PRESIDENCY UNIVERSITY

GAIN MORE KNOWLEDGE
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# PROGRAMME REGULATIONS & CURRICULUM

2023-27

## PRESIDENCY SCHOOL OF ENGINEERING

### DEPARTMENT OF PETROLEUM ENGINEERING

### BACHELOR OF TECHNOLOGY (B.TECH.)
### PETROLEUM ENGINEERING

# PRESIDENCY UNIVERSITY

Presidency University Act, 2013 of the Karnataka Act No. 41 of 2013 | Established under Section 2(f) of UGC Act, 1956
Approved by AICTE, New Delhi

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## PRESIDENCY SCHOOL OF ENGINEERING

### DEPARTMENT OF PETROLEUM ENGINEERING

# Program Regulations and Curriculum

# 2023-2027

## BACHELOR OF TECHNOLOGY (B.Tech.) in

## PETROLEUM ENGINEERING

## based on Choice Based Credit System (CBCS) and Outcome Based Education (OBE)

***(As amended up to the 24th Meeting of the Academic Council held on 3rd August 2024. This document supersedes all previous guidelines)***

**Regulations No.: PU/AC-24.11/PET18/PET/2023-27**

***Resolution No.11 of the 24th Meeting of the Academic Council held on 03rd August 2024, and ratified by the Board of Management in its 24th Meeting held on 05th August, 2024.***

**August 2024**

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## PART A – PROGRAM REGULATIONS

### 1. Vision & Mission of the University and the School / Department

#### *1.1 Vision of the University*

To be a Value-driven Global University, excelling beyond peers and creating professionals of integrity and character, having concern and care for society.

#### *1.2 Mission of the University*

- Commit to be an innovative and inclusive institution by seeking excellence in teaching, research and knowledge-transfer. Pursue Research and Development and its dissemination to the community, at large.
- Create, sustain and apply learning in an interdisciplinary environment with consideration for ethical, ecological and economic aspects of nation building.
- Provide knowledge-based technological support and services to the industry in its growth and development.
- To impart globally applicable skill sets to students through flexible course offerings and support industry's requirement and inculcate a spirit of new-venture creation.

#### *1.3 Vision of Presidency School of Engineering*

To be a value based, practice-driven School of Engineering and Technology, committed to developing globally competent Engineers, dedicated to transforming Society.

#### *1.4 Mission of Presidency School of Engineering*

- Cultivate a practice-driven environment with a contemporary Learning-pedagogy, integrating theory and practice.
- Attract and nurture world-class faculty to excel in Teaching and Research, in the field of Core Engineering.
- Establish state-of-the-art facilities for effective Teaching and Learning-experiences.
- Promote Interdisciplinary Studies to nurture talent and impart relevant skill sets for global impact.
- Instil Entrepreneurial and Leadership Skills to address Social, Environmental, and Community-needs.

#### *1.5 Vision of Department of Petroleum Engineering*

To be a value-based, industry driven Petroleum Engineering Department committed to develop globally competent Petroleum Engineering professionals dedicated to transform the society.

#### *1.6 Mission of Department of Petroleum Engineering*

- Committed to inculcate application of Engineering knowledge, develop problem analysis and solving skills to be able to investigate complex engineering problems with modern tools.
- Create value-driven engineering professionals who are sensitive to societal concerns of environmental sustainability through ethical conduct.
- Develop excellent communication abilities with core skills of project management and team work.
- Imbibe passion for lifelong learning with individual growth path.
- Commitment towards excellence in Petroleum Engineering education through advancements in research and innovation.

- Design flexible course contents in disciplinary, interdisciplinary and research areas to enhance student's competitiveness.

**2. Preamble to the Program Regulations and Curriculum**

This is the subset of Academic Regulations and it is to be followed as a requirement for the award of B.Tech. degree.

The Curriculum is designed to take into the factors listed in the Choice Based Credit System (CBCS) with focus on Social Project Based Learning, Industrial Training, and Internship to enable the students to become eligible and fully equipped for employment in industries, choose higher studies or entrepreneurship.

In exercise of the powers conferred by and in discharge of duties assigned under the relevant provision(s) of the Act, Statutes and Academic Regulations of the University, the Academic Council hereby makes the following Regulations.

**3. Short Title and Applicability**

a. These Regulations shall be called the Bachelor of Technology Degree Program Regulations and Curriculum 2023-2027.

b. These Regulations are subject to, and pursuant to the Academic Regulations.

c. These Regulations shall be applicable to the ongoing Bachelor of Technology Degree Programs of the 2023-2027 batch, and to all other Bachelor of Technology Degree Programs which may be introduced in future.

d. These Regulations shall supersede all the earlier Bachelor of Technology Degree Program Regulations and Curriculum, along with all the amendments thereto.

e. These Regulations shall come into force from the Academic Year 2023-2024.

**4. Definitions**

*In these Regulations, unless the context otherwise requires:*

*a. "Academic Calendar" means the schedule of academic and miscellaneous events as approved by the Vice Chancellor;*

*b. "Academic Council" means the Academic Council of the University;*

*c. "Academic Regulations" means the Academic Regulations, of the University;*

*d. "Academic Term" means a Semester or Summer Term;*

*e. "Act" means the Presidency University Act, 2013;*

*f. "AICTE" means All India Council for Technical Education;*

*g. "Basket" means a group of courses bundled together based on the nature / type of the course;*

*h. "BOE" means the Board of Examinations of the University;*

*i. "BOG" means the Board of Governors of the University;*

*j. "BOM" means the Board of Management of the University;*

*k. "BOS" means the Board of Studies of a particular Department / Program of Study of the University;*

*l. "CGPA" means Cumulative Grade Point Average as defined in the Academic Regulations;*

*m. "Clause" means the duly numbered Clause, with Sub-Clauses included, if any, of these Regulations;*

*n. "COE" means the Controller of Examinations of the University;*

*o. "Course In Charge" means the teacher / faculty member responsible for developing and organising the delivery of the Course;*

*p. "Course Instructor" means the teacher / faculty member responsible for teaching and evaluation of a Course;*

*q. "Course" means a specific subject usually identified by its Course-code and Course-title, with specified credits and syllabus / course-description, a set of references, taught by some teacher(s) / course-instructor(s) to a specific class (group of students) during a specific Academic Term;*

r. *"Curriculum Structure" means the Curriculum governing a specific Degree Program offered by the University, and, includes the set of Baskets of Courses along with minimum credit requirements to be earned under each basket for a degree / degree with specialization / minor / honours in addition to the relevant details of the Courses and Course catalogues (which describes the Course content and other important information about the Course). Any specific requirements for a particular program may be brought into the Curriculum structure of the specific program and relevant approvals should be taken from the BOS and Academic Council at that time.*

s. *"DAC" means the Departmental Academic Committee of a concerned Department / Program of Study of the University;*

t. *"DAC" means, the Departmental Academic Committee;*

u. *"Dean" means the Dean / Director of the concerned School;*

v. *"Dean" means the Dean of the concerned School;*

w. *"Degree Program" includes all Degree Programs;*

x. *"Degree Program" includes all Degree Programs;*

y. *"Department" means the Department offering the degree Program(s) / Course(s) / School offering the concerned Degree Programs / other Administrative Offices;*

z. *"Discipline" means specialization or branch of B.Tech. Degree Program;*

aa. *"HOD" means the Head of the concerned Department;*

bb. *"L-T-P-C" means Lecture-Tutorial-Practical-Credit – refers to the teaching – learning periods and the credit associated;*

cc. *"MOOC" means Massive Open Online Courses;*

dd. *"MOU" means the Memorandum of Understanding;*

ee. *"NPTEL" means National Program on Technology Enhanced Learning;*

ff. *"Parent Department" means the department that offers the Degree Program that a student undergoes;*

gg. *"Program Head" means the administrative head of a particular Degree Program(s);*

hh. *"Program Regulations" means the Bachelor of Technology Degree Program Regulations and Curriculum, 2023-2027;*

ii. *"Program" means the Bachelor of Technology (B.Tech.) Degree Program;*

jj. *"PSOE" means the Presidency School of Engineering;*

kk. *"Registrar" means the Registrar of the University;*

ll. *"School" means a constituent institution of the University established for monitoring, supervising and guiding, teaching, training and research activities in broadly related fields of studies;*

mm. *"Section" means the duly numbered Section, with Clauses included in that Section, of these Regulations;*

nn. *"SGPA" means the Semester Grade Point Average as defined in the Academic Regulations;*

oo. *"Statutes" means the Statutes of Presidency University;*

pp. *"Sub-Clause" means the duly numbered Sub-Clause of these Program Regulations;*

qq. *"Summer Term" means an additional Academic Term conducted during the summer break (typically in June-July) for a duration of about eight (08) calendar weeks, with a minimum of thirty (30) University teaching days;*

rr. *"SWAYAM" means Study Webs of Active Learning for Young Aspiring Minds.*

ss. *"UGC" means University Grant Commission;*

tt. *"University" means Presidency University, Bengaluru; and*

uu. *"Vice Chancellor" means the Vice Chancellor of the University.*

**5. Program Description**

The Bachelor of Technology Degree Program Regulations and Curriculum 2023-2027 are subject to, and, pursuant to the Academic Regulations. These Program Regulations shall be applicable to the following ongoing Bachelor of Technology (B.Tech.) Degree Programs of 2023-2027 offered by the Presidency School of Engineering (PSOE):

1. Bachelor of Technology in Civil Engineering, abbreviated as B.Tech. (Civil Engineering)
2. Bachelor of Technology in Electronics and Communication Engineering, abbreviated as B.Tech. (Electronics and Communication Engineering)
3. Bachelor of Technology in VLSI, abbreviated as B.Tech. (VLSI)
4. Bachelor of Technology in Electrical and Electronics Engineering, abbreviated as B.Tech. (Electrical and Electronics Engineering)
5. Bachelor of Technology in Mechanical Engineering, abbreviated as B.Tech. (Mechanical Engineering); and
6. Bachelor of Technology in Petroleum Engineering, abbreviated as B.Tech. (Petroleum Engineering)

5.1 These Program Regulations shall be applicable to other similar programs, which may be introduced in future.

5.2 These Regulations may evolve and get amended or modified or changed through appropriate approvals from the Academic Council, from time to time, and shall be binding on all concerned.

5.3 The effect of periodic amendments or changes in the Program Regulations, on the students admitted in earlier years, shall be dealt with appropriately and carefully, so as to ensure that those students are not subjected to any unfair situation whatsoever, although they are required to conform to these revised Program Regulations, without any undue favour or considerations

**6. Minimum and Maximum Duration**

6.1 Bachelor of Technology Degree Program is a Four-Year, Full-Time Semester based program. The minimum duration of the B.Tech. Program is four (04) years, and each year comprises of two academic Semesters (Odd and Even Semesters) and hence the duration of the B.Tech. program is eight (08) Semesters.

6.2 A student who for whatever reason is not able to complete the Program within the normal period or the minimum duration (number of years) prescribed for the Program, may be allowed a period of two years beyond the normal period to complete the mandatory minimum credits requirement as prescribed by the concerned Program Regulations and Curriculum. In general, the permissible maximum duration (number of years) for completion of Program is 'N' + 2 years, where 'N' stands for the normal or minimum duration (number of years) for completion of the concerned Program as prescribed by the concerned Program Regulations and Curriculum.

6.3 The time taken by the student to improve Grades / CGPA, and in case of temporary withdrawal / re-joining (Refer to Clause **Error! Reference source not found.** of Academic Regulations), shall be counted in the permissible maximum duration for completion of a Program.

6.4 In exceptional circumstances, such as temporary withdrawal for medical exigencies where there is a prolonged hospitalization and / or treatment, as certified through hospital / medical records, women students requiring extended maternity break (certified by registered medical practitioner), and, outstanding sportspersons representing the University / State / India requiring extended time to participate in National / International sports events, a further extension of one (01) year may be granted on the approval of the Academic Council.

6.5 The enrolment of the student who fails to complete the mandatory requirements for the award of the concerned Degree (refer Section 19.**Error! Reference source not found.** of Academic Regulations) in the

prescribed maximum duration (Sub-Clauses 18.1 and 18.2 of Academic Regulations), shall stand terminated and no Degree shall be awarded.

**7. Programme Educational Objectives (PEO)**

After four years of successful completion of the program, the graduates shall be able to:

**PEO1.** Establish as a successful Petroleum Engineering Professional with Innovative Skills and with a Moral and Ethical Values.

**PEO2.** Engage in life-long Learning through Research and Professional Development.

**PEO3.** Serve as a Leader in the profession through Consultancy, Extension Activities, and Entrepreneurship.

**8. Programme Outcomes (PO) and Programme Specific Outcomes (PSO)**

**8.1 Programme Outcomes (PO)**

On successful completion of the Program, the students shall be able to:

**PO1. Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

**PO2. Problem Analysis:** Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

**PO3**. **Design / Development of Solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

**PO4. Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

**PO5. Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

**PO6. The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

**PO7. Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

**PO8. Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

**PO9. Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

**PO10. Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

**PO11. Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

**PO12. Life-Long Learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

**8.2 Program Specific Outcomes (PSOs):**

On successful completion of the Program, the students shall be able to:

**PSO1:** Identify, formulate, research literature, and analyze complex engineering problems related to Drilling Engineering, Reservoir Engineering, Production Engineering, and Petrophysics.

**PSO2:** Design solutions for complex engineering problems related to Drilling Engineering, Drilling Fluids, Reservoir Engineering, and Production Engineering processes.

**PSO3:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities related to Drilling Engineering, Reservoir Engineering, Production Engineering, and Petrophysics with an understanding of the limitations.

**9. Admission Criteria (as per the concerned Statutory Body)**

The University admissions shall be open to all persons irrespective of caste, class, creed, gender or nation. All admissions shall be made on the basis of merit in the qualifying examinations; provided that forty percent of the admissions in all Programs of the University shall be reserved for the students of Karnataka State and admissions shall be made through a Common Entrance Examination conducted by the State Government or its agency and seats shall be allotted as per the merit and reservation policy of the State Government from time to time**.** The admission criteria to the B.Tech. Program is listed in the following Sub-Clauses:

9.2 An applicant who has successfully completed Pre-University course or Senior Secondary School course (+2) or equivalent such as (11+1), 'A' level in Senior School Leaving Certificate Course from a recognized university of India or outside or from Senior Secondary Board or equivalent, constituted or recognized by the Union or by the State Government of that Country for the purpose of issue of qualifying certificate on successful completion of the course, may apply for and be admitted into the Program.

9.3 Provided further, the applicant must have taken Physics and Mathematics as compulsory subjects in the Pre-University / Higher Secondary / (10+2) / (11+1) examination, along with either Chemistry / Biology / Electronics / Computer Science / Biotechnology subject, and, the applicant must have obtained a minimum of 45% of the total marks (40% in case of candidates belonging to the Reserved Category as classified by the Government of Karnataka) in these subjects taken together.

9.4 The applicant must have appeared for Joint Entrance Examinations (JEE) Main / JEE (Advanced) / Karnataka CET / COMED-K, or any other State-level Engineering Entrance Examinations.

9.5 Reservation for the SC / ST and other backward classes shall be made in accordance with the directives issued by the Government of Karnataka from time to time.

9.6 Admissions are offered to Foreign Nationals and Indians living abroad in accordance with the rules applicable for such admission, issued from time to time, by the Government of India.

9.7 Candidates must fulfil the medical standards required for admission as prescribed by the University.

9.8 If, at any time after admission, it is found that a candidate had not in fact fulfilled all the requirements stipulated in the offer of admission, in any form whatsoever, including possible misinformation and any other falsification, the Registrar shall report the matter to the Board of Management (BOM), recommending revoking the admission of the candidate.

9.9 The decision of the BOM regarding the admissions is final and binding.

## 10. Lateral Entry / Transfer Students Requirements

### 10.1 Lateral Entry

The University admits students directly to the second year (3rd Semester) of the B.Tech. Degree program as per the provisions and / or regulations of the Government of Karnataka pertaining to the "Lateral Entry" scheme announced by the Government from time to time. Further, the general conditions and rules governing the provision of Lateral Entry to the B.Tech. Program of the University are listed in the following Sub-Clauses:

10.1.1 Admission to 2nd year (3rd Semester) of the B.Tech. Degree program shall be open to the candidates who are holders of a 3-year Diploma in Engineering (or equivalent qualification as recognized by the University), who have secured not less than forty-five percentage (45%) marks in the final year examination (5th and 6th Semesters of the Diploma Program) in the appropriate branch of Engineering. Provided that, in case of SC / ST and OBC candidates from Karnataka the minimum marks for eligibility shall be forty percent (40%).

10.1.2 Provided further that, candidates seeking Lateral Entry may be required to complete specified bridge Courses as prescribed by the University. Such bridge Courses, if any, shall not be included in the CGPA computations.

10.1.3 All the existing Regulations and Policies of the University shall be binding on all the students admitted to the Program through the provision of Lateral Entry.

10.1.4 The Course requirements prescribed for the 1st Year of the B.Tech. Program shall be waived for the student(s) admitted through Lateral Entry and the duration of the B.Tech. Program for such students is three (03) years, commencing from the 3rd Semester (commencement of the 2nd Year) of the B.Tech. Program and culminating with the 8th Semester (end of the 4th Year) of the B.Tech. Program.

10.1.5 Provided that, if a Lateral Entry student misses any mandatory program specific courses that are typically offered in the 1st year (1st or 2nd semesters), then those courses must be cleared by the students as soon as possible, preferably during the Summer Term.

10.1.6 The existing Program Regulations of the concerned Program to which the student is admitted through the provision of Lateral Entry shall be binding on the student with effect from the 3rd Semester of the Program. i.e., the Program Structure and Curriculum from the 3rd to 8th Semesters of the Program concerned shall be binding on the student admitted through Lateral Entry. Further, any revisions / amendments made to the Program Regulations, thereafter, shall be binding on all the students of the concerned Program.

10.1.7 All the Courses (and the corresponding number of Credits) prescribed for the 1st Year of the concerned B.Tech. Program shall be waived for the student(s) admitted to the concerned B.Tech Program through Lateral Entry. Further, the *Minimum Credit Requirements* for the award of the B.Tech. Degree in the concerned Program shall be prescribed / calculated as follows:

The ***Minimum Credit Requirements*** for the award of the Bachelor of Technology (B.Tech.) Degree prescribed by the concerned Bachelor of Technology Degree Program Regulations and Curriculum, 2024-2028, minus the number of Credits prescribed / accepted by the Equivalence Committee for the 1st Year (1st and 2nd Semesters) of the B.Tech. Program.

For instance, if the *Minimum Credit Requirements* for the award of the Bachelor of Technology (B.Tech.) Degree as prescribed by the Regulations for B.Tech. (Petroleum Engineering) is "N" Credits, and, if the total credits prescribed in the 1st Year (total credits of the 1st and 2nd Semesters)

of the Program concerned is "M" Credits, then the *Minimum Credit Requirements* for the award of the B.Tech. in Petroleum Engineering for a student who joins the Program through the provision of the Lateral Entry, shall be "N – M" Credits.

10.1.8 Further, no other waiver except the Courses prescribed for the 1st year of the B.Tech. Program of the University shall be permissible for students joining the B.Tech. Program through the provision of Lateral Entry.

**10.2 Transfer of student(s) from another recognized University to the 2nd year (3rd Semester) of the B.Tech. Program of the University**

A student who has completed the 1st Year (i.e., passed in all the Courses / Subjects prescribed for the 1st Year) of the B.Tech. / B.E. / B.S., Four-Year Degree Program from another recognized University, may be permitted to transfer to the 2nd Year (3rd Semester) of the B.Tech. Program of the University as per the rules and guidelines prescribed in the following Sub-Clauses:

10.2.1 The concerned student fulfils the criteria specified in Sub-Clauses 10.1.1, 10.1.2 and 10.1.3.

10.2.2 The student shall submit the Application for Transfer along with a non-refundable Application Fee (as prescribed by the University from time to time) to the University no later than July 10 of the concerned year for admission to the 2nd Year (3rd Semester) B.Tech. Program commencing on August 1 on the year concerned.

10.2.3 The student shall submit copies of the respective Marks Cards / Grade Sheets / Certificates along with the Application for Transfer.

10.2.4 The transfer may be provided on the condition that the Courses and Credits completed by the concerned student in the 1st Year of the B.Tech. / B.E. / B.S. Four Degree Program from the concerned University, are declared equivalent and acceptable by the Equivalence Committee constituted by the Vice Chancellor for this purpose. Further, the Equivalence Committee may also prescribe the Courses and Credits the concerned students shall have to mandatorily complete, if admitted to the 2nd Year of the B.Tech. Program of the University.

10.2.5 The Branch / Discipline allotted to the student concerned shall be the decision of the University and binding on the student.

11 **Change of Branch / Discipline / Specialization**

A student admitted to a particular Branch of the B.Tech. Program will normally continue studying in that Branch till the completion of the program. However, the University reserves the right to provide the option for a change of Branch, or not to provide the option for a change of Branch, at the end of 1st Year of the B.Tech. Program to eligible students in accordance with the following rules and guidelines: framed by the University from time to time.

11.1 Normally, only those students, who have passed all the Courses prescribed for the 1st Year of the B.Tech. Program and obtained a CGPA of not less than 6.50 at the end of the 2nd Semester, shall be eligible for consideration for a change of Branch.

11.2 Change of Branch, if provided, shall be made effective from the commencement of the 3rd Semester of the B.Tech. Program. There shall be no provision for change of Branch thereafter under any circumstances whatsoever.

11.3 The student provided with the change of Branch shall fully adhere to and comply with the Program Regulations of the concerned Branch of the B.Tech. Program, the Fee Policy pertaining to that Branch of the B.Tech. Program, and, all other rules pertaining to the changed Branch existing at the time.

11.4 Change of Branch once made shall be final and binding on the student. No student shall be permitted, under any circumstances, to refuse the change of Branch offered.

11.5 The eligible student may be allowed a change in Branch, strictly in order of *inter se* merit, subject to the conditions given below:

11.5.1 The actual number of students in the 3rd Semester in any particular Branch to which the transfer is to be made, should not exceed the intake fixed by the University for the concerned Branch;

11.5.2 The actual number of students in any Branch from which transfer is being sought does not fall below 75% of the total intake fixed by the University for the concerned Branch.

The process of change of Branch shall be completed within the first five days of Registration for the 3rd Semester of the B.Tech. Program.

## 12 Specific Regulations regarding Assessment and Evaluation

12.1 The academic performance evaluation of a student in a Course shall be according to the University Letter Grading System based on the class performance distribution in the Course.

12.2 Academic performance evaluation of every registered student in every Course registered by the student is carried out through various components of Assessments spread across the Semester. The nature of components of Continuous Assessments and the weightage given to each component of Continuous Assessments (refer Clause 12.5) shall be clearly defined in the Course Plan for every Course, and approved by the DAC.

12.3 Format of the End-Term examination shall be specified in the Course Plan.

12.4 Grading is the process of rewarding the students for their overall performance in each Course. The University follows the system of Relative Grading with statistical approach to classify the students based on the relative performance of the students registered in the concerned Course except in the following cases:

- Non-Teaching Credit Courses (NTCC)
- Courses with a class strength less than 30

Absolute grading method may be adopted, where necessary with prior approval of concerned DAC.

Grading shall be done at the end of the Academic Term by considering the aggregate performance of the student in all components of Assessments prescribed for the Course. Letter Grades (Clause **Error! Reference source not found.**) shall be awarded to a student based on her / his overall performance relative to the class performance distribution in the concerned Course. These Letter Grades not only indicate a qualitative assessment of the student's performance but also carry a quantitative (numeric) equivalent called the Grade Point.

12.5 **Assessment Components and Weightage**

**Table 1: Assessment Components and Weightage for different category of Courses**

| Nature of Course and Structure | Evaluation Component | Weightage |
|---|---|---|
| **Lecture-based Course**<br>L component in the L-T-P Structure is predominant (more than 1)<br>(Examples: 3-0-0; 3-0-2; 2-1-0; 2-0-2, 2-0-4 etc.) | Continuous Assessments | 50% |
| | End Term Examination | 50% |
| **Lab/Practice-based Course**<br>P component in the L-T-P Structure is predominant<br>(Examples: 0-0-4; 1-0-4; 1-0-2; etc.) | Continuous Assessments | 100% |

| | |
|---|---|
| **Skill based Courses** like Industry Internship, Capstone project, Research Dissertation, Integrative Studio, Interdisciplinary Project, Summer / Short Internship, Social Engagement / Field Projects, Portfolio, and such similar Non-Teaching Credit Courses, where the pedagogy does not lend itself to a typical L-T-P structure | Guidelines for the assessment components for the various types of Courses, with recommended weightages, shall be specified in the concerned Program Regulations and Curriculum / Course Plans, as applicable. |

The exact weightages of Evaluation Components shall be clearly specified in the concerned PRC and respective Course Plan.

Normally, for Practice / Skill based Courses, without a defined credit structure (L–T–P) [NTCC], but with assigned Credits (as defined in Clause **Error! Reference source not found.** of the Academic Regulations), the method of evaluation shall be based only on Continuous Assessments. The various components of Continuous Assessments, the distribution of weightage among such components, and the method of evaluation / assessment, shall be as decided and indicated in the Course Plan / PRC. The same shall be approved by the respective DAC.

12.6 **Minimum Performance Criteria:**

12.6.1 **Theory only Course and Lab / Practice Embedded Theory Course**

A student shall satisfy the following minimum performance criteria to be eligible to earn the credits towards the concerned Course:

a. A student must obtain a minimum of 30% of the total marks / weightage assigned to the End Term Examinations in the concerned Course.

b. The student must obtain a minimum of 40% of the AGGREGATE of the marks / weightage of the components of Continuous Assessments, Mid Term Examinations and End Term Examinations in the concerned Course.

12.6.2 **Lab / Practice only Course and Project Based Courses**

The student must obtain a minimum of 40% of the AGGREGATE of the marks / weightage of all assessment components in the concerned Course.

12.6.3 A student who fails to meet the minimum performance criteria listed above in a Course shall be declared as “Fail” and given “F” Grade in the concerned Course. For theory Courses, the student shall have to re-appear in the “Make-Up Examinations” as scheduled by the University in any subsequent semester, or, re-appear in the End Term Examinations of the same Course when it is scheduled at the end of the following Semester or Summer Term, if offered. The marks obtained in the Continuous Assessments (other than the End Term Examination) shall be carried forward and be included in computing the final grade, if the student secures the minimum requirements (as per Clause 12.6.1 and 12.6.2 of Academic Regulations) in the “Make-Up Examinations” of the concerned Course. Further, the student has an option to re-register for the Course and clear the same in the summer term / subsequent semester if he / she wishes to do so, provided the Course is offered.

13 **Additional Clarifications - Rules and Guidelines for Transfer of Credits from MOOC, etc.**

The University allows students to acquire credits from other Indian or foreign institutions and / or Massive Open Online Course (MOOC) platforms, subject to prior approval. These credits may be transferred and counted toward

fulfilling the minimum credit requirements for the award of a degree. The process of transfer of credits is governed by the following rules and guidelines:

13.1 The transfer of credits shall be examined and recommended by the Equivalence Committee (Refer **Error! Reference source not found.** of Academic Regulations) and approved by the Dean - Academics.

13.2 Students may earn credits from other Indian or foreign Universities / Institutions with which the University has an MOU, and that MOU shall have specific provisions, rules and guidelines for transfer of credits. These transferred credits shall be counted towards the minimum credit requirements for the award of the degree.

13.3 Students may earn credits by registering for Online Courses offered by *Study Web of Active Learning by Young and Aspiring Minds* (SWAYAM) and *National Program on Technology Enhanced Learning* (NPTEL), or other such recognized Bodies / Universities / Institutions as approved by the concerned BOS and Academic Council from time to time. The concerned School / Parent Department shall publish / include the approved list of Courses and the rules and guidelines governing such transfer of credits of the concerned Program from time to time. The Rules and Guidelines for the transfer of credits specifically from the Online Courses conducted by SWAYAM / NPTEL / other approved MOOCs are as stated in the following Sub-Clauses:

13.3.1 A student may complete SWAYAM / NPTEL / other approved MOOCs as mentioned in Clause 13.2 (as per Academic Regulations) and transfer equivalent credits to partially or fully complete the mandatory credit requirements of Discipline Elective Courses and / or the mandatory credit requirements of Open Elective Courses as prescribed in the concerned Curriculum Structure. However, it is the sole responsibility of the student to complete the mandatory credit requirements of the Discipline Elective Courses and the Open Elective Courses as prescribed by the Curriculum Structure of the concerned Program.

13.3.2 SWAYAM / NPTEL / other approved MOOCs as mentioned in Clause 13.2 (as per Academic Regulations) shall be approved by the concerned Board of Studies and placed (as Annexures) in the concerned PRC.

13.3.3 Parent Departments may release a list of SWAYAM / NPTEL / other approved MOOCs for Pre-Registration as per schedule in the Academic Calendar or through University Notification to this effect.

13.3.4 Students may Pre-Register for the SWAYAM / NPTEL / other approved MOOCs in the respective Departments and register for the same Courses as per the schedule announced by respective Online Course Offering body / institute / university.

13.3.5 A student shall request for transfer of credits only from such approved Courses as mentioned in Sub-Clause 13.3.1 above.

13.3.6 SWAYAM / NPTEL / other approved MOOCs Courses are considered for transfer of credits only if the concerned student has successfully completed the SWAYAM / NPTEL / other approved MOOCs and obtained a certificate of successful / satisfactory completion.

13.3.7 A student who has successfully completed the approved SWAYAM / NPTEL / other approved MOOCs and wants to avail the provision of transfer of equivalent credits, must submit the original Certificate of Completion, or such similar authorized documents to the HOD concerned, with a written request for the transfer of the equivalent credits. On verification of the Certificates / Documents and approval by the HOD concerned, the Course(s) and equivalent Credits shall be forwarded to the COE for processing of results of the concerned Academic Term.

13.3.8 The credit equivalence of the SWAYAM / NPTEL / other approved MOOCs are based on Course durations and / or as recommended by the Course offering body / institute / university. The Credit Equivalence mapped to SWAYAM / NPTEL approved Courses based on Course durations for transfer of credits is summarised in Table shown below. The Grade will be calculated from the marks received by the Absolute Grading Table **Error! Reference source not found.** in Academic Regulations.

| **Table 2: Durations and Credit Equivalence for Transfer of Credits from SWAYAM-NPTEL / other approved MOOC Courses** | | |
|---|---|---|
| **Sl. No.** | **Course Duration** | **Credit Equivalence** |
| 1 | 4 Weeks | 1 Credit |
| 2 | 8 Weeks | 2 Credits |
| 3 | 12 Weeks | 3 Credits |

13.3.9 The maximum permissible number of credits that a student may request for credit transfer from MOOCs shall not exceed 20% of the mandatory minimum credit requirements specified by the concerned Program Regulations and Curriculum for the award of the concerned Degree.

13.3.10 The University shall not reimburse any fees / expense; a student may incur for the SWAYAM / NPTEL / other approved MOOCs.

13.4 The maximum number of credits that can be transferred by a student shall be limited to forty percent (40%) of the mandatory minimum credit requirements specified by the concerned Program Regulations and Curriculum for the award of the concerned Degree. However, the grades obtained in the Courses transferred from other Institutions / MOOCs, as mentioned in this Section (13.**Error! Reference source not found.**), shall not be included in the calculation of the CGPA.

## PART B – PROGRAM TRUCTURE

**14. Structure / Component with Credit Requirements Course Baskets & Minimum Basket wise Credit Requirements**

The B.Tech. (Petroleum Engineering) Program Structure (2023-2027) totalling 160 credits. Table 3A summarizes the type of baskets, and the associated credits that are mandatorily required for the completion of the Degree.

**Table 3A: B.Tech. (Petroleum Engineering) 2023-2027: Summary of Mandatory Courses and Minimum Credit Contribution from various Baskets**

| Sl. No. | Baskets | Credit Contribution |
|---|---|---|
| 1 | School Core Course (SCC) | 58 |
| 2 | Program Core Course (PCC) | 60 |
| 3 | Discipline Elective Course (DEC) | 30 |
| 4 | Open Elective Course (OEC) | 12 |
| | **Total Credits** | **160 (Minimum)** |

In the entire Program, the practical and skill-based course component contribute to an extent of approximately 57% out of the total credits of 160 for B.Tech. (Petroleum Engineering) program of four years' duration.

The curriculum structure is designed as per the CBCS and incorporating OBE Principles. The students are provided with at most flexibility in selection of the courses of their choice. The curriculum provides an opportunity to the students to obtain a specific specialization with the basic degree of Bachelor of Technology in Petroleum Engineering. To obtain a specialization. the student must register and earn minimum credits for discipline electives courses from the various specialization baskets as indicated in Table 3B.

**Table 3B: Minimum Credits for Discipline Elective Courses (DECs) from various Specialization Baskets**

| **Specialization Baskets** → ↓ | General Petroleum Engineering | Petroleum Exploration and Drilling Engineering | Reservoir and Production Engineering | Pipeline and Petroleum Refining Engineering |
|---|---|---|---|---|
| General Petroleum Engineering | 6 | 3 | 3 | 3 |
| Petroleum Exploration and Drilling Engineering | 6 | 15 | 6 | 6 |
| Reservoir and Production Engineering | 9 | 6 | 15 | 6 |
| Pipeline and Petroleum Refining Engineering | 9 | 6 | 6 | 15 |
| **TOTAL** | **30** | **30** | **30** | **30** |

NOTE:
(1) A student will have to earn a minimum of 15 credits from a given specialization basket, to earn that specialization. This rule does not apply to "General Petroleum Engineering" Basket.
(2) The credits from other baskets shown above for each minor are indicative and not binding.

A student will have to complete a minimum of 15 credits of Discipline Electives from a given specialization basket, to earn a specialization certificate in addition to the base degree to which he / she has taken admission

**15. Minimum Total Credit Requirements of Award of Degree**

As per the AICTE guidelines, a minimum of 160 credits is required for the award of a B.Tech. degree.

**16. Other Specific Requirements for Award of Degree, if any, as prescribed by the Statutory Bodies**

16.1 The award of the Degree shall be recommended by the Board of Examinations and approved by the Academic Council and Board of Management of the University**.**

16.2 A student shall be declared to be eligible for the award of the concerned Degree if she / he:

a. Fulfilled the Minimum Credit Requirements and the Minimum Credits requirements under various baskets;

b. Secure a minimum CGPA of 4.50 in the concerned Program at the end of the Semester / Academic Term in which she / he completes all the requirements for the award of the Degree as specified in Sub-Clause 19.2.1 of Academic Regulations;

c. No dues to the University, Departments, Hostels, Library, and any other such Centers / Departments of the University; and

d. No disciplinary action is pending against her / him.

## PART C – CURRICULUM STRUCTURE

### 17. Curriculum Structure – Basket Wise Course List

| Table 3.1: List of School Core Courses (SCCs) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Sl. No.** | **Course Code** | **Course Name** | **L** | **T** | **P** | **C** | **Contact Hours** | **Type of Skills** | **Course Caters To** |
| 1 | CIV1008 | Basic Engineering Sciences | 2 | 0 | 0 | 2 | 2 | | |
| 2 | CSE1006 | Problem Solving using JAVA | 2 | 0 | 2 | 3 | 4 | | |
| 3 | CSE1004 | Problem Solving Using C | 1 | 0 | 4 | 3 | 5 | | |
| 4 | CSE1005 | Programming in Python | 1 | 0 | 4 | 3 | 5 | | |
| 5 | CSE2001 | Data Structures and Algorithms | 3 | 0 | 2 | 4 | 5 | | |
| 6 | CSE3216 | Mastering Object-Oriented Concepts in Python | 0 | 0 | 2 | 1 | 2 | | |
| 7 | ECE2010 | Innovative Projects using Arduino | - | - | - | 1 | - | | |
| 8 | EEE1001 | Fundamentals of Electrical and Electronics Engineering | 3 | 0 | 2 | 4 | 5 | | |
| 9 | ECE2011 | Innovative Projects using Raspberry Pi | - | - | - | 1 | - | | |
| 10 | ENG1002 | Technical English | 1 | 0 | 2 | 2 | 3 | | |
| 11 | ENG2001 | Advanced English | 1 | 0 | 2 | 2 | 3 | | |
| 12 | MAT1001 | Calculus and Linear Algebra | 3 | 0 | 2 | 4 | 5 | | |
| 13 | MAT1002 | Transform Techniques, Partial Differential Equations and Their Applications | 3 | 0 | 0 | 3 | 3 | | |
| 14 | MAT1003 | Applied Statistics | 1 | 0 | 2 | 2 | 3 | | |
| 15 | MEC1006 | Engineering Graphics | 2 | 0 | 0 | 2 | 2 | | |
| 16 | MAT2003 | Numerical Methods for Engineers | 1 | 0 | 2 | 2 | 3 | | |
| 17 | PHY1001 | Material Physics | 2 | 0 | 2 | 3 | 4 | | |
| 18 | PPS1001 | Introduction to soft skills | 0 | 0 | 2 | 1 | 2 | | |
| 19 | PPS1012 | Enhancing Personality through Soft skills | 0 | 0 | 2 | 1 | 2 | | |
| 20 | PPS1011 | Introduction to Verbal Ability | 0 | 1 | 0 | 0 | 1 | | |
| 21 | PPS4002 | Introduction to Aptitude | 0 | 0 | 2 | 1 | 2 | | |
| 22 | PPS4004 | Aptitude Training Intermediate | 0 | 0 | 2 | 1 | 2 | | |
| 23 | CHE1018 | Environmental Science | 1 | 0 | 2 | 0 | 3 | | |
| 24 | PIP2001 | Capstone Project | - | - | - | 4 | - | SC | SD / EM / EN |
| 25 | PIP4006 | Internship | - | - | - | 8 | - | SC | SD / EM / EN |
| **Total No. of Credits** | | | | | | **58** | | | |

| Table 3.2: List of Program Core Courses (PCCs) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Sl. No.** | **Course Code** | **Course Name** | **L** | **T** | **P** | **C** | **Contact Hours** | **Type of Skills** | **Course Caters To** |
| 1 | CHE1017 | Applied Chemistry | 1 | 0 | 2 | 2 | 3 | SD | - |
| 2 | PET1001 | Petroleum Geology | 3 | 0 | 2 | 4 | 5 | SD | - |
| 3 | PET1002 | Introduction to Oil and Gas Industry | 3 | 0 | 0 | 3 | 3 | SD | ES/HP |
| 4 | PET2001 | Drilling Fluids and Cements | 3 | 0 | 2 | 4 | 5 | SD | - |
| 5 | PET2002 | Fundamentals of Geophysical Logging Techniques | 3 | 1 | 0 | 4 | 4 | SD | - |
| 6 | PET2003 | Fundamentals of Oil and Gas Well Drilling Technology | 3 | 0 | 0 | 3 | 3 | SD | - |
| 7 | PET2004 | Fundamentals of Petroleum Reservoir Engineering | 3 | 0 | 2 | 4 | 5 | SD | - |
| 8 | PET2008 | Heat and Mass Transfer for Petroleum Engineering | 2 | 0 | 2 | 3 | 4 | SD | - |
| 9 | PET2009 | Thermodynamics of Reservoir Fluids | 2 | 0 | 2 | 3 | 4 | SD | - |
| 10 | PET2010 | Introduction to Oil and Gas Reservoir Simulation | 1 | 0 | 2 | 2 | 3 | SD | - |
| 11 | PET2012 | Reservoir Fluid Mechanics | 2 | 0 | 2 | 3 | 4 | SD | - |
| 12 | PET2107 | Fundamentals of Instrumentation and Control Engineering | 2 | 0 | 0 | 2 | 2 | SD | - |
| 13 | PET2108 | Fundamentals of Instrumentation and Control Engineering Lab | 0 | 0 | 2 | 1 | 2 | SD | - |
| 14 | PET2109 | Oil and Gas Surface Facility Design | 2 | 0 | 0 | 2 | 2 | SD | - |
| 15 | PET2110 | Oil and Gas Surface Facility Design Lab | 0 | 0 | 2 | 1 | 2 | SD | - |
| 16 | PET2115 | Oil and Gas Downstream Operations | 3 | 0 | 0 | 3 | 3 | SD | - |
| 17 | PET2116 | Oil and Gas Downstream Operations Lab | 0 | 0 | 2 | 1 | 2 | SD | - |
| 18 | PET2123 | Fundamentals of Oil and Gas Production Technology | 2 | 1 | 0 | 3 | 3 | SD | - |
| 19 | PET2124 | Geophysical Methods for Oil and Gas Exploration | 3 | 0 | 0 | 3 | 3 | SD | - |
| 20 | PET2125 | Oil and Gas Well Test Analysis | 2 | 1 | 0 | 3 | 3 | SD | - |
| 21 | PET2126 | Offshore Drilling and Petroleum Production Practices | 3 | 0 | 0 | 3 | 3 | SD | ES |
| 22 | PET2127 | Advanced Petroleum Reservoir Engineering | 2 | 1 | 0 | 3 | 3 | SD | - |
| **Total No. of Credits** | | | | | | **60** | | | |

## 18. Practical / Skill based Courses – Internships / Thesis / Dissertation / Capstone Project Work / Portfolio / Mini Project

Practical / Skill based Courses like internship, project work, capstone project, research project / dissertation, and such similar courses, where the pedagogy does not lend itself to a typical L-T-P-C Structure as defined in Clause 5.1 of the Academic Regulations are simply assigned the number of Credits based on the quantum of work / effort required to fulfill the learning objectives and outcomes prescribed for the concerned Courses. Such courses are referred to as Non-Teaching Credit Courses (NTCC). These Courses are designed to provide students with hands-on experience and skills essential for their professional development. These courses aim to equip students with abilities

in problem identification, root cause analysis, problem-solving, innovation, and design thinking through industry exposure and project-based learning. The expected outcomes are first level proficiency in problem solving and design thinking skills to better equip B.Tech. graduates for their professional careers. The method of evaluation and grading for the Practical / Skill based Courses shall be prescribed and approved by the concerned Departmental Academic Committee (refer Annexure A of the Academic Regulations). The same shall be prescribed in the Course Plan.

### *18.1 Internship*

A student may undergo an Internship for a period of 4-6 weeks in an industry / company or academic / research institution during the Semester Break between 4th and 5th Semesters or 6th and 7th Semesters, subject to the following conditions:

18.1.1 The Internship shall be in conducted in accordance with the Internship Policy prescribed by the University from time to time.

18.1.2 The selection criteria (minimum CGPA, pass in all Courses as on date, and any other qualifying criteria) as applicable / stipulated by the concerned Industry / Company or academic / research institution for award of the Internship to a student;

18.1.3 The number of Internships available for the concerned Academic Term. Further, the available number of internships shall be awarded to the students by the University on the basis of merit using the CGPA secured by the student. Provided further, the student fulfils the criteria, as applicable, specified by the Industry / Company or academic / research institution providing the Internship, as stated in Sub-Clause 18.1.2 above.

18.1.4 A student may opt for Internship in an Industry / Company or academic / research institution of her / his choice, subject to the condition that the concerned student takes the responsibility to arrange the Internship on her / his own. Provided further, that the Industry / Company or academic / research institution offering such Internship confirms to the University that the Internship shall be conducted in accordance with the Program Regulations and Internship Policy of the University.

18.1.5 A student selected for an Internship in an industry / company or academic / research institution shall adhere to all the rules and guidelines prescribed in the Internship Policy of the University.

### *18.2 Project Work*

A student may opt to do a Project Work for a period of 4-6 weeks in an Industry / Company or academic / research institution or the University Department(s) as an equivalence of Internship during the Semester Break between 4th and 5th Semesters or 6th and 7th Semesters or during the 5th / 6th / 7th Semester as applicable, subject to the following conditions:

18.2.1 The Project Work shall be approved by the concerned HOD and be carried out under the guidance of a faculty member.

18.2.2 The student may do the project work in an Industry / Company or academic / research institution of her / his choice subject to the above mentioned condition (Sub-Clause 18.2.1). Provided further, that the Industry / Company or academic / research institution offering such project work confirms to the University that the project work will be conducted in accordance with the Program Regulations and requirements of the University.

### *18.3 Capstone Project*

A student may undergo a Capstone Project for a period of 12-14 weeks in an industry / company or academic / research institution in the 7th / 8th Semester as applicable, subject to the following conditions:

18.3.1 The Capstone Project shall be in conducted in accordance with the Capstone Project Policy prescribed by the University from time to time.

18.3.2 The selection criteria (minimum CGPA, pass in all Courses as on date, and any other qualifying criteria) as applicable / stipulated by the concerned Industry / Company or academic / research institution for award of the Capstone Project to a student;

18.3.3 The number of Capstone Project available for the concerned Academic Term. Further, the available number of Capstone Project shall be awarded to the students by the University on the basis of merit using the CGPA secured by the student. Provided further, the student fulfils the criteria, as applicable, specified by the Industry / Company or academic / research institution providing the Capstone Project, as stated in Sub-Clause 18.3.2 above.

18.3.4 A student may opt for Capstone Project in an Industry / Company or academic / research institution of her / his choice, subject to the condition that the concerned student takes the responsibility to arrange the Capstone Project on her / his own. Provided further, that the Industry / Company or academic / research institution offering such Capstone Project confirms to the University that the Capstone Project shall be conducted in accordance with the Program Regulations and Internship Policy of the University.

18.3.5 A student selected for a Capstone Project in an industry / company or academic / research institution shall adhere to all the rules and guidelines prescribed in the Capstone Project Policy of the University.

### *18.4 Research Project / Dissertation*

A student may opt to do a Research Project / Dissertation for a period of 12-14 weeks in an Industry / Company or academic / research institution or the University Department(s) as an equivalence of Capstone Project, subject to the following conditions:

18.4.1 The Research Project / Dissertation shall be approved by the concerned HOD and be carried out under the guidance of a faculty member.

18.4.2 The student may do the Research Project / Dissertation in an Industry / Company or academic / research institution of her / his choice subject to the above mentioned condition (Sub-Clause 18.4.1). Provided further, that the Industry / Company or academic / research institution offering such Research Project / Dissertation confirms to the University that the Research Project / Dissertation work will be conducted in accordance with the Program Regulations and requirements of the University.

