBUTION LAW AND SURFACE CHEMISTRY	14 hrs
Thermodynamics I: Thermodynamic processes, heat, work and internal energy, first law of thermodynamics. Concept of enthalpy, derivation of work done in isothermal and adiabatic expansion (T-V and P-V relationships) of an ideal gas for reversible and irreversible processes, numerical problems, Joule-Thomson effect and its derivation. Joule-Thomson co-efficient and its derivation. Effect of temperature on enthalpy of reaction (Kirchhoff's equation). **(5 Lectures)** **Distribution law:** Nernst distribution law and thermodynamic derivation of partition co-efficient. Distribution law for changes in molecular state. (association and dissociation). Applications in solvent extraction- simple and multiple extractions. Derivation for multiple extractions, numerical problems. **(4 Lectures)** **Chemical and Ionic Equilibria:** Law of chemical equilibrium and its thermodynamic derivation. Factors affecting equilibria (Le-Chatelier's principle). Relations between Kp, Kc and Kx for reactions involving ideal gases. Ionization of acids and bases, hydrolysis of three types of salts and derivation for determination of pH of their solutions. Numerical problems. Common ion effect, solubility and solubility product of sparingly soluble salts. **(5 Lectures)**	
UNIT-IV: INDUSTRIAL CHEMISTRY-I	14 hrs
Principles and processes of metallurgy: Minerals, ores, steps in metallurgy (crushing, concentration, calcination, roasting, smelting/reduction, refining). Characteristics, uses and limitations of Ellingham diagrams for reduction of metal oxides using carbon as reducing agent. Hydrometallurgy. Extraction of titanium from ilmenite, chromium from chromite, nickel by Mond's process and tungsten from wolframite, Extraction of thorium from monazite sand, and uranium from pitchblende. Powder metallurgy-preparation, uses and advantages. **(11 Lectures)** **Alloys-**Purpose of making alloys, preparation of alloys. Alloy steels-(ferrous alloys) specific effect of alloying elements, applications of alloy steels. Non- Ferrous alloys: composition, characteristics and uses of copper, nickel, zinc and aluminum alloys. **(3 Lectures)**	

Recommended Books/References

1. Modern Inorganic Chemistry: R.D.Madan, S.Chand and Co.Ltd, New Delhi, 2019

2. Chemistry of degree students, R.L.Madan, S.Chand and Co.Ltd, New Delhi.

3. Concise Inorganic Chemistry: J. D. Lee, , 5th Edn, New Age International (1996)

4. Basic Inorganic Chemistry, Cotton, F.A., Wilkinson, G. & Gaus, P.L., 3rd Ed., Wiley.

5. University Chemistry Mahan, B.H. 3rd Ed. Narosa (1998).

6. A Guidebook to Mechanism in Organic Chemistry Peter Sykes, Orient Longman, New Delhi
(1988).

7. Advanced Organic Chemistry, Bahl, A. & Bahl, B.S., S. Chand publications, 2010.

8. Organic Chemistry Volume-I, II- I. L. Finar, 6th Edition, ELBS London (2004).

9. Understanding Organic reaction mechanisms - A. Jacobs, Cambridge Univ. Press, 1998.

10. Organic Chemistry - M. K. Jain, Nagin & Co., 1987.

11. Organic Chemistry- Mehta and Mehta, 2005.

12. Physical Chemistry W.J. Moore:, 1972.

13. Text Book of Physical Chemistry - P. L. Soni, S. Chand & Co., 1993.

14. Text Book of Physical Chemistry - S. Glasstone, Mackmillan India Ltd., 1982.

15. Principles of Physical Chemistry - B. R. Puri, L. R. Sharma and M. S. Patania, S. L. N. Chand & Co.1987.

16. Physical Chemistry - Alberty R. A. and Silbey, R. J. John Wiley and sons, 1992.

17. Engineering Chemistry, P.C. Jain and Monika Jain, Dhanpad Rai and Sons, Delhi, Jalandhar, 1995.

18. Synthetic Organic Chemistry: Gurudeep R. Chatwal. Himalaya Publishing House – 1990.

19. Industrial Chemistry, Clerk Ranken MJP Publisher.

20. Industrial Chemistry, Vijay Varma, Arjun Publishing House.

21. Industrial Chemistry, B.K.Sharma, 9th Edn. Krishna Prakashan Media (P) Ltd. Meerut (1997-98)

DSCC-6: Chemistry (Practical) - VI (Code: 033CHE012)

Course Outcomes (CO):

After completion of Chemistry (Practical) – VI, students will be able to:

CO1: Understand solubility, solubility product, common ion effect, their applications. Physico-chemical principles of separation of cations into groups in qualitative analysis of inorganic salts

CO2: Develop the skill to perform Semi-micro qualitative analysis of mixtures of two simple inorganic salts containing two anions and two cations.

CO3: Able to write the chemical reactions involved in the analysis.

CO6: Study the preparation and mechanism of reactions, recrystallization, determination of melting point and calculation of quantitative yields.

CO7: Prepare the organic compound with bromination, nitration, acetylaton, hydrolysis oxidation and reduction

Syllabus **DSCC-6: Chemistry (Practical) - VI (033CHE012)**	**Total** **Hrs: 52**
INORGANIC CHEMISTRY EXPERIMENTS	
Explanation of solubility, solubility product, common ion effect and their applications in separation of cations into groups in qualitative analysis of inorganic salts (students should write in the journal regarding the above). **Experiments 1 to 6:** Systematic semi-micro qualitative analysis of mixtures of two simple inorganic salts containing two anions and two cations**.** Anions: CO_3^{2-} , Cl^-, Br^-, NO_3^-, SO_4^{2-}, $C_2O_4^{2-}$ and BO_3^{3-} Cations: Cu^{2+}, Al^{3+}, Fe^{2+}, Mn^{2+}, Ni^{2+}, Zn^{2+}, Ca^{2+}, Ba^{2+}, Mg^{2+}, Na^+, K^+ and NH_4^+. Note: Student has to write ionic reactions for group test and CT for anions and cations **Distribution of Marks:** Preliminary tests and presentation - 03 marks , Anions (group test + C.T +ionic reactions) $(1+1+1)\times2=6$ marks, Cations (group test + C.T+ ionic reactions) $(1+2+1)\times2=8$ marks, Journal-3 marks, Viva-Voce-5 marks, Total=25 marks.	
ORGANIC CHEMISTRY EXPERIMENTS	
Experiment No 7 to 12: Preparation of organic compounds 7. Acetylaton - Synthesis of acetanilide from aniline using Zn Dust/AcOH. (Green method) 8. Bromination – Acetanilide to p-bromo acetanilide. 9. Nitration – Acetanilide to p-nitro acetanilide. 10. Hydrolysis - Benzamide to benzoic acid. 11. Oxidation – Benzaldehyde to benzoic acid.	

12.Reduction – m-dinitrobenzene to m- nitro aniline. Note: Student has to write mechanism of reactions, calculation of quantitative yield, determination of melting point and to perform recrystallization. **Distribution of Marks:** Reaction & Mechanism-04 marks, calculation of theoretical yield – 02 mark, observed yield -08 marks, M.P- 03 marks, Journal – 03 marks , Viva-Voce-5 marks,(Total=25 marks.) **Deduction of marks for observed yield:** Less than 10% - 8 marks, 11-15% - 6 marks, 16-20% - 4 marks, 21-25 % - 2 marks & above 25% - zero mark.	
I **General instructions:** In the practical examination, in a batch of ten students, five students each will be performing inorganic and organic experiments. Selection of experiments may be done by the students based on lots. Viva questions may be asked on any of the experiments prescribed in the practical syllabus**.** *Manual is not allowed in the Examination*.	

Books recommended:

1. Vogel's Qualitative Inorganic Analysis, G.Svehla, 7th Ed, Longman (2001).

2. Advanced Practical Chemistry, agadamba Singh, R.K.P. Singh, Jaya Singh, L.D.S.Yadav, I.R.Siddiqui, Pragati prakashan, 7th edition, 2017.

3. College Practical Chemistry: V K Ahluwalia, Sunitha Dhingra and Adarsh Gulati. University Press-2011.

4. Advanced Practical Inorganic Chemistry, Gurdeep Raj, Goel Publishing House, Meerut.

5. Comprehensive Practical Organic Chemistry: V K Ahluwalia, and Renu Aggarwal, University Press-2000.

B.Sc. Semester – III

OEC- 3: Industrial & Environmental Chemistry (Code: 003CHE051)

Course Outcome (CO):

After completion of course, Industrial Chemistry, students will be able to:

CO1: Understand minerals, ores, steps in metallurgy, extraction of metals of d & f block elements and powder metallurgy-preparation,

CO2: Appreciate purpose of making, preparation, composition and applications of alloys.

CO3: Explain manufacture of glass, ceramics, Portland cement, chemical composition of cement, setting and hardening of Portland cement, Electroplating of nickel and chromium, Primary and secondary batteries, battery components and their role.

CO4: Explain sources of energy, nuclear fusion/fission, solar energy, hydrogen and geo-thermal energy.

CO5: Know air pollutants, control measures of air pollution, photochemical smog, green house effect, global warming and ozone depletion.

CO6: Aware of water pollutants and their sources, industrial effluents and their treatment, sludge disposal, water quality parameters for waste water, industrial water and domestic water, disposal of nuclear waste, nuclear disaster and its management.

Syllabus OEC- 3: Industrial & Environmental Chemistry (Code: 003CHE051).	Total Hrs: 42
UNIT-I METALLURGY & ALLOYS	**14 hrs**
Metallurgy: Minerals, ores, steps in metallurgy (crushing, concentration, calcination, roasting, smelting/reduction, refining), Extraction of titanium from ilmenite, chromium from chromite, nickel by Mond's process and uranium from pitchblende. Powder metallurgy-preparation, uses and advantages. **(10 Lectures)** **Alloys-** Purpose of making alloys, preparation of alloys. Alloy steels-(ferrous alloys) specific effect of alloying elements, applications of alloy steels. Non- Ferrous alloys: composition, characteristics and uses of copper, nickel, zinc and aluminum alloys. **(4 Lectures)**	
UNIT-II GLASS, CERAMICS, CEMENT, PROTECTIVE COATINGS & BATTERY	**14 hrs**
Glass and Ceramics: General properties, silicate and non silicate glasses, raw materials used, manufacture, types of glass and their applications**.** Types and manufacture, high-technology ceramics and their applications, super conducting and semi-conducting oxides. **(4 Lectures)** **Cement:** Classification with properties of cement, raw materials used in the manufacture of cement and their functions. Manufacture of Portland cement, chemical composition of cement, setting and hardening of Portland cement. RCC and quick setting cements.	

(3 Lectures) **Carbon materials:** Fullerenes, carbon nanotubes and their applications. **(2 Lectures)** **Protective Coatings:** Metallic coating, electroplating of nickel and chromium. **Battery:** Primary and secondary batteries, battery components and their role. Characteristics of battery. Working of Lead-acid battery, Lithium battery, solid-state electrolyte battery, fuel cells and solar cells. **(5 Lectures)**	
UNIT-III ENERGY AND ENVIRONMENT, AIR, WATER & NUCLEAR POLLUTION AND WATER QUALITY STANDARDS	**14 hrs**
Energy and Environment: Sources of energy: coal, petrol and natural gas. Nuclear fusion/fission, solar energy, hydrogen and geo-thermal energy. **(3 Lectures)** **Air pollution**: Major regions of atmosphere, chemical and photochemical reactions in atmosphere. Air pollutants: types, sources, particle size and chemical nature. Control measures of air pollution. Photochemical smog: its constituents and photochemistry. green house effect, global warming and ozone depletion. **(4 Lectures)** **Water pollution, water quality standards:** Water pollutants and their sources. Industrial effluents and their treatment (primary and secondary treatment). Sludge disposal. Water quality parameters for waste water, industrial water and domestic water. **Nuclear pollution:** Disposal of nuclear waste, nuclear disaster and its management. **(7 Lectures)**	

Recommended Books/References

1. Environmental Chemistry, A. K. De, 6th Edn. New Age International (P) Ltd.,(2008).

2. Environmental Chemistry-S. K. Banerji, (Prentice Hall India), 1993

3. Industrial Chemistry, B.K.Sharma, 9th Edn. Krishna Prakashan Media (P) Ltd. Meerut (1997-98)

4. A Guidebook to Mechanism in Organic Chemistry, Orient Longman, New Delhi (1988).
5. Stereochemistry-Conformation and Mechanism-P. S. Kalsi, Wiley-Eastern Ltd, New Delhi.
6. Organic Chemistry Morrison, R.T. & Boyd, R.N., Pearson, 2010.
7. Advanced Organic Chemistry Bahl, A. & Bahl, B.S., S. Chand, 2010.
8. Organic Chemistry Volume-I, II- I. L. Finar, 6th Edition, ELBS London (2004).
9. Understanding Organic reaction mechanisms - A. Jacobs, Cambridge Univ. Press, 1998.
10. Organic Chemistry - M. K. Jain, Nagin & Co., 1987.
11. Organic Chemistry- Mehta and Mehta, 2005.

Details of Formative assessment (IA) for DSCC theory/OEC: 40% weight age for total marks

Type of Assessment	Weight age	Duration	Commencement
Written test-1	10%	1 hr	8th Week
Written test-2	10%	1 hr	12th Week
Seminar	10%	10 minutes	--
Case study / Assignment / Field work / Project work/ Activity	10%	------	--
Total	40% of the maximum marks allotted for the paper		

GENERAL PATTERN OF THEORY QUESTION PAPER FOR DSCC/ OEC

(60 marks for semester end Examination with 2 hrs duration)

Part-A

1. Question number 1-06 carries 2 marks each. Answer any 05 questions   : 10marks

Part-B

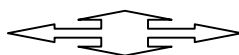2. Question number 07- 11 carries 05Marks each. Answer any 04 questions   : 20 marks

Part-C

3. Question number 12-15 carries 10 Marks each. Answer any 03 questions   :

   30 marks(Minimum 1 question from each unit and 10 marks question may have

   sub
     questions for 7+3 or 6+4 or 5+5 if necessary)

Total: 60 Marks

Note: Proportionate weight age shall be given to each unit based on number of hours prescribed.

B.Sc. Semester – IV

DSCC- 7: Chemistry (Theory) - VII (Code: 034CHE011)
Course Outcome (CO):

After completion of course (Theory), students will be able to:

CO1: Understand the general characteristics of d and f- block elements with reference to electronic configuration, colors, variable oxidation states, magnetic properties etc., separation of lanthanoids by ion-exchange method and preparation of trans-uranic elements (up to Z=103).

CO2: Acquaint with general properties and types of inorganic polymers, silicones and phosphazines.

CO3: Learn Bronsted-Lowry concept, Lux-flood concept, Lewis concept and Usanvich-sandvich concept and their limitations. HSAB concept and its applications.

CO4: Gain knowledge of acidic character, comparative acid strengths of alcohols and phenols and mechanism of named reactions.

CO5: Familiar with Williamson's ether synthesis, epoxides and Crown Ethers formation and properties

CO6: Understand the synthesis of aldehydes and ketones, their properties, named reactions mechanism.

CO7: Appreciate the significance of entropy, second law of thermodynamics, change in entropy and other thermodynamic parameters with respect temperature.

CO8: Know types of **a**dsorption isotherms, types of catalysis and their theories with examples and autocatalysis.

CO9: Know the manufacture, properties and applications of glass and cement.

CO10: Understand types, composition and manufacture of fertilizers.

CO11: Appreciate the paints and pigments formulations, composition and related properties.

CO12: Learn the types, manufacture of soaps, detergents and their cleansing actions.

Syllabus DSCC- 7: Chemistry (Theory) - VII (Code: 034CHE011)	Total Hrs: 56
UNIT-I : CHEMISTRY OF d- & f- BLOCK ELEMENTS, INORGANIC POLYMERS AND THEORIES OF ACIDS AND BASES	**14 hrs**
Chemistry of d- and f- block elements: General characteristics with reference to electronic configuration, colors, variable oxidation states, magnetic, catalytic properties and ability to form complexes. General characteristics of f-block elements with reference to electronic configuration, oxidation states, colors and magnetic properties. Lanthanide contraction and its consequences. Separation of lanthanoids by ion-exchange method. Preparation of trans-uranic elements (up to Z=103). **(6 Lectures)** **Inorganic Polymers:** General properties and types of inorganic polymers. Comparison with organic polymers. Silicones: Classifications, preparation, properties,	

uses and structure. Phosphazines: Preparation, properties, uses and structure.

(4 Lectures)

Modern concepts of acids and bases, Bronsted-Lowry concept, Lux-Flood concept, Lewis concept and Usanvich-Sandvich concept and their limitations. HSAB concept and its applications.

(4 Lectures)

UNIT-II : PHENOLS, ETHERS & CARBONYL COMPOUNDS	14 hrs

Phenols: Acidic character, comparative acid strengths of alcohols and phenols, Kolbe's reaction, Claisen rearrangement, Fries rearrangement, Ledrer-Mannase reaction, Reimer-Tiemann reaction. Houben–Hoesch reaction, Schotten – Baumann Reaction. (Mechanism to be discussed for all named reactions**)**

(4 Lectures)

Ethers: Preparation of ethers, mechanism of Williamson's ether synthesis, mechanism of synthesis of ethers by inter and intra molecular dehydration of alcohols. Reaction of ethers- mechanism of ether cleavage by strong acids. **Epoxides:** Synthesis from alkenes using peroxides, acid and base catalyzed ring opening of epoxides with mechanism and polyether formation. Crown Ethers: Formation and properties (Phase Transfer Catalyst).

(3 Lectures)

Carbonyl Compounds:
Structure of carbonyl compounds, synthesis of aldehydes and ketones by oxidation of alcohols, aldehydes by reduction of acyl chloride, esters, nitriles and ketones from Gillmann's reagent. General mechanism of nucleophilic addition to the carbonyl compounds, mechanism of addition of hydrogen cyanide and hydroxyl amine, addition of alcohol, amines and phosphorus ylids. Acidity of α-hydrogens, mechanism of aldol condensation, crossed aldol condensation, Perkin's reaction, Claisen's condensation, Dieckman condensation and Darzen's condensation. Reactions of compounds with no α-hydrogens -mechanism of Benzoin condensation and Cannizaro's reaction, crossed Cannizaro's reaction. Reduction of carbonyl groups via Wolf-Kishner reduction and Meerwein-Pondorff Verley reduction.

(7 Lectures)

UNIT-III THERMODYNAMICS-II & SURFACE CHEMISTRY	14 hrs

Thermodynamics II:
Concept of entropy and its physical significance, thermodynamic scale of temperature, statements of second law of thermodynamics, molecular and statistical interpretation of entropy, calculation of entropy change for reversible and irreversible processes.
Free energy functions: Gibbs and Helmholtz energy, variation of S, G, A with T, V and P. Gibbs-Helmholtz equation, free energy change and spontaneity. Numerical problems. Statement of third law, concept of residual entropy, calculation of absolute entropy of molecules.

(8 Lectures)

Surface chemistry:
Adsorption: Types of adsorption isotherms, Freundlich adsorption isotherm (only equation), its limitations. Langmuir adsorption isotherm and its derivation. BET equation and its derivation, numerical problems.
Catalysis**:** Types of catalysis and their theories with examples. Theory of acid-base catalysis, Michaelis-Menten mechanism. Heterogeneous catalysis (unimolecular and bimolecular surface reactions). Applications of heterogeneous catalysts. Autocatalysis with examples.

(6 Lectures)

UNIT-IV : INDUSTRIAL CHEMISTRY -II	14 hrs
Glass and Cement: General properties, silicate and non silicate glasses, raw materials used and manufacture. Composition, properties and applications of soda lime glass, lead glass, armored glass, safety glass, borosilicates glass, coloured glass, photosensitive glass.Classification with properties of cement, raw materials used in the manufacture of cement and their functions. Manufacture of Portland cement, chemical composition of cement, setting and hardening of Portland cement. RCC and quick setting cements. **(5 Lectures)** **Fertilizers:** Types of fertilizers, composition of fertilizers, manufacture and uses of urea, calcium ammonium nitrate, ammonium phosphate and super phosphate of lime. Mixed fertilizers (NPK). **(3 Lectures)** **Surface coatings:** Classification of surface coatings. Paints and pigments-formulations, composition and related properties, fillers, thinners, enamels and emulsifying agents. Special paints (heat resistant, fire resistant, eco-friendly and plastics paints). Dyes and wax polishing. **(2 Lectures)** **Soaps and detergents: Composition of soaps, t**ypes of soaps, manufacture of soap(Hot process and modern continuous process. Detergents: Comparison of soaps and detergents, classification of detergents (anionic, cationic and non-ionic). Preparation of detergents (sodium alkyl sulphate, sodium alkyl benzene sulphonates). Mechanism of cleansing action of soap and detergents (Concept of micelles and CMC). Detergents builders and additives (only examples). **(4 Lectures)**	

Recommended Books/References

1. Concise Inorganic Chemistry-J. D. Lee, 5th Edn, New Age International (1996)

2. Modern Inorganic Chemistry Sathya Prakash's by R.D.Madan, S.Chand and Co.Ltd, New Delhi.

3. Inorganic Chemistry-Principles of Structure and Reactivity, 4thEdn-J. E. Huheey, E.A. Keiter, R. L.Keiter and O.K. Medhi. Pearson Education (2009).

