Dr. Babasaheb Ambedkar Marathwada University,

Aurangabad - 431004 (MS) India

Undergraduate Bachelor Degree Program in Science

B. Sc. (Non Conventional and Conventional Energy)

Course Structure and Curriculum

(Outcome based Curriculum)

Choice Based Credit System

(Effective from Academic Year 2022-23)

Dr. Babasaheb Ambedkar Marathwada University,

Aurangabad - 431004 (MS) India

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1. Preamble

Energy Science has contributed a great deal towards national development by training students to take up leadership roles in extension and community outreach programs. The students are encouraged to develop a scientific temper. Familiarizing them with the use of newer technologies, methods in family and community linkages, and sustainable use of resources for human development are the hall mark of education in Energy Science. As a discipline Energy Science integrates the ingredients of the sciences, social sciences and technology to facilitate the study of and enhance the quality of human life. Its approach is therefore inherently interdisciplinary. Traditionally, Energy Science has adopted an ecological approach in its curriculum that engages the student through teaching, research and extension. The education process in Energy Studies underscores the importance of the individual's dynamic relationship with his/her family, community and society as a whole, as well as with the resources in the environment. Higher education learning in Energy Science subjects provides students the opportunity to sharpen their capacities with a sense of social responsibility.

In contemporary times, Scientists promote capacity building of individuals and communities for social and economic empowerment. They train community women and youth from various strata of society for entrepreneurship. Many Scientists have done exceptionally well as entrepreneurs themselves. They do not remain job seekers but have also become job creators. They gain and provide employment in research organizations, industries, education and development domains, accreditation of green Energy buildings, strategic planning and Energetic technologies. Keeping in view the growing aspirations of today's youth and the capacity of Energy Science discipline to deliver, the present 3-year choice based credit system has been drawn up.

2. Vision

The vision of Programme is to promote the installation of power plants based on renewable energy sources for Energy Security. To promote the energy conservation measures for efficient use of energy resource. To promote green building design for efficient use of energy in housing, commercial and industrial sector.

3. Mission

- To produce socially committed resourceful generation of citizens capable of willing to should Environmental responsibilities with a deep sense of morality.
- To empowerment of students of rural and urban people through learning of the Energy management skills Environmental resources management
- To enhance the employable opportunities of the students.

4. Program Educational Objectives (PEOs)

The objectives of the present B.Sc. Program Non Conventional and Conventional Energy course are:

- To develop the human recourse in Energy sector which is the need of the hour.
- To create the people who will teach the science of Non Conventional & Conventional Energy, this will be also helpful for the promotion of Research in this field.
- To create several self-employment opportunities in Non Conventional & Conventional Energy efficiency sectors for modestly-trained and self-trained human resources exist in all geographic locations of the country.
- It will help to develop the skills required in energy and energy management fields.
- To develop proficiencies and skills for becoming successful scientist, technicians in energy sector.
- To develop the expertise for the innovation of different skills and its implementation in energy Sector.
- To explore the different techniques in energy sector.

5. Program Outcome (POs)

- Develop basic skills for Energies.
- Develop understanding of Renewable Energy management.
- Gain better understanding and knowledge about different stages of Non Conventional and Conventional Energy Resources.

6. Applicability of the Grading System

These guidelines shall apply to all undergraduate level degree, diploma and certificate programs under the credit system awarded by the University.

7. Definitions of Key Words

7.1. Academic Year: Two consecutive (one odd + one even) semesters constitute one academic year.

7.2. Choice Based Credit System (CBCS): The CBCS provides choice for students to select from the prescribed courses (core, elective or minor or soft skill courses).

7.3. Course: Usually referred to, as 'papers' is a component of a program. All courses need not carry the same weightage. The courses should define learning objectives and learning outcomes. A course may be designed to comprise lectures/ tutorials/laboratory work/ field work/outreach activities/project work/vocational training/viva/seminars/term papers/ assignments / presentations/self-study etc. or a combination of some of these.

7.4. Credit Based Semester System (CBSS): Under the CBSS, the requirement for awarding a degree or diploma or certificate is prescribed in terms of number of credits to be completed by the students.

7.5. Credit Point: It is the product of grade point and number of credits for a course.

7.6. Credit: A unit by which the course work is measured. It determines the number of hours of instructions required per week. One credit is equivalent to one hour of teaching (lecture or tutorial) or two hours of practical work/field work for 15 weeks in a semester.

7.7. Cumulative Grade Point Average (CGPA): It is a measure of overall cumulative performance of a student over all semesters. The CGPA is the ratio of total credit points secured by a student in various courses in all semesters and the sum of the total credits of all courses in all the semesters. It is expressed up to two decimal places.

7.8. Grade Point: It is a numerical weight allotted to each letter grade on a 10-point scale.

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

7.10. Program: An educational program leading to award of a Degree, diploma or certificate.

7.11. Semester Grade Point Average (SGPA): It is a measure of performance of work done in a semester. It is ratio of total credit points secured by a student in various courses registered in a semester and the total course credits taken during that semester. It shall be expressed up to two decimal places.

7.12. Semester: Each semester will consist of 15 weeks of academic work equivalent to 90 actual teaching days. The odd semester may be scheduled from July to December and even semester from January to June.

7.13. Transcript or Grade Card or Certificate: Based on the grades earned, a grade certificate shall be issued to all the registered students after every semester. The grade certificate will display the course details (code, title, number of credits, grade secured) along with SGPA of that semester and CGPA earned till that semester.

8. Duration of the programs, requirement and Options

The total duration of the B.Sc. NCCE program shall be of 3 years. The pattern of CBCS program shall be of semester type. There shall be **SIX** semesters each of six months duration. Each semester shall consist of at least 15 weeks of study with minimum of 90 working days (Including the time spent for the conduct of final examination of each semester). The candidate shall complete courses equivalent to at least 149 credits to become eligible for the Regular Bachelor Degree. He/she shall be eligible to rejoin the program within three years to complete the degree. Further, all candidates will be awarded Bachelor Degree on successfully completion of SIX semesters (Three academic years) of the undergraduate program.

9. Eligibility for Admission

9.1. B.Sc. NCCE: A candidate who has passed the 10+2 Science examination conducted by the State Education Board or any other examination considered as equivalent thereto shall be eligible for admission to this program. Generally a candidate to opt a subject should have studied that subject at the qualifying examination.

9.2. B.Sc. NCCE: A Candidate who passed Diploma in Engineering of Government of Maharashtra, as well as the students who passed the XIIth Vocational are eligible for B.Sc. 'A' Group subject such as Chemistry, Physics, Mathematics, Electronics and Computer Science.

10. Maximum Period for Completion of the Program

The candidate shall complete the program within the period as prescribed in the regulation governing the maximum period for completing various degree/diploma programs from the dates of admission. It is generally twice the number of years of the program. The term completing the program means passing all the prescribed examinations of the program to become eligible for the degree.

11. Medium of Instruction: The medium of instruction and examination shall be English

12. Outline of Choice Based Credit System

An undergraduate program degree in science disciplines may be awarded if a student completes 3 core papers each in three disciplines of choice, 2 Ability Enhancement Compulsory Courses (AECC), minimum 4 Skill Enhancement Courses (SEC) and 2 papers each from a list of Discipline Specific Elective papers based on three disciplines of choice selected.

12.1 Detailed description of courses.

1. **Core courses:** A course, which should compulsorily be studied by a candidate as core requirement is termed as Core course.
2. **Elective courses:** Generally, a course which can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline/ subject of study or which provides an extended scope or which enables an exposure to some other discipline/subject/domain or nurtures the candidate's proficiency/skill is called an Elective Course.

i. **Discipline Specific Elective (DSE) Course**: Elective courses offered under the main discipline/subject of study are referred to as Discipline Specific Elective.

ii. **Dissertation/Project***:An elective course designed to acquire special/advanced knowledge, such as supplement study/ support study to a project work, and a candidate studies such a course on his own with an advisory support by a teacher/faculty member is called dissertation / project.

3. **Ability Enhancement Courses (AEC):** The Ability Enhancement Courses may be of two kinds: Ability Enhancement Compulsory Courses (AECC) and Skill Enhancement Courses (SEC). These are mandatory for all disciplines.

1. **Ability Enhancement Compulsory Courses (AECC):**
   - **a.** English Communication skill/Basic Mathematics/Computer Course.
   - **b.** Environmental Science

2. Skill Enhancement Courses (SEC): SEC courses are value-based and/or skill-based and are aimed at providing hands-on-training, competencies, skills, etc.

- **Practical's and/Tutorials** (One each with every core and discipline /generic specific elective paper).
- **Introducing Research Component in Under-Graduate Courses**
  Project work/Dissertation is considered as a special course involving application of knowledge in solving/analyzing/exploring a real life situation/difficult problem. A Project/Dissertation work would be of 6 credits. A Project/Dissertation work may be given in lieu of a discipline specific elective paper

A Norms & Procedure for Extra Credit Benefit for NSS, NCC or Sport Participation: - Universities/Institutes may evolve a system/policy about Extra Curricular Activities/ General Interest and Hobby Courses /Sports / NCC / NSS / Vocational courses / related courses on their own. **Evaluation of co-curricular and extension activities shall be as per the procedure evolved by the university from time to time.**

B. Course Pattern, Credit distribution and Scheme of Examination

The details of course patterns (hours of instruction per week) with course code and the scheme examination are given in detail. The syllabi of the course shall be as prescribed by the university.