## 19. List of Discipline Elective Courses under various Specialisation Baskets

**Table 3.3: List of Discipline Elective (DE) Courses / Specialization Baskets**

**Specialization Basket 1: General Petroleum Engineering Basket**

| Sl. No. | Course Code | Course Name | L | T | P | C | Contact Hours | Type of Skills | Course Caters To |
|---|---|---|---|---|---|---|---|---|---|
| 1 | PET1701 | Petroleum Data Analysis | 2 | 0 | 2 | 3 | 4 | SD/EM | ES |
| 2 | PET1702 | Carbon Capture and Utilization for Sustainability | 3 | 0 | 0 | 3 | 3 | SD/EM | ES |
| 3 | PET3101 | Quality Management Practices in Oil and Gas Industry | 3 | 0 | 0 | 3 | 3 | EM | HP |
| 4 | PET2030 | Occupational Health and Safety | 3 | 0 | 0 | **3** | 3 | EM | ES/HP |
| 5 | PET3103 | Overview of Material Science | 3 | 0 | 0 | 3 | 3 | FC/SD | - |
| 6 | PET4001 | Minor Project | - | - | - | 3 | - | EM | ES / HP |

**Specialization Basket 2: Petroleum Exploration and Drilling Engineering Basket**

| Sl. No. | Course Code | Course Name | L | T | P | C | Contact Hours | Type of Skills | Course Caters To |
|---|---|---|---|---|---|---|---|---|---|
| 1 | PET3104 | Introduction to Geoinformatics | 3 | 0 | 0 | 3 | 3 | SD | HP |
| 2 | PET3105 | Coal Bed Methane | 3 | 0 | 0 | 3 | 3 | SD | HP |
| 3 | PET2016 | Shale Gas | 2 | 0 | 0 | **2** | 2 | SD | HP |
| 4 | PET2017 | Natural Gas Hydrates | 3 | 0 | 0 | **3** | 3 | SD | HP |
| 5 | PET3108 | Geomechanics for Wellbore Stability Analysis | 2 | 1 | 0 | 3 | 3 | EM | ES/HP |
| 6 | PET3002 | Directional Drilling Technology | 3 | 0 | 0 | **3** | 3 | EM | HP |
| 7 | PET3004 | Advanced Well Engineering | 3 | 0 | 0 | **3** | 3 | EM | HP |
| 8 | PET3111 | Multilateral and Horizontal Well Technology | 3 | 0 | 0 | **3** | 3 | EM | HP |

**Specialization Basket 3: Reservoir and Production Engineering Basket**

| Sl. No. | Course Code | Course Name | L | T | P | C | Contact Hours | Type of Skills | Course Caters To |
|---|---|---|---|---|---|---|---|---|---|
| 1 | PET3112 | Integrated Field Development and Planning | 3 | 0 | 0 | **3** | 3 | SD | HP |
| 2 | PET3113 | Process Design and Calculations | 3 | 0 | 0 | **3** | 3 | SD | HP |
| 3 | PET3114 | Solids Handling in Oil and Gas Industry | 3 | 0 | 0 | **3** | 3 | SD | ES |
| 4 | PET3115 | Design in Production Engineering | 3 | 0 | 0 | **3** | 3 | EM | HP |
| 5 | PET2024 | Wellbore Problems and Mitigation | 3 | 0 | 0 | **3** | 3 | EM | HP |
| 6 | PET2128 | Enhanced Oil and Gas Recovery Techniques | 3 | 0 | 0 | **3** | 3 | EM | HP |
| 7 | PET3117 | Introduction to Computational Fluids Dynamics | 3 | 0 | 0 | 3 | 3 | SD/EN | - |
| 8 | PET3118 | Petroleum Economics | 3 | 0 | 0 | 3 | 3 | SD/EM/ EN | ES |
| 9 | PET3119 | Fluid Flow through Porous Media | 3 | 0 | 0 | **3** | 3 | EM | HP |
| 10 | PET3120 | Natural Gas Reservoir Engineering | 3 | 0 | 0 | **3** | 3 | EM | HP |
| 11 | PET3121 | Natural Gas Production Engineering | 3 | 0 | 0 | **3** | 3 | EM | HP |
| 12 | PET3122 | Well Intervention Technologies | 3 | 0 | 0 | **3** | 3 | EM | HP |

**Specialization Basket 4: Pipeline and Petroleum Refining Engineering Basket**

| Sl. No. | Course Code | Course Name | L | T | P | C | Contact Hours | Type of Skills | Course Caters To |
|---|---|---|---|---|---|---|---|---|---|
| 1 | PET3123 | Process Pipeline Design | 3 | 0 | 0 | 3 | 3 | EM | HP |
| 2 | PET3124 | Corrosion Science and Technology | 3 | 0 | 0 | 3 | 3 | EM | ES |
| 3 | PET3125 | Polymer Science and Technology | 3 | 0 | 0 | 3 | 3 | FC/SD/EM | - |
| 4 | PET3126 | Petroleum Logistics, Marketing, and Management | 3 | 0 | 0 | **3** | 3 | FC/SD/EM | - |
| 5 | PET3127 | Fundamentals of Chemical Engineering | 3 | 0 | 0 | **3** | 3 | SD | ES |
| 6 | PET3128 | Advanced Refining Engineering | 3 | 0 | 0 | **3** | 3 | EM | HP |
| 7 | PET3129 | Advanced Petrochemical Engineering | 3 | 0 | 0 | **3** | 3 | SD | HP/ES |
| 8 | PET3130 | Chemical Reaction Engineering | 3 | 0 | 0 | **3** | 3 | SD | HP |
| 9 | PET3131 | Process Equipment Design | 3 | 0 | 0 | **3** | 3 | EN | HP |

**20. List of Open Electives to be offered by the Department and various Schools**

| Table 3.4: Open Elective Courses Baskets | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Chemistry Basket** | | | | | | | | | |
| **Sl. No.** | **Course Code** | **Course Name** | **L** | **T** | **P** | **C** | **Contact Hours** | **Type of Skills** | **Course Caters To** |
| 1 | CHE1003 | Fundamentals of Sensors | 3 | 0 | 0 | 3 | 3 | SD | ES |
| 2 | CHE1004 | Smart materials for IOT | 3 | 0 | 0 | 3 | 3 | SD | ES |
| 3 | CHE1005 | Computational Chemistry | 2 | 0 | 0 | 2 | 2 | SD | ES |
| 4 | CHE1006 | Introduction to Nano technology | 3 | 0 | 0 | 3 | 3 | SD | ES |
| 5 | CHE1007 | Biodegradable electronics | 2 | 0 | 0 | 2 | 2 | SD | ES |
| 6 | CHE1008 | Energy and Sustainability | 2 | 0 | 0 | 2 | 2 | SD | ES |
| 7 | CHE1009 | 3D printing with Polymers | 2 | 0 | 0 | 2 | 2 | SD | ES |
| 8 | CHE1010 | Bioinformatics and Healthcare IT | 2 | 0 | 0 | 2 | 2 | SD | ES |
| 9 | CHE1011 | Chemical and Petrochemical catalysts | 3 | 0 | 0 | 3 | 3 | SD | ES |
| 10 | CHE1012 | Introduction to Composite materials | 2 | 0 | 0 | 2 | 2 | SD | ES |
| 11 | CHE1013 | Chemistry for Engineers | 3 | 0 | 0 | 3 | 3 | SD | ES |
| 12 | CHE1014 | Surface and Coatings technology | 3 | 0 | 0 | 3 | 3 | SD | ES |
| 13 | CHE1015 | Waste to Fuels | 2 | 0 | 0 | 2 | 2 | SD | ES |
| 14 | CHE1016 | Forensic Science | 3 | 0 | 0 | 3 | 3 | SD | HP |
| **Civil Engineering Basket** | | | | | | | | | |
| **Sl. No.** | **Course Code** | **Course Name** | **L** | **T** | **P** | **C** | **Contact Hours** | **Type of Skills** | **Course Caters To** |
| 1 | CIV1001 | Disaster mitigation and management | 3 | 0 | 0 | 3 | 3 | SD | ES/HP |
| 2 | CIV1002 | Environment Science and Disaster Management | 3 | 0 | 0 | 3 | 3 | FC | ES |
| 3 | CIV2001 | Sustainability Concepts in Engineering | 3 | 0 | 0 | 3 | 3 | SD | ES |
| 4 | CIV2002 | Occupational Health and Safety | 3 | 0 | 0 | 3 | 3 | SD | - |
| 5 | CIV2003 | Sustainable Materials and Green Buildings | 3 | 0 | 0 | 3 | 3 | EM | ES |
| 6 | CIV2004 | Integrated Project Management | 3 | 0 | 0 | 3 | 3 | EN | HP/GS |
| 7 | CIV2005 | Environmental Impact Assessment | 3 | 0 | 0 | 3 | 3 | EN | ES |
| 8 | CIV2006 | Infrastructure Systems for Smart Cities | 3 | 0 | 0 | 3 | 3 | EN | ES |
| 9 | CIV2044 | Geospatial Applications for Engineers | 2 | 0 | 2 | 3 | 4 | EM | ES |
| 10 | CIV2045 | Environmental Meteorology | 3 | 0 | 0 | 3 | 3 | SD | ES |
| 11 | CIV3046 | Project Problem Based Learning | 3 | 0 | 0 | 3 | 3 | SD | ES |
| 12 | CIV3059 | Sustainability for Professional Practice | 3 | 0 | 0 | 3 | 3 | SD | ES |
| **Commerce Basket** | | | | | | | | | |
| **Sl. No.** | **Course Code** | **Course Name** | **L** | **T** | **P** | **C** | **Contact Hours** | **Type of Skills** | **Course Caters To** |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | COM2001 | Introduction to Human Resource Management | 2 | 0 | 0 | 2 | 2 | FC | HP/GS |
| 2 | COM2002 | Finance for Non Finance | 2 | 0 | 0 | 2 | 2 | SD | - |
| 3 | COM2003 | Contemporary Management | 2 | 0 | 0 | 2 | 2 | FC | - |
| 4 | COM2004 | Introduction to Banking | 2 | 0 | 0 | 2 | 2 | FC | - |
| 5 | COM2005 | Introduction to Insurance | 2 | 0 | 0 | 2 | 2 | FC | - |
| 6 | COM2006 | Fundamentals of Management | 2 | 0 | 0 | 2 | 2 | FC | - |
| 7 | COM2007 | Basics of Accounting | 3 | 0 | 0 | 3 | 3 | FC | - |

**Computer Science Basket**

| Sl. No. | Course Code | Course Name | L | T | P | C | Contact Hours | Type of Skills | Course Caters To |
|---|---|---|---|---|---|---|---|---|---|
| 1 | CSE2002 | Programming in Java | 2 | 0 | 2 | 3 | 4 | SD/EM | - |
| 2 | CSE2003 | Social Network Analytics | 3 | 0 | 0 | 3 | 3 | SD | GS |
| 3 | CSE2004 | Python Application Programming | 2 | 0 | 2 | 3 | 4 | SD/EM | - |
| 4 | CSE2005 | Web design fundamentals | 2 | 0 | 2 | 3 | 4 | SD/EM/EN | - |
| 5 | CSE3111 | Artificial Intelligence: Search Methods For Problem Solving | 3 | 0 | 0 | 3 | 3 | SD/EM/EN | - |
| 6 | CSE3112 | Privacy And Security In Online Social Media | 3 | 0 | 0 | 3 | 3 | SD/EM/EN | - |
| 7 | CSE3113 | Computational Complexity | 3 | 0 | 0 | 3 | 3 | SD/EM/EN | - |
| 8 | CSE3114 | Deep Learning for Computer Vision | 3 | 0 | 0 | 3 | 3 | SD/EM/EN | - |
| 9 | CSE3115 | Learning Analytics Tools | 3 | 0 | 0 | 3 | 3 | SD/EM/EN | - |

**Design Basket**

| Sl. No. | Course Code | Course Name | L | T | P | C | Contact Hours | Type of Skills | Course Caters To |
|---|---|---|---|---|---|---|---|---|---|
| 1 | DES1001 | Sketching and Painting | 0 | 0 | 2 | 1 | 2 | SD | - |
| 2 | DES1002 | Innovation and Creativity | 2 | 0 | 0 | 2 | 2 | FC | - |
| 3 | DES1121 | Introduction to UX design | 1 | 0 | 2 | 2 | 3 | SD | - |
| 4 | DES1122 | Introduction to Jewellery Making | 1 | 0 | 2 | 2 | 3 | SD | - |
| 5 | DES1124 | Spatial Stories | 1 | 0 | 2 | 2 | 3 | SD | - |
| 6 | DES1125 | Polymer Clay | 1 | 0 | 2 | 2 | 3 | SD | - |
| 7 | DES2001 | Design Thinking | 3 | 0 | 0 | 3 | 3 | SD | - |
| 8 | DES1003 | Serviceability of Fashion Products | 1 | 0 | 2 | 2 | 3 | FC | ES |
| 9 | DES1004 | Choices in Virtual Fashion | 1 | 0 | 2 | 2 | 3 | FC | ES/GS/HP |
| 10 | DES1005 | Fashion Lifestyle and Product Diversity | 1 | 0 | 2 | 2 | 3 | FC | ES/GS/HP |
| 11 | DES1006 | Colour in Everyday Life | 1 | 0 | 2 | 2 | 3 | FC | ES |
| 12 | DES2080 | Art of Design Language | 3 | 0 | 0 | 3 | 3 | SD | - |
| 13 | DES2081 | Brand Building in Design | 3 | 0 | 0 | 3 | 3 | SD | - |
| 14 | DES2085 | Web Design Techniques | 3 | 0 | 0 | 3 | 3 | SD | - |
| 15 | DES2089 | 3D Modeling for Professionals | 1 | 0 | 4 | 3 | 5 | SD | - |
| 16 | DES2090 | Creative Thinking for Professionals | 3 | 0 | 0 | 3 | 3 | SD | - |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 17 | DES2091 | Idea Formulation | 3 | 0 | 0 | 3 | 3 | SD | - |

**Electrical and Electronics Engineering Basket**

| Sl. No. | Course Code | Course Name | L | T | P | C | Contact Hours | Type of Skills | Course Caters To |
|---|---|---|---|---|---|---|---|---|---|
| 1 | EEE1002 | IoT based Smart Building Technology | 3 | 0 | 0 | 3 | 3 | SD | - |
| 2 | EEE1003 | Basic Circuit Analysis | 3 | 0 | 0 | 3 | 3 | SD | - |
| 3 | EEE1004 | Fundamentals of Industrial Automation | 3 | 0 | 0 | 3 | 3 | SD | - |
| 4 | EEE1005 | Electric Vehicles & Battery Technology | 3 | 0 | 0 | 3 | 3 | SD | - |
| 5 | EEE1006 | Smart Sensors for Engineering Applications | 3 | 0 | 0 | 3 | 3 | SD | - |

**Electronics and Communication Engineering Basket**

| Sl. No. | Course Code | Course Name | L | T | P | C | Contact Hours | Type of Skills | Course Caters To |
|---|---|---|---|---|---|---|---|---|---|
| 1 | ECE1003 | Fundamentals of Electronics | 3 | 0 | 0 | 3 | 3 | FC | - |
| 2 | ECE3089 | Artificial Neural Networks | 3 | 0 | 0 | 3 | 3 | FC | - |
| 3 | ECE3090 | Digital System Design using VERILOG | 3 | 0 | 0 | 3 | 3 | FC | - |
| 4 | ECE3091 | Mathematical Physics | 3 | 0 | 0 | 3 | 3 | FC/EM | - |
| 5 | ECE3092 | Photonic Integrated Circuits | 3 | 0 | 0 | 3 | 3 | FC/EM | - |
| 6 | ECE3093 | Machine learning for Music Information Retrieval | 3 | 0 | 0 | 3 | 3 | SD/EM/EN | - |
| 7 | ECE3094 | Video Processing and Computer Vision | 3 | 0 | 0 | 3 | 3 | FC/EM/EN | - |
| 8 | ECE3095 | Blockchain and Cryptocurrency Technologies | 3 | 0 | 0 | 3 | 3 | FC/EM | - |
| 9 | ECE3096 | Natural Language Processing | 3 | 0 | 0 | 3 | 3 | FC/EM | - |
| 10 | ECE3097 | Smart Electronics in Agriculture | 3 | 0 | 0 | 3 | 3 | FC/EM/EN | - |
| 11 | ECE3098 | Environment Monitoring Systems | 3 | 0 | 0 | 3 | 3 | FC/EM/EN | - |
| 12 | ECE3099 | Modern Wireless Communication with 5G | 3 | 0 | 0 | 3 | 3 | SD/FC/EM | - |
| 13 | ECE3100 | Underwater Communication | 3 | 0 | 0 | 3 | 3 | FC/EM | - |
| 14 | ECE3101 | Printed Circuit Board Design | 3 | 0 | 0 | 3 | 3 | SD/FC/E/EN | - |
| 15 | ECE3102 | Consumer Electronics | 3 | 0 | 0 | 3 | 3 | FC/EM/EN | - |
| 16 | ECE3103 | Product Design of Electronic Equipment | 3 | 0 | 0 | 3 | 3 | FC/EM | - |
| 17 | ECE3104 | Vehicle to Vehicle Communication | 3 | 0 | 0 | 3 | 3 | FC/EM | - |
| 18 | ECE3105 | Wavelets and Filter Banks | 3 | 0 | 0 | 3 | 3 | FC/EM | - |
| 19 | ECE3106 | Introduction to Data Analytics | 3 | 0 | 0 | 3 | 3 | FC/EM | - |
| 20 | ECE3107 | Machine Vision for Robotics | 3 | 0 | 0 | 3 | 3 | FC/EM | - |

**English Basket**

| Sl. No. | Course Code | Course Name | L | T | P | C | Contact Hours | Type of Skills | Course Caters To |
|---|---|---|---|---|---|---|---|---|---|
| 1 | ENG1008 | Indian Literature | 2 | 0 | 0 | 2 | 2 | - | GS/HP |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 2 | ENG1009 | Reading Advertisement | 3 | 0 | 0 | 3 | 3 | SD | - |
| 3 | ENG1010 | Verbal Aptitude for Placement | 2 | 0 | 2 | 3 | 4 | SD | - |
| 4 | ENG1011 | English for Career Development | 3 | 0 | 0 | 3 | 3 | SD | - |
| 5 | ENG1012 | Gender and Society in India | 2 | 0 | 0 | 2 | 2 | - | GS/HP |
| 6 | ENG1013 | Indian English Drama | 3 | 0 | 0 | 3 | 3 | - | - |
| 7 | ENG1014 | Logic and Art of Negotiation | 2 | 0 | 2 | 3 | 4 | - | - |
| 8 | ENG1015 | Professional Communication Skills for Engineers | 1 | 0 | 0 | 1 | 1 | - | - |

**Fitness and Wellness Basket**

| Sl. No. | Course Code | Course Name | L | T | P | C | Contact Hours | Type of Skills | Course Caters To |
|---|---|---|---|---|---|---|---|---|---|
| 1 | DSA2001 | Spirituality for Health | 2 | 0 | 0 | 2 | 2 | FC | HP |
| 2 | DSA2002 | Yoga for Health | 2 | 0 | 0 | 2 | 2 | SD | HP |
| 3 | DSA2003 | Stress Management and Well Being | 2 | 0 | 0 | 2 | 2 | FC | - |

**Kannada Basket**

| Sl. No. | Course Code | Course Name | L | T | P | C | Contact Hours | Type of Skills | Course Caters To |
|---|---|---|---|---|---|---|---|---|---|
| 1 | KAN1001 | Kali Kannada | 1 | 0 | 0 | 1 | 1 | SD | - |
| 2 | KAN1003 | Kannada Kaipidi | 3 | 0 | 0 | 3 | 3 | SD | - |
| 3 | KAN2001 | Thili Kannada | 1 | 0 | 0 | 1 | 1 | SD | - |
| 4 | KAN2003 | Pradharshana Kale | 1 | 0 | 2 | 2 | 3 | SD | - |
| 5 | KAN2004 | Sahithya Vimarshe | 2 | 0 | 0 | 2 | 2 | SD | - |
| 6 | KAN2005 | Anuvadha Kala Sahithya | 3 | 0 | 0 | 3 | 3 | SD | - |
| 7 | KAN2006 | Vichara Manthana | 3 | 0 | 0 | 3 | 3 | SD | - |
| 8 | KAN2007 | Katha Sahithya Sampada | 3 | 0 | 0 | 3 | 3 | SD | - |
| 9 | KAN2008 | Ranga Pradarshana Kala | 3 | 0 | 0 | 3 | 3 | SD | - |

**Foreign Language Basket**

| Sl. No. | Course Code | Course Name | L | T | P | C | Contact Hours | Type of Skills | Course Caters To |
|---|---|---|---|---|---|---|---|---|---|
| 1 | FRL1004 | Introduction of French Language | 2 | 0 | 0 | 2 | 2 | SD | - |
| 2 | FRL1005 | Fundamentals of French | 2 | 0 | 0 | 2 | 2 | SD | - |
| 3 | FRL1009 | Mandarin Chinese for Beginners | 3 | 0 | 0 | 3 | 3 | SD | - |

**Law Basket**

| Sl. No. | Course Code | Course Name | L | T | P | C | Contact Hours | Type of Skills | Course Caters To |
|---|---|---|---|---|---|---|---|---|---|
| 1 | LAW1001 | Introduction to Sociology | 2 | 0 | 0 | 2 | 2 | FC | HP |
| 2 | LAW2001 | Indian Heritage and Culture | 2 | 0 | 0 | 2 | 2 | FC | GS/HP |
| 3 | LAW2002 | Introduction to Law of Succession | 2 | 0 | 0 | 2 | 2 | FC | GS/HP |
| 4 | LAW2003 | Introduction to Company Law | 2 | 0 | 0 | 2 | 2 | FC | HP |
| 5 | LAW2004 | Introduction to Contracts | 2 | 0 | 0 | 2 | 2 | FC | HP |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 6 | LAW2005 | Introduction to Copy Rights Law | 2 | 0 | 0 | 2 | 2 | FC | HP |
| 7 | LAW2006 | Introduction to Criminal Law | 2 | 0 | 0 | 2 | 2 | FC | HP |
| 8 | LAW2007 | Introduction to Insurance Law | 2 | 0 | 0 | 2 | 2 | FC | HP |
| 9 | LAW2008 | Introduction to Labour Law | 2 | 0 | 0 | 2 | 2 | FC | HP |
| 10 | LAW2009 | Introduction to Law of Marriages | 2 | 0 | 0 | 2 | 2 | FC | GS/HP |
| 11 | LAW2010 | Introduction to Patent Law | 2 | 0 | 0 | 2 | 2 | FC | HP |
| 12 | LAW2011 | Introduction to Personal Income Tax | 2 | 0 | 0 | 2 | 2 | FC | HP |
| 13 | LAW2012 | Introduction to Real Estate Law | 2 | 0 | 0 | 2 | 2 | FC | HP |
| 14 | LAW2013 | Introduction to Trademark Law | 2 | 0 | 0 | 2 | 2 | FC | HP |
| 15 | LAW2014 | Introduction to Competition Law | 3 | 0 | 0 | 3 | 3 | FC | HP |
| 16 | LAW2015 | Cyber Law | 3 | 0 | 0 | 3 | 3 | FC | HP |
| 17 | LAW2016 | Law on Sexual Harassment | 2 | 0 | 0 | 2 | 2 | FC | GS/HP |
| 18 | LAW2017 | Media Laws and Ethics | 2 | 0 | 0 | 2 | 2 | FC | GS/HP |

**Mathematics Basket**

| Sl. No. | Course Code | Course Name | L | T | P | C | Contact Hours | Type of Skills | Course Caters To |
|---|---|---|---|---|---|---|---|---|---|
| 1 | MAT2008 | Mathematical Reasoning | 3 | 0 | 0 | 3 | 3 | SD | - |
| 2 | MAT2014 | Advanced Business Mathematics | 3 | 0 | 0 | 3 | 3 | SD | - |
| 3 | MAT2031 | Optimization Techniques for Engineers | 3 | 0 | 0 | 3 | 3 | SD | - |
| 4 | MAT2041 | Functions of Complex Variables | 3 | 0 | 0 | 3 | 3 | SD | - |
| 5 | MAT2042 | Probability and Random Processes | 3 | 0 | 0 | 3 | 3 | SD | - |
| 6 | MAT2043 | Elements of Number Theory | 3 | 0 | 0 | 3 | 3 | SD | - |
| 7 | MAT2044 | Mathematical Modelling and Applications | 3 | 0 | 0 | 3 | 3 | SD | - |

**Mechanical Engineering Basket**

| Sl. No. | Course Code | Course Name | L | T | P | C | Contact Hours | Type of Skills | Course Caters To |
|---|---|---|---|---|---|---|---|---|---|
| 1 | MEC1001 | Fundamentals of Automobile Engineering | 3 | 0 | 0 | 3 | 3 | FC | - |
| 2 | MEC1002 | Introduction to Matlab and Simulink | 3 | 0 | 0 | 3 | 3 | SD/EM | - |
| 3 | MEC1003 | Engineering Drawing | 1 | 0 | 4 | 3 | 5 | SD | - |
| 4 | MEC2001 | Renewable Energy Systems | 3 | 0 | 0 | 3 | 3 | FC | ES |
| 5 | MEC2002 | Operations Research & Management | 3 | 0 | 0 | 3 | 3 | FC | - |
| 6 | MEC2003 | Supply Chain Management | 3 | 0 | 0 | 3 | 3 | SD/EM/EN | - |
| 7 | MEC2004 | Six Sigma for Professionals | 3 | 0 | 0 | 3 | 3 | SD/EM | - |
| 8 | MEC2005 | Fundamentals of Aerospace Engineering | 3 | 0 | 0 | 3 | 3 | FC | - |
| 9 | MEC2006 | Safety Engineering | 3 | 0 | 0 | 3 | 3 | SD/EM | ES |
| 10 | MEC2007 | Additive Manufacturing | 3 | 0 | 0 | 3 | 3 | FC/EM | - |
| 11 | MEC3069 | Engineering Optimisation | 3 | 0 | 0 | 3 | 3 | SD/EM | - |
| 12 | MEC3070 | Electronics Waste Management | 3 | 0 | 0 | 3 | 3 | FC/SD | ES |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 13 | MEC3071 | Hybrid Electric Vehicle Design | 3 | 0 | 0 | 3 | 3 | SD/EM | ES |
| 14 | MEC3072 | Thermal Management of Electronic Appliances | 3 | 0 | 0 | 3 | 3 | SD/EM | - |
| 15 | MEC3200 | Sustainable Technologies and Practices | 3 | 0 | 0 | 3 | 3 | SD/EM | - |
| 16 | MEC3201 | Industry 4.0 | 3 | 0 | 0 | 3 | 3 | SD/EM | - |

**Petroleum Engineering Basket**

| Sl. No. | Course Code | Course Name | L | T | P | C | Contact Hours | Type of Skills | Course Caters To |
|---|---|---|---|---|---|---|---|---|---|
| 1 | PET2129 | Energy Industry Dynamics | 3 | 0 | 0 | 3 | 3 | FC/SD/EM | ES |
| 2 | PET2130 | Energy Sustainability Practices | 3 | 0 | 0 | 3 | 3 | FC/SD/EM | ES |

**Physics Basket**

| Sl. No. | Course Code | Course Name | L | T | P | C | Contact Hours | Type of Skills | Course Caters To |
|---|---|---|---|---|---|---|---|---|---|
| 1 | PHY1003 | Mechanics and Physics of Materials | 3 | 0 | 0 | 3 | 3 | FC/SD | - |
| 2 | PHY1004 | Astronomy | 3 | 0 | 0 | 3 | 3 | FC | - |
| 3 | PHY1005 | Game Physics | 2 | 0 | 2 | 3 | 4 | FC/SD | - |
| 4 | PHY1006 | Statistical Mechanics | 2 | 0 | 0 | 2 | 2 | FC | - |
| 5 | PHY1007 | Physics of Nanomaterials | 3 | 0 | 0 | 3 | 3 | FC | - |
| 6 | PHY1008 | Adventures in nanoworld | 2 | 0 | 0 | 2 | 2 | FC | - |
| 7 | PHY2001 | Medical Physics | 2 | 0 | 0 | 2 | 2 | FC | ES |
| 8 | PHY2002 | Sensor Physics | 1 | 0 | 2 | 2 | 3 | FC/SD | - |
| 9 | PHY2003 | Computational Physics | 1 | 0 | 2 | 2 | 3 | FC | - |
| 10 | PHY2004 | Laser Physics | 3 | 0 | 0 | 3 | 3 | FC | ES |
| 11 | PHY2005 | Science and Technology of Energy | 3 | 0 | 0 | 3 | 3 | FC | ES |
| 12 | PHY2009 | Essentials of Physics | 2 | 0 | 0 | 2 | 2 | FC | - |

**Management Basket**

| Sl. No. | Course Code | Course Name | L | T | P | C | Contact Hours | Type of Skills | Course Caters To |
|---|---|---|---|---|---|---|---|---|---|
| 1 | MGT1001 | Introduction to Psychology | 3 | 0 | 0 | 3 | 3 | FC | HP |
| 2 | MGT1002 | Business Intelligence | 3 | 0 | 0 | 3 | 3 | EN | - |
| 3 | MGT1003 | NGO Management | 3 | 0 | 0 | 3 | 3 | SD | - |
| 4 | MGT1004 | Essentials of Leadership | 3 | 0 | 0 | 3 | 3 | EM/EN | GS/HP |
| 5 | MGT1005 | Cross Cultural Communication | 3 | 0 | 0 | 3 | 3 | SD/EM/EN | HP |
| 6 | MGT2001 | Business Analytics | 3 | 0 | 0 | 3 | 3 | EM/EN | - |
| 7 | MGT2002 | Organizational Behaviour | 3 | 0 | 0 | 3 | 3 | FC | HP |
| 8 | MGT2003 | Competitive Intelligence | 3 | 0 | 0 | 3 | 3 | SD | - |
| 9 | MGT2004 | Development of Enterprises | 3 | 0 | 0 | 3 | 3 | SD/EM/EN | - |
| 10 | MGT2005 | Economics and Cost Estimation | 3 | 0 | 0 | 3 | 3 | SD/EM | - |
| 11 | MGT2006 | Decision Making Under Uncertainty | 3 | 0 | 0 | 3 | 3 | SD | - |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 12 | MGT2007 | Digital Entrepreneurship | 3 | 0 | 0 | 3 | 3 | SD/EM/EN | - |
| 13 | MGT2008 | Econometrics for Managers | 3 | 0 | 0 | 3 | 3 | SD | - |
| 14 | MGT2009 | Management Consulting | 3 | 0 | 0 | 3 | 3 | SD/EM/EN | - |
| 15 | MGT2010 | Managing People and Performance | 3 | 0 | 0 | 3 | 3 | SD/EM/EN | HP/GS |
| 16 | MGT2011 | Personal Finance | 3 | 0 | 0 | 3 | 3 | FC | - |
| 17 | MGT2012 | E Business for Management | 3 | 0 | 0 | 3 | 3 | SD/EM | - |
| 18 | MGT2013 | Project Management | 3 | 0 | 0 | 3 | 3 | EM/EN | GS/HP/ES |
| 19 | MGT2014 | Project Finance | 3 | 0 | 0 | 3 | 3 | EM/EN | HP |
| 20 | MGT2015 | Engineering Economics | 3 | 0 | 0 | 3 | 3 | SD | - |
| 21 | MGT2016 | Business of Entertainment | 3 | 0 | 0 | 3 | 3 | EM/EN | - |
| 22 | MGT2017 | Principles of Management | 3 | 0 | 0 | 3 | 3 | SD/EM/EN | - |
| 23 | MGT2018 | Professional and Business Ethics | 3 | 0 | 0 | 3 | 3 | SD/EM/EN | HP |
| 24 | MGT2019 | Sales Techniques | 3 | 0 | 0 | 3 | 3 | SD/EM/EN | HP |
| 25 | MGT2020 | Marketing for Engineers | 3 | 0 | 0 | 3 | 3 | SD/EM/EN | HP |
| 26 | MGT2021 | Finance for Engineers | 3 | 0 | 0 | 3 | 3 | SD/EM/EN | HP |
| 27 | MGT2022 | Customer Relationship Management | 3 | 0 | 0 | 3 | 3 | SD/EM/EN | HP |
| 28 | MGT2023 | People Management | 3 | 0 | 0 | 3 | 3 | SD/EM/EN | HP |

**Media Studies Basket**

| Sl. No. | Course Code | Course Name | L | T | P | C | Contact Hours | Type of Skills | Course Caters To |
|---|---|---|---|---|---|---|---|---|---|
| 1 | BAJ3050 | Corporate Filmmaking and Film Business | 0 | 0 | 4 | 2 | 4 | EM | HP |
| 2 | BAJ3051 | Digital Photography | 2 | 0 | 2 | 3 | 4 | EM | HP |
| 3 | BAJ3055 | Introduction to New Anchoring and News Management | 0 | 0 | 2 | 1 | 2 | - | - |

**Research URE Basket**

| Sl. No. | Course Code | Course Name | L | T | P | C | Contact Hours | Type of Skills | Course Caters To |
|---|---|---|---|---|---|---|---|---|---|
| 1 | URE2001 | University Research Experience | - | - | - | 3 | - | SD/EM/EN | - |
| 2 | URE2002 | University Research Experience | - | - | - | 0 | - | SD/EM/EN | - |

(Students are required to carry out research work under the guidance of a faculty member / research scholar and the same shall be evaluated and credit will be granted as per the Academic Regulations)

Foundation Course = FC, Skill Development = SD, Employability = EM, Entrepreneurship = EN
Gender Sensitization = GS, Environment and Sustainability = ES, Human Values and Professional Ethics = HP

**21. List of MOOC (NPTEL) Courses**

As the Massive Open Online Courses (MOOC) offered by National Program on Techno0logy Enhanced Learning (NPTEL) keeps on changing alomost in event semester, therefore the Deparment of P0etroleum Engineeing, in general, update the lists of MOOC (NPTEL) courses in each Semester for the benefit of the students. A few previously approved courses are listed below for reference.

Sometimes the pre-approved courses are offered again (repeated) in the next semester / academic year with the same Course Name and Course Duration but with different Course Code. In this kind of circumstances, the respective

HOD will hold the authority to decide whether to approve the request of the interested student for NPTEL course enrollment.

**21.1 NPTEL - Discipline Elective Courses for B.Tech. (Petroleum Engineering)**

| Sl. No. | Course Code | Course Name | Course Duration (Weeks) |
|---|---|---|---|
| 1 | noc24-ch78 | Artificial Lift | 12 Weeks |
| 2 | noc24-ch50 | Polymers: Concepts, Properties, Uses and Sustainability | 12 Weeks |
| 3 | noc25-ce48 | Reservoir Geophysics for Hydrocarbon Exploration | 12 Weeks |

### 21.2 NPTEL - Open Elective Courses for B. Tech. (Petroleum Engineering)

| Sl. No. | Course Code | Course Name | Course Duration (Weeks) |
|---|---|---|---|
| 1 | noc24-mm38 | Nanomaterials and their Properties | 12 Weeks |
| 2 | noc24-ec12 | Environmental & Resource Economics | 12 Weeks |
| 3 | noc25-ce09 | Climate Change Science | 12 Weeks |

The NPTEL courses listed above are subjected to change based on the offering of NPTEL. The updated list of NPTEL courses shall be notified before the commencement of the semester after the same is approved by BoS.

**22. Recommended Semester Wise Course Structure / Flow including the Programme / Discipline Elective Paths / Options**

| Semester I | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Sl. No. | Course Code | Course Name | Credit Structure | | | | Contact Hours | Type of Course | Type of Skills | Course Addresses To |
| | | | L | T | P | C | | | | |
| 1 | MAT1001 | Calculus and Linear Algebra | 3 | 0 | 2 | 4 | 5 | SCC | | |
| 2 | ENG1002 | Technical English | 1 | 0 | 2 | 2 | 3 | SCC | | |
| 3 | CIV1008 | Basic Engineering Sciences | 2 | 0 | 0 | 2 | 2 | SCC | | |
| 4 | CSE1004 | Problem Solving Using C | 1 | 0 | 4 | 3 | 5 | SCC | | |
| 5 | MEC1006 | Engineering Graphics | 2 | 0 | 0 | 2 | 2 | SCC | | |
| 6 | PPS1001 | Introduction to soft skills | 0 | 0 | 2 | 1 | 2 | SCC | | |
| 7 | PPS1011 | Introduction to Verbal Ability | 0 | 1 | 0 | 0 | 1 | SCC | | |
| 8 | EEE1001 | Fundamentals of Electrical and Electronics Engineering | 3 | 0 | 2 | 4 | 5 | SCC | | |
| 9 | CHE1017 | Applied Chemistry | 1 | 0 | 2 | 2 | 3 | PCC | SD | - |
| 10 | PET1002 | Introduction to Oil and Gas Industry | 3 | 0 | 0 | 3 | 3 | PCC | SD | ES/HP |
| | | **TOTAL** | **16** | **01** | **14** | **23** | **31** | | | |
| SC = School Core, PC = Program Core, DE = Discipline Elective, OE = Open Elective<br>Foundation Course = FC, Skill Development = SD, Employability = EM, Entrepreneurship = EN<br>Gender Sensitization = GS, Environment and Sustainability = ES, Human Values and Professional Ethics = HP | | | | | | | | | | |

| Semester II | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Sl. No. | Course Code | Course Name | Credit Structure | | | | Contact Hours | Type of Course | Type of Skills | Course Addresses To |
| | | | L | T | P | C | | | | |
| 1 | MAT1003 | Applied Statistics | 1 | 0 | 2 | 2 | 3 | SCC | | |
| 2 | CSE1006 | Problem Solving using JAVA | 2 | 0 | 2 | 3 | 4 | SCC | | |
| 3 | PHY1001 | Material Physics | 2 | 0 | 2 | 3 | 4 | SCC | | |
| 4 | ENG2001 | Advanced English | 1 | 0 | 2 | 2 | 3 | SCC | | |
| 5 | PPS1012 | Enhancing Personality through Soft skills | 0 | 0 | 2 | 1 | 2 | SCC | | |
| 6 | ECE2010 | Innovative Projects using Arduino | - | - | - | 1 | 0 | SCC | | |
| 7 | CHE1018 | Environmental Science | 1 | 0 | 2 | 0 | 3 | SCC | | |
| 8 | PET1001 | Petroleum Geology | 3 | 0 | 2 | 4 | 5 | PCC | SD | - |
| 9 | PET2003 | Fundamentals of Oil and Gas Well Drilling Technology | 3 | 0 | 0 | 3 | 3 | PCC | SD | - |
| | | **TOTAL** | **13** | **00** | **14** | **19** | **27** | | | |

| Semester III | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Sl. No. | Course Code | Course Name | Credit Structure | | | | Contact Hours | Type of Course | Type of Skills | Course Addresses To |
| | | | L | T | P | C | | | | |
| 1 | MAT1002 | Transform Techniques, Partial Differential Equations and Their Applications | 3 | 0 | 0 | 3 | 3 | SCC | | |
| 2 | CSE2001 | Data Structures and Algorithms | 3 | 0 | 2 | 4 | 5 | SCC | | |
| 3 | ECE2011 | Innovative Projects using Raspberry Pi | - | - | - | 1 | 0 | SCC | | |
| 4 | PPS4002 | Introduction to Aptitude | 0 | 0 | 2 | 1 | 2 | SCC | | |
| 5 | CSE1005 | Programming in Python | 1 | 0 | 4 | 3 | 5 | SCC | | |
| 6 | PET2001 | Drilling Fluids and Cements | 3 | 0 | 2 | 4 | 5 | PCC | SD | - |
| 7 | PET2008 | Heat and Mass Transfer for Petroleum Engineering | 2 | 0 | 2 | 3 | 4 | PCC | SD | - |
| 8 | PET2009 | Thermodynamics of Reservoir Fluids | 2 | 0 | 2 | 3 | 4 | PCC | SD | - |
| 9 | PETXXXX | Discipline Elective - I | 3 | 0 | 0 | 3 | 3 | DEC | - | - |
| | | **TOTAL** | **17** | **00** | **14** | **25** | **31** | | | |

| Semester IV | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Sl. No. | Course Code | Course Name | Credit Structure | | | | Contact Hours | Type of Course | Type of Skills | Course Addresses To |
| | | | L | T | P | C | | | | |
| 1 | MAT2003 | Numerical Methods for Engineers | 1 | 0 | 2 | 2 | 3 | SCC | | |
| 2 | PPS4004 | Aptitude Training Intermediate | 0 | 0 | 2 | 1 | 2 | SCC | | |
| 3 | CSE3216 | Mastering Object-Oriented Concepts in Python | 0 | 0 | 2 | 1 | 2 | SCC | | |
| 4 | PET2002 | Fundamentals of Geophysical Logging Techniques | 3 | 1 | 0 | 4 | 4 | PCC | SD | - |
| 5 | PET2004 | Fundamentals of Petroleum Reservoir Engineering | 3 | 0 | 2 | 4 | 5 | PCC | SD | - |
| 6 | PET2012 | Reservoir Fluid Mechanics | 2 | 0 | 2 | 3 | 4 | PCC | SD | - |
| 7 | PETXXXX | Discipline Elective - II | 3 | 0 | 0 | 3 | 3 | DEC | - | - |
| 8 | PETXXXX | Discipline Elective - III | 3 | 0 | 0 | 3 | 3 | DEC | - | - |
| 9 | XXXXXXX | Open Elective - I | 3 | 0 | 0 | 3 | 3 | OEC | - | - |
| **TOTAL** | | | **18** | **01** | **10** | **24** | **29** | | | |

| Semester V | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Sl. No. | Course Code | Course Name | Credit Structure | | | | Contact Hours | Type of Course | Type of Skills | Course Addresses To |
| | | | L | T | P | C | | | | |
| 1 | PET2107 | Fundamentals of Instrumentation and Control Engineering | 2 | 0 | 0 | 2 | 2 | PCC | SD | - |
| 2 | PET2108 | Fundamentals of Instrumentation and Control Engineering Lab | 0 | 0 | 2 | 1 | 2 | PCC | SD | - |
| 3 | PET2123 | Fundamentals of Oil and Gas Production Technology | 2 | 1 | 0 | 3 | 3 | PCC | SD | - |
| 4 | PET2124 | Geophysical Methods for Oil and Gas Exploration | 3 | 0 | 0 | 3 | 3 | PCC | SD | - |
| 5 | PET2125 | Oil and Gas Well Test Analysis | 2 | 1 | 0 | 3 | 3 | PCC | SD | - |
| 6 | PET2127 | Advanced Petroleum Reservoir Engineering | 2 | 1 | 0 | 3 | 3 | PCC | SD | - |
| 7 | PETXXXX | Discipline Elective - IV | 3 | 0 | 0 | 3 | 3 | DEC | - | - |
| 8 | PETXXXX | Discipline Elective - V | 3 | 0 | 0 | 3 | 3 | DEC | - | - |
| 9 | XXXXXXX | Open Elective - II (Course from Management Basket) | 3 | 0 | 0 | 3 | 3 | OEC | - | - |
| **TOTAL** | | | **22** | **01** | **02** | **24** | **25** | | | |

| Semester VI | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Sl. No. | Course Code | Course Name | Credit Structure | | | | Contact Hours | Type of Course | Type of Skills | Course Addresses To |
| | | | L | T | P | C | | | | |
| 1 | PET2109 | Oil and Gas Surface Facility Design | 2 | 0 | 0 | 2 | 2 | PCC | SD | - |
| 2 | PET2110 | Oil and Gas Surface Facility Design Lab | 0 | 0 | 2 | 1 | 2 | PCC | SD | - |
| 3 | PET2119 | Petroleum Reservoir Modelling and Simulation | 2 | 0 | 0 | 2 | 2 | PCC | SD | - |
| 4 | PET2120 | Petroleum Reservoir Modelling and Simulation Lab | 0 | 0 | 2 | 1 | 2 | PCC | SD | - |
| 5 | PET2115 | Oil and Gas Downstream Operations | 3 | 0 | 0 | 3 | 3 | PCC | SD | - |
| 6 | PET2116 | Oil and Gas Downstream Operations Lab | 0 | 0 | 2 | 1 | 2 | PCC | SD | - |
| 7 | PET2126 | Offshore Drilling and Petroleum Production Practices | 3 | 0 | 0 | 3 | 3 | PCC | SD | ES |
| 8 | PETXXXX | Discipline Elective - VI | 3 | 0 | 0 | 3 | 3 | DEC | - | - |
| 9 | PETXXXX | Discipline Elective - VII | 3 | 0 | 0 | 3 | 3 | DEC | - | - |
| 10 | XXXXXXX | Open Elective - III (Course from Management Basket) | 3 | 0 | 0 | 3 | 3 | OEC | - | - |
| | | **TOTAL** | **18** | **00** | **06** | **21** | **24** | | | |

| Semester VII | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Sl. No. | Course Code | Course Name | Credit Structure | | | | Contact Hours | Type of Course | Type of Skills | Course Addresses To |
| | | | L | T | P | C | | | | |
| 1 | PIP2001 | Capstone Project | - | - | - | 4 | 0 | SCC | SD / EM / EN | ES / HP |
| 2 | PETXXXX | Discipline Elective - VIII | 3 | 0 | 0 | 3 | 3 | DEC | - | - |
| 3 | PETXXXX | Discipline Elective - IX | 3 | 0 | 0 | 3 | 3 | DEC | - | - |
| 4 | PETXXXX | Discipline Elective - X | 3 | 0 | 0 | 3 | 3 | DEC | - | - |
| 5 | XXXXXXX | Open Elective - IV | 3 | 0 | 0 | 3 | 3 | OEC | - | - |
| | | **TOTAL** | **12** | **00** | **00** | **16** | **12** | | | |

| Semester VIII | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Sl. No. | Course Code | Course Name | Credit Structure | | | | Contact Hours | Type of Course | Type of Skills | Course Addresses To |
| | | | L | T | P | C | | | | |
| 1 | PIP4006 | Internship | - | - | - | 8 | 0 | SCC | SD / EM / EN | ES / HP |
| | | **TOTAL** | **00** | **00** | **00** | **08** | **00** | | | |

**23. Course Catalogue**

Course Catalogue of all Courses are presented below.

## SCHOOL CORE COURSE (SCC)

| | | | | | | |
|---|---|---|---|---|---|---|
| **Course Code:** PIP2001 | **Course Title:** Capstone Project<br>**Type of Course:** 1] School Core Course<br>2] Project-based – Experiential Learning | **L-T-P-C** | - | - | - | 4 |
| **Version No.:** | 1.0 | | | | | |
| **Course Pre-requisites:** | Knowledge and Skills related to all the courses studied in previous semesters. | | | | | |
| **Anti-requisites:** | NIL | | | | | |
| **Course Description:** | The Mini Project is a 100% project-based experiential learning opportunity that immerses students in real-world industry or research settings. It bridges academic concepts with practical applications, allowing students to work on domain-specific projects under professional supervision. The course fosters technical competency, problem-solving, teamwork, and professional ethics. Students document progress, submit reports, and deliver final presentations, reinforcing industry readiness and lifelong learning attitudes essential for professional success. | | | | | |
| **Course Objective:** | The objective of the course is to familiarize the learners with the concepts of Professional Practice and attain **Employability Skills** through **Experiential Learning** techniques. | | | | | |
| **Course Outcomes:** | On successful completion of the course the students shall be able to:<br>CO1: Recall core concepts and engineering principles relevant to the project,<br>CO2: Explain the working process, technologies, or systems involved in the assigned project,<br>CO3: Apply theoretical knowledge to practical tasks and challenges during the project,<br>CO4: Analyze project requirements, data, and outcomes to identify gaps and propose improvements,<br>CO5: Evaluate the effectiveness of solutions implemented during the project using industry metrics, and<br>CO6: Design and develop a comprehensive project report and presentation that demonstrate project execution and impact.<br><br>NOTE: It is not mandatory to fulfil the requirement of all the Course Outcomes as it sometimes depends on the infrastructure availability. Student must satisfy the requirements of CO1 through CO4. | | | | | |
| **Course Content:** | | | | | | |
| **Module 1:** | | | | | | |
| **Topics:**<br>Not Applicable – Depends on the Supervisor. | | | | | | |
| **Targeted Application and Tools that can be used:**<br>**Applications:** Oil and Gas industry<br>**Tools:** MS Excel, and others (Specific equipment / apparatus / tool and software as prescribed by the Supervisor) | | | | | | |
| **Text Book:**<br>Not Applicable – Depends on the Supervisor. | | | | | | |
| **References:**<br>Not Applicable – Depends on the Supervisor.<br><br>**e-resources:**<br>Not Applicable – Depends on the Supervisor. | | | | | | |
| **Skill Sets:** Topics relevant to "**EMPLOYABILITY SKILL**": Specific equipment / apparatus / tool and software as prescribed by the Supervisor for enhancing **Employability Skills** through **Experiential Learning** techniques. | | | | | | |
| **Catalogue prepared by:** | Dr. Suman Paul, Dr. Deepjyoti Mech, Dr. Rohit Kumar Saw, Dr. Amolina Doley, Mr. Bhairab Jyoti Gogoi, Dr. Niladri Shekhar Samanta | | | | | |
| **Recommended by the Board of Studies on:** | 18th Meeting of the Board of Studies held on 4th July, 2024 | | | | | |
| **Date of Approval by the Academic Council:** | 24th Meeting of the Academic Council held on 3rd August, 2024 | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Course Code:** PIP4006 | **Course Title:** Internship<br>**Type of Course:** 1] School Core Course<br>2] Project-based – Experiential Learning | **L-T-P-C** | - | - | - | 8 |
| **Version No.:** | 1.0 | | | | | |
| **Course Pre-requisites:** | Knowledge and Skills related to all the courses studied in previous semesters. | | | | | |
| **Anti-requisites:** | NIL | | | | | |
| **Course Description:** | The Mini Project is a 100% project-based experiential learning opportunity that immerses students in real-world industry or research settings. It bridges academic concepts with practical applications, allowing students to work on domain-specific projects under professional supervision. The course fosters technical competency, problem-solving, teamwork, and professional ethics. Students document progress, submit reports, and deliver final presentations, reinforcing industry readiness and lifelong learning attitudes essential for professional success. | | | | | |
| **Course Objective:** | The objective of the course is to familiarize the learners with the concepts of Professional Practice and attain **Employability Skills** through **Experiential Learning** techniques. | | | | | |
| **Course Outcomes:** | On successful completion of the course the students shall be able to:<br>CO1: Recall core concepts and engineering principles relevant to the project,<br>CO2: Explain the working process, technologies, or systems involved in the assigned project,<br>CO3: Apply theoretical knowledge to practical tasks and challenges during the project,<br>CO4: Analyze project requirements, data, and outcomes to identify gaps and propose improvements,<br>CO5: Evaluate the effectiveness of solutions implemented during the project using industry metrics, and<br>CO6: Design and develop a comprehensive project report and presentation that demonstrate project execution and impact.<br><br>NOTE: It is not mandatory to fulfil the requirement of all the Course Outcomes as it sometimes depends on the infrastructure availability. Student must satisfy the requirements of CO1 through CO4. | | | | | |
| **Course Content:** | | | | | | |
| **Module 1:** | | | | | | |
| **Topics:**<br>Not Applicable – Depends on the Supervisor. | | | | | | |
| **Targeted Application and Tools that can be used:**<br>**Applications:** Oil and Gas industry<br>**Tools:** MS Excel, and others (Specific equipment / apparatus / tool and software as prescribed by the Supervisor) | | | | | | |
| **Text Book:**<br>Not Applicable – Depends on the Supervisor. | | | | | | |
| **References:**<br>Not Applicable – Depends on the Supervisor.<br><br>**e-resources:**<br>Not Applicable – Depends on the Supervisor. | | | | | | |
| **Skill Sets:** Topics relevant to "**EMPLOYABILITY SKILL**": Specific equipment / apparatus / tool and software as prescribed by the Supervisor for enhancing **Employability Skills** through **Experiential Learning** techniques. | | | | | | |
| **Catalogue prepared by:** | Dr. Suman Paul, Dr. Deepjyoti Mech, Dr. Rohit Kumar Saw, Dr. Amolina Doley, Mr. Bhairab Jyoti Gogoi, Dr. Niladri Shekhar Samanta | | | | | |
| **Recommended by the Board of Studies on:** | 18th Meeting of the Board of Studies held on 4th July, 2024 | | | | | |
| **Date of Approval by the Academic Council:** | 24th Meeting of the Academic Council held on 3rd August, 2024 | | | | | |

## PROGRAM CORE COURSES (PCC)

| | | | | | | |
|---|---|---|---|---|---|---|
| **Course Code:** CHE1017 | **Course Title:** Applied Chemistry<br>**Type of Course:** 1] Program Core Course<br>2] Laboratory Integrated | **L-T-P-C** | 1 | 0 | 2 | 2 |
| **Version No.:** | 1.0 | | | | | |
| **Course Pre-requisites:** | NIL | | | | | |
| **Anti-requisites:** | NIL | | | | | |
| **Course Description:** | The primary objective of the course is to emphasize the concepts and applications of chemistry in Engineering. The course also aims to enhance the knowledge of chemical composition and properties of chemical molecules. The course cultivates an ability to identify chemistry in each and every piece of smart engineered products used in households and industry. It targets to strengthen the fundamental concepts of chemistry and then builds an interface with their industrial applications. This course is designed to cater to Environment and Sustainability. | | | | | |
| **Course Objective:** | The objective of the course is 'SKILL DEVELOPMENT' of the student by using EXPERIENTIAL LEARNING techniques. | | | | | |
| **Course Outcomes:** | On successful completion of this course the students shall be able to:<br>CO1: Identify the suitable polymers to replace the conventional materials,<br>CO2: Summarize the importance of various electrochemical sources in energy systems,<br>CO3: Describe the knowledge of electrochemistry principles for protection of different metals from corrosion,<br>CO4: Explain the fundamental principles in water treatment | | | | | |
| **Course Content:** | | | | | | |
| **Module 1:** | Polymers | Case Study | Data Collection and analysis | 06 Periods | | |
| Polymers: Introduction, Types of Polymerization, Thermoplastics & thermosetting polymers. Preparation, properties, and applications of the Teflon, PVC, Nylon and Phenol formaldehyde; Elastomers: classification; Natural rubber, Vulcanization of rubber, Synthetic rubber and Inorganic rubbers, Polymer composites- Properties and advantages, Synthesis and applications of Kevlar, Conducting polymers | | | | | | |
| **Module 2:** | Battery Technology | Assignment | Data Collection | 06 Periods | | |
| Basics of electrochemical energy systems, Construction, working mechanism and applications of primary (dry cell) and Secondary (lead-acid) batteries, Lithium batteries: primary and secondary. Fuel cells: hydrogen-oxygen, Methanol-oxygen: Principle, working and their applications | | | | | | |
| **Module 3:** | Corrosion and its Control | Case Study | Data Analysis | 06 Periods | | |
| Definition, Dry and Wet Corrosion, Electrochemical theory of corrosion, types of wet corrosion –Differential aeration, Galvanic, and Stress Corrosion cracking. Factors that enhance corrosion and choice of parameters to mitigate corrosion. Corrosion Control – Anodic and cathodic coating, Cathodic protection- Sacrificial anodic protection, electro plating of chromium, electroless plating of copper on PCBs | | | | | | |
| **Module 4:** | Water Technology | Case Study | Data Analysis | 06 Periods | | |
| Degree of hardness, numerical problems on hardness domestic treatment, desalination techniques, boiler feed water, external and internal treatments, waste water treatment, rain water harvesting | | | | | | |
| **Laboratory Experiments:**<br>1. Estimation of Fe(II) in Mohr's salt using Std. Potassium permanganate solution<br>2. Estimation of Calcium in cement solution sample by rapid EDTA method<br>3. Estimation of Copper by Iodometry<br>4. Determination of Acid number of an oil<br>5. Synthesis of polyaniline<br>6. Potentiometric estimation of FAS using Std. Potassium dichromate solution<br>7. Estimation of strength of an acid by conductometric titration<br>8. Estimation of Copper by colorimetric method<br>9. Determination of Viscosity co-efficient of a liquid using Ostwald's viscometer<br>10. Estimation of corrosion by weight loss method | | | | | | |
| **Targeted Application and Tools that can be used:**<br>**Applications:** Polymer, oil and gas, Boiler, automotive and mechanical industries | | | | | | |

| | |
|---|---|
| **Tools:** Statistical analysis of Corrosion in materials using tools like Design expert software (ANOVA, RSM, etc.) | |
| **Text Book:**<br>T1: Wiley, "Engineering Chemistry", Wiley. | |
| **References:**<br>R1: Engineering Chemistry, Jain and Jain (18th Edition) Dhanpat Rai Publishing Company<br>R2: Engineering Chemistry, Shika Agrawal (2018), Cambridge University PressR3: Archer, J.S., Wall, C.G., "Petroleum Engineering Principles and Practice" Graham and Trotman Inc.<br><br>**e-resources**<br>1. https: / / presiuniv.knimbus.com / user# / searchresult?searchId=Polymers%20from%20Renewable%20Resources&_t=1660212823387<br>2. https: / / presiuniv.knimbus.com / user# / searchresult?searchId=fuel%20an%20ecocritical%20history&_t=1660213039873<br>3. https: / / presiuniv.knimbus.com / user# / viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=BOOKYARDS_1_13487<br>4. https: / / presiuniv.knimbus.com / user# / viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=DOAB_1_6676<br>5. https: / / nptel.ac.in / courses / 113108051 | |
| **Catalogue prepared by:** | Department of Chemistry |
| **Recommended by the Board of Studies on:** | PU / SOE / CHE / BOS-07 / 2022-23<br>7th BOS, held on 25 / 07 / 22 |
| **Date of Approval by the Academic Council:** | 18th Academic Council, PU / AC-18 / MEC / 2019-2023 / 2021<br>03rd August, 2022 |

| Course Code: PET1001 | Course Title: Petroleum Geology<br>Type of Course: 1] Program Core Course<br>2] Laboratory Integrated | L-T-P-C | 3 | 0 | 2 | 4 |
|---|---|---|---|---|---|---|
| Version No.: | 2.0 | | | | | |
| Course Pre-requisites: | NIL | | | | | |
| Anti-requisites: | NIL | | | | | |
| Course Description: | The course will deal with different essential aspects of Petroleum Geology like evaluating petroleum systems by analyzing the properties of the source, reservoir, and cap rocks; understanding the processes of generation, migration, and entrapment of hydrocarbon at different environmental conditions; visualizing the mechanisms of formation of sedimentary basins and differentiate their types based on hydrocarbon prospect, etc. This course will also discuss its implications at different stages in the oil and gas industry. | | | | | |
| Course Objective: | The objective of the course is to familiarize the learners with the concepts of Petroleum Geology and attain **Skill Development** through Experiential **Learning** techniques. | | | | | |
| Course Outcomes: | On successful completion of the course, the student shall be able to:<br>CO1: describe different processes acting below and above the surface of the earth,<br>CO2: explain the role of petroleum system in the oil and gas industry,<br>CO3: recognize different types of sedimentary basins and sedimentary environments,<br>CO4: apply basic knowledge of geology while performing laboratory experiments. | | | | | |
| Course Content: | | | | | | |

| Module 1: | Overview of Geology and Geological Processes | e-resource Review / Report Writing | Writing Communication / Analytical Skills Development | 08 Periods |
|---|---|---|---|---|

**Topics:**

Introduction to Geology: Definition of Geology, Branches of Geology, Importance of Geology in Petroleum Engineering. The Solar System and the Earth: Orbital Characteristics of the Earth, Shape of the Earth, Physical Characteristics of the Earth, Origin of the Earth, Envelopes of the Earth, Internal Structure of the Earth, Chemical Composition of the Earth, Origin of Heat of the Earth, Age of the Earth.

Dynamic Processes of the Earth: Internal Processes - Plate Tectonics, Continental Drift, Earthquake, and Volcanism, External Processes - Weathering, Erosion, Transportation, and Deposition.

| Module 2: | Petroleum Geology and Petroleum Systems | Poster Designing and Presentation | Verbal Communication Skill Development | 18 Periods |
|---|---|---|---|---|

**Topics:**

Petroleum Geology: Definition of Petroleum Geology, Responsibilities of Petroleum Geologists.