4. A Guidebook to Mechanism in Organic Chemistry Sykes, P., Orient Longman, New Delhi (1988).

5. Stereochemistry-Conformation and Mechanism-P. S. Kalsi, Wiley-Eastern Ltd, New Delhi.

6. Organic Chemistry Morrison, R.T. & Boyd, R.N., Pearson, 2010.

7. Advanced Organic Chemistry Bahl, A. & Bahl, B.S., S. Chand, 2010.

8. Organic Chemistry - M. K. Jain, Nagin & Co., 1987.

9. Organic Chemistry- Mehta and Mehta, 2005.

10. Physical Chemistry P.W. Atkins:, 2002.
11. Physical Chemistry W.J. Moore:, 1972.
12. Text Book of Physical Chemistry - P. L. Soni, S. Chand & Co., 1993.
13. Text Book of Physical Chemistry - S. Glasstone, Mackmillan India Ltd., 1982.
14. Principles of Physical Chemistry - B. R. Puri, L. R. Sharma and M. S. Patania, S. L. N. Chand & Co.1987.
15. Engineering Chemistry, P.C.Jain and Monika Jain, Dhanpad Rai and Sons, Delhi, Jalandhar.
16. Industrial Chemistry, Clerk Ranken MJP Publisher.
17. Industrial Chemistry, Dr. Vijay Varma, Arjun Publishing House.
18. Industrial Chemistry, B.K.Sharma, 9th Edn. Krishna Prakashan Media (P) Ltd. Meerut (1997-98)

DSCC-8: Chemistry (Practical) - VIII (Code: 034CHE012)

Course Outcomes (CO)

After completion of course (Practical), students will be able to:

CO1: Explain regarding errors, types of errors, accuracy, precision, significant figures, standard deviation, and Use of log table

CO2: Determine the percentage of chlorine in bleaching powder, free acidity in ammonium sulphate fertilizer, phosphoric acid in super phosphate fertilizer, calcium in CAN fertilizer/dolomite ore by complexometric method, copper in brass by iodometric method/ calcium in cement by oxalate method.

CO3: Understand the effect of acid strength on hydrolysis of methyl acetate using HCl and H_2SO_4, for the pseudo first order reaction.

CO4: Determine the change in enthalpy of solution and ionization.

CO5: Learn the concepts of degree of dissociation, adsorption and distribution law.

Syllabus	Total
DSCC-8: Chemistry (Practical) - VIII (034CHE012)	**Hrs: 52**
Unit-I Industrial chemistry experiments	

1. Determination of percentage of available chlorine in bleaching powder (two samples).
 2. Determination of free acidity in ammonium sulphate fertilizer (two samples)
 3. Determination of phosphoric acid in super phosphate of lime fertilizer (two samples) .
 4. Determination of calcium in CAN fertilizer (two samples) /dolomite ore (in duplicate) by complexometric method
 5. Determination of copper in brass by iodometric method (two samples) / calcium in cement (in duplicate) by oxalate method
 6. Determination of iron in haematite ore (in duplicate) by reduction method ($SnCl_2$) using $K_2Cr_2O_7$ solution
 	
 Distribution of marks
 	
   1.   Accuracy: (06+06) Marks
   2.   Technique and presentation :   02Marks
   3.   Reactions and Calculations: 03 Marks
   4.   Viva: 05 Marks
   5.   Journal: 03 Marks
              Total   25 marks
 	
 Deduction of marks for accuracy: : ±0.4 CC -06 marks, ± 0.6 CC- 04 marks, ±0.8 CC- 02 marks, ±1.0 CC- above 1.0 CC - 01 marks.	

Physical chemistry experiments	
Explanation regarding errors, types of errors, accuracy, precision, significant figures, standard deviation, and Use of log table (students should write in the journal regarding the above). 1. Study the effect of acid strength of HCl and H_2SO_4 on hydrolysis of methyl acetate. 2. Study the effect of concentration on velocity constant of second order reaction:	

$KI + K_2S_2O_8$ (a = b).	
3. Study the adsorption of acetic acid on animal charcoal (Freundlich adsorption isotherm).	
4. Study the distribution of acetic acid/ benzoic acid between water and toluene.	
5. Determination of enthalpy of ionization of acetic acid/enthalpy of solution of KNO_3 by calorimetric method.	
6. Determination of degree of dissociation of KCl by Landsberger's method.	
Distribution of Marks:	
Accuracy-10 marks, Technique and Presentation-3marks Calculation and graph- 4 marks, Journal-3 marks, Viva-Voce-5 marks, Total=25 marks.	
Deduction of Marks for accuracy:	
Error up to 5% - 10 marks, 6 - 10% - 08 marks, 11-15% - 06 marks, 16-20% - 04 marks, above 20% - zero (0) marks	
General instructions:	
In the practical examination, in a batch of ten students, five students each will be performing Industrial and physical experiments. . Selection of experiments may be done by the students based on lots. Viva questions may be asked on any of the experiments prescribed in the practical syllabus. *Manual is not allowed in the examination.*	

Recommended Books/References

1. Vogel's Qualitative Inorganic Analysis, G.Svehla, 7th Ed, Longman (2001).

2. Advanced Practical Chemistry, agadamba Singh, R.K.P. Singh, Jaya Singh, L.D.S.Yadav, I.R.Siddiqui, Pragati prakashan, 7th edition, 2017.

3. College Practical Chemistry: V K Ahluwalia, Sunitha Dhingra and Adarsh Gulati. University Press-2011.

4. Advanced Practical Inorganic Chemistry, Gurdeep Raj, Goel Publishing House, Meerut.

5. Comprehensive Practical Organic Chemistry: V K Ahluwalia, and Renu Aggarwal, University Press-2000.

B.Sc. Semester – IV

OEC – 4 : Analytical Chemistry (004CHE051).

Course Outcomes (CO)

After completion of course, Analytical Chemistry students will be able to:

CO1: Understand the principle, classification of volumetric analysis, different methods of expression of concentration term, titration curves of all type of acid-base titrations.

CO2: Understand the theory, titration curves, indicators of precipitation and complexometric titration.

CO3: Acquaint with steps involved in gravimetric analysis and advantages of organic reagents over inorganic reagents.

CO4: Learn the Composition of soil and the determination of pH of soil samples. Estimation of Calcium and Magnesium in the soil.

CO3: Identify pure and contaminated water, water sampling & water purification methods and water quality measurements.

CO4: Understand the principle, techniques and applications of chromatography, paper chromatography, Gas chromatography and High Performance Liquid Chromatography.

CO5 : Learn the ion-exchange chromatography. Resins, types with examples, mechanism of cation and anion exchange processes and applications of ion-exchange chromatography in softening of hard water, separation of lanthanides and industrial applications.

CO6: Know the solvent extraction method, its types and factors affecting the solvent extraction.

CO7: Make out the nutritional value of food, food processing, food preservation and adulteration.

Syllabus	Total Hrs: 42
OEC – 4 : Analytical Chemistry (Code: 004CHE051).	
Unit-I VOLUMETRIC AND GRAVIMETRIC ANALYSIS	**14 hrs**
Titrimetric analysis: Principle, classification, normality, molarity, molality, mole fraction, ppm, ppb etc. Standard solutions, preparation and dilution of reagents/solutions using $N_1V_1 = N_2V_2$, preparation of ppm level solutions from source materials (salts). **Acid-base titrimetry**: Theory, titration curves for all types of acids – base titrations. **Redox titrimetry**: Theory, balancing redox equations, titration curves, theory of redox indicators and applications. **Precipitation titrimetry:** Theory, titration curves, indicators for precipitation titrations involving silver nitrate- Volhard's and Mohr's methods and their differences. **Complexometric titrimetry:** Theory, titration methods employing EDTA (direct, back, displacement and indirect determinations). Indicators for EDTA titrations - theory of metal ion indicators. (**10 Lectures**)	

Gravimetric analysis: Steps involved in gravimetric analysis, requisites of precipitation, factors influencing precipitation, co-precipitation and post precipitation. Advantages of organic reagents over inorganic reagents. Determination of Barium and Iron gravimetrically.

(**4 Lectures**)

UNIT-II ANALYSIS OF SOIL, WATER AND FOOD PRODUCTS	14 hrs

Analysis of soil : Composition of soil, Concept of pH and pH measurement. Determination of pH of soil samples. Estimation o f Calcium a n d Magnesium by complexometric titration.

(**3 Lectures**)

Analysis of water: Definition of pure water, sources responsible for contaminating water, water sampling methods, water purification methods (reverse osmosis, electro dialysis, ionic exchange). Determination of pH, hardness, TDS and alkalinity of a water sample. Determination of dissolved oxygen (DO) and COD of a water sample.

(**6 Lectures**)

Analysis of food products: Nutritional value of food, idea about food processing and food preservation and adulteration.
Identification of adulterants in some common food items like coffee powder, asafoetida, chilli powder, turmeric powder, coriander powder and pulses, edible oils etc. Analysis of preservatives and colouring matter

(**5 Lectures**)

UNIT-III SEPERATION METHODS	14 hrs

Chromatography: Definition, general introduction on principles of chromatography, classification, selection of stationary and mobile phases.
Paper chromatography: principle and applications (separation of mixture of metal ions (Fe^{3+} and Al^{3+}).
Thin layer chromatography: principle, advantages over other methods, methodology and applications (To compare paint samples by TLC method).
Gas chromatography and High Performance Liquid Chromatography: Principles and applications.

(**6 Lectures**)

Ion-exchange: Column, ion-exchange chromatography. Resins, types with examples, mechanism of cation and anion exchange processes and applications of ion-exchange chromatography in softening of hard water, separation of lanthanides and industrial applications.

(**4 Lectures**)

Solvent extraction :- Types, batch, continuous, efficiency, selectivity, distribution co efficient, Nernst distribution law, derivation, factors affecting the partition, relationship between percent extraction and volume fraction . Solvent extraction of iron and copper.

(**4 Lectures**)

Recommended Books/References

1. Fundamentals of Analytical Chemistry, D.A. Skoog, D.M. West, Holler and Crouch, 8th edition, Saunders College Publishing, New York (2005).

2. . Instrumental methods of chemical Analysis, B.K. Sharma, Goel Publishing House, Meerut,

3. .Vogel's Textbook of Quantitative Chemical Analysis, J. Mendham, R.C. Denney, J.D.Barnes and

   M.J.K. Thomas, 6th edition, Third Indian Reprint, Pearson Education Pvt.Ltd.(2007).

4. Laboratory manual for Environmental Chemistry: Sunita Hooda and Sumanjeet Kaur by S. Chand &Company 1999.

5. Soils and soil fertility, Troch, F.R. And Thompson, L.M. Oxford Press.

6. Fundamentals of soil science, Foth, H.D. Wiley Books. .

7. Handbook of Agricultural Sciences, S.S. Singh, P. Gupta, A. K. Gupta, Kalyani Publication.

8. Introduction to soil laboratory manual - J. J. Harsett Stipes.

Details of Formative assessment (IA) for DSCC theory/OEC: 40% weightage for total marks

Type of Assessment	Weightage	Duration	Commencement
Written test-1	10%	1 hr	8th Week
Written test-2	10%	1 hr	12th Week
Seminar	10%	10 minutes	--
Case study / Assignment / Field work / Project work/ Activity	10%	------	--
Total	40% of the maximum marks allotted for the paper		

GENERAL PATTERN OF THEORY QUESTION PAPER FOR DSCC/ OEC

(60 marks for semester end Examination with 2 hrs duration)

Part-A

1. Question number 1-06 carries 2 marks each. Answer any 05 questions   : 10marks

Part-B

2. Question number 07- 11 carries 05Marks each. Answer any 04 questions   : 20 marks

Part-C

3. Question number 12-15 carries 10 Marks each. Answer any 03 questions   :

   30 marks(Minimum 1 question from each unit and 10 marks question may have

   sub
   questions for 7+3 or 6+4 or 5+5 if necessary)

                                                            Total: 60 Marks

Note: Proportionate weightage shall be given to each unit based on number of hours prescribed.

KARNATAK UNIVERSITY, DHARWAD

04 - Year B.Sc. (Hons) Programme

SYLLABUS FOR

GEOLOGY

FOR SEM - III

DSCC-05: Geology (Theory)-I (Code: 033GEG011)

DSCC-06: Geology (Practical)-II (Code: 033GEG012)

OEC-03: Marine Geology (Code: 003GEG051)

FOR SEM - IV

DSCC-07: Geology (Theory)-I (Code: 034GEG011)

DSCC-08: Geology (Practical)-II (Code: 034GEG012)

OEC-04: Geology and Society (Code: 004GEG051)

EFFECTIVE FROM-2022-23

AS PER N E P – 2020

KARNATAK UNIVERSITY, DHARWAD

SYLLABY AND COURSES OF STUDY IN GEOLOGY (B.Sc NEP-2020 Pattern)

Effective from-2022-23

Sem	Type of Course	Theory/ Practical	Instruction hour per week	Total hours of Syllabus / Sem	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks	Credits
III	DSCC-5 Geology (Theory)-V	033GEG011	04 Hrs	56	02 Hrs	40	60	100	04
	DSCC-6 (Practical)-VI	033GEG012	04 Hrs	52	03 Hrs	25	25	50	02
	OEC-3 Marine Geology	003GEG051	03 Hrs	42	02 Hrs	40	60	100	03
IV	DSCC-7 Geology (Theory)-VII	034GEG011	04 Hrs	56	02 Hrs	40	60	100	04
	DSCC-8 Geology (Practical)-VIII	034GEG012	04 Hrs	52	03 Hrs	25	25	50	02
	OEC-4 Geology and Society	004GEG051	03 Hrs	42	02 Hrs	40	60	100	03

* Student can opt digital fluency as SEC or the SEC of his/ her any one DSCC selected.

Study Tour/Field work/Resource Mapping / Institution visit/ Project /Viva /Mine Visit/ Report/Sample collection.

Study tour forms integral part of the course. Since it is a field-oriented course as many numbers of field visits will help the student to get an exposure in the subject. Observation mind is very important in the case of Geology students. Combined study tour in II, IV and VI Semester has to be arranged. One study tour can be restricted to the State and another as far as possible in different areas so that students will get good collection of rocks, minerals and fossils. The college museum can also be enriched. Field work, Resource mapping, Geological Institution visit, Mine visit etc are part of the study tour. The students may be trained to write field reports. Sample collections collectively and individually have to be encouraged. They have to prepare a detailed report on the assignment carried out and submit it for the examination for evaluation. Project means a small Group work as decided by the Departmental Council to generate a research mind in the student. It can be their observation on the geological work of ground water, stream, wind, waves or detailed observation of a Quarry, landslide area or flood plain or groundwater conservation, waste management, land use pattern, Resource mapping of a Panchayath etc., as decided by the Departmental Council every year.

Without project and study tour report student should not be allowed to take up the Practical examination. All the male and female students should undergo all these trainings. Viva-Voce should be conducted internally and externally

Name of Course /Subject: GEOLOGY

Programme Specific Outcome (PSO): On completion of the 03/ 04 years Degree in Geology students will be able to:

PSO 1: The study of this paper strengthens student's knowledge with respect to understanding the essentials of the dynamics of earth.

PSO 2: The students will understand the origin and age of our Solar system and planets including earth.

PSO 3: The students will able to learn the dynamic nature of the Earth processes. They will learn about the geodynamics of the lithosphere, concept of ocean floor spreading, continental drift and plate tectonics.

PSO 4: The courses designed for the students of understand geomorphological features of developed during glaciations, circulation of groundwater and oceans and coastal land forms.

PSO 5: To determine possible causes of formation of structures and forces responsible for it. This course also helps to know the relation of structure with tectonics.

PSO 6: Learn how to read geological features occurred by different endogenic process.

PSO 7: Collaborative learning is encouraged during the field training programmes and educational tours

PSO 8: Overall development of an ethical sense and increasing awareness in terms of gender sensitization, cleanliness, environmental protection etc.

PSO 9: Inculcation of value-orientation in students through the promotion of a sensitive attitude towards one's surrounding and culture

PSO 10: Assists students in competitive examination (JAM etc.)

THEORY PAPER			
Programme/Class: B. Sc / B. Sc Hons.	**Year: Second**		**Semester: Third**
DSCC-5 Theory (Code: 033GEG011)		**Subject: GEOLOGY**	
Course Title: Principles of Stratigraphy & Palaeontology		**Credits : 4**	**Total Hrs-56**

Course Outcomes (CO):

After completion of course, Geology (Theory) students will be able to:

CO-1: Understand and describe the basic principles of Stratigraphy and breaks in stratigraphic successions and their significance.

CO 2: Understand and explain the elements of stratigraphic classification, Geological Time Scale, Stratigraphic correlation and define typical terms related to stratigraphic studies

CO 3: Understand and describe the physiographic and geological divisions of India and acquire knowledge about cratons and mobile belts.

CO 4: Understand and describe the Early Precambrian and Late Precambrian formations of India with emphasis on lithology, classification, age, structure, post- tectonic intrusives, and organic remainsand economic resources.

CO 5: Understand and describe the important Palaeozoic, Mesozoic and Cenozoic formations of India with reference to their distribution, lithology, classification, fossils and age.

CO 6: Understand and describe the stratigraphy of Karnataka and explain the characteristics of the Precambrian terrain of Karnataka.

CO 7: Understand and explain significance of palaeontology, the conditions and methods of fossilization, classification and nomenclature of fossils and the basic principles of Taxonomy, Systematics and Binomial nomenclature.

CO 8: Understand and explain the morphology, classification, geological history and stratigraphic importance of Phylum Protozoa, Phylum Coelenterata – Class Anthozoa, Phylum Brachiopoda, Phylum Mollusca – Classes Pelecypoda, Gastropoda, Cephalopoda.

CO 9: Understand and describe the morphology, classification, geological history and stratigraphic importance of Phylum Arthropoda – Class Trilobita, Phylum Echinodermata – Class Echinoidea and Phylum Hemichordata – Class Graptolithina.

CO 10: Understand the basic ideas of Micropalaeontology and describe the characteristics of important plant fossils, morphology, distribution and significance of Gondwana flora.

UNIT 1	
Principles of Stratigraphy: Concepts in stratigraphy: Basic principles and definitions of stratigraphy, Elements of Stratigraphic classification and code of Stratigraphic nomenclature, Stratigraphic correlation. Brief description of principal stratigraphic units: Lithostratigraphy, Biostratigraphy, Chronostratigraphy. Standard Geological time scale.	**14 Hrs**

UNIT 2	
Geology of India: Physiographic divisions of India; Brief introduction to the physiographic and tectonic subdivisions of India. Archaean and Proterozoic Formations of Peninsular India–distribution and classification with reference to Karnataka. Sargur Group, Dharwar Super Group, Peninsular Gneiss. **Proterozoic:** distribution, classification and economic importance of Cuddapah and Kaladgi, Vindhyan, Bhima and Kurnool Groups.	**14 Hrs**

UNIT 3	
Palaeozoic Group: Palaeozoic rocks of the Spiti. **Mesozoic**: (i) Triassic successions of Spiti, (ii) Jurassic of Kutch, (iii) Cretaceous successions of Cauvery basins. Cenozoic stratigraphy of India: (i). Kutch basin (ii). Siwalik successions. (iii). Assam basins.	**14 Hrs**

Volcanic provinces of India: Deccan traps: Distribution, lithology and biostratigraphy, classification, intertrappeans, intratrappeans, infratrappeans, Bhag beds and lameta beds, age of Deccan traps, economic importance of Deccan traps. Siwaliks – lithology, distributions, classification, life and age.	
UNIT 4	
Palaeontology: Introduction to palaeontology. Definition and classification of fossils. Types of fossils and fossilization- Modes of Preservation- Fossils of soft parts, fossils of hard parts (unaltered hard parts, altered hard parts (Moulds & Casts, Petrifaction: Permineralization & Replacement, and Carbonisation) and indirect fossils (Imprints, Traces of Biological Activity: Tracks, Trails and Burrows -Ichnofossils :). Significance of fossils. General classification, morphological characters, distribution and geological history of Following Invertebrate Fossils: Coelenterata, Brachiopods, Lamellibranchia, Cephalopods, Echinodermata, Arthropoda. **MicrofossilsandClassification of Microfossils:** Morphology, classification and evolution of foraminifera. Brief study of vertebrate life through ages. Plant fossils through ages. Gondwana flora and their significance.	**14 Hrs**

PRACTICALS			
Programme: B. Sc/B. Sc Hons		Year: Second	Semester: Third
Subject: GEOLOGY			
DSCC-6 Practical-VI (Code: 033GEG011)		Course Title: Stratigraphy and Palaeontology	
Max. Marks: 25+25=50		Core: Compulsory Total= 52 Hrs	
I	**Stratigraphy**		
01	1. Preparation and study of Lithostratigraphic maps of India showing distribution of important geological formations. 2. Dharwar Province (Group), Cuddapah super group, Vindhyan super group, Jurassic of Kutch, Cretaceous of Trichinopoly, Gondwana super group and Deccan Traps.		3 Practical's
II	**Palaeontology**		
02	Study of fossils showing various modes of preservation– Moulds& Casts, Petrifaction: Permineralization & Replacement, and Carbonisation, Imprints.		1 Practical
03	Study of diagnostic morphological characters, systematic position, stratigraphic position and age of various invertebrate, vertebrate and plant fossils.		1 Practical
04	Coelenterata: Calceola, Zaphrentis and Montlivaltia		1 Practical
05	Brachiopoda-Terebratulata, Productus,Spirifer, Rhynchonella.		1 Practical
05	Lamellibranchia-Pectin, Gryphaea, Trigonia, Venus, Exogyra, Alectryonia, Areta and Arca.		1 Practical
06	Gastropods: Turitella, Murex, Cyprea, Voluta, Conus and Physa		
07	Cephalopods: Nautiloids- Nautilus, Orthoceras and Accanthoceras. Ammonoidea:Goniatite, Ceratite, Ammonite and Belemnites. Suture lines in Ammonites.		1 Practical
08	Echinodermata- Clypeaster, Clypeolampus, Breynia, Cidaris, Micrastar, Hemiaster, Holaster, Stigmatopygus, Schizaster.		1Practical
09	Trilobites -Calamine, Dalmanite, Paradoxide, Phacops		1 Practical
10	Plant fossils- Lepidodendron, Calamites, Sigilaria, Glossopteris, Gangamopteris, Neuropteris, Ptilophyllum, Alethopteris, Pecopteris, Sphenopteris.		2 Practical's

References: Stratigraphy and Principles of Stratigraphy

1. Krishnan, M.S. (1982) Geology of India and Burma, 6thEdition, CBS.
2. Wadia, D.N. (1944) Geology of India, Tata McGraw–Hill.
3. Ravindra Kumar (2020) Fundamentals of Historical Geology and Stratigraphy of India. 2nd edition, New Age International Private Limited.
4. Pascoe, E.H. (1954) A Manual of the Geology India and Burma, Govt. of India Publications.
5. Vaidyanathan and Ramakrishnan (2008). Geology of India (Vol. I & II). Geological Society of India, Bangalore.
6. Soman, K. (2013) Geology of Kerala, Geological Society of India, Bangalore.
7. Radhakrishna, B.P and R. Vaidyanadhan (1997) Geology of Karnataka, Geological Society of India, Bangalore.
8. Sanjib Chandra, Sarkar, Anupendra Gupta (2012). Crustal evolution and Metallogeny in India. Cambridge University Press, Delhi, India.
9. Amal Das Gupta (2006). An introduction to Earth Science, World Press Private Limited, Kolkata.