Skill Enhancement Courses: Any four skill development courses in the third, fourth, fifth and sixth semesters, one in each semester as prescribed by respective Board of Studies, the concern faculty and approved by the Academic Council. Any one SEC course to be chosen (any one fromthree optional subjects) from the basket of SEC courses.

a. The SEC consists of lecture course and practical course, as decided by respective B.O.S.
b. All three SEC (Skill Enhancement Courses) have 2 credits in respective semester.

13 Rules and regulation

13.1 Number of Core papers for all Universities has to be same for both UG Honors as well as UG Program.

13.2 Credit score earned by a student for any elective paper has to be included in the student's overall score tally irrespective of whether the paper is offered by the parent university (degree awarding university/institute) or not.

13.3 The university/Institute may plan the number of seats per elective paper as per the facility and infrastructure available.

13.4 Total number of credits required for the completion of programs is 149 credits.

13.5 The credit(s) for each theory paper/practical/tutorial/project/dissertation will be as per the details given in A, and table 1to 6 for B.Sc. Program.

13.6 CGPA will be calculated on the basis of core 149 credits only.

13.7 Each theory credit is equivalent to 15 clock hours of teaching and each practical credit is equivalent to 30 clock hours of teaching in a semester.

13.8 There is 15 weeks of teacher-student interaction during the semester.

13.9 The Universities/Institutes may offer any number of choices of papers from different disciplines under Generic Elective and Discipline Specific Elective as per the availability of the courses/faculty.

13.10 Universities/Institutes may evolve a system/policy about Extra Curricular Activities/ General Interest and Hobby Courses /Sports / NCC / NSS / Vocational courses / related courses on their own.

13.11 A student can opt for more number of Elective and AE Elective papers than proposed under the model curriculum of UGC. However the total credit score earned will not exceed 149 credits for UG Program degree.

13.12 The new scheme of UG courses should be given due consideration while framing the admission eligibility requirement for PG/Technical courses in Indian Universities / Institutions to ensure that students following inter and multi-disciplinary format under CBCS are not at a disadvantage. It is suggested that wherever required, obtaining 24 credits in particular discipline may be considered as the minimum eligibility, for admission in the concerned discipline, for entry to PG/Technical courses in Indian Universities/Institutions.

13.13 The student can perform their project any one of the optional subjects.

13.14 The project of the student should be examined by the external examiner at the time of ESE practical course.

13.15 Project work has a weightage of 2 credits as par mentioned in syllabus.

13.16 SL and English Communication are added as "General Interest & Hobby courses" in "AECC''.

13.17 Each theory lecture is of 50 minutes

13.18 There shall be Five (5) lectures/week of 50 minutes each for 3 credits to Ability Enhancement compulsory courses (AECC) "English Communication" to align with existing B.Sc. Pattern.

13.19 There shall be Four (4) lectures/week of 50 minutes each for 3 credits to Ability Enhancement compulsory courses (AECC) "SL " to align with existing B.Sc. Pattern**.**

13.20 Two credits course of 50 Marks "**Constitution of India"** is mandatory to all faculties as per Dr. Babasaheb Ambedkar Marathwada University Letter Ref. No. SU/Con./I Yr/Cur/2020/7416-25 dated 28.01.2020.

13.21 Compulsory "Computer and information Technology Course "is mandatory for science faculty as per Dr. Babasaheb Ambedkar Marathwada University regulation 1473, Reference No. ACD/NP/COMP.SCI.ENV.SCI./20086587-6786 dated 20.06.2008.This course may be included in SEC course.

13.22 For all faculty environmental studies is mandatory course for all faculties as per Dr. Babasaheb Ambedkar Marathwada University regulation 1473. Reference No. ACD/NP/COMP.SCI.ENV.SCI./20086587-6786 dated 20.06.2008.

14 Attendance and change of subject:

14.1 A candidate shall be considered to have satisfied the requirement of attendance for a semester if he/she attends not less than 75% of the number of classes actually held up to the end of the semester in each subjects. There shall be no minimum attendance requirement for the Co-curricular and extension activities**.**

14.2 An option to change a language /subject may be exercised only once within four weeks from the date of commencement of the Ist semester**.**

14.3 Wherever a change in a subject is permitted the attendance in the changes subject shall be calculated by taking into consideration the attendance in the previous subjects studied.

14.4 If candidate represents his/her institution/university/Maharashtra state/Nation in sports/NCC/NSS/Cultural or any officially sponsored activities he/she may be permitted to claim attendance for actual number of days participated, based on the recommendation of the Head of the Institution concern. If a candidate is selected to participate in national level event such as Republic Day Parade etc., he/she may be permitted to claim attendance for actual number of days participated based on the recommendation of the Head of the Institution concerned.

15 Examination and Assessment rules

15.1 Assessment shall consist of End of Semester Examination (ESE) and Continuous Assessment (CA). The CA will be a continuous activity (Internal) conducted by Concern College and ESE will be conducted by university. Each CA & ESE shall have weightages of 10:40. There shall be combine passing for CA and ESE.

15.2 Weightages- for 2 Credits (50 Marks) paper:

15.3 CA = 10 marks and ESE = 40 marks (MCQ =10 & Subjective & descriptive questions = 30 marks on entire syllabus).

15.4 Continuous Internal Assessment (CA)

15.5 Methods of assessment for internal examination (CA):

a. **Theory (10 marks**) – Internal test 5 marks (Two internal tests of 5 marks each and average of two test will be considered) and five marks for assignment/tutorials **(**Written test, Field work, Assignment, Internship, Seminar presentation, Industrial Practicum, Case study, Project work (on approval of the Head of the Centre).

b. **Practical-**(10 marks); 7 Marks for internal practical examination and 3 Marks for record book/submission of collection and filed survey report and excursion tour for each semester.

15.6 A student should obtained 40% marks in the combined examination of CA and ESE with a minimum passing of 40%.

15.7 To pass the UG degree program, a student shall have to obtain a minimum aggregate of 40% marks (P and above in the grade point scale) in each course.

15.8 If a student remains absent or fails in an internal assessment examination, he/she will have a second chance with the endorsement of the principal in consultation with the concerned teacher and Head of the department. The Principal in the consultation with the concerned teacher and HOD shall decide about the genuineness of the case and decide to conduct special test to such candidate on the date suitable to the concerned teacher but before commencement of the concerned semester end examination. Such a second chance shall not be the right of student.

15.9 The marks of CA shall be published on the notice board of the department/college for information of students.

15.10 The CA marks shall be communicated to the Director, Board of Examination and Evaluation at least 10 days before the commencement of the University examinations.

15.11 CA marks shall not change. A student cannot repeat CA. In case she/he wants to repeat CA, then she/he can do only by registering their names for course during the semester in which the course is conducted and up to 3 years program provided the student has failed in that course.

15.12 Internal assessment marks shall be shown separately in the marks card. Candidate who has failed or rejected the result, shall retain the internal assessment marks.

15. Registration for (ESE) Examination: A candidate shall register for all the papers of a semester when he/she appears for the examination of that semester for the first time.

15.1 Conduct of examination

The 3 years B.Sc. NCCE CBCS Program shall consist of 3 years consisting of 2 semesters each. Semester examination for theory papers shall be held at the end of each semester. The practical examination shall be held at the end of each semester/year.

15.2 The outline of the distribution of maximum marks for various aspects / mechanism towards ESE (Theory and Annual practical Examination) is as follows

a. Theory examination: ESE = 40 marks (MCQ =10 & subjective & descriptive questions = 30 marks on entire syllabus)

b. practical Examination

Total marks 50 for each practical paper of B. Sc. NCCE For annual examination

1. Experimental Performance: 40 marks
3. Viva-Voce on experiments -10 marks
4. Certified Journal should be produced by the candidate at the time of ESE practical examination.
5. The practical examination shall be conducted by two Examiners (one internal and one external) per batch.
6. The statement of marks sheet and the answer books of practical examination shall be sent to the Director, Board of Examination and Evaluation by the Principal of the respective colleges respectively immediately after the practical examinations.

16. Letter Grades and Grade Points (Completion of degree)

The Dr. Babasaheb Ambedkar Marathwada University, Aurangabad has decided to implement "absolute grading" system. A student who earns 149 credits, shall be considered to have completed the requirement of B.Sc. degree program and CGPA will be calculated for such student. On the basis of only 149 credits.

i. The UGC recommends a 10-point grading system with the following letter grades as given below:

Table 1: Grades and Grade Points and description:

Marks obtained	Grade	Grade pints
=> 80	O (Outstanding)	10
70-79	A+ (Excellent)	09
60-69	A (Very Good)	08
55-59	B+ (Good)	07
50-54	B(Above Average)	06
45-49	C (Average)	05
40-44	P (Pass)	04
< 40	F (Fail)	0
---	Ab (Absent)	0

Classification of degree

Classification	**Overall letter Grade**
First-class with Distinction	A+ and Above
First class	A
Higher Second class	B+
Second class	B
Pass	C to P

ii. A student obtaining Grade F shall be considered failed and will be required to reappear in the examination.

iii. For noncredit courses 'Satisfactory' or "Unsatisfactory' shall be indicated instead of the letter grade and this shall not be counted for the computation of SGPA/CGPA.

iv. The statutory requirement for eligibility to enter as assistant professor in colleges and universities in the disciplines of arts, science, commerce etc., is a minimum average mark of 50% and 55% in relevant postgraduate degree respectively for reserved and general category. Hence, it is recommended that the cut-off marks for grade B shall not be less than 50% and for grade B+, it should not be less than 55% under the absolute grading system. Similarly cut-off marks shall be fixed for grade B and B+ based on the recommendation of the statutory bodies (AICTE, NCTE etc.,) of the relevant disciplines.