Petroleum Systems: Definition, Concept of Petroleum System, Essential Elements of Petroleum System - Source Rock - Definition, Origin of Petroleum, Organic rich Sediments, Source Rock Materials, Nature and Types of Source Rocks, Conversion of Organic Materials to Hydrocarbons, Generation of Hydrocarbons, Kerogen, Evaluation of Petroleum Source Rock Potential, Subsurface condition for Petroleum Generation, Oil Window. Reservoir Rock - Definition, Characteristics of Reservoir Rocks, Principle properties of Reservoir Rocks, Clastic Reservoirs, Carbonate Reservoirs, Conventional and Unconventional Reservoirs, Fractures Reservoirs, Properties of Reservoir, Understanding the parameters to evaluate Reservoirs. Seal (Cap) Rock - Definition, Mechanism of Sealing, Factors affecting the effectiveness of Cap Rocks. Overburden Rock. Processes of Petroleum System – Generation of Hydrocarbons. Migration of Hydrocarbons - Definition, Types of Migration, Processes of Migration, Oil and Gas Seepages, Factors affecting Primary and Secondary Migrations – Buoyancy, Surface Tension, Capillary Pressure, Tilted Oil-Water Contact – Spill Point, Lateral Migration, Vertical Migration. Accumulation of Hydrocarbons - Definition, Pre-requisites for Formation and Accumulation of Hydrocarbons, Entrapment of Hydrocarbons - Definition, Classification of Traps, Traps associated with diapir.

| Module 3: | Sedimentary Basins and Depositional Environments | Quiz / Written Tests | Preparedness for Competitive Exams | 07 Periods |
|---|---|---|---|---|

**Topics:**

Sedimentary Basin: Definition, Mechanisms of Basin Formation, Plate Tectonics and Sedimentary Basins; Classification of Sedimentary Basins; Sedimentary Basins of India.

Depositional Environments: Continental Environments, Marginal-Marine Environments, Siliciclastic Marine Environments, Carbonate and Evaporite Environments.

| Module 4: | Laboratory Experiments | Quiz / Viva-Voce / Lab Performance Test | Evaluation for Real-life Situations | 22 Periods |
|---|---|---|---|---|

**Topics:**

Introduction to Mapping: Definition, Purpose of Maps, Types of Maps, Analysis of Contour Maps, Interpretation of Geological Maps. Related Experiment No.: 1A, 1B, 1C, 1D, 1E, and 2.

Mineralogy: Definition of Mineral, Importance of study of minerals, Different methods to identify minerals, Identification of minerals in hand specimen. Related Experiment No.: 3A, and 3B.

Petrology: Definition of Rock, Classification of rocks, Rock Cycle, Distinguishing properties of Rocks. Related Experiment No.: 4A, 4B, and 4C.

Introduction to Geological Structures and their Measurements: Folds, Faults, Joints, Fractures, Unconformity, Measurement of Planar and Linear features. Related Experiment No. 5, and 6.

**List of Laboratory Tasks:**

**Experiment No. 1: Analysis of different Contour Profiles**

**Level 1:** To draw and interpret the contour profile in the given map along Section line A-A' (Exp. No. 1A)
**Level 2:** To draw and interpret the contour profile in the given map along the Section line A-B (Exp. No. 1B)
**Level 3:** To draw and interpret the contour profile along Section X-Y (Exp. No. 1C)
**Level 4:** To draw and interpret the contour profile in the map along Section A-B (Exp. No. 1D)
**Level 5:** To interpret the 3-D schematic diagrams and the contour profiles given for six V-shaped valleys (Exp. No. 1E)

**Experiment No. 2: Interpretation of Geological Maps**

**Level 1:** In the given map, a part of the geological outcrops are shown. Complete the geological outcrops.
**Level 2:** In the given map, the geological outcrops are shown. Explain the relationship between lithological boundary and contour lines and determine the dip of the bed.
**Level 3:** In the given map, the geological outcrops are shown. Draw a vertical column showing each bed to scale: 1cm:100m and draw a section along Section line A-B (Contours in meters).

**Experiment No. 3: Identification of minerals in the hand specimen**

**Level 1:** To study the physical properties of any given mineral in the hand specimen
**Level 2:** To study the physical properties of rock-forming minerals
**Level 3:** To study the physical properties of ore minerals

**Experiment No. 4: Identification of rocks in the hand specimen**

**Level 1:** To study the physical properties of any given rock in the hand specimen
**Level 2:** To study the physical properties of igneous rocks
**Level 3:** To study the physical properties of sedimentary rocks
**Level 4:** To study the physical properties of metamorphic rocks

**Experiment No. 5: Estimation of Dip and Strike of Planer Surface using Clinometer Compass**

**Level 1:** To estimate the dip and strike of a given planar surface in the laboratory
**Level 2:** To identify a suitable planer surface in the field and estimate the attitude of the same planer surface

**Experiment No. 6: Estimation of Plunge and Trend of Linear Features using Clinometer Compass**

**Level 1:** To estimate plunge and trend of given linear feature in laboratory
**Level 2:** To identify suitable linear feature in the field and estimate attitude of the same planer surface

**Targeted Application and Tools that can be used:**

**Applications:** Geoscientist or Wellsite Geologist at Oil & Gas industry.
**Tools:** Microsoft Excel and other Data Analysis Tools

**Text Book:**

T1: Knut Bjørlykke, Petroleum Geoscience: From Sedimentary Environments to Rock Physics, Springer Berlin Heidelberg, 2nd Edition, 2015.
T2: Richard C. Selley, and Stephen A. Sonnenberg, Elements of Petroleum Geology, 3rd Edition, Elsevier Science, 2014.
T3: Richard J. Lisle, Peter J. Brabham, and John W. Barnes, Basic Geological Mapping, 5th Edition, Wiley-Blackwell, 2011.
T4: Maurice E. Tucker, Sedimentary Rocks in the Field – The Geological Field Guide Series, 3rd Edition, Wiley, 2003.
T5: R.E. Chapman, Petroleum Geology, Elsevier Science, 2000.

**References:**

R1: Caineng Zou, Unconventional Petroleum Geology, Elsevier Science, 2017.
R2: D.H. Welte, B. Harsfieldand and D. R. Baker (Eds.), Petroleum and Basin Evolution – Insights from Petroleum Geochemistry, Geology and Basin Modeling, Springer-Verlag, Berlin Heidelberg, 2012.
R3: Arville Irving Levorsen, Geology of Petroleum, 2nd Edition (Reprint), CBS Publishers & Distributors, 2004.
R4: Richard J. Lisle, Geological Structures and Maps – A Practical Guide, 3rd Edition, Elsevier Butterworth – Heinemann, 2004.

**e-resources:**

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|---|---|
| 1. Link for PU e-resources: https: / / puniversity.informaticsglobal.com / login<br>2. Link for DGH Website: https: / / dghindia.gov.in /<br>3. An Introduction to Geology (YouTube Video): https: / / www.youtube.com / watch?v=rAYiBSo3JKY<br>4. From Black Oil to Green Gas (TEDx Talk): https: / / www.youtube.com / watch?v=Pd4BqGXHxy8<br>5. What if fossil fuels had never existed? (TEDx Talk): https: / / www.youtube.com / watch?v=K67Qou3m4_E<br>6. Why renewables can't save the planet (TEDx Talk): https: / / www.youtube.com / watch?v=N-yALPEpV4w<br>7. Can 100% renewable energy power the world? (TED Ed): https: / / www.youtube.com / watch?v=RnvCbquYeIM<br>8. CNBC Exclusive Interview with Chevron CEO Mike Wirth: https: / / www.youtube.com / watch?v=PG1g8cohcMU<br>9. The future of oil & gas: Interview with Head of Research at OPEC: https: / / www.youtube.com / watch?v=RCN1hRHq32o | |
| **Skill Sets:**<br>Topics relevant to "**SKILL DEVELOPMENT**": As it is a laboratory integrated course, all the experiments are designed for **Skill Development** through **Experiential Learning techniques**. The course attainment will be assessed through assessment component mentioned in course handout. | |
| **Catalogue prepared by:** | Dr. Suman Paul, Dr. Deepjyoti Mech, and Dr. Kalpajit Hazarika |
| **Recommended by the Board of Studies on:** | 14th Meeting of the Board of Studies held on 27th July 2022 |
| **Date of Approval by the Academic Council:** | 18th Meeting of the Academic Council held on 3rd August 2022 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Course Code:** PET1002 | **Course Title:** Introduction to Oil and Gas Industry<br>**Type of Course:** 1] Program Core Course<br>2] Theory Only | | | **L-T-P-C** | 3 | 0 | 0 | 3 |
| **Version No.:** | 1.0 | | | | | | |
| **Course Pre-requisites:** | NIL | | | | | | |
| **Anti-requisites:** | NIL | | | | | | |
| **Course Description:** | The aim of the course is to provide a broad overview of the Oil and Gas industry so that advanced courses can be understood within a broader Petroleum engineering context. The concepts such as oil and gas production, reservoir energy and forces, petroleum deposit drainage, development systems, well operation techniques will be covered. The course will develop an understanding of field life cycle and interdisciplinary approach to petroleum field development and operation. | | | | | | |
| **Course Objective:** | The objective of the course is to familiarize the learners with the concepts of Introduction to Oil and Gas Industry and attain **Skill Development** through **Participative Learning** techniques. | | | | | | |
| **Course Outcomes:** | Upon successful completion of the course the students shall be able to:<br>CO1: Describe the Oil and Gas industry,<br>CO2: Outline the life cycle of a well,<br>CO3: Summarize Oil and Gas processing facilities,<br>CO4: Review the climate change | | | | | | |
| **Course Content:** | | | | | | | |
| **Module 1:** | Introduction to the Oil & Gas Industry | Assignment / Quiz | Literature Survey | 08 Periods | | | |
| **Topics:**<br>Introduction to the energy business: energy resources; energy demand and supply. Energy security.<br>Scope of the Oil & Gas industry: producer and consumer countries; national / independent / international oil companies; services companies; international organizations. Risks related to the Oil & Gas industry | | | | | | | |
| **Module 2:** | Life Cycle of a Well | Assignment / Quiz | Programming | 09 Periods | | | |
| **Topics:**<br>Drilling: Organization on well site, Various designation at well site, Drilling rigs, Drilling operations chronology, Reservoir-wellbore interface, Offshore wells | | | | | | | |
| **Module 3:** | Oil & Gas Processing Facilities | Assignment, Quiz | Project work | 08 Periods | | | |
| **Topics:**<br>Produced fluid properties, well head assembly, Gathering system, Crude oil treatment, Storage, metering and shipment transportation. | | | | | | | |
| **Module 4:** | Petroleum and the Environment | Quiz / Team Activity | Literature Survey and Report Submission | 10 Periods | | | |
| **Topics:**<br>Definition, Scope and Importance of ecosystem. Classification, structure, and function of an ecosystem, Environmental Pollution, Classification of pollution, Climate change and impacts on human environment. Ozone depletion and Ozone depleting substances (ODS) Deforestation and desertification. International conventions / Protocols: Earth summit, Kyoto protocol, and Montreal Protocol. | | | | | | | |
| **Targeted Applications and Tools that can be used:**<br>**Applications:** Oil and Gas Industry<br>**Tools:** MS Office | | | | | | | |
| **Text Book:**<br>T1 John R. Fanchi, Richard L. Christiansen, Introduction to Petroleum Engineering, Wiley; 1st edition, November, https: / / www.wiley.com / en-us / Introduction+to+Petroleum+Engineering-p-9781119193449<br>T2 Samir Dalvi, Fundamentals of Oil & Gas Industry for Beginners, Notion Press, First edition, 2015, https: / / books.google.co.in / books?id=gYfZCgAAQBAJ&source=gbs_similarbooks | | | | | | | |
| **Reference Book(s)**<br>R1 Mohamed A. Fahim, Taher A. Al-Sahhaf, Amal Elkilani, Fundamentals of Petroleum Refining, Elsevier Science; 1st edition (December 28, 2009), https: / / www.elsevier.com / books / fundamentals-of-petroleum-refining / fahim / 978-0-444-52785-1 | | | | | | | |

R2 F.A. Giuliano, Introduction to Oil and Gas Technology, Springer Netherlands, 1981, https: / / books.google.co.in / books / about / Introduction_to_Oil_and_Gas_Technology.html?id=efBvtQAACAAJ&redir_esc=y

R3 Havard Devold, Oil and Gas Production Handbook: An Introduction to Oil and Gas Production, Lulu.com, 2013, https: / / books.google.co.in / books / about / Oil_and_Gas_Production_Handbook_An_Intro.html?id=nJ2XAwAAQBAJ&redir_esc=y

**Case Study:**

1. A case study of electrostatic accidents in the process of oil-gas storage and transportation, https: / / iopscience.iop.org / article / 10.1088 / 1742-6596 / 418 / 1 / 012037
2. Prevention of Major Accidents in the Oil & Gas Industry, https: / / www.grin.com / document / 176591

**e-Resource:**

1. Presidency University e-resource Remote Access (KNIMBUS) portal through the shared link: https: / / presiuniv.knimbus.com / user# / home
2. Introduction to the Oil and Gas Sector (https: / / youtu.be / k4cVxGndh9g)
3. Oil and Gas Industry Overview (https: / / youtu.be / O-qiUD9TEtQ)
4. Conflict in the Middle-East OPEC's 1970's Oil Embargo (https: / / youtu.be / FiLnj5WD0ao)
5. Birth of an oil field 1949 shell oil industrial film (https: / / youtu.be / uPUC-GDfYO8)

**Skill Sets:** Topics relevant to "**SKILL DEVELOPMENT**": Energy resources; energy demand and supply for **Skill Development** through **Participative Learning techniques**. This is attained through assessment component mentioned in course plan.

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| **Catalogue prepared by:** | Mr. Bhairab Jyoti Gogoi, Dr. Suman Paul, Dr. Deepjyoti Mech, and Dr. Kalpajit Hazarika |
| **Recommended by the Board of Studies on:** | 11th Meeting of the Board of Studies held on 5th Sept, 2020 |
| **Date of Approval by the Academic Council:** | 13th Meeting of the Academic Council held on 6th Nov 2020 |

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|---|---|---|---|---|---|---|---|
| **Course Code:** PET2001 | **Course Title:** Drilling Fluids and Cements<br>**Type of Course:** 1] Program Core Course<br>2] Laboratory Integrated | | | **L-T-P- C** | 3 | 0 | 2 | 4 |
| **Version No.:** | 2.0 | | | | | | | |
| **Course Pre-requisites:** | NIL | | | | | | | |
| **Anti-requisites:** | NIL | | | | | | | |
| **Course Description:** | This course enables students to select, develop and formulate drilling fluid as per the subsurface requirement. This course is both conceptual and analytical in nature and require the knowledge on basic sciences. Along with practical sessions the standards operating procedure of the equipment used in Oil field operations will be taught. This course also enables to compute a cementing plan for oil field jobs. | | | | | | | |
| **Course Objective** | The objective of the course is to familiarize the learners with the concepts of Drilling Fluids and Cements and attain **Skill Development** through **Participative Learning** techniques. | | | | | | | |
| **Course Outcomes:** | On successful completion of the course the students shall be able to:<br>CO1: recognize different type of drilling fluid,<br>CO2: discuss the clay industry,<br>CO3: manipulate the rheological properties of drilling fluid as per requirement,<br>CO4: identify different component of mud conditioning system,<br>CO5: review a cementing job. | | | | | | | |
| **Course Content:** | | | | | | | | |
| **Module 1:** | Introduction to Drilling Fluid | Seminar | Literature Survey | 07 Periods | | | | |
| **Topics:**<br>Drilling fluid, its classification, components and Clay chemistry | | | | | | | | |
| **Module 2:** | Clay Chemistry | Seminar | Literature Survey | 07 Periods | | | | |
| **Topics:**<br>Clay, Type of clay, Particle association, Electrostatic double layer, Nernst Potential, Zeta potential | | | | | | | | |
| **Module 3:** | Properties of Drilling Fluid | Assignment, Quiz | Programming | 09 Periods | | | | |
| **Topics:**<br>Study of different flow models for Drilling fluid, Rheological properties of Drilling fluid, Mud calculation<br>**Related Experiment No:** 1, 2, 3, 4, 5, 6, 7 and 8 | | | | | | | | |
| **Module 4:** | Mud Conditioning System | Case Study | Project Work | 11 Periods | | | | |
| **Topics:**<br>Basics of Shale shaker, Desander and Desilter, Mud cleaner, Hydro cyclone, Centrifuge | | | | | | | | |
| **Module 5:** | Oil well Cement | Quiz | Online Quiz | 04 Periods | | | | |
| **Topics:**<br>Cements, its functions, classification, cementing accessories, Cementing method | | | | | | | | |

**List of Laboratory Tasks:**

**Experiment No. 1:**
**Level 1:** To prepare drilling with the given composition using Hamilton Beach mixer
**Level 2:** To prepare drilling with the given composition using RAMI stirrer

**Experiment No. 2:**
**Level 1:** To determine the mud weight of the given fluid sample using Mud balance and Hydrometer
**Level 2:** Analyze the change in Hydrostatic head with the addition of weighting material and water

**Experiment No. 3:**
**Level 1:** To determine the $P^H$ and Gel strength of the given fluid sample using $P^H$ meter and Shearometer
**Level 2:** Analyze the variance in Gel strength with the change in $P^H$ of the Drilling fluid sample

**Experiment No. 4:**
**Level 1:** To determine the Plastic viscosity, Apparent viscosity, Yield Point and Gel strength of the given fluid sample Hand crank viscometer and 6-Speed viscometer

**Level 2:** Development of Drilling fluid with the help of various additives to meet YP / PV ratio

**Experiment No. 5:**
**Level 1:** To determine the sand content and Marsh Funnel viscosity of the given fluid sample using Sand content kit and Marsh Funnel apparatus
**Level 2:** Study the effect of Sand content on the Funnel viscosity of the Drilling fluid

**Experiment No. 6:**
**Level 1:** To determine the filtrate loss and filter cake thickness on the given fluid sample using LPLT Filter Press
**Level 2:** To determine the filtrate loss and filter cake thickness on the given fluid sample using HPHT Filter Press

**Experiment No. 7:**
**Level 1:** To determine the lubricity coefficient of the given fluid sample using EP Lubricity Tester
**Level 2:** Compression of Lubricity coefficient of different Lube oils to smooth conduction of Drilling operation

**Experiment No. 8:**
**Level 1:** To determine the reactive clay content of the Drilling fluid using Methylene Blue apparatus
**Level 2:** To study the effect of particle size distribution on the reactivity of the clay

**Targeted Application and Tools that can be used:**
**Applications:** Mud Engineer / Cement Engineer at Oil & Gas industry.
**Tools:** MUDWERE, Equipment used in Drilling fluid testing as per API standards, Microsoft excel

**Text Book:**
T1. H.C. H. Darly and George R. Gray, "Composition and Properties of Drilling fluid Completion Fluid", 2011 6th Edition, Gulf Publication.
T2. Samuel Bridges, Leon Robinson, A Practical Handbook for Drilling Fluids Processing (Gulf Drilling Guides) Hardcover – 18 February 2020

**References:**
R1. Hayden H. murray, "Applied clay Mineralogy"; 2006, Volume-1, First edition, Elsevier
R2. R. Monicard, Drilling Mud and Cement Slurry Rheology Manual, 1982, Springer
R3. H. Rabia, Graham and Trotman, "Oil Well Drilling Engineering: Principle and Practice", 1985, Gaithersburg, MD, USA: Graham & Trotman, 1985.

**Case Study:**
1. Verified 99.9% Drilling Fluids Recovery
https: / / www.katchkan.com / 2019 / 09 / 03 / case-study-verified-drilling-fluids-recovery /
2. Hollow-Glass Sphere Application in Drilling Fluids
https: / / doi.org / 10.2118 / 174010-MS

**e-book:**
1. Fundamentals and Applications of Bionic Drilling Fluids Book by Guancheng Jiang https: / / www.google.co.in / books / edition / Fundamentals_and_Applications_of_Bionic / CgUhEAAAQBAJ?hl=en&gbpv=0
2. Shale Shakers and Drilling Fluid Systems: Techniques and Technology for Improving Solids Control Management https: / / www.google.co.in / books / edition / Shale_Shakers_and_Drilling_Fluid_Systems / M8LbOAw9sykC?hl=en&gbpv=1&printsec=frontcover

**e-resources:**
1. Presidency University e-Resource:
https: / / puniversity.informaticsglobal.com / login
2. Drilling Fluid Software: MUDWARE
https: / / www.slb.com / drilling / drilling-fluids-and-well-cementing / drilling-fluids / drilling-fluids-simulation-software / mudware
3. Online 5 day course on Drilling Fluid:
https: / / www.nexttraining.net / course / drilling-fluids / 1420
4. Newpark, Drilling Fluid service provider's website:
https: / / www.newpark.com / drilling-fluids /

**Online videos:**
1. Oil Well drilling process-A shell film https: / / youtu.be / guFiQ87tg_s
2. Drilling animation- https: / / youtu.be / eBOtXD_UQSo
3. Oil well drilling animation- https: / / youtu.be / SdgeSFbxQps
4. Functions of Drilling fluid- https: / / youtu.be / grdEOy7AKv4
5. Introduction to drilling fluid- https: / / youtu.be / 9rnYK7cQ6wA

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| **Skill Sets:** Topics relevant to "**SKILL DEVELOPMENT**": As it is a laboratory-integrated course, all the experiments are designed for **Skill Development** through **Experiential Learning techniques**. The course attainment will be assessed through assessment component mentioned in course handout. | |
| **Catalogue prepared by:** | Dr. Suman Paul, Dr. Deepjyoti Mech, Dr. Kalpajit Hazarika, Mr. Bhairab Jyoti Gogoi |
| **Recommended by the Board of Studies on:** | 14th Meeting of the Board of Studies held on 27th July 2022 |
| **Date of Approval by the Academic Council:** | 18th Meeting of the Academic Council held on 3rd August 2022 |

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|---|---|---|---|---|---|---|---|
| **Course Code:** PET2002 | **Course Title:** Fundamentals of Geophysical Logging Techniques<br>**Type of Course:** 1] Program Core Course<br>2] Theory only | | | **L-T-P-C** | 4 | 0 | 0 | 4 |
| **Version No.:** | 2.0 | | | | | | | |
| **Course Pre-requisites:** | NIL | | | | | | | |
| **Anti-requisites:** | NIL | | | | | | | |
| **Course Description:** | Geophysical Logging is very crucial to be carried out during the life cycle of any oilfield drilling operation. It provides data to answer fundamental questions associated with petrophysical, geological, and mechanical properties required to evaluate, develop, and produce a field. The purpose of this course is to provide a broad understanding of various geophysical logging techniques used for the determination of lithology, porosity, fluid content, saturation, permeability, etc., and applications of these results in formation evaluation. This course is both conceptual and analytical in nature and requires knowledge of basic science and engineering. The students will learn how to interpret well log data through exercises and assignments. | | | | | | | |
| **Course Objective:** | The objective of the course is to familiarize the learners with the concepts of Fundamentals of Geophysical Logging Techniques and attain **Skill Development** through **Participative Learning** techniques. | | | | | | | |
| **Course Outcomes:** | Upon successful completion of the course the students shall be able to:<br>CO1: discuss the importance of geophysical logging in the petroleum industry,<br>CO2: explain various geophysical logging techniques,<br>CO3: interpret basic geophysical logging tools,<br>CO4: describe special and advanced logging tools, and<br>CO5: demonstrate different cross-plotting techniques. | | | | | | | |
| **Course Content:** | | | | | | | | |
| **Module 1:** | An Overview of Well Logging | e-resource Review / Report Writing | Writing Communication / Analytical Skills Development | 08 Periods | | | | |
| **Topics:**<br>Well Logging: Definition, Objectives and Principles of Log Interpretation, Applications of Well Logging; Well Log Analysts / Petrophysicists – Job Description; Basic Log Types – Logging While Drilling, Wireline Open Hole Logging, Wireline Cased Hole Logging, Pipe-Conveyed Logging; Operational Decisions – Tool Failure, Stuck Tools. | | | | | | | | |
| **Module 2:** | Basic Concepts of Well Logging and Measurement Techniques | Interpretation of Oil Field Charts | Exercises | 12 Periods | | | | |
| **Topics:**<br>Basic Concepts of Well Logging: Properties of Rocks – Composition, Texture and Structure; Relationship between Porosity and Resistivity (Formation Factor), Relationship between Saturation and Resistivity (Archie's Equation), Effect of Shaliness on the Resistivity, Effect of Shale distribution, Permeability, Thickness and internal structure of strata.<br>Measurement Techniques: Classification of Log Measurements - Natural Phenomena, Physical properties measured by inducing responses from the formation; Problems specific to Well Log Measurements - Borehole Effects (Invasion), Effect of Tool Geometry, Logging Speed, Hostile Environments; Logging Equipment (Surface and Downhole) - Logging Truck and Offshore Units, Cable, Logging Tool, Recording Equipment, Tool Combinations, Memorization; Log Presentation; Repeatability and Calibrations.<br>*Related Exercise No.: 2.1 through 2.4.* | | | | | | | | |
| **Module 3:** | Basic Logging Tools | Analysis of Well Log Data | Exercises | 14 Periods | | | | |
| **Topics:**<br>Resistivity Log, Induction Log, Spontaneous Potential (SP) Log, Gamma Ray (GR) Log, Sonic Log, Density Log, and Neutron Log - Principle, Types of Tools used, Limitations, and Applications; Caliper Log; Temperature Log.<br>*Related Exercise No.: 3.1 through 3.5.* | | | | | | | | |
| **Module 4:** | Special and Advanced Logging Tools | Poster Designing and Presentation | Verbal Communication Skill Development | 06 Periods | | | | |
| **Topics:**<br>Principles, Limitations, and Applications of Production Logging; CBL / VDL, USIT, SFT, and RFT; NMR Log, and FMS Log. | | | | | | | | |
| **Module 5:** | Cross-plots and their Applications | Analysis of Cross-Plots | Exercises | 03 Periods | | | | |

**Topics:**
Cross-plots and their applications, Neutron – Density, Sonic – Neutron, Sonic – Density.

**Targeted Application and Tools that can be used:**
**Applications:** Well Log Analyst / Petrophysicist in Petroleum / Mineral Exploration industry
**Tools:** Microsoft Excel (Basics), Python, MatLab, Grapher, DecisionSpace G1 Edition (Halliburton Software)

**Text Book:**
T1. Darling, Toby, "Well Logging and Formation Evaluation", 1st Edition, Elsevier, Gulf Professional Publishing, 2005.
T2. Serra, Oberto, "Fundamentals of Well Log Interpretation - 1. The Acquisition of Logging Data", 1st Edition, Elsevier Science Publisher B V, 1984.

**References:**
R1. Rider, M., "The Geological Interpretation of Well Logs", Rider-French Consulting Ltd., 2004
R2. Ellis, Darwin V., and Singer, Julian M., "Well Logging for Earth Scientists", 2nd Edition, Springer, 2007.
R3. Boyer, Sylvain and Mari, Jean-Luc, "Seismic Surveying and Well Logging", 1st Edition, Editions Technip, Paris, 1997.
R4. Ransom, Robert C., "Practical Formation Evaluation", John Wiley and Sons Ltd., 1996.
R5. Bateman, Richard M., "Openhole Log Analysis and Formation Evaluation", 2nd Edition, Society of Petroleum Engineers, 1986.

**e-resources:**
1. Link for PU e-resources: https: / / puniversity.informaticsglobal.com / login
2. Reservoir Petrophysics: https: / / www.youtube.com / watch?v=iubNxQLKcow
3. An Overview of Well Logging: https: / / www.youtube.com / watch?v=A5MEEX_pwys
4. Cross-plots and their Applications: https: / / www.youtube.com / watch?v=IkRygF3MORw&t=2243s
5. Research Article: https: / / www.sciencedirect.com / topics / earth-and-planetary-sciences / formation-evaluation

**Skill Sets:** Topics relevant to **"SKILL DEVELOPMENT":** Resistivity Log, Induction Log, Spontaneous Potential (SP) Log, Gamma Ray (GR) Log and Sonic Log for **Skill Development** through **Participative Learning** techniques. This is attained through assessment component mentioned in course plan.

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| **Catalogue prepared by:** | Dr. Suman Paul, Dr. Deepjyoti Mech, Dr. Kalpajit Hazarika |
| **Recommended by the Board of Studies on:** | 14th Meeting of the Board of Studies held on 27th July 2022 |
| **Date of Approval by the Academic Council:** | 18th Meeting of the Academic Council held on 3rd August 2022 |

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|---|---|---|---|---|---|---|---|
| **Course Code:** PET2003 | **Course Title:** **Fundamentals of Oil and Gas Well Drilling Technology**<br>**Type of Course:** **1] Program Core Course**<br>**2] Theory only** | | | **L-T-P-C** | 3 | 0 | 0 | 3 |
| **Version No.:** | 2.0 | | | | | | | |
| **Course Pre-requisites:** | NIL | | | | | | | |
| **Anti-requisites:** | NIL | | | | | | | |
| **Course Description:** | Fundamentals of Drilling Engineering deals with understanding the processes and selecting the equipment required for drilling a stable wellbore and providing it with casing for preventing various wellbore problems. This course discusses about various mechanical systems used for drilling a well bore and how to design them. This course is both conceptual and analytical in nature and require the knowledge on basic science. | | | | | | | |
| **Course Objective:** | The objective of the course is to familiarize the learners with the concepts of Fundamentals of Oil and Gas Well Drilling Technology and attain **Skill Development** through **Participative Learning** techniques. | | | | | | | |
| **Course Outcomes:** | On successful completion of the course the student shall be able to:<br>CO1: Compute the load capacity and power requirement of various rig components,<br>CO2: Choose appropriate drill string components according to pressure requirements,<br>CO3: Select appropriate casing string according to pressure requirements,<br>CO4: Classify drilling bits based on the drilling mechanism. | | | | | | | |
| **Course Content:** | | | | | | | | |
| **Module 1:** | Drilling Rig Components | Assignment / Quiz | Programming | 10 Periods | | | | |
| **Topics:**<br>Drilling fluid and cementation; Introduction to Oil Well Drilling; Drilling Rig Component: Hoisting system, Derrick and derrick capacity, Circulation system, Rotary system, Pressure control system, Power systems. | | | | | | | | |
| **Module 2:** | Drill String Design | Assignment / Quiz | Programming | 09 Periods | | | | |
| **Topics:**<br>Functions and components of drill string; Drill collar design; Drill pipe design: Collapse calculation, Burst calculation; Drill string washout; Drill string vibration; Shock sub. | | | | | | | | |
| **Module 3:** | Casing Design | Assignment / Quiz | Group discussion | 09 Periods | | | | |
| **Topics:**<br>Functions of casing; Type of casing; Casing seat selection; Collapse, burst and tension calculation: Based on mechanical properties, Based on mud and hole characters. | | | | | | | | |
| **Module 4:** | Drill Bit and Rig Hydraulics | Article Review | Presentation | 08 Periods | | | | |
| **Topics:**<br>Drill bit - Types of drill bits; Roller cone bit design: Milled tooth bit and Insert bit; PDC bit design; Diamond bit design; Drilling cost calculation. Rig hydraulics - Pressure loss in circulation system; Pressure loss through bit; Bit velocity and area calculation; Bit hydraulic optimization. | | | | | | | | |
| **Targeted Application and Tools that can be used:**<br>**Applications:** Targeted for Upstream oil and gas industry as a Drilling Engineer in Upstream Oil and Gas Industry / Mineral Exploration Company<br>**Tools:** Drillworks Predict (Landmark Halliburton) | | | | | | | | |
| **Text Book:**<br>T1. Deepak Sharma, "Oil Well Drilling Technology", 1st Edition, 2015, Venus Books Publications.<br>T2. H. Rabia, Graham and Trotman, "Oil Well Drilling Engineering: Principles and Practice", 1st Edition, 1986, Springer. | | | | | | | | |
| **References:**<br>R1. Drilling Engineering, Heriot Watt Institute of Petroleum Engineering, Herriot Watt University, 2005.<br>R2. V.K. Jain, A.B. Sharma, R. Dhupar, R.P. Patel, D. Das Gupta, A. K. Joshi, and R. Shanker, "ONGC – Drilling Operation Practices Manual", 1st Edition, 2007, Shiva Offset Press, Dehradun.<br>R3. Drilling Engineering: A Complete Well Planning Approach, Neal Adams, Tommie Charrier; 1985; 1st Edition; 1985; PennWell Books | | | | | | | | |

R4. V.K. Jain, A.B. Sharma, R. Dhupar, R.P. Patel, D. Das Gupta, A. K. Joshi, and R. Shanker, "ONGC – Drilling Operation Practices Manual", 1st Edition, 2007, Shiva Offset Press, Dehradun

**e-resources:**

1. Presidency University e-access portal: https: / / presiuniv.knimbus.com / user# / home
2. Dr. Petro YouTube channel: Drilling Rig Components Animated- https: / / youtu.be / JjGXsLWcwI0
3. Drilling Rig Online Courses YouTube channel: Drill String components and their functions- https: / / youtu.be / M6tic_OcNPY
4. Encyclopedia of petrochemistry YouTube channel: Casing and Cementing- https: / / youtu.be / iMUsMOopwpU
5. Harvest Chemical YouTube channel: Bit Hydraulics-https: / / youtu.be / I178EdbDV_Y
6. Case Studies: Best Practice Case Studies for Drilling Engineers: https: / / www.drillingpoint.com /
7. Robert F. Mitchell, "Fundamentals of Drilling Engineering", 1st Edition, 2016, Society of Petroleum Engineers, Inc. https: / / www.amazon.in / Fundamentals-Drilling-Engineering-Robert-Mitchell-ebook / dp / B01L0O8WJA

**Skill Sets:** Topics relevant to "**SKILL DEVELOPMENT**": Drill bit - Types of drill bits; Roller cone bit design: Milled tooth bit and Insert bit; PDC bit design for **Skill Development** through **Participative Learning techniques**. This is attained through assessment component mentioned in course plan.

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| **Catalogue prepared by:** | Dr. Deepjyoti Mech, Dr. Kalpajit Hazarika, Mr. Bhairab Jyoti Gogoi |
| **Recommended by the Board of Studies on:** | 14th Meeting of the Board of Studies held on 27th July 2022 |
| **Date of Approval by the Academic Council:** | 18th Meeting of the Academic Council held on 3rd August 2022 |

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|---|---|---|---|---|---|---|---|
| **Course Code:** PET2004 | **Course Title:** Fundamentals of Petroleum Reservoir Engineering<br>**Type of Course:** 1] Program Core Course<br>2] Laboratory Integrated | | | **L-T-P-C** | 3 | 0 | 2 | 4 |
| **Version No.** | 2.0 | | | | | | | |
| **Course Pre-requisites** | NIL | | | | | | | |
| **Anti-requisites** | NIL | | | | | | | |
| **Course Description** | The purpose of this lab-integrated course is to get hands on experience on flow of fluids through the reservoir. This course is both conceptual and analytical in nature and require the knowledge on basic science. This course develops the critical thinking, analytical skills and programming abilities through assignments. The associated laboratory provides an opportunity to validate the concepts taught and enhances the ability to correlate with the real time field experiment. | | | | | | | |
| **Course Objectives** | The objective of the course is to familiarize the learners with the concepts of Fundamentals of Petroleum Reservoir Engineering and attain **Skill Development** through **Experiential Learning** techniques. | | | | | | | |
| **Course Outcomes** | On successful completion of this course the students shall be able to:<br>CO1: explain the reservoir rock and fluid properties of a hydrocarbon reservoir<br>CO2: compare the flow behavior of reservoir fluid through porous media<br>CO3: differentiate various drive mechanisms<br>CO4: apply the concept of different reserve estimation methods | | | | | | | |
| **Course Content:** | | | | | | | | |
| **Module 1** | Fundamentals of Reservoir Rock Properties | Assessment 1: Assignment | Quiz | 09 Periods | | | | |
| **Topics:**<br>Porosity: absolute porosity, effective porosity, Saturation, Wettability, Surface and interfacial tension, capillary pressure, Permeability (K): relative permeability: two phase relative permeability: drainage, imbibition problems, Saturation-K relationship.<br>**Related Experiment: Experiment No**-1, 6, 7 and 8 | | | | | | | | |
| **Module 2** | Fundamentals of Reservoir Fluid Flow | Assessment 2: Assignment / Quiz | Programming | 09 Periods | | | | |
| **Topics:**<br>Types of fluids, flow regimes, reservoir geometry, Fluid flow through porous media: Application of Darcy's law, Different types of flow.<br>**Related Experiment:** Experiment No 2, 3, 4, 5 and 9 | | | | | | | | |
| **Module 3** | Oil Recovery Mechanisms | Assessment 3: Assignment / Quiz | Data analysis task | 06 Periods | | | | |
| **Topics:**<br>Primary recovery mechanisms: Expansion of the individual rock grains and Formation compaction, Solution gas drive, gas cap with little or no water drive, water drive, gravity drainage drive, combination drive mechanisms | | | | | | | | |
| **Module 4** | Reserve Estimation Technique | Assessment 4: Term Paper | Programming | 10 Periods | | | | |
| **Topics:**<br>Volumetric estimation of reserve, The material balance equation and Decline curve analysis | | | | | | | | |
| **List of Laboratory Tasks:**<br>**Exp. No 1:** Bulk volume measure measurement using Vernier caliper<br>Level 1: To determine the bulk volume of core sample using Vernier Calliper<br>Level 2: To compare the calibrations before and after the experiment<br><br>**Exp. No 2:** To determine Fluid Density of a given sample using Pycnometer<br>Level 1: Determine the density of liquid sample at ambient temperature<br>Level 2: Compare the density of liquid sample at different temperature<br><br>**Exp. No 3:** To prepare Core Sample using Soxhlet Apparatus<br>Level 1: Clean the core sample and remove the organic and inorganic present inside the pore space.<br>Level 2: Extract the dissolved solid in liquid sample<br><br>**Exp. No 4:** To estimate Surface Tension of a given liquid(s) sample using Ring Tensiometer | | | | | | | | |

Level 1: Determine the surface tension for liquid sample
Level 2: Find the relationship of Surface tension with temperature

**Exp. No 5:** To estimate Interfacial Tension of a given liquid(s) sample using Ring Tensiometer
Level 1: Determine the interfacial tension for liquid sample
Level 2: Find the relationship of interfacial tension with temperature and concentration of surfactant

**Exp. No 6:** To estimate Effective Porosity of a given Core Sample using saturation method
Level 1: Estimate Effective Porosity of a given Core Sample
Level 2: Estimate Effective Porosity of a Core Samples from different depth and correlate the porosity with respect to depth.

**Exp. No 7:** To estimate Absolute Permeability of Water for a given Core Sample using Liquid Permeameter
Level 1: Estimate the Absolute Permeability of Water for a given Core Sample
Level 2: Estimate the relative permeability of oil, water and injection fluid

**Exp. No 8:** To estimate Permeability of Air for a given Core Sample using Gas Permeameter
Level 1: Estimate the air Permeability for a given Core Sample
Level 2: Determine the Klinkenberg effect.

**Exp. No 9:** To determine the viscosity of given fluid by using Cannon Fansky Viscometer
Level 1: Determine the viscosity of given fluid
Level 2: Determine the viscosity of given fluid with respect to temperature

**Targeted Application & Tools that can be used:**
**Applications**: Reservoir Engineer in Oil and Gas industry
**Professionally used Software**: Eclipse, Petrel

**Text Book:**
T1. Abhijit Y. Dandekar, "Petroleum Reservoir Rock and Fluid Properties", CRC Press.
T2. Tarek Ahmed, "Reservoir Engineering Handbook" Elsevier, 5th Edition, 2019.

**References**
R1. L. P. Dake, "Fundamentals of Reservoir Engineering", Elsevier, 17th Impression, 1998.
R2. SM1 "Reservoir Engineering Lab Manual", Presidency University

**e-resources:**
1. Presidency University Link- https: / / puniversity.informaticsglobal.com / login
2. Reservoir rock properties- https: / / www.youtube.com / watch?v=iubNxQLKcow
3. Fundamentals of reservoir fluid flow- https: / / wiki.aapg.org / Fluid_flow_fundamentals
4. Oil recovery mechanisms- http: / / large.stanford.edu / courses / 2015 / ph240 / zerkalov2 / docs / sino.pdf
5. Reserve estimation technique- https: / / wiki.aapg.org / Reserves_estimation

**Skill Sets:** Topics relevant to "**SKILL DEVELOPMENT**": As it is a laboratory integrated course, all the experiments are designed for **Skill Development** through **Experiential Learning techniques**. The course attainment will be assessed through assessment component mentioned in course plan.

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| **Catalogue prepared by** | Dr. Kalpajit Hazarika, Dr. Deepjyoti Mech, Mr. Bhairab Jyoti Gogoi |
| **Recommended by the Board of Studies on** | 14th Meeting of the Board of Studies held on 27th July 2022 |
| **Date of Approval by the Academic Council** | 18th Meeting of the Academic Council held on 3rd August 2022 |

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| **Course Code:** PET2008 | **Course Title: Heat and Mass Transfer for Petroleum Engineering**<br>**Type of Course: 1] Program Core Course**<br>**2] Laboratory integrated** | | | **L-T-P-C** | 2 | 0 | 2 | 3 |
| **Version No.:** | 2.0 | | | | | | | |
| **Course Pre-requisites:** | NIL | | | | | | | |
| **Anti-requisites:** | NIL | | | | | | | |
| **Course Description:** | The course is designed to discuss the fundamental laws relating to the heat and mass transfer processes. It enables the need for analyze the heat and mass transfer applications in oil and gas industries. The course is both conceptual and analytical in nature. It needs fair knowledge of Physics and Mathematics. The course develops the critical thinking and analytical skills. The associated laboratory experiments provide an opportunity to validate the concepts taught and enhances the ability to visualize the real system performance. Knowledge gained from this course can be applied for analyzing the heat and mass transfer applications in oil and gas industries. | | | | | | | |
| **Course Objective** | The objective of the course is to familiarize the learners with the concepts of Heat and Mass Transfer for Petroleum and attain **Skill Development** through **Experiential Learning** techniques. | | | | | | | |
| **Course Outcomes:** | On successful completion of the course the students shall be able to:<br>CO1: Solve the heat transfer problems of Conduction and Convection,<br>CO2: Illustrate the concept of radiation and the working of heat exchanger,<br>CO3: Apply diffusive and convective mass transfer equations to solve problems for different applications. | | | | | | | |
| **Course Content:** | | | | | | | | |
| **Module 1:** | Heat Transfer by Conduction and Convection | Assignment / Quiz | Data Collection and Report Submission | 09 Periods | | | | |
| **Topics:**<br>Introduction, Basic modes of heat transfer – conduction, Convection and Radiation, General heat conduction equation in Cartesian, cylindrical and spherical coordinates – extended surface heat transfer – fin performance –<br>Newton's law – concept of boundary layer – boundary layer equations– film and drop wise condensation – film boiling and pool boiling – boiling curve.<br>**Related Experiment No:** 1, 2 ,3, 4, 5 and 6 | | | | | | | | |
| **Module 2:** | Radiation Heat Transfer and Heat -Exchange Equipment | Assignment / Quiz | Poster Designing and Presentation | 08 Periods | | | | |
| **Topics:**<br>Fundamentals of radiation – radiation spectrum – thermal radiation – concept of black body and grey body – monochromatic and total emissive power – absorptivity, reflectivity and transmissivity - laws of radiation – radiation between two surfaces –Classification – log mean temperature difference – overall heat transfer coefficient – fouling and scaling of heat exchangers.<br>**Related Experiment No:** 7, and 8 | | | | | | | | |
| **Module 3:** | Mass Transfer | Assignment / Quiz | Data Collection and Report Submission | 07 Periods | | | | |
| **Topics:**<br>Basic Concepts – Diffusion Mass Transfer – Fick's Law of Diffusion – Steady state Molecular Diffusion – Convective Mass Transfer – Momentum, Heat and Mass Transfer Analogy – Convective Mass Transfer Correlations<br>**Related Experiment No:** 1, 6, and 7 | | | | | | | | |
| **List of Laboratory Tasks:**<br>**Experiment No. 1:** Thermal Conductivity of Metal Rod<br>**Level 1:** To find the thermal conductivity of the metal rod<br>**Level 2**: To plot the variation of temperature along the length of the metal rod. (Graph Paper / Grapher / MS Excel)<br><br>**Experiment No. 2**: Thermal Conductivity of Insulating Powder<br>**Level 1**: To find the thermal conductivity of insulating powder.<br>**Level 2:** To plot the variation of temperature along the length of the metal rod.<br><br>**Experiment No. 3**: Computer Controlled Heat Transfer Through Composite Wall<br>**Level 1:** To calculate total thermal resistance of the composite wall<br>**Level 2:** To calculate total thermal conductivity of the composite wall | | | | | | | | |

**Experiment No. 4:** Computer Controlled Heat Transfer Through Lagged Pipe
Level 1: To find the actual rate of heat transfer through the composite cylinders from the measured interface temperature of the two insulating materials with known thermal conductivities
Level 2: To find the effective thermal conductivity of the composite cylinders

**Experiment No. 5:** Unsteady State Heat Transfer
**Level 1:** To find the Fourier number, the Biot number.
**Level 2:** To find the heat transfer coefficient, and the heat transfer rate.

**Experiment No. 6:** Heat Transfer from A Pin – Fin By Free & Forced Convection
**Level 1:** To calculate the heat transfer coefficient experimentally and theoretically for forced convection.
**Level 2:** To plot a graph between theoretical temperature distributions with experimentally obtained distribution.

**Experiment No. 7:** To study the heat transfer phenomena in parallel and counter flow heat exchanger

**Level 1:** To find out the heat transfer rate for given fluids in parallel and counter flow condition.
**Level 2:** To calculate the overall heat transfer coefficient for both parallel and counter flow arrangements.

**Experiment No. 8:** Emissivity Measurement Apparatus
**Level 1**: To find the emissivity of the test plate
**Level 2:** To find the emissivity of different test plate.

**Targeted Application and Tools that can be used:**
**Application:** Process Engineer in Chemicals Industries, Pipeline Engineer in Upstream / Midstream Oil and Gas Industry
**Tools:** MS Excel, Grapher, Unisim Design Software

**Text Book:**
T1: R,K Rajput, "A Textbook Of Heat And Mass Transfer Si Units", S Chand, 1st ed,2018
T2: P.K Nag, "Heat and Mass transfer", McGraw Hill, 3rd ed,2011

**References:**
R1. Robert W. Fox, Alan T. McDonald, Philip J. Pritchard, John W. Mitchell, "Fluid Mechanics: SI Version", Wiley India.
R2. J.P. Holman, "Heat Transfer", 10th Edition, McGraw Hill, 2002.
R3. Treybal "Mass Transfer Operations", 3rd Edition, Mc.Graw Hill Book Co., New York.

**e- References:**
1. https: / / puniversity.informaticsglobal.com / login
2. https: / / nptel.ac.in / courses / 112 / 108 / 112108149 /
3. https: / / nptel.ac.in / courses / 112 / 101 / 112101097 /
4. https: / / www.newtondesk.com / heat-and-mass-transfer-study-notes-hand-written /

**Skill Sets:** Topics relevant to "**SKILL DEVELOPMENT**": As it is a laboratory integrated course, all the experiments are designed for **Skill Development** through **Experiential Learning techniques**. The course attainment will be assessed through assessment component mentioned in course plan.

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|---|---|
| **Catalogue prepared by:** | Dr. Suman Paul, Dr. Deepjyoti Mech, Dr. Kalpajit Hazarika, Mr. Ankur Neog |
| **Recommended by the Board of Studies on:** | 14th Meeting of the Board of Studies held on 27th July 2022 |
| **Date of Approval by the Academic Council:** | 18th Meeting of the Academic Council held on 3rd August 2022 |

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|---|---|---|---|---|---|---|
| **Course Code:** PET2009 | **Course Title:** Thermodynamics of Reservoir Fluids<br>**Type of Course:** 1] Program Core Course<br>2] Laboratory Integrated | | **L-T-P-C** | 2 | 0 | 2 | 3 |
| **Version No.:** | 2.0 | | | | | | |
| **Course Pre-requisites:** | Nil | | | | | | |
| **Anti-requisites:** | Nil | | | | | | |
| **Course Description:** | The main aim of this course is to get an overview of the thermodynamics of fluids present in the reservoir and how they are identified and controlled on time in the oil and gas industry. The course intends to develop understanding of laws of thermodynamics and how they may influence the behavior of reservoir fluids. The course will highlight important aspects of the fluid flow equations and other flow process related to compressors and throttling devices. This course will also discuss properties of reservoirs fluids including formation volume factors and will discuss their behaviour in reservoir and surface. The course will also include team exercises and numerical solving activities, which will help to improve the employability skills. The course is both conceptual and analytical in nature and needs fair knowledge of Mathematical and computing. The course develops the critical thinking and analytical skills. The associated laboratory provides an opportunity to validate the concepts taught and enhances the ability to correlate with the real time field experiment. | | | | | | |
| **Course Objective:** | The objective of the course is to familiarize the learners with the concepts of Thermodynamics of Reservoir Fluids and attain **Skill Development** through **Experiential Learning** techniques. | | | | | | |
| **Course Outcomes:** | On successful completion of the course the students shall be able to:<br>CO1: Understand first law and second law of thermodynamics,<br>CO2: Apply the thermodynamics understanding to fluid flow processes such as turbine and compressor,<br>CO3: Classify different types of oil and gas reservoirs based on the fundamentals of reservoir fluid behavior and properties<br>CO4: Interpret the theoretical knowledge of thermodynamics with lab experiments. | | | | | | |
| **Course Content:** | | | | | | | |
| **Module 1:** | First and Second Law of Thermodynamics | Assignment | Data Collection | 10 Periods | | | |
| **Topics:**<br>The scope of thermodynamics, Dimensions and Units.<br>**First law and other basic concepts**: Joule's Experiments, Internal Energy, First law of thermodynamics, Energy balance for closed systems, Equilibrium, Reversible process, Constant-V & P process, Enthalpy, Heat Capacity, Mass and Energy balances for Open systems; Statements of Second law, Heat engines, Mathematical statement of the second law, Entropy balance for open systems.<br>**Thermodynamic properties of fluids**: Property relations for homogenous phases, Two-Phase systems, Generalized property correlations for gases. | | | | | | | |
| **Module 2:** | Applications of Thermodynamics to Flow Processes | Case Study | Programming / Simulation | 06 Periods | | | |
| **Topics:**<br>Phase Behavior of pure component and hydrocarbon mixture, Gibbs Phase Rule, PVT Experiments, PVT / Phase Behavior Simulation. | | | | | | | |
| **Module 3:** | Fundamentals of Reservoir Fluid Behavior | Case Study | Data Collection | 07 Periods | | | |
| **Topics:**<br>Classification of reservoirs and reservoir fluids, Raoult's Law, Dew point and Bubble point Calculations with Raoult's Law, Oil reservoirs, Gas reservoirs, behavior of ideal and real gases, Compressibility factor, viscosity of fluid<br>**Related Experiment No.:** 1 to 6 | | | | | | | |
| **List of Laboratory Tasks:**<br>**Experiment 1:** Introduction to CMG-winprop, PVT Simulator Applications, Other PVT Software<br>Level 1: Reservoir Fluid modelling: Basic Understanding of Reservoir fluid properties that can be quantified in a PVT simulation software.<br>Level 2: Reservoir Fluid properties modelling: Input of basic reservoir fluid data into simulator | | | | | | | |

**Experiment 2:** Developing P-T envelope of reservoir Fluid using given fluid data.
Level 1: Calculation of vapor pressure or saturation pressure using CMG-winprop software.
Level 2: Generate phase envelope diagram and note down Cricondenbar, Cricondentherm, critical temperature and critical pressure.

**Experiment 3:** Developing reservoir fluid model, understand basic concepts of Plus fraction splitting and Lumping matching experimental data by regression.
Level 1: Generating reservoir fluid model by Plus fraction splitting of pseudo component.
Level 2: Developing fluid model for by regression of plus fraction.

**Experiment 4:** Developing reservoir fluid model by matching minimum miscibility pressure.
Level 1: To develop reservoir fluid model using PVT simulator.
Level 2: Calculation of minimum miscibility pressure of given reservoir fluid data.

**Experiment 5:** Determination of apparent molecular weight of given natural gas data.
Level 1: Determination of pseudocritical pressure, pseudocritical temperature of given natural gas data.
Level 2: Determination of apparent molecular weight of given natural gas data.

**Experiment 6:** Determination of Gas viscosity of given natural gas data.
Level 1: Determination of pseudocritical properties of given natural gas data.
Level 2: Determination of Gas viscosity of given natural gas data.

**Targeted Application and Tools that can be used:**
**Application Area**: Oil and Gas industry
**Professionally used Software:** PVTSIM, CMG-WINPROP

**Text Book:**
T1: Smith J.M., H.C. Van Ness, M.M. Abbott, Introduction to Chemical Engineering Thermodynamics, 7th Edition, Tata Mc. Graw – Hill Publishing Company Limited, New Delhi, 2009.
T2: Nag, P.K.. Engineering thermodynamics, 5th Edition, Tata Mc. Graw – Hill Publishing Company Limited New Delhi, 2008

**References:**
R1: Jean Vidal, Thermodynamics Application in Chemical Engineering and the Petroleum Industry, Institute Francal Sbupetrole Publications, France.
R2: John J.Mcketta Jr., Advances in Petroleum Chemistry and Refining-volume 9, Inter Science Publications, New York.
R3: Danesh, A., 1998. PVT and phase behaviour of petroleum reservoir fluids. Elsevier.
R4: Ahmed, T., 2013. Equations of state and PVT analysis. Elsevier.