References: Palaeontology

1. Woods, H. (1961) Invertebrate Palaeontolgy. Cambridge University Press.
2. Romer, A.S. (1966) Vertebrate Palaeontology. 3rd Edn., Chicago Univ. Press.
3. Arnold C,A. (1947) An Introduction to Palaeobotany. McGraw Hill.
4. Haq, B.U. and Boersma, A. (1978) Introduction to marine Micropalaeontology. Elsevier, Netherlands.
5. Raup, D.M. and Stanely, M.S. (1978) Principles of Palaeontology. CBS Publishers.
6. Moore, R.C., Lalicker, C.G. and Fishcher, A.G. (1952) Invertebrate Fossils, Mc-Graw Hill.
7. Shrock, R.R. and Twenhofel, W.H. (1953) Principles of Invertebrate Palaeontology. 2 ndEdn. Mc-Graw Hill.
8. Brasier, M.D. (1980) Microfossils. George Allen & Unwin. -29-
9. Bignot, G. (1985) Elements of Micropaleontology. IHRDC-Boston.
10. Nield, E.W.; Tucker, V.C.T. (1985) Palaeontology – An Introduction. Pergamon Press, Oxford, England.
11. Anis Kumar Ray, (2008) Fossils in Earth Sciences, Prentice-Hall of India Pvt. Ltd, New Delhi.

OPEN ELECTIVE SUBJECT (OEC)		
THEORY PAPER- OEC-3		
Programme/Class: B.Sc. / B.Sc. Hons.	**Year: Second**	**Semester: Third**
OEC -3 Theory (Code: 003GEG051)	**Subject: GEOLOGY**	
Credits: 3 L + T + P Model.	**Course Title: MARINE GEOLOGY (42 Hrs)**	

Course outcomes: After completing the course, the student will be able to;

CO 1: Understand the morphological features of ocean floor with reference to Indian Ocean and describe the distribution various parameters in sea water and explain eustatic sea level changes.

CO 2: Understand and describe the oceanographic expeditions, ocean floor drilling programmes and ocean floor mapping and understand and explain marine pollution.

CO 3: Understand and describe the types of coasts and coastal geomorphological features and processes; explain tides and law of the sea.

CO 4: Understand and describe the different type of marine sediments and their distribution; explain the mineral resources of ocean floor including coal and petroleum.

Theory Paper OEC-3:

Marine Geology Importance of the course: It is one of the branches of Earth Science. As the oceans cover about 71% of the Earth, study of this subject is important for the exploration of earth to a greater extent as the continental resources are depleting. Therefore, it is a good scope for multidisciplinary students for better understanding of the subject.

Unit-1	Oceanography - Physical properties of sea water, waves, tides and currents, Composition of seawater and processes controlling it. Food-web, primary, secondary and tertiary production. Classification of marine life, planktonic and benthic life in the ocean.	**14 hrs.**
Unit-2	Geological oceanography: Morphology of Ocean floor, Origin and evolution of the ocean basins. Continental drift, Sea-floor spreading and plate tectonics.	**14 hrs.**
Unit-3	Marine mineral resources: Distribution and classification of minerals of economic importance in different oceanographic settings: Seawater as sources of elements/minerals. Placer and heavy mineral deposits, petroleum and coal, phosphorites, gas hydrates, poly-metallic nodules, hydrothermal and metalliferous sediments.	**14 hrs.**

List of Reference:

1. Alan Strahler (2016) Introducing Physical Geography, 6th Edition, Wiley.
2. Miller, C.B. (2004) Biological Oceanography. Blackwell Publishers. 416p.
3. Paul R. Pinet (1992) Oceanography: An introduction to the Planet Oceanus, West Publ., Co.571p.
4. Thruman, H. V. (1994) Introductory Oceanography. 7th Ed. McMillan Pub., Co.

5. George Karleskint, Richard Turner, James Small, (2012) Introduction to Marine Biology Publisher: Brooks Cole, 512p.
6. Fasham, Michael J.R. (2003) Ocean Biogeochemistry. The Role of the Ocean Carbon Cycle in Global Change Series.
7. Komar, P. D., (1976) Beach Processes and Sedimentation, Prentice-Hall. 429p. 8. Reddy M.P.M. (2001) Descriptive Physical Oceanography, AA Balkema Press. 440p.

Details of Formative assessment (IA) for DSCC theory/OEC: 40% weight age for total marks

Type of Assessment	Weight age	Duration	Commencement
Written test-1	10%	1 hr	8th Week
Written test-2	10%	1 hr	12th Week
Seminar	10%	10 minutes	--
Case study / Assignment / Field work / Project work/ Activity	10%	------	--
Total	40% of the maximum marks allotted for the paper		

GENERAL PATTERN OF THEORY QUESTION PAPER FOR DSCC/ OEC
(60 marks for semester end Examination with 2 hrs duration)

Part-A

1. Question number 1-06 carries 2 marks each. Answer any 05 questions: 10marks

Part-B

2. Question number 07- 11 carries 05Marks each. Answer any 04 questions: 20 marks

Part-C

3. Question number 12-15 carries 10 Marks each. Answer any 03 questions: 30 marks

(Minimum 1 question from each unit and 10 marks question may have sub questions for 7+3 or 6+4 or 5+5 if necessary)

Total: 60 Marks

Note: Proportionate weight age shall be given to each unit based on number of hours prescribed.

THEORY PAPER		
Programme/Class: B.Sc. / B.Sc.Hons.	Year: Second	Semester: Fourth
DSCC-7 Theory-VII (Code: 034GEG011)	Subject: GEOLOGY	
Course Title: Structural Geology and Hydrogeology	Credits: 04	Total Hrs: 56

Course Outcome: Structural Geology

CO-1. Describe various structural forms of rocks.

CO-2. Describe concept of brittle and ductile deformation.

CO-3. Describe primary and secondary structural forms.

CO-4. Give classification and describe various types of folds and their recognition criteria.

CO-5. Describe faults on the basis of geometrical pattern.

CO-6. Give classification of joints and describe joints of tectonic origin.

CO-7. Describe fault and mention its types.

CO-8. Give an account of linear and planar structures and describe secondary foliations.

Course Outcome: Hydrogeology

CO-1. Discuss hydrological cycle and its importance.

CO-2. What is precipitation? Discuss its different types.

CO-3. Explain vertical distribution of water in the crust with diagram.

CO-4. Discuss porosity, permeability, specific yield and specific retention.

CO-5. What is aquifer? Describe their various types.

CO-6. Describe Darcy's Law.

CO-7. Describe physical and chemical characteristics of groundwater.

CO-8. Explain water harvesting and watershed management.

CO-9. Give in detail about natural and artificial recharge of groundwater.

STRUCTURAL GEOLOGY

UNIT- 1

Introduction. Structural Forms of Rocks: Primary Structural Forms & Secondary Structural Forms. Concept of brittle and ductile deformation. Forces – compression, tension, torsion and shear. **Contours and Types;** topographic and geological map. Elementary idea of bed, Strike and Dip and its types. Brunton compass and uses.**Primary structural forms** – Sedimentary and Igneous Rocks-Stratification, current or crossbedding, graded bedding, ripple marks, mud cracks and rain prints,flow layers, primary joints,vesicular and amygdaloidal structures and pillowstructure. Lineation, Foliation and Unconformities. Description and origin of foliations: axial plane cleavage and its tectonic significance. Description and origin of lineation and relationship with the major structures. Unconformity types – para, dis, non, angular and regional unconformities.	**14 Hrs**

UNIT-2

Secondary structural forms:A. Cohesive Dislocations – Distortion, bending and Folds. **Folds:** Definitions - Parts of folds, axis, axial planes, limb, plunge. Crest and troughs. Mechanics of folding: Buckling, Bending, Flexural slip and flow folding. **Types of folds**-symmetrical and asymmetrical-anticline, syncline, anticlinorium, synclinorium, overturned fold, recumbent fold. Isoclinal, chevron, fan folds, monocline and drag folds. **Denudational structures** - Outlier and inlier. **B. Disruptive Dislocations** – Joints and Faults. **Joints:** Definition, Dip, Strike. Joint plane, block Joint, Joint set, Joint system. **Classification**–I. **Geometrical:** Dip, Strike, Oblique and bedding joints **II. Genetic**–columnar, mural sheet joints, Master joints. Importance of joints. **Faults**: Definition - Elements of fault, Fault planes, Dip, Strike, Hade, Heave and Throw. Hanging and footwalls. **Classification** – I.	**14 Hrs**

Geometrical: a) Based on attitude of faults as compared to the adjacent beds. Dip, Strike, Diagonal and Bedding faults. b) Based on Apparent movement; Normal and Reverse faults. **II. Genetic**: Thrust faults, over thrust, and under thrust. Gravity faults - Step fault, Ridge fault. trough faults. Criteria for recognition of faults in the field.	
HYDROGEOLOGY	
UNIT-3	
Introduction and basic concepts. Scope of hydrogeology and its societal relevance. Hydrologic cycle. Precipitation, evapo-transpiration, run-off, infiltration and subsurface movement of water. Rock properties affecting groundwater- **S**pecific yield, Specific retention, Permeability, Porosity, Openings in rocks and types of openings, Vertical distribution of subsurface groundwater-Zone of aeration and Zone of saturation and Water table. Types of aquifers-Confined and unconfined; Artesian aquifers; Perched aquifers, Leaky or Semi-confined aquifers; Darcy's law and its validity, hydraulic head and groundwater flow directions. Intrinsic permeability and hydraulic conductivity, Groundwater flow rates and flow direction, Laminar and turbulent groundwater flow.	**14 Hrs**
UNIT-4	
Groundwater chemistry: Physical and chemical properties of water and water quality, Introduction to methods of interpreting groundwater quality data using standard graphical plots, Sea water intrusion in coastal aquifers. Groundwater management, Surface and subsurface water interaction, Groundwater level fluctuations, Basic concepts of water balance studies, issues related to groundwater resources development and management, Rainwater harvesting and artificial recharge of groundwater.	**14 Hrs**

References: Structural Geology

1. Davis, G. R. (1984) Structural Geology of Rocks and Region. John Wiley
2. Billings, M. P. (1987) Structural Geology, 4th edition, Prentice-Hall.
3. Park, R. G. (2004) Foundations of Structural Geology.Chapman& Hall.
4. Pollard, D. D. (2005) Fundamental of Structural Geology. Cambridge University Press.
5. Ragan, D. M. (2009) Structural Geology: an introduction to geometrical techniques (4th Ed). Cambridge University Press (For Practical)
6. Lahee F. H. (1962) Field Geology. McGraw Hill
7. Hills, E. S. (1961) Elements of Structural Geology, Asia Publishing House.
8. Hobbs, Means and Williams (1976). An Outline of Structural Geology. John Wiley.
9. John Robberts (1982) Introduction to Geological Maps and Structures, Pergamon Press.
10. Ken McClay (1991) The mapping of Geological Structures. Geological Society of London. Wiley, New edition.
11. R. J. Twiss and E M Moore (2007) Structural Geology 2nd edition. Freeman & Company

References: Hydrogeology

1. Todd, D.K. (1980). Groundwater Hydrology. John Wiley & Sons.
2. Todd, D.K. and L.W. Mays (2004). Groundwater Hydrology. 3rd Edn. John Wiley & Sons.
3. Davis, S.N. &Deweist, R.J.M. (1966). Hydrogeology, John Wiley & Sons, New York.
4. Ragunath, H.M (2007). Groundwater, New Age International Publishers, Delhi
5. Karanath, K.R. (1987). Groundwater Assessment, Development & Management, Tata Mc-Graw Hill.
6. Ramakrishnan, S. (1998). Groundwater. K.G. Graph Arts, Chennai.
7. C. W. Fetter, 2005. Applied Hydrogeology, Second edition; CBS Publishers and Distributers, New Delhi

PRACTICALS		
Programme: B. Sc/B. Sc Hons	Year: Second	Semester: Fourth
Subject: GEOLOGY		
DSCC-8 Practical-VIII (Code: 034GEG012) (Credits- 02)	Course Title: Structural Geology and Hydrogeology	
Max. Marks: 25+25=50	Core: Compulsory Total= 52 Hrs	
Structural Geology		
UNIT-1 1. Study of Brunton Compass, Identification of different types of folds/faults, joints and unconformity from block models. 2. Exercise on structural maps: Preparation of cross-section profile from geological map. a) Horizontal and inclined strata with and without intrusion. b) Inclined strata with faults; with and without intrusions. c) Map showing combined features such as faults, folds, unconformities and intrusions; unconformities without intrusions (at least a minimum of 2 (two) maps in each type to be given during practical's. d) Completion of outcrops. e) Solving Strike and Dip problems. (Minimum of 2 (two) problems from each set.		**26 Hrs**
Hydrogeology		
UNIT-2 **Water Analysis**: 1. Collection and preservation of water samples from: open well, tap, and bore well, river, water treatment plants, waste water treatment plants and proper labelling of samples. 2. Selection of parameters to be determined: a) pH, Electrical Conductivity, and Hardness of water. b) Estimation of Ca, Mg, Carbonates & Bicarbonates, Chemical Oxygen Deman (COD), Biological Oxygen Demand (BOD). 1. Water quality analysis by Most Probable Number (MPN) test.		**26 Hrs**

OPEN ELECTIVE COURSE- (OEC-04)

Programme/Class: B.Sc. / B.Sc.Hons.	Year: Second	Semester: FOURTH
OEC-4 Theory (Code: 004GEG051)	Subject: GEOLOGY	
Course Title: Geology and Society	Credits: 3. Model: L + T + P	42 Hrs

Course outcomes: After completion of the course the student will be able to;

CO-1: The challenges and opportunities posed by the climate change, resource demands and conflicts, and natural disasters (due to man-made structures as well as natural climate change) point to the importance of studying transdisciplinary nature of the earth processes and their implications to our society.

CO-2: This interdisciplinary nature of Earth Science draws a special attention from the students with other branches of science.

CO-3: From this interdisciplinary optional course on Earth and Social Science, students gain an understanding of natural processes and the impact the distribution and use of natural resources such as water, fossil fuels, and critical minerals for economic growth.

CO-4: It also facilitates the understanding natural hazards such as climate change, landslides, tsunami induced coastal erosions, thermal disturbances in sea water & sea food, and earthquakes.

Course Title: Geology and Society	
Unit – 1: Geological History of mineral evolution; Critical minerals for economic growth; rare earth elements and their uses in modern technology for low carbon economic growth. Water-Future: ground water exploration and exploitation, recycling water and pollution monitoring and water management. Desalination of coastal region water to improve the water quality. Understanding of hydrogeology and environmental conditions for water management.	14 Hrs
Unit – 2: Engineering geology for construction of earthquake resilience infrastructure for public; micro-zonation studies of seismic hazards analyses of smart cities, dams and nuclear power stations.	14 Hrs
Unit – 3: Understanding the basics of past climate change through field work near ancient stalagmites bearing caves to provide basic parameters for future earth. Thermodynamic modelling of carbon capture and sequestration using naturally occurring minerals. Modelling of probable risks of natural hazard and climate change with precise uncertainties.	14 Hrs

Details of Formative assessment (IA) for DSCC theory/OEC: 40% weight age for total marks

Type of Assessment	Weight age	Duration	Commencement
Written test-1	10%	1 hr	8th Week
Written test-2	10%	1 hr	12th Week
Seminar	10%	10 minutes	--
Case study / Assignment / Field work / Project work/ Activity	10%	------	--
Total	40% of the maximum marks allotted for the paper		

GENERAL PATTERN OF THEORY QUESTION PAPER FOR DSCC/ OEC
(60 marks for semester end Examination with 2 hrs duration)

Part-A

1. Question number 1-06 carries 2 marks each. Answer any 05 questions: 10marks

Part-B

2. Question number 07- 11 carries 05Marks each. Answer any 04 questions: 20 marks

Part-C

3. Question number 12-15 carries 10 Marks each. Answer any 03 questions: 30 marks

(Minimum 1 question from each unit and 10 marks question may have sub questions for 7+3 or 6+4 or 5+5 if necessary)

Total: 60 Marks

Note: Proportionate weight age shall be given to each unit based on number of hours prescribed.

Practical Subject

KARNATAK UNIVERSITY, DHARWAD

Four - Year B.Sc. (Hons.) Program

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SYLLABUS FOR SEM III & IV

COURSE: PHYSICS

SEMESTER - III:

DISCIPLINE SPECIFIC CORE COURSE (DSCC)

DSCC – 5: Physics (Theory) - V   (Code:033PHY011)

DSCC – 6: Physics (Practical) –VI   (Code: 033PHY012)

OEC- 3: Sports Science (Code: 003PHY051)

SEMESTER - IV:

DSCC – 7 : Physics (Theory) - VII (Code:034PHY011)

DSCC - 8 : Physics (Practical) -VIII (Code:034PHY012)

OEC- 4 : Medical Physics (Code:004PHY051)

Effective from 2022-23

AS PER N E P – 2020

Sem	Type of Course	Course Code	Instruction hour per week (hrs)	Total hours of Syllabus / Sem	Duration of Exam (hrs)	Formative Assessment Marks	Summative Assessment Marks	Total Marks	Credits
III	DSCC -5 Physics(Theory) –V	033PHY011	04	56	02	40	60	100	04
	DSCC -6 Physics (Practical) – VI	033PHY012	04	52	03	25	25	50	02
	OEC- 3 Sports Science	003PHY051	03	42	02	40	60	100	03
IV	DSCC -7 Physics (Theory) – VII	034PHY011	04	56	02	40	60	100	04
	DSCC -8 Physics (Practical) – VIII	034PHY012	04	52	03	25	25	50	02
	OEC- 4 Medical Physics	004PHY051	03	42	02	40	60	100	03
Details of the other Semesters will be given later									

Karnatak University, Dharwad

Programme Specific Outcome (PSO):

On completion of the 03/ 04 years Degree in PHYSICS students will be able to:

PSO 1 : Culminate in depth knowledge of almost all basic branches of physics such as mechanics, properties of matter, relativity, electricity and magnetism, wave motion, optics, thermal physics, electronics, classical mechanics, quantum mechanics, spectroscopy, nuclear physics, condensed matter physics and also advanced areas like Nanoscience, energy science, astrophysics, instrumentation.

PSO 2 : Communicate effectively physics concepts with examples related to day to day life. Acquire   ability of recognizing and distinguishing various aspects of physics found in real life.

PSO 3 : Learn, perform and design experiments in the laboratory to demonstrate the concepts principles, laws of physics, theories learnt in the class rooms.

PSO 4 : Acquire ability of critical thinking and logical reasoning in physics problems and their solutions. Develop ability to analyze physics problem including simple to thought provoking problems and apply the acquired knowledge to solve.

PSO 5 : Appreciate the importance of physics subjects and its application for pursuing interdisciplinary and multidisciplinary higher education and research in these areas.

PSO 6 : Understand the vast scope of physics as theoretical and experimental science with application in finding solution of problems in nature spanning from smallest dimension 10^{-15} m to highest dimension 10^{26} m in space, covering energy ranges from 10^{-10} eV to 10^{25} eV.

PSO 7 : Think independently and develop algorithm and program using programming techniques for solving real world physics problems.

PSO 8 : Develop ability of working independently and to make in-depth study of various notions of physics.

PSO 9 Develop ability to apply the knowledge and skill acquired through experiments of physics in laboratories to solve real life problems.

PSO 10 : Pursue advanced studies and research in varied areas of physical science.