17. Computation of SGPA and CGPA

The UGC recommends the following procedure to compute the Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA):

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

$$\textbf{SGPA}\ (Si) = \Sigma\ (Ci \times Gi) / \Sigma Ci$$

Where Ci is the number of credits of the i^{th} course and Gi is the grade point scored by the student in the i^{th} course.

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

$$\textbf{CGPA} = \Sigma\ (Ci \times Si) / \Sigma\ Ci$$

Where *Si* is the SGPA of the i^{th} semester and Ci is the total number of credits in that semester.

iii. The SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

iv. Student who have failed in a course may reappear for ESE only twice in the subsequent period. The student shall be finally declared as failed if He /she does not pass in all credits within a total period of three years. After that such students shall have to seek fresh admission as per the admission rules prevailing at that time.

v. While marks shall be given for all examinations, they shall be converted into grades.

vi. The semester end grade sheets shall have only grades and final grade sheets and transcripts shall have grade points average and total percentage of marks up to two decimal points. The final grade sheet shall also indicate the UG Centre to which the candidate belongs.

vii. A student cannot register for the III/IV semester, if she/he fails to complete 75% credits of the total credits expected to be ordinarily completed within two semesters (I/II). Also a student cannot register their name for V/VI semester if he/she fail to complete 100% credits of the total credits of I & II Semesters.

18. Assessment and Grade Point Average

a. **The system of evaluation will be as follows:** Each CA and ESE shall be evaluated in terms of marks. The marks for CA and ESE will be added together and then converted into grade and later a grade point average.

b. Result shall be declared for each semester.

c. After gaining minimum number of credits towards a completion of UG program, a student will get a grade sheet with total grads earned and a grade point average.

Final Grade

CGPA	Grade
9.01-10.00	O
8.01- 9.00	A+
7.01-8.00	A
6.01-7.00	B+
5.01-6.00	B
4.01-5.00	C
4.00	P
< 4	F

d. B+ Grade is equivalent to at least 55% of the marks as per circular No. UGC-1298/ [4619] UNI-4 dated December11, 1999.

e. A ten point grade system [guided by the Government of India Ministry of Human resource Development Department of Higher Education, Do No. SECYCHES/2014/139980 dated November 28, 2014].

f. If the CGPA is higher than the indicated upper limit in three decimal digits then higher final grade will be awarded (e. g. a student getting GPA of 6.095 may be awarded B+ grade).

g. For grade improvement a student may reappear for ESE for a minimum 40%credits.

h. Students can appear only once for the grade improvement program only after successful completion of the degree and only within one year of completion of the Degree.

i. The final CGPA will not be printed unless a student earns all credits from courses at UG programs.

j. One credit is equivalent to 25 marks for evaluation purpose.

k. The one credit is equivalent to 15 contact hours for fifteen weeks in a semester.

l. If student failed to obtain a grade other than F in a course then such a course will not be taken into account for calculating CGPA and overall grade. In fact, all the courses in which a student has passed will be taken into account for calculating the CGPA and overall grade.

m. The credit of SEC should be collected by the college appointed coordinator.

n. Collected SEC credits will be communicated to controller of University examinations.

o. The SEC consists of lecture course and practical course as decided by B.O.S

p. The project of the student should be examined by the external examiner at the time of ESE practical course.

q. There shall be revaluation of the answer scripts of semester-end examination of theory papers only but not internal assessment papers.

19. Promotion

Once the student is admitted to the concern college/course, he /she will be promoted to the next semester with full carryon; subject to the registration of student in every consecutive semester. Dropout student will be allowed to register for respective semester as and when the concerned course are offered by the college, subject to the condition that his /her tenure should not exceed more than twice the duration of course from the date of first registration at parent college. The admission of concern student will be automatically get cancelled if he/she fails to complete the course in maximum period (six years/twelve semesters)

20. Standard of Passing at B. Sc.NCCE Examination

a. For a subject all papers shall from a separate head of passing i.e. Theory, and the Practical.

b. A student shall have to secure 40% of marks in Theory, and Practical examination separately in order to pass in those heads of passing.

c. He shall be declared to have passed the examination if he passes in all heads of passing at I^{st} to VI semester examinations separately.

d. The class will be awarded on the aggregate total of all the subjects of I, II & III years examinations, excluding the marks of English or SL at I^{st} to IV^{th} Semester**.**

21. Rejection of Results

a. A candidate may be permitted to reject of the result of the whole examination of any semester. Rejection of result paper wise /subject wise shall be not be permitted. The

candidate who has rejected the result shall appear for the immediately following examination.

b. The rejection shall be exercised only once in each semester and the rejection once exercised shall not be revoked.

c. Application for rejection of results along with the payment of the prescribed fee shall be submitted to the Dy. Registrar (Academic) through the college of study together with the original statement of marks within 30 days from the date of publication of the result.

d. A candidate who rejects the result is eligible for only class and not for ranking.

22. Transfer of candidate

Transfer of admission are permissible only for III and V Semester for the students of the other universities and within university.

22.1. Conditions for transfer of admission of students within university.

1. His /her transfer of admission shall be within the intake permitted to the college.
2. Availability of same combination of the subjects studied in the previous college.
3. He/she shall fulfill the attendance requirements as per the University regulation.
4. He/she shall complete the program as per the regulation governing the maximum duration of completing the program.
5. He/she shall complete the program as per the regulation governing the maximum duration of completing the program.

22.2. Conditions for transfer admission of students of other Universities

a. A candidate migrating from any other University may be permitted to join III/V semester of the degree program provided he/she has passed all the subjects of previous semesters/years as the case may be. Such candidates must satisfy all other conditions of eligibility stipulated in the regulations of this University.

b. His/her transfer admission shall be within the intake permitted to the college.

c. He/she shall fulfill the attendance requirements as per the University regulations

d. The candidate who is migrating from other Universities is eligible for overall classes and not for ranking.

e. He/she shall complete the program as per the regulation governing the maximum duration of completing the program as per this regulation.

23. Power to remove difficulties

If any difficulties arises in giving effect to the provisions of these regulations, the Vice-Chancellor may by order make such provisions not inconsistent with the Act, Statutes, Ordinance or other regulations, as appears to be necessary or expedient to remove the

difficulty. Every order made under this rule shall be subject to ratification by the appropriate authorities.

24. Grade Card: The University shall issue at the beginning of each semester a grade card for the students, containing the grades obtained by the students in the previous semester and his semester Grade Point Average (SGPA)

The grade card shall contain

1. The title of the courses along with code taken by the students,
2. The credits associated with the course
3. The grade and grade points secured by the student
4. The total credits earned by the student in the semester
5. The SGPA of the student
6. The total credits earned by the student till that semester and
7. The CGPA of the student (at the end of the VI semester)
8. **Cumulative Grade Card:** At the end of the VIth semester, the university shall issue Cumulative Grade Card to the students showing details of Grades obtained by the students in each subject in all semesters along with CGPA and total credits earned.

25. Repeal and Savings: The existing regulation governing three years Bachelor degree programs and shall stand repealed. However, the above regulation shall continue to be enforce for the students who have been admitted to the course before the enforcement of this regulation.

26) Structure of B.Sc. (Non Conventional and Conventional Energy) program (Faculty of Science) under CBCS pattern

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad

Choice Based Credit System (CBCS) Curriculum
For
Faculty of Science and Technology
Course Structure and Scheme of Examination

B.Sc. Non Conventional and Conventional Energy
First Year Undergraduate Degree Program

Semester I

	Course Code	Course Title	Total periods (Teaching periods/week)	Credits	Scheme of Examination			
					Max Marks	CIA	UA	Min Marks
Optional I (DSC-1A) Core Courses	NCCE-101-T	Fundamentals of Energy Systems-I	45(3/week)	2	50	10	40	20
	NCCE-102-T	Energy Conversion System-I	45(3/week)	2	50	10	40	20
	NCCE-109-P	Practical Based on NCCE-101-T & NCCE-102-T	45(3/week)	1.5	50	10	40	20
Optional II (DSC-2A) Core Courses	NCCE-103-T	Mechanics	45(3/week)	2	50	10	40	20
	NCCE-104-T	Heat And Thermodynamics	45(3/week)	2	50	10	40	20
	NCCE-110-P	Practical Based on NCCE-103-T & NCCE-104-T	45(3/week)	1.5	50	10	40	20
Optional III (DSC-3A) Core Courses	NCCE-105-T	Physical & Inorganic Chemistry-I	45(3/week)	2	50	10	40	20
	NCCE-106-T	Organic & Inorganic Chemistry-I	45(3/week)	2	50	10	40	20
	NCCE-111-P	Practical Based on NCCE-105-T & NCCE-106-T	45(3/week)	1.5	50	10	40	20
Ability Enhancement compulsory courses (AECC-1)	NCCE-107-T	Marathi OR Hindi	45(5/week)	3	50	10	40	20
	NCCE-108-T	Communication skills -I	45(4/week)	3	50	10	40	20
			495	22.5	550	110	440	