**e-resources**
1. Link for Knimbus remote login: https: / / presiuniv.knimbus.com
2. Pressure –Temperature Diagram of Reservoir Fluids:
https: / / petrowiki.spe.org / Phase_diagrams_for_reservoir_fluid_systems
3. Reservoir Types: https: / / www.informit.com / articles / article.aspx?p=2241145&seqNum=4
4. Oil and Gas Formation Volume Factor:
https: / / www.sciencedirect.com / topics / engineering / oil-formation-volume-factor
5. Laws of Thermodynamics: https: / / en.wikipedia.org / wiki / Laws_of_thermodynamics
6. NPTEL Videos: https: / / archive.nptel.ac.in / courses / 112 / 105 / 112105123 / .
7. Engineering Thermodynamics – A Graphical Approach: https: / / www.ohio.edu / mechanical / thermo /
8. Thermodynamics Notes (MIT OPENCOURSEWARE)
https: / / ocw.mit.edu / courses / 5-60-thermodynamics-kinetics-spring-2008 / pages / lecture-notes /

**Skill Sets:** Topics relevant to "**SKILL DEVELOPMENT**": As it is a laboratory-integrated course, all the experiments are designed for **Skill Development** through **Experiential Learning** techniques. The course attainment will be assessed through the assessment component(s) mentioned in the course plan.

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| **Catalogue prepared by:** | Dr. Suman Paul, Dr. Deepjyoti Mech, Mr. Bhairab Jyoti Gogoi, Mr. Gaurav Kundu |
| **Recommended by the Board of Studies on:** | 16th Meeting of the Board of Studies held on 8th July, 2023 |
| **Date of Approval by the Academic Council:** | 21st Meeting of the Academic Council held on 6th September, 2023 |

| Course Code: PET2010 | Course Title: Introduction to Oil and Gas Reservoir Simulation<br>Type of Course: 1] Program Core Course<br>2] Laboratory Integrated | L-T-P-C | 1 | 0 | 2 | 2 |
|---|---|---|---|---|---|---|
| Version No.: | 2.0 | | | | | |
| Course Pre-requisites: | NIL | | | | | |
| Anti-requisites: | NIL | | | | | |
| Course Description: | The main aim of this lab is to understand reservoir engineering simulation using software's. Solution of production and reservoir engineering problems using state-of-the-art commercial reservoir simulation software, using data commonly available in industry; emphasis on reservoir description, reservoir model design and calibration, production forecasting and optimization, economic analysis and decision making under uncertainty | | | | | |
| Course Objectives: | The objective of the course is to familiarize the learners with the concepts of Introduction to Oil and Gas Reservoir Simulation and attain **Skill Development** through Experiential **Learning** techniques. | | | | | |
| Course Outcomes: | On successful completion of the course, the student shall be able to:<br>CO1: explain reservoir simulation fundamentals- the underlying equations, the numerical techniques used to solve them and History matching,<br>CO2: design a reservoir simulation model, construct the data set, execute the simulator, and view simulation results visually using software,<br>CO3: predict and optimize future performance of petroleum reservoirs using reservoir simulation and economic models. | | | | | |
| Course Content | | | | | | |

| Module 1: | Introduction to Reservoir Modelling and Simulation | Quiz | Programme | 12 Periods |
|---|---|---|---|---|
| Introduction to reservoir simulation, Modelling Types and Applications, Description in Modelling-Reservoir geometry and Continuity, Uncertainty in reservoir model description; Numerical Discretization, Grids, Numerical Techniques and approaches, Equations of Multiphase Flow, History Matching, Implicit and Explicit Formulation, Comparative study of Black Oil and Compositional Model, Fundamentals - IMPES | | | | |
| **Module 2:** | Introduction to CMG | Case study | Model Simulation | 20 Sessions |
| Introduction, Simulators in CMG, Simulator Applications, Other Commercial Software<br>**Experiment 1:**<br>Level 1: CMG introduction: Basic understanding of available reservoir simulator<br>Level 2: Working Environment of simulator<br><br>**Experiment 2:**<br>To enable learners to learn the basic steps of building black oil simulation model using IMEX – CMG simulator.<br>Level 1: Geometric modelling: Input and modify model dimensions and geometry as per given conditions.<br>Level 2: Creating and importing grid and grid properties,<br><br>**Experiment 3:**<br>Level 1: Fluid properties modelling: Understand fluid properties that can be quantified in a given simulator.<br>Level 2: Fluid properties modelling: Apply fluid properties that can be quantified in a given simulator.<br><br>**Experiment 4**<br>Level 1: Fluid properties modelling: Add the fluids PVT data for simple model.<br>Level 2: Importing or creating fluid models, locating wells, importing well production data, rock fluid properties.<br><br>**Experiment 5:**<br>Phase Behavior Prediction of Reservoir Fluid using Winprop Simulator<br>Level 1: Introduction to Winprop Simulator<br>Level 2: Develop a compositional model with the given data.<br><br>**Experiment 6:**<br>Level 1: Calculate saturation pressure at temperatures above and below critical temperature.<br>Level 2: Generate phase envelope diagram and note down Cricondenbar, Cricondentherm, critical temperature and critical pressure. | | | | |

**Experiment 7:**
To enable students, learn the basic steps of building a Coalbed Methane Reservoir Model
Level 1: Introduction to CMG-GEM simulator
Level 2: Creating dual porosity reservoir model using cmg gem model.

**Experiment 8:**
Level 1: Using cmg gem to model cbm reservoir model
Level 2: Performance prediction of cbm reservoir using cmg gem model

**Experiment 9:**
To enable learners, understand basic concepts of Plus fraction splitting and Lumping matching experimental data by regression.
Level 1: To create a reservoir fluid model by Plus fraction splitting.
Level 2: Lumping matching experimental data by regression.

**Experiment 10:**
To enable learners to learn the basic steps of Compositional oil simulation model using CMG – GEM simulator.
Level 1: To create a fluid model using Winprop simulator.
Level 2: Performance prediction: Predict and compare reservoir performance by importing fluid model in CMG -GEM simulator

**Targeted Application and Tools that can be used:**
**Applications:** Production and design engineer
**Tools:** CMG, Eclipse

**Text Book:**
T1: Abou Kassem J.H. "Petroleum Reservoir Simulation", Elsevier; 1st Edition; 2013; Gulf Publishing
T2: Tarek Ahmed "Advanced Reservoir Engineering", Elsevier; 1st Edition; 2004; Gulf Publishing

**References:**
R1: John R. Fanchi "Principles of Applied Reservoir Simulation", Elsevier; 3rd Edition; 2005; Gulf Publishing
R2: Abdullah Alajmi "Handbook of Applied Petroleum Reservoir Simulation", 1st Edition; 2016; Auris
R3: CMG. 2022a. CMG GEM User's Guide. Calgary, Alberta, Canada: Computer Modelling Group Ltd.

**e-resources:**
1. Presidency University official ID: https: / / presiuniv.knimbus.com / user# / home
2. Youtube Videos Lecture Series- PGE 323M Reservoir Engineering III (Simulation):
https: / / www.youtube.com / channel / UCkCwNnLZnRoaHYFyKTdySDw
3. Case Study- A collection of Case Studies for verification of Reservoir Simulators:
https: / / repositories.lib.utexas.edu / handle / 2152 / 23014

**Skill Sets:** Topics relevant to "**SKILL DEVELOPMENT**": As it is a laboratory-integrated course, all the experiments are designed for **Skill Development** through **Experiential Learning** techniques. The course attainment will be assessed through the assessment component(s) mentioned in the course plan.

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|---|---|
| **Catalogue prepared by:** | Dr. Deepjyoti Mech, Mr. Bhairab Jyoti Gogoi, Mr. Sugat Srivastava, Mr. Gaurav Kundu |
| **Recommended by the Board of Studies on:** | 16th Meeting of the Board of Studies held on 8th July, 2023 |
| **Date of Approval by the Academic Council:** | 21st Meeting of the Academic Council held on 6th September, 2023 |

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|---|---|---|---|---|---|---|---|
| **Course Code:** PET2012 | **Course Title:** Reservoir Fluid Mechanics<br>**Type of Course:** 1] Program Core Course<br>2] Laboratory Integrated | | **L-T-P-C** | 2 | 0 | 2 | 3 |
| **Version No.** | 1.0 | | | | | | |
| **Course Pre-requisites** | NIL | | | | | | |
| **Anti-requisites** | NIL | | | | | | |
| **Course Description** | The course is designed to discuss the fundamental laws relating to the static and dynamic behavior of fluids. It enables the need for analyze the fluid flow behavior and its applications in porous media. The course is both conceptual and analytical in nature. It needs fair knowledge of Physics and Mathematics. The course develops the critical thinking and analytical skills. The associated laboratory experiments provide an opportunity to validate the concepts taught and enhances the ability to visualize the real system performance. Knowledge gained from this course can be applied for analyzing fluid flow through hydrocarbon reservoir. | | | | | | |
| **Course objective** | The objective of the course is to familiarize the learners with the concepts of Reservoir Fluid Mechanics and attain **Skill Development** through **Experiential Learning** techniques. | | | | | | |
| **Course Outcomes** | On successful completion of this course the students shall be able to:<br>CO1: Summarize the basic properties of fluids,<br>CO2: Employ the concept of hydrostatics to pressure measuring devices,<br>CO3: Apply the principle of energy conservation to flow measuring devices,<br>CO4: Calculate different parameters for compressible fluid flow,<br>CO5: Interpret the fluid dynamics theoretical knowledge with lab experiments. | | | | | | |
| **Course Content:** | | | | | | | |
| **Module 1** | Fluid Statics | Assignment | Data Collection | 05 Periods | | | |
| **Topics:**<br>Fluid pressure at a point, Pascal's law, pressure variation in a static fluid, absolute, gauge, atmosphere and vacuum pressure. Manometers, simple and differential manometers, total pressure and location of center of pressure on horizontal / vertical / inclined plane surfaces and curved surfaces submerged in a liquid.<br>**Related Experiment No:** 1 | | | | | | | |
| **Module 2** | Fluid Kinematics | Assignment | Data Collection | 05 Periods | | | |
| **Topics:**<br>Types of fluid flow-introduction, continuity equation in three dimensions (Cartesian co-ordinate system only), velocity and acceleration, velocity potential function and stream function and flow nets. | | | | | | | |
| **Module 3** | Fluid Dynamics | Assignment | Literature Survey and Presentation | 08 Periods | | | |
| **Topics:**<br>Fluid Dynamics: Introduction, equations of motion, Euler's equation of motion, Bernoulli's equation from Euler's equation, limitation of Bernoulli's equation, fluid flow measurements: Venturimeter, vertical orifice & orifice meter, Pitot tube, v-notch and rectangular notch, rotameter. Laminar flow and viscous effects: Reynolds number, laminar and turbulent flows, critical Reynolds number, laminar flow between parallel plates, steady state flow, unsteady state flow.<br>**Related Experiment No:** 2, 3, 4, 5, and 8 | | | | | | | |
| **Module 4** | Compressible Flow | Assignment | Coding | 07 Periods | | | |
| **Topics:**<br>Compressible Flow- Introduction: Review of Thermodynamics, The Speed of Sound, Adiabatic and Isentropic Steady Flow, Isentropic Flow with Area Changes, The Normal Shock Wave, Operation of Converging and Diverging Nozzles, Compressible Duct Flow with Friction.<br>Flow through pipes: Frictional loss in pipe flow, Darcy's-equation and Chezy's equation for loss of head due to friction in pipes, hydraulic gradient line and total energy line, hydrate formation pipeline, Darcy's equation of fluid flow through porous media.<br>**Related Experiment No:** 6, and 7 | | | | | | | |
| **List of Laboratory Tasks:**<br>**Experiment No. 1:** To measure the viscosity of fluids<br>Level 1: To determine the viscosity at room temperature | | | | | | | |

Level 2: To find the viscosity variation with respect to temperature (Students will learn to plot the graphs on normal graph paper manually and also using free available software / tool)

**Experiment No. 2:** Verification of Bernoulli's Theorem
Level 1: To calculate the total energy at different cross section of pipe
Level 2: To plot the graph between total energy versus distance and prove the Theorem (Students will learn to plot the graphs on normal graph paper manually and also using free available software / tool)

**Experiment No. 3:** To determine flow regime from Reynolds number
Level 1: To determine the type of flow
Level 2: To study transition zone

**Experiment No. 4:** To study the variation of coefficient of discharge
Level 1: To demonstrate the use of Venturimeter for fluid flow measurement
Level 1: To demonstrate the use of Orifice for fluid flow measurement
Level 2: To determine the coefficient of discharge for a given input

**Experiment No. 5:** To calculate the rate of flow
Level 1: To calculate the rate of flow using Rotameter
Level 2: To calibrate the rotameter

**Experiment No. 6:** To determine loss of head due to bend, enlargement and contraction in pipes
Level 1: To determine loss of head due to bend, enlargement and contraction in pipes using minor loss
Level 2: To compare the head losses in the presence of different sections of pipes

**Experiment No. 7:** To evaluate the friction losses in pipes
Level 1: To determine the friction factor for Darcy - Weisbach equation using major loss
Level 2: To determine the reason for friction loss

**Experiment No. 8:** To measure the force developed by impact of jet of water on plates of different configurations and compare with the theoretical value
Level 1: To determine the impact forces of jet on flat vane
Level 2: To plot the performance characteristics
Level 2: To compare the force exerted on different plates (Students will learn to plot the graphs on normal graph paper manually and also using free available software / tool)

**Targeted Application & Tools that can be used:**
**Applications:** Process Engineer, Pipeline Engineer, Reservoir Engineer in Oil and Gas Industry
**Tools:** MS Excel, Grapher

**Text Book:**
T1: White, Frank M., "Fluid Mechanics," 7th Edition, 2011, McGraw Hill Education (India)
T2: Modi P.N., Seth S.M., Hydraulics and Fluid Mechanics Including Hydraulics Machines, 21st Edition, 2017, Raispns Publications Pvt. Ltd.

**References:**
R1: Çengel, Yunus A., and John M. Cimbala. Fluid mechanics: Fundamentals and applications, 15th Edition. 2006, Boston: McGraw-HillHigher Education
R2: Robert W. Fox, Alan T. McDonald, Philip J. Pritchard, John W. Mitchell, "Fluid Mechanics: SI Version," Wiley India.
R3: Tarek Ahmed, Elsevier, "Reservoir Engineering Handbook".

**e- References:**
1. Link for Knimbus remote login: https: / / presiuniv.knimbus.com
2. https: / / byjus.com / physics / fluid-dynamics /
3. https: / / www.youtube.com / watch?v=djx9jlkYAt4
4. https: / / www.youtube.com / watch?v=Cdpoo2XM6Hg

**Skill Sets:** Topics relevant to "**SKILL DEVELOPMENT**": As it is a laboratory-integrated course, all the experiments are designed for **Skill Development** through **Experiential Learning techniques**. The course attainment will be assessed through assessment component mentioned in course plan.

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| **Catalogue prepared by:** | Dr. Suman Paul, Dr. Deepjyoti Mech, Dr. Kalpajit Hazarika, Mr. Indraneel Agasty, Mr. Anmol Bhargava, Mr. Sugat Srivastava |
| **Recommended by the Board of Studies on:** | 11th Meeting of the Board of Studies held on 5th Sept, 2020 |
| **Date of Approval by the Academic Council:** | 13th Meeting of the Academic Council held on 6th Nov 2020 |

<table>
<tr><td>Course Code:<br>PET2107</td><td colspan="3">Course Title: Fundamentals of Instrumentation and Control Engineering<br>Type of Course: 1] Program Core Course<br>2] Theory Only</td><td>L-T-P-C</td><td>2</td><td>0</td><td>0</td><td>2</td></tr>
<tr><td>Version No.:</td><td colspan="8">1.0</td></tr>
<tr><td>Course Pre-requisites:</td><td colspan="8">NIL</td></tr>
<tr><td>Anti-requisites:</td><td colspan="8">NIL</td></tr>
<tr><td>Course Description:</td><td colspan="8">This course introduces the principles and applications of process control in engineering systems. Students learn fundamental concepts of feedback control, open and closed-loop systems, and control strategies. It covers the dynamic behavior of first and second-order systems, transportation lag, and the design and analysis of linear control systems. Emphasis is placed on understanding control elements, block diagrams, and transient response, preparing students for real-world control system implementation.</td></tr>
<tr><td>Course Objective:</td><td colspan="8">The objective of the course is to familiarize the learners with the concepts of Fundamentals of Instrumentation and Control Engineering and attain Skill Development through Participative Learning techniques.</td></tr>
<tr><td>Course Outcomes:</td><td colspan="8">On successful completion of the course the students shall be able to:<br>CO1: Illustrate the dynamic behavior and feedback loops for linear systems,<br>CO2: Apply the concept of various response of first and second order systems,<br>CO3: Identify the open and closed loop stability and performance of simple processes.</td></tr>
<tr><td>Course Content:</td><td colspan="8"></td></tr>
<tr><td>Module 1:</td><td colspan="2">Introduction to Process Control</td><td colspan="2">Team Exercise</td><td colspan="2">Presentation</td><td>07 Periods</td></tr>
<tr><td colspan="9">Topics:<br>Introductory Concepts: Introduction, Technique of control, Feedback control system-Advantage and disadvantage, Block diagram, Open and Closed loop system, Ideal control actions, Control Strategies.</td></tr>
<tr><td>Module 2:</td><td colspan="2">Linear Open-Loop System</td><td colspan="2">Quiz</td><td colspan="2">Online Quiz</td><td>09 Periods</td></tr>
<tr><td colspan="9">Topics:<br>Response of first order systems- Physical examples of First-Order systems- Response of first order systems in series- Higher Order systems: Second-Order and transportation lag.</td></tr>
<tr><td>Module 3:</td><td colspan="2">Linear Closed-Loop System</td><td colspan="2">Team Activity</td><td colspan="2">Poster Presentation</td><td>09 Periods</td></tr>
<tr><td colspan="9">Topics:<br>Control System- Controllers and Final Control Elements- Block Diagram of a Chemical-Reactor Control System- Closed-Loop Transfer Functions- Transient response of Simple Control Systems.</td></tr>
<tr><td colspan="9">Targeted Application and Tools that can be used:<br>Applications: Process Engineer in various Chemical and Petrochemical Industry.<br>Tools: Grapher</td></tr>
<tr><td colspan="9">Text Book:<br>T1.”Process systems analysis and control”, Donald R. Coughanowr, Steven E. LeBlanc. 3rd Edition, 2009, Mcgraw-Hill Chemical Engineering Series.<br>T2. Process Control And Instrumentation, R. P. Vyas,7th Edition,2015, Denett & Co</td></tr>
<tr><td colspan="9">References:<br>R1. “Process Dynamics and Control”, Sudheer S.Bhagade, First Edition, 2011, PHI Learning.<br>R2. “Instrumentation and Process Control”, M.N.Jayaswal, First Edition, 2009 IK International House Pvt. Ltd.<br><br>e- References:<br>1. https://puniversity.informaticsglobal.com/login<br>2. https://nptel.ac.in/courses/103/103/103103037<br>3. https://ch503ns.wordpress.com/a-to-z/lecture-notes/</td></tr>
<tr><td colspan="9">Skill Sets: Topics relevant to “SKILL DEVELOPMENT”: Open and Closed loop system, Ideal control actions, Control Strategies, Response of first order systems in series- Higher Order systems: Second-Order and transportation lag, and Control System- Controllers and Final Control Elements are designed for Skill Development through Participative Learning techniques. The course attainment will be assessed through assessment component mentioned in course handout.</td></tr>
</table>

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| **Catalogue prepared by:** | Dr. Suman Paul, Dr. Deepjyoti Mech, Dr. Rohit Kumar Saw, Dr. Niladri Shekhar Samanta |
| **Recommended by the Board of Studies on:** | 18th Meeting of the Board of Studies held on 4th July, 2024 |
| **Date of Approval by the Academic Council:** | 24th Meeting of the Academic Council held on 3rd August, 2024 |

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|---|---|---|---|---|---|---|
| **Course Code:** PET2108 | **Course Title: Fundamentals of Instrumentation and Control Engineering Lab**<br>**Type of Course: 1] Program Core Course**<br>**2] Laboratory Only** | **L-T-P-C** | 0 | 0 | 2 | 1 |
| **Version No.:** | 1.0 | | | | | |
| **Course Pre-requisites:** | NIL | | | | | |
| **Anti-requisites:** | NIL | | | | | |
| **Course Description:** | This course provides foundational knowledge in process control systems, focusing on both theoretical concepts and practical applications. Topics include first and second-order system responses, transportation lag, control system components, and transient analysis. Through hands-on laboratory experiments with single and multi-tank systems, mercury manometers, thermocouples, and control valves, students gain experience in analyzing dynamic behaviors, determining system constants, and calibrating instruments, bridging the gap between control theory and real-world industrial processes. | | | | | |
| **Course Objective:** | The objective of the course is to familiarize the learners with the concepts of Fundamentals of Instrumentation and Control Engineering and attain **Skill Development** through **Experiential Learning** techniques. | | | | | |
| **Course Outcomes:** | On successful completion of the course the students shall be able to:<br>CO1: Apply the principles governing the dynamic behavior of first and second-order systems in process control,<br>CO2: Analyse the stability and performance characteristics of open-loop and closed-loop control systems for basic industrial processes. | | | | | |
| **Course Content:** | | | | | | |
| **Module 1:** | Introduction to Process Control and Open & Closed Lop Systems | Conduction of Experiment | Presentation | 15 Sessions | | |

**Topics:**
Introduction to Process Control, Response of first order systems- Physical examples of First-Order systems- Response of first order systems in series- Higher Order systems: Second-Order and transportation lag. Control System- Controllers and Final Control Elements- Block Diagram of a Chemical-Reactor Control System- Closed-Loop Transfer Functions- Transient response of Simple Control Systems.

**List of Laboratory Tasks:**

**Experiment No. 1:** To study the Dynamics and Compare Theoretical Response with Actual Response in a single tank system for step input.
**Level 1**: To find the time constant of single tank system for single step input,
**Level 2:** To plot the response graph for single tank.

**Experiment No. 2:** To study the dynamics and compare theoretical response with actual response in a Two Tank Interacting System for step input.
**Level 1:** To find the time constant of Two Tank Interacting System for single step input,
**Level 2:** To plot the response graph of Two Tank Interacting.

**Experiment No. 3**: To study the dynamics and compare theoretical response with actual response in a Two Tank Non Interacting System for step input.
**Level 1:** To find the time constant of Two Tank Non Interacting System for single step input,
**Level 2:** To plot the response graph of Two Tank Non Interacting System.

**Experiment No. 4:** To study the dynamics and compare theoretical response with actual response in a Two Tank Interacting System for multi-step input.
**Level 1**: To find the time constant of Two Tank Interacting System for multi-step input,
**Level 2:** To plot the response graph of Two Tank Interacting.

**Experiment No. 5**: To study the dynamics and compare theoretical response with actual response in a Two Tank Non Interacting System for multi-step input.
**Level 1**: To find the time constant of Two Tank Non Interacting System for multi-step input,
**Level 2:** To plot the response graph of Two Tank Non Interacting System.

**Experiment No. 6:** To determine the time constant of a second order system (Mercury manometer).
**Level 1:** To find the time constant of Mercury manometer,

**Level 2**: To plot the response graph Mercury manometer.

**Experiment No. 7:** To calibrate the given thermocouple using resistance temperature detector.
**Level 1:** To find out the error and error% of the thermocouple,
**Level 2:** Plot the graph for error and error %.

**Experiment No. 8:** To study of Characteristics of Diaphragm actuated pneumatic Linear control valve and Equal percentage valve.
**Level 1:** To find the flow rate for the valve Characteristics,
**Level 2:** To plot the valve trip characteristics graph.

**Targeted Application and Tools that can be used:**
**Applications:** Process Engineer in various Chemical and Petrochemical Industry.
**Tools:** Grapher

**Text Book:**

T1."Process systems analysis and control", Donald R. Coughanowr, Steven E. LeBlanc. 3rd Edition, 2009, Mcgraw-Hill Chemical Engineering Series.
T2. Process Control And Instrumentation, R. P. Vyas,7th Edition,2015, Denett & Co

**References:**

R1. Process Control Lab Manual, Presidency University, Bengaluru.
R2. "Process Dynamics and Control", Sudheer S.Bhagade, First Edition, 2011, PHI Learning.
R3. "Instrumentation and Process Control", M.N.Jayaswal, First Edition, 2009 IK International House Pvt. Ltd.

**e- References:**

1. https://puniversity.informaticsglobal.com/login
2. https://nptel.ac.in/courses/103/103/103103037
3. https://ch503ns.wordpress.com/a-to-z/lecture-notes/

**Skill Sets:** Topics relevant to "**SKILL DEVELOPMENT**": All the experiments are designed for **Skill Development** through **Experiential Learning** techniques. The course attainment will be assessed through assessment component mentioned in course handout.

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|---|---|
| **Catalogue prepared by:** | Dr. Suman Paul, Dr. Deepjyoti Mech, Dr. Rohit Kumar Saw, Dr. Niladri Shekhar Samanta |
| **Recommended by the Board of Studies on:** | 18th Meeting of the Board of Studies held on 4th July, 2024 |
| **Date of Approval by the Academic Council:** | 24th Meeting of the Academic Council held on 3rd August, 2024 |

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|---|---|---|---|---|---|---|---|
| **Course Code:** PET2109 | **Course Title:** Oil and Gas Surface Facility Design<br>**Type of Course:** 1] Program Core Course<br>2] Theory Only | | | **L-T-P-C** | 2 | 0 | 0 | 2 |
| **Version No.:** | 1.0 | | | | | | |
| **Course Pre-requisites:** | NIL | | | | | | |
| **Anti-requisites:** | NIL | | | | | | |
| **Course Description:** | This course offers a comprehensive understanding of surface production operations in the oil and gas industry. Students learn about subsurface equipment, reservoir fluid behavior, and the design of surface facilities. Key topics include two- and three-phase separation, crude oil treatment techniques, and produced water handling. Emphasis is placed on the function, design, and operation of separators, treaters, and heaters, with practical assessments in simulation, data analysis, and case-based learning. | | | | | | |
| **Course Objectives:** | The objective of the course is to familiarize the learners with the concepts of Oil and Gas Surface Facility Design and attain **Skill Development** through **Participative learning** techniques. | | | | | | |
| **Course Outcomes:** | On successful completion of the course the students shall be able to:<br>CO1: Explain the surface production facilities and importance of separations,<br>CO2: Compare the different types of phase separator for handling different fluids and environment,<br>CO3: Identify different treating equipment, emulsion treatment and desalting systems,<br>CO4: Select produced water treatment systems for hydrocarbon extraction and water purification | | | | | | |
| **Course Content:** | | | | | | | |
| **Module 1:** | Basic Facilities of Surface Production | Assessment 1: Assignment | Quiz | 06 Periods | | | |
| **Topics:**<br>Subsurface Process and Equipment, Properties of Reservoir fluids and Phase behavior studies Surface Production facilities: Various types of facilities - Basic system configuration design & selection of facilities: Wellhead and manifold – Separation - Initial separation pressure - Stage Separation, Selection of Stages. | | | | | | | |
| **Module 2:** | Phase Separation | Assessment 2: Assignment / Quiz | Simulation | 06 Periods | | | |
| **Topics:**<br>Two phase liquid and gas separation: Functional sections of a gas-liquid separator – Sizing of two phase separators- Equipment description of different separators.<br>Three phase oil, gas and water separation: Equipment description - Horizontal separators - Derivation of equation - Free-water knockout - Flow splitter - Horizontal three-phase separator with a liquid “Boot” - Vertical separator. | | | | | | | |
| **Module 3:** | Crude Oil Treatment | Assessment 3: Assignment / Quiz | Data Collection and Analysis | 07 Periods | | | |
| **Topics:**<br>Equipment description of various treaters and heaters - Indirect & Direct fired heaters - Vertical heater-treaters - Horizontal heater treaters - Electrostatic heater-treaters - Emulsion treating theory – Agitation - Field optimization - Emulsion treating methods - Bottle test considerations. | | | | | | | |
| **Module 4:** | Produced Water Treatment | Assessment 4: Case Study | Poster Presentation | 06 Periods | | | |
| **Topics:**<br>Oil desalting systems - Produced water treating systems: Characteristics of produced water - Sand and other suspended solids - Dissolved gases - Oil in water emulsions - Dissolved oil concentrations - Dispersed oil - Gravity separation – Coalescence – Dispersion – Miscellaneous Equipments. | | | | | | | |
| **Targeted Application and Tools that can be used:**<br>**Applications:** Process Engineer, Surface facilities engineer, Plant Design.<br>**Professional Software:** UNISIM Design, ASPEN HYSYS | | | | | | | |
| **Text Book:**<br>T1: Ken Arnold and Maurice Stewart, “Surface Production Operations”, Vol. 1, 2nd Edition, Gulf Professional Publishing, 1999.<br>T2: W.L. Mc Cab and J.C. Smith and Peter Harriott, Unit operations in Chemical Engineering, 5th Edition, Mc Graw Hill, 1993. | | | | | | | |

**References:**

R1: Petroleum and Gas Field Processing, H.K.Abdel-Aal and Mohamed Aggour and M.A. Fahim, 1st Edition, Marcel Dekkar Inc., 2003.

**e-resources:**

1. https://cheguide.com/flash_raoult.html
2. https://ifsolutions.com/two-phase-separator-vs-three-phase-separator-differences/
3. https://www.youtube.com/watch?v=J_9b69F-Seg
4. https://www.netsolwater.com/what-is-effluent-treatment-plant-and-etp-working-process.php?blog=107

**Skill Sets:** Topics relevant to "**SKILL DEVELOPMENT**": Phase Separation, Crude Oil Treatment, and Produced Water Treatment are designed for **Skill Development** through **Participative Learning** techniques. The course attainment will be assessed through assessment component mentioned in course handout.

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|---|---|
| **Catalogue prepared by:** | Dr. Deepjyoti Mech, Dr. Rohit Kumar Saw, Dr. Amolina Doley, Dr. Niladri Shekhar Samanta |
| **Recommended by the Board of Studies on:** | 18th Meeting of the Board of Studies held on 4th July, 2024 |
| **Date of Approval by the Academic Council:** | 24th Meeting of the Academic Council held on 3rd August, 2024 |

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|---|---|---|---|---|---|---|
| **Course Code:** PET2110 | **Course Title:** Oil and Gas Surface Facility Design Lab<br>**Type of Course:** 1] Program Core Course<br>2] Laboratory Only | | **L-T-P-C** | 0 | 0 | 2 | 1 |
| **Version No.:** | 1.0 | | | | | | |
| **Course Pre-requisites:** | NIL | | | | | | |
| **Anti-requisites:** | NIL | | | | | | |
| **Course Description:** | The purpose of this course is to enable the students to appreciate the need for surface production facilities. The course is both conceptual and analytical in nature and needs fair knowledge of Mathematical and computing. The course develops the critical thinking and analytical skills. The course also enhances the programming abilities through assignments.<br>The associated laboratory provides an opportunity to validate the concepts taught and enhances the ability to visualize the real system performance. | | | | | | |
| **Course Objectives:** | The objective of the course is to familiarize the learners with the concepts of Oil and Gas Surface Facility Design and attain **Skill Development** through **Experiential Learning** techniques. | | | | | | |
| **Course Outcomes:** | On successful completion of the course the students shall be able to:<br>CO1: Identify various types of phase separators suitable for managing different fluid compositions and operating environments,<br>CO2: Explain the working principles of produced water treatment systems used in hydrocarbon processing and water purification. | | | | | | |
| **Course Content:** | | | | | | | |
| **Module 1:** | Introduction to Surface Facility and Phase Separation | Conduction of Experiment | Presentation | 15 Sessions | | | |

**Topics:**
Various Types of Surface Facility, Basic system configuration design and selection of facilities, Three phase oil, gas and water separation, Functional sections of a gas-liquid separator – Sizing of two phase separators- Equipment description of different separators, Vertical heater-treaters - Horizontal heater treaters - Electrostatic heater-treaters Sand and other suspended solids - Dissolved gases - Oil in water emulsions - Dissolved oil concentrations - Dispersed oil - Gravity separation – Coalescence – Dispersion,

**List of Laboratory Tasks:**

**Experiment No. 1:** Introduction to HONEYWELL – UNISIM Design

**Experiment No. 2:** Flash calculation and phase envelope
Level 1: Perform Flash calculation for a crude oil using Peng Robinson Equation of state.
Level 2: Perform Flash calculation for a crude oil and draw the phase envelope using Peng Robinson Equation of state.

**Experiment No. 3:** Simulation of separation process
Level 1: Find the concentration of components of crude oil leaving a separator at a given Temperature and Pressure Condition.
Level 2: Find the concentration of components of crude oil leaving a stage separator at a given Temperature and Pressure condition.

**Experiment No. 4:** Simulate a desalter using the P&ID given in the text.

**Targeted Application and Tools that can be used:**
**Applications:** Process Engineer, Surface facilities engineer, Plant Design.
**Professional Software:** UNISIM Design, ASPEN HYSYS

**Text Book:**
T1: Ken Arnold and Maurice Stewart, "Surface Production Operations", Vol. 1, 2nd Edition, Gulf Professional Publishing, 1999.
T2: W.L. Mc Cab and J.C. Smith and Peter Harriott, Unit operations in Chemical Engineering, 5th Edition, Mc Graw Hill, 1993.

**References:**
R1: Oil and Gas Surface Facility Design Lab Manual, Presidency University, Bengaluru.
R2: Petroleum and Gas Field Processing, H.K.Abdel-Aal and Mohamed Aggour and M.A. Fahim, 1st Edition, Marcel Dekkar Inc., 2003.

**e-resources:**

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|---|---|
| 1. https://cheguide.com/flash_raoult.html<br>2. https://ifsolutions.com/two-phase-separator-vs-three-phase-separator-differences/<br>3. https://www.youtube.com/watch?v=J_9b69F-Seg<br>4. https://www.netsolwater.com/what-is-effluent-treatment-plant-and-etp-working-process.php?blog=107 | |
| **Skill Sets:** Topics relevant to "**SKILL DEVELOPMENT**": All the experiments are designed for **Skill Development** through **Experiential Learning** techniques. The course attainment will be assessed through assessment component mentioned in course handout. | |
| **Catalogue prepared by:** | Dr. Deepjyoti Mech, Dr. Rohit Kumar Saw, Dr. Amolina Doley, Dr. Niladri Shekhar Samanta |
| **Recommended by the Board of Studies on:** | 18th Meeting of the Board of Studies held on 4th July, 2024 |
| **Date of Approval by the Academic Council:** | 24th Meeting of the Academic Council held on 3rd August, 2024 |

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|---|---|---|---|---|---|---|
| **Course Code:** PET2115 | **Course Title:** Oil and Gas Downstream Operations<br>**Type of Course:** 1] Program Core Course<br>2] Theory Only | | **L-T- P- C** | 3 | 0 | 0 | 3 |
| **Version No.:** | 1.0 | | | | | |
| **Course Pre-requisites:** | NIL | | | | | |
| **Anti-requisites:** | NIL | | | | | |
| **Course Description:** | This course offers an in-depth understanding of refinery operations and the Indian petrochemical industry. It covers crude oil classification, petroleum product specifications, and their industrial applications. Students explore key processes like distillation, catalytic reforming, cracking, and hydro processing. Emphasis is placed on feedstocks, process variables, and product yields, along with the production of fuels, petrochemicals, and polymers, providing a comprehensive insight into modern refining and downstream operations. | | | | | |
| **Course Objectives:** | The objective of the course is to familiarize the learners with the concepts of Oil and Gas Downstream Operations and attain **Skill Development** through **Participative Learning** techniques. | | | | | |
| **Course Outcomes:** | On successful completion of the course the students shall be able to:<br>CO1: Compare the different product specification in downstream,<br>CO2: Illustrate the different gas properties,<br>CO3: Apply the knowledge of various crude distillation and catalytic reforming processes,<br>CO4: Solve the thermal and catalytic cracking related numerical problems. | | | | | |
| **Course Content:** | | | | | | |
| **Module 1:** | Overall Refinery Operations and Indian Scenario | Assignment | Data Collection | 10 Periods | | |
| **Topics:**<br>Overall refinery operations. Refinery feed stocks: Crude oil Classification-Composition and Properties-Composition of petroleum crude suitable for asphalt/coke manufacture – Evaluation of crude oils. Indian Petrochemical Industry- Feed stocks – Process description and Process variables-Naphtha cracking-Gas cracking and Gas reforming. | | | | | | |
| **Module 2:** | Petroleum Products and their Specifications | Assignment | Data Collection | 10 Periods | | |
| **Topics:**<br>LPG- Gasoline- Diesel fuels- Jet and turbine fuels –Lube oils-Heating oils – Residual fuel oils - Wax and Asphalt-Petroleum coke- All Product specifications-Product blending. Chemicals from gas reforming: Methanol- Acetic acid-Ammonia and urea. Chemicals from ethylene: Ethylene oxide-Monoethylene glycol-Ethyl benzene-Styrene. Polymers: LDPE, HDPE & LLDPE and Polypropylene – PVC - Polystyrene. | | | | | | |
| **Module 3:** | Crude Distillation | Poster Presentation | Programming | 10 Periods | | |
| **Topics:**<br>Atmospheric and Vacuum distillation units, Auxiliary equipment such as desalters, pipe-still heaters and heat exchanger trains etc. Catalytic reforming processes for petroleum and petrochemical feed stocks, Isomerization Processes -Feed stocks-Feed preparation – Yields | | | | | | |
| **Module 4:** | Thermal and Catalytic Cracking Processes | Assignment | Data Collection | 10 Periods | | |
| **Topics:**<br>Visbreaking- Delayed Coking, Fluid Catalytic cracking and Hydrocracking, Feed stocks Catalysts - Process variables, Product Recoveries Yield estimation, Naphtha, Kerosene, Diesel, VGO &Resid, Hydrotreating / Hydroprocessing – Feed stocks – Process description and Process variables. | | | | | | |
| **Targeted Application and Tools that can be used:**<br>**Applications:** Process Engineering Industries in operation such as Distillation column, Solvent Adsorption and extraction and fuel testing services.<br>**Tools:** Petroleum Testing Lab equipment and related software | | | | | | |
| **Text Books:**<br>T1: Roychoudhury, U, "Fundamental of Petrochemical Engineering", PHI Learning<br>T2: Robert A. Meyers, "Handbook of Petroleum Refining Processes", McGraw-Hill Education, 2003. | | | | | | |
| **Reference Books:**<br>R1: Margo Andy, "Petroleum and Petrochemical Industry", Willey. | | | | | | |

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| R2: James G. Speight, "Refinery Feedstocks, CRC Press, 2020. | |
| **Skill Sets:** Topics relevant to "**SKILL DEVELOPMENT**": Refinery Operations and Indian Scenario, Petroleum Products and their Specifications, Crude Distillation, and Thermal and Catalytic Cracking Processes are designed for **Skill Development** through **Participative Learning** techniques. The course attainment will be assessed through assessment component mentioned in course handout. | |
| **Catalogue prepared by:** | Dr. Deepjyoti Mech, Dr. Rohit Kumar Saw, Dr. Niladri Shekhar Samanta |
| **Recommended by the Board of Studies on:** | 18$^{th}$ Meeting of the Board of Studies held on 4$^{th}$ July, 2024 |
| **Date of Approval by the Academic Council:** | 24$^{th}$ Meeting of the Academic Council held on 3$^{rd}$ August, 2024 |

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|---|---|---|---|---|---|---|
| **Course Code:** PET2116 | **Course Title:** Oil and Gas Downstream Operations Lab<br>**Type of Course:** 1] Program Core Course<br>2] Laboratory Only | **L-T- P- C** | 0 | 0 | 2 | 1 |
| **Version No.:** | 1.0 | | | | | |
| **Course Pre-requisites:** | NIL | | | | | |
| **Anti-requisites:** | NIL | | | | | |
| **Course Description:** | This course provides practical insights into petroleum product properties and refining processes. Topics include crude oil classification, distillation, catalytic reforming, cracking, hydroprocessing, and fuel specifications. Laboratory experiments focus on fuel characterization, calorific value, viscosity, and distillation techniques. Students gain hands-on experience with industry-relevant tools and equipment, enhancing their understanding of petroleum refining operations and product testing used in modern process engineering industries. | | | | | |
| **Course Objectives:** | The objective of the course is to familiarize the learners with the concepts of Oil and Gas Downstream Operations and attain **Skill Development** through **Experiential Learning** techniques. | | | | | |
| **Course Outcomes:** | On successful completion of the course the students shall be able to:<br>CO1: Apply fundamental knowledge of petroleum product specifications, crude oil classification, and refining processes to analyze and interpret the operational principles of distillation, catalytic cracking, and hydroprocessing units in refining and petrochemical industries,<br>CO2: Choose standard laboratory experiments and evaluate key fuel properties—such as viscosity, calorific value, flash point, and refractive index—using appropriate testing equipment, and interpret data for product quality assessment and process optimization in petroleum refining. | | | | | |
| **Course Content:** | | | | | | |
| **Module 1:** | Petroleum Products, Crude Distillation and Cracking Process | Conduction of Experiment | Presentation | 15 Sessions | | |

**Topics:**

Crude oil Classification-Composition and Properties-Composition of petroleum crude suitable for asphalt/coke manufacture – Evaluation of crude oils. Feed stocks – Process description and Process variables-Naphtha cracking-Gas cracking and Gas reforming. LPG- Gasoline- Diesel fuels- Jet and turbine fuels –Lube oils-Heating oils – Residual fuel oils - Wax and Asphalt- Petroleum coke- All Product specifications-Product blending. Atmospheric and Vacuum distillation units, Catalytic reforming processes for petroleum and petrochemical feed stocks ,Isomerization Processes. Fluid Catalytic cracking and Hydrocracking, Feed stocks Catalysts - Process variables, Product Recoveries Yield estimation, Naphtha, Kerosene, Diesel, VGO &Resid, Hydrotreating / Hydroprocessing.

**List of Laboratory Tasks:**

**Experiment No. 1:** Determine the refractive index of different petroleum product
**Level 1**: Determine the refractive index of petrol diesel at different temperature,
**Level 2:** Determine the refractive index of blended petrol diesel at different temperature.

**Experiment No. 2:** Determine the flash and fire point of bio-fuel
**Level 1:** Determine the flash and fire point of bio-fuel by Pensky Martin,
**Level 2:** Determine flash and fire point of blended biofuel.

**Experiment No. 3**: Extraction of different product from crude oil using distillation column
**Level 1:** Extraction of different product from crude oil using distillation column
**Level 2:** Determination of class of crude, characterization index and correlation factor using distillation colomn.

**Experiment No. 4:** Measurement of strength consistency using penetrometer
**Level 1**: Determine strength consistency of different grades of bitumen,
**Level 2:** Determine strength consistency of different grades of bitumen at different temperature.

**Experiment No. 5**: Determine the calorific value of given fuel
**Level 1**: Determine the calorific value of given fuel
**Level 2:** Determine the calorific value of blended fuel

**Experiment No. 6:** Determine the viscosity of high density products using redwood II viscometer

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| **Level 1:** Determine the viscosity of grease naptha by redwood II at different temperature,<br>**Level 2**: Compare the viscosity of these products at different temperaure.<br><br>**Experiment No. 7:** To study of Characteristics of Diaphragm actuated pneumatic Linear control valve and Equal percentage valve<br>**Level 1:** To find the flow rate for the valve Characteristics,<br>**Level 2:** To plot the valve trip characteristics graph. | |
| **Targeted Application and Tools that can be used:**<br>**Applications:** Process Engineering Industries in operation such as Distillation column, Solvent Adsorption and extraction and fuel testing services.<br>**Tools:** Petroleum Testing Lab equipment and related software | |
| **Text Books:**<br>T1: Roychoudhury, U, "Fundamental of Petrochemical Engineering", PHI Learning<br>T2: Robert A. Meyers, "Handbook of Petroleum Refining Processes", McGraw-Hill Education, 2003. | |
| **Reference Books:**<br>R1: Petroleum Testing Lab Manual, Presidency University, Bengaluru.<br>R2: Margo Andy, "Petroleum and Petrochemical Industry", Willey.<br>R3: James G. Speight, "Refinery Feedstocks, CRC Press, 2020. | |
| **Skill Sets:** Topics relevant to "**SKILL DEVELOPMENT**": All the experiments are designed for **Skill Development** through **Experiential Learning** techniques. The course attainment will be assessed through assessment component mentioned in course handout. | |
| **Catalogue prepared by:** | Dr. Deepjyoti Mech, Dr. Rohit Kumar Saw, Dr. Niladri Shekhar Samanta |
| **Recommended by the Board of Studies on:** | 18th Meeting of the Board of Studies held on 4th July, 2024 |
| **Date of Approval by the Academic Council:** | 24th Meeting of the Academic Council held on 3rd August, 2024 |

<table>
<tr><td>Course Code:<br>PET2123</td><td colspan="4">Course Title: Fundamentals of Oil and Gas Production Technology<br>Type of Course: 1] Program Core Course<br>2] Theory only</td><td>L-T-P-C</td><td>2</td><td>1</td><td>0</td><td>3</td></tr>
<tr><td>Version No.:</td><td colspan="9">1.0</td></tr>
<tr><td>Course Pre-requisites:</td><td colspan="9">NIL</td></tr>
<tr><td>Anti-requisites:</td><td colspan="9">NIL</td></tr>
<tr><td>Course Description:</td><td colspan="9">This course deals with the various processes dealing with production of petroleum from the subsurface. The course also discuss the well performance analysis through inflow and tubing performance relationships, multiphase fluid flow regimes; productivity index, well potential, flow rate variation with pressure drawdown, nodal analysis and choke performance; Artificial lift systems and their working; Flow assurance techniques applicable in the petroleum industry.</td></tr>
<tr><td>Course Objective:</td><td colspan="9">The objective of the course is to familiarize the learners with the concepts of Fundamentals of Oil and Gas Production Technology and attain Skill Development through Problem Solving techniques.</td></tr>
<tr><td>Course Outcomes:</td><td colspan="9">On successful completion of the course the students shall be able to:<br>CO1: apply the knowledge of IPR, TPR and nodal analysis for determining various well performance parameters,<br>CO2: illustrate different pumps for artificial lift techniques,<br>CO3: compute various operating parameters of gas lift technique,<br>CO4: discuss ESP and other pumps along with their components and working principle.</td></tr>
<tr><td>Course Content:</td><td colspan="9"></td></tr>
<tr><td>Module 1:</td><td colspan="3">Well Performance</td><td>Assignment 1</td><td colspan="3">Quiz</td><td>10 Periods</td></tr>
<tr><td colspan="10">Topics:<br>Basic surface equipment; Productivity index; IPR: Vogel / Fetkovich; Absolute open flow potential; Future IPR; Tubing performance relationship; Well potential; Choke Performance; Nodal Analysis.</td></tr>
<tr><td>Module 2:</td><td colspan="3">Artificial Lift Introduction and SRP</td><td>Assignment 2</td><td colspan="3">Course Based Problems</td><td>10 Periods</td></tr>
<tr><td colspan="10">Topics:<br>Definition and purpose of artificial lift; Type of artificial lifts: SRP, Gas lift, ESP, Hydraulic pumps. SRP - Introduction; Surface components; Wellhead equipment; Type of pump; working mechanism; subsurface components; Dynamometer; Operating parameter description and calculation.</td></tr>
<tr><td>Module 3:</td><td colspan="3">Gas Lift</td><td>Assignment 3</td><td colspan="3">Quiz</td><td>10 Periods</td></tr>
<tr><td colspan="10">Topics:<br>Introduction; Working mechanism; Types of gas lifts: Continuous gas lift, intermittent gas lift; Gas lift valves: Valve mechanism, Type of valves, Valve selection, Valve pressure calculation; Gas lift mandrel; Type of installations; Surface components; Basic design calculation; Plunger and chamber gas lifts.</td></tr>
<tr><td>Module 4:</td><td colspan="3">ESP and Other Pump</td><td>Assignment 4</td><td colspan="3">Article Review</td><td>10 Periods</td></tr>
<tr><td colspan="10">Topics:<br>ESP - Introduction; ESP system; Subsurface components; Wellhead equipment; surface components; Working principle; Basic design calculations.<br>Other Pumps - Hydraulic pumps: Components and working principle; PCP: Components and working principle. Comparison Between Various Artificial Lift Techniques.</td></tr>
<tr><td colspan="10">Targeted Application and Tools that can be used:<br>Applications: Oil and Gas Industries- Production engineer<br>Tools: PROSPER and OLGA Multi Phase Flow Simulator</td></tr>
<tr><td colspan="10">Text Book:<br>T1. BoyunGuo, Xinghui Liu, Xuehao Tan, “Petroleum production engineering”, Gulf Professional Publishing. (2nd Edition, 2017)<br>T2. Tan Nguyen, “Artificial Lift Methods: Design, Practices and Applications”, Springer.(1st Edition, March 2020)</td></tr>
<tr><td colspan="10">References:<br>R1. Boyun Guo Ali Ghalambor William C. Lyons,"Petroleum Production Engineering, A Computer-Assisted Approach”, Gulf Professional Publishing. (1 Edition, 2007)</td></tr>
</table>

| | |
|---|---|
| R2. Kermit E Brown, "The Technology of Artificial Lift Methods", PennWell Books. (Volume: 3B, 1983)<br><br>**e-resources:**<br>1. Presidency University e-access portal: https: / / presiuniv.knimbus.com / user# / home<br>2. Petrowiki Forum: https: / / petrowiki.spe.org / Oil_well_performance<br>3. Well Performance Model One Petro: https: / / onepetro.org / JPT / article-abstract / 44 / 02 / 220 / 107815 / Well-Performance-Model?redirectedFrom=PDF<br>4. Petrowiki: https: / / petrowiki.spe.org / Gas_lift#:~:text=Gas%20lift%20is%20a%20method,scrubbing%E2%80%9D%20action%20on%20the%20liquids<br>5. Kimray Official Website: https: / / kimray.com / training / 5-common-methods-artificial-lift<br>6.Oil and Gas IQ Website: https: / / www.oilandgasiq.com / oil-and-gas-production-and-operations / news / what-is-flow-assurance | |
| **Skill Sets:** Topics relevant to "**SKILL DEVELOPMENT**": Gas lift valves: Valve mechanism, Type of valves, Valve selection, and Valve pressure calculation for **Skill Development** through **Problem Solving** techniques. This is attained through assessment component mentioned in course plan. | |
| **Catalogue prepared by:** | Dr. Deepjyoti Mech, Dr. Amolina Doley, Mr. Bhairab Jyoti Gogoi |
| **Recommended by the Board of Studies on:** | 18th Meeting of the Board of Studies held on 4th July, 2024 |
| **Date of Approval by the Academic Council:** | 24th Meeting of the Academic Council held on 3rd August, 2024 |

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|---|---|---|---|---|---|---|---|
| **Course Code:** PET2124 | **Course Title:** Geophysical Methods for Oil and Gas Exploration<br>**Type of Course:** 1] Program Core Course<br>2] Theory Only | | | **L-T-P-C** | 3 | 0 | 0 | 3 |
| **Version No.:** | 1.0 | | | | | | |
| **Course Pre-requisites:** | NIL | | | | | | |
| **Anti-requisites:** | NIL | | | | | | |
| **Course Description:** | The aim of this Course is to understand different Oil and Gas exploration techniques used in industry. It is a theory-based course where an overview of petroleum exploration methods will be discussed. Global Oil and Gas Exploration Scenario with Role of Sedimentology, Biostratigraphy, Geochemistry and Microfossils in Oil and Gas Exploration will be discussed. Basic concepts, principles and limitations different Geophysical Methods like Gravity Survey, Magnetic Survey, Electromagnetic Survey and Seismic Survey will be discussed along with their applications in Oil and Gas Exploration. | | | | | | |
| **Course Objective:** | The objective of the course is to familiarize the learners with the concepts of Geophysical Methods for Oil and Gas Exploration and attain **Skill Development** through **Participative Learning** techniques. | | | | | | |
| **Course Outcomes:** | On successful completion of the course, the student shall be able to:<br>CO1: Explain basic features associated with the origin and maturation of petroleum<br>CO2: Describe the geochemical methods for hydrocarbon detection<br>CO3: Summarize the Magnetic and gravity survey method as well as interpret the related anomalies,<br>CO4: Demonstrate the theory and working behind different seismic exploration methods. | | | | | | |
| **Course Content:** | | | | | | | |
| **Module 1:** | Geological Concepts of Petroleum | Assessment 1: Assignment / Quiz | Literature Survey | 03 Periods | | | |
| **Topics:**<br>Formation of Petroleum accumulations, Kerogen formation, Van Krevelen Diagram; Surface indications of petroleum accumulation. Fossils and its application in Hydrocarbon Exploration. Uses of Foraminifera, Calcareous nanofossils, Nanoliths and Ostracods; Importance of palynology and micropaleontology. | | | | | | | |
| **Module 2:** | Geochemical Methods | Assessment 2: Assignment / Quiz | Data Collection | 03 Periods | | | |
| **Topics:**<br>Introduction to Geochemical methods, Seepage, Seepage activity, direct and indirect methods of geochemical exploration, benefits of geochemical prospecting, limitations and uncertainties of geochemical exploration. | | | | | | | |
| **Module 3:** | Gravity Survey and Magnetic Survey | Assessment 3: Assignment / Quiz | Programming Task | 10 Periods | | | |
| **Topics:**<br>Introduction to gravity surveying, gravimeters, gravity corrections, applications of gravity measurements, Magnetic survey: The earth's geomagnetic field, field instruments, magnetic response of simple shapes, Rock magnetism, Types of magnetism, magnetic anomalies and correction and their application. | | | | | | | |
| **Module 4:** | Seismic Survey | Assessment 4: Case Study | Data Collection and Analysis | 16 Periods | | | |
| **Topics:**<br>Waveforms: Theory of seismic reflectance, Seismic wave veolocity of rock, Reflection seismogram, shot gathers and CMP gathers, Attenuation of seismic energy along ray paths; Equipment used in seismic survey, Multichannel reflection survey design; Interpretation of seismic reflection data. | | | | | | | |
| **Targeted Application and Tools that can be used:**<br>**Applications:** Exploration Geochemist / Geologist / Geophysicist in Oil and Gas / Mineral Exploration companies<br>**Tools:** MS Excel, Grapher, Decision Space G1 Edition (Professionally used Landmark Halliburton Software) | | | | | | | |
| **Text Book:**<br>T1. Philip Kearey, Michael Brooks and Ian Hill, 2002. An Introduction to Geophysical Exploration, 3rd Edition, Blackwell Science.<br>T2: W.M. Telford, L.P. Geldart and R.E. Sheriff, 1990. Applied Geophysics, 2nd Edition, Cambridge University Press. | | | | | | | |
| **References**<br>R1. R1: Milton B. Dobrin, and Carl H. Savit, 1988. Introduction to Geophysical Prospecting, 4th Edition, McGraw Hill. | | | | | | | |

R2: M.B. Ramachandra Rao, 1993. Outlines of Geophysical Prospecting: A Manual for Geologists, EBD Educational Pvt Ltd.