B.Sc. Semester – III

DSCC-5 : Physics (Theory) V (Code: 033PHY011)

Course No.5 (Theory): Title of the Course (Theory): <mark>Wave motion and Optics</mark>

Syllabus	Total Hrs: 56
Unit-I: Wave Motion:	**14 hrs**
Wave motion: Types of waves, Plane and spherical waves, Transverse and longitudinal wave. Displacement, velocity and pressure curve. Expression for a plane progressive wave, particle velocity. Relation between particle velocity and wave velocity. Differential equation of wave motion, mention of differential equation of three dimensional wave. Derivation of energy density of a plane progressive wave. Distribution of energy in a plane progressive wave. Expression of intensity of progressive wave. Superposition of waves: Interference-Beats, theory of beats (analytical treatment). Super position of two perpendicular SHM: Lissajous figures with equal and unequal frequency- analytical treatment and use of Lissajous figures. Velocity of transverse wave along stretched string, wave equation for transverse wave in a string. Longitudinal (sound) waves in fluid medium -derivation of Newton's formula - Laplace's corrections for Newton's formula. Effect of pressure, temperature and humidity on the velocity of sound. Group velocity-its relationship with wave (or phase) velocity. Concept of resonance. Theory of Helmholtz resonator. **Suggested Activities: please refer foot note**	
Unit-II: Geometrical Optics:	**14 hrs**
Fermat principle: Derivation of laws of reflection and refraction, sign convention, refraction at a spherical surface, derivation of Lagrange's law and Helmholtz relation, Abbe's sine condition derivation, aplanatic points of a spherical surface(qualitative). **Aberrations:** Spherical aberrations**:** methods to reduce spherical aberration (qualitative). Chromatic aberrations: Conditions for achromatism of two thin lenses in contact, two thin lenses separated by finite distance. **Cardinal points**: Cardinal points of a optical system. Equivalent focal length of two thin lenses separated by a distance. Location of cardinal points of a thick lens (derivation). Experimental determination of cardinal points of a lens system using Searle's Goniometer and Turn Table (Nodal slide). **Suggested Activities: please refer foot note**	

Unit-III: Interference :	14 hrs
Interference due to division of wave front: Fresnel's biprism. Determination of wavelength of monochromatic light & thickness of a thin film using biprism. Lloyd's single mirror: Determination of wavelength using Lloyd's single mirror. **Interference due to division of amplitude:** Interference phenomenon with a plane parallel thin film: in case of reflected light and transmitted light (with derivation). Interference using wedge shaped film. Theory of Newton's rings. Determination of wavelength of monochromatic light by Newton's rings. Michelson interferometer: Principle, construction and working. Formation of circular & straight fringes (qualitative). Mention applications of Michelson's Interferometer. **Suggested Activities: please refer foot note**	
Unit-IV: Diffraction and Polarization:	14 hrs
Introduction to diffraction and classification of diffraction phenomena. **Fresnel diffraction**: Fresnel's treatment of the wavefront and Fresnel assumptions. Theory of half period zones considering plane wave fronts. Zone plate: construction, theory and expression for focal length. Comparison between zone plate and convex lens. **Fraunhofer diffraction**: Fraunhofer diffraction at a single slit and at a double slit. Diffraction grating. Theory of Plane transmission grating. Dispersive power of grating. Comparison of grating and Prism spectra. **Polarization:** Review of basics of polarization. Malus law. Huygen's theory of double refraction. Positive and negative crystals. Wave plates: quarter wave plate and half wave plate. Optical activity, specific rotation. Laurent's Half Shade Polarimeter: Construction and working. **Suggested Activities: please refer foot note**	

Suggested Activities:

1. Preparation of report and presentation on harmonics in musical instruments.
2. Study of Characteristics of loud speaker and microphone.
3. Preparation of report and presentation on resonance phenomenon in natural and artificial systems.
4. Using CDs and DVDs as diffraction gratings.
5. What is the physics behind 3D movies? Group Discussion.

Note:

1. Total teaching hours are inclusive of solving numerical problems on all the topics.
2. Preference may be given to solve maximum number of numerical problems and thought-provoking problems are to be solved wherever necessary.
3. Questions should not be framed on review of basic aspects in the semester end examination as it is revision of topics in the lower class.
4. Guide/Students are permitted to do any relevant and thought provoking activity, which gives in depth understanding of physics concepts and their application in a specific chapter.
5. Guide/students are also permitted to take up any innovative project work/field work/ problem solving activity, so that students get clear understanding of underlying principles of physics/concepts of physics in a particular topic/area of physics.
6. Teacher should encourage students to think out of the box and take up activity beyond the syllabus.

Books recommended.

1. The Physics of Waves and Oscillations by N. K.. Bajaj Tata McGraw-Hill., 1984.
2. Waves and Oscillations by N. Subramanyam and Brij Lal Vikas Publishing House Pvt. Ltd
3. A Text Book of Sound D R Khanna and RS Bedi Atma Ram & Sons, ThirdEdition 1952
4. Oscillations and Waves by Satya Prakash Pragathi Prakashan, Meerut, Second Edition 2003
5. Optics by Ajoy Ghatak McGraw Hill Education (India) Pvt Ltd 2017
6. A text Book of Optics by Brij Lal, M N Avadhanulu & N Subrahmanyam S. Chand Publishing 2012
7. Mechanics by D. S. Mathur P. S. Hemne S. Chand Publishing 2012
8. Berkeley Physics Course – Waves, Frank S Crawford Jr Tata Mc Graw-Hill 2011
9. Optics Eugene *Hecht* Pearson Paper back 2019
10. Introduction To Optics Pedrotti and Frank L Pearson India 3rd Edition
11. Fundamentals of Optics Francis Jenkins Harvey White McGraw Hill Education 2017
12. Geometrical Optics (I-Edition) – D. P. Acharya – Oxford & IBH Pub. Co., New-Delhi, 1970.

13. Geometrical Optics – A. Verstraeten. Publisher: Bombay Orient Longmans 1961
14. Optics & Spectroscopy (VI-Edition) Murugeshan, Kirutiga & Shivaprasath - S. Chand & Company.

Pedagogy: Problem solving, seminar, presentation, activities, group discussion, field visit etc.,

B.Sc. Semester – III

DSCC-6: Physics (Practical) - VI Code: 033PHY012

Title of the Course (Practical): Wave motion and optics

List of the Experiments for 52 hrs / Semesters

1. Velocity of sound through wire using Sonometer.
2. Study of Lissajous Figures.
3. Helmholtz resonator using tuning fork/electrical signal generator.
4. Calibration of a spectrometer.
5. Dispersive curve and dispersive power of a prism.
6. Polarimeter: Determination of specific rotation of sugar solution
7. Study of elliptically polarized light/Verification of Malus law
8. Goniometer.
9. Turn table.
10. Newton's rings.
11. Resolving power of grating.
12. Determination of wavelength of monochromatic light using biprism/Lloyd's mirror.
13. Michelson interferometer: Determination of wavelength of monochromatic light.
14. Determination of wavelength of laser light by diffraction single slit method.
15. Determination of wavelength of laser light by Interference Young's Double slit method.

General instructions:
1.   Minimum of eight experiments to be performed.
2.   Any new experiment may be added to the list with the prior approval from the BOS.

Scheme of Practical Examination (distribution of marks): 25 marks for Semester end examination

1 Basic formula,Units & Nature of graph,

   Circuit Diagram/RayDiagram/Schematic diagram   - 05   Marks

2 Tabular Column with quantities and unit mentioned,

    experimental skills.   - 05   Marks

3 Recording ofobservations, calculations and drawing graph,

   and accuracy of the result   - 11   Marks

4 Viva-voce   - 02   Marks

5 Completed & Certified Journal   - 02 Marks

                                                                         Total 25 marks

Note: Same Scheme may be used for IA (Formative Assessment) examination

Books recommended.

1. Physics For Degree Students B. Sc. First Year, S. Chand & Company.
2. Electronics Instrumentation by H. S. Kalasi.
3. B.Sc. Practical Physics – C.L. Arora.
4. Advanced Practical Physics – Samir Kumar Ghosh.
5. Advanced Practical Physics – Worshnop and Flint.

Pedagogy: Problem solving, seminar, presentation, activities, group discussion, field visit etc.,

B. Sc. Semester – III

OEC- 3: Sports Science (Code: 003PHY051)

Syllabus	Total Hrs: 42
Unit-I	**14 hrs**
Measurement: Physical quantities. Standards and Units. International system of Units. Standards of time, length and mass. Precision and significant figures. **Newton's laws of motion**: Newton's first law. Force, mass. Newton's second law. Newton's third law. Mass and weight. Applications of Newton's laws. **Projectile motion**: Shooting a falling target, Physics behind Shooting, Javelin throw and Discus throw. **Topics for self - Study (if any):** **https://www.real-world-physics-problems.com/physics-of-sports.html**	
Unit-II	**14 hrs**
Conservation laws: Conservation of linear momentum, collisions – elastic and inelastic. Angular momentum. (Physics behind Carom, Billiards, Racing). **Centre of mass**: Physics behind Cycling, rock climbing, Skating, **Gravitation**: Origin, Newton's law of gravitation. Archimedes principle, Buoyancy (Physics behind swimming) **Topics for self study (if any)** Archimedes' Principle: Made EASY	Physics in You tube	
Unit-III	**14 hrs**
Food and Nutrition: Proteins, Vitamins, Fat, Blood pressure. Problems due to the deficiency of vitamins. **Energy:** Different forms of Energy, Conservation of mass-energy. **Physical exercises:** Walking, Jogging and Running, Weight management. **Topics for self - Study (if any):** 10 Best Exercises for Everyone – Healthline	
Suggested Activities: 1. Identify the methods of measurement of time, length and mass from ancient time and build models for them. Reference : History of measurement - Wikipedia*https://en.wikipedia.org › wiki › History_of_measurement.* 2.Identify Physics principles behind various Sports activities. **https://www.real-world-physics-problems.com/physics-of-sports.html** 3.List the difficulties experienced in Gymnastics, Cycling and weight lifting 4. List the difficulties experienced in Gymnastics, Cycling and weight lifting. 5. List the difficulties experienced in swimming.	

Books Recommended:

Sl No	Title of the Book	Authors Name	Publisher	Year of Publication
1	Physics for Entertainment	Yakov Perelman	Createspace Independent Pub.	
2	Physics Everywhere	Yakov Perelman	Prodinnova	2014
3	Mechanics for Entertainment	Yakov Perelman	Prodinnova	2014
4	Handbook of Food and Nutrition	M.Swaminathan	Bangalore Press 2012	2012
5	Food Science	B. Srilakshmi	New Age International Pub	2015
6	Physics	Resnick, Halliday and Krane, Vol 1	Wiley Student Edition.	
7	For the love of Physics	Walter Lewin	Taxmann Publications Private Limited	2012
8	An Introduction to the Physics of Sports	VassiliosMcInnesS pathopoulos	Create Spacee Independet Publishing Platform	2013

Internet resources https://www.topendsports.com/biomechanics/physics.htm
https://www.real-world-physics-problems.com/physics-of-sports.html
https://www.healthline.com/
https://www.mayoclinic.org/

Details of Formative assessment (IA) for DSCC theory/OEC: 40% weight age for total marks

Type of Assessment	Weight age	Duration	Commencement
Written test-1	10%	1 hr	8th Week
Written test-2	10%	1 hr	12th Week
Seminar	10%	10 minutes	--
Case study / Assignment / Field work / Project work/ Activity	10%	------	--
Total	40% of the maximum marks allotted for the paper		

Faculty of Science
04 - Year UG Honors programme: 2021-22

GENERAL PATTERN OF THEORY QUESTION PAPER FOR DSCC/ OEC
(60 marks for semester end Examination with 2 hrs duration)
Part-A

7. Question number 1-06 carries 2 marks each. Answer any 05 questions   : 10marks

Part-B

8. Question number 07- 11 carries 05 marks each. Answer any 04 questions   : 20 marks

Part-C

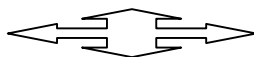9. Question number 12-15 carries 10 marks each. Answer any 03 questions   : 30 marks

   (Minimum 1 question from each unit and 10 marks question may have sub
    questions for 7+3 or 6+4 or 5+5 if necessary)

                                                                              Total: 60 Marks

Note: Proportionate weightage shall be given to each unit based on number of hours prescribed.

B.Sc. Semester – IV

DSCC-7 : Physics (Theory): VII   (Code: 034PHY011)

Title of the Course (Theory) : Thermal Physics and Electronics

Syllabus	Total Hrs: 56
Unit-I: Thermodynamics-I	**14 hrs**
Second Law of Thermodynamics: Review of basics of thermodynamics. Statements of second law of thermodynamics, Carnot theorem: statement and proof. Steam engine, Otto engine (Internal combustion engine) and expression for efficiency. Diesel engine and expression for efficiency. **Entropy:** Concept of entropy, change in entropy, physical concept of entropy, change of entropy in reversible cycle, principle of increase of entropy, change of entropy in irreversible process with examples. Temperature- entropy diagram, physical significance of entropy, entropy of a perfect gas. Second law of thermodynamics in terms of entropy. Entropy of the Universe. Third law of thermodynamics: Nernst's heat theorem statement. *Suggested Activities: please refer foot note*	
Unit-II: Thermodynamics-II	**14 hrs**
Maxwell's Thermodynamic Relations: Thermodynamic variables, extensive and intensive variables. Derivation of Maxwell's thermodynamical relations (general relationship). Applications: specific heat equation for Van der Waals gas, Joule-Thomson-cooling and Joule-Thomson coefficient for perfect and Van der Waal gas. Clausius - Clapeyron's equation (first latent heat equation). **Thermodynamic Potentials:** Internal energy, Enthalpy, Helmholtz free energy, Gibbs free energy. Significance of thermodynamic potentials. Relations of thermodynamical potentials with their variables. First and second order phase transitions. *Suggested Activities: please refer foot note*	
Unit-III: Electronics - I	**14 hrs**
Current and voltage sources and Network Theorems: Concept of voltage source: ideal and practical voltage source. Concept of current source: ideal and practical current source. Thevenin's and Norton's Theorems: statement and proof. **Power supply**: Power supply with filters (LC and π- section), IC regulated power supply (78XX). **Bipolar Junction Transistor:** BJT characteristics in CE mode, Operating point. Biasing of BJT: Mention different types of biasing, analysis of voltage divider biasing, derivation of I_C and V_{CE}. DC *h*-parameters and their determination using low frequency transistor model. Single stage RC coupled CE amplifier, Expression for current gain and voltage gain, input impedance and output impedance, frequency response. Brief explanation of positive and negative feedback. Transistor as an oscillator: Hartley, Colpitts and Phase shift oscillators (qualitative only).	

Junction Field Effect Transistor: Types, characteristics and parameters of JFET. *Suggested Activities: please refer foot note*	
Unit-IV: Electronics- II	**14 hrs**
Integrated Circuits (ICs): Introduction of ICs, Types of ICs, IC555 internal configuration, IC555 timer as astable multivibrator. **Operational Amplifier (Op-Amp):** Ideal Op-Amp and its characteristics, practical Op-Amp, concept of virtual ground, Op-Amp parameters, Op-Amp with negative feedback, Inverting Op-amp: close loop voltage gain expression, input and output impedance. Non-inverting Op-Amp: close loop voltage gain expression. Op-Amp as adder, subtractor, voltage follower, integrator and differentiator. **Digital Electronics:** Positive and negative logic levels, logic operations, NOT, OR, AND operations, construction of truth table. Digital logic gates: NOT, OR, AND, NOR, NAND, XOR, XNOR gates. Input-output timing diagram for NAND and NOR gates. Boolean theorems, De Morgan's theorems using truth table, using gates. Design of basic gates using NAND and NOR. Simplification of Boolean expressions. *Suggested Activities: please refer foot note*	

Suggested Activities:

1. Make a dissertation on Laws of thermodynamics.
2. Make a write up of heat engines and refrigerators.
3. List the reversible and irreversible processes which we may come across.
4. Three important concepts in the study of thermodynamics are, temperature, heat, and internal energy. Discuss the meaning of these three concepts being careful to distinguish between them.
5. Wire a DC power supply on a bread board or groove board to give a regulated output voltage of + 5 V; +15 V; Dual power output : ± 5 V; Dual power output : ± 15 V
6. In the case of power transistors, learn how to fix a heat sink for the transistor.
7. Understand the concept of virtual ground of an Op-Amp.
8. Learn the different types of Op-Amps used for different applications.
9. What is a buffer? Prepare a report on the application of buffers in instrumentation electronics.
10. Learn how to implement logic functions (AND and OR) using just diodes, resistors and transistors.

Note:

1. Total teaching hours are inclusive of solving numerical problems on all the topics.

2. Preference may kindly be given to solve maximum number of numerical problems and thought-provoking problems are to be solved wherever necessary.

3. Questions should not be framed on review of basic aspects in the semester end examination as it is revision of topics in the lower class.

4. Guide/Students are permitted to do any relevant and thought provoking activity, which gives in depth understanding of physics concepts and their application in a specific chapter.

5. Guide/students are also permitted to take up any innovative project work/field work/ problem solving activity, so that students get clear understanding of underlying principles of physics/concepts of physics in a particular topic/area of physics.

6. Teacher should encourage students to think out of the box and take up activity beyond the syllabus.

Books recommended.

1. Heat & Thermodynamics and Statistical Physics by Brijlal Subramanyam & Hemne - S Chand., Delhi
2. Heat and Thermodynamics, M.W. Zemansky, Richard Dittman, 1981, McGraw-Hill.
3. Thermal Physics, S. Garg, R. Bansal and Ghosh, 2nd Edition, 1993, Tata McGraw-Hill
4. A Treatise on Heat, Meghnad Saha, and B.N.Srivastava, 1958, Indian Press
5. Heat and Thermodynamics (I-Edition) – D.S. Mathur - S. Chand & Company Ltd., New-Delhi, 1991.
6. A text book of heat - J.B. Rajam S. Chand and Co.
7. Modern Thermodynamics with Statistical Mechanics, Carl S. Helrich, 2009, Springe
8. An Introduction to Thermal Physics, Daniel V Schroeder, 2020, Oxford University Press
9. Electronic Devices and Circuits by David A. Bell PHI, New Delhi 2004.
10. Integrated Electronics by Jacob Millman and CC Halkias.
11. Digital Fundamentals by Floyd PHI, New Delhi 2001.
12. Principle of Electronics by V. K. Mehta and Rakshit.
13. Basic electronics and solid state physics- B.L.Theraja- S.Chand Publication,New Dehli
14. Basic Electronics- B.L.Theraja- S.Chand Publication,New Delhi.
15. Integrated Electroniics- Millmans Ans Halkias-McGraw Hill, New Delhi.
16. Electronic devices and circuits- Allan Mottersed-.McGraw Hill, New Delhi.
17. Basic Electronics and Linear Circuits- TTTI- Bhargav & Others. McGraw Hill Education (1983)
18. A text book Thermodynamics by Y. V. C. Rao, Universities Press (Ind.) Hyderabad.
19. A text book of heat by G. R. Noakes, London Macmillan and Co. Ltd.
20. Berkely Physics, Vol. No.I – ABC Publications, Bangalore & New-Delhi.
21. University Physics (XI-Edition)- Young & Freedman – Pearson Education, 2004

Pedagogy: Problem solving, seminar, presentation, activities, group discussion, field visit etc.,

B.Sc. Semester – IV
DSCC-8: Physics (Practical) - VIII   Code : 034PHY012
Title of the Course (Practical): **Thermal Physics and Electronics**

List of the Experiments for 52 hrs / Semesters

1. Thermal conductivity of a bad conductor by Lee's and Charlton's method.
2. Thermal conductivity of copper by Searle's apparatus / Angstrom's method.
3. Verification of Clausius – Clapeyron equation and determination of specific enthalpy.
4. Mechanical equivalent of heat Callender and Barn's method.
5. To find the ratio of specific heats at constant pressure and constant volume for air using Clement and Desorme's apparatus.
6. Specific Heat by cooling.
7. Norton's and Thevenin's theorem using unbalanced Wheatstone network.
8. Power supply using π- section filter and study of IC regulator 78XX
9. Astable multivibrator using IC 555
10. Hybrid parameters of BJT in CE mode
11. Single stage RC coupled CE amplifier
12. JFET characteristics
13. Hartley / Collpit's oscillator using BJT / Phase shift Oscillator using OP-Amp
14. Op-Amp as Inverting and non-inverting amplifier
15. Op-amp as Adder and Subtractor.

General instructions:

1.   Minimum of Eight experiments to be performed.
2.   Any new experiment may be added to the list with the prior approval from the BOS

Scheme of Practical Examination (distribution of marks): 25 marks for Semester end examination

2 **Basic formula, Units & Nature of graph,**
   Circuit Diagram / Ray Diagram / Schematic diagram   - 05   Marks
3 **Tabular Column with quantities and unit mentioned,**
   experimental skills.   - 05   Marks
3 **Recording of observations, calculations and drawing graph,**
   and accuracy of the result   - 11   Marks
5 **Viva-voce**   - 02   Marks
5 **Completed & Certified Journal**   - 02   Marks
                                                                    Total 25 marks

Note: Same Scheme may be used for IA (Formative Assessment) examination.

Books recommended.

1.   Physics for Degree Students B. Sc. First Year, S. Chand & Company.
2.   Electronics Instrumentation by H. S. Kalasi.
3.   B.Sc. practical Physics – C.L. Arora.
4.   Advanced practical Physics – Samir Kumar Ghosh.