Total Credits for Semester I : 22.5 (Theory : 18 ; Laboratory : 4.5)

Semester II								
	Course Code	**Course Title**	**Total periods (Teaching periods/week)**	**Credits**	**Scheme of Examination**			
					Max Marks	**CIA**	**UA**	**Min Marks**
Optional I (DSC-1B) Core Courses	NCCE-201-T	Fundamentals of Energy Systems-II	45(3/week)	2	50	10	40	20
	NCCE-202-T	Energy Conversion System-II	45(3/week)	2	50	10	40	20
	NCCE-209-P	Practical Based on NCCE-201-T & NCCE-202-T	45(3/week)	1.5	50	10	40	20
Optional II (DSC-2B) Core Courses	NCCE-203-T	Emerging Physics	45(3/week)	2	50	10	40	20
	NCCE-204-T	Electricity And Magnetism	45(3/week)	2	50	10	40	20
	NCCE-210-P	Practical Based on NCCE-203-T & NCCE-204-T	45(3/week)	1.5	50	10	40	20
Optional III (DSC-3B) Core Courses	NCCE-205-T	Physical & Inorganic Chemistry-II	45(3/week)	2	50	10	40	20
	NCCE-206-T	Organic & Inorganic Chemistry-II	45(3/week)	2	50	10	40	20
	NCCE-211-P	Practical Based on NCCE-205-T & NCCE-206-T	45(3/week)	1.5	50	10	40	20
Ability Enhancement compulsory courses (AECC-2)	NCCE-207-T	Marathi OR Hindi	45(5/week)	3	50	10	40	20
	NCCE-208-T	Communication skills -II	45(4/week)	3	50	10	40	20
Non-Credit Course /additional credits	XXX-213	Constitution of India	45(3/week)	2 *	50	10	40	20
Non-Credit Course /additional credits	XXX-214	Compulsory Computer Course	45(3/week)	2*	50	10	40	20
			495	22.5	550	110	440	

Total Credits for Semester II : 22.5 (Theory : 18 ; Laboratory : 4.5

27. Curriculum Semester-I

B.Sc.
(Non Conventional & Conventional Energy)

Semester I

Course : B.Sc.(NCCE.) I Sem. **Max. Marks :** 50

Paper Title: FUNDAMENTALS OF ENERGY SYSTEM - I **Paper No. :** NCCE-101-T

Sr. No.	Details	No. of Lectures
	FUNDAMENTALS OF ENERGY SYSTEM – I	
1.	**CONVENTIONAL & NON-CONVENTIONAL ENERGY SOURCES** **1.1 Energy Sources & World Energy Status :** 1.1.1 Energy Sectors: Domestic, Transportation, Agriculture, Industry 1.1.2 Energy Scenario 1.1.3 World Energy Present Situation 1.1.4 Availability of Conventional & Non-Conventional Energy Resources **1.2 Conventional Energy Sources :** 1.2.1Fossil Fuel, Hydro Resources, Nuclear Resources, Coal, Oil, Gas, Thermal Power Stations 1.2.2Comparison of various conventional energy systems, their prospects and limitations 1.2.3Advantages and Disadvantages of Conventional Energy Sources **1.3 Non-Conventional Energy Sources :** 1.3.1Solar Energy, Wind Energy, Energy from Biomass & Biogas, Ocean Thermal Energy Conversion, Tidal Energy, Geothermal Energy, Hydrogen Energy, Fuel Cell, Magneto Hydro-Dynamics Generator 1.3.2Advantages & Limitations of Non-Conventional Energy Sources	**10**
2.	**FLUID MECAHNICS** **Fluid Properties and Classification of Fluid** 2.1 Definition of Fluid, Distinction between solids & fluid and liquid & gas fluid continuum 2.2 Mass density, Specific Volume 2.3 Viscosity, Newton's law of viscosity 2.4 Newtonian and Non-Newtonian Fluids 2.5Ideal and Real fluids 2.6Steady & Unsteady Flow	**10**

	2.7 Uniform & Non-Uniform Flow 2.8 Laminar & Turbulent Flow 2.9 Compressible & Incompressible Flow 2.10 Surface tension, Definitions, units and dimensions	
3.	**Fluid Pressure & Its Measurement** 3.1 Definition of pressure, units and dimensions 3.2 Pressure at a point 3.3 Pascal's law 3.4 Hydrostatic pressure law 3.5 Absolute and Gauge pressure 3.6 Measurement of pressure, Simple Manometer & Differential Manometer theory and problems 3.7 Mechanical Pressure Gauges **3.2 Kinematics of Fluid Flow** 3.2.1 Description of fluid flow 3.2.2 Lagrange and Eulerian approaches 3.2.3 Definition of path line, streamline, streak line, stream tube, Acceleration of flow	**10**
4.	**Dynamics of Fluid Flow Measurements** 4.1 Concept of Inertia force and other forces causing motion 4.2 Derivation of Euler's equation and 4.3 Modification of Bernoulli's equation, problem on Bernoulli's equation without and with losses **Flow Measurements** 4.4Flow through Orifices; classification 4.5 Hydraulic Co-efficient of an Orifice and relation between them 4.6 Equation for Co-efficient of velocity, problems 4.7 Flow Through Pipes 4.8 Venturi Meter	**10**

REFERENCES (CONVENTIONAL & NON- CONVENTIONAL ENERGY)

1. Non-Conventional Energy Sources, **G. D. Rai, Khanna Publication**.
2. Non-Conventional Energy Resources, **B. H. Khan, The McGraw Hill Publishers**.

REFERENCE BOOKS: FLUID MECHANICS

1. Fluid Mechanics and Fluid Power Engineering by D.S. Kumar, S. K. Kataria & Sons
2. Fluid Mechanics and Hydraulic Machines by R.K. Bansal, Laxmi Prakashan
3. Theory and Applications of Fluid Mechanics by K. Subramanya, TMH outline series, Tata McGraw Hill Publishing Company Lt

Course : B.Sc.(NCCE.) I Sem. **Max. Marks :** 50

Paper Title: Energy Conversion System-I **Paper No. :** NCCE-102-T

Sr. No.	Particulars	No. of Lectures
	ENERGY CONVERSION SYSTEM – I	
1.	**ELEMENTS OF ELECTRO-MECHANICAL ENERGY CONVERSION** 1.1 Introduction 1.2 Salient aspects of conversions 1.3 Energy- Balance 1.4 Magnetic-field System; Energy and Co-energy 1.5 A Simple Electromechanical System 1.6 Energy in Terms of Electrical Parameters 1.7 Rotary Motion 1.8 Dynamic Equations and system-model of a simple system	**10**
2.	**D.C. GENERATORS** 2.1 Simple Loop Generator 2.2 Practical Generator 2.3 Yoke 2.4 Pole Cores and pole shoes 2.5 Pole Coils 2.6 Armature Core 2.7 Armature Windings 2.8 Commutator 2.9 Brushes and Bearings 2.10Armature windings 2.11Pole-pitch 2.12Conductor 2.13 Types of Generators 2.13.1 Separately-excited 2.13.2 Self-excited generators : Shunt Wound, Series Wound, Compound Wound 2.14 Measurement of Generator Efficiency 2.15Irons Loss in Armature 2.14.1 Hysteresis Loss (W_h) 2.14.2 Eddy Current Loss (W_e) 2.16Total Loss in a D.C. Generator 2.15.1 Copper Losses	**10**

	2.15.2 Magnetic Losses 2.15.3 Mechanical Losses 2.17 Stray Losses 2.18 Constant or Standing Losses	
3.	**GENERATOR CHARACTERISTICS** 3.1 Characteristics of D. C. Generators 3.2 Separately-excited Generator 3.2.1 (i) No-load Saturation Characteristic (ii) Load Saturation Curve 3.2.2 Internal and External Characteristics	**10**
4.	**D. C. MOTOR** 4.1 Motor Principle 4.2 Comparison of Generator and Motor Action 4.3 Significance of the Back e.m.f. 4.4 Voltage Equation of a Motor 4.5 Condition for Maximum power 4.6 Torque: Armature Torque of Motor, Shaft Torque 4.7 Speed of D. C. Motor 4.8 Speed Regulation 4.9 Torque and Speed of D. C. Motor 4.10 Motor Characteristics 4.11 Characteristics of Series Motors 4.12 Characteristics of Shunt Motors 4.13 Compound Motors 4.13.1 Cumulative-compound Motors 4.13.2 Differential-Compound 4.14 Performance Curves 4.14.1 Shunt Motor 4.14.2 Series Motor	**10**

Reference Book:

1. Text Book of **"Electrical Technology"** Vol. II, B.L. Theraja & A.K. Theraja, S. Chand Publications.
2. **"Electrical Machines" by** P. S. Bhimbra.