Class Note (CN) / Materials / Other materials

**e-resources**

1. E-remote access portal: https: / / presiuniv.knimbus.com / user# / home
2. Basics of Hydrocarbon exploration: https: / / www.youtube.com / watch?v=eT9bXXKBtTk
3. Technical Guidance to Exploration & Production Plans: http: / / dx.doi.org / 10.1007 / 978-3-030-45250-6_1
4. HELP (Hydrocarbon Exploration and Licensing Policy: https: / / www.youtube.com / watch?v=xvdetYz7UIA
5. Using 3D Seismic Exploration to Find and Drill for Oil and Natural Gas Sources: https: / / www.youtube.com / watch?v=8h35KsRD0c0

**Skill Sets:** Topics relevant to "**SKILL DEVELOPMENT**": Gravity surveying, gravimeters, gravity corrections, applications of gravity measurements for **Skill Development** through **Participative Learning** techniques. This is attained through assessment component mentioned in course plan.

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|---|---|
| **Catalogue prepared by:** | Dr. Suman Paul, Dr. Deepjyoti Mech, Dr. Amolina Doley, Mr. Bhairab Jyoti Gogoi |
| **Recommended by the Board of Studies on:** | 18th Meeting of the Board of Studies held on 4th July, 2024 |
| **Date of Approval by the Academic Council:** | 24th Meeting of the Academic Council held on 3rd August, 2024 |

<table>
<tr><td>Course Code:<br>PET2125</td><td colspan="4">Course Title: Oil and Gas Well Test Analysis<br>Type of Course: 1] Program Core Course<br>2] Theory Only</td><td>L-T-P-C</td><td>2</td><td>1</td><td>0</td><td>3</td></tr>
<tr><td>Version No.:</td><td colspan="9">1.0</td></tr>
<tr><td>Course Pre-requisites:</td><td colspan="9">NIL</td></tr>
<tr><td>Anti-requisites:</td><td colspan="9">NIL</td></tr>
<tr><td>Course Description:</td><td colspan="9">This course is aims to improve the knowledge of the students about fluid flow through porous media, solutions of diffusivity equations, pressure transient analysis, and gas well testing. To excel in this course, students should be well versed in the numerical solving and reservoir engineering. The course is mathematically rich with modelling and derivations of complex flow through porous media phenomena, pressure and flow rate relationship for different conditions, and the flow in non-circular reservoirs. This course will enhance programming knowledge of the students through assignments.</td></tr>
<tr><td>Course Objective:</td><td colspan="9">The objective of the course is to familiarize the learners with the concepts of Oil and Gas Well Test Analysis and attain Skill Development through Problem Solving techniques.</td></tr>
<tr><td>Course Outcomes:</td><td colspan="9">On successful completion of the course the students shall be able to:<br>CO1: explain diffusivity equation, its derivation and solution, Principle of superposition,<br>CO2: apply the knowledge to determine the reservoir Pressure, Permeability and Skin factor using pressure build-up test analysis,<br>CO3: apply the knowledge of flow tests in order to calculate the pore volume of the reservoir,<br>CO4: explain the different types of gas well tests and their uses.</td></tr>
<tr><td>Course Content:</td><td colspan="9"></td></tr>
<tr><td>Module 1:</td><td colspan="2">Introduction to Well Test Analysis</td><td colspan="2">Assignment</td><td colspan="2">Programming</td><td colspan="2">09 Periods</td></tr>
<tr><td colspan="10">Topics: Ideal reservoir model, mathematical preparation for well test analysis, derivation for diffusivity equation, radius of investigation, Principle of superposition, Horner’s approximation.</td></tr>
<tr><td>Module 2:</td><td colspan="2">Pressure Build-up tests</td><td colspan="2">Assignment</td><td colspan="2">Programming</td><td colspan="2">11 Periods</td></tr>
<tr><td colspan="10">Topics: Ideal buildup test, Actual buildup test, derivation from assumptions in ideal test theory, Qualitative behaviours of field test, Effect and duration of after flow, Permeability determination, skin factor, Well damage and stimulation, Reservoir limit tests.</td></tr>
<tr><td>Module 3:</td><td colspan="2">Flow Test</td><td colspan="2">Assignment</td><td colspan="2">Programming</td><td colspan="2">11 Periods</td></tr>
<tr><td colspan="10">Topics: Introduction, Pressure draw down test, Multirate tests, Application of Flow tests.</td></tr>
<tr><td>Module 4:</td><td colspan="2">Gas Well Testing</td><td colspan="2">Assignment</td><td colspan="2">Programming</td><td colspan="2">09 Periods</td></tr>
<tr><td colspan="10">Topics: Basic theory of Gas flow in reservoirs, Flow after flow tests, Isochronal test, Modified Isochronal tests.</td></tr>
<tr><td colspan="10">Targeted Application and Tools that can be used:<br>Applications: Well Testing Engineer, Reservoir Engineer in companies like Schlumberger, ONGC, Baker Hughes, etc.<br>Tools: Schlumberger – KAPPA software</td></tr>
<tr><td colspan="10">Text Book:<br>T1: Lee, J., 1982. Well testing.<br>T2: Lee, J., Rollins, J.B. and Spivey, J.P., 2003. Pressure transient testing (eBook). SPE textbook series, 9.</td></tr>
<tr><td colspan="10">References:<br>R1: Bourdet, Dominique. Well Test Analysis: The Use of Advanced Interpretation Models. Netherlands, Elsevier Science, 2002.<br>R2: McAleese, S. Operational Aspects of Oil and Gas Well Testing. Netherlands, Elsevier Science, 2000.<br><br>e-resources:<br>1. Presidency University e-access portal :https: / / presiuniv.knimbus.com / user# / home<br>2. YouTube Well Test Analysis: https: / / www.youtube.com / watch?v=kQvQtU0n1YQ<br>3. SPE Well Test Series: https: / / www.youtube.com / watch?v=3R3JV-zzHJU</td></tr>
<tr><td colspan="10">Skill Sets: Topics relevant to “SKILL DEVELOPMENT”: Pressure draw down test and Multirate tests for Skill Development through Problem Solving techniques. This is attained through assessment component mentioned in course plan.</td></tr>
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|---|---|
| **Catalogue prepared by:** | Dr. Deepjyoti Mech, Dr. Rohit Kumar Saw, Dr. Amolina Doley, Mr. Bhairab Jyoti Gogoi |
| **Recommended by the Board of Studies on:** | 18th Meeting of the Board of Studies held on 4th July, 2024 |
| **Date of Approval by the Academic Council:** | 24th Meeting of the Academic Council held on 3rd August, 2024 |

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|---|---|---|---|---|---|---|---|
| **Course Code:** PET2126 | **Course Title:** Offshore Drilling and Petroleum Production Practices<br>**Type of Course:** 1] Program Core Course<br>2] Theory only | | **L-T-P-C** | 3 | 0 | 0 | 3 |
| **Version No.:** | 1.0 | | | | | | |
| **Course Pre-requisites:** | NIL | | | | | | |
| **Anti-requisites:** | NIL | | | | | | |
| **Course Description:** | This course is theory course. The main objective of this course is to focus on the sea behavior and the platforms used for drilling & production operation. It also helps to understand drilling and production practices used in offshore environment and problems associated with offshore operation. This course is both conceptual and analytical in nature. With the knowledge of basic sciences are preferable to register in this course. | | | | | | |
| **Course Objective:** | The objective of the course is to familiarize the learners with the concepts of Offshore Drilling and Petroleum Production Practices and attain **Skill Development** through **Problem Solving** techniques. | | | | | | |
| **Course Outcomes:** | On successful completion of the course the students shall be able to:<br>CO1: Discuss the offshore sea environment and station keeping mechanism of offshore structures,<br>CO2: Explain various fixed offshore drilling and production structures,<br>CO3: Summarize various floating offshore platforms,<br>CO4: Distinguish between the offshore production facilities. | | | | | | |
| **Course Content:** | | | | | | | |
| **Module 1:** | Introduction to Offshore and Sea Environment | Assignment | Literature Survey and Group Discussion | 06 Periods | | | |
| **Topics:**<br>Introduction, Historical development of offshore Structures, Deep water challenges and offshore disasters, Functions of offshore structures, Water Depth classification, Offshore India. Classification Societies and Industry Standard Groups Buoyancy and Gravity Principals, Metacenter, Station keeping, Motions of floating vessel. | | | | | | | |
| **Module 2:** | Fixed Offshore Drilling and Production Platform | Quiz | Model Making | 10 Periods | | | |
| **Topics:**<br>Bottom Supported structures- Minimal platforms, Jacket structures, Gravity based structures, Jack ups, Subsea templates and pipelines; Complaint structures- Articulated Platforms, Complaint tower, Guyed tower. | | | | | | | |
| **Module 3:** | Floating Offshore Drilling and Production Platforms | Quiz | Data Collection and Programming | 15 Periods | | | |
| **Topics:**<br>Floating offshore drilling units- introduction to Mobile offshore drilling units, semisubmersible, Drill ships; Floating offshore production units: Floating production systems (FPS) structures- Semisubmersibles, SPARS, Conventional TLP, Mini TLP; Floating storage and offloading (FSO) systems- Ship shaped vessels; Floating production systems (FPS)- Ship / barge;, Mooring systems, Dynamic positioning system. | | | | | | | |
| **Module 4:** | Offshore Production Facilities | Assignment | Literature Survey and Group Discussion | 09 Periods | | | |
| **Topics:**<br>Oil and Gas Separation, Treatment of Oil, Treatment of Gas, Treatment of Produced, Water, Storage of Oil and, Gas, Transportation of Oil and Gas . | | | | | | | |
| **Targeted Application and Tools that can be used:**<br>**Applications:** Offshore Drilling / Production / Structural / Pipeline Engineer in Oil and Gas Industry<br>**Tools:** Marine Riser, Riser Tensioner, Engineer's Desktop (Landmark Halliburton software), Petrel | | | | | | | |
| **Text Book:**<br>T1. S. Chakrabarti, "Handbook of Offshore Engineering", Volume 1 and 2, Elsevier (2005)<br>T2. S. Laik "Offshore Petroleum Drilling and Production" CRC Press, Taylor and Francis, 2018 | | | | | | | |
| **References:**<br>R1. The Technology of Offshore Drilling: Completion and Production ETA Offshore Seminars, Inc<br>R2. Dr. Ignatius Louis Prashanth , Onshore Gas Drilling Hardcover – 1 January 2022<br><br>**e-resources:**<br>1. Presidency University e-Resource: https: / / puniversity.informaticsglobal.com / login<br>2. Basics of Soil Mechanics I https: / / nptel.ac.in / courses / 114 / 106 / 114106015 / | | | | | | | |

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|---|---|
| 3. Offshore Structures Under Special Loads Including Fire Resistance https: / / nptel.ac.in / courses / 114 / 106 / 114106043 / | |
| **Skill Sets:** Topics relevant to "**SKILL DEVELOPMENT**": Bottom Supported structures- Minimal platforms and Jacket structures for **Skill Development** through **Problem Solving** techniques. This is attained through assessment component mentioned in course plan. | |
| **Catalogue prepared by:** | Dr. Suman Paul, Dr. Rohit Kumar Saw, Dr. Deepjyoti Mech, Mr. Bhairab Jyoti Gogoi |
| **Recommended by the Board of Studies on:** | 18th Meeting of the Board of Studies held on 4th July, 2024 |
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|---|---|---|---|---|---|---|
| **Course Code:** PET2127 | **Course Title:** Advanced Petroleum Reservoir Engineering<br>**Type of Course:** 1] Program Core Course<br>2] Theory Only | | **L-T-P-C** | 2 | 1 | 0 | 3 |
| **Version No.:** | 1.0 | | | | | |
| **Course Pre-requisites:** | NIL | | | | | |
| **Anti-requisites:** | NIL | | | | | |
| **Course Description:** | The purpose of this course is to provide the practical application of the concepts like MBE and GOR equations in predicting the oil reservoir performance under different scenarios of drive mechanisms as well as in depth study of water influx models, immiscible displacement and reservoir management concepts. This course is both conceptual and analytical in nature and requires good knowledge of mathematics and programming. The course also enhances the programming skills of the students through different assignments. | | | | | |
| **Course Objective:** | The objective of the course is to familiarize the learners with the concepts of Advanced Petroleum Reservoir Engineering and attain **Skill Development** through **Problem Solving** techniques. | | | | | |
| **Course Outcomes:** | On successful completion of the course the students shall be able to:<br>CO1: interpret different Water influx models,<br>CO2: explain immiscible drive mechanism for Improved Oil Recovery through water and gas flooding,<br>CO3: compute different natural drive indices in a combination drive in an oil reservoir,<br>CO4: discuss the reservoir management concepts. | | | | | |
| **Course Content:** | | | | | | |
| **Module 1:** | Water Influx | Assignment | Programming | 10 Periods | | |
| **Topics:** Classification of Aquifers: Degree of Pressure Maintenance, Aquifer Boundary, Flow Regimes, Flow Geometry, Water Influx Models: Steady state models – Pot Aquifer, Schilthuis; Pseudo steady State model – Fetkovich; Unsteady State Models – van Everdingen and Hurst. | | | | | | |
| **Module 2:** | Improved Oil Recovery and Immiscible Displacement | Case Study | Simulation | 10 Periods | | |
| **Topics:** Secondary Recovery Techniques, Water Flooding: Factors, Procedure, Patterns. Recovery Efficiencies, Frontal Displacement and Advancement Theories. | | | | | | |
| **Module 3:** | Oil Reservoir Performance | Assignment | Programming | 10 Periods | | |
| **Topics:** Reservoir Performance Prediction: Instantaneous GOR, Reservoir Saturation Equations, Undersaturated Oil Reservoir, Saturated Oil Reservoir, Tracy's Method. Oil Well Performance: Inflow Performance Relationship, Vogel's Equation. Relating Reservoir Performance with Time. | | | | | | |
| **Module 4:** | Introduction to Reservoir Management | Term paper | Class Presentation | 10 Periods | | |
| **Topics:** Reservoir Management: Definition, History, Concept. Reservoir Management Process: Setting Goals, Developing Plans, Economic Implementation. Reservoir Management Economics: Time Value of Money, NPV, IRR | | | | | | |
| **Targeted Application and Tools that can be used:**<br>**Applications:** Waterflooding, Reservoir performance prediction<br>**Tools:** MBal (Software package), CMG – IMEX (Software Package) | | | | | | |
| **Text Book:**<br>T1: Dake L. P. "Fundamentals of Reservoir Engineering", 17th Impression, Elsevier. | | | | | | |
| **References:**<br>R1: Ahmed, T., "Advanced Reservoir Engineering and Management" Elsevier.<br>R2: Ahmed, T., "Reservoir Engineering Handbook", Elsevier.<br>R3: Archer, J.S., Wall, C.G., "Petroleum Engineering Principles and Practice" Graham and Trotman Inc.<br><br>**e-resources:**<br>1. Presidency University e-access portal:https: / / presiuniv.knimbus.com / user# / home<br>2. Reservoir Engineering Analyses : https: / / www.youtube.com / watch?v=NBJC_KVo4Ug<br>3. Advanced Petroleum Reservoir Engineering https: / / www.youtube.com / watch?v=m9PLxDOu5WI | | | | | | |

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| **Skill Sets:** Topics relevant to "**SKILL DEVELOPMENT**": Water Influx Models: Steady state models – Pot Aquifer, Schilthuis for **Skill Development** through **Problem Solving** techniques. This is attained through assessment component mentioned in course plan. | |
| **Catalogue prepared by:** | Dr. Suman Paul, Dr. Deepjyoti Mech, Dr. Rohit Kumar Saw, Dr. Amolina Doley, Mr. Bhairab Jyoti Gogoi |
| **Recommended by the Board of Studies on:** | 18th Meeting of the Board of Studies held on 4th July, 2024 |
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## DISCIPLINE ELECTIVE COURSE (DEC)

### Specialization Basket 1: Petroleum Upstream and Downstream Basket

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|---|---|---|---|---|---|---|
| **Course Code:** PET1701 | **Course Title:** Petroleum Data Analysis<br>**Type of Course:** 1] Discipline Elective Course<br>2] Laboratory Integrated | **L-T-P-C** | 2 | 0 | 2 | 3 |
| **Version No.:** | 1.0 | | | | | |
| **Course Pre-requisites:** | NIL | | | | | |
| **Anti-requisites:** | NIL | | | | | |
| **Course Description:** | The purpose of the course is to enable the students to appreciate the need to understand the significance of data analytics in the oil and gas industry. The course is conceptual in nature, and is intended to develop understanding of data analytics concepts, problems, and implementation. The course develops critical and analytical thinking skills through various case studies. The course also enhances programming abilities through assignments. The course will also include team exercises and numerical solving activities, which will help to improve employability skills. The course is both conceptual and analytical in nature and needs fair knowledge of Mathematical and computing. The course develops the critical thinking and analytical skills. The associated laboratory provides an opportunity to validate the concepts taught and enhances the ability to correlate with the real time field experiment. | | | | | |
| **Course Objective:** | The objective of the course is to familiarize the learners with the concepts of Petroleum Data Analysis and attain **Employability** through **Experiential Learning** techniques. | | | | | |
| **Course Outcomes:** | On successful completion of the course the students shall be able to:<br>CO1: explain the basics of data analytics in the oil and gas industries,<br>CO2: identify the importance of data management in oil and gas industry,<br>CO3: describe different attributes in reservoir characterization,<br>CO4: discuss various factors to optimize drilling. | | | | | |
| **Course Content:** | | | | | | |
| **Module 1:** | Fundamentals of Soft Computing | Assignment | Data Collection | 07 Periods | | |
| **Topics:** Introduction to Data Analytics, Digital Oilfields, Fundamentals of Regression and Correlation, Soft Computing Techniques, Three Tenets of Upstream Data, Basic concepts of Statistics, Big data Analytics, Data Analysis, Application of data analytics in oil and gas. Analysis of oil and gas field data Univariate Data, Bivariate Data, Multivariate Data. | | | | | | |
| **Module 2:** | Data Management | Assignment | Programming Task | 06 Periods | | |
| **Topics:** Data Management Platform, Subsurface Data Types, Hard Data and Soft Data, Sampling and Sampling Distribution, Standard Data Sources, Essential Probability and Statistics concepts for Oil and Gas. Parametric models, Normal and Log-Normal Distributions, Fitting distributions to data. | | | | | | |
| **Module 3:** | Reservoir Characterization and Simulation | Assignment | Simulation Task | 06 Periods | | |
| **Topics:** Exploratory Data Analysis, Reservoir characterization Cycle, Traditional Data Analysis, Reservoir Simulation Models, Role of Machine Learning in Reservoir Engineering, Reservoir Modelling Using Fast Predictive Machine Learning Algorithms for Geological Carbon Storage | | | | | | |
| **Module 4:** | Drilling and Completion Optimization | Case Study | Programming Task | 06 Periods | | |
| **Topics:** Mitigation of Non-Productive Time, Drilling Parameter Optimization, Real-Time Drilling and Completion Analytics, Case studies | | | | | | |
| **Module 5:** | Analysis of Petroleum Data | Conduction of Experiment | Presentation | 15 Sessions | | |
| **List of Laboratory Experiments:** | | | | | | |
| **Experiment 1:**<br>Equation of state modelling of pure component data using MS Excel / Fortran programming.<br>Level 1: To determine saturation pressure of pure component.<br>Level 2: To determine the liquid phase density and vapor phase density of pure component.<br><br>**Experiment 2:**<br>Flash calculation of reservoir fluid data using MS Excel.<br>Level 1: To determine bubble point and dew point of reservoir fluid data.<br>Level 2: To determine the liquid phase density and vapor phase density of reservoir fluid data. | | | | | | |

**Experiment 3:**
Estimation of original oil in place using Monte Carlo method.
Level 1: Implementation of Monte Carlo method in oil and gas data.
Level 2: Determination of original oil in place using Monte Carlo method using MS Excel.

**Experiment 4:**
Analysis of Material Balance Equation using MS Excel.
Level 1: Determine total cumulative production of given data.
Level 2: To Plot total cumulative production vs time.

**Experiment 5:**
Generating IPR and TPR curve of well data using MS Excel / PYTHON
Level 1: Determine well flowing bottom hole pressure and production rate of given data.
Level 2: Determine tubing-head pressure and the flow performance of production string.

**Experiment 6:**
Determination of abnormal pressure by modelling of Dc exponent.
Level 1: Determine abnormal pressure of given well data using MS Excel
Level 2: Comparative study of abnormal pressure using Rehm-Mclendon method, Eaton method and Zamora method.

**Experiment 7:**
Generating relative permeability curve using given data.
Level 1: To determine the relative permeability of given reservoir data.
Level 2: To generate relative permeability curve of given reservoir data.

**Experiment 8:**
Generating Klinkerberg effect curve for gas permeability using Python.
Level 1: To determine the gas permeability.
Level 2: To determine water permeability from the measurement of gas permeability.

**Targeted Application and Tools that can be used:**
**Application:** Oil and Gas Data Analyst, Data Scientist, Market Research Analyst in O&G industry
**Tools:** MS Excel, Tableau, PowerBI, Code blocks, Curve Expert

**Text Book:**
T1. Holdaway, Keith; Harness Oil and Gas Big Data with Data Analytics; 1st Edition; Wiley; 2014.
T2. Sanskaran, Sathish; Data Analytics in Reservoir Engineering; 1st Edition; SPE; 2020.

**References:**
R1. Xue, Qilong; Data analytics for drilling engineering: theory, algorithms, experiments, software; 1st Edition; Springer Nature; 2019
R2. Belyadi, Hoss; Machine Learning Guide for Oil and Gas using Python; 1st Edition; Gulf Professional Publishing; 2021
R3. Mohammadpoor, Mehdi, and Farshid Torabi. "Big Data analytics in oil and gas industry: An emerging trend." Petroleum 6, no. 4 (2020): 321-328.
R4. Desai, Jas Nitesh, Sivakumar Pandian, and Rakesh Kumar Vij. "Big data analytics in upstream oil and gas industries for sustainable exploration and development: A review." Environmental Technology & Innovation 21 (2021): 101186.

**e-resources:**
1. Presidency University e-resource library:
2. Data Analytics with Python-NPTEL Online Course: https: / / nptel.ac.in / courses / 106 / 107 / 106107220 /
3. Petroleum from Scratch YouTube Channel: https: / / www.youtube.com / c / PetroleumFromScratch / videos
4. Google Cloud Platform YouTube Channel: https: / / www.youtube.com / user / googlecloudplatform

**Skill Sets:** Topics relevant to "**SKILL DEVELOPMENT**": As it is a laboratory-integrated course, all the experiments are designed for **Skill Development** through **Experiential Learning** techniques. The course attainment will be assessed through the assessment component(s) mentioned in the course plan.

| | |
|---|---|
| **Catalogue prepared by:** | Dr. Suman Paul, Dr. Deepjyoti Mech, Dr. Rohit Kumar Saw, Mr. Bhairab Jyoti Gogoi |
| **Recommended by the Board of Studies on:** | 18th Meeting of the Board of Studies held on 4th July, 2024 |
| **Date of Approval by the Academic Council:** | 24th Meeting of the Academic Council held on 3rd August, 2024 |

<table>
<tr><td>Course Code:<br>PET1702</td><td colspan="4">Course Title: Carbon Capture and Utilization for Sustainability<br>Type of Course: 1] Discipline Elective Course<br>2] Theory only</td><td>L-T-P-C</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Version No.:</td><td colspan="9">1.0</td></tr>
<tr><td>Course Pre-requisites:</td><td colspan="9">NIL</td></tr>
<tr><td>Anti-requisites:</td><td colspan="9">NIL</td></tr>
<tr><td>Course Description:</td><td colspan="9">The purpose of this course is to introduce climate change and how to assess and explore $CO_2$ capture and utilization technologies, and assess geologic utilization and sub-surface storage options.</td></tr>
<tr><td>Course Objective:</td><td colspan="9">The objective of the course is to familiarize the learners with the concepts of Carbon Capture and Utilization for Sustainability and attain Employability through Participative Learning techniques.</td></tr>
<tr><td>Course Outcomes:</td><td colspan="9">On successful completion of the course, the student shall be able to:<br>CO1: Develop carbon capture, utilization, and storage strategies<br>CO2: Define the role of carbon capture, utilization, and storage in reducing emissions.<br>CO3: Classify different principles of $CO_2$ capture<br>CO4: Develop new technologies for low carbon energy supply with $CO_2$ capture and storage</td></tr>
<tr><td>Course Content:</td><td colspan="9"></td></tr>
<tr><td>Module 1:</td><td colspan="2">Introduction</td><td colspan="3">Quiz / Assignment</td><td colspan="2">Data Collection and Review Paper</td><td>10 Periods</td></tr>
<tr><td colspan="10">Topics: Introduction to carbon capture, utilization, and storage; legal and regulatory issues for implementing $CO_2$ storage; role of carbon capture and utilization in sustainability</td></tr>
<tr><td>Module 2:</td><td colspan="2">CCS Technology</td><td colspan="3">Assignment / Poster Presentation</td><td colspan="2">Poster Designing and Presentation</td><td>10 Periods</td></tr>
<tr><td colspan="10">Topics: Applications for CCUS, characteristics of CCS, current status of CCS technology, costs for CCS and technical and economic potential</td></tr>
<tr><td>Module 3:</td><td colspan="2">$CO_2$ Transport and Emission</td><td colspan="3">Assignment</td><td colspan="2">Numerical Solving</td><td>10 Periods</td></tr>
<tr><td colspan="10">Topics: Sources of $CO_2$, capture of $CO_2$, transport of $CO_2$, Low emission solutions when using $CO_2$ in petroleum production</td></tr>
<tr><td>Module 4:</td><td colspan="2">$CO_2$ Storage</td><td colspan="3">Case Study</td><td colspan="2">Group Discussion</td><td>10 Periods</td></tr>
<tr><td colspan="10">Topics: Carbon storage: geological storage, ocean storage, geographical relationship between the sources and storage opportunities for $CO_2$, health, safety and environment risks of CCS</td></tr>
<tr><td colspan="10">Targeted Application and Tools that can be used:<br>Application Area: Project Planning and Management Analyst, Management trainee<br>Tools: Kato, MS-Excel</td></tr>
<tr><td colspan="10">Text Books:<br>T1. Metz, B., Davidson, O., Coninck, H.D., Loos, M., Meyer, L. 2005. Carbon dioxide capture and storage. Intergovernmental Panel on Climate Change, Cambridge University Press.<br>T2. Feng, D., Sun, J., Zhou, Z., 2023. Carbon Dioxide Capture, Utilization and Storage (CCUS), MDPI.</td></tr>
<tr><td colspan="10">Reference Book(s)<br>R1. Goel, M., 2008. Carbon capture and storage: R&D technologies for sustainable energy future. Alpha Science.<br>R2. Shah, Y.T., 2021 $CO_2$ Capture, Utilization, and Sequestration Strategies, CRC Press.<br><br>e-resources:<br>1. Link for Knimbus remote login: https: / / presiuniv.knimbus.com<br>2. SWAYAM Course - Introduction to Climate Change, By Dr V. Venkat Ramanan, https: / / www.classcentral.com / course / swayam-introduction-to-climate-change-58478</td></tr>
<tr><td colspan="10">Skill Sets: Topics relevant to “SKILL DEVELOPMENT”: CCS Technology for developing Employability through Participative Learning techniques. This is attained through assessment component mentioned in course plan.</td></tr>
<tr><td>Catalogue prepared by:</td><td colspan="9">Dr. Suman Paul, Dr. Deepjyoti Mech, Dr. Rohit Kumar Saw, Mr. Bhairab Jyoti Gogoi</td></tr>
<tr><td>Recommended by the Board of Studies on:</td><td colspan="9">18th Meeting of the Board of Studies held on 4th July, 2024</td></tr>
<tr><td>Date of Approval by the Academic Council:</td><td colspan="9">24th Meeting of the Academic Council held on 3rd August, 2024</td></tr>
</table>

| Course Code: PET3101 | Course Title: Quality Management Practices in Oil and Gas Industry<br>Type of Course: 1] Discipline Elective Course<br>2] Theory only | L-T-P-C | 3 | 0 | 0 | 3 |
|---|---|---|---|---|---|---|
| Version No.: | 1.0 | | | | | |
| Course Pre-requisites: | NIL | | | | | |
| Anti-requisites: | NIL | | | | | |
| Course Description: | The purpose of the course is to enable the students to appreciate the need for understanding the management activities related to oil and gas industry for enhancement of quality. The course is conceptual and analytical in nature and needs fair knowledge of basic engineering science and computing. The course develops the critical and analytical thinking, as well as management skills. The course also improves the programming abilities through assignments. | | | | | |
| Course Objective: | The objective of the course is to familiarize the learners with the concepts of Quality Management Practices in Oil and Gas Industry and attain **Employability** through **Participative Learning** techniques. | | | | | |
| Course Outcomes: | On successful completion of the course the students shall be able to:<br>CO1: define project management and importance of the project life cycle<br>CO2: identify the project organization with roles and responsibility of the project manager<br>CO3: discuss the quality system and quality management requirement<br>CO4: explain the risk management, assessment and identification | | | | | |
| Course Content: | | | | | | |

| Module 1: | Project Management of Oil and Gas Industry | Assignment | Data Collection | 09 Periods |
|---|---|---|---|---|
| **Topics:**<br>The Principle of Project Management, Project Management goals and tasks, Project economic analysis, Pitfalls in time schedule planning, Time schedule preparation. | | | | |
| **Module 2:** | Resource Hiring | Assignment / Quiz | Data collection and analyses | 10 Periods |
| **Topics:**<br>Introduction, Project organization, Types of project organization, Administrative organization for total Quality Management, Allocate resources to project plan, Tendering, Bidding and Contract Traps. | | | | |
| **Module 3:** | New Approach in Managing Oil and Gas Projects | Assignment / Quiz | Group discussion | 11 Periods |
| **Topics:**<br>Introduction, Quality system, Quality management requirements, Quality Assurance, Project Quality control in various stages, Operational phase of the project. | | | | |
| **Module 4:** | Practical Risk Management for Oil and Gas Projects | Assignment / Quiz / Term Paper | Presentation | 10 Periods |
| **Topics:**<br>Introduction, Risk management process, Risk Assessment, Risk identification, Methods of defining risk, Define Priorities, Methods of risk avoidance, Operations Risk. | | | | |

**Targeted Application and Tools that can be used:**

**Applications:** Project Planning and Management Analyst, Management Trainee

**Tools:** Kato, MS-Excel

**Text Book:**

T1: Mohamed A; El-Reedy, Project Management in the Oil and Gas Industry, Scrivener Publications, Wiley, 2016.

T2: Dale H.Besterfiled, et al., "Total Quality Management, Pearson Education", Inc. Third Edition, 2006; Indian Reprint.

**References**

R1: Jens J. Dahlgaard. Kai Kristensen and Gopal K. Kanji, Fundamentals of Total Quality Management, First Edition, 2007, Taylor and Francis e-library.

R2: A. Inkpen, M. H. Moffett, The Global Oil & Gas Industry_ Management, Strategy and Finance-PennWell Corp, 2011.

**e-resources**

1. Presidency University Link: https: / / puniversity.informaticsglobal.com / login
2. Webinar on introduction on Quality management system: https: / / www.youtube.com / watch?v=HDeHcoM0eIY
3. Total Quality management - https: / / journals.sagepub.com / doi / 10.1177 / 097324701100700207
4. Application of Six Sigma - https: / / doi.org / 10.2118 / 84434-PA

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|---|---|
| 5. Quality Management - https: / / www.youtube.com / watch?v=7ZDGyzqh9EY<br>6. Risk Assessment - https: / / www.youtube.com / watch?v=HyGb_eaT-U8 | |
| **Skill Sets:** Topics relevant to **"EMPLOYABILITY SKILLS":** Project Quality control for developing **Employability Skills** through **Participative Learning** techniques. This is attained through assessment component mentioned in course plan. | |
| **Catalogue prepared by:** | Dr. Suman Paul, Dr. Deepjyoti Mech, Dr. Rohit Kumar Saw, Dr. Amolina Doley |
| **Recommended by the Board of Studies on:** | 18th Meeting of the Board of Studies held on 4th July, 2024 |
| **Date of Approval by the Academic Council:** | 24th Meeting of the Academic Council held on 3rd August, 2024 |

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|---|---|---|---|---|---|---|---|
| **Course Code:** PET2030 | **Course Title:** Occupational Health and Safety<br>**Type of Course:** 1] Discipline Elective Course<br>2] Theory only | | | **L-T-P-C** | 3 | 0 | 0 | 3 |
| **Version No.:** | 2.0 | | | | | | |
| **Course Pre-requisites:** | NIL | | | | | | |
| **Anti-requisites:** | NIL | | | | | | |
| **Course Description:** | The purpose of this course is to understand the safety rules, regulations, guidelines, and accident investigations, reliability characteristics in oil and gas industry. The course is conceptual and analytical in nature, aims to provide detailed coverage of environmental laws and regulation, guidelines for safety and health programs as well as accident reporting and accident investigations. The course develops the critical and analytical thinking skills. The course also enhances the programming abilities through assignments. | | | | | | |
| **Course Objective:** | The objective of the course is to familiarize the learners with the concepts of Occupational Health and Safety and attain **Employability** through **Problem Solving** methodologies. | | | | | | |
| **Course Outcomes:** | On successful completion of the course the students shall be able to:<br>CO1: Recognize importance of reliability and safety at workplace,<br>CO2: Apply the risk assessment techniques,<br>CO3: Describe the safety practices applicable in drill site,<br>CO4: Classify methods to control oil spill and treat waste water. | | | | | | |
| **Course Content:** | | | | | | | |
| **Module 1:** | Introduction | Assignment / Quiz | Literature Survey | 08 Periods | | | |
| **Topics:**<br>Introduction to Safety, Health, and Environment Management, History, Terms and definitions, Environment concepts, Impact on Eco system, Air, Water and Soil, Toxicity. | | | | | | | |
| **Module 2:** | Accident Modeling, Risk Assessment & Management | Assignment / Quiz | Data Collection | 12 Periods | | | |
| **Topics:**<br>Dose assessment, safety regulations-Toxic releases-models and methods-Chemical risk analysis-Chemical exposure index (CEI)-Case studies in oil industries-Quantitative risk assessment-Fire and explosion models-Flammability diagrams-Exposure models-Fire and explosion: prevention methods-Event tree and fault tree analyses | | | | | | | |
| **Module 3:** | Safety Practices at Work site | Assignment / Quiz | Programming | 11 Periods | | | |
| **Topics:**<br>Impact of Drilling on environment, Safety practices in Drilling sites: Preparation of Drill sites, Storage and Material Handling, Precautions for Drilling in landfills, Electrical safety, General equipment safety, PPE, Caselet issues related to any Industry. | | | | | | | |
| **Module 4:** | Oil Spill Remediation | Case Study | Data Collection | 09 Periods | | | |
| **Topics:**<br>Offshore environmental studies, Fate and behavior of Oil spill, Response strategies and techniques, Mechanical and chemical treatments, Soil remediation. What is waste water, Waste water treatment, Case studies. | | | | | | | |
| **Targeted Application and Tools that can be used:**<br>**Applications:** HSE Engineer / Officer in Oil and Gas / Process / Steel / Manufacturing Industry, Thermal / Power Plants.<br>**Tools:** MS Excel | | | | | | | |
| **Text Book:**<br>T1. B.S. Dhillon, "Safety and Reliability in the Oil and Gas Industry: A Practical Approach", 1st edition, CRC Press, 2019.<br>T2. S. Chandrasekaran, "Health, Safety, and Environmental Management in Offshore and Petroleum Engineering", 1st edition, Wiley, 2016. | | | | | | | |
| **References:**<br>R1. Charles D. Reese, "Occupational Health and Safety Management:" A Practical Approach", 3rd edition, CRC Press, 2016.<br>R2.Morten Holmager, Søren Dybdahl, "Offshore Book Oil and Gas", 3rd edition, Offshoreenergy.dk, 2014.<br><br>**e-resources:**<br>1. https: / / puniversity.informaticsglobal.com / login | | | | | | | |

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|---|---|
| 2. https: / / youtu.be / 7cqGjBj77Zs?list=PLbMVogVj5nJTKcMfWNwQfPkT014KEJAzE<br>3. https: / / youtu.be / 7CwPDiqlmv0<br>4. https: / / youtu.be / IJqKyBHHdI8<br>5. https: / / youtu.be / 0dcQcNARKOI | |
| **Skill Sets:** Topics relevant to **"EMPLOYABILITY SKILLS":** Oil Spill Control for developing **Employability Skills** through **Problem Solving** methodologies. This is attained through assessment component mentioned in course plan. | |
| **Catalogue prepared by:** | Dr. Suman Paul, Dr. Deepjyoti Mech, Dr. Kalpajit Hazarika, Mr. Bhairab Jyoti Gogoi, Mr. Ankur Neog |
| **Recommended by the Board of Studies on:** | 14th Meeting of the Board of Studies held on 27th July 2022 |
| **Date of Approval by the Academic Council:** | 18th Meeting of the Academic Council held on 3rd August 2022 |

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|---|---|---|---|---|---|---|
| **Course Code:** PET3103 | **Course Title:** Overview of Material Science<br>**Type of Course:** 1] Discipline Elective Course 2] Theory Only | | **L-T-P-C** | 3 | 0 | 0 | 3 |
| **Version No.:** | 1.0 | | | | | |
| **Course Pre-requisites:** | NIL | | | | | |
| **Anti-requisites:** | NIL | | | | | |
| **Course Description:** | Materials Science is a dynamic field, which involves analysis of processing, structure, property and performance relation for engineered materials and methods of manufacturing such materials having desired applications. Material scientists working in laboratories, industries, strive to understand and manipulate the structure of materials at molecular level to gain control over their properties. All sophisticated devices like computers, aircraft, biomedical devices etc., require materials manufactured to precise specifications. The evolution of advanced products can be hobbled by the limitations of the available materials. | | | | | |
| **Course Objective:** | The objective of the course is to familiarize the learners with the concepts of Overview of Material Science and attain **Entrepreneurship** through **Participative Learning** techniques. | | | | | |
| **Course Outcomes:** | On successful completion of the course the students shall be able to:<br>CO1: define material science and importance of the material engineering world,<br>CO2: identify the mechanical behavior for different types of materials,<br>CO3: discuss different phase diagrams for alloy systems,<br>CO4: explain mechanical characteristics for a material often results from a phase transformation | | | | | |
| **Course Content:** | | | | | | |
| **Module 1:** | Structure of Metals | Term Paper | Data Collection and Analysis | 07 Periods | | |
| **Topics:**<br>Classification of Materials, Structure of Metals and Ceramics, Unit cell, FCC, BCC, SC, HCP, Atomic Packing factor, Miller indices for line, plane, Polymer structures, Imperfections in Solids. | | | | | | |
| **Module 2:** | Mechanical Properties | Assignment | Data Collection and Analysis | 08 Periods | | |
| **Topics:**<br>Introduction, Concepts of Stress and Strain, Stress-Strain Behavior, Ductile material, Brittle material, Mechanical Behavior – Metals – Ceramics – Polymers, Hardness, Property Variability, Safety Factors. | | | | | | |
| **Module 3:** | Phase Diagrams | Assignment | Programming Task | 08 Periods | | |
| **Topics:**<br>Introduction, Equilibrium Phase Diagrams, The Phase Rules – Single Component System – Binary Phase Diagrams – Ternary Phase Diagrams, Typical Phase Diagrams – Magnesia–Alumina System – Copper–Zinc System – Iron–Iron-carbide System. | | | | | | |
| **Module 4:** | Phase Transformations | Term Paper | Simulation / Data Analysis | 09 Periods | | |
| **Topics:**<br>Phase Transformations In Metals – Multiphase Transformations, Microstructural and Property Changes In Iron–Carbon Alloys, Precipitation Hardening – Heat Treatments – Mechanism of Hardening – Miscellaneous Considerations, Crystallization, Melting, and Glass Transition Phenomena In Polymers. | | | | | | |
| **Targeted Application and Tools that can be used:**<br>**Applications:** Engineer in Oil and Gas Industry, Steel Industry, Manufacturing Industry<br>**Tools:** Image Analysis Software / Polarizing Microscope (Professionally used Software / Equipment) | | | | | | |
| **Text Book:**<br>T1. Raghavan V, "Materials Science and Engineering: A First Course", 6th Revised Edition, PHI Learning Private Limited-New Delhi, 2015.<br>T2. James F. Shackelford, William Alexander, MATERIALS SCIENCE AND ENGINEERING HANDBOOK, 3rd edition, 2001 by CRC Press, 2001 | | | | | | |
| **References:**<br>R1. William Callister S., "Materials Science and Engineering", 2nd Edition, Wiley India, 2014.<br>R2: George E. Dieter, "Mechanical Metallurgy", 3rd Edition, McGraw Hill, 1988. | | | | | | |

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| **e-resources:**<br>1. https: / / puniversity.informaticsglobal.com / login<br>2. https: / / www.nap.edu / read / 10435 / chapter / 2<br>3. https: / / www.linearmotiontips.com / mechanical-properties-of-materials-stress-and-strain /<br>4. https: / / nptel.ac.in / content / storage2 / courses / 112108150 / pdf / PPTs / MTS_07_m.pdf | |
| **Skill Sets:** Topics relevant to **"ENTREPRENEURIAL SKILLS":** Phase transformation for developing **Entrepreneurial Skills** through **Participative Learning** techniques. This is attained through assessment component mentioned in course plan. | |
| **Catalogue prepared by:** | Dr. Deepjyoti Mech, Dr. Suman Paul, Dr. Rohit Kumar Saw, Dr. Niladri Shekhar Samanta |
| **Recommended by the Board of Studies on:** | 18th Meeting of the Board of Studies held on 4th July, 2024 |
| **Date of Approval by the Academic Council:** | 24th Meeting of the Academic Council held on 3rd August, 2024 |

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|---|---|---|---|---|---|---|
| **Course Code:** PET7101 | **Course Title:** Minor Project<br>**Type of Course:** 1] Discipline Elective Course<br>2] Project-based – Experiential Learning | **L-T-P-C** | - | - | - | 3 |
| **Version No.:** | 1.0 | | | | | |
| **Course Pre-requisites:** | Knowledge and Skills related to all the courses studied in previous semesters. | | | | | |
| **Anti-requisites:** | NIL | | | | | |
| **Course Description:** | The Mini Project is a 100% project-based experiential learning opportunity that immerses students in real-world industry or research settings. It bridges academic concepts with practical applications, allowing students to work on domain-specific projects under professional supervision. The course fosters technical competency, problem-solving, teamwork, and professional ethics. Students document progress, submit reports, and deliver final presentations, reinforcing industry readiness and lifelong learning attitudes essential for professional success. | | | | | |
| **Course Objective:** | The objective of the course is to familiarize the learners with the concepts of Professional Practice and attain **Employability Skills** through **Experiential Learning** techniques. | | | | | |
| **Course Outcomes:** | On successful completion of the course the students shall be able to:<br>CO1: Recall core concepts and engineering principles relevant to the project,<br>CO2: Explain the working process, technologies, or systems involved in the assigned project,<br>CO3: Apply theoretical knowledge to practical tasks and challenges during the project,<br>CO4: Analyze project requirements, data, and outcomes to identify gaps and propose improvements,<br>CO5: Evaluate the effectiveness of solutions implemented during the project using industry metrics, and<br>CO6: Design and develop a comprehensive project report and presentation that demonstrate project execution and impact.<br><br>NOTE: It is not mandatory to fulfil the requirement of all the Course Outcomes as it sometimes depends on the infrastructure availability. Student must satisfy the requirements of CO1 through CO4. | | | | | |
| **Course Content:** | | | | | | |
| **Module 1:** | | | | | | |
| **Topics:**<br>Not Applicable – Depends on the Supervisor. | | | | | | |
| **Targeted Application and Tools that can be used:**<br>**Applications:** Oil and Gas industry<br>**Tools:** MS Excel, and others (Specific equipment / apparatus / tool and software as prescribed by the Supervisor) | | | | | | |
| **Text Book:**<br>Not Applicable – Depends on the Supervisor. | | | | | | |
| **References:**<br>Not Applicable – Depends on the Supervisor.<br><br>**e-resources:**<br>Not Applicable – Depends on the Supervisor. | | | | | | |
| **Skill Sets:** Topics relevant to "**EMPLOYABILITY SKILL**": Specific equipment / apparatus / tool and software as prescribed by the Supervisor for enhancing **Employability Skills** through **Experiential Learning** techniques. | | | | | | |
| **Catalogue prepared by:** | Dr. Suman Paul, Dr. Deepjyoti Mech, Dr. Rohit Kumar Saw, Dr. Amolina Doley, Mr. Bhairab Jyoti Gogoi, Dr. Niladri Shekhar Samanta | | | | | |
| **Recommended by the Board of Studies on:** | 18th Meeting of the Board of Studies held on 4th July, 2024 | | | | | |
| **Date of Approval by the Academic Council:** | 24th Meeting of the Academic Council held on 3rd August, 2024 | | | | | |

## Specialization Basket 2: Petroleum Exploration and Drilling Engineering Basket

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|---|---|---|---|---|---|---|
| **Course Code:** PET3104 | **Course Title:** Introduction to Geoinformatics<br>**Type of Course:** 1] Discipline Elective Course<br>2] Theory Based | **L-T-P-C** | 3 | 0 | 0 | 3 |
| **Version No.:** | 1.0 | | | | | |
| **Course Pre-requisites:** | NIL | | | | | |
| **Anti-requisites:** | NIL | | | | | |
| **Course Description:** | The purpose of this course is to give a comprehensive understanding about the fundamentals and application of Remote Sensing and GIS. Along with principles of remote sensing, it gives insights about classification of maps, grid systems, Remote sensing platforms – satellite-based and airborne sensors; Basic principles of image interpretation; Spectra of earths. The course develops the critical thinking and analytical skills. | | | | | |
| **Course Objective** | The objective of the course is to familiarize the learners with the concepts of Introduction to Geoinformatics and attain **Employability** through **Participative Learning** techniques. | | | | | |
| **Course Outcomes:** | On successful completion of the course, the student shall be able to:<br>CO1: Identify various remote sensing systems,<br>CO2: Explain various Remote Sensing process,<br>CO3: Interpret the Visual Image and Digital Image,<br>CO4: Describe the various GIS operations. | | | | | |
| **Course Content:** | | | | | | |
| **Module 1:** | Introduction to Remote Sensing: Types and Applications | Assignment / Quiz | Data Collection | 10 Periods | | |
| **Topics:**<br>Introduction: Active Remote sensing, Passive remote sensing, Overview on applications of remote sensing; Principles and Process of Remote sensing; Types of Remote Sensing Systems, how satellites acquire images, Application of Remote Sensing in Seismology and mineral Exploration | | | | | | |
| **Module 2:** | Remote sensing: Basic principles and microwave Remote Sensing | Case Study / Quiz | Data Collection | 10 Periods | | |
| **Topics:**<br>Introduction, Electromagnetic remote sensing process, Electromagnetic spectrum, Energy source and its characteristics, Atmospheric Window, Atmospheric properties – Absorption of ozone – Atmospheric effects on spectral response pattern, Data Acquisition, Sensing Devices-Multispectral scanners. Introduction, Radar principle, Factors affecting microwave measurements – surface roughness – radar scattering mechanism, Radar wavebands, Side Looking Airborne Radar (SLAR) systems, Synthetic Aperture Radar (SAR). | | | | | | |
| **Module 3:** | Remote Sensing Platforms: Sensor, Visual Image Interpretation and Digital Image Processing | Quiz / Poster Presentation | Data Collection | 10 Periods | | |
| **Topics:**<br>Introduction, Platforms and sensor systems, Satellite System Parameters - Instrumental Parameters -Viewing Parameters, Sensor Parameters - Spatial Resolution - Spectral Resolution - Radiometric resolution, Imaging Sensor Systems - Multispectral imaging sensor systems - Thermal sensing systems - Microwave image systems, Earth resources satellites. Introduction, Types of Pictorial Data Products, Image interpretation strategy – Levels of interpretation keys, Process of image interpretation, Interpretation of Aerial Photo, General procedure for photo interpretation – Stereoscopic depth perception – Stereo scope, Basic elements of Image Interpretation, Application of Aerial Photo Interpretation, Key elements of visual image interpretation , Visual Image interpretation of satellite imagery. Digital Image Processing: Introduction, Basic Character of Digital Image, Preprocessing, Image Registration, Image Classification. Applications of remote sensing, Verification of analyses. | | | | | | |
| **Module 4:** | Fundamentals of GIS | Article Writing | Data collection | 10 Periods | | |
| **Topics:**<br>Introduction, Roots of GIS, Spatial data and geoinformation, Geographic Phenomena, Interactions of data types within a GIS, Image Processing of remotely sensed data, GIS. Definitions and Terminology – Geographical entities, Attributes, Topology, Cognitive models, Theoretical Models of GIS – Functional elements of GIS, Fundamental operations of GIS, Theoretical Framework for GIS, Levels / Scales of Measurement. Spatial Data Modelling: Introduction, Stages of GIS data modelling, Graphic Representation of Spatial Data –Raster data representation – Vector data representation – Spatial data models, Comparison of Raster and Vector models. | | | | | | |

**Targeted Application and Tools that can be used:**

**Applications:** GIS engineer and specialist

**Tool:** MS Excel, Arc GIS

**Text Book:**

T1: M. Anji Reddy, Text book of Remote sensing and GIS by, BSP Publications, Hyderabad.

T2: A.M. Chandra, S.K. Ghosh, Remote Sensing and Geographic Information System, Second Edition, Alpha Science International Ltd., 2015

T3: Dr. Abdul Rahman K. Ali, Remote Sensing, 3rd Class, 1st Edition, Department of Applied Sciences, University of Technology

**References:**

R1: B.H.G. Brady and E.T. Brown, Rock Mechanics for underground mining, 3rd Edition, Kluwer Academic Publishers, 2004.

R2: Basudeb Bhatta, Remote Sensing and GIS, 2nd edition, New Delhi, India: Oxford University Press, 2015.

**e-resources:**

1. E- remote access portal: https: / / presiuniv.knimbus.com / user# / home
2. Remote Sensing for Mineral Exploration - https: / / youtu.be / epw74U4IoR8
3. SAR: https: / / www.youtube.com / watch?v=Xemo2ZpduHA
4. Electromagnetic Spectrum: https: / / www.youtube.com / watch?v=pj_ya0e20vE
5. Atmospheric Windows: https: / / www.youtube.com / watch?v=dykqL1xGG_A

**Skill Sets:** Topics relevant to **"EMPLOYABILITY SKILLS":** Remote Sensing: Types and Applications for developing **Employability Skills** through **Participative Learning** techniques. This is attained through assessment component mentioned in course plan.