5.   Advanced practical Physics – Worshnop and Flint.

B.Sc. Semester – IV

OEC- 4: Medical Physics (Code: 004PHY051)

Syllabus	Total Hrs: 42
Unit-I: Human Anatomy and Physiology	**14 hrs**
Overview of human anatomy - cells, cell structure, type of cells and their functions, tissues, organs, and their functions. Different systems in the human body, their structure and function, physiological properties of the circulatory system, digestive system, respiratory system endocrine system and nervous system.	
Unit-II: Physics of Medical Diagnostics	**14 hrs**
Principle of production of X-rays. Use of X-rays in medical diagnosis, X-ray imagingsystems. Computed Tomography (CT): principle and generation of CT. Magnetic Resonance Imaging (MRI): basic principle and image characteristics. Ultrasound Imaging: production of ultrasound, transducers, Interaction of sound waves with body tissues, , acoustic coupling, image formation, modes of image display and color Doppler.	
Unit-III: Radiation Physics	**14 hrs**
Radiation units exposure, absorbed dose, units: Rad, gray, relative biological electiveness, effective dose, inverse square law. Interaction of radiation with matter: Compton and Photoelectric effect, Rem and Sievert, linear attenuation coefficient. Radiation detectors: Thimble Chamber, Condenser Chambers, Geiger Muller counter, Scintillation counters and solid state detectors, ionization chamber, Dosimeters, survey methods, area monitors, TLD, Semiconductor detectors.	
Class Room Activities Unit I: Students can demonstrate the shape, size, positions and functions of different organs in the body with the help of models. Unit II: The use of X-rays in the diagnosis of the fractured bone can be demonstrated with the help of a gamma source and a gamma ray survey meter. As the density of materials between the source and the detector changes the reading on the meter (or intensity of the beefing sound) changes. Unit III: (i) Students can be asked to list out different type of cancers and possible causative factors. They can be asked to list out the healthy practices to reduce the risk of cancers. (ii) As there will be students from different disciplines in the OE course, group discussion can be arranged to discuss about their programme and outcome. This willbe an opportunity for the students to know about other disciplines. **Other related activities/projects:** 1. Visit to nearby hospitals/diagnostic centers to study the working of X-ray machines. 2. Visit to ultrasound diagnostic centers to study the principle and use of ultrasound in diagnosis. 3. Project on principle and use of X-ray films in imaging. 4. Visit to radiotherapy centers to study the modalities of radiotherapy.	

Text Books

1. C. H. Best and N. B. Taylor. A Test in Applied Physiology. Williams and Wilkins Company, Baltimore, 1999.

2. C. K. Warrick. Anatomy and Physiology for Radiographers. Oxford University Press, 2001.

3. Jerrold T. Bushberg. The Essential Physics for Medical Imaging (2nd Edition). Lippincott Williams & Wilkins, 2002.

4. Jean A. Pope. Medical Physics: Imaging. Heinemann Publishers, 2012.

5. Faiz M. Khan and Roger A. Potish. Treatment Planning in Radiation Oncology. Williams and Wilkins, USA, 2003.

6. D. Baltas. The physics of modern brachytherapy for oncology. Taylor and Francis, 2007.

Reference Books

1. J. R. Brobek. Physiological Basis of Medical Practice. Williams and Wilkins, London, 1995.

2. Edward Alcamo, Barbara Krumhardt. Barron's Anatomy and Physiology the Easy Way. Barron's Educational Series, 2004.

3. Lippincott, Anatomy and Physiology. Lippincott Williams & Wilkins, 2002.

4. W. E. Arnould Taylor. A textbook of anatomy and physiology, Nelson Thornes, 1998.

5. G. S. Pant. Advances in Diagnositc Medical Physics. Himalaya Publishing House, 2006.

6. Sabbahaga, Diagnositc Ultrasound applied to OBG. Maryland, 1980.

7. Faiz M Khan. The Physics of Radiation Therapy (3rd edition). Lippincott Williams & Wilkins, USA, 2003.

8. Jatinder R. Palta and T. Rockwell Mackie. Intensity Modulation Radiation Therapy. Medical Physics publishing, Madison, Wisconsin, 2003.

9. AAPM Report No. 72. Basic Applications of Multileaf collimators, AAPM, USA, 2001.

10. AAPM Report No. 91. Management of Respiratory motion in radiation oncology, 2006.

11. CA Joslin, A. Flynn, E. J. hall. Principles and Practice of Brachytherapy. Arnold publications, 2001.

12. Peter Hoskin, Catherine Coyle. Radiotherapy in Practice. Oxford University Press, 2011.

13. W. R. Handee. Medical Radiation Physics. Year Book Medical Publishers Inc., London, 2003.

14. Donald T. Graham, Paul J. Cloke. Principles of Radiological Physics. Churchill Livingstone, 2003.

15. Thomas S. Curry. Christensen',s Physics of Diagnostic Radiology (4th Edition). Lippincott Williams & Wilkins, 1990.

16. Madison. MRI – Perry Sprawls – Medical Physics Publishing. Wisconsin, 2000.

Note:

1. Total teaching hours are inclusive of solving numerical problems on all the topics.
2. Preference may be given to solve maximum number of numerical problems and thought-provoking problems are to be solved wherever necessary.
3. Questions should not be framed on review of basic aspects in the semester end examination as it is revision of topics in the lower class.
4. Guide/Students are permitted to do any relevant and thought provoking activity, which gives in depth understanding of physics concepts and their application in a specific chapter.
5. Guide/students are also permitted to take up any innovative project work/field work/ problem solving activity, so that students get clear understanding of underlying principles of physics/concepts of physics in a particular topic/area of physics.
6. Teacher should encourage students to think out of the box and take up activity beyond the syllabus.

Details of Formative assessment (IA) for DSCC theory/OEC: 40% weight age for total marks

Type of Assessment	Weight age	Duration	Commencement
Written test-1	10%	1 hr	8th Week
Written test-2	10%	1 hr	12th Week
Seminar	10%	10 minutes	--
Case study / Assignment / Field work / Project work/ Activity	10%	------	--
Total	40% of the maximum marks allotted for the paper		

Faculty of Science
04 - Year UG Honors programme: 2022-23

GENERAL PATTERN OF THEORY QUESTION PAPER FOR DSCC/ OEC
(60 marks for semester end Examination with 2 hrs duration)

Part-A

4. Question number 1-06 carries 2 marks each. Answer any 05 questions   : 10marks

Part-B

5. Question number 07- 11 carries 05 marks each. Answer any 04 questions   : 20 marks

Part-C

6. Question number 12-15 carries 10 marks each. Answer any 03 questions   : 30 marks

   (Minimum 1 question from each unit and 10 marks question may have sub
      question for 7+3 or 6+4 or 5+5 if necessary)

                                                                Total: 60 Marks

Note: Proportionate weightage shall be given to each unit based on number of hours prescribed.
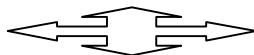
Practical Subject

KARNATAK UNIVERSITY, DHARWAD

Four - Year B. Sc. (Hons.) Program

SYLLABUS FOR SEM III & IV

Course: ELECTRONICS

SEMESTER - III:

DISCIPLINE SPECIFIC CORE COURSE(DSCC)

DSCC – 5 : Electronics (Theory) - I (Code:033ELE011)

DSCC – 6 : Electronics (Practical) - II (Code:033ELE012)

OEC- 3 : Basic Instrumentation (Code: 003ELE051)

SEMESTER - IV:

DSCC – 7 : Electronics (Theory) - III (Code:034ELE011)

DSCC - 8 : Electronics (Practical) - IV (Code:034ELE012)

OEC- 4 : Communication (Code:004ELE051)

Effective from 2022-23

AS PER N E P – 2020

Sem	Type of Course	Course Code	Instruction hour per week (hrs)	Total hours of Syllabus / Sem	Duration of Exam (hrs)	Formative Assessment Marks	Summative Assessment Marks	Total Marks	Credits
III	DSCC -5 Electronics (Theory) - V	033CHE011	04	56	02	40	60	100	04
	DSCC -6 Electronics (Practical) - VI	033CHE012	04	52	03	25	25	50	02
	OEC- 3 Basic Instrumentation	003CHE051	03	42	02	40	60	100	03
IV	DSCC -7 Electronics (Theory) - VII	034CHE011	04	56	02	40	60	100	04
	DSCC -8 Electronics (Practical) - VIII	034CHE012	04	52	03	25	25	50	02
	OEC- 4 Communications	004CHE051	03	42	02	40	60	100	03
Details of the other Semesters will be given later									

Karnatak University, Dharwad

Name of Course (Subject): ELECTRONICS

Programme Specific Outcome (PSO):

On completion of the 03/ 04 years Degree in ELECTRONICS students will be able to:

PSO 1: Provide students with learning experiences that provide broad knowledge and understanding of key concepts of Electronics and equip students with advanced scientific / technological capabilities for analysing and tackling then issues and problems in the field od Electronics.

PSO 2. Develop ability in students to apply knowledge and skills they have acquired to solve specific theoretical and applied problems in Electronics

PSO3: Develop abilities in students to design and develop innovative solutions for the benefit of society.

PSO4:. Provide students with skills that enable them to get employment in industries or pursue higher studies or research assignments or turn as enterpreneurs.

B.Sc. Semester – III

DSCC-5 : Electronics (Theory) V   (Code: 033ELE011)

Title of the Course (Theory) : Digital design using Verilog and programming in C

Syllabus-	Total Hrs: 56
Unit-I	**14 hrs**
Introduction to Verilog: A Brief History of HDL, Structure of HDL Module, Comparison of VHDL and Verilog, Introduction to Simulation and Synthesis Tools, Test Benches. Verilog: Module, Delays, brief description - data flow style, behavioral style, structural style, mixed design style, simulating design. Language Elements- Introduction, Keywords, Identifiers, White Space Characters, Comments, format, Integers, reals and strings. Logic Values, Data Types-net types, undeclared nets, scalars and vector nets, Expressions: Operands, Operators, types of Expressions Gate level modeling - Introduction, built in Primitive Gates, multiple input gates, Tri-state gates, Illustrative Examples (both combinational and sequential logic circuits).	
Unit-II	**14 hrs**
Data flow Modeling and Behavioral Modeling: Data flow Modeling: Continuous assignment, net declaration assignments, delays, net delays and examples. Behavioral Modeling: Procedural constructs, timing controls, block statement, procedural assignments, conditional statement, The 'Case' Statement, 'If' and 'if-Else' Constructs, loop statement, 'Repeat' Construct, for loop, 'The Disable' Construct, 'While Loop', Forever Loop, procedural continuous assignment, Illustrative Examples	
Unit-III:	**14 hrs**
C- Programming: Brief explanation of basic block diagram of computer, Computer programming preliminaries, Algorithm, Flowcharts and their symbols, some simple examples. Introduction to C-programming, Importance of C, Character set, Basic Structure of C program, Execution of C, C tokens, key words, identifiers, Constants, Variables and data types,data type modifiers. Declaration of variables, assigning values to variables, defining symbolic constants,Formatted and unformatted Input and output statements,Operators and expressions (All type),Precedence of operators. Solve sufficient problems.	

Unit-IV	14 hrs
Decision making & branching: Conditional & control statements- if statement, if-else statement, Nested if statement, Switch statement and goto- statement. Loop control structures- while, do-while and for statements. **Arrays:** One- and two-dimensional arrays, Declaration and initialization of arrays, multidimensional arrays. **Strings:** and initializing of string variables, reading and writing of strings, String handling functions. **Functions:** Function definition, arguments and parameters, local and global variable, Function declaration, simple C-programs using functions. Solve sufficient problems	

Books recommended.

1. Digital Fundamentals : Thomas Floyd , Pearson publication *Eleventh Edition.*

2. Modern Digital Electronics: R.P. Jain, 3rd Edition, TMH Publications.

 3. A Verilog HDL Primer – J. Bhasker, BSP, 2003 II Edition.

4. Verilog HDL-A Guide to Digital Design and Synthesis-SAMIR PALNITKAR, Pearson, 2nd
    edition.

5. Design through Verilog HDL – T.R. Padmanabhan and B. Bala Tripura Sundari, WSE, 2004 IEEE

6. Fundamentals of Computers - V Rajaram, NeeharikaAdabala - PHI.

7. Computer Fundamentals - Peter Norton, McGraw-Hill Education.

8. Computer concepts and C-programmimng, P.B.Kotur.

9. Let Us C, Yashavant Kanetkar, BPB Publications

10.Programming in ANSI C, Balagurusamy, 2nd edition, TMH.

11. Byron S Gottfried, Programming with C, Schaum Series

B.Sc. Semester – III
DSCC-6: Electronics (Practical) - VI (Code: 033ELE012)

Title of the Course (Practical): Digital design using Verilog and programming in C

List of the Experiments for 52 hrs / Semesters

1. C-program to find i)area of a triangle ii) area of triangle when sides are given iii) area of a circle.
2. C-program using if-else statement i)to check whether given number is odd or even ii)to find whether a given integer is positive or negative.
3. C-program to find largest and smallest of given numbers.
4. C-program to find the roots of a quadratic equation.
5. C-program to illustrate switch statement.
6. C-program to find factorial of a number using while, do and for loops.
7. C-program to generate the Fibonacci series.
8. C-program to find the
9. string handling functions.
10. C-program to find sum of odd and even numbers using functions.
11. 12. Write code to realize basic and sum & difference of two matrices using arrays.
12. C-program to find reverse of a number and to check whether it is a palindrome or not.
13 C-program to illustrate any two derived logic gates.
14. Write code to study Half adder, Full Adder using basic and derived gates.
15. Write code to study Half subtractor and Full Subtractor using basic and derived gates.

General instructions:

3. *Minimum of eight experiments to be performed.*
4. *Any new experiment may be added to the list with the prior approval from the BOS.*

Scheme of Practical Examination (distribution of marks): 25 marks for Semester end examination

1 Basic formula, Units & Nature of graph,
   Circuit Diagram/Ray Diagram/Schematic diagram   - 05   Marks
2 Tabular Column with quantities and unit mentioned,
    experimental skills.   - 05   Marks
3 Recording of observations, calculations and drawing graph,
   and accuracy of the result   - 11   Marks

4 Viva-voce   - 02   Marks

5 Completed & Certified Journal   - 02   Marks

                                            Total 25 marks

Note: Same Scheme may be used for IA (Formative Assessment) examination

General instructions:

1. Minimum of eight experiments to be performed.
2. Any new experiment may be added to the list with the prior approval from the BOS.

Scheme of Practical Examination (distribution of marks): 25 marks for Semester end examination

1. Basic formula, Units & Nature of graph,
    Circuit Diagram / Ray Diagram / Schematic diagram   - 05   Marks
2. Tabular Column with quantities and unit mentioned,
    experimental skills.   - 05   Marks
3   Recording of observations, calculations and drawing graph,
    and accuracy of the result   - 11   Marks

1. Viva-voce   - 02   Marks

5   Completed & Certified Journal   - 02 Marks

                                                    Total 25 marks

Note: Same Scheme may be used for IA (Formative Assessment) examination

Books recommended.

1.Electronic instruments and systems: Principles, maintenance and troubleshooting by R. G. Gupta Tata McGraw Hill.
 2. Modern electronic equipment: Troubleshooting, repair and maintenance by Khandpur, Tata McGraw Hill
3.Electronic fault diagnosis by G. C. Loveday, A. H. Wheeler publishing
4. Modern Electronics Instrumentation and measurement techniques- Helfrick Cooper
5. Basics of Electronics (Solid State) – BL

B.Sc. Semester – III

OEC – 3 : Electronics (003ELE051).

Title of the Course : Communication

Syllabus	Total Hrs: 42
Unit-I Radio Communication	**14 hrs**
Antenna: Function of antenna, Types of antenna, working of Yagi- Uda antenna and dish antenna (qualitative only) Classification of EM waves, Propagation of Radio waves: Ground wave propagation, Space wave propagation and Ionosphere: classification of ionosphere in to layers, Sky wave propagation, virtual height, critical frequency, critical angle. Modulation: definition of modulation, Types of modulation, AM FM. Modulation index in AM, FM . Representation of complete communication system using Simple block diagram (both transmitter & Receiver), Explanation of function of each block. Demodulation: AM detection (Diode as detector), Simple FM detector(balanced detector) Concepts of amplifiers used in communication system: audio frequency amplifier, Radio frequency amplifier.	
Unit-II Optical Fiber Communication:	**14 hrs**
Fiber Optic Cable (FOC): Optical fiber definition and general construction, Principle of working, Types of FOC: step index, graded index . Cable mode: Single mode and Multi-mode fiber(Construction and profile) comparison of single and multi-mode fiber. Simple Block Diagram of Optical Fiber Communication system: Functions of each block, Sources of Light in OFC: LED: principle & working (qualitative) and Laser diode: Principle & working (qualitative)Comparison of Optical Fiber Communication System with cable communication and Radio communication systems Applications of OFC in other fields	
Unit-III Satellite Communication:	**14 hrs**
Satellite Orbits & Positioning: : Definition of satellite, satellite orbits: circular orbit & elliptical orbit, Satellite Height, apogee and perigee in case of elliptical orbits, satellite speed, satellite period, (Mention of Keplers Laws of planetary motion) Angle of elevation, Geosynchronous orbits, position coordinates of satellite in terms of longitude and latitude(with clear illustration)Satellite communication System:	

| general block diagram. Repeaters and transponders (qualitative), uplinking and down linking. Frequency allocation. Satellite Applications: Discuss application of satellite in (1) communication (2) GPS (global positioning system) (3) weather forecasting (4) disaster management (5) agriculture Mention of various other applications of satellite to create awareness. | |

Books recommended

1. Principle of Electronic Communication Systems by Lois E Frenzel Jr. : Mc Graw Hill Education Pvt Ltd
2. Electronic Communication by Dennis Roddy & John Coolen : Pearson Education
3. 3. Electronic Communication Systems by George Kennedy & Bernard Davis : Mc Graw Hill Education Pvt Ltd
4. Introduction To Fiber Optics by Ajoy Ghatak & K.Thyagarajan : Cambridge University Press
5. Satellite Communication by Dennis Roddy : Mc Graw Hill

Details of Formative assessment (IA) for DSCC theory/OEC: 40% weight age for total marks

Type of Assessment	Weight age	Duration	Commencement
Written test-1	10%	1 hr	8th Week
Written test-2	10%	1 hr	12th Week
Seminar	10%	10 minutes	--
Case study / Assignment / Field work / Project work/ Activity	10%	------	--
Total	40% of the maximum marks allotted for the paper		

Faculty of Science
04 - Year UG Honors programme:2021-22

GENERAL PATTERN OF THEORY QUESTION PAPER FOR DSCC/ OEC
(60 marks for semester end Examination with 2 hrs duration)

Part-A

10. Question number 1-06 carries 2 marks each. Answer any 05 questions   : 10marks

Part-B

11. Question number 07- 11 carries 05marks each. Answer any 04 questions   : 20 marks

Part-C

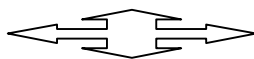12. Question number 12-15 carries 10 marks each. Answer any 03 questions   : 30 marks

   (Minimum 1 question from each unit and 10 marks question may have sub
     questions for 7+3 or 6+4 or 5+5 if necessary)

                                                                    Total: 60 Marks

Note: Proportionate weightage shall be given to each unit based on number of hours prescribed.

B.Sc. Semester – IV

DSCC- 7: Electronics (Theory) - VII (Code: 034ELE011)

Title of the Course (Theory) : Communication I

Syllabus	Total Hrs: 56
Unit-I	**14 hrs**
Radio wave propagation: Ionosphere, propagation of EM waves through Ionosphere, skip-distance, maximum usable frequency, Secant law, virtual height and critical frequency, critical angle and fading. **Modulation:** Need for modulation, Types of modulations. Theory of amplitude modulation. Modulation index, side bands, power relations, AM collector modulator. FM – modulation index, side bands, Demodulation-Diode AM detector, transistor AM detector.FM –detector, balanced slope detector, Foster Seeley discriminator ,ratio detector.	
Unit-II	**14 hrs**
Transmitters and Receivers: Introduction, Block diagram of AM and FM Transmitter (Qualitative explanation) Functions of radio receiver, characteristics of radio receiver; Sensitivity, Selectivity, Fidelity, Signal-to-noise figure and Stability.AM receivers; Straight radio receiver and Super heterodyne receiver, advantages and disadvantages. Problems.Image frequency, intermediate frequency and its choice. Block diagram of FM Super heterodyne receiver, Comparison of AM and FM, problems	
Unit-III	**14 hrs**
Introduction, radiation mechanism, wire radiators in space-Resonant antenna s-radiation Pattern and current distribution for different lengths, non-resonant antenna, antenna parameters-gain, directive gain power gain. Problems. Bandwidth, beam width, polarization, efficiency, radiation resistance, total effective resistance. Derivation for the expression of radiation resistance and power radiated by antenna (qualitative), ungrounded and grounded antennas, effect of antenna height, antenna couplers, dipole arrays, folded dipole. Problems. Yagi-antenna. Qualitative study of helical antenna, loop antenna, parabolic reflector, Horn antenna. Micro strip antenna. Problems	
Unit-IV	**14 hrs**
Introduction – Introduction, Block diagram of OFC system,Fiber optic cables, light propagation through fiber –Snell's law, numerical aperture (derivation). Types of optical fiber cables, step index fiber, graded index fiber, light sources – requirements, LEDs and semiconductor laser diodes. Photo detectors – PN, PIN and avalanche photodiodes. Losses in optical fibers – Rayleigh scattering, absorption, leaky modes, bending, joint junction losses. Advantages and disadvantages of OFC over metallic cables.	

Books recommended:

1. Electronic Communications, D. Roddy and J. Coolen, Pearson Education India.
2. Advanced Electronics Communication Systems- Tomasi, 6th edition, Prentice Hall.
3. Radio Eng. – G K Mittal, Khanna Publication, 1986**.**

4. Electronic Communication systems, G. Kennedy, 3rdEdn., 1999,
5. Principles of Electronic communication systems - Frenzel, 3rd edition.
6. Communication Systems, S. Haykin, 2006, Wiley India.
7. Electronic Communication system, Blake, Cengage, 5th edition
8. Optical Fiber Communication by- Gerd Keyser
9. Electronic Communication – Sanjeev Gupta.(Khanna Publishers, Delhi
10. Antenna and wave propagation - K D Prasad

B.Sc. Semester – IV
DSCC-8: Electronics (Practical) - VIII (Code: 034ELE012)
Title of the Course (Practical): Communications I

List of the Experiments for 52 hrs / Semesters

1. Amplitude Modulator using Transistor.
2. .FM - Generator
3. AM Transmitter and Receiver.
4. FM Transmitter and Receiver
5. Diode as a detector (Sketch input and output wave forms)
6. Straight radio receiver (Selectivity, Sensitivity)
7. Selectivity of a super heterodyne radio receiver
8. Radiation pattern studies of different dipole Antenna
9. Numerical aperture of OFC.
10. Characteristics of OFC.
11. Bending losses in OFC.
12. Impedance characteristics of microphone.