Course : B.Sc.(NCCE.) I Sem. **Max. Marks :** 50
Paper Title: MECHANICS **Paper No. :** NCCE-103-T

Sr. No.	Details	No. of Lectures
	MECHANICS	
1.	**Kinematics** 1.1 Displacement, Time and Average Velocity (x-t graph illustrations to be included) 1.2 Instantaneous Velocity (Finding of velocity on an x-t graph) 1.3 Average and Instantaneous Acceleration (Illustration with v – t and a – t graph) 1.4 Motion with Constant Acceleration (Illustration with a – t and v – t graph) 1.5 Freely Falling Bodies (Up and Down motion in fall with y-t and vy-t graph) 1.6 Velocity and Position by Integration 1.7 Position and Velocity Vectors 1.8 Acceleration Vector 1.9 Problems	**10**
2.	**Work and Energy** 3.1 Kinetic Energy 3.2 Work and Work-Energy Theorem 3.3 Calculation of Work done with i) Constant Force ii) Spring Force 3.4 Work-Energy Theorem 3.5 Potential Energy 3.6 Conservative and Non-conservative Forces 3.7 Definition of potential energy and conservation of Mechanical energy 3.8 Change in the potential energy in a rigid body motion 3.9 Mass-energy equivalence, problems	**10**

3.	**Surface Tension** 3.1 Surface Tension (Definition), Angle of Contact, Revision of Capillary Rise Method. 3.2 Rise of liquid in capillary tube of insufficient length 3.3 Rise of liquid in a conical capillary tube. 3.4 Energy required to raise a liquid in capillary tube. 3.5 Rise of liquid between two parallel plates. 3.6 Factors affecting surface tension. 3.7 Jeager's Method for Determination of surface tension 3.8 Applications of Surface Tension	**10**
4.	**Viscosity and Fluid Mechanics** 4.1 Fluids, Friction in Solid surfaces in contact verses Friction in Fluid 4.2 Pressure in a fluid (a) Definition of buoyancy 4.3 Atmospheric Pressure and Barometer 4.4 Archimedes' Principle 4.5 Pressure difference and Buoyant Force in accelerating fluids 4.6 Steady and Turbulent Flow. 4.7 Equation of continuity 4.8 Bernoulli's Principle 4.9 Application of Bernoulli's equation i. Speed of Efflux ii. Venturi meter iii. Aspirator Pump iv. Change of plane of motion of a spinning ball. v. Atomiser or spray 4.10 Aerodynamics, Concept of Aerofoil, Forces acting on aerofoil.	**10**

MECHANICS

Reference Books:

1. University Physics, Sears and Zeemansky XIth edition, Pearson education.
2. Concepts of Physics H.C. Varma Bharati Bhavan Publishers
3. Problems in Physics P.K. Srivastava Wiley Eastern Ltd.
4. Applied Fluid Mechanics, Mott Robert Pearson Benjamin Cummir, VI Edition, Pearson Education/Prentice Hall International, New Delhi.
5. Properties of Matter, D. S. Mathur, Shamlal Chritable Trust New Delhi.

Course : B.Sc.(NCCE.) I Sem. **Max. Marks :** 50
Paper Title: HEAT AND THERMODYNAMICS **Paper No. :** NCCE-104-T

Sr. No.	Details	No. of Lectures
	HEAT AND THERMODYNAMICS	
1	**Basic Concepts of Thermodynamics** 1.1 Thermodynamic state of a system 1.2 Thermal Equilibrium 1.3 Zeroth law of Thermodynamics 1.4 Internal Energy of System-Concept of heat 1.5 Equation of State : The Ideal Gas Equation 1.6 Indicator Diagram 1.7 First law of Thermodynamics 1.8 Thermodynamic Process-Isothermal, Adiabatic, Isobaric, Isochoric. 1.9 Adiabatic relations of system for perfect gas. 1.10 Work done during Isothermal and Adiabatic changes. 1.11 Reversible and Irreversible changes. 1.12 Problems	**10**
2	**Second Law of Thermodynamics: Entropy** 2.1 Conversion of Heat into Work and its converse 2.2 Reversible and Irreversible Processes. 2.3 Examples of Irreversible Processes. 2.4 Carnot's Cycle and Carnot's Heat Engine and its efficiency 2.5 Second law of Thermodynamics: Statements 2.6 Carnot Theorem 2.7 Entropy 2.8 Principle of Increase in Entropy 2.9 Generalised form of the First and Second laws: i Entropy changes for an Ideal Gas. ii Entropy of van der Waals' gas. iii Problems	**10**
3	**Heat engines & Refrigerators** 3.1 Heat Engines 3.1.1 Otto cycle and its efficiency 3.1.2 Diesel cycle and its efficiency 3.1.3 Comparison between Otto and Diesel cycle 3.2 Refrigerators:	**10**

	3.2.1 General Principle and Coefficient of performance of refrigerator & Heat Pump 3.2.2 The Carnot Refrigerator & Heat Pump 3.2.3 Simple structure of vapour compression refrigerator 3.3 Air conditioning: principle and its applications 3.4 Problems	
4	**Equation of state and Thermodynamic relations** 4.1 Various equations of state 4.2 Andrew's experiment 4.3 Amagat's experiment 4.4 van der Waals' equation of state, Critical constants, 4.5 Reduced equation of state 4.6 Thermodynamic functions: Internal energy, Helmholtz' function, Enthalpy, Gibb's function. 4.7 Problems **Thermometry** 4.8 Principle and Types of Thermometry 4.9 Gas filled and Liquid Filled Thermometers 4.10 Problems	**10**

HEAT AND THERMODYNAMICS

Reference Books:

1. Physics, 4th Edition, Volume I, Resnick/Halliday/Krane JOHN WILEY & SONS (SEA) PTE LTD.
2. Heat and Thermodynamics Mark. W. Zemansky, Richard H. Dittman Seventh Edition, McGraw-Hill International Editions.
3. Thermal Physics (Heat & Thermodynamics) A.B. Gupta, H.P. Roy Books and Allied (P) Ltd, Calcutta.
4. Heat and Thermodynamics Brijlal, N. Subrahmanyam S. Chand & Company Ltd, New Delhi.
5. Thermodynamics and Statistical Physics J.K. Sharma, K.K. Sarkar, Himalaya Publishing House.
6. Concept of Physics H.C. Verma Bharati Bhavan Publishers

Course: B.Sc.(NCCE.) I Sem. **Max. Marks:** 50
Paper Title: PHYSICAL & INORGANIC CHEMISTERY-I **Paper No. :** NCCE-105-T

Sr. No.	Details	No. of Lectures
	PHYSICAL & INORGANIC CHEMISTERY-I	
1	**Chemical Mathematics:-** 1.1 Logarithm: Rules of logarithm, Characteristic and mantissa, Change of sign 1.2 Graphical representation of equations: Rules for drawing graph co-ordinates etc., Equation of straight line, slope and intercept, plotting the graph from the data of chemical properties and problems. 1.3 Derivative: Rules of differentiation and partial differentiation, Algebraic, logarithmic and exponential functions and problems. 1.4 Integration: Rules of integration, Algebraic and exponential functions and problems.	**10**
2	**Gaseous and Liquids State:-** 2.1 Ideal and non- ideal gases, deviation of gases from ideal behavior, compressibility factor (Z), van der Waal's equation of state and its application to explain deviation of gases. 2.2 Critical constant of gas in terms of van der Waal's constant, Experimental determination of Pc, Tc and Vc, Reduced equation of state, Law of corresponding state. 2.3 Measurable physical properties of liquid such as vapour pressure, Surface tension and viscosity and their experimental determination (One method of each)	**10**
3	**Chemical Thermodynamics:-** 3.1 Second law of thermodynamics, Carnot cycle, mechanical efficiency 3.2 Entropy changes for system and surroundings for reversible and irreversible processes 3.3 Entropy changes for an ideal gas in isothermal, isobaric and isochoric changes 3.4 Entropy Changes in chemical reactions. Entropy changes accompanying fusion.	**10**

4	**Chemistry of hydrogen** 4.1 Position of hydrogen in periodic table, 4.2 Isotopes of Hydrogen, 4.3 Properties of Isotopes, heavy water, its preparation and application **Hydrogen bonding** 4.4 Types of hydrogen, bonding 4.5 Effect of hydrogen boding on physical properties of substances like. a) Physical State b) MP & BP c) Solubility d) Viscosity	**10**

Reference Books :-(1 2 & 3)

1. Mathematical preparation for physical Chemistry By F. Daniel, Mc. Graw Hill publication.
2. University General Chemistry. By C.N. R. Rao Mc. Millan Publication.
3. Principles of Physical Chemistry. By Maron and Pruton 4th Ed. Oxford and IBH publication.
4. Physical Chemistry. By G.M. Barrow.