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|---|---|
| **Catalogue prepared by:** | Dr. Suman Paul, Dr. Deepjyoti Mech, Dr. Amolina Doley |
| **Recommended by the Board of Studies on:** | 18th Meeting of the Board of Studies held on 4th July, 2024 |
| **Date of Approval by the Academic Council:** | 24th Meeting of the Academic Council held on 3rd August, 2024 |

| Course Code: PET3105 | Course Title: Coal Bed Methane<br>Type of Course: 1] Discipline Elective Course<br>2] Theory only | L-T-P-C | 3 | 0 | 0 | 3 |
|---|---|---|---|---|---|---|
| Version No.: | 1.0 | | | | | |
| Course Pre-requisites: | NIL | | | | | |
| Anti-requisites: | NIL | | | | | |
| Course Description: | This conceptual course is designed so that students will be able to understand the requirement for exploring unconventional energy resources that are trapped beneath the Earth's surface. A few practical approaches to solving a variety of problems common to coalbed methane reservoir analysis and development will be discussed through case studies. The processes involved in optimizing the methane recovery and economics of existing coalbed methane operations and more effectively evaluate the potential of coalbed methane prospects will be discussed. A structured approach would be taken to engage, relate and contextualize the fundamentals of Coal Bed Methane projects. The understanding level will be enhanced through the assignments. | | | | | |
| Course Objective: | The objective of the course is to familiarize the learners with the concepts of Coal Bed Methane and attain **Employability Skills** through **Problem Solving** methodologies. | | | | | |
| Course Outcomes: | Upon successful completion of the course the students shall be able to:<br>CO1: explain the origin of coal bed methane,<br>CO2: illustrate the process of evaluating coal bed methane using wireline logs,<br>CO3: demonstrate the critical factors that influence the production of coal bed methane, and<br>CO4: analyze the basic data for coal bed methane projects. | | | | | |
| Course Content: | | | | | | |

| Module 1: | Coal as a Reservoir and Coal Bed Methane | Quiz / Team Exercise | Data Collection and Presentation | 10 Periods |
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**Topics:**
Coal as a Reservoir: Introduction, Origin and Formation of Coal, Physical and Chemical Properties of Coal, Coal Rank, Porosity in Coal, Coal Cleat and Permeability, Influence of Coal Rank on Coal Cleat, Gas in Coal.
Coal Bed Methane: Introduction, Methods for Characterizing the Origin – Biogenic Gases and Thermogenic Gases – Controls on Distribution and Producibility, Catalytic Hypothesis of Gas Generation.
Coal Bed Methane Reservoir Properties: Structure of Coal, Storage Mechanisms – Gas Storage in the Coal Matrix (Langmuir Isotherm), and Gas Diffusion through the Coal Matrix, Transport Mechanisms – Gas Flow through the Natural Fracture System, Factors controlling Well Productivity, Preparing Basic Reservoir Data.

| Module 2: | Evaluation of Coal Bed Methane Reservoirs | Quiz / Team Activity | Digital Poster Presentation | 10 Periods |
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**Topics:**
Evaluation of CBM Reservoirs: Introduction, Prospect Evaluation, Production Forecasting, Enhanced CBM Recovery, Wireline Logs for CBM Evaluation – Basic Coalbed Log Evaluation, Advanced Coal Analysis, Imaging and Mechanical Properties

| Module 3: | Coal Bed Methane Wells and Emerging Practices | Quiz / Team Exercise | Data and Map Analysis | 10 Periods |
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**Topics:**
Coal Bed Methane Wells: Vertical Well Construction and Hydraulic Fracturing – Introduction, Well Construction, Completion Processes, Hydraulic Fracturing, Horizontal Well Construction – Introduction, Critical Factors Influencing Surface CBM Wells, Directional Drilling Technology Development.
Emerging Practices: Introduction, CBM Produced Water Management and Treatment.

| Module 4: | Economic Analysis of Coal Bed Methane Projects and Present Status | Quiz / Team Activity | Literature Survey and Report Submission | 10 Periods |
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**Topics:**
Economic Analysis of Coal Bed Methane Projects: Introduction, Reserve Categories, Project Area Map, Geologic Assessment, Forecasting Future Production, Economic Evaluation Model, Economic Output, Project Risk.
Present Status of Coal Bed Methane: Introduction, CMM and CBM in selected Countries; Coal Bed Methane in India: Geological Feasibility, Government Policy towards CBM, CBM Potential Assessment for Gondwana Coalfields, Economic and Environmental Aspects.

**Targeted Applications and Tools that can be used:**
**Applications:** CBM Exploration, Development, and Production Engineer in CBM Company
**Tools:** Data Analysis using MS Excel

**Text Book:**

T1: Jerrald L. Saulsberry, Paul S. Schafer, and Ricjard A. Schraufnagel, 1996. "A Guide To Coalbed Methane Reservoir Engineering", Gas Research Institute, Chicago. [GRI Reference No.: GRI-94 / 0397]

T2: Pramod Thakur, Steve Schatzel, and Kashy Aminian, 2015. "Coal Bed Methane – From Prospect To Pipeline", 2nd Edition, Elsevier.

T3: Ajay Kumar Singh, and Partha Narayan Hajra, 2018. "Coalbed Methane in India - Opportunities, Issues and Challenges for Recovery and Utilization", 1st Edition, Springer.

**References:**

R1: Vicki A. Hollub and Paul S. Schafer, 1992. "A Guide to Coalbed Methane Operations", Gas Research Institute, Chicago.

R2: R. E. Rogers, 1994. "Coal Bed Methane: Principles and Practice", 3rd Edition, Prentice Hall.

R3: Promod Thakur, 2016. "Advanced Reservoir and Production Engineering for Coal Bed Methane", 1st Edition, Elsevier.

**e-resources:**

1. Link for PU e-resources: https: / / puniversity.informaticsglobal.com / login
2. What If Earth Released All Its Methane (YouTube Video): https: / / www.youtube.com / watch?v=FmMmgW3R3UI
3. Coal Bed Methane Engineering: https: / / www.youtube.com / watch?v=jHnIRw-iETg
4. What is Coal Bed Methane (YouTube Video): https: / / www.youtube.com / watch?v=TgeZ4WC0HEE
5. Coal Bed Methane (YouTube Video): https: / / www.youtube.com / watch?v=xcKDI0IZiBc&t=128s
6. What is Coal Seam Gas? (YouTube Video): https: / / www.youtube.com / watch?v=kNa5pvh_4tQ
7. The Journey of Natural Gas (YouTube Video): https: / / www.youtube.com / watch?v=V8EHHW-3N5Y&t=326s
8. Coal Gas Seam Drilling (YouTube Video): https: / / www.youtube.com / watch?v=o0J_Xzfo3rI&t=219s
9. Coal Bed Methane Drilling Technology (YouTube Video): https: / / www.youtube.com / watch?v=xTUe7JgzJak

**Skill Sets:** Topics relevant to **"EMPLOYABILITY SKILLS":** Evaluation of CBM Reservoirs for developing **Employability Skills** through **Problem Solving** methodologies. This is attained through assessment component mentioned in course plan.

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| **Catalogue prepared by:** | Dr. Suman Paul, Dr. Rohit Kumar Saw, Dr. Amolina Doley |
| **Recommended by the Board of Studies on:** | 18th Meeting of the Board of Studies held on 4th July, 2024 |
| **Date of Approval by the Academic Council:** | 24th Meeting of the Academic Council held on 3rd August, 2024 |

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|---|---|---|---|---|---|---|---|
| **Course Code:** PET2016 | **Course Title:** Shale Gas<br>**Type of Course:** 1] Discipline Elective Course<br>2] Theory only | | | **L-T-P-C** | 3 | 0 | 0 | 3 |
| **Version No.:** | 2.0 | | | | | | |
| **Course Pre-requisites:** | NIL | | | | | | |
| **Anti-requisites:** | NIL | | | | | | |
| **Course Description:** | This conceptual course is designed so that students will be able to understand the requirement for exploring unconventional energy resources that are trapped beneath the Earth's surface. A few practical approaches for solving a variety of problems common to shale gas reservoir analysis and development will be discussed through case studies. Shale gas is seen as a major game changer for the global petroleum industry. The processes involved in optimizing the shale gas recovery and economics of existing shale gas operations and more effectively evaluating the potential of shale gas prospects will be discussed. A structured approach would be taken to engage, relate and contextualize the fundamentals of shale gas projects. The understanding level will be enhanced through the assignments. | | | | | | |
| **Course Objective:** | The objective of the course is to familiarize the learners with the concepts of Shale Gas and attain **Employability Skills** through **Participative Learning** techniques. | | | | | | |
| **Course Outcomes:** | Upon successful completion of the course the students shall be able to:<br>CO1: discuss the properties of shale and the environments of shale deposition,<br>CO2: explain the importance of studying the geomechanical properties of shale gas reservoirs,<br>CO3: demonstrate the critical factors that influence the shale gas exploration technique, and<br>CO4: illustrate the environmental concerns of shale gas production. | | | | | | |
| **Course Content:** | | | | | | | |
| **Module 1:** | Shale as a Reservoir and Shale Gas | Quiz / Team Exercise | Data Collection and Presentation | 08 Periods | | | |
| **Topics:**<br>Shale as a Reservoir: Introduction, Shale Composition, Environments of Shale Deposition, Physical Properties of Shale, Deposition and Diagenesis.<br>Shale Gas: Introduction, Geochemistry of Shale Gas, Organic Matter in Gas Shales, Basin Structure, Tectonics, and Stratigraphy. | | | | | | | |
| **Module 2:** | Geomechanics of Gas Shales | Quiz / Team Activity | Digital Poster Presentation | 08 Periods | | | |
| **Topics:**<br>Geomechanics of Gas Shales: Introduction, Mechanical Properties of Gas Shale Reservoirs, Anisotropy, Wellbore Instability in Gas Shale Reservoirs. | | | | | | | |
| **Module 3:** | Shale Gas Exploration Technique and Hydraulic Fracturing | Quiz / Team Exercise | Data Analysis | 09 Periods | | | |
| **Topics:**<br>Shale Gas Exploration Technique: Introduction, Shallow Seismic, Geochemical Exploration, Petrophysics.<br>Hydraulic Fracturing: Introduction, Hydraulic Fracturing, Hazards, Fracturing Fluids, Water Management, Transportation, Fluid Disposal, Risks in Hydraulic Fracturing, Induced Earthquakes, Hazard Management, Waste Water Disposal. | | | | | | | |
| **Module 4:** | Environmental Concerns of Shale Gas Production | Quiz / Team Activity | Literature Survey and Report Submission | 11 Periods | | | |
| **Topics:**<br>Environmental Concerns of Shale Gas Production: Introduction, Induced Seismicity, Groundwater Contamination, Atmospheric Emissions, Shale Gas Exploitation and Health Hazard, Impact on Water and Environment, Noise Pollution, Environmental Impact of Blowout, Guidelines for Shale Gas Development, Site Disposal after the Completion of Shale Gas Exploitation, Regulations for Shale Gas Exploration and Exploitation. | | | | | | | |
| **Targeted Applications and Tools that can be used:**<br>**Applications:** Shale Gas Exploration, Development, and Production Engineer in Oil and Gas Company<br>**Tools:** Data Analysis using MS Excel | | | | | | | |
| **Text Book:**<br>T1: Reza Rezaee, 2015. "Fundamentals of Shale Gas Reservoirs", John Wiley & Sons, Inc., Hoboken, New Jersey. | | | | | | | |

T2: Dayal, A.M., Kalpana, M.S., Mani, D., Patil, D.J., Vadapalli, U., Varma, A.K., and Vedanti, N., 2017. "Shale Gas Exploration and Environmental and Economic Impacts", Elsevier.

T3: Jebraeel Gholinezhad, John Senam Fianu, Mohamed Galal Hassan, 2018. "Challenges in Modelling and Simulation of Shale Gas Reservoirs", Springer.

**References:**

R1: James G. Speight, 2017. "Deep Shale Oil and Gas", Gulf Professional Publishing, Elsevier.

R2: Sohrab Zendehboud, and Alireza Bahadori, 2017. "Shale Oil and Gas Handbook - Theory, Technologies, and Challenges", Gulf Professional Publishing, Elsevier.

R3: José A. Torres, and Hector Klie, 2020. "Shale Oil and Shale Gas Resources" Multidisciplinary Digital Publishing Institute.

**e-resources:**

1. Link for PU Knimbus e-resources: https: / / presiuniv.knimbus.com / user# / home
2. What is Shale Gas? (YouTube Video): https: / / www.youtube.com / watch?v=1lHC74fCyeI
3. Shale Gas Risk or Opportunity? (YouTube Video): https: / / www.youtube.com / watch?v=Ag9GUogWEa0
4. Shale Gas – Hydraulic Fracturing (YouTube Video): https: / / www.youtube.com / watch?v=CM8Lh7SAm6A
5. Impact of Shale Gas and Shale Oil Extraction on the Environment and on Human Health (Workshop): https: / / www.europarl.europa.eu / document / activities / cont / 201312 / 20131205ATT75545 / 20131205ATT75545EN.pdf
6. Shale Energy Engineering 2014: Technical Challenges, Environmental Issues, and Public Policy (Proceedings): https: / / ascelibrary.org / doi / book / 10.1061 / 9780784413654

**Skill Sets:** Topics relevant to **"EMPLOYABILITY SKILLS":** Shale Gas Exploration Technique for developing **Employability Skills** through **Participative Learning** techniques. This is attained through assessment component mentioned in course plan.

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| **Catalogue prepared by:** | Dr. Suman Paul, Dr. Deepjyoti Mech, and Dr. Kalpajit Hazarika |
| **Recommended by the Board of Studies on:** | 14th Meeting of the Board of Studies held on 27th July 2022 |
| **Date of Approval by the Academic Council:** | 18th Meeting of the Academic Council held on 3rd August 2022 |

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|---|---|---|---|---|---|---|
| **Course Code:** PET2017 | **Course Title:** Natural Gas Hydrates<br>**Type of Course:** 1] Discipline Elective Course<br>2] Theory only | | **L-T-P-C** | 3 | 0 | 0 | 3 |
| **Version No.:** | 2.0 | | | | | |
| **Course Pre-requisites:** | NIL | | | | | |
| **Anti-requisites:** | NIL | | | | | |
| **Course Description:** | The purpose of the course is to understand about the importance of one of the upcoming natural energy resources, i.e., gas hydrates. This gas hydrate is widely spread throughout the world. It is estimated that the methane gas from the hydrate reservoirs can efficiently fulfil the world's energy demand for more than 200 years. The course is to enable the students to appreciate the need for understanding the extraction of natural gas hydrates reservoirs and utilization of this method for other applications. The course is conceptual and analytical in nature and needs fair knowledge of basic engineering science and computing. The course develops the critical and analytical thinking skills. The course also enhances the programming abilities through assessments. | | | | | | |
| **Course Objective:** | The objective of the course is to familiarize the learners with the concepts of Natural Gas Hydrates and attain **Employability** through **Problem Solving** methodologies. | | | | | | |
| **Course Outcomes:** | On successful completion of the course the students shall be able to:<br>CO1: state the importance and scope of gas hydrates<br>CO2: discuss the significance of thermodynamic studies for gas hydrates<br>CO3: describe the significance of kinetic studies for gas hydrates<br>CO4: explain the utility of gas hydrates for different applications | | | | | | |
| **Course Content:** | | | | | | | |
| **Module 1:** | Overview and Prospect of Gas Hydrates | Assessment 1: Assignment / Quiz | Data Collection | 06 Periods | | | |
| **Topics:**<br>Properties of Natural Gases, Hydrates as a Laboratory Curiosity, Hydrates in the Natural Gas Industry, Hydrates as an Energy Resource, Environmental Aspects of Hydrates, Safety Aspects of Hydrates. | | | | | | | |
| **Module 2:** | Thermodynamics of Gas Hydrates | Assessment 2: Assignment / Quiz | Slide Designing and Presentation | 07 Periods | | | |
| **Topics:**<br>Hydrate Nucleation, Growth and Dissociation, Estimation Techniques for Phase Equilibria of Natural Gas Hydrates, Statistical Thermodynamic Approach to Hydrate Phase Equilibria, Measurement Methods. | | | | | | | |
| **Module 3:** | Kinetics of Gas Hydrates | Assessment 3: Assignment / Quiz | Poster designing | 08 Periods | | | |
| **Topics:**<br>Hydrate Nucleation, Growth and Dissociation, Estimation Techniques for Kinetics of Natural Gas Hydrates, Measurement Methods, Gas equations for Kinetic studies. | | | | | | | |
| **Module 4:** | Gas Hydrates for Flow assurance and other Applications | Assessment 4: Term Paper | Coding | 11 Periods | | | |
| **Topics:**<br>Hydrates as a threat in flowline and storage vessels, Prevention of hydrates, Removal of Hydrate Plugs, Applications towards Gas Transport and Storage, $CO_2$ sequestration and Desalination. | | | | | | | |
| **Targeted Application and Tools that can be used:**<br>**Applications:** Oil and Gas / Energy Industry, Waste Water Treatment Plants, Desalination Plant as a Project Engineer and / or Research Officer.<br>**Tools:** MS Office, CSMGem (Industry used software). | | | | | | | |
| **Text Book:**<br>T1: E.D. Sloan and C.A Koh, Clathrate Hydrates of Natural Gases, 3rd Edition, CRC Press, Taylor and Francis Group, 2008.<br>T2: Makogon, Y.F., Hydrates of Natural Gas, Moscow, Nedra, Izadatelstro, 208 (1974 in Russian). Translated by W.J. Cieslesicz, PennWell Books, Tulsa, Oklahoma, 237 (1981 in English). | | | | | | | |
| **References:**<br>R1: Y Yuguang and L Changling, Natural gas hydrates: Experimental Techniques and their Applications, Springer, 2013.<br>R2: E.D. Sloan et al., Natural Gas Hydrates in Flow Assurance, Elsevier, 2010.<br><br>**e-resources:**<br>1. Presidency University e-resource Remote Access (KNIMBUS) portal through the shared link: | | | | | | | |

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| https: / / presiuniv.knimbus.com / user# / home<br>2. https: / / www.usgs.gov / faqs / what-are-gas-hydrates<br>3. https: / / pemedianetwork.com / petroleum-economist / articles / upstream / 2005 / gas-hydrates-a-nice-idea<br>4. https: / / youtu.be / QEJmhokSmZM<br>5. https: / / youtu.be / dVM_-2hzFrk<br>6. https: / / puniversity.informaticsglobal.com / login | |
| **Skill Sets:** Topics relevant to **"EMPLOYABILITY SKILLS":** Kinetics of Gas Hydrates for developing **Employability Skills** through **Problem Solving** methodologies. This is attained through assessment component mentioned in course plan. | |
| **Catalogue prepared by:** | Dr. Deepjyoti Mech, Dr. Suman Paul, Dr. Kalpajit Hazarika, Mr. Ankur Neog |
| **Recommended by the Board of Studies on:** | 14th Meeting of the Board of Studies held on 27th July 2022 |
| **Date of Approval by the Academic Council:** | 18th Meeting of the Academic Council held on 3rd August 2022 |

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|---|---|---|---|---|---|---|
| **Course Code:** PET3108 | **Course Title:** Geomechanics for Wellbore Stability Analysis<br>**Type of Course:** 1] Discipline Elective Course<br>2] Theory only | | **L-T-P-C** | 2 | 1 | 0 | 3 |
| **Version No.:** | 1.0 | | | | | | |
| **Course Pre-requisites:** | NIL | | | | | | |
| **Anti-requisites:** | NIL | | | | | | |
| **Course Description:** | It is an interdisciplinary course encompasses the fields of rock mechanics, structural geology, earthquake seismology and petroleum engineering to address a wide range of geomechanical problems that arise during the exploitation of oil and gas reservoirs. The purpose of this course is to provide a broad understanding of various geomechanical techniques used in the oil and gas industry. This course is both conceptual and analytical in nature and requires knowledge of basic science and engineering. | | | | | | |
| **Course Objective:** | The objective of the course is to familiarize the learners with the concepts of Geomechanics for Wellbore Stability Analysis and attain **Employability** through **Problem Solving** methodologies. | | | | | | |
| **Course Outcomes:** | On successful completion of the course, the student shall be able to:<br>CO1: Apply basic concepts of reservoir Geomechanics and tectonic stresses responsible for the deformation of Earth's crust,<br>CO2: Illustrate mechanisms of overpressure generation and basic constitutive laws for the deformation of rocks,<br>CO3: Identify various types of rock failure and the importance of fracture pressure estimation,<br>CO4: Compare compressive and tensile failure in vertical wells and wellbore failure in deviated wells,<br>CO5: Demonstrate wellbore stability of penetrating wellbore and stress variations outside of depleting reservoir. | | | | | | |
| **Course Content:** | | | | | | | |
| **Module 1:** | Geomechanics and Tectonic Stress Field | e-resource Review / Report Writing | Writing Communication / Analytical Skills Development | 08 Periods | | | |
| **Topics:**<br>Introduction to Geomechanics: Definition; Fundamentals of Rock Mechanics; Deformation of Rocks; Behaviour of Rocks; Geomechanical Model - Application of Geomechanical Model in Reservoir, Component of a Geomechanical Model, Foundation of the Geomechanical Model, Building a Geomechanical Model.<br>Tectonic Stress Field: Distribution of stress in the Earth's crust. Basic definitions: Anderson's stress classification scheme; Stress orientations near Salt domes; Stress magnitudes at depth – Calculation of overburden stress; Measuring in-situ stress; Stress orientation indicators. | | | | | | | |
| **Module 2:** | Pore Pressure and Basic Constitutive Laws | Quiz / Written Tests | Preparedness for Competitive Exams | 10 Periods | | | |
| **Topics:**<br>Pore Pressure: Basic definitions; Reservoir compartmentalization; Mechanisms of overpressure generation; Estimation of pore pressure at depth.<br>Basic Constitutive Laws: Linear elasticity; Elastic moduli and seismic wave velocity; Elastic anisotropy; Poroelasticity and effective stress; Poroelasticity and dispersion; Viscous deformation in uncemented sands; Thermoporoelasticity. | | | | | | | |
| **Module 3:** | Rock Failure and Faults / Fractures at Depth | Case Study Presentation | Verbal Communication Skill Development | 10 Periods | | | |
| **Topics:**<br>Rock Failure: Rock strength in compression; Strength and pore pressure; Rock strength anisotropy; Estimation of rock strength form geophysical data; Shear-enhanced compaction; Tensile rock failure; Shear failure and the frictional strength of rocks.<br>Faults / Fractures at Depth : Faults, fractures and fluid flow; Wellbore imaging; Representation of fault and fracture data; Three-dimensional Mohr diagrams; Earthquake focal mechanisms; Fracture pressure – Estimation of fracture gradient; Case study. | | | | | | | |
| **Module 4:** | Failures in Vertical Wells and Deviated Wells | Poster Designing and Presentation | Verbal Communication Skill Development | 06 Periods | | | |
| **Topics:**<br>Compressive and Tensile Failures in Vertical Wells: Stress concentration around a cylindrical hole and wellbore failure. | | | | | | | |

<table>
<tr><td colspan="5">Wellbore Failure and Stress Determination in Deviated Wells: State of stress surrounding an arbitrarily deviated well; Failure of arbitrarily deviated wells.</td></tr>
<tr><td>Module 5:</td><td>Wellbore Stability and Effects of Reservoir Depletion</td><td>Group Discussion</td><td>Analytical and Verbal Communication Skill Development</td><td>06 Periods</td></tr>
<tr><td colspan="5">Topics:<br>Wellbore Stability: Preventing wellbore instability during drilling; Quantitative risk assessment; Role of rock strength anisotropy; Mud / Rock interaction; Maximizing the frac gradient; Mud penetration and time-dependent wellbore failure, Preventing sand production.<br>Effects of Reservoir Depletion: Stress changes in depleting reservoirs; Deformation of depleting reservoirs; Deformation and stress changes outside of depleting reservoirs.</td></tr>
<tr><td colspan="5">Targeted Application and Tools that can be used:<br>Applications: Geomechanical Engineer at Oil & Gas industry.<br>Tools: Microsoft Excel and other Data Analysis Tools</td></tr>
<tr><td colspan="5">Text Book:<br>T1: Mark D. Zoback, Reservoir Geomechanics, Cambridge University Press, 2010.<br>T2: J.C. Jaeger, N.G.W. Cook and R.W. Zimmerman, Fundamentals of Rock Mechanics, 4th Edition, Blackwell Publishing, 2007.</td></tr>
<tr><td colspan="5">References:<br>R1: Mark D. Zoback, and Arjun H. Kohli, Unconventional Reservoir Geomechanics – Shale Gas, Tight Gas, and Induced Seismicity, Cambridge University Press, 2019.<br>R2: C. David, and M. Le Ravalec-Dupin, Rock Physics and Geomechanics in the Study of Reservoirs and Repositories, Geological Society, Special Publication 284, 2007.<br><br>e-resources:<br>1. Link for e-resources: https: / / www.google.co.in /<br>2. Geomechanical Case Study (You Tube Video): https: / / www.youtube.com / watch?v=E1q15O4kOLk<br>3. Measuring and Estimating Pore Pressure (You Tube Video): https: / / www.youtube.com / watch?v=H6dvYn_HDrk</td></tr>
<tr><td colspan="5">Skill Sets: Topics relevant to “EMPLOYABILITY SKILLS”: Topics such as Calculation of Overburden Stress, Estimation of Pore Pressure at Depth, Estimation of Rock Strength from Geophysical Data, State of Stress surrounding a Wellbore, and Quantitative Risk Assessment will be discussed for developing Employability Skills through Problem Solving methodologies. This is attained through assessment component mentioned in course plan.</td></tr>
<tr><td colspan="2">Catalogue prepared by:</td><td colspan="3">Dr. Suman Paul, Dr. Deepjyoti Mech</td></tr>
<tr><td colspan="2">Recommended by the Board of Studies on:</td><td colspan="3">18th Meeting of the Board of Studies held on 4th July, 2024</td></tr>
<tr><td colspan="2">Date of Approval by the Academic Council:</td><td colspan="3">24th Meeting of the Academic Council held on 3rd August, 2024</td></tr>
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|---|---|---|---|---|---|---|---|
| **Course Code:** PET3002 | **Course Title:** Directional Drilling Technology<br>**Type of Course:** 1] Discipline Elective Course<br>2] Theory Only | | | **L-T-P-C** | 3 | 0 | 0 | 3 |
| **Version No.:** | 1.0 | | | | | | |
| **Course Pre-requisites:** | Nil | | | | | | |
| **Anti-requisites:** | Nil | | | | | | |
| **Course Description:** | The course helps to understand the advance drilling techniques like directional drilling, slant hole drilling, their design procedures for different types of well profiles. The course is both conceptual and analytical in nature and needs fair knowledge of Mathematical and computing. The course develops the critical thinking and analytical skills. The course also enhances the programming abilities through assignments. | | | | | | |
| **Course Objective** | The objective of the course is to familiarize the learners with the concepts of Directional Drilling Technology and attain **Employability** through **Problem Solving** methodologies | | | | | | |
| **Course Outcomes:** | On successful completion of the course the students shall be able to:<br>CO1: explain directional drilling, its applications and deflection tools,<br>CO2: sketch the different directional well profiles,<br>CO3: discuss techniques used in directional drilling,<br>CO4: describe the recent advances in directional well technologies as well as the associated problems. | | | | | | |
| **Course Content:** | | | | | | | |
| **Module 1:** | Introduction and Deflection Tools and Techniques | Assignment / Quiz | Seminar | 10 Periods | | | |
| **Topics:**<br>Introduction, Applications, Coordinates Systems, Map Projections, Geographic North, Grid North, Magnetic North, Magnetic Declination, Azimuth, Well Coordinates, Slots, Targets, Inclination angle, Measured Depth, TVD, KOP, Rotary assembly, Deflection tools, Positive Displacement Motor and TurboDrill | | | | | | | |
| **Module 2:** | Directional Well planning and Directional Survey Calculations | Project | Programming | 10 Periods | | | |
| **Topics:**<br>General consideration, Types of well profile-Type 1, Type 2 and Type 3, Survey calculation techniques- Tangential method, Balance tangential method, Average angle method, Radius of curvature method, Minimum curvature method. | | | | | | | |
| **Module 3:** | Directional Survey Tools | Assignment / Quiz | Programming | 10 Periods | | | |
| **Topics:**<br>Dog leg angle, Acid bottle, Photo chemical devices, Steering tools, Solid state directional sensors, Rate Gyros, GCT, MWD, Telemetry channels, Transmission system, Power sources, MWD sensors, Surface system, Drilling with MWD, Applications | | | | | | | |
| **Module 4:** | Problem in Directional wells and Recent Advances | Case Study | Literature Survey | 10 Periods | | | |
| **Topics:**<br>Control over borehole geometry, Dog leg severity, Key seating, Wellbore instability, Differential sticking, Freeing stuck pipe, Backing off the drill string, Oil well fishing operation, Sidetracking.<br>Highly deviated and Horizontal wells, Extended reach drilling Slant hole drilling, Plasma drilling, Laser Drilling | | | | | | | |
| **Targeted Application and Tools that can be used:**<br>**Applications:** Directional drilling companies as a driller<br>**Tools:** Landmark drill works, Petrel | | | | | | | |
| **Text Book:**<br>T1: Tom Inglis, "Directional Drilling", 1st Edition, 1987, Springer Netherlands.<br>T2: H. Rabia, Graham and Trotman, "Oil Well Drilling Engineering: Principles and Practice", 1st Edition, 1986, Springer. | | | | | | | |
| **References:**<br>R1: Hussain Rabia, "Well engineering and construction",1998, 1st Edition, Entrac Consulting Ltf. London.<br>R2: Miska, S., 2011. Directional drilling. Fundamentals of Drilling Engineering, pp.449-583. | | | | | | | |

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| **e-resources:**<br>1. Presidency University e-access portal: https: / / presiuniv.knimbus.com / user# / home<br>2. Dr. Petro YouTube channel: Drilling Rig Components Animated- https: / / youtu.be / JjGXsLWcwI0<br>3. Drilling Rig Online Courses YouTube channel: Drill String components and their functions- https: / / youtu.be / M6tic_OcNPY<br>4. Encyclopedia of petrochemistry YouTube channel: Casing and Cementing- https: / / youtu.be / iMUsMOopwpU<br>5. Harvest Chemical YouTube channel: Bit Hydraulics-https: / / youtu.be / I178EdbDV_Y<br>6. Case Studies: Best Practice Case Studies for Drilling Engineers: https: / / www.drillingpoint.com /<br>7. Robert F. Mitchell, "Fundamentals of Drilling Engineering", 1st Edition, 2016, Society of Petroleum Engineers, Inc. https: / / www.amazon.in / Fundamentals-Drilling-Engineering-Robert-Mitchell-ebook / dp / B01L0O8WJA<br>8. Directional Drilling https: / / www.youtube.com / watch?v=HOvmZ4rW7Hc<br>9. Directional Drilling [Montana Tech] https: / / www.youtube.com / watch?v=yYdsVrm9FEk<br>10.Introduction to Directional Drilling [By Ahmed Osman] https: / / www.youtube.com / watch?v=pensrhsGNac<br>11.Webinar on Directional Drilling Practices & Application by Nitin Kulkarni https: / / www.youtube.com / watch?v=1DQMecBnVdc | |
| **Skill Sets:** Topics relevant to **"EMPLOYABILITY SKILLS":** Problem and Recent Advances in Directional wells for developing **Employability Skills** through **Problem Solving** methodologies. This is attained through assessment component mentioned in course plan | |
| **Catalogue prepared by:** | Dr. Kalpajit Hazarika, Dr. Deepjyoti Mech, Mr. Bhairab Jyoti Gogoi, Mr. Anmol Bhargava, Mr. Sugat Srivastava |
| **Recommended by the Board of Studies on:** | 11th Meeting of the Board of Studies held on 5th Sept, 2020 |
| **Date of Approval by the Academic Council:** | 13th Meeting of the Academic Council held on 6th Nov 2020 |

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|---|---|---|---|---|---|---|---|
| **Course Code:** PET3004 | **Course Title: Advanced Well Engineering**<br>**Type of Course: 1] Discipline Elective Course**<br>**2] Theory Only** | | | **L-T-P-C** | 3 | 0 | 0 | 3 |
| **Version No.:** | 1.0 | | | | | | |
| **Course Pre-requisites:** | NIL | | | | | | |
| **Anti-requisites:** | NIL | | | | | | |
| **Course Description:** | The goal of the course is to provide an insight into the planning and execution of a modern drilling operation This course gives an overview of the well construction process to design surface and subsurface component during drilling operation as per the requirement. Through conceptual and detailed engineering design calculations involved in planning a well, an attempt has been made to develop analytical skills. | | | | | | |
| **Course Objective** | This course is designed to improve the learners' **Employability Skills Development** by using **Problem Solving** methodologies. | | | | | | |
| **Course Outcomes:** | On successful completion of the course the students shall be able to:<br>CO1: practice engineering design calculations involved in planning a well,<br>CO2: summarize well control equipment and well control methods,<br>CO3: discuss about the drilling fluid system, practical rig hydraulics,<br>CO4: outline well costing methods. | | | | | | |
| **Course Content:** | | | | | | | |
| **Module 1:** | Overview of Drilling Operations | Assignment, Quiz | Programming | 10 Periods | | | |
| **Topics:**<br>Exploration & production licenses, Drilling personnel and Rotary drilling equipment, the drilling process onshore and offshore, Drilling economics, Rig Components, The Drill string, Design of the drill string, Drilling Bits, Design of PDC and Roller Cone Bits, selection of bits, grading of dull bits, assessing and improving the performance of drill bits. | | | | | | | |
| **Module 2:** | Formation Pressures & Well Control | Case study, Assignment | Programming, Data collection | 10 Periods | | | |
| **Topics:**<br>Introduction to origin and representation of pore pressures and fracture pressures, Origin, prediction and detection of abnormal pressures, Drilling problems associated with abnormal pressures, Prediction and confirmation of formation fracture pressures, Principles of primary & secondary well control, Warning signs of kicks, Well killing procedures, BOP equipment and BOP stack arrangements. | | | | | | | |
| **Module 3:** | Casing Design principles | Assignment | Programming | 10 Periods | | | |
| **Topics:**<br>Data Collection, Factors Influencing Casing Design, Design Criteria, Collapse Criterion, Burst Criterion, Combination Strings, Tension Criterion, Service Loads During Drilling And Production Operations, Compression Loads, Biaxial Effects. | | | | | | | |
| **Module 4:** | Well costing | Assignment and Case study | Programming | 10 Periods | | | |
| **Topics:**<br>Reasons For Costing, Factors Affecting Well Costs, Drilling Time Estimate, Detailed Time Estimate, Elements of Well Costing, Total Well Costs, Non Productive Time (NPT), Risk Assessment In Drilling Cost Calculations, Technical Limit Drilling, Cost Reduction, Drilling Contracting Strategies. | | | | | | | |
| **Targeted Application and Tools that can be used:**<br>**Applications:** Well design calculation required for well planning, GTO Preparation.<br>**Tools:** MS Excel, Halliburton Software Pacakge | | | | | | | |
| **Text Book:**<br>T1: Hussain Rabia, "Well engineering and construction", 2001, Entrac Consulting.<br>T2: T2. Rabia, H., 1985. Oil Well Drilling Engineering: Principleand Practice. *Graham and Trotman Inc., Gaihersburg, USA*. | | | | | | | |
| **References:**<br>R1: V.K.Jain, "Drilling operation practices manual", Institute of Drilling Technology, 2007, oil and Natural Gas Corporation Ltd.<br>**e-resources:**<br>1. E- remote acess portal: https: / / presiuniv.knimbus.com / user# / home | | | | | | | |

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| 2. BHA Design, https: / / youtu.be / z7nKncXNTJI<br>3. Drilling Assembly BHA Design, https: / / youtu.be / czyc2SU4734<br>4. Overburden, Pore Pressure and Fracture Pressure Overview, https: / / youtu.be / QmgFxC6HnZE<br>5. Workshop on Drilling Optimization in Oil and Gas Industry: https: / / www.youtube.com / watch?v=2Ia5H_fEQQ0 | |
| **Skill Sets:** Topics relevant to **"EMPLOYABILITY SKILLS":** Well Costing methods for developing **Employability Skills** through **Problem Solving** methodologies. This is attained through assessment component mentioned in course plan. | |
| **Catalogue prepared by:** | Dr. Kalpajit Hazarika, Mr. Bhairab Jyoti Gogoi, Mr. Anmol Bhargava, Mr. Sugar Srivastava |
| **Recommended by the Board of Studies on:** | 11th Meeting of the Board of Studies held on 5th Sept, 2020 |
| **Date of Approval by the Academic Council:** | 13th Meeting of the Academic Council held on 6th Nov 2020 |

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|---|---|---|---|---|---|---|
| **Course Code:** PET3111 | **Course Title: Multilateral and Horizontal Well Technology**<br>**Type of Course: 1] Discipline Elective Course**<br>**2] Theory Only** | | **L-T-P-C** | 3 | 0 | 0 | 3 |
| **Version No.:** | 1.0 | | | | | |
| **Course Pre-requisites:** | NIL | | | | | |
| **Anti-requisites:** | NIL | | | | | |
| **Course Description:** | This course is designed with the aim of familiarize with the latest advancements in drilling technologies such as Horizontal, Multilateral and Extended Reach Drilling. The course gives a comprehensive account of the methodology, processes and techniques utilized while Drilling a Horizontal, Multilateral and Extended Reach Drilling. A comprehensive hands-on case study provided to the participants with enable the students to develop their computational ability. | | | | | |
| **Course Objectives:** | The objective of the course is to familiarize the learners with the concepts of Multilateral and Horizontal Well Technology and attain **Employability** through **Problem Solving** methodologies. | | | | | |
| **Course Outcomes:** | On successful completion of the course the students shall be able to:<br>CO1: Evaluate the advantages of new drilling technologies like horizontal drilling and Extended Reached Drilling,<br>CO2: Evaluate the application of horizontal wells in oil and gas industry,<br>CO3: Analyze the importance of formation evaluation techniques in horizontal wellbores,<br>CO4: Examine the production performance of horizontal wells. | | | | | |
| **Course Content:** | | | | | | |
| **Module 1:** | Advanced Drilling Technologies | Quiz and Assignment | Poster Making | 11 Periods | | |
| **Topics:**<br>Introduction and Objectives of Horizontal wells, Extended Reach Drilling (ERD), Multilateral Drilling and Side tracking, Managed Pressure Drilling (MPD) and Managed Pressure Cementation (MPC). | | | | | | |
| **Module 2:** | Applications of Horizontal Wells | Assignment | Programming | 10 Periods | | |
| **Topics:**<br>Geological aspects and development of oil and gas field using horizontal wells, Drilling and completion of Horizontal wells, Reservoir engineering concepts of horizontal wells. | | | | | | |
| **Module 3:** | Formation Evaluation in Horizontal Wells | Case Study | Type Curve Matching | 09 Periods | | |
| **Topics:**<br>Different Logging Tools, Well Logging methods in Horizontal wells, Basics of Well Testing method, Well Test Analysis of Horizontal wells, Logging While Drilling (LWD) Tools | | | | | | |
| **Module 4:** | Horizontal Wellbore Productivity | Assignment / Quiz | Data Collection and Group Discussion | 10 Periods | | |
| **Topics:**<br>IPR and TPR graphs, Well Performance and Productivity of Horizontal wells, Water and Gas conning in Horizontal wells, Application of Horizontal wells in gas reservoirs and in recovery of heavy oils | | | | | | |
| **Targeted Application and Tools that can be used:**<br>**Applications:** Drilling Engineer / Driller in Drilling companies<br>**Tools:** Engineer's Desktop (Landmark Halliburton), Petrel | | | | | | |
| **Text Book:**<br>T1 Drilling Engineering Workbook by Baker Hughes INTEQ, December 1995<br>T2 Sada Joshi , Horizontal Well Technology Hardcover – 1 January 1991 | | | | | | |
| **References:**<br>R1. Drilling and well completions by carl Gartin, Department of Petroleum Engineering, The University of Texas, Hughes<br>R2. Surface Logging Systems Training Guide, Baker Hughes INTEQ, July 1996.<br><br>**e-resources:**<br>1. Presidency University e-resource Remote Access (KNIMBUS) portal through the shared link: https: / / presiuniv.knimbus.com / user# / home<br>2. Shadizadeh, Seyed Reza & Kargarpour, Mohammadali & Zoveidavianpoor, Mansoor. (2011). Modeling of Inflow Well Performance of Multilateral Wells: Employing the Concept of Well Interference and the Joshi's Expression. Iranian Journal of Chemistry and Chemical Engineering. 30. 119-133. | | | | | | |

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| 3. Zhang Yanping, Ren Rongquan, Wang Hui, Wang Jun, Multilateral drilling & completion technology based on Solid Expandable Tubular fixing system, Petroleum Exploration and Development, Volume 36, Issue 6, 2009,Pages 768-775, ISSN 1876-3804, https: / / doi.org / 10.1016 / S1876-3804(10)60008-0 | |
| **Skill Sets:** Topics relevant to **"EMPLOYABILITY SKILLS":** Horizontal Wellbore Productivity for developing **Employability Skills** through **Problem Solving** methodologies. This is attained through assessment component mentioned in course plan. | |
| **Catalogue prepared by:** | Dr. Suman Paul, Dr. Deepjyoti Mech, Dr. Rohit Kumar Saw, Mr. Bhairab Jyoti Gogoi |
| **Recommended by the Board of Studies on:** | 18th Meeting of the Board of Studies held on 4th July, 2024 |
| **Date of Approval by the Academic Council:** | 24th Meeting of the Academic Council held on 3rd August, 2024 |

## Specialization Basket 3: Reservoir and Production Engineering Basket

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|---|---|---|---|---|---|---|
| **Course Code:** PET3112 | **Course Title:** Integrated Field Development and Planning<br>**Type of Course:** 1] Discipline Elective Course<br>2] Theory Only | **L-T-P-C** | 3 | 0 | 0 | 3 |
| **Version No.:** | 1.0 | | | | | |
| **Course Pre-requisites:** | NIL | | | | | |
| **Anti-requisites:** | NIL | | | | | |
| **Course Description:** | This course is designed with the aim of developing a decision-making ability as a Reservoir Engineer. The course gives a comprehensive account of the methodology, processes and techniques utilized in developing an oil or gas field. A comprehensive hand on case study provides practical exposure to the issues discussed and group study sessions helps to develop the planning and organization skills. | | | | | |
| **Course Objectives:** | The objective of the course is to familiarize the learners with the concepts of Integrated Field Development and Planning and attain **Employability** through **Problem Solving** methodologies. | | | | | |
| **Course Outcomes:** | On successful completion of the course the students shall be able to:<br>CO1: Discuss decision making process of field development projects and related economic criteria,<br>CO2: Describe main reservoirs monitoring techniques allowing to apply IOR / EOR methods and increase recovery,<br>CO3: Dramatize the main concepts of risks and uncertainties and their integration into reserves evaluation,<br>CO4: Apply the main concepts of Reservoir Management, process and economics. | | | | | |
| **Course Content:** | | | | | | |
| **Module 1:** | Introduction to Field Development | Assignment | Decision Tree Analysis | 10 Periods | | |
| **Topics:**<br>The field cycle: Exploration Phase, Appraisal Phase, Development Planning, Production Phase, Decommissioning, Hydrocarbon Accumulations, Exploration Methods and Techniques, and PVT analysis, Pressure - depth relationships, Data Gathering, Classification of methods, Coring and core analysis, Wire line logging, Petroleum Agreements and Bidding | | | | | | |
| **Module 2:** | Field Appraisal and Study of Well Dynamic Behavior | Quiz and Assignment | Simulation | 10 Periods | | |
| **Topics:**<br>The role of appraisal in the field life cycle, objective of performing appraisal activities, Identifying and quantifying sources of uncertainty, Appraisal tools, Cost-benefit calculations for appraisal Practical aspects of appraisal, Reservoir dynamic behavior and Well dynamic behavior: The driving force for production, Reservoir drive mechanisms, Gas reservoirs, Major differences between oil and gas field development, Estimating the number of development wells, Fluid flow near the wellbore, Horizontal wells, Production testing and bottom hole pressure testing, Tubing performance, Well completions. | | | | | | |
| **Module 3:** | Production Operations and Management of Producing Field | Assignment | Programming | 08 Periods | | |
| **Topics:**<br>Operating and Maintenance Objectives, Production Operations input to the FDP, Maintenance engineering input to the FDP, Managing the producing field: Managing the reservoir: Managing the Surface Facilities: Decommissioning: Legislation, Economic lifetime, decommissioning funding, Decommissioning methods, Phasing and organization, planning and control, Safety and Environment: Safety management system, current environmental concern. | | | | | | |
| **Module 4:** | Introduction to Reservoir Management, Process and Economics | Case Study | Data Collection | 12 Periods | | |
| **Topics:**<br>Definition, Scope, History, Integration Geoscience and Engineering, Integration of Exploration and Development, Goal setting, Developing plan, Economics, Surveillance and Monitoring, Evaluation, Data acquisition, Analysis and management, Economic criteria, Scenario, Data, Economic evaluation, Risk management and Uncertainties. Case studies on reservoir management. Reservoir management plans: Newly operated Field, secondary and EOR operated field. | | | | | | |
| **Targeted Application and Tools that can be used:**<br>**Applications:** Oil and Gas Fields Development | | | | | | |

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| **Tools:** MS Excel, Halliburton Software Package | |
| **Text Book:**<br>T1. Abdus Satter and Ganesh C. Thakur, "Integrated Reservoir management", PennwellBooks<br>T2. Frank Jahn, Mark Cook and Mark Graham," Hydrocarbon exploration and Production"<br>T3. "Introduction to fundamentals of reservoir engineering" L.P. Dake | |
| **References:**<br>R1 Tarek Ahmed and D. Nathan Meehan, "Advanced Reservoir Management and Engineering", Baker Hughes<br>R2 Pathak, A. (2021). Petroleum Reservoir Management (1st ed.). CRC Press. Retrieved from https: / / www.perlego.com / book / 2555058 / petroleum-reservoir-management-considerations-and-practices-pdf<br><br>**e-resources:**<br>1. E- remote access portal: https: / / presiuniv.knimbus.com / user# / home<br>2. Integrated Reservoir management: https: / / www.youtube.com / watch?v=e3b0ttaEzZI<br>3. Webinar: Reservoir Management Part 1: https: / / www.youtube.com / watch?v=yiSSHmlg8l4<br>4. Webinar: Reservoir Management Part 2: https: / / www.youtube.com / watch?v=9yiNIJkr-WA | |
| **Skill Sets:** Topics relevant to **"EMPLOYABILITY SKILLS":** Field Development and study of Well dynamic behavior for developing **Employability Skills** through **Problem Solving** methodologies. This is attained through assessment component mentioned in course plan. | |
| **Catalogue prepared by:** | Dr. Suman Paul, Dr. Deepjyoti Mech, Dr. Rohit Kumar Saw, Mr. Bhairab Jyoti Gogoi |
| **Recommended by the Board of Studies on:** | 18th Meeting of the Board of Studies held on 4th July, 2024 |
| **Date of Approval by the Academic Council:** | 24th Meeting of the Academic Council held on 3rd August, 2024 |

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|---|---|---|---|---|---|---|---|
| **Course Code:** PET3113 | **Course Title:** Process Design and Calculations<br>**Type of Course:** 1] Discipline Elective Course<br>2] Theory Only | | | **L-T-P-C** | 3 | 0 | 0 | 3 |
| **Version No.:** | 1.0 | | | | | | |
| **Course Pre-requisites:** | NIL | | | | | | |
| **Anti-requisites:** | NIL | | | | | | |
| **Course Description:** | The purpose of this course is to enable the student to understand the basics of Engineering calculations, Stoichiometry and Material and Energy Balance. They will learn definition and estimation of properties of process materials and engineering approach to problem solving using material and energy balance equations. The course is both conceptual and analytical in nature and needs fair knowledge of Mathematics. The course develops the critical thinking and analytical skills. | | | | | | |
| **Course Objective:** | The objective of the course is to familiarize the learners with the concepts of Process Design and Calculations and attain **Employability** through **Problem Solving** methodologies. | | | | | | |
| **Course Outcomes:** | On successful completion of the course the students shall be able to:<br>CO1: describe the different stoichiometric relationship,<br>CO2: define the different gas properties,<br>CO3: apply the material balance in different process calculation,<br>CO4: classify the different types of fuel combustion. | | | | | | |
| **Course Content:** | | | | | | | |
| **Module 1:** | Stoichiometry | Assignment | Data Collection | 10 Periods | | | |
| **Topics:**<br>Stoichiometric & Composition relations: Stoichiometric relation, basis of calculations, methods of expressing compositions of mixtures and solutions, density and specific gravity, Baume and API gravity scales. Behavior of Ideal gases: Kinetic theory of gases, application of ideal gas law, gaseous mixtures, gases in chemical reactions. | | | | | | | |
| **Module 2:** | Basic chemical calculations | Assignment | Data Collection | 11 Periods | | | |
| **Topics:**<br>Vapor pressure: Liquefaction and liquid state, vaporization, boiling point, effect of temperature on vapor pressure, Antoine equation, vapor pressure plots, estimation of critical properties, vapor pressure of immiscible liquids and ideal solutions, Raoult's law, Non-volatile solutes.<br>Humidity and Saturation: Partial saturation, Humidity- Absolute Humidity, Vaporization process, Molal humidity, Relative and percentage saturation, dew point, humid heat, wet bulb and dry bulb temperatures, use of humidity charts, adiabatic vaporization. | | | | | | | |
| **Module 3:** | Material balance without chemical reactions | Poster Presentation | Programming | 12 Periods | | | |
| **Topics:**<br>Process flowsheet, Degree of freedom, Material balance with and without recycle; Bypass and purge streams, Material balance around equipments related to unit operations like absorber and stripper, distillation towers, extractors, dryers, evaporators, etc. Material balance of unsteady state operations. | | | | | | | |
| **Module 4:** | Fuels and Combustions | Assignment | Data Collection | 07 Periods | | | |
| **Topics:**<br>Combustion Calculations: Introduction, fuels, calorific value of fuels, coal, liquid fuels, gaseous fuels, air requirement and flue gases, combustion calculations, incomplete combustion, material and energy balances, thermal efficiency calculations. Problems on combustion of coal, liquid fuels, gaseous fuels, etc., Proximate and ultimate analysis, Combustion calculations, theoretical flame temperature, etc., Air requirement and flue gases. | | | | | | | |
| **Targeted Application and Tools that can be used:**<br>**Applications:** Process Engineering Industries in operation such as Distillation column, Solvent Adsorption and extraction and fuel testing services.<br>**Tools:** MS Excel | | | | | | | |
| **Text Book:**<br>T1: Hougen O A, Watson K.M. and Ragatz R.A, "Chemical Process Principles", Part -I: Material and Energy Balance, John Wiley and Sons, New York. | | | | | | | |

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| **References:**<br>R1: D.H. Himmelblau, "Basic Principles and Calculation in Chemical Engineering", PHI.<br>R2: B.I. Bhatt and S.M.Vora, "Stoichiometry", Tata McGraw Hill Publishing Company Ltd. | |
| **Skill Sets:** Topics relevant to development of "**EMPLOYABILITY SKILLS**": Fuels and Combustions for developing **Employability Skills** through **Problem Solving** methodologies. This is attained through assessment component mentioned in course plan. | |
| **Catalogue prepared by:** | Dr. Suman Paul, Dr. Deepjyoti Mech, Dr. Rohit Kumar Saw, Dr. Amolina Doley, Mr. Bhairab Jyoti Gogoi |
| **Recommended by the Board of Studies on:** | 18th Meeting of the Board of Studies held on 4th July, 2024 |
| **Date of Approval by the Academic Council:** | 24th Meeting of the Academic Council held on 3rd August, 2024 |

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| **Course Code:** PET3114 | **Course Title:** Solids Handling in Oil and Gas Industry<br>**Type of Course:** 1] Discipline Elective Course<br>2] Theory Only | | | **L-T-P-C** | 3 | 0 | 0 | 3 |
| **Version No.:** | 1.0 | | | | | | |
| **Course Pre-requisites:** | NIL | | | | | | |
| **Anti-requisites:** | NIL | | | | | | |
| **Course Description:** | The purpose of the course is to enable to appreciate the need for understanding the significance of unit operations in the various industries for proper functioning of the system. The course is conceptual in nature and analytical in nature and needs fair knowledge of basic engineering science and computing. The course develops the critical and analytical thinking skills. The course also enhances the programming abilities through assignments. | | | | | | |
| **Course Objectives** | The objective of the course is to familiarize the learners with the concepts of Solids Handling in Oil and Gas Industry and attain **Employability** through **Problem Solving** methodologies. | | | | | | |
| **Course Outcomes:** | On successful completion of the course the students shall be able to:<br>CO1: state the properties and characteristics of different particulate solids,<br>CO2: identify the different types of transportation modes of handling the solid particulate mass,<br>CO3: discuss different screening equipments, filtration and separation processes for different particulate solids,<br>CO4: explain separation and filtration operations for hydrocarbon components | | | | | | |
| **Course Content:** | | | | | | | |
| **Module 1:** | Properties and Handling of Particulate Solids | Assignment | Data Collection | 08 Periods | | | |
| **Topics:**<br>Handling and mixing of particulate solids: Characterization of solid particles, properties of particulate masses, storage and mixing of solids, types of mixers, mixers for cohesive solids, mixers for free flowing solids. | | | | | | | |
| **Module 2:** | Transportation of solid particulates | Term paper | Data Collection and Analysis | 09 Periods | | | |
| **Topics:**<br>Transportation of solid particulate mass, belt, screw, apron conveyers, bucket elevators pneumatic. | | | | | | | |
| **Module 3:** | Screening and Filtration | Assignment | Programming | 11 Periods | | | |
| **Topics:**<br>Screening, Industrial screening equipment's, Filtration, cake filters, centrifugal filters, Principles of cake filtration. Clarifying filters, liquid clarification, gas cleaning, and principles of clarification, Cross flow filtration. | | | | | | | |
| **Module 4:** | Separations and Distillation | Term paper | Simulation | 10 Periods | | | |
| **Topics:**<br>Separation through gravity settling processes and centrifugal settling processes, Agitation and mixing of liquids: Agitation of liquids. Blending and mixing of liquids, suspension of solid particles, dispersion operations. Distillation and separation of hydrocarbon components. | | | | | | | |
| **Targeted Application and Tools that can be used:**<br>**Applications:** Oil and Gas Industry but the knowledge can be used for other industries such as steel industry, manufacturing industry, etc..<br>**Tools:** ASPEN and UNISIM. | | | | | | | |
| **Text Book:**<br>T1: W.L. Mc Cab and J.C. Smith and Peter Harriott, Unit operations in Chemical Engineering, 5th Edition, Mc Graw Hill, 1993.<br>T2: Unit Operations Handbook Mass Transfer Edited ByJohn J. McKetta, 1st edition, 1976, Taylor & Francis | | | | | | | |
| **Reference Book:**<br>R1: A. Levy, H. KalmanHandbook of Conveying and Handling of Particulate Solids, 1st edition, 2001, Elsevier<br>R2: Don McGlinchey, Bulk Solids Handling: Equipment Selection and Operation, 1st edition, 2008, Wiley<br><br>**e-resources:**<br>1. Link for Knimbus remote login: https: / / presiuniv.knimbus.com<br>2. https: / / www.youtube.com / watch?v=1Rq1F1i7BN4&list=PL18CkeOzU3AIHQBmf7ZpYbjDEa-aVF964 | | | | | | | |