General instructions:

1. *Minimum Four Experiments to be performed in each Part*
   1. *Any new experiment may be added to the list with the prior approval from the BOS.*

Scheme of Practical Examination (distribution of marks): 25 marks for Semester end examination

1. Basic formula, Units & Nature of graph,
   Circuit Diagram / Ray Diagram / Schematic diagram — 05 Marks
2. Tabular Column with quantities and unit mentioned, experimental skills. - 05 Marks
3. Recording of observations, calculations and drawing graph, and accuracy of the result - 11 Marks

13. Viva-voce - 02 Marks

5. Completed & Certified Journal - 02 Marks

Total 25 marks

Note: Same Scheme may be used for IA (Formative Assessment) examination

B. Sc. Semester – IV

OEC-4: Basic Instrumentation (Code: 004ELE051)

Syllabus	Total Hrs: 42
Unit-I	**14 hrs**
Basics of Measurements: Instrumentation, accuracy, precision, sensitivity, resolution, errors in measurements, classification of instruments Basic d'Arsonvel meter movement, principle of voltmeter, construction of multirange voltmeter examples, voltmeter sensitivity, loading effect of voltmeter, principle of ammeter, construction of multirange milliammeter, examples. **Ohmmeter**- series type ohmmeter construction, problems, Shunt type Ohmmeter Construction, examples. **Multimeter:** Principles of measurement of dc voltage and dc current, ac voltage, ac current and resistance. Specifications and their significance. **Electronic Voltmeter:** Block diagram, advantages over conventional multimeter for voltage measurement, **AC millivoltmeter:** Types of AC millivoltmeters: Amplifier-rectifier, rectifier-amplifier. Block diagram of ac millivoltmeter, specifications and their significance.	
Unit-II	**14 hrs**
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 single trace.	
Unit-III	**14 hrs**
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. **Digital Instruments:** Principle and working of digital meters. Comparison of analog and digital instruments. Characteristics of a digital meter. Working principle of digital Voltmeter. **Digital Multimeter:** Block diagram and working of digital multimeter. Working principle of time interval, frequency and period measurement using universal counter/frequency counter, time-base stability, accuracy and resolution.	

Books recommended:

1.A text book in Electrical Technology- B. L. Theraja – S. Chand and Co.

2. Performance and design of AC machines- M. G. Say ELBS Edn.

3. Digital Circuits and Systems, Venugopal, 2011, Tata McGraw Hill.

4. Logic circuit design, Shimon P. Vingron, 2012, Springer.

5. Digital Electronics, Subrata Ghoshal, 2012,Cengage Learning.

6. Electronic Devices and Circuits, S. Salivahanan and N. S. Kumar,Third Ed.2012 Tata Mc-Graw Hill.

7. Electronic circuits: Handbook of design and applications, U Tieze, Ch.Schenk, 2008, Springer.

8. Electronic Devices, 7/e Thomas L. Floyd, 2008, Pearson India

Details of Formative assessment (IA) for DSCC theory/OEC: 40% weight age for total marks

Type of Assessment	Weight age	Duration	Commencement
Written test-1	10%	1 hr	8th Week
Written test-2	10%	1 hr	12th Week
Seminar	10%	10 minutes	--
Case study / Assignment / Field work / Project work/ Activity	10%	------	--
Total	40% of the maximum marks allotted for the paper		

Faculty of Science
04 - Year UG Honors programme:2021-22

GENERAL PATTERN OF THEORY QUESTION PAPER FOR DSCC/ OEC
(60 marks for semester end Examination with 2 hrs duration)

Part-A

7. Question number 1-06 carries 2 marks each. Answer any 05 questions   : 10marks

Part-B

8. Question number 07- 11 carries 05Marks each. Answer any 04 questions   : 20 marks

Part-C

9. Question number 12-15 carries 10 Marks each. Answer any 03 questions   : 30 marks

   (Minimum 1 question from each unit and 10 marks question may have sub
      questions for 7+3 or 6+4 or 5+5 if necessary)

Total: 60 Marks

Note: Proportionate weight age shall be given to each unit based on number of hours prescribed.

Encl. No. 07

KARNATAK UNIVERITY, DHARWAD

04 – Year B.Sc. (Hons.) Program

SYLLABUS

Subject: Botany

[Effective from 2022-2023]

**DISCIPLINE SPECIFIC CORE COURSE (DSCC) FOR SEM III AND IV AND
OPEN ELECTIVE COURSE (OEC) FOR SEM III AND IV.**

AS PER NEP- 2020

KARNATAK UNIVERITY, DHARWAD

Four Years Under Graduate Program in Botany for B.Sc. (Hons.)
Effective from 2022-23

Sem	Type of Course	Theory/ Practical	Instruction hour per week	Total hours of Syllabus / Sem	Duration Of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks	Credits
III	DSCC	Theory	04 hrs	56	02 hrs	40	60	100	04
		Practical	04 hrs	52	03 hrs	25	25	50	02
	OEC-3	Theory	03 hrs	42	02 hrs	40	60	100	03
IV	DSCC	Theory	04 hrs	56	02 hrs	40	60	100	04
		Practical	04 hrs	52	03 hrs	25	25	50	02
	OEC-4	Theory	03 hrs	42	02 hrs	40	60	100	03

B.Sc.: Semester – III
Subject: Botany
Theory: Discipline Specific Core Course (DSCC)

The Course Botany in III semester has two papers (Theory paper- 033 BOT 011 for 04 credits and Practical paper- 033 BOT 012 for 02 credits) for 06 credits: Both the papers are compulsory, Details of the courses are as

Course No.: 05
Course code (Theory): 033 BOT 011

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/ Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
033 BOT 011	DSCC	Theory	04	04	56 hrs	3hrs	40	60	100

Title of the Course and Code:
DSSC 033 BOT 011: PLANT ANATOMY AND DEVELOPMENT BIOLOGY

Course Outcomes:

On completion of this course, the students will be able to:
1. Observation of variations that exist in internal structure of various parts of a plant and as well as among different plant groups in support for the evolutionary concept.
2. Skill development for the proper description of internal structure using botanical terms, their identification and further classification.
3. Induction of the enthusiasm on internal structure of locally available plants.
4. Understanding various levels of organization in a plant body with an outlook in the relationship between the structure and function through comparative studies.
5. Observation and classification of the floral variations from the premises of college and house.
6. Understanding the various reproductive methods sub-stages in the life cycle of plants
7. Observation and classification of the embryological variations in angiosperms.
8. Enthusiasm to understand evolution based on the variations in reproduction among plants.

PLANT ANATOMY

Unit 1: ANGIOSPERM ANATOMY, PLANT CELL STRUCTURE AND TISSUES

14 Hrs

Introduction, objectives and scope of Plant Anatomy, Plant cell structure – nature of plant cell wall.
Tissue and tissue systems - meristematic tissue, permanent tissue and secretary cells.
Classification of meristem: (apical, intercalary and lateral), primary and secondary meristem.
Apical meristem: Theories on organization of meristem (apical cell theory, Tunica-Corpus theory, histogen theory and Korper-Kappe theory), quiescent centre, Root cap.
Evolution and concept of organization of shoot apex (Apical cell theory, Histogen theory, Tunica Corpus theory continuing meristematic residue, cytohistological zonation).

Unit II: MORPHOGENESIS AND DIFFERENTIATION   14 Hrs.

Morphogenesis in plants - Differentiation of root, stem and leaf.

Types of vascular bundles and Vascular cambium, Origin, development, arrangement and diversity in size and shape of leaves.

Structure of Dicot root: primary and secondary structures (Tridax/Sunflower), Structure of monocot root (Maize).

Structure of Dicot stem: Primary and secondary structures (Tridax/Sunflower), Structure of Monocot stem (Maize), Nodal anatomy.

Structure of Dicot leaf: primary structure (Tridax/Sunflower), primary structure of Monocot leaf (Maize), Stomatal types. Anomalous secondary growth: Aristolochia, Boerhaavia (dicot stem) Dracaena (monocot stem)

Applications in systematics, forensics and Pharmacognosy.

DEVELOPMENT BIOLOGY

Unit III: Morphogenesis and Differentiation   14 Hrs.

Differentiation and cell polarity in acellular (*Dictyostelium*), Unicellular (*Acetabularia*) and multicellular system (root hair and stomata formation) Shoot Apical meristem (SAM): Origin, structure and function, Cytohistological zonation and Ultrastructure of meristems. Organogenesis: Differentiation of root, stem, leaf and axillary buds, bud dormancy

Mechanism of leaf primordium initiation, development and Phyllotaxis (Diversity in size and shape of leaves)

Structure and function of root apical meristem (RAM): Root cap, quiescent centre and origin of lateral roots.

Transition from vegetative apex into reproductive apex

Developmental patterns at flowering apex: ABC model specification of floral organs. Modification of gene action by growth hormones and cellular differences between floral organs. Senescence – a general account.

Unit IV: Reproductive Biology   14 Hrs.

Introduction, Scope and contributions of Indian embryologists: P. Maheswari, B G L Swamy, P.Maheshwari, M.S. Swaminathan and K.C. Mehta.

Microsporangium: Development and structure of mature anther, Anther wall layers, Tapetum -types, structure and functions and sporogenous tissue.

Microsporogenesis - Microspore mother cells, microspore tetrads, Pollinia.

Microgametogenesis – Formation of vegetative and generative cells, structure of male gametophyte. Pollen embryosac (Nemec phenomenon).

Megasporangium – Structure of typical Angiosperm ovule. Types of ovule - Anatropous, Orthotropous, Amphitropous, Circinotropous. **Megagametogenesis –** Types of development of Female gametophyte/embryosac- monosporic- *Polygonum* type, bisporic – *Allium* type, tetrasporic - *Fritillaria* type. Structure of mature embryosac.

Pollination and fertilization: Structural and functional aspects of pollen, stigma and style. Post pollination events; Current aspects of fertilization and Significance of double fertilization, Post fertilization changes.

Endosperm – Types and its biological importance. Free nuclear (*Cocos nucifera*) cellular (*Cucumis),* helobial types. Ruminate endosperm.

Embryogenesis – Structure and composition of zygote ,Dicot (*Capsella bursa-pastoris)*and Monocot (*Najas)* embryo development. A general account of seed development.

B.Sc. BOTANY: Semester - 3
Practical: Discipline Specific Core Course (DSCC)
Title of the Course and Code:
DSCC 033 BOT 012: PLANT ANATOMY AND DEVELOPMENT BIOLOGY

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/ Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
033 BOT 012	DSCC	Practical	02	04	52 hrs	3hrs	25	25	50

LIST OF EXPERIMENTS TO BE CONDUCTED

Practical No.1
i) Study of meristem (Permanent slides/ Photographs).
ii) Study of Simple Tissues (Parenchyma, Collenchyma and Sclerenchyma) and Complex Tissues (xylem and phloem).

Practical No.2
Maceration technique to study elements of xylem and phloem, Study of primary structure of dicot root, stem and leaf (Sunflower) and monocot root, stem and leaf (Maize).

Practical No.3
Study of Normal secondary growth structure in dicot stem and root (Sunflower) and Anomalous secondary growth: *Aristolochia, Boerhaavia* (dicot stem) *Dracaena* (monocot stem).

Practical No. 4
Study of trichomes (any three types) and stomata (any three types) with the help of locally available plant materials.

Practical No. 5
Permanent slides of Microsporogenesis and male gametophyte Mounting of Pollen grains of Grass and Hibiscus and Pollinia of Calotropis.

Practical No. 6
Pollen germination (hanging drop method) and Effect of Boron and Calcium on pollen germination.

Practical No. 7
Permanent slides of types of ovules, Megasporogenesis & embryosac development and types of placentation: Axile, Marginal and Parietal types. Sectioning of ovary, for the studied types of placentation.

Practical No. 8
Mounting of embryo: Tridax and Cyamopsis, Mounting of endosperm: Cucumis.

Practical No. 09
Histochemical localization of proteins/ carbohydrates.

Practical No. 10 and 11
Mini project work in groups of 3-5 students, from the following list
a) Study of pollen morphology of different flowers with respect to shape, colour, aperture etc.
b) Pollen germination of different pollen grains and calculates percentage of germination.
c) Calculating percentage of germination of one particular type of pollen grain collected from different localities/ under different conditions.

d) Study of placentation of different flowers.
e) Any other relevant study related to Anatomy / Embryology.

Pedagogy
Scheme of Practical Examination (Distribution of Marks): 25 Marks for semester end Examination.

1. Practical: 15 (3X5 to cover all the Practicals) Marks/ Based on Nature of Practical/ Optional/Availability of specimen/ Infrastructure/ Sectioning and staining/ Mounting (may be modified).
2. Viva: 05 Marks.
3. Journal: 05 Marks.
   Total 25 Marks.
   Note: The same scheme may be used for IA (Formative assessment) Examination.

Text Books for Reference:

1. Bhojwani and Bhatnagar, Introduction to Embryology of Angiosperms –Oxford & IBH, Delhi
2. Bhojwani Sant Saran, 2014.Current Trends in the Embryology of Angiosperms**,** Woong-Young Soh, Springer Netherlands,
3. Coutler E. G. , 1969. Plant Anatomy – Part I Cells and Tissues – Edward Arnold, London.
4. Dickison, W.C. (2000). Integrative Plant Anatomy, Harcourt Academic Press, USA
5. Eames A. J. - Morphology of Angiosperms - Mc Graw Hill, New York.
6. Esau, K. 1990. Plant Anatomy, Wiley Eastern Pvt Ltd New Delhi
7. Evert, R.F. (2006) Esau's Plant Anatomy: Meristem, Cells, and Tissues of the Plant Body: Their Structure, Function and Development. John Wiley and Sons, Inc
8. Fahn, A.1992. Plant Anatomy, Pergamon Press, USA
9. Johri, B.M. l., 1984.Embryology of Angiosperms, Springer-Verlag, Netherlands.
10. Karp G., 1985. Cell Biology; Mc.Graw Hill Company
11. Maheshwari,P 1950. An introduction to the embryology of angiosperms. New York: McGraw-Hill
12. Mauseth, J.D. (1988). Plant Anatomy, the Benjammin/Cummings Publisher, USA.
13. Nair P .K .K - Pollen Morphology of Angiosperms - Scholar Publishing House, Lucknow
14. Pandey S.N. 1997, Plant Anatomy and Embryology. A. Chadha, Vikas Publication House Pvt Ltd;
15. Pandey, B. P., 1997. Plant Anatomy, S.Chand and Co. New Delhi
16. Raghavan, V., 2000. Developmental Biology of Flowering plants, Springer, Netherlands.
17. Saxena M. R. – Palynology – A treatise - Oxford & I. B .H., New Delhi.
18. Shivanna, K.R., 2003. Pollen Biology and Biotechnology. Oxford and IBH Publishing Co. Pvt.Ltd. Delhi.
19. Vashishta .P.C .,1984. Plant Anatomy – Pradeep Publications – Jalandhar
20. Vashishta, P.C. 1997. Plant Anatomy, Pradeep Publications.
21. N. N. Bhandari The Microsporangium.
22. F. Bouman The Ovule.
23. M. T. M. Willemse, J. L. van Went: The Female Gametophyte.
24. R. B. Knox :The Pollen Grain.
25. J. L. van Went, M. T. M. Willems :Fertilization.

B.Sc. – III Semester
Subject: Botany
Open Elective Course (OEC - 3)
(OEC for other students)
Code: OEC-003 BOT 051

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures / Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
003 BOT 051	OEC	Theory	03	03	42 hrs	2 hrs	40	60	100

OEC-3 (OEC for other students): 003 BOT 051
Title of the Paper: BOTANICAL GARDEN AND LANDSCAPING

Learning outcomes:

After the completion of this course the learner will be able to:

- Apply the basic principles and components of gardening
- Conceptualize flower arrangement and bio-aesthetic planning
- Design various types of gardens according to the culture and art of bonsai
- Distinguish between formal, informal and free style gardens
- Establish and maintain special types of gardens for outdoor and indoor land scaping

Keywords:

Gardening, Landscaping, Flower arrangement, Vertical gardens, Roof gardens, Computer aided designing

Unit I   **14 lectures**

Principles of gardening, garden components, adornments, lawn making, methods of designing rockery, water garden, etc. Special types of gardens, their walk-paths, bridges, constructed features. Green house, Special types of gardens, trees, their design, values in land scaping, propagation, planting shrubs and herbaceous perennials. Importance, design values, propagation, planting, climbers and creepers, palms, ferns, grasses and cacti succulents.

Unit II   **14 lectures**

Flower arrangement: importance, production details and cultural operations, constraints, post-harvest practices. Bio-aesthetic planning, definition, need, round country planning, urban planning and planting avenues, schools, villages, beautifying railway stations, dam sites, hydroelectric stations, colonies, river banks, planting material for play grounds.

Unit III   **14 lectures**

Vertical gardens, roof gardens. Culture of bonsai, art of making bonsai. Parks and public gardens. Land scape designs, Styles of garden, formal, informal and freestyle gardens, types of gardens, Urban land scaping, Land scaping for specific situations, institutions, industries, residents, hospitals, road sides, traffic islands, dam sites, IT parks, corporate. Establishment and maintenance, special types of gardens, Bio-aesthetic planning, eco-tourism, indoor gardening, therapeutic gardening, non-plant components, water-scaping, xeri-scaping, hardscaping; Computer Aided Designing (CAD) for outdoor and indoor scaping Exposure to CAD (Computer Aided Designing) components of a nursery, sowing, pricking, use of greenhouse for nursery production, propagation through cuttings, layering, grafting and budding.

Ethnobotany and Folk medicines. Definition; Ethnobotany in India: Methods to study ethnobotany; Applications of Ethnobotany: National interacts, Palaeo-ethno-botany. Folk medicines of ethnobotany, ethnomedicine, ethnoecology, ethnic communities of India.

Suggested Readings

1. Berry, F. and Kress, J. (1991). Heliconia: An Identification Guide. Smithsonian Books

2. Butts, E. and Stensson, K. (2012). Sheridan Nurseries: One hundred years of People, Plans, and Plants. Dundurn Group Ltd.

3. Russell, T.(2012). Nature Guide: Trees: The world in your hands (Nature Guides).

Details of Formative Assessment (IA) For DSCC theory/OEC: 40% weightage for Total Marks

Type of Assessment	Weightage	Duration	Comment
Written Test- 1	10%	1 hrs	8th Week
Written Test- 2	10%	1 hrs	12th Week
Seminar	10%	10 minutes	-----
Case study/ Assignment/ Field work/ Project work/ Activity	10%	-----	-----
Total	40% of the Maximum marks allotted for the Paper		

Faculty of Science
04- Year UG Honors Programme: 2022-23

General Pattern of Theory Question paper for DSCC/ OEC
(60 Marks for semester end Examination with 2 hrs duration)

Part-A
1. Question number 1-6 carries 2 marks each. Answer any 5 questions.   :10 marks

Part- B

2. Question number 7-11 carries 5 marks each. Answer any 4 questions.   :20 marks

Part- C

3. Question number 12- 15 carries 10 marks each. Answer any 3 question.   : 30 marks

(Minimum 1 question from each unit and 10 marks question may have sub questions for 7+3 or 6+4 or 5+5 if necessary)

Total: 60 Marks

Format for Model Question paper Unit wise
DSCC 033 BOT 012: PLANT ANATOMY AND DEVELOPMENT BIOLOGY

Question Number	Number of question to be set in Unit	Number of questions to be answered	Marks of each question	Max marks for the question
1	Unit-I ----2 Unit II ----1 Unit III ----1 Unit IV ----2 Total- 6	Lower Order Teaching Skills (LOTS) (Remembering and Learning)		
		5	2	10
2	Unit-I ----1 Unit II ----2 Unit III ----1 Unit IV ----1 Total- 5	High Order Teaching Skills (HOTS) (Analyzing, Evaluating and Creating Descriptive Question)		
		4	5	20
3	Unit-I ----1 Unit II ----1 Unit III ----1 Unit IV ----1 Total- 4	3	10	30

OEC-003 BOT 051
BOTANICAL GARDEN AND LANDSCAPING

Question Number	Number of question to be set in Unit	Number of questions to be answered	Marks of each question	Max marks for the question
1	Unit-I ----2 Unit II ----2 Unit III ----2 Total- 6	Lower Order Teaching Skills (LOTS) (Remembering and Learning)		
		5	2	10
2	Unit-I ----1 Unit II ----2 Unit III ----2 Total- 5	High Order Teaching Skills (HOTS) (Analyzing, Evaluating and Creating Descriptive Question)		
		4	5	20
3	Unit-I ----2 Unit II ----1 Unit III ----1 Total- 4	3	10	30

B.Sc.: Semester – IV
Subject: Botany
Discipline Specific Core Course (DSCC)
The Course Botany in III semester has two papers (Theory paper- 033 BOT 011 for 04 credits and Practical paper-033 BOT 012 for 02 credits) for 06 credits: Both the papers are compulsory, Details of the courses are as

Course no: 7
Course Code: 034 BOT 011

Number of Theory Credits	Total Lecture Hours/Semester	Number of Practical Credits	Total Practical hours/Semester
04	56	02	56

Title of the course (theory): DSSC ECOLOGY AND CONSERVATION BIOLOGY

Course outcome
Students will be able to

- Know the principles and concept of ecosystems- Components, productions,
  Energy and limiting factors.
- Know the concepts of productivity, measurements of productivity, food chain, food webs and trophic levels
- Understand the diversity and characters of major ecosystems – Aquatic (Marine and Freshwater), Terrestrial and Agricultural ecosystems
- Know the Concept of biotic community with their Size and structure of biotic community- Physiognomy, Life-forms, stratification, ecotones and concept of edge-effect.
- Understand the causes and patterns of ecological succession, concept of climax.
- Know the Concept of ecological niches, species coexistence, overlapping and niche segregation.
- Know the concept of Eutrophication, Heavy metal pollution, Ozone depletion, greenhouse effect, Global warming and its effect, Acid rains. Pesticide, particulate and nuclear radiation.
- Understand the Solid wastes. Noise Pollution. Pest population and its biological control, invasive species and their effects on native species in aquatic and terrestrial ecosystems.
- Know the Patterns of diversity in a community, Diversity measurement and indices.
- Understand the Global distribution of organisms, concept of islands, biodiversity hotspots. Methods of conservation of biodiversity.Centers for origin of cultivator plants.
- Know the population density, Natality and mortality. Life table, population growth curves, carrying capacity.
- Know the positive and negative interactions among the organisms.