Text Books (for Chapter 4 & 5)

1. Concise Inorganic Chemistry By J.D. Lee, Chapman & Hall 5th Ed. (1996) (Page No. 240 – 247)
2. Advanced Inorganic Chemistry by Satya Prakash Tuli, Basu & Madan 6th edn. (page 301 – 303, 311-318, 319-322)
3. A new guide to Modern Valency Theory by G.I. Brown (Pages 142 – 149, 154 – 160)

Course : B.Sc.(NCCE.) I Sem. **Max. Marks :** 50

Paper Title: Organic & Inorganic Chemistry-I **Paper No. :** NCCE-106-T

Sr. No.	Details	No. of Lectures
	ORGANIC & INORGANIC CHEMISTRY	
1.	**Structure & Bonding in organic Molecules:-** 1.1 Covalent bond, Hybridization in organic molecules (sp3, sp2, sp), bond length, bond angles, bond energies, localized & delocalized chemical bond, vander Waal's interactions, Inter & Intra molecular forces & their effects on physical properties. 1.2Structural effects like inductive, Resonance, Hyper conjugation, steric effect, Hydrogen bounding	**10**
2.	**Isomerism in organic compounds:-** 2.1 Concept of isomerism, type, (Structural chain, position, functional group) 2.2 Representation of organic, Molecules – zig- zag structures, projection formulae – (Saw horse (Andiron), Newman, Fisher & Dotted – wedge) 2.3 Conformational isomerism in alkanes, free rotation about carbon- carbon single bond, conformation of ethane, propane n, butane , relative stability of different conformations. 2.4 Optical isomers – Isomer number & tetrahedral carbon atom chirality, optical isomerism with one asymmetric carbon atom, Polarimeter, Specific rotation, Enantiomerism R & S Nomenclature. 2.5 Geometrical isomerism – Definition, conditions for geometrical isomerism, cis-trans & E-Z nomenclature, physical & chemical properties of geometrical isomerism	**10**

3.	**Modern Periodic table and electronic configurations of elements:-** 3.1 Electronic Configuration of Elements, Aufbau principle, Hund's rule of Maximum multiplicity, (n+1) rules, shapes of s, p, and d orbital, Paulis exclusion Principle, Heisenberg's uncertainty principle and problems based on uncertainty in velocity and position 3.2 Periodic table Types of elements: inert gases, representative elements, transition and inner transition elements, Blocks in periodic table S, p, d & f blocks. 3.3 Nomenclature of super heavy elements periodic law periodicity in properties throughout the periodic table (Only general trends in each block.) a) Size and atoms of ions. b) Ionisation energy c) Electron affinity d) Electro negativity. 3.4 Shielding effect and shielding constant, Slater's rule to calculate shielding constant, numerical Problems bases on shielding constant.	**10**
4	**Oxidation & Reduction:-** 4.1 Introduction, definition of related terms like oxidation, reduction, oxidizing agent and reducing agent. 4.2 Balancing of redox reaction using ion electron method and oxidation number method. 4.3 Rules to find oxidation number. 4.4 Problems based on equivalent weight of oxidant and reluctant.	**10**

References: (Inorganic Chemistry)

1. Consicse Inorganic Chemistry by J.D. Lee, Chaman and Hall, 5th edn. (1996) (Pages 17 to 24).
2. Theoretical Inorganic Chemistry by Day & Selbin.
3. Chemistry by Raymond Chang (pages 292 – 314)
4. Concepts, Models of inorganic chemistry by B. Douglas & D. Mc. Daniels, J. Alexander, Mohan wiley & sons 3rd Edn (2007) Relevant Pages.

Course : B.Sc.(NCCE.) I Sem. **Max. Marks :** 50

Paper Title: Communication Skill-I **Paper No. :** NCCE-108-T

No.	Details	No. of Lectures
	Communication Skill- 1	
1.	**BASIC ELEMENTS OF COMMUNICATION** 1.1 Role of Communication in Business- 1.2 Characteristics of Communication- 1.3 Definitions 1.4 Elements of Communication 1.5 Process of Communication	**10**
2.	**OBJECTIVES OF COMMUNICATION** 2.1 Information 2.2 Objectives of Downward Communication 2.3 Objectives of Communication to Authority 2.4 Objectives of Communication Among Equals	**10**
3.	**METHODS OF COMMUNICATION (VERBAL) (NON-VERBAL)** 3.1 Attributes of Oral and Written 3.2 Channels of Oral Communication 3.3 Channels of Written Communication 3.4 Used of Non-Verbal Communication 3.5 Methods 3.6 Non-Verbal Aspects of Written Communication 3.7 Body Language 3.8 Paralanguage	**10**
4.	**MEDIA AND MODES** 4.1 Conventional Modes 4.2 Emergence of Modern Communication Technology 4.3 Communication Technology and Business Productivity 4.4 Choice of Medium 4.5 Media of Mass Communication	**10**

TEXT-BOOKS:

1. Business Communication , By Urmila Rai &S.M.Rai. Himalaya Pub.
2. Communication Skill for Effective Management ByDr.AnjaliGhanekar. Everest Pub. House.
3. Developing Communication Skill By Krishna Mohan, MeeraBanerji. McMillan

B.Sc.

(Non Conventional & Conventional Energy)

Semester II

Course : : B.Sc.(NCCE.) II Sem. **Max. Marks :** 50

Paper Title: Fundamentals of Energy Systems-II **Paper No. :** NCCE-201-T

Sr. No.	Details	No. of Lectures
	FUNDAMENTALS OF ENERGY SYSTEM – II	
1.	**1.1 Introduction & Laws of Thermodynamics** 1.1.1 Basic Concepts : System, Control Volume, Surrounding, Boundaries, Universe, Types of Systems, Thermodynamic Equilibrium, Property, Process 1.1.2 Cycle – Reversibility – Quasi – static Process, Irreversible Process, Types, Work and Heat, Point and Path function 1.1.3 Concept of quality of Temperature 1.1.4 Principles of Thermometry 1.1.5 Const. Volume gas Thermometer 1.1.6 Ideal Gas Scale 1.1.7 Joule's Experiments 1.1.8 Steady Flow Energy Equation 1.1.9 Limitations of First Law of Thermodynamics 1.1.10 Thermodynamic scale of Temperature, Clausius Inequality, Entropy	**10**
2.	**Laws of Perfect Gas** 2.1 Perfect Gas Laws 2.2 Specific and Universal Gas Constants 2.3 Heat and Work Transfer, changes in Internal Energy 2.4 Throttling and Free Expansion Processes, Flow processes 2.5 Deviations from perfect Gas Model 2.6 Vander Waals Equation of State 2.7 Mixtures of perfect Gases 2.8 Avogadro's Laws of additive volume 2.9 Dalton's and Amagat's laws	**10**
3.	**HEAT TRANSFER** **Conduction Heat Transfer** 3.1Various modes of Heat Transfer 3.2 Mechanisms of Different Modes of Heat Transfer	**10**

	3.3Fourier's Law of Heat Conduction, Conductivity 3.4 Electrical Analogy, Concept of Thermal Resistance 3.5 Introduction to Newton's Law of Cooling 3.6Unidirectional Heat Conduction, Heat Conduction with Convective Environment **3.2 Convection** 3.2.1 Basic Concepts: Convective Heat Transfer Coefficients, Boundary Layer Concept, Types of Convection, Forced Convection 3.2.2 Laminar and Turbulent Flow, Combined Laminar and Turbulent 3.2.3 Nusselt Theory 3.2.4 Film Wise and Drop Wise Condensation **3.3 Radiation Heat Transfer** 3.3.1 Basic Concepts, Laws of Radiation 3.3.2Stefan Boltzmann Law, Kirchoff Law 3.3.3 Black Body Radiation **3.3 Heat Exchanger & Insulation** 3.3.1 Classification of Heat Exchangers 3.3.2 Overall Heat Transfer Coefficient 3.3.3 Fouling Factor 3.3.4 Design & Selection of Heat Exchanger 3.3.5 Practical Application of Heat Exchanger 3.3.6 Purpose of Insulation 3.3.7 Classification of Insulation 3.3.8 Types of Insulation Material 3.3.9 Economic Thickness of Insulation	
4.	**REFRIGERATION & AIR CONDITIONING** **4. 1 Introduction : First and Second law applied to refrigerating machines, Unit of refrigeration, COP, EER** **4. 2 Air Refrigeration** 4.2.1 Air refrigeration cycle 4.2.2 Reverse Carnot cycle 4.2.3 Bell-Coleman cycle 4.2.4 Thermodynamic processes 4.2.5 Types of Air refrigeration system, Simple, Boot Strap, Regeneration, Reduced Ambient **4. 3 Vapour Compression Cycle** 4.3.1Thermodynamic processes in VCC 4.3.2 Compound vapour Compression System: Need of compound compression, Two stage compression, Three Stage Compressions: Various arrangements for improvement in C.O.P. 4.3.3 Multiple Evaporator System **4.4 Refrigerants** 4.4.1 Desirable properties of refrigerant : R-12, R-22, R-717, R-134 4.4.2 Butane recent substitute for refrigerants	**10**

THERMODYNAMICS

TEXT BOOKS:

1. Engineering Thermodynamics / PK Nag /TMH, III Edition
2. Fundamentals of Thermodynamics – Sonntag, Borgnakke and van wylen / John Wiley & sons (ASIA) Pvt. Ltd.

REFERENCES:

1. Engineering Thermodynamics – Jones & Dugan
2. Thermodynamics – An Engineering Approach – Yunus Cengel & Boles /TMH
3. Thermodynamics – J.P.Holman / McGrawHill
4. An introduction to Thermodynamics / YVC Rao / New Age For more details, visit Http://www.jntu.ac.in/

REFRIGERATION & AIR CONDITIONING

REFERENCES:

1. Refrigeration and Air Conditioning, Arora C. P., Tata McGraw Hill Publications.
2. Principles of Refrigeration, Dossat R. J., Prentice Hall Publications.
3. Refrigeration and Air Conditioning, Domkundwar, Dhanpat Rai Publications.
4. Refrigeration and Air Conditioning, Ballany P.L., Khanna Publications
5. Air Conditioning System design Handbook, Carrier Corporation, USA

DIGITAL REFERENCES:

1. www.science direct.com
2. www.Howstuffworks.com

www.efunda.com

HEAT & MASS TRANSFER

REFERENCES:

1. Sachdeva R C, "Fundamentals of Engineering Heat and Mass Transfer" New Age International, 1995
2. Yadav R "Heat and Mass Transfer" Central Publishing House, 1995.
3. Heat Transfer, S.P. Sukhatme.
4. Heat Transfer, P.K. Nag, Tata McGraw Hill 2002 Publications.
5. Heat Transfer, R C Sachdeva.
6. Thermal Insulation and Refractories -PCRA.
7. Insulation and Refractories - British Energy Efficiency Office.