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| 3. https: / / www.youtube.com / watch?v=WX-vJ90rFjQ<br>4. https: / / www.youtube.com / watch?v=iJiQZjVpQmY | |
| **Skill Sets:** Topics relevant to **"EMPLOYABILITY SKILLS":** Screening and Filtration for developing **Employability Skills** through **Problem Solving** methodologies. This is attained through assessment component mentioned in course plan. | |
| **Catalogue prepared by:** | Dr. Suman Paul, Dr. Deepjyoti Mech, Dr. Rohit Kumar Saw, Dr. Amolina Doley, Mr. Bhairab Jyoti Gogoi |
| **Recommended by the Board of Studies on:** | 18th Meeting of the Board of Studies held on 4th July, 2024 |
| **Date of Approval by the Academic Council:** | 24th Meeting of the Academic Council held on 3rd August, 2024 |

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|---|---|---|---|---|---|---|
| **Course Code:** PET3115 | **Course Title:** Design in Production Engineering<br>**Type of Course:** 1] Discipline Elective Course<br>2] Theory Only | | **L-T-P-C** | 3 | 0 | 0 | 3 |
| **Version No.:** | 1.0 | | | | | |
| **Course Pre-requisites:** | NIL | | | | | |
| **Anti-requisites:** | NIL | | | | | |
| **Course Description:** | This course deals with the design basis of petroleum production equipment. The subject will help the students to recognize the basic requirements to design any production equipment. The course is both conceptual and analytical in nature. It develops the mathematical and computing skills in students. The course also enhances the programming abilities through assignment work. | | | | | |
| **Course Objective:** | The objective of the course is to familiarize the learners with the concepts of Design in Production Engineering and attain **Employability** through **Problem Solving** methodologies**.** | | | | | |
| **Course Outcomes:** | On successful completion of the course the students shall be able to:<br>CO1: illustrate different types of Perforating Techniques,<br>CO2: demonstrate design calculations and factors for Gas Lift,<br>CO3: discuss basic aspects and design procedure of heater treater,<br>CO4: ecognize design theory and working principles of shell & tube heat exchangers. | | | | | |
| **Course Content:** | | | | | | |
| **Module 1:** | Perforating Techniques | Assignment | Presentation | 09 Periods | | |
| **Topics:**<br>Specialty Perforators, Overbalance and Underbalance Perforation, Perforating Methods and Equipment, Order, Types of Perforating Guns, Types of Explosives, Shot Density, Gun Phasing, Temperature Effect, Perforation Length design, Perforation Diameter, Perforating in Highly Deviated Wells. | | | | | | |
| **Module 2:** | Gas Lift Design | Assignment | Programming | 11 Periods | | |
| **Topics:**<br>Fundamentals of Gas for Gas Lift Design, Factors having an effect on design of gas lift system, Dynamic Gas Lift Valve Performance, Determination of Depths of Unloading Valves and Operating Point of Injection, Constant pressure drop method for design of Continuous Gas Lift, Fallback Method for Design of Intermittent Lift, Gas Lift Valve Port Size and test rack opening pressures calculation | | | | | | |
| **Module 3:** | Heater Treater | Quiz | Presentation | 09 Periods | | |
| **Topics:**<br>Basics of heater treater; Emulsion Treating Methods; Gravity separation in heater treater; Coalescence in heater treater; Heat input equations; Sizing of heater treater. | | | | | | |
| **Module 4:** | Shell & Tube heat exchangers | Case study | Poster Presentation | 11 Periods | | |
| **Topics:**<br>Working principles of heat exchangers; Heat transfer theory: Sensible design, Latent design, Gas heat duty, Oil heat duty, Water heat duty; Fluid placement in shell and tube heat exchanger; Heat exchanger sizing. | | | | | | |
| **Targeted Application and Tools that can be used:**<br>**Applications:** Oil and Gas Industry; Manufacturing Industry.<br>**Tools:** MySep and S&THex. | | | | | | |
| **Text Book:**<br>T1: Ken Arnold and Maurice Stewart, "Surface Production Operations", Vol. 1, 2nd Edition, Gulf Professional Publishing, 1999.<br>T2: Ken Arnold and Maurice Stewart, "Surface Production Operations", Vol. 2, 2nd Edition, Gulf Professional Publishing, 1999. | | | | | | |
| **References:**<br>R1: Boyun Guo, William C. Lyons, Ali Ghalambor, "Petroleum Production Engineering: A Computer-Assisted Approach" Elsevier Science & Technology Books, 2007.<br>R2: Tan Nguyen, "Artificial Lift Methods: Design, Practices and Applications", Springer.(1st Edition, March 2020)<br>**e-Resources:**<br>1. Presidency University e-access portal:https: / / presiuniv.knimbus.com / user# / home | | | | | | |

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| 2. Web Channel Whatispiping: https: / / whatispiping.com / heatertreater-design basics / #:~:text=A%20Separator%20is%20a%20type,gas%20phases%20from%20the%20mixture<br>3. Web Channel Whatispiping: https: / / whatispiping.com / 3-phase-separator-design /<br>4. Web Channel Whatispiping: https: / / whatispiping.com / shell-and-tube-heat-exchangers /<br>5. Energy(YoutubeChannel):<br>https: / / www.youtube.com / watch?v=SiMLey6XLTI&list=PLWVdW85uAEcqZVfjn8sRB7NKIDu0KE_LM | |
| **Skill Sets:** Topics relevant to **"EMPLOYABILITY SKILLS":** Heat exchanger sizing for developing **Employability Skills** through **Problem Solving** methodologies. This is attained through assessment component mentioned in course plan | |
| **Catalogue prepared by:** | Dr. Deepjyoti Mech, Dr. Rohit Kumar Saw, Dr. Amolina Doley, Mr. Bhairab Jyoti Gogoi |
| **Recommended by the Board of Studies on:** | 18th Meeting of the Board of Studies held on 4th July, 2024 |
| **Date of Approval by the Academic Council:** | 24th Meeting of the Academic Council held on 3rd August, 2024 |

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|---|---|---|---|---|---|---|
| **Course Code:** PET2024 | **Course Title:** Wellbore Problems and Mitigation<br>**Type of Course:** 1] Discipline Elective Course<br>2] Theory Only | | **L-T-P-C** | 3 | 0 | 0 | 3 |
| **Version No.:** | 1.0 | | | | | |
| **Course Pre-requisites:** | NIL | | | | | |
| **Anti-requisites:** | NIL | | | | | |
| **Course Description:** | This course deals with the various problems that may be encountered during well bore drilling. The subject will help the students to recognize the problems and possible ways to mitigate the problems. The course is both conceptual and analytical in nature. It develops the critical thinking and analytical skills in students. The course also enhances the programming abilities through project work. | | | | | |
| **Course objective** | The objective of the course is to familiarize the learners with the concepts of Wellbore Problems and Mitigation and attain **Employability** through **Problem Solving** methodologies. | | | | | |
| **Course Outcomes:** | On successful completion of the course the students shall be able to:<br>CO1: Discuss different scenarios that may result in drill pipe sticking,<br>CO2: Discuss causes and mitigation of lost circulation,<br>CO3: Compute abnormal pore pressure based on shale pressure trend,<br>CO4: Compute kick tolerance and kill mud density under specified condition. | | | | | |
| **Course Content:** | | | | | | |
| **Module 1:** | Drill String Sticking | Assignment | Literature Survey and Presentation | 12 Periods | | |
| **Topics:**<br>Differential sticking; Mechanical sticking: Settled cuttings, Shale instability, Unconsolidated formation, Fractured formation, Cement blocks, Junk falling, Key seating, Mobile formation, Under gauge hole, Ledges and micro dogleg; Fishing, Problems and Remedies. | | | | | | |
| **Module 2:** | Lost Circulation | Assignment | Data Collection and Presentation | 06 Periods | | |
| **Topics:**<br>Introduction; Causes of lost circulation: Natural losses, Induced fracture; Classes of lost circulation; Prevention of lost circulation; Curing of lost circulation. | | | | | | |
| **Module 3:** | Abnormal Pressure | Assignment / Quiz | Presentation | 10 Periods | | |
| **Topics:**<br>Introduction; Causes of abnormal pressure; Tools for determination of abnormal pressure: MWD, RFT, DST; Quantitative estimation of abnormal pore pressure. | | | | | | |
| **Module 4:** | Kick and Well Control | Assignment / Quiz | Programming | 10 Periods | | |
| **Topics:**<br>Kick: Definition, Cause, Detection; Pressure calculation; Kick control method; Kick tolerance. | | | | | | |
| **Targeted Application and Tools that can be used:**<br>**Applications:** Drilling Engineer / Well Control Operation Engineer in Oil and Gas industry<br>**Tools:** Lost Circulation Tester, WellPlanTM Software - Landmark Solutions | | | | | | |
| **Text Book:**<br>T1. H. Rabia, Graham and Trotman, "Oil Well Drilling Engineering: Principles and Practice", 1st Edition, 1986, Springer.<br>T2. V.K. Jain, A.B. Sharma, R. Dhupar, R.P. Patel, D. Das Gupta, A. K. Joshi, and R. Shanker, "ONGC – Drilling Operation Practices Manual", 1st Edition, 2007, Shiva Offset Press, Dehradun. | | | | | | |
| **References:**<br>R1. Drilling Engineering, Heriot Watt Institute of Petroleum Engineering, Herriot Watt University, 2005.<br><br>**e-resources:**<br>1. Presidency University Login: https: / / puniversity.informaticsglobal.com / login<br>2. Link for Knimbus remote login: https: / / presiuniv.knimbus.com<br>3. https: / / www.youtube.com / watch?v=W8dWwV9v9S8<br>4. https: / / www.youtube.com / watch?v=qb_ypXh1Rl8<br>5. https: / / www.youtube.com / watch?v=tZtjlg5oxKc<br>6. https: / / www.youtube.com / watch?v=DowMnQrcKuE | | | | | | |

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| 7. https: / / www.youtube.com / watch?v=fkNyBLUHW6Y | |
| **Skill Sets:** Topics relevant to **"EMPLOYABILITY SKILLS":** Kick and Well Control for developing **Employability Skills** through **Problem Solving methodologies**. This is attained through assessment component mentioned in course plan. | |
| **Catalogue prepared by:** | Dr. Suman Paul, Dr. Deepjyoti Mech, Dr. Kalpajit Hazarika, Mr. Bhairab Jyoti Gogoi, Mr. Anmol Bhargava, Mr. Sugar Srivastava |
| **Recommended by the Board of Studies on:** | 11th Meeting of the Board of Studies held on 5th Sept, 2020 |
| **Date of Approval by the Academic Council:** | 13th Meeting of the Academic Council held on 6th Nov 2020 |

| Course Code: PET2128 | Course Title: Enhanced Oil and Gas Recovery Techniques<br>Type of Course: 1] Discipline Elective Course<br>2] Theory only | L-T-P-C | 3 | 0 | 0 | 3 |
|---|---|---|---|---|---|---|
| Version No.: | 1.0 | | | | | |
| Course Pre-requisites: | NIL | | | | | |
| Anti-requisites: | Nil | | | | | |
| Course Description: | The purpose of this course is to enable to understand the oil recovery concepts using different methods, and performance analysis and to develop the basic abilities of modelling and analyzing the reservoir simulation software. The course is both conceptual and analytical in nature and needs fair knowledge of Mathematical and computing. The course develops the critical thinking and analytical skills. The course also enhances the programming abilities through assignments. | | | | | |
| Course objective | The objective of the course is to familiarize the learners with the concepts of Enhanced Oil and Gas Recovery Techniques and attain **Employability** through **Problem Solving** techniques. | | | | | |
| Course Outcomes: | On successful completion of the course the students shall be able to:<br>CO1: Characterize the rock and fluid properties for different chemical EOR processes,<br>CO2: Choose the reservoir for thermal recovery process,<br>CO3: Categorize the reservoir for gas injection process,<br>CO4: Understand the recent trends in enhanced oil recovery . | | | | | |
| Course Content: | | | | | | |

| Module 1: | Chemical Flooding | Term paper | Programming / Simulation | 11 Periods |
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**Topics:**
Introduction: Oil recovery processes, Geological factors in EOR, EOR Methods
Polymer flooding: Introduction- Planning polymer flood projects - Application of PAM / AA in enhanced oil recovery- Factors affecting flow in porous media- Field considerations- Site factors- Field operation
Alkaline Flooding - Types of alkali used - Entrapment of residue oil - Displacement mechanisms in alkaline flooding - Reservoir selection.
Use of surfactants in oil recovery: Introduction- Classification of EOR surfactants- Mechanism of oil displacement by surfactant flooding- Ultra low interfacial tension in relation to oil displacement by surfactant flooding- Factors influencing oil recovery - Mechanism of surfactant loss in porous media

| Module 2: | Thermal Flooding for Enhanced Oil Recovery | Assignment | Data Collection | 09 Periods |
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**Topics:**
Introduction- Theory- Screening criteria for steam flood prospects- Reservoir rock and fluid properties- heat losses and formation heating- oil recovery calculations- An overview of steam flood modeling, parametric studies in steam flooding- Economics of the steam flooding process - Water treatment for steam generation- Steam generators- Determination of steam quality.
**In-situ combustion technology:** Introduction-Reservoir characteristics- Ignition- Ignition methods, Process In-situ Combustion- Use of In-situ Combustion- conclusions

| Module 3: | Gas Injection | Assignment | Seminar | 12 Periods |
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**Topics:**
Predictive techniques, Reservoir performance, Gas injection in carbonate reservoirs, Inert gas injection, Candidates for gas injection, Immiscible gas injection
**Miscible flooding:** Introduction- Difference between miscible and immiscible flooding, Sweep efficiency- High pressure gas injection- Enriched gas drive- LPG slug drive- Predictive technique- Field applications.
**Carbon dioxide flooding:** Process description- Field projects- $CO_2$ sources- problem areas- designing a $CO_2$ flood- Guidelines for selection of miscible $CO_2$ projects- Immiscible $CO_2$ flooding Conclusions

| Module 4: | MEOR and Nano Particles in Enhanced Oil Recovery | Assignment | Data Collection | 08 Periods |
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**Topics:**
MEOR, Types of NP used in EOR, Effects of Nanoparticles on Oil Recovery, Effects of Nanoparticles on IFT Stability of nano particles, Surfactant-NPs Combined Flooding, Field Applications, Challenges, and Perspective.

**Targeted Application and Tools that can be used:**
**Applications:** Upstream oil and gas companies

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| **Tools:** CMG, Eclipse | |
| **Text Book:**<br>T1: E. C. Donaldson, G. V. Chilingarian, T. F. Yew, “Enhanced Oil Recovery: Processes and Operations”, Elsevier. | |
| **References:**<br>R1: Larry W. Lake, “Enhanced Oil Recovery”, Prentice Hall.<br>R2: H. R. Van Pollew and Associates, “Fundamentals of Enhanced Oil Recovery”, PennWell.<br>R3: Gogoi S.B., ''Advances in Petroleum Technology'' Pan Stanford Publishing. 1st edition<br><br>**e-resources:**<br>1. https: / / puniversity.informaticsglobal.com / login<br>2. https: / / www.youtube.com / watch?v=azLVjYij5U4<br>3.https: / / www.youtube.com / playlist?list=PLXpyHm2f8CTdq4GYer8Wh9RtPnVFq7_Mj (Video Tutorials on Reservoir Engineering )<br>4. https: / / www.youtube.com / watch?v=RtPdFsyqbrw<br>5. https: / / www.youtube.com / watch?v=BBk2pN4L2Kg | |
| **Skill Sets:** Topics relevant to **“EMPLOYABILITY SKILLS”:** Oil Recovery calculations for developing **Employability Skills** through **Problem Solving** techniques. This is attained through assessment component mentioned in course plan. | |
| **Catalogue prepared by:** | Dr. Suman Paul, Dr. Deepjyoti Mech, Dr. Rohit Kumar Saw, Mr. Bhairab Jyoti Gogoi |
| **Recommended by the Board of Studies on:** | 18th Meeting of the Board of Studies held on 4th July, 2024 |
| **Date of Approval by the Academic Council:** | 24th Meeting of the Academic Council held on 3rd August, 2024 |

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|---|---|---|---|---|---|---|
| **Course Code:** PET3117 | **Course Title: Introduction to Computational Fluid Dynamics**<br>**Type of Course: 1] Discipline Elective Course**<br>**2] Theory Only** | | **L-T-P-C** | 3 | 0 | 0 | 3 |
| **Version No.:** | 1.0 | | | | | |
| **Course Pre-requisites:** | NIL | | | | | |
| **Anti-requisites:** | NIL | | | | | |
| **Course Description:** | This course intends to give an overview of the Computational Fluid Dynamics and the flow modelling. The students will develop a strong foundation in numerical methods like FDM and FVM as they would apply the knowledge to formulate the equations. The course is theoretical in nature with special emphasis on the numerical modelling. Students should have strong background in mathematics, heat, and momentum and programming in order to excel in this course. It will lay the foundation of computational programming for the students. | | | | | |
| **Course Objective:** | The objective of the course is to familiarize the learners with the concepts of Introduction to Computational Fluids Dynamics and attain **Skill Development** through **Problem Solving** methodologies. | | | | | |
| **Course Outcomes:** | On successful completion of the course the students shall be able to:<br>CO1: Describe the basic mechanism of computational fluid dynamics<br>CO2: Apply Finite difference and Finite volume method for diffusion problems<br>CO3: Explain discretization and its importance in numerical simulations<br>CO4: Solve diffusion equation using Finite Volume Method | | | | | |
| **Course Content:** | | | | | | |
| **Module 1:** | Introduction to Computational Fluid Dynamics | Term Paper | Data Collection and Review Paper | 08 Periods | | |
| **Topics:**<br>Computational Fluid Dynamics: What, When, and Why?, CFD Applications, Numerical versus Analytical versus Experimental, Modeling vs Experimentation, Fundamental principles of conservation, Reynolds transport theorem, Conservation of mass, Conservation of linear momentum: Navier-Stokes Equation, Conservation of Energy, General Scalar Transport Equation. | | | | | | |
| **Module 2:** | Introduction to Numerical Techniques in Computational Fluid Dynamics | Assignment | Programming | 10 Periods | | |
| **Topics:**<br>Derivation of finite difference equations – Simple Methods – General Methods for first and second order accuracy – Finite volume formulation for steady state One, Two and Three -dimensional diffusion problems -Parabolic equations – Explicit and Implicit schemes -Example problems on elliptic and parabolic equations – Use of Finite Difference and Finite Volume methods. | | | | | | |
| **Module 3:** | Discretization | Assignment | Programming | 06 Periods | | |
| **Topics:**<br>Discretization Principles: Preprocessing, Solution, Postprocessing, Finite Element Method, Finite difference method, Well posed boundary value problem, Possible types of boundary conditions, Conservativeness, Boundedness, Transportiveness, Finite Volume Method (FVM), Illustrative examples: 1-D steady state heat conduction without and with constant source term, 1-D unsteady state diffusion problems: implicit, fully explicit and Crank-Nicholson scheme. | | | | | | |
| **Module 4:** | Finite Volume Method | Assignment | Programming | 08 Periods | | |
| **Topics:**<br>Some Conceptual Basics and Illustrations through 1-D Steady State Diffusion Problems: Physical consistency, Overall balance, FV Discretization of a 1-D steady state diffusion type problem, Composite material with position dependent thermal conductivity, Four basic rules for FV Discretization of 1-D steady state diffusion type problem, Source term linearization, Implementation of boundary conditions. | | | | | | |
| **Targeted Application and Tools that can be used:**<br>**Applications:** CFD Engineer / Flow Dynamics / Numerical Modelling Engineer<br>**Tools:** ANSYS FLUENT, OPENFOAM, and ANSYS CFX (Professionally used Software) | | | | | | |
| **Text Book:**<br>T1. John D. Anderson Jr., "Computational Fluid Dynamics: The basics with Applications", McGraw Hill Education. | | | | | | |
| **References:** | | | | | | |

R1. H. Versteeg, W. Malalasekra “An Introduction to Computational Fluid Dynamics: The Finite Volume Method”, Pearson edition.
R2. JiyuanTu, Guan Yeoh, Chaoqan Liu, “Computational Fluid Dynamics: A Practical Approach”, Second edition, Elsevier.

**e-resources:**
1. https: / / puniversity.informaticsglobal.com / login
2. https: / / www.youtube.com / watch?v=jQHp49OyPn8
3. https: / / www.youtube.com / watch?v=NlLy-u61yyk
4. https: / / www.youtube.com / watch?v=ygOcv4ynZ8A

**Skill Sets:** Topics relevant to **“SKILL DEVELOPMENT”:** Introduction to Numerical Techniques in Computational Fluid Dynamics for **Skill Development** through **Problem Solving** methodologies. This is attained through the Assignment as mentioned in the assessment component.

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| **Catalogue prepared by:** | Dr. Suman Paul, Dr. Deepjyoti Mech, Dr. Niladri Shekhar Samanta, Dr. Rohit Kumar Saw |
| **Recommended by the Board of Studies on:** | 18th Meeting of the Board of Studies held on 4th July, 2024 |
| **Date of Approval by the Academic Council:** | 24th Meeting of the Academic Council held on 3rd August, 2024 |

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|---|---|---|---|---|---|---|
| **Course Code:** PET3118 | **Course Title:** Petroleum Economics<br>**Type of Course:** 1] Discipline Elective Course<br>2] Theory Only | | | **L-T-P-C** | 3 | 0 | 0 | 3 |
| **Version No.:** | 1.0 | | | | | | | |
| **Course Pre-requisites:** | NIL | | | | | | | |
| **Anti-requisites:** | NIL | | | | | | | |
| **Course Description:** | The purpose of this course is to enable the student to understand the status of oil sector with respect to oil exploration. The overall theme of the course is to emphasize the process of thinking: qualitatively and quantitatively; strategically, using concrete; real-life practical examples. The course is theoretical in nature. The course develops the critical thinking and analytical skills. | | | | | | | |
| **Course Objective:** | The objective of the course is to familiarize the learners with the concepts of Petroleum Economics and attain **Employability** through **Problem Solving** methodologies. | | | | | | | |
| **Course Outcomes:** | On successful completion of the course the students shall be able to:<br>CO1: valuate the Time value of Money in Capital Expenditure,<br>CO2: explain various Profitability Indicators for viability of project,<br>CO3: determine the Decision Tree for evaluating projects,<br>CO4: evaluate financial position, cash flow, marketing and distribution in O & G projects. | | | | | | | |
| **Course Content:** | | | | | | | | |
| **Module 1:** | Time Value of Money (TVM) in Capital Expenditures | Assignment | Data Collection | 10 Periods | | | | |
| **Topics:**<br>Basic Definitions- Types of Interest- Interest Calculation- Effective Interest- Annuities and Periodic Payments; Derivation of the Basic Equation (Sinking Fund Factor); Applications of the Annuity Technique- Capitalized Costs; Calculation of Capitalized Costs of an Asset to Be Replaced Perpetually; Calculation of the Capitalized Costs of a Perpetual Annual Expense- Equivalence | | | | | | | | |
| **Module 2:** | Depreciation and Depletion in Oil Projects | Assignment | Data Collection | 10 Periods | | | | |
| **Topics:**<br>Introduction and Basic Definitions- Valuation of Assets Using Depreciation and Depletion: General Outlook- Methods for Determining Depreciation: Straight-Line Depreciation (S.L.D.); Declining Balance Depreciation (D.B.D.); Sum-of-the-Digits Depreciation (S.D.D.); Sinking Fund Depreciation (S.F.D.)- Methods for Determining Depletion: Background-Methods | | | | | | | | |
| **Module 3:** | Financial Measures and Profitability Analysis | Quiz | Data Collection | 10 Periods | | | | |
| **Topics:**<br>Introduction- Mathematical Methods for Evaluating Profitability: Annual Rate of Return (Return on Investment, R.O.I.); Payout Period (P.P.), Payback Time, or Cash Recovery Period; Discounted Cash-Flow Rate of Return (D.C.F.R.) and Present Value Index (P.V.I.); Net Present Value (N.P.V.)- Techniques of Economic Analysis | | | | | | | | |
| **Module 4:** | Risk, Uncertainty, and Decision Analysis | Poster Presentation | Programming | 10 Periods | | | | |
| **Topics:**<br>Global Distribution and Consumption of Gas, Energy Cost from Different Sources: Coal, O&G, Electricity, etc., O&G Pricing Mechanism, Pricing issues, Commercial and financial aspects of retail business, Cost Control in retail business: Cost control and Reduction, Role of Inventory Management, Product placements – Importance of logistics in Petro-refining., Costs: Demand forecasting and its Importance. | | | | | | | | |
| **Targeted Application and Tools that can be used:**<br>**Applications:** Petroleum Engineer in the decision making of the projects and also assessing the risk associated with new projects.<br>**Tools:** Excel, CMG-CMOST | | | | | | | | |
| **Text Book:**<br>T1: Petroleum Engineering and Economics-Hussein K. Abdel-Aal, Mohammed A. Alsahlawi (CRC Press) | | | | | | | | |
| **References:**<br>R1: International Exploration Economics, Risk, and Contract Analysis, Daniel Johnston,2003, Penn Well Corporation, Tulsa, Oklahoma, USA, 401P,First Edition.<br>R2: An Introduction to Exploration Economics (2nd ed.), The Petroleum Publishing Company, Tuls, Oklahoma, 1977. | | | | | | | | |

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| **e-resource:**<br>1. https: / / puniversity.informaticsglobal.com / login<br>2. https: / / www.sciencedirect.com / science / article / abs / pii / S0376736107000143<br>3. https: / / petex.utexas.edu / e-learning / 325-petroleum-economics | |
| **Skill Sets:** Topics relevant to **"EMPLOYABILITY SKILLS":** Depreciation and Depletion in Oil Projects for developing **Employability Skills** through **Problem Solving** methodologies. This is attained through the Assignment as mentioned in the course plan. | |
| **Catalogue prepared by:** | Dr. Suman Paul, Dr. Deepjyoti Mech, Dr. Amolina Doley, Dr. Rohit Kumar Saw, Mr. Bhairab Jyoti Gogoi |
| **Recommended by the Board of Studies on:** | 18th Meeting of the Board of Studies held on 4th July, 2024 |
| **Date of Approval by the Academic Council:** | 24th Meeting of the Academic Council held on 3rd August, 2024 |

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|---|---|---|---|---|---|---|---|
| **Course Code:** PET3119 | **Course Title:** Fluid Flow through Porous Media<br>**Type of Course:** 1] Discipline Elective Course<br>2] Theory Only | | | **L-T-P-C** | 3 | 0 | 0 | 3 |
| **Version No.:** | 1.0 | | | | | | | |
| **Course Pre-requisites:** | NIL | | | | | | | |
| **Anti-requisites:** | NIL | | | | | | | |
| **Course Description:** | The main objective of this course is to enable the students to construct flow model for fluid flow through porous media and to develop the basic abilities of modelling and analyzing the flow regimes. The course is both conceptual and analytical in nature and needs fair knowledge of Mathematical and computing. The course develops the critical thinking and analytical skills. Through the assignments given in this course student's programming abilities has been enhances. | | | | | | | |
| **Course Objectives:** | The objective of the course is to familiarize the learners with the concepts of Fluid Flow through Porous Media and attain **Employability** through **Problem Solving** methodologies. | | | | | | | |
| **Course Outcomes:** | On successful completion of the course the students shall be able to:<br>CO1: interpret the behavior of fluid flow in porous media,<br>CO2: develop skills in modelling single- and multiphase fluid flow in porous media,<br>CO3: understand fluid flow in rocks and its applications in reservoir engineering,<br>CO4: describe mass, momentum and energy conservation equations for flow in porous media. | | | | | | | |
| **Course Content:** | | | | | | | | |
| **Module 1:** | Introduction to Fluid Flow | Term paper and Quiz, Assignment | Data Collection | 09 Periods | | | | |
| **Topics:**<br>Importance of studying fluid flow through porous medium, natural vs. synthetic porous media, differences in fluid flow phenomena in porous materials with those in channels / pipes / tubes, pore structure, homogeneous vs heterogeneous porous media, scale-dependence of heterogeneity, and fractals. Properties of Porous Media, bundle of capillary tube models of porous medium, porosity-permeability relationships, pore connectivity and parametric functions, data analysis and correlation methods of typical permeability data. | | | | | | | | |
| **Module 2:** | Single-phase Flow in Porous Media | Quiz, Assignment | Programming | 09 Periods | | | | |
| **Topics:**<br>Flow potential, incompressible and compressible flow in porous media, Darcy's law and non-Darcy effects, mass, momentum and energy transport equations, Forchheimer's equation and determination of its parameters, and viscous dissipation in porous media flow. | | | | | | | | |
| **Module 3:** | Gas Transport in Tight Rocks | Term paper & Assignment | Programming | 11 Periods | | | | |
| **Topics:**<br>Gas transport mechanisms through nanopores, flow regimes, Knudsen number and mean flow paths, slip flow, thermal effects, apparent gas permeability, single- and multicomponent gas flow, and effect of pore size distribution on gas transport through porous media. | | | | | | | | |
| **Module 4:** | Multi-phase Flow in Porous Media | Term paper & Assignment | Simulation | 11 Periods | | | | |
| **Topics:**<br>Multi-phase flow in porous media: Wettability and threshold potential, capillary pressure and its estimation, capillary pressure function, permeability dependence of capillary pressure and Leverett scaling, relative permeability, steady-state and unsteady-state relative permeability measurements and data interpretation.<br>Mass, momentum, and energy transport in porous Media: Molecular diffusion, hydrodynamic dispersion, advective / convective flux functions, coupled transport equations, constitutive relationships, sources and sinks, phase transition and applications. | | | | | | | | |
| **Targeted Application and Tools that can be used:**<br>**Applications:** Oil and Gas industry<br>**Tools:** Landmark nexus software. | | | | | | | | |
| **Text Book:**<br>T1: Civan, F.A, Porous Media Transport Phenomena, Wiley, 2011.<br>T2: Dullien, F.A.L, Porous Media 2nd Edition, Fluid Transport and Pore Structure, Elsevier, 1991. | | | | | | | | |
| **References:** | | | | | | | | |

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| R1: Bear, J., Dynamics of Fluids in Porous Media, Dover, 1989 | |
| **Skill Sets:** Topics relevant to **"EMPLOYABILITY SKILLS":** Wettability and threshold potential for developing **Employability Skills** through **Problem Solving** methodologies. This is attained through assessment component mentioned in course plan. | |
| **Catalogue prepared by:** | Dr. Suman Paul, Dr. Deepjyoti Mech, Dr. Niladri Shekhar Samanta, Dr. Rohit Kumar Saw |
| **Recommended by the Board of Studies on:** | 18th Meeting of the Board of Studies held on 4th July, 2024 |
| **Date of Approval by the Academic Council:** | 24th Meeting of the Academic Council held on 3rd August, 2024 |

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|---|---|---|---|---|---|---|---|
| **Course Code:** PET3120 | **Course Title:** Natural Gas Reservoir Engineering<br>**Type of Course:** 1] Discipline Elective Course<br>2] Theory only | | **L-T-P-C** | 3 | 0 | 0 | 3 |
| **Version No.:** | 1.0 | | | | | | |
| **Course Pre-requisites:** | NIL | | | | | | |
| **Anti-requisites:** | NIL | | | | | | |
| **Course Description:** | The course will deal with essential aspects of Gas Reservoir Engineering like understanding the properties of natural gas and reservoir fluids; evaluating original gas in place (OGIP) using volumetric and material balance methods; analyzing gas deliverability in various types of gas reservoirs including dry, wet, and condensate systems; interpreting gas well performance through decline curve analysis techniques like Fetkovich and Carter; and understanding pressure-transient testing for diagnosing reservoir behavior. This course will also discuss its implications at different stages of gas field development and production planning. | | | | | | |
| **Course Objective:** | The objective of the course is to familiarize the learners with the concepts of Natural Gas Reservoir Engineering and attain **Employability** through **Problem Solving** methodologies. | | | | | | |
| **Course Outcomes:** | On successful completion of the course the students shall be able to:<br>CO1: Describe the properties of natural gas and different reservoir drive mechanisms,<br>CO2: Explain various methods for estimating original gas in place (OGIP),<br>CO3: Recognize different types of gas reservoirs and analyze their deliverability using appropriate techniques,<br>CO4: Apply decline curve and pressure-transient analysis to evaluate gas well performance. | | | | | | |
| **Course Content:** | | | | | | | |
| **Module 1:** | Basic Gas Reservoir Engineering and Gas Reserves | Assignment / Quiz | Literature Survey and Presentation | 06 Periods | | | |
| **Topics:**<br>Fluids and fluid types, Drive mechanisms, Properties of natural gas, Material balance, Determining gas reserves, Estimation of Original Gas In-Place, OGIP, Using the Volumetric Method Estimation of Original Gas In-Place, OGIP, Using the Volumetric Method. | | | | | | | |
| **Module 2:** | Gas Volumes and Material-Balance Calculations | Assignment / Quiz | Programming | 10 Periods | | | |
| **Topics:**<br>Gas Volumes and Material-Balance Calculations, Gas Reserve and Volumetric Method, Volumetric method for dry gas reservoir, Volumetric method for wet gas and condensate gas reservoir, Material-Balance Method, Material-Balance Method For Dry-Gas Reservoirs with Water Influx, Material Balance Method for Dry-Gas Reservoirs with Water Influx, Material Balance method For Volumetric Geopressured Gas Reservoir. | | | | | | | |
| **Module 3:** | Decline Curve Analysis for Gas Wells | Assignment / Quiz | Group Discussion | 10 Periods | | | |
| **Topics:**<br>Introduction to Decline Curve Analysis, Conventional Analysis Techniques--Decline Types and Applications, Fetkovich Decline Type Curve, Carter Decline Type Curve. | | | | | | | |
| **Module 4:** | Pressure-Transient Testing of Gas Wells | Article Review | Presentation | 14 Periods | | | |
| **Topics:**<br>Types and Purposes of Pressure-Transient Tests, Pressure-Transient Analysis--Slightly Compressible Liquids, Complications in Actual Tests, Fundamentals of Pressure-Transient Testing In Gas Wells, Non-Darcy Flow, Gas Flow Tests with Discrete Rate Changes, Gas Flow Tests with Smoothly Changing Rates, Gas Buildup Test with Constant-Rate Production Before Shut In, Discrete Change in Rate Before Shut In, Type Curve Analysis 1, Type Curve Analysis 2 | | | | | | | |
| **Targeted Application and Tools that can be used:**<br>**Targeted Application:** Reservoir Engineer, Production Engineer, Gas Field Analyst in Oil & Gas Industry, Energy Sector, and Petroleum Consulting Firms.<br>**Tool Used:** MS Excel | | | | | | | |
| **Text Book:**<br>T1. Chi U. Ikoku, “Natural Gas Reservoir Engineering”, Krieger Publishing Company (September 1, 1992)<br>T2. John Lee, Robert A Wattenbarger, "Gas Reservoir Engineering" Society of Petroleum Engineers (1 May 2014) | | | | | | | |
| **References:** | | | | | | | |

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|---|---|
| R1. Nnaemeka Ezekwe , "Petroleum Reservoir Engineering Practice"<br>R2. Michael Golan and Curtis H. Whitson, “Well Performance"<br><br>**e-resources:**<br>Presidency University e-resource Remote Access (KNIMBUS) portal through the shared link:<br>https: / / presiuniv.knimbus.com / user# / home | |
| **Skill Sets:** Topics relevant to **“EMPLOYABILITY SKILLS”:** Oil Spill Control for developing **Employability Skills** through **Problem Solving** methodologies. This is attained through assessment component mentioned in course handout. | |
| **Catalogue prepared by:** | Dr. Suman Paul, Dr. Deepjyoti Mech, Mr. Bhairab Jyoti Gogoi, Dr. Rohit Kumar Saw |
| **Recommended by the Board of Studies on:** | 18th Meeting of the Board of Studies held on 4th July, 2024 |
| **Date of Approval by the Academic Council:** | 24th Meeting of the Academic Council held on 3rd August, 2024 |

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|---|---|---|---|---|---|---|---|
| **Course Code:** PET3121 | **Course Title: Natural Gas Production Engineering**<br>**Type of Course: 1] Discipline Elective Course**<br>**2] Theory Only** | | | **L-T-P-C** | 3 | 0 | 0 | 3 |
| **Version No.:** | 1.0 | | | | | | |
| Course **Pre-requisites:** | NIL | | | | | | |
| **Anti-requisites:** | NIL | | | | | | |
| **Course Description:** | The purpose of this course is to understand the natural gas reservoirs and their production, and performance analysis and to develop the basic abilities of designing the different facilities for natural gas treatment. The course is both conceptual and analytical in nature and needs fair knowledge of Mathematical computation. The course also develops the programming abilities through assignments. | | | | | | |
| **Course Objective:** | The objective of the course is to familiarize the learners with the concepts of Natural Gas Production Engineering and attain **Employability** through **Problem Solving** methodologies. | | | | | | |
| **Course Outcomes:** | On successful completion of the course the students shall be able to:<br>CO1: identify the basic properties of natural gas,<br>CO2: recognize different curves of IPR and Nodal Analysis,<br>CO3: apply the knowledge in designing the problems involved with Dehydration Column, Flow measuring meters,<br>CO4: compute the volumetric measurement of gas using different flow meter. | | | | | | |
| **Course Content:** | | | | | | | |
| **Module 1:** | Properties of Natural Gas | Quiz | Data Collection | 10 Periods | | | |
| **Topics:**<br>Production of Natural Gas, Gas well, Problems related to gas production, Surface facilities.<br>What is natural gas – Utilization of natural gas – Natural gas industry (World and India) – Natural gas reserves – Types of natural gas resources – Future of natural gas industry<br>Properties of natural gas: Specific gravity – Pseudo critical properties – Viscosity – Compressibility factor – Gas density – Formation volume factor and expansion factor – Compressibility of natural gas – Real gas pseudo pressure and real gas normalized pressure. | | | | | | | |
| **Module 2:** | Gas Reservoir Deliverability | Assignment | Programming, Simulation | 08 Periods | | | |
| **Topics:**<br>Introduction – Analytical methods – Empirical methods – Construction of inflow performance relation curve.<br>Well deliverability: Introduction – Nodal analysis – Analysis with wellhead node. | | | | | | | |
| **Module 3:** | Wellbore and Choke Performance | Assignment | Programming, Simulation | 11 Periods | | | |
| **Topics:**<br>Wellbore performance**:** Introduction – Single phase gas well – Mist flow in gas wells.<br>Choke performance**:** Introduction – Sonic and subsonic flow – Dry gas flow through chokes – Wet gas flow through chokes | | | | | | | |
| **Module 4:** | Gas Processing and Volumetric Measurement | Case Study | Model making | 11 Periods | | | |
| **Topics:**<br>Dehydration**:** Water content of natural gas streams, Dehydration systems, Glycol dehydrator design.<br>Removal of acid gases**:** Iron – Sponge sweetening – Alkanol amine sweetening – Glycol / Amine process –Sulfinol process.<br>Volumetric measurement**:** Measurement with orifice meters – Displacement metering – Turbine meter – Elbow meter – Natural gas liquid measurement | | | | | | | |
| **Targeted Application and Tools that can be used:**<br>**Applications:** Oil and Gas Industry<br>**Tools:** Honeywell, OGPPT | | | | | | | |
| **Text Book:**<br>T1: Boyan Guo Ali Ghalambor, “Natural Gas Engineering Handbook”, Gulf publishing company.<br>T2: D.L.Katz, “Handbook of Natural Gas Engineering”, McGraw, Hill. | | | | | | | |

**References:**

R1: Chi U. Ikoku, “Natural Gas Production Engineering”, Krieger Publishing Company.
R2: Tarek Ahmed, Elsevier, “Reservoir Engineering Handbook”.

**e-resources:**

1. https: / / petrowiki.spe.org / Gas_well_deliverability
2. Link for Knimbus remote login: https: / / presiuniv.knimbus.com
3. Natural gas production: https: / / www.oreilly.com / library / view / petroleum-production-engineering / 9780128096123 / xhtml / chp003.xhtml
4. Wellbore performance: https: / / petrowiki.spe.org / Wellbore_flow_performance
5. Choke performance: https: / / www.sciencedirect.com / topics / earth-and-planetary-sciences / choke
6. Oil and gas industry: https: / / www.petroleumonline.com / modules / m014 / hl_014_001.asp
7. Natural gas processing: https: / / www.e-education.psu.edu / fsc432 / content / natural-gas-processing

**Skill Sets:** Topics relevant to **“EMPLOYABILITY SKILLS”:** Tubing Performance Relationship for developing **Employability Skills** through **Problem Solving** methodologies. This is attained through assessment component mentioned in course plan.

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| **Catalogue prepared by:** | Dr. Suman Paul, Dr. Deepjyoti Mech, Dr. Amolina Doley, Dr. Rohit Kumar Saw, Mr. Bhairab Jyoti Gogoi |
| **Recommended by the Board of Studies on:** | 18th Meeting of the Board of Studies held on 4th July, 2024 |
| **Date of Approval by the Academic Council:** | 24th Meeting of the Academic Council held on 3rd August, 2024 |

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|---|---|---|---|---|---|---|
| **Course Code:** PET3122 | **Course Title:** Well Intervention Technologies<br>**Type of Course:** 1] Discipline Elective Course<br>2] Theory Only | | **L-T-P-C** | 3 | 0 | 0 | 3 |
| **Version No.:** | 1.0 | | | | | |
| **Course Pre-requisites:** | NA | | | | | |
| **Anti-requisites:** | NA | | | | | |
| **Course Description:** | This course looks at the workover operations that are done because the well is not performing up to expectations. In addition, it sheds the lights on the equipment used while performing the workover operations. Main concepts of this course will be delivered through lectures, and readings. After every lesson, learners will take short quizzes to test their newly acquired knowledge. | | | | | |
| **Course Objective:** | The objective of the course is to familiarize the learners with the concepts of Well Intervention Technologies and attain **Employability** through **Problem Solving** methodologies | | | | | |
| **Course Outcomes:** | On successful completion of the course the students shall be able to:<br>CO1: Explain the requirement of well intervention and the processes involved,<br>CO2: Discuss the functions and working of well stimulation by acidizing,<br>CO3: Summarize the process of Hydraulic Fracturing,<br>CO4: Summarize different sand control methods employed in the industry. | | | | | |
| **Course Content:** | | | | | | |
| **Module 1:** | Well Servicing and Workover | Term paper / Assignment | Data Collection | 09 Periods | | |
| **Topics:**<br>Workover system, workover rigs and selection, rig less workover including Endless / Coiled tubing Module, minor & major workover jobs-diagnosis & remedial measures water shut off and gas shut off- Chemical treatment and conformance control. Wire-line operations, Workover & completion fluids - types & selection, Formation damage, Workover planning & economics. | | | | | | |
| **Module 2:** | Well Stimulation: Acidizing | Assignment | Programming | 11 Periods | | |
| **Topics:**<br>Well problem identification; Types of Acids; Acid-Rock interaction; Sandstone acidizing design; Carbonate acidizing design; Acid volume requirement; Acid fracturing; Acid diversion | | | | | | |
| **Module 3:** | Hydro Fracturing | Assignment / Case Study | Data Collection | 11 Periods | | |
| **Topics:**<br>Basic rock mechanism; fracture plane, effective stresses, fracture geometry; fracturing materials; fracturing fluids, proppants; fracturing equipment; fracturing treatment design. | | | | | | |
| **Module 4:** | Sand Control | Quiz / Seminar / Assignment / Case Study | Group Discussion | 09 Periods | | |
| **Topics:**<br>Definition and control mechanism, Rock strength, Well bore stresses, Gravel packing, Screen and Liner consideration, Placing techniques, Screen types, Resin consolidation methods, Screen less methods, Coping with sand production, Gravel and screen selection, Open / Cased hole gravel packing, choosing the sand control method. | | | | | | |
| **Targeted Application and Tools that can be used:**<br>**Applications:** Oil Field Applications of working over sick wells, Stimulation Techniques<br>**Tools:** Petrel, Kinetix | | | | | | |
| **Text Book:**<br>T1. D Perrin, Michel Caron, Georges Gaillot, "Well completion and Servicing", Paris: Editions Technip; Rueil-Malmaison: Institut français du pétrole, c1999, https: / / searchworks.stanford.edu / view / 4273875<br>T2. Jonathan Bellarby, "Well Completion Design", 1st Edition - February 20, 2009, https: / / www.elsevier.com / books / well-completion-design / bellarby / 978-0-444-53210-7 | | | | | | |
| **References:**<br>R1. Thomas O. Allen and Alan P. Roberts, "Production Operation Volume 1", Oil and Gas International Inc, https: / / petroleumpdf.com / production-operations-volume-1-pdf /<br>R2. Thomas O. Allen and Alan P. Roberts, "Production Operation Volume 2", Oil and Gas International Inc.<br>R3. Wan Renpu, Advanced Well Completion Engineering, Third Edition, 2011 | | | | | | |

https: / / www.sciencedirect.com / book / 9780123858689 / advanced-well-completion-engineering

R4. Ding Zhu; Kenji Furui, Modern Completion Technology for Oil and Gas Wells, New York, N.Y.: McGraw-Hill Education, [2019]. ©2019
https: / / www.worldcat.org / title / modern-completion-technology-for-oil-and-gas-wells / oclc / 1046074889

R5. Boyun Guo, PhD, Xinghui Lou Liu and Xuehao Tan (Auth.), "Petroleum Production Engineering", 2017, Gulf Professional Publishing, https: / / www.elsevier.com / books / petroleum-production-engineering / guo-phd / 978-0-12-809374-0

**Case Study:**

1. A Case Study of Open and Cased Hole Well Completions in More than 400 Wells in On-Shore Block in India, https: / / doi.org / 10.2118 / 181660-MS
2. Case Studies for Improving Completion Design through Comprehensive Well Performance Modeling, https: / / doi.org / 10.2118 / 104078-MS
3. Determination of Dynamic Limits for Rig Heave and Running Speed Based on Drilling Parameters, Well Data and Completion Tool Limitations, https: / / doi.org / 10.2118 / 204023-MS

**Online course on Well Completion:**

1. Society of Petroleum Engineers, "Well Stimulation and Sand Control"
2. Society of Petroleum Engineers, "Well Completion Operations"
3. Petroleum Extension, Course on Well Completion
https: / / petex.utexas.edu / index.php / training / online-learning / e-learning / production-elearning / 356-well-completion
4. Petroleum Extension, Course on Well Servicing and Workover
https: / / petex.utexas.edu / index.php / training / online-learning / e-learning / production-elearning / 354

**e-Resource:**

1. Presidency University e-Resource: https: / / puniversity.informaticsglobal.com / login
2. Lecture on Well servicing and Workover, https: / / youtu.be / 443BNVOfpRs
3. Well intervention & workover IWCF, https: / / youtu.be / MSePDLpUPEg
4. Matrix Acidizing | Acid Fracking | acid stimulation, https: / / youtu.be / DizZHX0td1w

**Skill Sets:** Topics relevant to **"EMPLOYABILITY SKILLS":** Fracturing treatment design for developing **Employability Skills** through **Problem Solving** methodologies. This is attained through assessment component mentioned in course plan.

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|---|---|
| **Catalogue prepared by:** | Dr. Deepjyoti Mech, Mr. Bhairab Jyoti Gogoi, Dr. Rohit Kumar Saw |
| **Recommended by the Board of Studies on:** | 18th Meeting of the Board of Studies held on 4th July, 2024 |
| **Date of Approval by the Academic Council:** | 24th Meeting of the Academic Council held on 3rd August, 2024 |

## Specialization Basket 4: Pipeline and Petroleum Refining Engineering Basket

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|---|---|---|---|---|---|---|
| **Course Code:** PET3123 | **Course Title:** Process Pipeline Design<br>**Type of Course:** 1] Discipline Elective Course<br>2] Theory Only | **L-T-P-C** | 3 | 0 | 0 | 3 |
| **Version No.:** | 1.0 | | | | | |
| **Course Pre-requisites:** | NIL | | | | | |
| **Anti-requisites:** | NIL | | | | | |
| **Course Description:** | The main aim of learning this course is to understand the fundamental principles and design of pipelines, land piping systems and integrity of pipelines. This course helps in learning the fundamental principles in materials, design, fabrication, inspection, testing, operation, maintenance, and integrity of plant piping systems and pipelines. | | | | | |
| **Course Objective:** | The objective of the course is to familiarize the learners with the concepts of Process Pipeline Design and attain **Employability** through **Problem Solving** methodologies. | | | | | |
| **Course Outcomes:** | On successful completion of the course, the student shall be able to:<br>CO1: Compute the pressure required to transport liquids and gases through pipelines,<br>CO2: Locate the optimum position for installing pumps and compressors,<br>CO3: Explain different aspects of material selection, fabrication, maintenance, and integrity of a pipeline,<br>CO4: Determine the economic feasibility of a pipeline project. | | | | | |
| **Course Content:** | | | | | | |
| **Module 1:** | Pipeline Hydraulics | Assignment 1 | Programming | 12 Periods | | |
| **Topics:**<br>Types of Pipelines, Properties of Liquids and Gases, Flow-through Pipelines, Series and Parallel Pipeline systems, Injections and Deliveries. | | | | | | |
| **Module 2:** | Pumps and Compressors | Assignment 2 | Group discussion | 08 Periods | | |
| **Topics:**<br>Pumps, Affinity Laws, Pump Station Location,Pump Curve Analysis, Compressors, Types of Compressors, Compressor station location, Compressor Performance Curves, Types of Compression. | | | | | | |
| **Module 3:** | Pipeline fabrication, inspection, and quality control | Assignment 3 | Presentation | 12 Periods | | |
| **Topics:**<br>Pipeline Sizing, NPS, Schedule Number, Mechanical Properties of Materials, Pipeline Construction – materials and stages,Fabrication, Pipeline Coating, Cleaning and Inspection, Pipeline Inspection Gauge (PIG), Pipeline Testing, Corrosion, Pipeline Failure, Color Code of different types of pipelines, Valves, Pipeline Supports. | | | | | | |
| **Module 4:** | Pipeline Economics | Assignment 4 | Case Study | 08 Periods | | |
| **Topics:**<br>CAPEX, OPEX, and other costs, Risk Analysis, Feasibility studies, Economic Pipe Size, CNG. | | | | | | |
| **Targeted Application and Tools that can be used:**<br>**Applications**: Oil and Gas Industries- Pipeline engineer<br>**Tools:** PIPESIM and OLGA Multi Phase Flow Simulator | | | | | | |
| **Text Book:**<br>T1: Geoff, Barker, "Engineer's guide to plant layout and piping design for the oil and gas industries", Elsevier (2018).<br>T2: Miesner, Thomas O, "Oil and gas pipelines in nontechnical language",Pennwell (2015). | | | | | | |
| **References:**<br>R1: Krishna Murty, "All in one manual of industrial piping practice and maintenance", Kindle edition.<br>R2: Keith Escoe, "Piping and pipelines assessment guide", Kindle edition.<br><br>**e-resources:**<br>1.Presidency University e-resource library: https: / / presiuniv.knimbus.com / user# / home<br>2.Pipeline Pressure Drop Calculation Article: https: / / whatispiping.com / pressure-drop-equation-calculation /<br>3. Pipeline Pressure Drop Calculation: https: / / petrowiki.spe.org / Pressure_drop_evaluation_along_pipelines<br>4. Pipeline Knowledge and Development You Tube Channel: https: / / www.youtube.com / channel / UCG4_koi2AZs_C8BxfXAaw7A | | | | | | |

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| **Skill Sets:** Topics relevant to **"EMPLOYABILITY SKILLS":** Pumps and Compressors for developing **Employability Skills** through **Problem Solving** methodologies. This is attained through assessment component mentioned in course plan. | |
| **Catalogue prepared by:** | Dr. Deepjyoti Mech, Mr. Bhairab Jyoti Gogoi, Dr. Rohit Kumar Saw |
| **Recommended by the Board of Studies on:** | 18th Meeting of the Board of Studies held on 4th July, 2024 |
| **Date of Approval by the Academic Council:** | 24th Meeting of the Academic Council held on 3rd August, 2024 |

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|---|---|---|---|---|---|---|
| **Course Code:** PET3124 | **Course Title:** Corrosion Science and Technology<br>**Type of Course:** 1] Discipline Elective Course<br>2] Theory only | | | **L-T-P-C** | 3 | 0 | 0 | 3 |
| **Version No.:** | 1.0 | | | | | | | |
| **Course Pre-requisites:** | NIL | | | | | | | |
| **Anti-requisites:** | NIL | | | | | | | |
| **Course Description:** | The main aim of this course is to get an overview how corrosion problems are identified and rectified especially in the oil and gas industry. The course deals to understand the occurrence of different types of corrosion such as, general corrosion, localized corrosion, bimetallic corrosion, erosion-corrosion or impingement, intergranular corrosion, etc., in nature especially in oil and gas equipment's. Corrosion in oil and gas industries based on using different materials. Importance of protective coatings and different inhibition mechanisms for different type of material's applications in oil and gas industries. Corrosion detection methods, monitoring and prevention techniques. Case studies related to corrosion failures in oil and gas industries. | | | | | | | |
| **Course Objective:** | The objective of the course is to familiarize the learners with the concepts of Corrosion Science and Technology and attain **Employability** through **Problem Solving** methodologies. | | | | | | | |
| **Course Outcomes:** | On successful completion of the course the students shall be able to:<br>CO1: explain the basics of corrosion, different types of mechanisms, nature of corrosion, causes and problems in the oil and gas industries,<br>CO2: identify the importance and impact of corrosion problems and how it can be monitored and controlled to mitigate / avoid losses of time and money of the oil and gas industry,<br>CO3: illustrate the effect of inhibition methods and interpret the mechanisms of different inhibitors which eventually be able to help the oil and gas industries,<br>CO4: applying knowledge to simulate the real conditions of corrosion problems and can find the appropriate solutions. | | | | | | | |
| **Course Content:** | | | | | | | | |
| **Module 1:** | Introduction to Corrosion in Oil and Gas Sector | Assessment 1: Assignment / Quiz | Literature Survey | 09 Periods | | | | |
| **Topics:**<br>Introduction, Basics of corrosion, Different types of corrosion. Corrosion challenges in oil and gas industries: mainly for upstream and downstream equipment. | | | | | | | | |
| **Module 2:** | Protective measurements | Assessment 2: Assignment / Quiz | Data Collection | 10 Periods | | | | |
| **Topics:**<br>Protective coatings: classifications, coating formulation, coating systems, coating applications, inspection, coating of production facilities and equipment. | | | | | | | | |
| **Module 3:** | Inhibition and Controlling systems | Assessment 3: Assignment / Quiz | Programming Task | 13 Periods | | | | |
| **Topics:**<br>Inhibition mechanisms: usage of different inhibitors such as, MEA (mono ethanol amine), Propanol, etc., Corrosion detection and monitoring. | | | | | | | | |
| **Module 4:** | Corrosion Prevention | Assessment 4: Case Study | Data Collection and Analysis | 08 Periods | | | | |
| **Topics:**<br>Introduction to Cathodic Protection (CP), Principles, Criteria, CP Systems, Survey and Test methods, Applications in Oil and Gas Industries. | | | | | | | | |
| **Targeted Application and Tools that can be used:**<br>**Applications:** Corrosion Engineer in Oil and Gas / Steel / Process / Manufacturing Industry<br>**Tools:** Predict 7.1 and iFILMS ( Professionally Used Software) | | | | | | | | |
| **Text Book:**<br>T1. H.G.Byars, Corrosion control in Petroleum production, 2nd Edition, TPC 5 Publications, 1999.<br>T2. Ropital; Harston, Amine Unit Corrosion in Refineries, 1st Edition, CRC Press, 2007. | | | | | | | | |
| **References:** | | | | | | | | |

R1: Sankara Papavinasam; Corrosion Control in the Oil and Gas Industry, Gulf Professional Publishing ,2014.