Contents of Theory Course		
Unit 1	**Topics**	**Teaching Hours**
I	**Introduction to Ecology and Conservation Biology:** Definitions, Principles of Ecology, Brief History, Major Indian Contributions, Scope and importance. Ecological levels of organisation. **Ecological factors:** Climatic factors: light, temperature, precipitation and humidity. **Edaphic factors**: Soil and its types, soil texture, soil profile, soil formation; physico-chemical properties of soil - mineral particle, soil pH, soil aeration, organic matter, soil	14 hrs

I	humus and soil microorganisms. Topographic Factors: Altitude **Ecological groups of plants and their adaptations:** Morphological and anatomical adaptations of hydrophytes, xerophytes, epiphytes and halophytes.	
II	**Ecosystem Ecology:** Introduction, types of ecosystems with examples -terrestrial and aquatic, natural and artificial. Structure of ecosystem: Biotic and Abiotic components, detailed structure of a pond ecosystem. Ecosystem functions and processes: Food chain-grazing and detritus; Food web. Ecological pyramids -Pyramids of energy, biomass and number. Principles of Energy flow in ecosystem. Bio-geo chemical cycles: Gaseous cycles -carbon and nitrogen, Sedimentary cycle-Phosphorus. Ecological succession: Definition, types- primary and secondary. General stages of succession. Hydrosere and xerosere. **Community Ecology:** Community and its characteristics – frequency, density, Abundance, cover and basal area, phenology, stratifications, life-forms. Concept of Ecotone and Ecotypes. Intra-specific and Inter-specific interactions with examples. **Ecological methods and techniques:** Methods of sampling plant communities – transects and quadrates. Remote sensing as a tool for vegetation analysis, land use – land cover mapping. **Population Ecology:** Population and its characteristics – Population density, natality, mortality, age distribution, population growth curves and dispersal.	14 hrs
III	**Phytogeography and Environmental issues:** Theory of land bridge, theory of continental drift, polar oscillations and glaciations. Centre of origin of plant – Vavilov's concept, types. Phytogeographical regions – concept, phytogeographical regions of India. Vegetation types of Karnataka – Composition and distribution of evergreen, semi-evergreen, deciduous, scrub, mangroves, shoal forests and grasslands. An account of the vegetation of the Western Ghats. Pollution: Water pollution: Causes, effect, types; water quality indicators, water quality standards in India, control of water pollution (Waste water treatment). Water pollution disasters – National mission on clean Ganga , Minimata, Pacific gyre garbage patch, Exxon valdez oil spill. Air pollution: Causes, effect, air quality standards, acid rain, control. Soil pollution: Causes, effect, solid waste management, control measures of soil pollution.	14hrs
IV	**Biodiversity and its conservation:** Biodiversity: Definition, types of biodiversity - habitat diversity, species diversity and genetic diversity, Global and Indian species diversity. SDG's in biodiversity conservation. Values of Biodiversity – Economic and aesthetic value, Medicinal and timber yielding	14 hrs

		plants. NTFP. Threats to biodiversity. Concept of Biodiversity Hotspots, Biodiversity hot spots of India. Concept of endemism and endemic species. ICUN plant categories with special reference to Karnataka/ Western Ghats. Biodiversity Conservation- Indian forest conservation act, Biodiversity bill (2002). Conservation methods – *In-situ* and *ex-situ* methods *In-situ* methods –Biosphere reserves, National parks, Sanctuaries, Sacred grooves. *Ex-situ* methods-Botanical gardens, Seed bank, Gene banks, Pollen banks, Culture collections, Cryopreservation.	
	Total	**56 Hours**

SUGGESTED REFERENCE BOOKS:
1. Sharma, P.D. 2018. Fundamentals of Ecology. Rastogi Publications.
2. Odum E.P. (1975): Ecology By Holt, Rinert& Winston.
3. Oosting, H.G. (1978): Plants and Ecosystem Wadworth Belmont.
4. Kochhar, P.L. (1975): Plant Ecology. (9th Edn.,) New Delhi, Bombay, Calcutta-226pp.,
5. Kumar, H.D. (1992): Modern Concepts of Ecology (7th Edn.,) Vikas Publishing Co., New Delhi.
6. Kumar H.D. (2000): Biodiversity & Sustainable Conservation. Oxford & IBH Publishing Co Ltd. New Delhi.
7. Newman, E.I. (2000): Applied Ecology, Blackwell Scientific Publisher, U.K.
8. Chapman, J.L&M.J. Reiss (1992): Ecology (Principles & Applications). Cambridge University Press, U.K.
9. Malcolm L. Hunter Jr., James P. Gibbs, Viorel D. Popescu, 2020. Fundamentals of Conservation Biology, 4th Edition. Wiley-Blackwel.

10. Saha T. K., 2017. Ecology and Environmental Biology. Books and Allied Publishers.

B.Sc. BOTANY: Semester - 4
Theory: Discipline Specific Core Course (DSCC)
Title of the Course and Code:
DSSC 034 BOT 012: ECOLOGY AND CONSERVATION BIOLOGY

LIST OF PRACTICALS TO BE COUNDUCTED

Practical No.	Experiments
1	Determination of pH of different types of Soils, Estimation of salinity of soil/water samples.
2	Study of Ecological instruments – Wet and Dry thermometer, Altimeter, Hygrometer, Soil thermometer, Rain Gauge, Barometer, etc
3	Hydrophytes: Morphological adaptations in *Pistia, Eichhornia, Hydrilla, Nymphaea*. Anatomical adaptations in *Hydrilla*(stem) and *Nymphaea* (petiole).
4	Xerophytes: Morphological adaptations in *Asparagus, Casuarina, Acacia, Aloe vera, Euphorbiatirucalli*. Anatomical adaptations in phylloclade of *Casuarina* .
5	Epiphytes: Morphological adaptations in *Acampe, Bulbophyllum, Drynaria*.Anatomical adaptations in epiphytic root of *Acampe/ Vanda.* Halophytes: study of Viviparyin mangroves, Morphology and anatomy of Pneumatophores.
6	Study of a pond/forest ecosystem and recording the different biotic and abiotic components
7	Demonstration of different types of vegetation sampling methods – transects and quadrats. Determination of Density and frequency.
8	Application of remote sensing to vegetation analysis using satellite imageries
9	Field visits to study different types of local vegetations/ecosystems and the report to be written in practical record book.
10	Determination of water holding capacity of soil samples
11	Determination of Biological oxygen demand (BOD)
12	Determination of Chemical oxygen demand (COD)
13	Determination of soil texture of different soil samples.

Pedagogy
Scheme of Practical Examination (Distribution of Marks): 25 Marks for semester end Examination.

1. Practical: 15 (3X5 to cover all the Practicals) Marks/ Based on Nature of Practical/ Optional/Availability of specimen/ Infrastructure/ Sectioning and staining/ Mounting (may be modified).
2. Viva: 05 Marks.
3. Journal: 05 Marks.
   Total 25 Marks.
   Note: The same scheme may be used for IA (Formative assessment) Examination.

B.Sc. BOTANY – IV Semester
Open Elective Course (OEC - 4)
(OEC for other students)
Paper: MEDICINAL PLANTS IN HEALTH CARE
Code: OEC-004 BOT 051

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures / Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
OEC -004 BOT 051	OEC	Theory	03	03	42 hrs	2 hrs	40	60	100

Learning outcomes:

On completion of this course, the students will be able to:

- Recognize the basic medicinal plants
- Apply techniques of conservation and propagation of medicinal plants.
- Setup process of harvesting, drying and storage of medicinal herbs
- Propose new strategies to enhance growth of medicinal herbs considering the practical issues pertinent to India

Keywords:

Medicinal plants, Traditional systems, endangered medicinal plants, Ethnobotany, Folk medicines, Ethnic communities

Unit I: History and Traditional System of Medicine   14   lectures
History, Scope and Importance of Medicinal Plants; Traditional systems of medicine; Definition and Scope.

Ayurveda: History, origin, panchamahabhutas, saptadhatu and tridosha concepts, Rasayana, plants used in ayurvedic treatments,
Siddha: Origin of Siddha medicinal systems, Basis of Siddha system, plants used in Siddha medicine.
Unani: History, concept: Umoor-e-tabiya, tumors treatments / therapy, polyherbal formulations.

Unit II: Conservation, Augmentation and Ethnobotany and Folk Medicine

14   lectures

Conservation of Endemic and endangered medicinal plants, Red list criteria; *In situ* conservation: Biosphere reserves, sacred groves, National Parks; *Ex situ* conservation: Botanic Gardens, Ethnomedicinal plant Gardens.

Propagation of Medicinal Plants: Objectives of the nursery, its classification, important

Unit III Medicinal Plants   **14 lectures**

Brief description of selected plants and derived drugs, namely Guggul (*Commiphora*) for hypercholesterolemia, *Boswellia* for inflammatory disorders, Arjuna (*Terminalia arjuna*) for cardioprotection, turmeric (*Curcuma longa*)f or wound healing, antioxidant and anticancer properties, Kutaki (*Picrorhiza kurroa*) for hepatoprotection, Opium Poppy for analgesic and antitussive, *Salix* for analgesic, *Cincona* and *Artemisia* for Malaria, *Rauwolfia* as tranquilizer, Belladona as anticholinergic, *Digitalis* as cardiotonic, *Podophyllum* as antitumor.

Suggested Readings:

1. Akerele, O., Heywood, V. and Synge, H. (1991). The Conservation of Medicinal Plants. Cambridge University Press.
2. AYUSH (www.indianmedicine.nic.in). About the systems—An overview of Ayurveda, Yoga and Naturopathy, Unani, Siddha and Homeopathy. New Delhi: Department of Ayurveda, Yogaand Naturopathy, Unani, Siddha and Homoeopathy (AYUSH), Ministry and Family Welfare, Government of India.
3. CSIR- Central Institute of Medicinal and Aromatic Plants, Lucknow (2016). *Aush Gyanya*: Handbook of Medicinal and Aromatic Plant Cultivation.
4. Dev, S. (1997). Ethno-therapeutics and modern drug development: The potential of Ayurveda. *Current Science* 73:909–928.
5. Evans, W.C. (2009). Trease and Evans Pharmacognosy, 16[th]edn. Philadelphia, PA: Elsevier Saunders Ltd.
6. Jain, S.K. and Jain, Vartika. (eds.) (2017). Methods and Approaches in Ethnobotany: Concepts, Practices and Prospects. Deep Publications, Delhi
7. Kapoor, L.D. (2001). Handbook of Ayurvedic medicinal plants. Boca Raton, FL: CRC Press.
8. Saroya, A.S. (2017). Ethnobotany. ICAR publication.
9. Sharma, R.(2003). Medicinal Plants of India-An Encyclopaedia. Delhi: Daya Publishing House.
10. Sharma, R. (2013) Agro Techniques of Medicinal Plants. Daya Publishing House, Delhi.
11. Thakur, R.S., H.S. Puri, and Husain, A.(1989). Major medicinal plants of India. Central Institute of Medicinal and Aromatic Plants, Lucknow, India.

Details of Formative Assessment (IA) For DSCC theory/OEC: 40% weightage for Total Marks

Type of Assessment	Weightage	Duration	Comment
Written Test- 1	10%	1 hrs	8th Week
Written Test- 2	10%	1 hrs	12th Week
Seminar	10%	10 minutes	-----
Case study/ Assignment/ Field work/ Project work/ Activity	10%	-----	-----
Total	40% of the Maximum marks allotted for the Paper		

Faculty of Science
04- Year UG Honors Programme: 2022-23

General Pattern of Theory Question paper for DSCC/ OEC
(60 Marks for semester end Examination with 2 hrs duration)

Part-A

1. Question number 1-6 carries 2 marks each. Answer any 5 questions.   :10 marks

Part- B

2. Question number 7-11 carries 5 marks each. Answer any 4 questions.   :20 marks

Part- C

3. Question number 12- 15 carries 10 marks each. Answer any 3 question.   : 30 marks

(Minimum 1 question from each unit and 10 marks question may have sub questions for 7+3 or 6+4 or 5+5 if necessary)

Total: 60 Marks

Format for Model Question paper Unit wise
DSCC 034 BOT 011: DSCC ECOLOGY AND CONSERVATION BIOLOGY

Question Number	Number of question to be set in Unit	Number of questions to be answered	Marks of each question	Max marks for the question
1	Unit-I ----2 Unit II ----1 Unit III ----1 Unit IV ----2 Total- 6	Lower Order Teaching Skills (LOTS) (Remembering and Learning)		
		5	2	10
2	Unit-I ----1 Unit II ----2 Unit III ----1 Unit IV ----1 Total- 5	High Order Teaching Skills (HOTS) (Analyzing, Evaluating and Creating Descriptive Question)		
		4	5	20
3	Unit-I ----1 Unit II ----1 Unit III ----1 Unit IV ----1 Total- 4	3	10	30

OEC-004 BOT 051
MEDICINAL PLANTS IN HEALTH CARE

Question Number	Number of question to be set in Unit	Number of questions to be answered	Marks of each question	Max marks for the question
1	Unit-I ----2 Unit II ----2 Unit III ----2 Total- 6	Lower Order Teaching Skills (LOTS) (Remembering and Learning)		
		5	2	10
2	Unit-I ----1 Unit II ----2 Unit III ----2 Total- 5	High Order Teaching Skills (HOTS) (Analyzing, Evaluating and Creating Descriptive Question)		
		4	5	20
3	Unit-I ----2 Unit II ----1 Unit III ----1 Total- 4	3	10	30

KARNATAK UNIVERSITY, DHARWAD

Four - Year B.Sc. (Hons.) Program

SYLLABUS FOR III & IV SEMESTER

Course: ZOOLOGY

DISCIPLINE SPECIFIC CORE COURSE (DSCC) AND

OPEN ELECTIVE COURSE (OEC)

III-SEMESTER:

DSCC – 5: Molecular Biology, Bioinstrumentation and Techniques in Biology (Theory) - V (Code: 033ZOO011)

DSCC – 6: Molecular Biology, Bioinstrumentation and Techniques in Biology (Practical) - VI (Code: 033ZOO012)

OEC- 3: Endocrinology (Code: 003ZOO051)

IV-SEMESTER:

DSCC – 7: Gene Technology, Immunology and Computational Biology (Theory) - VII (Code: 034ZOO011)

DSCC - 8: Gene Technology, Immunology and Computational Biology (Practical) - VIII (Code: 034ZOO012)

OEC- 4: Animal Behaviour (Code: 004ZOO051)

Effective from 2022-23

AS PER N E P - 2020

Karnatak University, Dharwad
Subject: Zoology

Seme ster	Type of Course	Course Code	Instructio nhour / week (hrs)	Total hours of Syllabus / Semester	Duration of Exam (hrs)	Formative Assessment Marks	Summative Assessment Marks	Total Marks	Credits
III	DSCC-5: Molecular Biology, Bioinstrumentation and Techniques in Biology (Theory) - V	033ZOO011	04	56	02	40	60	100	04
	DSCC-6: Molecular Biology, Bioinstrumentation and Techniques in Biology (Practical) -VI	033ZOO012	04	52	03	25	25	50	02
	OEC- 3 Endocrinology	003ZOO051	03	42	02	40	60	100	03
IV	DSCC -7: Gene Technology, Immunology and Computational Biology (Theory) - VII	034ZOO011	04	56	02	40	60	100	04
	DSCC -8: Gene Technology, Immunology and Computational Biology (Practical) - VIII	034ZOO012	04	52	03	25	25	50	02
	OEC- 4: Animal Behaviour	004ZOO051	03	42	02	40	60	100	03
Details of the other semesters will be given later									

Programme Outcome (PO)

After the completion of 03/ 04 years Degree in Zoology, students will be able to:

PO 1: Students gain knowledge and skill in the fundamentals of animal sciences, understands the complex interactions among various living organisms

PO 2: Analyze complex interactions among the various animals of different phyla, their distribution and their relationship with the environment

PO 3: Apply the knowledge of internal structure of cell, its functions in control of various metabolic functions of organisms

PO 4: Understands the complex evolutionary processes and behaviour of animals

PO 5: Correlates the physiological processes of animals and relationship of organ systems

PO 6: Understanding of environmental conservation processes and its importance, pollution control and biodiversity and protection of endangered species

PO 7: Gain knowledge of agro based small scale industries like sericulture, fish farming, butterfly farming and vermicompost production

PO 8: Understands about various concepts of genetics and its importance in human health

PO 9: Apply the knowledge and understanding of Zoology to one's own life and work

PO 10: Develops empathy and love towards the animals

PO 11: Candidates find opportunities in government departments, environmental agencies, universities, colleges, biotechnological, pharmaceutical, environmental/ecological fields

PO 12: There are numerous career opportunities for candidates completing their B.Sc, M.Sc and Ph.D. in Zoology in public and private sectors

Programme Specific Outcomes (PSO)

PSO III:

PSO 1: Understanding of the processes of central dogma viz. transcription, translation etc. underlying survival and propagation of life at molecular level

PSO 2: Understanding how genes are ultimately expressed as proteins, which are responsible for the structure and function of all the organisms

PSO 3: Learn how four sequences (3 letter codons) generate the transcripts of life and determine the phenotypes of organisms

PSO 4: Understand the basics of various instruments like microscopes and bioinstruments

used in biological studies and their applications

PSO 5: They are able to understand the use of biological instrumentation and proper

laboratory techniques

PSO 6: The students will be acquiring basic experimental skills in various techniques in the fields of molecular biology

PSO 7: To learn various techniques used in biology like histochemistry and immunotechniques

PSO IV:

PSO 1: To understand the principles of genetic engineering and its applications

PSO 2: To understand the basics of immunology and various mechanisms involved in immunity and their response

PSO 3: Acquired skills in diagnostic testing, haematology, staining procedures used in clinical and research laboratories, will provide them opportunity to work in diagnostic or research laboratory.

PSO 4: Acquired practical skills in biostatistics, bioinformatics can be used to pursue career as a scientist in drug development industry in India or abroad.

PSO 5: To know various type of biostatistical and bioinformatics techniques

PSO 6: Students gain skills in basics of computers, operating systems, overview of programming languages, internet services, sequencing techniques

PSO 7: Attained knowledge of data collection, tabulation and presentation of data and measures of central tendency, probability and Chi-square test.

PSO 8: Know the applications of internet and statistical bioinformatics in research

B.Sc. Semester – III

DSCC-5: Molecular Biology, Bioinstrumentation and Techniques in Biology (Theory) - V (Code: 033ZOO011)

Course Outcome (CO):

After completion of this course (Theory)-V, students will be able to:

CO1: Acquire knowledge in the processes of central dogma of molecular biology

CO2: Understand about nucleic acids and protein biosynthesis.

CO3: Learn about different microscopes and biological instruments.

CO4: Students will acquire knowledge about replication, transcription, translation, post transcriptional and post translational modifications, gene regulation, DNA repair mechanisms and various other molecular tools and techniques

CO5: They will also know the different tools and techniques used in modern biology.

CO6: Understanding of basic concepts of laboratory instrumentation like different microscopes, micrometry etc.

CO7: Students gain skills in techniques of centrifugation, chromatography, electrophoresis, colorimetry and spectrophotometry etc.

Syllabus DSCC-5: Molecular Biology, Bioinstrumentation and Techniques in Biology (Theory)-V (Code: 033ZOO011)	Total Hrs: 56
Unit 1: Protein Biosynthesis:	**14 hrs**

1.1 Process of transcription
Fine structure of genes: Cistron, Recon and Muton
RNA polymerases- Types and functions
Synthesis of rRNA and mRNA
Transcription factors and machinery
Formation of initiation complex
Initiation, elongation and termination of transcription in prokaryotes and eukaryotes

1.2: Process of translation
The genetic code and its characteristics
Ribosomes –Structure and assembly
Factors involved in translation
Aminoacylation of tRNA, rRNA identity, Aminoacyl tRNA synthetase
Initiation, elongation and termination of translation in prokaryotes and eukaryotes

Unit-2 : Gene Expression:	**14 hrs**

2.1: Regulation of gene expression I
Regulation of gene expression in prokaryotes: *lac* and *trp* operons in *E. coli*
Regulation of gene expression in eukaryotes: Role of chromatin in gene expression
Regulation at transcriptional level; Post-transcriptional modifications; Capping, Splicing, Polyadenylation
RNA editing

2.2: Regulation of gene expression II
Regulation at translational level; Post- translational modifications; Protein folding, packaging and targeting
Intracellular protein degradation
Gene silencing and role of RNAi

Unit-3: Bioinstrumentation and Microtechniques:	**14 hrs**

3.1: Microscopy
Principle of microscopy and applications
Types of Microscopes: Light, Phase-contrast, Dark field, Confocal, Fluorescence and Electron microscopy

3.2: Microtechniques:
Fixation, embedding, microtomy: types, staining (simple and differential) and mounting
Principle and applications of micrometry

Unit 4:Techniques in Biology:	14 hrs

4.1: Biochemical techniques
    Principle and applications of centrifugation.
    Principle and applications of colorimeter and spectrophotometer.
    Principle and applications of chromatography; Types: thin layer, paper, column, HPLC.
 	