Course : : B.Sc.(NCCE.) II Sem. **Max. Marks :** 50

Paper Title: ENERGY CONVERSION SYSTEM - II **Paper No. :** NCCE-202

Sr. No.	Particulars	No. of Lectures
	ENERGY CONVERSION SYSTEM - II	
1.	**SPEED CONTROL OF D.C. MOTORS** 1.1 Factors Controlling Motor Speed 1.2 Speed Control of Shunt motors 1.2.1 Variation of flux or Flux Control Method 1.2.2 Armature or Rheostatic Control Method 1.2.3 Voltage Control Method 1.3 Speed Control or series Motors 1.3.1 Flux Control Method 1.3.2 Variable Resistance in series with motor 1.4 Measurement of Motor Efficiency	**10**
2.	**TRANSFORMER** 2. 1 Working principle of a Transformer 2. 2 Transformer Construction 2. 3 Core-type Transformers 2. 4 Shell-type Transformers 2. 5 Elementary Theory of an ideal Transformer 2. 6 D.M.F. Equation of Transformer 2. 7 Voltage Transformation Ratio (K) 2. 8 Transformer with losses but no magnetic Leakage 2. 9 Transformer on No-load 2. 10 Transformer on load 2. 11 Transformer with winding resistance but no Magnetic leakage 2. 12 Magnetic leakage 2. 13 Transformer with resistance and leakage reactance 2. 14 Estimation of Transformer Efficiency (at Full Load & Actual Load)	**10**

3.	**INDUCTION MOTOR** 3.1 Classification of A.C. Motors 3.2 Induction Motor : General Principle 3.3 Construction 3.4 Squirrel-cage rotor △ 3.5 Phase-wound rotor 3.6 Production of Rotating field 3.7 Three-Phase supply 3.8 Mathematical proof 3.9 Why does the rotor rotate? 3.10 Slip 3.11 Frequency of rotor current 3.12 Starting Torque of a squirrel-cage motor 3.13 Starting Torque of a slip-ring motor 3.14 Torque/Speed Curve 3.15 Current /speed curve of on induction motor	**10**
4.	**SINGLE-PHASE MOTORS** 4.1 Types of single-phase motors 4.2 Single-phase induction motor 4.3 Double-field revolving Theory 4.4 Making single-phase induction motor self-starting 4.5 Types of capacitor-start motors 4.6 Single-voltage, externally-reversible motors 4.7 single-voltage, non-reversible type 4.8 single-voltage reversible and with thermostat type 4.9 Single-voltage, non-reversible with magnetic switch type 4.10 Two-voltage , non-reversible Type 4.11 Two-voltage, reversible type 4.12 single-voltage, three-lead reversible type 4.13 single-voltage, instantly-reversible type 4.14 Two-speed type 4.15 Two speed with two-capacitor type	**10**

Reference Book:

1. Text Book of "Electrical Technology" Vol. II, B.L. Theraja & A.K. Theraja, S. Chand Publications.
2. "Electrical Machines" by P. S. Bhimbra**.**

Course : : B.Sc.(NCCE.) II Sem. **Max. Marks :** 50

Paper Title: Emerging Physics **Paper No. :** NCCE-203

Sr. No.	Details	No. of Lectures
	EMERGING PHYSICS	
1.	**Lasers and Laser applications** 1.1 A brief history of lasers 1.2 Einstein prediction : The Three Processes 1.3 Einstein's relations (qualitative discussion only) 1.4 Pumping schemes Characteristics of Types of lasers : 1. Ruby laser, 2. He-Ne 1.5 Applications of lasers	**10**
2.	**Sensors and Transducers** 2.1 Overview – need, definition and qualities of transducers 2.2 Temperature – thermocouples, thermisters, platinum resistance thermometer, IC temperature sensors, quartz thermometer, pyrometers, cryogenic temperature measurements 2.3 Light Sensors-Photodiodes, Phototransistors, and Photomultipliers	**10**
3.	**Bioelectricity** 3.1 Electricity observed in living systems 3.2 Origin of bioelectricity 3.3 Sodium and potassium transport 3.4 Resting potential and action potential 3.5 Nernst's equation 3.6 Conduction velocity 3.7 Origin of compound action potential 3.8 Neuron structure and function 3.9 An axon as cable 3.10 Membrane resistance and capacitance	**10**
4.	**Nanomaterials** 4.1 Introduction 4.2 Reduction of dimensions 3D, 2D, 1D, 0D materials. 4.3 Surface and Interface effect 4.4 Modelling of quantum size effect 4.5 Synthesis of nano particles – Bottom Up and Top Down approach, Wet Chemical Method 4.6 Idea of Biomimicking, naturally occurring nanocrystals	**10**

LASERS AND LASER APPLICATIONS

References:

1. An introduction to Lasers – Theory and Applications M. N. Avadhanalu, S. Chand and Co, Ltd.
2. Solid State Physics P. K. Palanisamy, Scitech Publications (India) Pvt. Ltd

SENSORS AND TRANSDUCERS

References:

1. Instrument measurement and Analysis by B. C. Narka and K. K. Chaudhary, Tata McGraw Hill Publishing Company 16th reprint Chapter 1.

BIOELECTRICITY

Reference :

1. From Neuron to Brain, Kuffler and Nicholas, Sinauer Associates, Inc Pub. Sunderland, Massachusetts

NANOMATERIALS

References :

1. Nanomaterial- Synthesis, Properties and Applications - Edelstein, Camarata, Institute of Physics Publishing, Bristol and Philadelphia.
2. Introduction to Nanotechnology Charles P. Poole Jr, Frank J. Owens John Wiley and Sons publications.
3. Physics Education Vol. 14, No. 4, Jan – March 1998.
4. Nanotechnology : Principles and Practices S. K. Kulkarni, Capital Publishing Company.

Course : : B.Sc.(NCCE.) II Sem. **Max. Marks :** 50
Paper Title: Electricity And Magnetism **Paper No. :** NCCE-204

Sr. No.	Details	No. of Lectures
	ELECTRICITY AND MAGNETISM	
1.	**Electrostatics** 1.1 Coulomb's law 1.1.1 Statement 1.1.2 Vector form of Coulomb's law for like and unlike charges. 1.1.3 Variation force with distance (F. vs. r graph) (Ref. 2, 21.3) 1.2 Superposition principle 1.2.1 Statement and explanation with illustration 1.2.2 Illustrations with specific configuration of three charges (triangular form) and four charges (square form) 1.2.3 Problems on superposition principle 1.3 Energy of the system of charges 1.3.1 Illustration with three charges 1.3.2 Electric potential energy (Ref. 1, 1.5 and Ref. 2, 23.1) 1.4 Concept of electric field 1.4.1 Electric field due to point charge 1.4.2 Electric field due to group of charges 1.4.3 Lines of force 1.4.4 Relation between electric intensity and electric potential 1.5 Concept of electric flux 1.5.1 Gauss's theorem in electrostatics (statement only and explanation) 1.5.2 Illustrations of Gauss law with examples	**10**
2.	**Dielectrics** 2.1 Electric Dipole 2.1.1 Electric dipole and dipole moment 2.1.2 Electric potential due to dipole 2.1.3 Electric intensity due to dipole 2.1.4 Torque on electric dipole in external electric field 2.1.5 Polar and non – polar molecules with examples 2.1.6 Effect of external electric field on polar and non – polar molecules 2.2 Dielectric materials 2.2.1 Electric polarization of dielectric material 2.2.2 Electric polarization vector 2.2.3 Strength of dielectric material and Dielectric breakdown 2.2.4 Electric displacement and Gauss law in dielectric 2.2.5 Relation between three electric vectors (E, D and P) 2.2.6 Effect of dielectric on capacitance of problems (parallel plate capacitor only) 2.2.7 Problems	**10**

3.	**Magnetostatics** 3.1 Concept of magnetic field: Definition and properties of magnetic field 3.2 Revision of Biot – Savart's law: 1. Long straight conductor. 2. Current carrying circular loop on the axis 3.3 Ampere's circuital law: Field of solenoid, Field of toroidal solenoid 3.4 Magnetic Field lines and Magnetic flux, Gauss's law for magnetism 3.5 Problems	**10**
4.	**Magnetic Properties Of Material** 4.1 Magnetic Materials, Bohr magneton 4.2 Magnetisation (M), Magnetic Intensity (H) and magnetic induction (B) 4.3 Magnetisation and Susceptibility and magnetic permeability 4.4 Relation between B, M and H (without derivation, qualitative discussion only) 4.5 Diamagnetic, paramagnetic and ferromagnetic. Explanation with the help of susceptibility and permeability 4.6 Hysteresis **Transient Currents** 4.7 Transient currents 4.8 Growth of current in an inductive (LR) circuit 4.9 Decay of current in an inductive circuit, Physical meaning of time constant 4.10 Charging of condenser through resistance 4.11 Discharging of condenser through resistance, Time constant	**10**

ELECTRICITY AND MAGNETISM

Reference books:

1. Berkeley Physics Course – Vol. – II Electricity and Magnetism. Edward M. Purcell.
2. University Physics – H.D. Young R. A. Freedman Pearson – Freedman.
3. Resnick and Halliday, Physics Vol. – II.
4. Electromagnetics by B.B.Laud.