**e-resources :**

1. https: / / presiuniv.knimbus.com
2. https: / / www.usna.edu / NAOE / _files / documents / Courses / EN380 / Course_Notes / Corrosion%20Basics.pdf (Notes - Corrosion Basics)
3. https: / / link.springer.com / article / 10.1186 / 2228-5547-4-35 (Review Journal Article- Corrosion problems during oil and gas production and its mitigation)
4. https: / / www.corrosionpedia.com / definition / 2301 / protective-coating-corrosion (Basic Definition- Protective Coating)
5. https: / / www.uv.mx / personal / rorozco / files / 2011 / 02 / CORROSION-INHIBITORS.pdf (Textbook on Corrosion Inhibitor)
6. https: / / cdn.intechopen.com / pdfs / 46243.pdf (Book Chapter - Corrosion Inhibitors – Principles, Mechanisms and Applications)

**Skill Sets:** Topics relevant to **"EMPLOYABILITY SKILLS":** Corrosion challenges for Petroleum Equipments for developing **Employability Skills** through **Problem Solving** methodologies. This is attained through assessment component mentioned in course plan.

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| **Catalogue prepared by:** | Dr. Suman Paul, Dr. Deepjyoti Mech, Dr. Niladri Shekhar Samanta, Dr. Rohit Kumar Saw |
| **Recommended by the Board of Studies on:** | 18th Meeting of the Board of Studies held on 4th July, 2024 |
| **Date of Approval by the Academic Council:** | 24th Meeting of the Academic Council held on 3rd August, 2024 |

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|---|---|---|---|---|---|---|
| **Course Code:** PET3125 | **Course Title:** Polymer Science and Technology<br>**Type of Course:** 1] Discipline Elective Course<br>2] Theory Only | | **L-T-P-C** | 3 | 0 | 0 | 3 |
| **Version No.:** | 1.0 | | | | | |
| **Course Pre-requisites:** | NIL | | | | | |
| **Anti-requisites:** | NIL | | | | | |
| **Course Description:** | The purpose of the course is to enable the students to understand basic scientific and engineering principles used in the polymer industry. This course will provide an integrated view of the fundamentals of polymer science and Technology. The course is theoretical in nature and needs fair knowledge of basic engineering science and computing. The course develops the critical and analytical thinking skills. The course also enhances the programming abilities through assignments. | | | | | |
| **Course Objective:** | The objective of the course is to familiarize the learners with the concepts of Polymer Science and Technology and attain **Entrepreneurship** through **Problem Solving** methodologies. | | | | | |
| **Course Outcomes:** | On successful completion of the course the students shall be able to:<br>CO1: Explain various types of polymers and polymerization method,<br>CO2: Describe thermal, mechanical properties & elastic behavior of polymers,<br>CO3: Discuss various polymer additives and polymer processing operations,<br>CO4: Apply industrial use of various polymers based on their composition and properties. | | | | | |
| **Course Content:** | | | | | | |
| **Module 1:** | Introduction to Polymer Technology | Assignment | Programming | 10 Periods | | |
| **Topics:**<br>Basic definition; Classification of polymers; Molecular Weight determination; Chemical structure. Step and Chain Growth Polymerization; Polymerization kinetics; Polymerization Techniques; Polymer Reactivity. | | | | | | |
| **Module 2:** | Polymer Properties | Assignment | Data Collection and Presentation | 09 Periods | | |
| **Topics:**<br>Solid-State Properties - Amorphous and Crystalline State, Thermal Transitions and Properties, Mechanical Properties and Solid-State Characterization Methods. Polymer Elasticity - Introduction to Viscoelasticity and Rubber Elasticity. Polymer Degradation and the Environment - Polymer Degradation and Stability; Plastic management. | | | | | | |
| **Module 3:** | Polymer Components and Processing | Assignment | Data Collection and Group Discussion | 11 Periods | | |
| **Topics:**<br>Polymer Components - Additives, Polymer Blends and Interpenetrating Networks, Block Copolymers, Composites. Polymer Processing and Rheology - Basic Processing Operations, Introduction to Polymer Rheology, Rheometry. | | | | | | |
| **Module 4:** | Industrial Polymers | Assignment | Data Collection and Presentation | 12 Periods | | |
| **Topics:**<br>Introduction to industrial polymers- Biopolymers and Other Naturally Occurring Polymers, Fibers, Thermoplastics, Elastomers, Thermosets, Industrial application of polymers, Plastics – Properties and uses of plastics as engineering materials, Ecology and environmental aspects of polymer industries; Polymer waste management. | | | | | | |
| **Targeted Application and Tools that can be used:**<br>**Applications:** Engineer in Polymer industry (Manufacturing and Selection), Petroleum industry (Hydro-Frac & EOR)<br>**Tools:** FTIR – Microscopy, Injection Molding Unit, Extruder | | | | | | |
| **Text Book:**<br>T1: Joel R. Fried, "Polymer Science and Technology", Prentice Hall. Third Edition (2014) | | | | | | |
| **References:**<br>R1: Billmeyer, F.W.Jr., "Textbook of Polymer Science", John Wiley and sons. Third Edition (1984)<br>R2: R. Sinha, "Textbook of Polymer Technology – I and II", Biotech Pharma Publications. First Edition (2018)<br><br>**e-resources:**<br>1. Link for Knimbus remote login: https: / / presiuniv.knimbus.com<br>2. Polymer Technology: https: / / www.youtube.com / watch?v=rzVeVd16vFQ<br>3. Introduction to polymer Technology: https: / / www.youtube.com / watch?v= GBx1xzYMo8<br>4. NPTEL Lecture: Polymer Processing: https: / / www.youtube.com / watch?v=MV0MXWaxBv4 | | | | | | |

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| 5. NPTEL Lecture: Polymer Processing: https: / / www.youtube.com / watch?v=T-m045Rm6G0<br>6. Injection molding: https: / / www.youtube.com / watch?v=b1U9W4iNDiQ&t=30s | |
| **Skill Sets:** Topics relevant to **"ENTREPRENEURIAL SKILLS":** Polymer Components and Processing for developing **Entrepreneurial Skills** through **Problem Solving** methodologies. This is attained through the Assignment as mentioned in the assessment component. | |
| **Catalogue prepared by:** | Dr. Deepjyoti Mech, Dr. Niladri Shekhar Samanta, Dr. Rohit Kumar Saw |
| **Recommended by the Board of Studies on:** | 18th Meeting of the Board of Studies held on 4th July, 2024 |
| **Date of Approval by the Academic Council:** | 24th Meeting of the Academic Council held on 3rd August, 2024 |

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|---|---|---|---|---|---|---|---|
| **Course Code:** PET3126 | **Course Title:** Petroleum Logistics, Marketing and Management<br>**Type of Course:** 1] Discipline Elective Course<br>2] Theory Only | | | **L-T-P-C** | 3 | 0 | 0 | 3 |
| **Version No.:** | 1.0 | | | | | | |
| **Course Pre-requisites:** | NIL | | | | | | |
| **Anti-requisites:** | NIL | | | | | | |
| **Course Description:** | This course provides a comprehensive understanding of the fundamentals and practical aspects of the petroleum industry's logistical, marketing, and management facets. Students will have a well-rounded understanding of the logistical, marketing, and management aspects of the petroleum industry, preparing them for careers in this dynamic and critical sector. They will develop analytical and practical skills necessary to address the industry's challenges and opportunities, with a strong emphasis on sustainability and strategic decision-making. | | | | | | |
| **Course Objective:** | The objective of the course is to familiarize the learners with the concepts of Petroleum Logistics, Marketing, and Management and attain **Employability Skills** through **Problem Solving** methodologies. | | | | | | |
| **Course Outcomes:** | On successful completion of the course the students shall be able to:<br>CO1: Explain the various transportation modes and infrastructure used in petroleum logistics,<br>CO2: Summarize the process of market analysis and demand forecasting,<br>CO3: Illustrate the application of project management techniques in petroleum operations,<br>CO4: Demonstrate the implementation of corporate social responsibility (CSR) initiatives. | | | | | | |
| **Course Content:** | | | | | | | |
| **Module 1:** | Fundamentals of Petroleum Logistics | Team Exercise | Presentation | 08 Periods | | | |
| **Topics:**<br>Overview of Petroleum Supply Chain, Transportation Modes and Infrastructure, Pipeline Logistics and Management, Storage Facilities and Strategies, Health, Safety, and Environmental Considerations in Logistics. | | | | | | | |
| **Module 2:** | Petroleum Marketing and Trading | Team Activity | Poster Designing and Presentation | 09 Periods | | | |
| **Topics:**<br>Basics of Petroleum Marketing and Geopolitics, Market Analysis and Demand Forecasting, Crude Oil and Petroleum Product Trading, Pricing Mechanisms and Market Dynamics, Conservation of petroleum and its products, Spot and other market control mechanisms, Indian and Global supply scenario of petroleum and petroleum products, Risk Management in Petroleum Marketing. | | | | | | | |
| **Module 3:** | Petroleum Management and Operations | Team Activity | Poster Designing and Presentation | 12 Periods | | | |
| **Topics:**<br>Overview of Petroleum Industry Management, Petroleum Resource Classification, Analysis of Resource Management, International and National Institutions of Oil and Gas: API, OPEC, OECD, OIDB, DGH, PNGRB, CHT, PII, PPAC, PCRA. Petroleum Contracts: NELP - Role & Background, Types of Contracts and fiscal components, Production sharing contracts in India. Strategic Reserves concepts, Operational Strategies and Best Practices, Project Management in the Petroleum Sector, Regulatory and Compliance Issues, Technology and Innovation in Petroleum Management. | | | | | | | |
| **Module 4:** | Strategic and Sustainable Practices in Petroleum | Exercise | Data Collection and Report submission | 07 Periods | | | |
| **Topics:**<br>Strategic Planning and Decision Making, Sustainable Practices in Petroleum Operations, Corporate Social Responsibility (CSR) in the Petroleum Industry, Energy Transition and Future Trends, Case Studies of Successful Petroleum Companies. | | | | | | | |
| **Targeted Application and Tools that can be used:**<br>**Applications:** CGD Engineer / Oil and Gas Marketing Professional in Energy Industry<br>**Tools:** OLGA, OFM, PIPESIM (Professionally used Software) | | | | | | | |
| **Text Books:**<br>T1. "Managing Growth and Expansion Into Global Markets: Logistics, Transportation, and Distribution", Thomas A. Cook, Taylor & Francis, 2015.<br>T2. "Trading and Pricing Financial Derivatives: A Guide to Futures, Options, and Swaps", Patrick Boyle, and Jesse Mcdougall, Createspace Independent Pub, 2015. | | | | | | | |

T3. "Energy Trading and Risk Management: A Practical Approach to Hedging, Trading and Portfolio Diversification", Iris Marie Mack, Wiley, 1st Edition, 2014.

T4: "Oil and Gas Production Handbook: An Introduction to Oil and Gas Production, Transport, Refining and Petrochemical Industry", Håvard Devold, ABB, 2013.

**Reference Books:**

R1. "Oil Transport Management", Y.H. Venus Lun, Olli-Pekka Hilmola, Alexander M. Goulielmos, Kee-hung Lai, T.C. Edwin Cheng, Springer London, 2012.

R2. "Optimal Supply Chain Management in Oil, Gas, and Power Generation", David Jacoby, PennWell Corporation, 2012.

R3. "Petroleum Refining: Technology and Economics", Mark J. Kaiser, James H. Gary, and Glenn E. Handwerk, CRC Press, 5th Edition, 2007.

R4. "Oil, Gas and Chemical Logistics Management: Advanced Project Inbound Material Logistics Management And 5PL", Wei Li, Kogan Page, Limited, 1st Edition, 1998.

R5. "Fundamentals of Petroleum", Kate Van Dyke, University of Texas at Austin Petroleum 4th Edition, 1997.

**e- References:**

1. Link for PU e-resources: https://presiuniv.knimbus.com/user#/home
2. Oil and Gas Industry Downstream: https://guides.loc.gov/oil-and-gas-industry/downstream
3. Oil Transportation: https://energyeducation.ca/encyclopedia/Transportation_of_oil

**Skill Sets:** Topics relevant to **"EMPLOYABILITY SKILLS"**: Risk Management in Petroleum Marketing, Operational Strategies and Best Practices, Project Management in the Petroleum Sector, Regulatory and Compliance Issues, Technology and Innovation in Petroleum Management, Strategic Planning and Decision Making, Sustainable Practices in Petroleum Operations, Corporate Social Responsibility (CSR) in the Petroleum Industry for developing **Employability Skills** through **Problem Solving** methodologies. This is attained through assessment component mentioned in course handout.

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| **Catalogue prepared by:** | Dr. Abhinav Kumar, Mr. Bhairab Jyoti Gogoi, and Dr. Suman Paul |
| **Recommended by the Board of Studies on:** | 18th Meeting of the Board of Studies held on 4th July, 2024 |
| **Date of Approval by the Academic Council:** | 24th Meeting of the Academic Council held on 3rd August, 2024 |

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|---|---|---|---|---|---|---|---|
| **Course Code:** PET3127 | **Course Title:** Fundamental of Chemical Engineering<br>**Type of Course:** 1] Discipline Elective Course<br>2] Theory Only | | | **L-T-P-C** | 3 | 0 | 0 | 3 |
| **Version No.:** | 1.0 | | | | | | |
| **Course Pre-requisites:** | NIL | | | | | | |
| **Anti-requisites:** | NIL | | | | | | |
| **Course Description:** | The purpose of this course is to enable the student to understand the basics of Chemical Engineering calculations, Stoichiometry and Material and Energy Balance, distillation types of reactors and their application. They will learn definition and estimation of properties of process approach to problem solving using fundamental equations. The course is both conceptual and analytical in nature and needs fair knowledge of Mathematics. The course develops the critical thinking and analytical skills. | | | | | | |
| **Course Objective:** | The objective of the course is to familiarize the learners with the concepts of Fundamental of Chemical Engineering and attain **Employability** through **Problem Solving** methodologies. | | | | | | |
| **Course Outcomes:** | On successful completion of the course the students shall be able to:<br>CO1: describe the different stoichiometric relationship and apply material heat energy balance in process calculation,<br>CO2: define the different reactor and pumps and their applications,<br>CO3: learn the types of separation process specially design distillation column and application in downstream process,<br>CO4: classify the different types of heat transfer process heat exchanger and their application | | | | | | |
| **Course Content:** | | | | | | | |
| **Module 1:** | Stoichiometry and Process Calculations | Assignment | Data Collection | 10 Periods | | | |
| **Topics:**<br>Stoichiometric & Composition relations: Stoichiometric relation, basis of calculations, methods of expressing compositions of mixtures and solutions, density and specific gravity, : Liquefaction and liquid state, vaporization, boiling point, effect of temperature on vapor pressure, Antoine equation, vapor pressure plots, estimation of critical properties, vapor pressure of immiscible liquids and ideal solutions, Raoult's law, Non-volatile solutes. | | | | | | | |
| **Module 2:** | Principles Fluid Mechanics and Reaction Engineering | Assignment | Data Collection | 10 Periods | | | |
| **Topics:**<br>Fluid flow phenomena: Laminar flow shear Rate, Shear stress, Rheological Properties of Fluids, Turbulence and Boundary Layer, Drag coefficients, Pipe fittings and Valves, Pumps; Types, mechanisms and design of different isothermal reactor design | | | | | | | |
| **Module 3:** | Mass Transfer and its Application | Poster Presentation | Programming | 10 Periods | | | |
| **Topics:**<br>Principles of Diffusion and Mass Transfer, Fick's Law and it's application, Mass Transfer Coefficients: Absorption with Chemical Reaction; Distillation, Flash distillation, Plate calculation and efficiency using Maccabe Thielie Method, Packed distillation, Azeotropic and extractive distillation for single and multi-component distillation | | | | | | | |
| **Module 4:** | Heat Transfer and its Application | Assignment | Data Collection | 10 Periods | | | |
| **Topics:**<br>Heat transfer by conduction convection and radiation; Heat transfer through fluids both laminar and turbulent flow; Heat exchanger designing and application | | | | | | | |
| **Targeted Application and Tools that can be used:**<br>**Applications:** Process Engineering Industries in operation such as Distillation column, Solvent Adsorption and extraction and designing of heat exchanger services.<br>**Tools:** MS Excel | | | | | | | |
| **Text Book:**<br>T1: Hougen O A, Watson K.M. and Ragatz R.A, "Chemical Process Principles", Part -I: Material and Energy Balance, John Wiley and Sons, New York.<br>T2. McCabe W.L, Smith,J.C, Harriot P "Unit Operations of Chemical Engineering", McGraw-Hill INTERNATIONAL EDITION | | | | | | | |

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|---|---|
| T3. Levenspiel O “Chemical Reaction Engineering” Wiley Student Edition | |
| **References:**<br>R1: B.I. Bhatt and S.M.Vora,“Stoichiometry”, Tata McGraw Hill Publishing Company Ltd.<br>R2: Coulson and Richardson’s Chemical Engineering Prticle Technology and Separation Process | |
| **Skill Sets:** Topics relevant to **“EMPLOYABILITY SKILLS”:** Estimation of critical properties, vapor pressure of immiscible liquids and ideal solutions for developing **Employability Skills** through **Problem Solving** methodologies. This is attained through assessment component mentioned in course plan. | |
| **Catalogue prepared by:** | Dr. Deepjyoti Mech, Dr. Niladri Shekhar Samanta, Dr. Rohit Kumar Saw |
| **Recommended by the Board of Studies on:** | 18th Meeting of the Board of Studies held on 4th July, 2024 |
| **Date of Approval by the Academic Council:** | 24th Meeting of the Academic Council held on 3rd August, 2024 |

| Course Code: PET3128 | Course Title: **Advanced Refining Engineering**<br>Type of Course: **1] Discipline Elective Course**<br>**2] Theory Only** | L-T-P-C | 3 | 0 | 0 | 3 |
|---|---|---|---|---|---|---|
| **Version No.:** | 1.0 | | | | | |
| **Course Pre-requisites:** | NIL | | | | | |
| **Anti-requisites:** | NIL | | | | | |
| **Course Description:** | The purpose of this course is to understand the different process used in refining industries. They will learn the different cracking methods, reforming techniques to be used in various processes to increase the efficiency of the products. The course is and analytical in nature and needs fair knowledge of chemical reactions. The course develops the critical thinking and analytical skills. | | | | | |
| **Course Objective:** | The objective of the course is to familiarize the learners with the concepts of Advanced Refining Engineering and attain **Employability** through **Problem Solving** methodologies | | | | | |
| **Course Outcomes:** | On successful completion of the course the students shall be able to:<br>C01: Explain the different types thermal cracking process,<br>CO2: Describe the catalytic cracking process,<br>CO3: Discuss the different catalytic reforming process,<br>CO4: Illustrate the alkylation and isomerization process. | | | | | |
| **Course Content:** | | | | | | |

| **Module 1:** | Thermal Cracking And Coking | Exercise | Data Collection and Report Presentation | 08 Periods |
|---|---|---|---|---|

**Topics:**
Need and significance, types and functions of Secondary Processing. Cracking, Thermal Cracking and Visbreaking. Different Feed Stocks, Products Yields, Qualities and Recent Development. Hydro Cracking- principles, reactions in Hydro Cracking, Catalyst, Hydro Cracking Reaction Conditions, Iso Max Processes and Hydro Desulphurization Processes. Methods of Petroleum Coke Production – Koppers, Thermal Cracking, Delayed Coking, Fluid Coking and Contact Coking.

| **Module 2:** | Catalytic Cracking and Hydro Cracking | Team Activity | Poster Presentation | 11 Periods |
|---|---|---|---|---|

**Topics**:
Catalytic Cracking, Commercial Catalyst, Feedstock and Catalytic Cracking Conditions, Types and Processes- Fixed Bed Cracker, Fluid Catalytic Cracking (FCC), Flexi Cracking.

| **Module 3:** | Catalytic Reforming | Quiz | Online Quiz | 11 Periods |
|---|---|---|---|---|

**Topics:**
Theory, Reaction Conditions and Catalyst for Catalytic Reforming, Platforming, Houdri Forming, Rhein Forming, Power Forming, Selecto Forming. Ultra Forming and Rex Forming. Naphtha Cracking, Feedstock Selection and Effect of Steam

| **Module 4:** | Alkylation And Isomerization | Team Exercise | Presentation | 10 Periods |
|---|---|---|---|---|

**Topics:**
Feed Stocks and Reactions for Alkylation Process- Cascade Sulphuric Acid Alkylation, Hydrofluoric Acid Alkylation. Isomerization Process- Isomerization with Platinum Catalyst and Aluminium Chloride Process.

**Targeted Application and Tools that can be used:**
**Applications:** Process Engineering Industries in operation such as Cracking, Hydrogenation and in operations relating to different chemical reactors.
**Tools:** UniSim Design Software

**Text Book:**
T1. Ram Prasad, “Petroleum Refining Technology”, First Edition,1998 Khanna Publishers.
T2. Bhaskara Rao, B.K., “Modern Petroleum Refining Processes”, 3rd edition, Oxford and IBH Publishing Company Pvt. Ltd. Limited,1985.
T3. Watkins, R. N “Petroleum Refinery Distillations”, 2nd Edition, Gulf Publishing Company, Texas, 1981.

**References:**
R1. Parkash, S., Refining processes handbook, Gulf Professional Publishing, First Edition 2003.
R2. Hobson, G. D “Modern Petroleum Refining Technology”, 4th Edition, Institute of Petroleum, U. K. 1973.

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|---|---|
| **e- References:**<br>1. https: / / puniversity.informaticsglobal.com / login<br>2. https: / / www.slideshare.net / janapra / notes-petrorefine1<br>3. https: / / nptel.ac.in / courses / 103 / 102 / 103102022 / | |
| **Skill Sets:** Topics relevant to **"EMPLOYABILITY SKILLS":** Fluid Catalytic Cracking for developing **Employability Skills** through **Problem Solving** methodologies. This is attained through assessment component mentioned in course plan. | |
| **Catalogue prepared by:** | Dr. Deepjyoti Mech, Dr. Niladri Shekhar Samanta, Dr. Rohit Kumar Saw |
| **Recommended by the Board of Studies on:** | 18th Meeting of the Board of Studies held on 4th July, 2024 |
| **Date of Approval by the Academic Council:** | 24th Meeting of the Academic Council held on 3rd August, 2024 |

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|---|---|---|---|---|---|---|---|
| **Course Code:** PET3129 | **Course Title:** Advanced Petrochemical Engineering<br>**Type of Course:** 1] Discipline Elective Course<br>2] Theory Only | | | **L-T-P-C** | 3 | 0 | 0 | 3 |
| **Version No.:** | 1.0 | | | | | | |
| **Course Pre-requisites:** | NIL | | | | | | |
| **Anti-requisites:** | NIL | | | | | | |
| **Course Description:** | The purpose of this course is to understand the different petrochemicals obtained from the Petroleum industry. They will learn the different composition, classification, separation and production techniques of different petrochemicals. The course develops the critical thinking and analytical skills. | | | | | | |
| **Course Objective:** | The objective of the course is to familiarize the learners with the concepts of Advanced Petrochemical Engineering and attain **Employability** through **Problem Solving** methodologies. | | | | | | |
| **Course Outcomes:** | On successful completion of the course the students shall be able to:<br>CO1: Describe the different types of production techniques of synthesis gas and its derivatives,<br>CO2: Classify different petrochemicals based on methane, ethylene, acetylene, propylene and butane,<br>CO3: Illustrate the different separation techniques for aromatics,<br>CO4: Explain different production methods of synthetic fibers and polymers. | | | | | | |
| **Course Content:** | | | | | | | |
| **Module 1:** | Synthesis Gas | Quiz | Online Quiz | 09 Periods | | | |
| **Topics:**<br>Production and utilization of synthesis gas: generation of synthesis gas by steam reforming of naptha and natural gas, fuel oil partial oxidation. Chemicals from synthesis gas, methanol via synthesis gas route, formaldehyde from methanol, chloromethane by direct chlorination of methane, trichloroethylene, perchloroethylene by pyrolysis of carbon tetra chloride. Fischer Tropsch process. | | | | | | | |
| **Module 2:** | Petrochemical based on methane, ethylene, acetylene | Exercise | Data Collection and Report Presentation | 11 Periods | | | |
| **Topics**:<br>Petrochemical based on methane, ethylene, acetylene, propylene and butane: acetylene and methanol from methane, VCM, VAM, ethylene oxide and ethylene glycol, ethanol amides from ethylene. VCM, VAM, acrylonitrile etc. from acetylene. Isopropanol, Propylene oxide, Glycerine, acrylonitrile, Acrylic acid, etc. From propylene. Production of butadiene by dehydrogenation of butane, nitrogen | | | | | | | |
| **Module 3:** | Separation and utilization of aromatics | Team Exercise | Presentation | 12 Periods | | | |
| **Topics:**<br>Separation and utilization of aromatics: catalytic reforming operation-separation of BTX from Reformate, isolation of benzene, toluene, xylene, aromatics derived from thermal cracking of naptha, pyrolysis gasoline hydrogenation process. Alkylation of benzene. production of pthalic anhydride etc. synthetic detergents: classification of detergents production of KERYL Benzene Sulphonate etc., filter, binders, dyes, perfumes, etc. for detergents. Hard and soft detergents | | | | | | | |
| **Module 4:** | Synthetic fibres, rubbers, plastics, resins | Team Activity | Poster Presentation | 08 Periods | | | |
| **Topics:**<br>Synthetic fibres, rubbers, plastics, resins: method, mechanism and types of polymerization, production of HDPE,LDPE, PP,PVC, polystyrene, poly butadiene, etc., manufacture of polyesters, nylons, acrylic fibres, etc. production of phenol formaldehyde resin, epoxy resin, production principle of ABS plastic, polycarbonates, etc. manufacturing techniques of butyl rubber, SBR, isoprene rubber, etc. | | | | | | | |
| **Targeted Application and Tools that can be used:**<br>**Applications**: Process Engineer in Refining Industries, petrochemical industry.<br>**Tools:** UniSim Design Software | | | | | | | |
| **Text Book:**<br>T1: A Text on Petrochemicals, B.K.B.Rao, 5th Edition, 2004, Khanna publishers.<br>T2: Petrochemical process technology, I D Mall, 2nd Edition, 2006, Macmillan. | | | | | | | |

**References:**

R1: Trends in Petrochemical Technology, Brownstein A.M. 1976, First Edition, Petroleum Publishing Company.
R2: Handbook of Petrochemicals Production Processes, Robert Meyers, First Edition, 2004, McGraw Hill Handbooks.

**e-Reference**

1. https: / / puniversity.informaticsglobal.com / login
2. https: / / www.slideshare.net / sajjad al-amery / episode-3-production-of-synthesis-gas-by-steam-methane-reforming
3. https: / / nptel.ac.in / courses / 103 / 102 / 103102022 /

**Skill Sets:** Topics relevant to **"EMPLOYABILITY SKILLS":** Production of butadiene by dehydrogenation of butane for developing **Employability Skills** through **Problem Solving** methodologies. This is attained through assessment component mentioned in course plan.

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|---|---|
| **Catalogue prepared by:** | Dr. Deepjyoti Mech, Dr. Niladri Shekhar Samanta, Dr. Rohit Kumar Saw |
| **Recommended by the Board of Studies on:** | 18th Meeting of the Board of Studies held on 4th July, 2024 |
| **Date of Approval by the Academic Council:** | 24th Meeting of the Academic Council held on 3rd August, 2024 |

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|---|---|---|---|---|---|---|---|
| **Course Code:** PET3130 | **Course Title:** Chemical Reaction Engineering<br>**Type of Course:** 1] Discipline Elective Course<br>2] Theory Only | | | **L-T-P-C** | 3 | 0 | 0 | 3 |
| **Version No.:** | 1.0 | | | | | | |
| **Course Pre-requisites:** | NIL | | | | | | |
| **Anti-requisites:** | NIL | | | | | | |
| **Course Description:** | The purpose of this course is to understand the basics concepts of chemical reaction in various process. They will learn the different design parameter. The course is both conceptual and theoretical in nature and needs fair knowledge of Mathematics. The course develops the critical thinking and analytical skills. | | | | | | |
| **Course Objective:** | The objective of the course is to familiarize the learners with the concepts of Chemical Reaction Engineering and attain **Employability** through **Problem Solving** methodologies. | | | | | | |
| **Course Outcomes:** | On successful completion of the course the students shall be able to:<br>CO1: Explain the kinetics and classification of chemical reactions,<br>CO2: Describe the Kinetics of homogeneous reaction,<br>CO3: Identify the different types of Batch Reactors,<br>CO4: Classify the types of rectors and size comparison. | | | | | | |
| **Course Content:** | | | | | | | |
| **Module 1:** | Introduction to Chemical Reaction Engineering | Exercise | Data Collection and Report Presentation | 10 Periods | | | |
| **Topics:**<br>Introduction, kinetics, classification of chemical reactions, rate of reaction - Factors affecting reaction rate, molecularity and order of reaction pseudo molecularity of reaction- Zero order reaction, chemical equilibrium, Le-chatelier's Principle. Thermodynamics first and second law, - system, surroundings, intensive and extensive properties, thermodynamics properties-internal energy, enthalpy, entropy, free energy, chemical potential, fugacity, and activity. Feasibility of chemical reaction from the free energy change. | | | | | | | |
| **Module 2:** | Kinetics of Homogenous Reaction | Quiz | Online Quiz | 11 Periods | | | |
| **Topics:**<br>Concentration dependent term of a rate equation, rate constant 'K', representation of reaction rate-kinetic model for non-elementary reaction-Testing kinetic model for non-elementary reaction -Temperature dependent term of a rate equation, significance of activation energy-Temperature dependency from thermodynamics, collision theory, transition state theory.-Comparison of these theories with Arrhenius law | | | | | | | |
| **Module 3:** | Introduction to Batch Reactor Data | Team Exercise | Presentation | 09 Periods | | | |
| **Topics:**<br>Constant volume batch reactor and analysis of total pressure data obtained in a constant Volume system. Analysis of kinetic data by integral and by differential method for first order, second order, zero order nth order-parallel, autocatalytic, series irreversible reactions and first order reversible reaction. – Half-life method, differential method of analysis, variable volume batch reactor, - Integral method of analysis of reactions for variable volume. Temperature and reaction rate. | | | | | | | |
| **Module 4:** | Introduction to Reactor Design and Types of Reactor | Team Activity | Poster Presentation | 10 Periods | | | |
| **Topics:**<br>General view of reactor design, classification of chemical reactor-single ideal reactors, ideal batch reactor- Performance equations for ideal batch reactor,-Steady state mixed flow reactor, space - time and space velocity,-Holding time and space time for flow system.-Multiple reactor system, plug flow reactor in series-mixed flow reactor of different sizes in series, autocatalytic reactions | | | | | | | |
| **Targeted Application and Tools that can be used:**<br>**Applications:** Engineer in Process Industries refineries in operation such as Distillation Column, Evaporators and Dryers, Heat exchangers.<br>**Tools:** Aspen HYSIS Software | | | | | | | |
| **Text Book:**<br>T1: Chemical Engineering Kinetics, J. M. Smith, First Edition 1981, McGraw-Hill Chemical Engineering Series.<br>T2: Chemical Reaction Engineering, Gavane K.A., First edition, 2019, Nirali Prakashan publisher. | | | | | | | |

**References:**

R1: Levenspiel O, “Chemical Reaction Engineering”, Wiley Eastern Ltd., II Edition, 2000.
R2: Smith, J.M, “Chemical Engineering Kinetics”, McGraw Hill, III Edition, 1981.
R3: Fogler. H.S., “Elements of Chemical Reaction Engineering”, Prentice Hall of India Ltd., 3rd Edition, 2000.

**e- References:**

1. https: / / puniversity.informaticsglobal.com / login
2. https: / / nptel.ac.in / courses / 103 / 108 / 103108097 /
3. https: / / ocw.mit.edu / courses / chemical-engineering / 10-37-chemical-and-biological-reaction-engineering-spring-2007 / lecture-notes /

**Skill Sets:** Topics relevant to **“EMPLOYABILITY SKILLS”:** Model for non-elementary reaction-Testing kinetic model for non-elementary reaction for developing **Employability Skills** through **Problem Solving** methodologies. This is attained through assessment component mentioned in course plan.

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| **Catalogue prepared by:** | Dr. Deepjyoti Mech, Dr. Niladri Shekhar Samanta, Dr. Rohit Kumar Saw |
| **Recommended by the Board of Studies on:** | 18th Meeting of the Board of Studies held on 4th July, 2024 |
| **Date of Approval by the Academic Council:** | 24th Meeting of the Academic Council held on 3rd August, 2024 |

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|---|---|---|---|---|---|---|---|
| **Course Code:** PET3131 | **Course Title:** Process Equipment Design<br>**Type of Course:** 1] Discipline Elective Course<br>2] Theory Only | | | **L-T-P-C** | 3 | 0 | 0 | 3 |
| **Version No.:** | 1.0 | | | | | | |
| **Course Pre-requisites:** | NIL | | | | | | |
| **Anti-requisites:** | NIL | | | | | | |
| **Course Description:** | The purpose of this course is to understand the basics of the design part of the process equipment. They will learn the different design parameters to take into consideration while designing the different equipment for various processes. The course is both conceptual and analytical in nature and needs fair knowledge of Mathematics. The course develops the critical thinking and analytical skills. | | | | | | |
| **Course Objective** | The objective of the course is to familiarize the learners with the concepts of Process Equipment Design and attain **Employability** through **Problem Solving** methodologies. | | | | | | |
| **Course Outcomes:** | On successful completion of the course the students shall be able to:<br>CO1: Discuss the various thermodynamic properties for design evaluation,<br>CO2: Explain the Heat exchanger design parameters,<br>CO3: Describe the evaporation design parameters,<br>CO4: Classify the different types of pumps, fans and compressors. | | | | | | |
| **Course Content:** | | | | | | | |
| **Module 1:** | Thermodynamic Properties Evaluation For Design | Quiz | Online Quiz | 09 Periods | | | |
| **Topics:**<br>Physical properties evaluation, Thermodynamic properties of gases and binary mixtures – Methods of calculations – Vapour-liquid equilibrium data for ideal and non-ideal mixtures. Bubble points and dew points, flash distillation calculation. | | | | | | | |
| **Module 2:** | Heat Exchanger Design | Team Activity | Poster Presentation | 11 Periods | | | |
| **Topics:**<br>Design of double pipe heat exchangers, Heat exchanger types and its selection – shell and tube heat exchangers and Condensers – Effectiveness – NTU method of heat exchanger analysis. Design of cooling towers. | | | | | | | |
| **Module 3:** | Evaporator Design | Exercise | Data Collection and Report Presentation | 08 Periods | | | |
| **Topics:**<br>Steam – Uses of steam – Outstanding qualities of steam – BPE – Duhring's Rule – Principle of multiple effect evaporation – Temperature driving force – Evaporators types and its selection – Design of single and multiple effect evaporators. Design of batch and continuous Dryers. | | | | | | | |
| **Module 4:** | Pumps, Fans And Compressors | Team Exercise | Presentation | 12 Periods | | | |
| **Topics:**<br>Pumps, fans and compressors – Types and its applications – Selection criteria - Characteristics – NPSHR and NPSHA – Power rating calculations based on process duty - Performance analysis of pumps, fans and compressors - Pump Cavitation. Surge problem in compressors. | | | | | | | |
| **Targeted Application and Tools that can be used:**<br>**Applications:** Process Engineers in Industries for operation such as Distillation column, Evaporators and Dryers, Heat exchangers etc.<br>**Tools:** UniSim Design Software. | | | | | | | |
| **Text Book:**<br>T1: Ernest E. Ludwig., "Applied Process Design for Chemical and Petrochemical Plants", Vol.I, II and III, Gulf Professional Publishing, 2002.<br>T2: Dawande, S. D., "Process Design of Equiments", 4th Edition, Central Techno Publications, Nagpure, 2005. | | | | | | | |
| **References:**<br>R1: Coulson, M. and Richardson, J.F., "Chemical Engineering", Vol.6, 3rd Edition, Pergamon Press, 1987. | | | | | | | |

<table>
<tr><td colspan="2">R2: Robert H. Perry and Don W. Green, “Perry’s Chemical Engineer’s Hand Book”, 7th Edition, McGraw Hill – International, 1997.<br>R3: Van Winkle, “Distillation Operations”, McGraw Hill Publications, First Edition, 1987.<br>R4: D. Q. Kern, “Process Heat Transfer", Tata McGraw Hill Publishing Co., New Delhi, First Edition, 1990.<br><br>e- References:<br>1. https: / / puniversity.informaticsglobal.com / login<br>2. https: / / nptel.ac.in / courses / 103 / 107 / 103107207 /<br>3. https: / / www.msubbu.in / ln / design /</td></tr>
<tr><td colspan="2">Skill Sets: Topics relevant to “EMPLOYABILITY SKILLS”: Design of cooling towers for developing Employability Skills through Problem Solving methodologies. This is attained through assessment component mentioned in course plan.</td></tr>
<tr><td>Catalogue prepared by:</td><td>Dr. Deepjyoti Mech, Dr. Niladri Shekhar Samanta, Dr. Rohit Kumar Saw</td></tr>
<tr><td>Recommended by the Board of Studies on:</td><td>18th Meeting of the Board of Studies held on 4th July, 2024</td></tr>
<tr><td>Date of Approval by the Academic Council:</td><td>24th Meeting of the Academic Council held on 3rd August, 2024</td></tr>
</table>

## OPEN ELECTIVE COURSE (OEC)

<table>
<tr><td>Course Code:<br>PET2129</td><td colspan="4">Course Title: Energy Industry Dynamics<br>Type of Course: 1] Open Elective Course<br>2] Theory Only</td><td>L-T-P-C</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Version No.:</td><td colspan="9">1.0</td></tr>
<tr><td>Course Pre-requisites:</td><td colspan="9">NIL</td></tr>
<tr><td>Anti-requisites:</td><td colspan="9">NIL</td></tr>
<tr><td>Course Description:</td><td colspan="9">This course provides a comprehensive understanding of the complex and evolving energy sector, focusing on the interplay between market forces, technological advancements, policy frameworks, and environmental considerations. Students will have a thorough understanding of the dynamics within the energy industry, enabling them to analyze market trends, evaluate policy impacts, and contribute to the development and implementation of innovative energy solutions.</td></tr>
<tr><td>Course Objective:</td><td colspan="9">The objective of the course is to familiarize the learners with the concepts of Energy Industry Dynamics and attain Skill Development through Participative Learning techniques.</td></tr>
<tr><td>Course Outcomes:</td><td colspan="9">Upon successful completion of the course the students shall be able to:<br>CO1: Classify the various sources of energy and their characteristics,<br>CO2: Demonstrate energy efficiency technologies in practical scenarios,<br>CO3: Identify the processes involved in energy trading and risk management,<br>CO4: Select policy and regulatory changes needed for sustainable energy development.</td></tr>
<tr><td>Course Content:</td><td colspan="9"></td></tr>
<tr><td>Module 1:</td><td colspan="3">Introduction to the Energy Industry</td><td>Assignment / Quiz</td><td colspan="3">Analytical Skills Development</td><td>09 Periods</td></tr>
<tr><td colspan="10">Topics:<br>Overview of Energy Sources - Renewables and Non-renewables, History and Evolution of the Energy Industry, Sectors in Energy Industry, Energy Demand and Supply Dynamics, Energy Policy and Regulation, Environmental Impact of Energy Production and Consumption.</td></tr>
<tr><td>Module 2:</td><td colspan="3">Energy Production and Technologies</td><td>Assignment / Quiz</td><td colspan="3">Analytical Skills Development</td><td>11 Periods</td></tr>
<tr><td colspan="10">Topics:<br>Exploration and Production of Fossil Fuels, Renewable Energy Technologies - Solar, Wind, Hydro, and Biomass, Nuclear Energy Production, Advances in Energy Storage and Grid Management, Energy Efficiency Technologies.</td></tr>
<tr><td>Module 3:</td><td colspan="3">Energy Markets and Economics</td><td>Poster Presentation</td><td colspan="3">Verbal Communication Skill Development</td><td>09 Periods</td></tr>
<tr><td colspan="10">Topics:<br>Structure and Dynamics of Energy Markets, Pricing Mechanisms and Market Regulation, Energy Trading and Risk Management, Economics of Energy Production and Consumption, Case Studies of National and Regional Energy Markets.</td></tr>
<tr><td>Module 4:</td><td colspan="3">Future Trends and Innovations in the Energy Industry</td><td>e-Resource Review</td><td colspan="3">Literature Survey and Report Submission</td><td>11 Periods</td></tr>
<tr><td colspan="10">Topics:<br>Transition to Sustainable Energy Systems, Technological Innovations in Energy, Policy and Regulatory Changes for Sustainable Energy, Impact of Digitalization and Smart Grids, Energy Industry's Role in Climate Change Mitigation.</td></tr>
<tr><td colspan="10">Targeted Applications and Tools that can be used:<br>Applications: Energy Management, Policy, and Technology Development and related fields.<br>Tools: EIA Open Data, MATLAB Simulink.</td></tr>
<tr><td colspan="10">Text Books:<br>T1. “Energy Market and Energy Transition: Dynamics and Prospects”, Dayong Zhang, Farhad Taghizadeh-Hesary, Phoumin Han, Qiang Ji, Xunpeng (Roc) Shi, Frontiers Media SA, 2021.<br>T2. “Innovation Dynamics and Policy in the Energy Sector: Building Global Energy Markets, Institutions, Public Policy, Technology and Culture on the Texan Innovation Example”, Milton L. Holloway, Elsevier Science, 2021.<br>T3. “Dynamics of Energy, Environment and Economy: A Sustainability Perspective”, Hassan Qudrat-Ullah, Muhammad Asif, Springer International Publishing, 2020.<br>T4. “Fundamentals of Oil & Gas Industry for Beginners”, Samir Dalvi, Notion Press; 1st Edition, 2015.</td></tr>
<tr><td colspan="10">Reference Books:</td></tr>
</table>

R1. “Renewable Energy in India: Economics and Market Dynamics”, Pramod Deo, Sushanta Kumar Chatterjee, Shrikant Modak, Sage PublicationsIndia Pvt Limited, 2021.
R2. “Handbook of Energy Economics and Policy - Fundamentals and Applications for Engineers and Energy Planners”, Alessandro Rubino, Alessandro Sapio, and Massimo La Scala, Elsevier, 2021.
R3. “Energy Economics: Concepts, Issues, Markets, and Governance”, Subhes C. Bhattacharyya, Springer, 2019.
R4. “Energy Economics: Markets, History and Policy”, Roy L. Nersesian, Routledge; 1st Edition, 2016.
R5. “The Quest: Energy, Security, and the Remaking of the Modern World”, Daniel Yergin, Penguin Publication, Revised and Updated Version, 2012.
R6. “Renewable Energy: Power for a Sustainable Future”, Godfrey Boyle, Oxford University Press, 2012.

**e-resources:**

1. Link for PU e-resources: https://presiuniv.knimbus.com/user#/home
2. The Oil and Gas Industry in Net Zero Transitions: https://www.youtube.com/watch?v=NcGyZfIPtOw
3. Energy Information Administration https://www.eia.gov/energyexplained/
4. Energy Information Administration (EIA) Reports: https://www.eia.gov/
5. International Energy Agency (IEA) Reports: https://www.iea.org/
6. Renewable Energy World Reports: https://www.renewableenergyworld.com/
7. The U.S. Department of Energy (DOE) Reports: https://www.energy.gov/
8. Energy Central Reports: https://energycentral.com/

World Energy Council Reports: https://www.worldenergy.org/

**Skill Sets:** Topics relevant to **“SKILL DEVELOPMENT”**: Advances in Energy Storage and Grid Management, Energy Efficiency Technologies, Pricing Mechanisms and Market Regulation, Energy Trading and Risk Management, Economics of Energy Production and Consumption, Technological Innovations in Energy, Policy and Regulatory Changes for Sustainable Energy, Impact of Digitalization and Smart Grids for **Skill Development** through **Participative Learning** techniques**.** This is attained through assessment component mentioned in course handout.

| | |
|---|---|
| **Catalogue prepared by:** | Mr. Bhairab Jyoti Gogoi, Dr. Abhinav Kumar, and Dr. Suman Paul |
| **Recommended by the Board of Studies on:** | 18th Meeting of the Board of Studies held on 4th July, 2024 |
| **Date of Approval by the Academic Council:** | 24th Meeting of the Academic Council held on 3rd August, 2024 |

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|---|---|---|---|---|---|---|---|
| **Course Code:** PET2130 | **Course Title:** Energy Sustainability Practices<br>**Type of Course:** 1] Open Elective Course<br>2] Theory Only | | | **L-T-P-C** | 3 | 0 | 0 | 3 |
| **Version No.:** | 1.0 | | | | | | |
| **Course Pre-requisites:** | NIL | | | | | | |
| **Anti-requisites:** | NIL | | | | | | |
| **Course Description:** | This course offers an in-depth exploration of both renewable and non-renewable energy sources, focusing on the technologies, environmental impacts, and policies that drive sustainable energy practices. Students will engage with theoretical concepts and practical applications, equipping them with the knowledge and skills needed to contribute effectively to the field of energy sustainability. | | | | | | |
| **Course Objective:** | The objective of the course is to familiarize the learners with the concepts Energy Sustainability Practices and attain **Skill Development** through **Participative Learning** techniques. | | | | | | |
| **Course Outcomes:** | Upon successful completion of the course the students shall be able to:<br>CO1: Explain key concepts of energy sustainability,<br>CO2: Explain the role of emerging renewable technologies in sustainable energy systems,<br>CO3: Summarise the principles and technologies of carbon capture and storage,<br>CO4: Illustrate the role of smart grids and energy storage in energy sustainability. | | | | | | |
| **Course Content:** | | | | | | | |
| **Module 1:** | Fundamentals of Energy Sustainability | Assignment / Quiz | Analytical Skills Development | 09 Periods | | | |
| **Topics:**<br>Overview of Energy Sustainability, Global Energy Landscape and Challenges, Environmental Impact of Energy Production and Consumption, Energy Policy and Regulation for Sustainability, Introduction to Life Cycle Assessment (LCA). | | | | | | | |
| **Module 2:** | Renewable Energy Sources and Technologies | Assignment / Quiz | Analytical Skills Development | 11 Periods | | | |
| **Topics:**<br>Solar Energy: Photovoltaics and Solar Thermal Systems, Wind Energy: Onshore and Offshore Technologies, Hydropower: Large-scale and Small-scale Systems, Biomass and Bioenergy, Emerging Renewable Technologies: Geothermal, Ocean Energy, and Hydrogen. | | | | | | | |
| **Module 3:** | Non-Renewable Energy Sources and their Impacts | Poster Presentation | Verbal Communication Skill Development | 09 Periods | | | |
| **Topics:**<br>Fossil Fuels: Coal, Oil, and Natural Gas, Nuclear Energy: Fission and Fusion Technologies, Environmental and Health Impacts of Non-Renewable Energy, Carbon Capture and Storage (CCS), Transition Strategies from Non-Renewable to Renewable Energy. | | | | | | | |
| **Module 4:** | Energy Efficiency and Sustainable Practices | e-Resource Review | Literature Survey and Report Submission | 11 Periods | | | |
| **Topics:**<br>Principles of Energy Efficiency, Energy-Efficient Technologies for Buildings, Industrial Energy Efficiency Practices, Sustainable Transportation Solutions, Smart Grids and Energy Storage. | | | | | | | |
| **Targeted Applications and Tools that can be used:**<br>**Applications:** Energy Management, Policy, and Technology Development and related fields.<br>**Tools:** EIA Open Data, MATLAB Simulink. | | | | | | | |
| **Text Books:**<br>T1. "Sustainable Policies and Practices in Energy, Environment and Health Research: Addressing Cross-cutting Issues", Diogo Guedes Vidal, Maria Alzira Pimenta Dinis, Ricardo Cunha Dias, Walter Leal Filho, Springer International Publishing, 2021.<br>T2. "Renewable Energy and Green Technology: Principles and Practices", Amit Kumar, Hukum Singh, Narendra Kumar, CRC Press, 2021.<br>T3. "Sustainability and Energy Management: Innovative and Responsible Business Practices for Sustainable Energy Strategies of Enterprises in Relation with CSR", Gregor Weber, Springer Fachmedien Wiesbaden, 2017.<br>T4: "An Introduction to Sustainable Transportation: Policy, Planning, and Implementation", Preston L. Schiller, and Jeffrey R. Kenworthy, Routledge, 1st Edition, 2010. | | | | | | | |

**Reference Books:**

R1. "Introduction to Renewable Energy", Vaughn C. Nelson, and Kenneth L. Starcher, CRC Press, 2nd Edition, 2016.
R2. "Transport, Climate Change and the City", Robin Hickman, and David Banister, Routledge, 1st Edition, 2014.
R3. "Sustainable Energy: Choosing Among Options" by Elisabeth M. Drake, Jefferson W. Tester, Michael J. Driscoll, Michael W. Golay, and William A. Peters, MIT Press, 2nd Edition, 2012.
R4. "The Quest: Energy, Security, and the Remaking of the Modern World", Daniel Yergin, Penguin Publication, Revised and Updated Version, 2012.
R5. "Renewable Energy: Power for a Sustainable Future", Godfrey Boyle, Oxford University Press, 3rd Edition, 2012.

**e-resources:**

1. Link for PU e-resources: https://presiuniv.knimbus.com/user#/home
2. Project Drawdown: https://drawdown.org/
3. UN Sustainable Development Goals (SDGs): https://sdgs.un.org/
4. GreenBiz: https://www.greenbiz.com/
5. Global Footprint Network: https://www.wri.org/
6. Environmental Protection Agency (EPA) on Sustainability: https://www.epa.gov/sustainability
7. Courses on Coursera Online Platform: https://www.coursera.org/en-IN

TED Talks on Sustainability: https://www.ted.com/topics/sustainability

**Skill Sets:** Topics relevant to **"SKILL DEVELOPMENT"**: Carbon Capture and Storage (CCS), Transition Strategies from Non-Renewable to Renewable Energy, Energy-Efficient Technologies for Buildings, Industrial Energy Efficiency Practices, Sustainable Transportation Solutions, Smart Grids and Energy Storage for **Skill Development** through **Participative Learning** techniques**.** This is attained through assessment component mentioned in course handout.

| | |
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| **Catalogue prepared by:** | Mr. Bhairab Jyoti Gogoi, Dr. Abhinav Kumar, and Dr. Suman Paul |
| **Recommended by the Board of Studies on:** | 18th Meeting of the Board of Studies held on 4th July, 2024 |
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