4.2:Molecular Techniques
    Nucleic acid fragmentation by Electrophoresis
    DNA sequencing
    Polymerase Chain Reaction (PCR)- Principle and applications
    Primer designing; DNA fingerprinting; RFLP
    Detection of proteins- PAGE, ELISA
    Blotting techniques	

Recommended Books/References:

1. Principles & Techniques Of Biochemistry And Molecular Biology Keith Wilson and John Walker 7th Edition Cambridge University Press (2010)
2. Lodish et al: Molecular Cell Biology: Freeman & Co, USA (2004).
3. Alberts et al: Molecular Biology of the Cell: Garland (2002).
4. Cooper: The Cell: A Molecular Approach: ASM Press (2000).
5. Karp: Cell and Molecular Biology: Wiley (2002).
6. Watson et al. Molecular Biology of the Gene. Pearson (2004).
7. Lewin. Genes VIII. Pearson (2004).
8. Pierce B. Genetics. Freeman (2004).
9. Sambrooket al. Molecular Cloning Vols I, II, III. CSHL (2001).
10. Primrose. Molecular Biotechnology. Panima (2001).
11. Clark and Switzer. Experimental Biochemistry. Freeman (2000)
12. Principles of Genetics Robert H. Tamarin WC B/McGraw-Hill (1999)
13. Animal Microtechniques by Humason(1962)

14. De- Robertis- Cell and Molecular Biology.
15. Verma, P.S. and Agrawal, V.K. Molecular Biology
16. Bioinstrumentation by L. Veerakumari

B.Sc. Semester – III

DSCC-6: Molecular Biology, Bioinstrumentation and Techniques in Biology (Practical) - VI (Code: 033ZOO012)

Course Outcomes (CO):

After completion of this Course (Practical) - VI, students will be able to:

CO 1: To understand the principle of qualitative and quantitative analysis of nucleic acids (DNA and RNA)

CO 2: Understand the basic principles and applications of bioinstruments and biotechniques

CO 3: Understand the basic principles of microscopy, working of different types of microscopes

CO 4: Understand the principle of measuring the concentrations of macromolecules in solutions by colorimeter and spectrophotometer

CO 5: Learn about some of the commonly used separation techniques like centrifugation, chromatography

CO 6: To know about measurement of cells types through micrometry and also to get knowledge about virtual labs

Syllabus

DSCC-6: Molecular Biology, Bioinstrumentation and Techniques in Biology (Practical) - VI (Code: 033ZOO012)

List of the experiments for 52 hrs / Semester

1. To study the working principle of Simple, Compound, Phase contrast, Fluorescent and Electron microscopy (TEM and SEM).
2. To study the working principle of various laboratory equipments: pH Meter, Electronic balance, Laminar air flow, Incubator, Water bath, Centrifuge, Micropipettes, Chromatography apparatus, Colorimeter , Spectrophotometer, PCR, Electrophoresis.

3. To prepare fixatives, stains and buffers.

4. To learn the working of measurement of the absorbance of any sample by using Colorimeter and/ or Spectrophotometer
5. Demonstration of differential centrifugation to fractionate different components in a mixture

6. To study Blotting techniques (working principle, procedure and applications)
7. Estimation of RNA by Orcinol method.
8. Estimate of DNA by Diphenyl Amine (DPA) method
9. Separation of dyes from mixtures by using circular paper chromatography
10. Isolation of DNA extraction from blood or any tissue samples.
11. Micrometry study of different cell types

12. Virtual labs:www. Labinapp.com;www.uwlax.edu; www.labster.com; www.onlinelabs.in; www.powershow.in

13. Visit to nearby University/Research Institutions for demonstration of molecular biology techniques, bioinstruments/ biotechniques for students (not mandatory)

14. Any other practical's related to this paper may be added based on the feasibility

Recommended Books/References:

1. Principles & Techniques of Biochemistry And Molecular Biology Keith Wilson and John Walker 7th Edition Cambridge University Press (2010)
   2. Lodish et al: Molecular Cell Biology: Freeman & Co, USA (2004).
   3. Alberts et al: Molecular Biology of the Cell: Garland (2002).
   4. Cooper: The Cell: A Molecular Approach: ASM Press (2000).
 5. Karp: Cell and Molecular Biology: Wiley (2002).
   6. Watson et al. Molecular Biology of the Gene. Pearson (2004).
   7. Sambrooket *al.* Molecular Cloning Vols I, II, III. CSHL (2001).
   8. Primrose. Molecular Biotechnology. Panima (2001).
   9. Clark & Switzer. Experimental Biochemistry. Freeman (2000)
   10. Principles of Genetics Robert H. Tamarin WC B/McGraw-Hill (1999)
11. Animal Microtechniques by Humason(1962)

12. Animal Microtechniques by Humason(1962)

   13. De- Robertis- Cell and Molecular Biology.
   14. Verma, P.S. and Agrawal, V.K. Molecular Biology
   15. Bioinstrumentation by L. Veerakumari

General instructions:

Perform all the experiments as per the instructions in each question.

Scheme of Practical Examination (distribution of marks): 25 marks for Semester endExamination

1. **Major Experiments**	08	**Marks**
2. **Minor Experiments**	05	**Marks**
3. **Identifications (A-D)**	08	**Marks**
4. **Viva**	02	**Marks**
5. **Journal**	02	**Marks**

_____
Total 25 Marks

Note: Same Scheme may be used for IA (Formative Assessment) examination

B.Sc. Semester – III

OEC- 3: Endocrinology (Code: 003ZOO051)

Course Outcome (CO):

After completion of this course, Endocrinology, students will be able to:

CO 1: Understand the endocrine system and their hormones

CO 2. Understand how endocrine systems function.

CO 3: Students should develop the ability to integrate across multiple endocrine systems

to better understand the complexity of endocrine-related disorders.

CO 4: Gain a general understanding of the approaches used to study various facets of

endocrinology.

CO 5: Understand the basic properties of hormones.

CO 6. Gain insight knowledge about different endocrine glands, their hormones and its regulation.

Syllabus OEC-3: Title- Endocrinology (Code: 003ZOO051)	Total Hrs: 42
Unit-1: Introduction to Endocrinology:	**14 hrs**
Aim and scope of Endocrinology History of endocrinology, characteristic and transport of hormones Endocrine system Hormones- types Hormones in invertebrates Structure of Pituitary gland; hormones and their functions, hypothalamo-hypophysial portal system, disorders of pituitary gland	

Unit-2: Endocrine Glands:	14 hrs
Structure, function and hormones of following glands and their hypo and hyper secretion disorders: -Pineal -Thyroid -Parathyroid -Adrenal -Pancreas	
Unit-3: Gastrointestinal and Reproductive Endocrine Glands:	**14 hrs**
Structure, function and hormones of gastrointestinal tract- hormonal disorders Structure, function and hormones of ovary, testis and placenta – hypo and hyper secretion disorders	

Recommended Books/References:

1. Hadley: Endocrinology (5th ed. 2000, Prentice-Hall)

2. Turner and Bagnara: General Endocrinology, 6th ed.1984, Saunders)

3. Norris: Vertebrate Endocrinology, Fourth Edition, 2007, Academic Press

4. John F- Laycock and Peter H. Wise, Essential of Endocrinology

5. Wiliaimas R.H.(1974). Textbook of Endocrinology V.Ed. Saunders Press, London.

6. Endocrinlogy- Hadley

7. General endocrinology Bagrara and Tumer, W.B. Saunders.

Details of Formative Assessment (IA) for DSCC/OEC (Theory):40% weightage for total marks

Type of Assessment	Weightage	Duration	Commencement
Written test-1	10%	1 hr	8th Week
Written test-2	10%	1 hr	12th Week
Seminar	10%	10 minutes	--
Case study / Assignment / Field work / Project work/ Activity	10%	------	--
Total	40% of the maximum marks allotted for the paper		

GENERAL PATTERN OF THEORY QUESTION PAPER FOR DSCC/ OEC

(60 marks for Semester end Examination with 2 Hrs duration)

Part-A

1. Question number 1-06 carries 2 Marks each. Answer any 05 questions : 10 marks

Part-B

2. Question number 07- 11 carries 05 Marks each. Answer any 04 questions   : 20 marks

Part-C

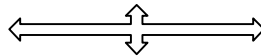3. Question number 12-15 carries 10 Marks each. Answer any 03

questions   : 30 marks

(Minimum 1 question from each unit and 10 marks question may

have sub- questions for 7+3 or 6+4 or 5+5 if necessary)

_____

Total: 60 Marks

Note: Proportionate weightage shall be given to each unit based on number of hours prescribed.

B.Sc. Semester – IV

DSCC- 7: Gene Technology, Immunology and Computational Biology (Theory) - VII (Code: 034ZOO011)

Course Outcome (CO):

After completion of this course (Theory)-VII, students will be able to:

CO 1: Understand the principles of genetic engineering, and its applications

CO 2: Understand how genes can be cloned and various technologies involved in gene manipulation

CO 3: Provides basics knowledge about immune system and allows the student to create insight as how to improve their immune system and good health.

CO 4: Types of immunity, antigens-antibodies and their properties, MHC's and immune responses

CO 5: Ability to understand concepts of tumor immunology and transplantation immunology

CO 6: Get introduced to computers and use of bioinformatic tools in biology

CO 7: To learn about various biostatistical and bioinformatical techniques in biological research

CO 8: Application of internet and statistical bioinformatics in biological research

Syllabus	Total Hrs: 56
DSCC- 7: Gene Technology, Immunology and Computational Biology (Theory) - VII (Code: 034ZOO011)	
Unit-1: Genetic Engineering and Applications:	**14 hrs**
1.1: Principles of gene manipulation Recombinant DNA Technology Restriction enzymes, DNA modifying enzymes; Ligation; Cloning Vectors Gene transfer techniques (direct and indirect) Selection and identification of recombinant cells **1.2: Applications of genetic engineering** Production of single cell proteins; Biosensors, Biochips, Live stock improvement; Development of transgenics Development of DNA drugs and vaccines Gene therapy	
Unit-2: Basic Immunology:	**14 hrs**
2.1: Introduction to the immune system Historical perspective of immunology Types of immunity; Innate and acquired Organs of immune system: Thymus, Bone marrow, Spleen, Lymph node. Cells involved in immune response: T and B-lymphocytes (Humoral immunity and Cell mediated immunity), NK cells, K cells , Macrophages, WBC and Mast cells **2.2: Antigens and antibodies** Structure and function of antigen, types of antigens, antigenicity; Antigen – Antibody reaction. Immunoglobulins: Structure and functions of different classes of immunoglobulins Major Histocompatibility Complex (MHC) Hypersensitivity- Allergens; Allergy: causes and types	

Unit-3: Clinical Immunology:	14 hrs
Immunity against viral (HIV), bacterial (Tuberculosis) and parasitic (Malaria) infection Vaccines: Types and uses Transplantation immunology: Brief account on transplantation of organs with suitable examples ; Types of graft rejection, Immuno-suppressors	

Unit-4: Computational Biology:	14 hrs
4.1: Biostatistics Measures of central tendency: Mean, Median, Mode, Standard deviation Concept of Correlation and Regression Data summarizing: Frequency distribution, Graphical presentation—bar, pie diagram, Hstogram Elementary idea of Probability and applications Tests of significance: ANOVA, t-test and Chi square test **4.2: Computer basics and bioinformatics** Basics of computers (CPU, I/O units), operating systems, concepts of home pages and websites. World Wide Web (WWW) , URLs, using search engines Introduction to bioinformatics: Importance, applications and limitations Databases: nucleic acids, genomes, protein sequences and structures, Bibliography Sequence analysis (homology): Pairwise and Multiple Sequence alignment-BLAST, CLUSTALW Phylogenetic analysis	

Recommended Books/References:

1. Primrose &Twyman. Principles of Genome Analysis and Genomics. Blackwell (2003).
2. Hartl& Jones. Genetics: Principles & Analsysis of Genes & Genomes. Jones & Bartlett
        (1998).
3. Sambrook *et al* .Molecular Cloning Vols I, II, III. CSHL (2001).
4. Primrose. Molecular Biotechnology. Panima (2001).

5. Biostatistical Analysis (Fourth Edition) by Jerrold H. Zarr, Pearson Education Inc.,

   Delhi.
6. Statistical Methods (Eighth Edition) by G. W. Snecdecor and W. G. Cochran, Willey
            Blackwell
7. Biostatistics (Tenth Edition) by W.W. Daniel and C. L. Cross, Wiley
8. Introductory Biological Statistics (Fourth Edition) by John E. Havel, Raymond E. Hampton and Scott J. Meiners
9. Westhead *et al* Bioinformatics: Instant Notes. Viva Books (2003)
10. An Introduction to Genetic Engineering by Desmond S. T. Nicholl
11. Fundamental Immunology by William E. Paul
12. A Textbook of Immunology by Dr. P Madhavee Latha
13. Basic Bioinformatics by S. Ignacimuthu
14. Kuby Immunology by Punt, W. H. Freeman
15. Introduction to Bioinformatics (2003) by T.K. Attwood & D.J. Parry
16. Introduction to Biostatistics by Dr. Pranab Kr. Banarjee.

17. Bioinformatics: Sequence and Genome Analysis by David W. Mount.

18. Basic Bioinformatics by S. Ignacimuthu Published by Narosa Publishing House New
    Delhi

B.Sc. Semester – IV

DSCC-8: Gene Technology, Immunology and Computational Biology (Practical) – VIII (Code: 034ZOO012)

Course Outcomes (CO)

After completion of this course (Practical)-VIII, students will be able to:

CO 1: Understand the principles of genetic engineering with hands on experiments in detection of diseases

CO 2: Get introduced to DNA testing and utility of genetic engineering in forensic sciences.

CO 3: Understand the basics of immunology and its applications in clinical research.

CO 4: Study on immune system and its components

CO 5: Apply knowledge and awareness of the basic principles and concepts of biology, computers science and mathematics existing software's effectively to extract information from large data bases to use this in computer modeling

CO 6: Use bioinformatics tools to find out evolutionary/ phylogenetic relationship of organisms using gene /protein sequences

CO 7: Understand and can apply biostatistics and bioinformatics tools in research.

Syllabus

DSCC-8: Gene Technology, Immunology and Computational Biology (Practical) - VIII (Code: 034ZOO012)

List of the Experiments for 52 hrs / Semesters

1. To study Restriction enzyme digestion using teaching kits.
2. To study Polymerase Chain Reaction (PCR) using teaching kits.
3. Demonstration of Agarose gel electrophoresis for detection of DNA
4. Demonstration of Polyacrylamide Gel Electrophoresis (PAGE) for detection of proteins.
5. To calculate molecular weight of unknown DNA and protein fragments from gel pictures.
6. Determination of ABO Blood group and Rh factor
7. To study of lymphoid organs: Thymus, Bone marrow, Spleen, Tonsil, Lymph node (Slides /Charts/ Video)
8. Study of immune-techniques (ELISA, RIA)
9. Preparation of blood smears to study various blood cells like RBC, WBC, Platelets, Lymphocytes & Monocytes
10. Separation of different blood cells like RBC, WBC, Platelets, Lymphocytes & Monocytes
11. Calculate Mean, Median, Mode, Standard deviation for a given set of samples.
12. Measure the height and weight of all students in the class and apply statistical measures.
13. To learn about basics of computer applications in biology
14. To learn nucleotide sequence database
15. To learn sequence alignment: Pairwise alignment
16. Accessing biological database
17. To learn sequence analysis using BLAST
18. To learn multiple sequence alignment using CLUSTALW
19. To learn about phylogenetic analysis using the programme PHYLIP
20. Visit to nearby University/Research Institutions for demonstration of genetic engineering / Immunology/Bioinformatic techniques for students

21. Any other practical's related to this paper may be added based on the feasibility

Recommended Books/References:

1. Primrose &Twyman. Principles of Genome Analysis and Genomics. Blackwell (2003).
2. Hartl& Jones. Genetics: Principles &Analsysis of Genes & Genomes. Jones & Bartlett(1998).
3. Sambrook *et al* .Molecular Cloning Vols I, II, III. CSHL (2001).
4. Primrose. Molecular Biotechnology. Panima (2001).
5. An Introduction to Genetic Engineering by Desmond S. T. Nicholl
6. Principles of Genetics by D. Peter Snustad and Michael J. Simmons
7. Fundamental Immunology by William E. Paul
8. A Textbook of Immunology by Dr. P Madhavee Latha
9. Basic Bioinformatics by S. Ignacimuthu
10. Kuby Immunology by Punt, W. H. Freeman
11. Introduction to Bioinformatics (2003) by T.K. Attwood & D.J. Parry
12. Statistical Methods by G. W. Snecdeor and W. G. Cochran, Willey Blackwell.
13. Introductory Biological Statistics by John E. Havel, Raymond E. Hampton and Scott J. Meiners.

General instructions:

Perform all the experiments as per the instructions in each question.

Scheme of Practical Examination (distribution of marks): 25 marks for Semester endExamination

1. Major Experiments	08 Marks
2. Minor Experiments	05 Marks
3. Identifications (A-D)	08 Marks
4. Viva	02 Marks
5. Journal	02 Marks
	Total 25 marks

Note: Same Scheme may be used for IA (Formative Assessment) examination

B.Sc. Semester – IV

OEC – 4: Animal Behaviour (004ZOO051)

Course Outcomes (CO)

After completion of this course, Animal Behaviour students will be able to:
CO 1: Understand types of animal behaviour and their importance to the organisms

CO 2: Explain about behaviour, migration and communication in animals

CO 3: Understand about ecological aspects of behaviour and social behaviour

CO 4: Understand animal behaviour and response of animals to different instincts

CO 5: Understand the proximate controls of behavior including the role of pheromones

CO 6: Learn about reproductive behaviour and parental care in animals

Syllabus OEC-4: Animal Behaviour (Code: 004ZOO051)	Total Hrs: 42
Unit-1: Introduction to Animal Behaviour	**14 hrs**
Origin, History, Aim and Objectives of Ethology Brief profile of Karl Von Frish, Ivan Pavlov, Konard Lorenz Types of behaviors: Innate behavior (Stereotype behaviour) : Kinesis, Taxes, Reflexes, Instincts and Motivation with suitable examples Acquired behavior (Learnt behavior): Imprinting, Habituation, Trial and error learning.	
Unit-2: Social Behaviour and Communication:	**14 hrs**
Social behavior in insects- Honey bee and termites; Advantages of waggle dance. Social system in Primates- Monkey and Apes Communication in animals- Visual, Olfactory, Mimicry, Bioluminiscence Pheromones: Types and functions	
Unit-3: Parental Care and Courtship Behaviour:	**14 hrs**
Parental care in fishes and amphibians with suitable examples Special/ unique behavior- Courtship behavior in animals, Altruism, kin selection with suitable examples Sexual dimorphism, Mate choice, Intra-sexual selection (male rivalry), Inter-sexual selection (female choice) Sexual conflict in parental care.	

Recommended Books/References:

1. Drickameré Vessey: Animal Behaviour, Concepts, Processes and Methods (Wadsworth)

2. Grier: Bilogy of Animal Behaviour (Mosby College)

3. Immelmann: Introduction to Ethology (Plenum Press)

4. Lorenz: The Foundation of Ethology (Springer-Verlag)

5. Manning: An Introduction to Animal Behaviour (Addison - Wesley)

6. McFarland: Animal Behaviour, Psychology, Ethology and Evolution (Pitman)

7. Price & Stoker: Animal behaviour in laboratory and field (Freeman)

8. Wood-Gush: Elements of Ethology (Chapman and Hall)

9. Animal Behaviour by Alock (2013)

11. Introduction to Animal Behaviour by Manning A. & M.S.Dawkins (2012)

12. Ecology by Charles J. Krebs (2009)

13. Elements of Ecology by Clarke (2015).

Details of Formative Assessment (IA) for DSCC /OEC (Theory):40% weightage for total marks

Type of Assessment	Weightage	Duration	Commencement
Written test-1	10%	1 hr	8th Week
Written test-2	10%	1 hr	12th Week
Seminar	10%	10 minutes	--
Case study / Assignment / Field work / Project work/ Activity	10%	------	--
Total	40% of the maximum marks allotted for the paper		

GENERAL PATTERN OF THEORY QUESTION PAPER FOR DSCC/ OEC

(60 marks for Semester end Examination with 2 hrs duration)

Part-A

1. Question number 1-06 carries 2 Marks each. Answer any 05 questions

    : 10 marks

Part-B

2. Question number 07- 11 carries 05 Marks each. Answer any 04 questions

    : 20 marks

Part-C

3. Question number 12-15 carries 10 Marks each. Answer any

03 questions   : 30 marks

   (Minimum 1 question from each unit and 10 marks question

   may have sub
   questions for 7+3 or 6+4 or 5+5 if necessary)

                                                                                   _____
                                                                             _____

                                                                       **Total:
                                                                       60 Marks**

Note: Proportionate weightage shall be given to each unit based on number of hours prescribed.