Course : : B.Sc.(NCCE.) II Sem. **Max. Marks :** 50
Paper Title: Physical & Inorganic Chemistry-II **Paper No. :** NCCE-205

Sr. No.	Details	No. of Lectures
	PHYSICAL & INORGANIC CHEMISTRY	
1	**Atomic structure:** 1.1 Historical Development, Dalton's atomic theory, Limitation of Daltons atomic theory, Electron, its discovery and properties. e/m ratio of electron by Thomson's method. 1.2 Charge on electron by Milliken's oil drop method, Proton- its discovery and properties, 'Thomson's Atomic model and its drawbacks. 1.3 Rutherford's alpha particles scattering experiments, Rutherford's atomic model and its drawbacks. Prouty's hypothesis, Moseley experiment and its importance. 1.4 The Neutron – its discovery and properties, atomic spectra. Ritz – combination principle. **1.5** Bohr's model of hydrogen atom, postulates, derivation for its radius and energy. Application of Bohr's theory, spectra and ionization potential of hydrogen, Limitations of Bohr's theory, spectra and ionization potential of hydrogen, Limitations of Bohr's theory, Quantum number, Pauling's Exclusion principle, Hund's principles of maximum multiplicity and Aufbau's principle**.**	**10**
2	**Colloids:-** 2.1 Preparation, purification, Optical properties. 2.2 Tyndall effect, shape and size, stability, solvation, interaction between, colloids, solution, emulsions and gels. **Catalysis:** 2.3 Catalyst and catalysis, positive and negative catalysis, 2.4 Type of catalysis, Characteristics of catalytic reactions, promoters, Catalytic poisoning* 2. 5 Theories of catalysis, Active centre on catalyst surface, Adsorption theory and catalytic activity. 3. 4 Acid – Base catalysis, Enzyme catalysis, Mechanism of enzyme catalysis, characteristics of enzyme catalysis, application of catalysis in industries. 2.6 Autocatalysis, negative catalysis, Activation energy and catalysis.	**10**

3	**Chemical bonding and structure:-** 3.1 Attainment of stable configuration. 3.2 Types of bonds a) ionic, b) covalent c) Coordinate d) Metallic. 3.3 Types of overlap, formulation of σ and π bonds S – S overlap, P-P overlap, p-d overlap with suitable examples. 3.4 Theories of bonding, Valence bond theory a) Hitler London theory and b) Pauling Slater theory.	**10**
4	**Concept of hybridization** 4.1 Definition, need of hybridization, steps involved in Hybridization. 4.2 Explanation of covalency of atoms in the molecules on the basis of hybridization. 4.3 Types of hybridization involving S, P orbitals and S, P, d, orbitals. 4.4 Applications of hybridization concept, geometries of molecules like BeF2 CH4, BF3, SiCl4, PCI5, IF7, SF6, [Ni (CN)4]2- 4.5 VSEPR theory Assumptions, need of theory, application of the theory to explain geometry of irregular molecules like H2O, NH3, TiCl4, ClF3, ICl2, BrF3, BrF5, OF2	**10**

Reference Books For second term.

1. University General Chemistry. By C.N. R. Rao. Mc Millan Publication.
2. Principles of Physical Chemistry. By Maron and Pruton 4th Ed. Oxford and IBH publication.
3. Physical Chemistry. By G.M. Barrow.

References:

1. Concise Inorganic Chemistry by J.D. Lee 5th Edn. (page No. 30 to 36, 90 – 96)
2. A new guide to modern valency theory by G.I. Brown (Pages 106, 114, 165 – 168)

References:

1. Consise Inorganic Chemistry by J.D. Lee 5th edn. (Page 30-36, 72-96
2. Basic Inorganic Chemistry by Cotton & Wilkison.
3. Inorganic Chemistry – Principles of structure and reactivity by J.E. Huheey, E.A. Keiter, R.L. Keiter, U.k. Medhi, 1st impression (2006) person Education Publishers (Pages 117 – 170) and (171-190)
4. New guide to modern valence Theory By G.I. Brown (Pages 106-114, 165-168).

Course : : B.Sc.(NCCE.) II Sem. **Max. Marks :** 50
Paper Title: Organic & Inorganic Chemistry-II **Paper No. :** NCCE-206

Sr. No.	Details	No. of Lectures
	ORGANIC & INORGANIC CHEMISTRY-II	
1	**Alkenes, Dienes & Alkynes:-** 1.1 Alkenes: Introduction, higher alkenes, Nomenclature, physical properties, preparations, Reactions of alkenes, Analysis of Alkenes. 1.2 Dienes: Structure & Properties, Conjugated dienes, Reactions of dienes, analysis of dienes. 1.3 Alkynes:- Introduction , Nomenclature, Physical properties, preparation, Reactions & analysis of alkynes. **Halogen derivatives of Alkanes:-** 1.4 Introduction & Classification of Halogen derivatives, Structure of alkyl halides, 1.5 Classification, Nomenclature, physical properties, preparation, reactions, analysis of alkyl halides.	**10**
2	**Alcohols & Ethers:-** 2.1 Alcohols: - Introduction, physical properties, Reactions of alcohols. 2.2 Industrial sources of ethyl alcohol, proof, spirit, denatured spirit, absolute alcohol, analysis of alcohols. **Benzene & its Reactions:-** 2.3 Structure of benzene, Kekule structure, stability of benzene. 2.4 Reactions of benzene, aromatic character, Huckel rule, 2.5 Nomenclature of benzene derivatives, sulphonation, halogenation, Friedal – Crafts reactions of benzene.	**10**
3	**Phenols:-** 3.1 Structure, classification, Physical properties. 3.2 Nomenclature, Preparation of phenols, industrial source, Laboratory methods. 3.3 Reactions of Phenols Nitration, Sulphonation, Halogenation, nitrosation, carbonation (Kolbe synthesis,) Reimer –Tiemann reaction & analysis of phenols.	**10**

	Chemistry S. Blocks Elements:- 3.4 Position of elements in periodic Table, Electronic configuration, Periodic trends in Properties viz. size of atom, ion, oxidation state, ionization potential, & reactivity. 3.5 Anomalous behavior of Li, Be Diagonal relationship between Li & Mg. 3.6 Industrial biological and Agricultural applications of these elements & their Compounds, Crown ethers, Separation of these elements using Crown ethers. Solution of these metals in liquor NH3	
4	**Chemistry of Noble Gases:-** 4.1 Position of these elements in periodic table, Electronic configuration. 4.2 Chemical Properties of Noble Gases. 4.3 Chemistry of xenon structure and bonding in xenon compounds. XeF2, XeF4, XeO6, XeO4, XeO2 F2, [XeO6]-4, XeOF4.	**10**

List of Reference Books (Organic Chemistry)

1. Ref. 1 Organic Chemistry by Clayden, Oxford uni.press.
2. Ref. 2 Organic Chemistry by Morrison & Boyd, 6th Edition.
3. Ref. 3 A guide book to Mechanism in Organic Chemistry by Peter Sykes, 6th Edition.

Text Book:- (6) – Inrganic Chemistry

1. Concise inorganic Chemistry by J.D. Lee, Chapman & Hall 5th Edn. (1996) (Page No. 273, 281, 302, 308, 325, 326, 329, 335 and 353)

Ref Books:- (7) - Inorganic Chemistry

1. Concise Inorganic Chemistry by J.D. Lee Chapman and hall 5th edn. (1996) pages (635 – 647)
2. Concepts and Models of Inorganic Chemistry by B. Douglas & D. Mc. Daniels Alexander Mohan Wiley & sons 3rd Edn. (2007) Relevant pages.
3. Inorganic Chemistry Principles of structure & reactivity By James Huheey, Keiter, Medhi (Pearson Education) Pages 342-348.

Course : : B.Sc.(NCCE.) II Sem. **Max. Marks :** 50

Paper Title: Communication Skill - II **Paper No. :** NCCE-208

Sr. No.	Details	No. of Lectures
	Communication Skill- II	
1.	**GROUP OF COMMUNICATION** 1.1 Meetings 1.2 Types of Meeting 1.3 Advantages an d Disadvantages of Meeting 1.4 Making Preparations for a Meeting 1.5 Conduct of a Meeting 1.6 Responsibilities of Participants	**10**
2.	**INTERVIEWS** 2.1 Types of Interviews 2.2 Employment Interview 2.3 Candidates Preparation 2.4 Question Commonly asked in Interview 2.5 Interviewers Preparation	**10**
3.	**SPEECHES** 3.1 Finding out about surrounding 3.2 Preparing the text 3.3 Speaker's Appearance and Personality 3.4 Practice Delivery of Speech 3.5 Commemorative Speeches	**10**
4.	**PRESENTATINOS** 4.1 Finding out about the Environment 4.2 Preparing the text 4.3 Using Visual Aids 4.4 Appearance and Posture 4.5 Practicing Delivery of Presentation	**10**

TEXT-BOOKS:

1. Business Communication,ByUrmila Rai &S.M.Rai. Himalaya Pub.(Tenth Ed.)

REFERENCES

1. Teacher should demonstrate various format of concerned contents
2. For Report writing practice demonstrate IEEE paper Format.
http://www.ieee.org/portal/cms_docs/pubs/confpubcenter/pdfs/samplems.pdf